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Musculoskeletal Discomfort During COVID-19 Pandemic Lockdown among the Faculty Members in Selected Schools in Mega Manila and Metro Cebu: A Cross-sectional Study

Consuelo Gonzalez-Suarez[1,7], Ivan Neil Gomez[2], Ken Erbvin Sosa[2], Maria Lourdes Corazon Tapang[1], Cristina Castro-Cabral[3], John Christopher Mesana[8], Elda Grace Anota[4], Cherie-Lee Apiag[5], Jacqueline Calaycay[6]

[1]Faculty of Medicine and Surgery, University of Santo Tomas, Manila, Philippines; [2] College of Rehabilitation Science, University of Santo Tomas, Manila, Philippines; [3] Colegio De San Juan de Letran, Manila, Philippines; [4] Cebu Institute of Medicine, Cebu City, Philippines; [5] College of Medicine, Cebu Doctors' University, Cebu City, Philippines; [6] Pamantasan ng Lungsod ng Marikina, Marikina City, Philippines;[7] Our Lady of Lourdes Hospital, Manila, Philippines; [8]National University, Philippines

Correspondence should be addressed to: Consuelo Gonzalez-Suarez[1,7]; cgsuarez@ust.edu.ph

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Abstract

Background: The COVID-19 pandemic brought insurmountable changes, leading to work demands and resource limitations that placed additional physical and occupational stress. **Objectives:** This study aimed to determine the change in the occurrence and intensity of musculoskeletal discomfort among selected university faculty members. It also determined the association of sociodemographic and anthropometric factors, workplace conditions, and involvement in physical activity with musculoskeletal pain**. Methods**: This is an analytical cross-sectional study conducted from June 2022 to May 2023 that surveyed university faculty members from Metro Manila and Metro Cebu. Outcome measures include sociodemographic data, anthropometric measures of weight, height, body mass index, workplace conditions, exercise participation, and musculoskeletal discomfort using the Cornell Musculoskeletal Discomfort Questionnaire. **Results**: Data from 120 participants, mostly female, with an average BMI of 27.78 ± 12.09 kg/m^2 and 11.82 ± 10.39 years of teaching experience revealed increased computer usage and reduced teaching hours during the Pandemic lockdown. There was also prevalent musculoskeletal discomfort (MSD), particularly in the neck, shoulder, and upper back. Factors associated with increased MSD were female gender, longer computer use, and pre-pandemic MSD history. **Conclusion**: This study underscores the significance of addressing ergonomic factors and work conditions to mitigate MSD risks among educators during challenging situations.

Key Words*: Musculoskeletal discomfort, musculoskeletal pain, Covid-19 pandemic, occupational stress, faculty members*

INTRODUCTION

The COVID-19 pandemic that started in March 2020 brought insurmountable changes in society. Because of fear of spreading infection, many institutions, businesses, or academics enforced a work-from-home set-up.

The academe has shifted from classroom teaching to computer-based learning using different educational platforms. Faculty members were compelled to deliver their lectures and activities seated in front of a computer for hours on end without adequate preparation. The home suddenly became the workplace. Thus, current work demands and resource limitations shifted and affected workers were exposed to additional physical and occupational stress.

The Philippines had the longest enhanced community quarantine among Asian countries.[1] All academic levels employed solely computer-based learning at the start of the pandemic. By the last quarter of 2021, when the incidence of COVID-19 infection lowered, limited face-to-face interaction was allowed at the tertiary level, mostly in the paramedical and medical fields. However, with the emergence of Omicron as the dominant variant of COVID, onsite learning was

put to a halt, and online learning was placed into full effect again up to the first quarter of 2022. After which, different modes of instruction are being utilized, such as fully asynchronous online, fully synchronous online, HyFlex, BlendFlex, mixed modes, and fully face-to-face classrooms.[2]

A rapid review of musculoskeletal pain during the COVID-19 Pandemic showed that the highest prevalence of musculoskeletal discomfort (MSD) is neck pain (20.3-76.9%), low back pain (19.5-74.1%), and shoulder pain (3.0-72.9%).[3] Individuals working in the academic sector were more likely to complain of musculoskeletal pain. The participants of the review came from Turkey, Indonesia, Saudi Arabia, and the Philippines.

Furthermore, studies involving university students and professors show an increasing prevalence of MSDs during the pandemic as compared to the pre-pandemic period. Different putative factors are associated with MSD: age, female gender, working hours, increased sedentary time, decreased active time, and no ergonomic study chair.[4-7] Being cognizant of the modifiable factors associated with MSD will provide academic administrators guidance in crafting policies that will alleviate the increasing prevalence of musculoskeletal pain in the academic setting with an online teaching set-up.[4-7] It will also provide information to other workforce sectors, which still allows a work-from-home set-up even after the COVID pandemic.

The study aims to determine the change in occurrence and intensity of MSDs among faculty members of selected universities in Mega Manila and Metro Cebu before and during the COVID-19 pandemic. National Capital Region and Metro Cebu are urbanized areas with the highest prevalence of COVID-19.[8] It also determines the sociodemographic and anthropometric factors (age, gender, years of being a faculty member, body mass index), workplace conditions (hours and days spent in front of the computer, breaks taken during work), and involvement in physical activity that are associated with musculoskeletal pain.

METHODS

Study Design and Ethical Considerations. This is an analytical cross-sectional study conducted from June 2022 to May 2023 and approved by the Ethics Review Committee of the College of Rehabilitation Sciences, University of Santo Tomas (FI-2021-033-R1).

Subjects. Sample size was computed using G*Power ver 3.1. We considered an a priori sample size computation for a one-tailed linear regression using a moderate effect size (f^2= 0.15) at a critical α= 0.05 and power of 0.95. A minimum sample size of n=74 was needed.[9,10]

Purposive homogenous convenient sampling was used. Faculty members in selected universities in Mega Manila and Metrocebu were included. They had a full academic load of either teaching or administrative work and worked solely online. Faculty members involved in any other kind of employment like clinical practice or other office work and those who participated in face-to-face classes were excluded.

Outcome Measures. An online survey via Google Form was used to assess the following variables: (1) sociodemographic data (i.e., age, gender, years being a faculty member, academic teaching load/unit); (2) anthropometric measurements (i.e., weight in kilos and height in meters); (3) workplace conditions (i.e., hours in front of the computer daily, days in front of computers, number of hours doing synchronous teaching); (4) breaks (i.e., duration , frequency, and kinds of break including standing from sitting and doing exercises, performing exercise while sitting, leaving the computer, and standing from siting while performing computer work); (5) exercise (i.e., frequency and type of exercise including aerobic exercise like walking, jogging, or aerobic dance, and/or strengthening exercise like use of dumbbells or body weight, sit-ups, planks, jumping jacks); and (6) musculoskeletal discomfort before and during the COVID -19 Pandemic of eligible participants using the Cornell Musculoskeletal Discomfort Questionnaire (CMDQ).

The CMDQ is a screening tool that assesses the frequency, discomfort, and work interference effect of musculoskeletal discomfort on nine different body parts. The validity of CMDQ has

not been assessed in the English version, but the validity of the Turkish and Spanish versions has been compared with the Visual Analogue Scale and showed a Pearson's correlation of 0.7 and from 0.62–0.92, respectively.[11,12] Additionally, the CMDQ was highly reliable, with an ICC of 0.883–0.975, p<0.001.[13]

The frequency subscale has five answers: never, 1-2 times/week, 3 -4 times/week, every day, and several times every day. Each answer is given a score of 0, 1.5,3.5, 5, and 10, respectively. The discomfort subscale has three answers: slightly, moderate, and severe, with a score of 1, 2, and 3, respectively. The interference subscale has three answers: not at all, slightly, and substantially interfered with a score of 1, 2, and 3, respectively. A total score is obtained by multiplying the frequency score by the discomfort and inference scores.[14]

All the outcome measures except the sociodemographic data were asked twice. The first set measured pre-pandemic situation; the second set assessed pandemic situation up to March 2022.

Data Gathering Procedures Permission was sought from the administrators of the participating colleges. Faculty members were invited to participate in an online survey distributed via Google Form through Viber or e-mail. An electronic informed consent was signed prior to answering the questionnaire. The participants are not allowed to go to the questionnaire without ticking the voluntary consent option. Those who consented were directed to the main questionnaire that assessed the variables of interest. The required option was enabled in each question to ensure that no item would be left unfilled.

Statistical Analysis. To describe the demographic characteristics of the participants, as well as their MSD and work-related conditions, measures of proportion, central tendency, and variance were used. For gender, one was assigned to males, while two were assigned to females. The CMDQ dimensions were computed based on the recommended scoring guidelines, rendering each dimension (frequency, discomfort, interference) multiplied by its frequency of score.

Shapiro-Wilk test was utilized to determine the normality of variance on MSD, and the result was p=0.05, suggesting employment of nonparametric measures of group differences. The Wilcoxon signed-rank test was used to compare MSD before and during the pandemic. A Spearman correlation test was then applied to determine significant associations between MSDs with sociodemographic, anthropometric factors, and pandemic work conditions. Significant variables were then factored in a regression analysis as independent variables to determine their association with MSD during the pandemic. SPSS ver. 25 was used to statistically analyze the results using an α= 0.05 and 95% CI.

RESULTS

Participants Characteristics. A total of 120 participated in this study, majority being females (55%). Participants had average measures of BMI of 27.78 ± 12.09 kg/m^2, teaching for 11.82 ±10.39 years, and academic load of 22.25 ± 5.01 units (see Table 1).

Work-related conditions before and during the pandemic lockdown. This study looked at work-related variables before and during the pandemic lockdown (see Table 2). Hours in front of the computer significantly increased during the pandemic lockdown (z= -6.51, p<0.000), with an increase in the number of participants working 1-6 hours from 52.50% before the pandemic to 63.30% during the pandemic lockdown, whereas a significant decrease in teaching hours was noted during the pandemic (z= -2.49, p=0.013). Synchronous teaching hours were reduced from 1-6 hours (69.20%) to <1 hour (67.50%). The number of days spent in front of a computer significantly increased during teaching during the pandemic lockdown (z=-2.80, p=0.005), with 78.30% of the participants reported spending 5-7 days in front of the computer, whereas 21.70% had 3-4 days per week having classes.

Other factors like duration of break, type of break activity, exercise involvement, type of exercise and frequency were not significantly different before and during the pandemic.

Table 1: Subjects' Profile

Variables	n (%)	Mean (SD)
Age (yr)		38.75 (11.99)
Sex		
Male	54 (45.0%)	
Female	66 (55.0%)	
Weight (kg)		74.49 (32.24)
Height (m)		2.09 (4.88)
BMI (kg/m2)		27.78 (12.09)
Marital Status		
Single	64 (53.3%)	
Married	46 (38.3%)	
Widowed	6 (5.0%)	
Separated	1 (0.8%)	
No answer	3 (2.6%)	
Years teaching in current institution		11.82 (10.39)
Current academic teaching unit		22.25 (5.01)

Table 2: Work Conditions before and during the COVID-19 pandemic

Work Conditions	Before	During	Z	p
Hours in front of Computer/Laptop				
< 1 hour	3 (2.5)	22 (18.3%)		
1 – 6 hours	63 (52.5%)	76 (63.3%)	-6.51	p<0.000*
7 – 12 hours	48 (40.0%)	22 (18.3%)		
> 12 hours	6 (5.0%)	0		
Teaching Hours				
< 1 hour	5 (4.2%)	81 (67.5%)		
1 – 6 hours	83 (69.2%)	33 (27.5%)	-2.49	0.013*
7 – 12 hours	31 (25.8%)	6 (5.0%)		
> 12 hours	1 (0.8%)	0		
Days in front of Computer/Laptop				
1 – 2 days a week	9 (7.5%)	0	-2.80	0.005*
3 – 4 days a week	28 (23.3%)	26 (21.7%)		
5 – 7 days a week	83 (69.2%)	94 (78.3%)		
Days Teaching				
1 – 2 days a week	7 (5.8%)	1 (0.8%)	-1.04	0.300
3 – 4 days a week	54 (45.0%)	60 (50.0%)		NS
5 – 7 days a week	59 (49.2%)	59 (49.2%)		
Frequency of Break from Computer/Laptop				
Never	2 (1.7%)	2 (1.7%)		
Rarely	10 (8.3%)	14 (11.7%)	-1.89	0.059
Sometimes	59 (49.2%)	66 (55.0%)		NS
Most of the time	36 (30.0%)	24 (20.0%)		
Always	13 (10.8%)	14 (11.7%)		
Duration of Break from Computer/Laptop				
No break	3 (2.5%)	2 (1.7%)		
<10 minutes	18 (15.0%)	19 (15.8%)	-1.54	0.124
10 - 20 minutes	44 (36.7%)	55 (45.8%)		NS
> 20 minutes	55 (45.8%)	44 (36.7%)		
Break Activity				
Sitting while doing other non-work related activities such as watching movies or playing games.	28 (23.3%)	21 (17.5%)		
Perform exercise while in sitting	3 (2.5%)	5 (4.2%)	-0.67	0.505
Standing, leaving the computer or sitting somewhere else	62 (51.7%)	68 (56.7%)		NS
Stand from sitting while performing computer work	4 (3.3%)	4 (3.3%)		
Stand from sitting and do exercise	20 (16.7%)	19 (15.8%)		
No Answer	3 (2.5%)	3 (2.5%)		
Exercise				
No	12 (10.0%)	14 (11.7%)	-0.71	0.480
Yes	108 (90.0%)	106 (88.3%)		NS
Type of Exercise				
Aerobic Exercise such as Zumba, walking, or jogging	86 (71.7%)	85 (70.8%)		
Strengthening exercise like body weights (sit-ups, planks, jumping jacks) or the use of dumbbells	18 (15.0%)	15 (12.5%)	-1.30	0.194 NS
Both Aerobic and Strengthening exercises	16 (13.3%)	20 (16.7%)		
Frequency of Exercise				
1 – 2 times a week	75 (62.5%)	77 (64.2%)	-0.25	0.806
3 – 4 times a week	33 (27.5%)	30 (25.0%)		NS
5 – 7 times a week	12 (10.0%)	13 (10.8%)		

* Significant; NS: not significant

Table 3. Frequency, discomfort, and interference score from Cornell Musculoskeletal Discomfort Questionnaire(CMDQ) of different regions before and during the COVID-19 pandemic

CMDQ Dimensions	Neck		Shoulder		Upper Back		Upper Arm	
	Before	During	Before	During	Before	During	Before	During
Frequency								
Never	40 (33.3%)	29 (24.2%)	41 (34.2%)	39 (32.5%)	40 (33.3%)	38 (31.7%)	77 (64.2%)	67 (55.8%)
1-2 times in a week	60 (50.0%)	52 (43.3%)	60 (50.0%)	52 (43.3%)	59 (49.2%)	52 (43.3%)	32 (26.7%)	34 (28.3%)
3-4 times in a week	13 (10.8%)	25 (20.8%)	12 (10.0%)	17 (14.2%)	15 (12.5%)	20 (16.7%)	8 (6.7%)	11 (9.2%)
Once everyday	2 1.7%)	7 (5.8%)	3 (2.5%)	7 (5.8%)	1 (0.8%)	4 (3.3%)	1 (0.8%)	5 (4.2%)
Several times everyday	5 (4.2%)	7 (5.8%)	4 (3.3%)	5 (4.2%)	5 (4.2%)	6 (5.0%)	2 (1.7%)	3 (2.5%)
Discomfort								
I do not have any pain	35 (29.2%)	32 (26.7%)	39 (32.5%)	39 (32.5%)	40 (33.3%)	38 (31.7%)	74 (61.7%)	68 (56.7%)
Slightly uncomfortable	67 (55.8%)	70 (58.3%)	67 (55.8%)	65 (54.2%)	63 (52.5%)	62 (51.7%)	42 (35.0%)	42 (35.0%)
Moderately uncomfortable	16 (13.3%)	16 (13.3%)	11 (9.2%)	13 (10.8%)	13 (10.8%)	18 (15.0%)	3 (2.5%)	10 (8.3%)
Very uncomfortable	2 1.7%)	2 (1.7%)	3 (2.5%)	3 (2.5%)	4 (3.3%)	2 (1.7%)	1 (0.8%)	0
Interference								
I do not have any pain	30 25.0%)	30 25.0%)	35 (29.2%)	37 (30.8%)	39 (32.5%)	37 (30.8%)	71 (59.2%)	65 (54.2%)
Not at all	33 27.5%)	22 (18.3%)	33 (27.5%)	27 (22.5%)	24 (20.0%)	21 (17.5%)	16 (13.3%)	16 (13.3%)
Slightly interfered	53 44.2%)	55 (45.8%)	48 (40.0%)	43 (35.8%)	52 (43.3%)	55 (45.8%)	32 (26.7%)	35 (29.2%)
Substantially interfered	4 3.3%)	13 (10.8%)	4 (3.3%)	13 (10.8%)	5 (4.2%)	7 (5.8%)	1 (0.8%)	4 (3.3%)

CMDQ Dimensions	Lower Back		Forearm		Wrist		Hip/Buttocks	
	Before	During	Before	During	Before	During	Before	During
Frequency								
Never	29 (24.2%)	24 (20.0%)	78 (65.0%)	68 (56.7%)	69 (57.5%)	51 (42.5%)	63 (52.5%)	46 (38.3%)
1-2 times in a week	62 (51.7%)	48 (40.0%)	34 (28.3%)	35 (29.2%)	36 (30.o%)	42 (35.0%)	36 (30.0%)	44 (36.7%)
3-4 times in a week	19 (15.8%)	26 (21.7%)	6 (5.0%)	10 (8.3%)	8 (6.7%)	16 (13.3%)	14 (11.7%)	12 (10.0%)
Once everyday	5 (4.2%)	10 (8.3%)	1 (0.8%)	5 (4.2%)	1 (0.8%)	3 (2.5%)	3 (2.5%)	11 (9.2%)
Several times everyday	5 (4.2%)	12 (10.0%)	1 (0.8%)	2 (1.2%)	6 (5.0%)	8 (6.7%)	4 (3.3%)	7 (5.8%)
Discomfort								
I do not have any pain	28 (23.3%)	23 (19.2%)	77 (64.2%)	68 (56.7%)	64 (53.3%)	52 (43.3%)	61 (50.8%)	45 (37.5%)
Slightly uncomfortable	73 (60.8%)	61 (50.8%)	39 (32.5%)	44 (36.7%)	50 (41.7%)	51 (42.5%)	50 (41.7%)	51 (42.5%)
Moderately uncomfortable	15 (12.5%)	29 (24.2)	4 (3.3%)	8 (6.7%)	4 (3.3%)	12 (10.0%)	8 (6.7%)	21 (17.5%)
Very uncomfortable	4 (3.3%)	7 (5.8%)	0	0	2 (1.7%)	5 (4.2%)	1 (0.8%)	3 (2.5%)
Interference								
I do not have any pain	27 (22.5%)	23 (19.2%)	76 (63.3%)	65 (54.2%)	62 (51.7%)	46 (38.3%)	60 (50.0%)	46 (38.3%)
Not at all	26 (21.7%)	24 (20.0%)	18 (15.0%)	21 (17.5%)	18 (15.0%)	26 (21.7%)	21 (17.5%)	22 (18.3%)
Slightly interfered	59 (49.2%)	51 (42.5%)	26 (21.7%)	31 (25.8%)	37 (30.8%)	39 (32.5%)	33 (27.5%)	35 (29.2%)
Substantially interfered	8 (6.7%)	22 (18.3%)	0	3 (2.5%)	3 (2.5%)	9 (7.5%)	6 (5.0%)	17 (14.2%)

CMDQ Dimensions	Thigh		Knee		Lower Leg	
	Before	During	Before	During	Before	During
Frequency						
Never	85 (70.8%)	69 (57.5%)	79 (65.8%)	71 (59.2%)	69 (57.5%)	66 (55.0%)
1-2 times in a week	28 (23.3%)	37 (30.8%)	29 (24.2%)	30 (25.0%)	39 (32.5%)	41 (34.2%)
3-4 times in a week	4 (3.3%)	8 (6.7%)	8 (6.7%)	14 (11.7%)	7 (5.8%)	7 (5.8%)
Once everyday	1 (0.8%)	2 (1.7%)	1 (0.8%)	2 (1.7%)	2 (1.7%)	1 (0.8%)
Several times everyday	2 (1.7%)	4 (3.3%)	3 (2.5%)	3 (2.5%)	3 (2.5%)	5 (4.2%)
Discomfort						
I do not have any pain	84 (70.0%)	70 (58.3%)	76 (63.3%)	70 (58.3%)	67 (55.8%)	66 (55.0%)
Slightly uncomfortable	34 (28.3%)	44 (36.7%)	38 (31.7%)	41 (34.7%)	50 (41.7%)	48 (40.0%)
Moderately uncomfortable	2 (1.7%)	6 (5.0%)	6 (5.0%)	9 (7.5%)	3 (2.5%)	6 (5.0%)

Interference	Very uncomfortable	0	0	0	0	0	0
	I do not have any pain	82 (68.3%)	68 (56.7%)	74 (61.7%)	67 (55.8%)	64 (53.3%)	60 (50.0%)
	Not at all	19 (15.8%)	25 (20.8%)	14 (11.7%)	16 (13.3%)	21 (17.5%)	24 (20.0%)
	Slightly interfered	18 (15.0%)	25 (20.8%)	31 (25.8%)	33 (27.5%)	32 (26.7%)	32 (26.7%)
	Substantially interfered	1 (0.8%)	2 (1.7%)	1 (0.8%)	4 (3.3%)	3 (2.5%)	4 (3.3%)

Table 4: Total score (frequency, discomfort, and interference score) from Cornell Musculoskeletal Discomfort Questionnaire(CMDQ) before and during the COVID-19 pandemic

Musculoskeletal Pain Score	Before	During	z	p value
Neck	2.96 (4.64)	4.47 (6.08)	-3.41	0.001*
Shoulder	2.63 (3.90)	4.53 (8.26)	-2.42	0.016*
Upper Back	2.99 (4.28)	3.88 (5.50)	-1.66	0.09
Upper Arm	1.41 (2.56)	2.51 (4.98)	-2.33	0.02*
Lower Back	3.95 (5.30)	6.71 (9.48)	-3.38	0.001*
Forearm	1.20 (2.83)	2.34 (4.96)	-3.08	0.002*
Wrist	1.51 (2.35)	3.10 (4.77)	-4.22	0.000*
Hip/Buttocks	2.23 (4.10)	4.98 (9.02)	-3.36	0.001*
Thigh	0.89 (2.31)	1.62 (3.60)	-2.85	0.004*
Knee	1.42 (2.97)	2.15 (4.11)	-1.91	0.06
Lower Leg	1.53 (3.38)	1.80 (4.12)	-0.22	0.83

* significant

Table 5: Factors associated with MSK-related pain during the COVID-19 pandemic

Variables	Neck Pain Score	Shoulder Pain Score	Upper Back Pain Score	Upper Arm Pain Score	Lower Back Pain Score	Forearm Pain Score	Wrist Pain Score	Hip/Buttocks Pain Score	Thigh Pain Score	Knee Pain Score	Lower Leg Pain Score
Age (years)	-0.17	-0.008	-0.08	0.16	-0.14	0.09	-0.004	0.14	0.12	0.26**	0.15
Sex	0.30**	0.26**	0.28**	0.20*	0.23*	0.26**	0.26**	0.27**	0.24**	0.19*	0.20*
Weight (kg)	-0.05	0.16	0.01	0.21*	-0.01	0.04	-0.1	0.01	0.14	0.12	0.14
Height (meters)	-0.06	0.005	-0.09	-0.07	-0.07	-0.1	-0.08	-0.11	-0.07	0.002	-0.12
BMI (kg/m2)	-0.08	0.11	0.000	0.18*	-0.04	0.02	-0.1	-0.001	0.12	0.09	0.22*
Years of Teaching	-0.07	0.1	0.03	0.22*	0.001	0.13	0.1	0.23*	0.19*	0.33**	0.19*
Teaching Unit Load	-0.06	0.03	0.033	0.09	-0.05	0.08	0.04	0.09	0.06	-0.02	0.11
Hours in front of Computer	0.26**	0.16	0.29**	0.20*	0.32**	0.23*	0.31**	0.18	0.23*	0.14	0.24**
Teaching Hours	0.001	0.06	0.1	0.04	0.21*	0.05	0.08	0.09	0.02	-0.09	-0.01
Days in front of Computer	0.18	0.14	0.13	0.14	0.15	0.15	0.16	0.13	0.11	0.11	0.11
Days Teaching	-0.03	0.03	0.09	0.04	0.04	-0.03	-0.002	0.1	0.11	0.08	-0.07
Frequency of Break from Computer	-0.05	0.03	-0.01	0.05	-0.07	0.05	-0.06	-0.09	0.04	-0.02	-0.06
Duration of Break from Computer	-0.08	-0.11	-0.09	-0.03	-0.1	-0.14	-0.09	-0.13	0.004	-0.00	-0.1
Exercise	-0.05	-0.08	-0.01	0.08	-0.09	0.03	-0.06	0.02	0.003	-0.05	0.07
Type of Exercise	0.003	-0.05	0.05	-0.09	-0.02	0.01	0.05	0.02	0.01	-0.18	-0.04
Frequency of Exercise	-0.16	0.02	0.04	-0.01	-0.15	-0.14	-0.12	0.21*	-0.14	-0.04	-0.13
Pre-pandemic pain in the same region	0.53**	0.57**	0.58**	0.58**	0.55**	0.54**	0.60**	0.56**	0.57**	0.60**	0.58**

** is significant at the 0.01 level (2-tailed); * is significant at the 0.05 level (2-tailed)

Occurrence of musculoskeletal discomfort during the pandemic. The frequency of pain experienced 1-2 times a week was highest for the neck, shoulder, and upper back regions, as reported by 43.40% of the sample. Slight discomfort was reported by participants for the neck (58.30%), shoulder (54.20%), and upper back (51.70%) regions. The lower back region had the most reported cases of moderate to severe discomfort, accounting for 30.00% of participants. Slight interference with work caused by pain was seen in participants reporting MSD of the neck (45.80%), upper back (45.80%), and lower back regions. Substantial work interference due to lower back (18.30%.) and shoulder (10.80%) pains were likewise reported. A complete summary of the MSD is seen in Table 3.

MSD before and during the COVID-19 pandemic lockdown. MSD scores on the CMDQ among participants were compared before and during the pandemic lockdown (Table 4). Overall, there was an increased report of MSD. We found significant differences in CMDQ scores in all regions ($p<0.05$), except for the upper back, knee, and lower leg. During the pandemic lockdown, pain was reported highest for the lower back (6.71 ± 9.48), hip/buttocks (4.98 ± 9.02), and shoulder (4.53 ± 8.26).

Factors associated with MSD during the pandemic. This study looked at the correlation between subjects' characteristics and pandemic work-related conditions with MSD during the pandemic lockdown (Table 5).

A history of pre-pandemic MSD in the same region significantly correlated with MSD across all regions (r_s= 0.53-0.60, p<0.000). Female gender is significantly correlated positively with MSD across all regions (r_s= 0.19 -0.30, p= 0.001-0.04). When looking at weight and BMI, findings point to a positive correlation with upper arm pain/discomfort at (r_s= 0.21, p= 0.02) and (r_s= 0.18, p= 0.01), respectively. Total years of teaching significantly correlated positively with discomfort reported in the upper arm (r_s= 0.222, p= 0.01), hip/buttocks (r_s= 0.23, p= 0.01), and thigh (r_s= 0.19, p= 0.03). Hours spent in front of the computer during the pandemic lockdown has positive linear correlation between pains reported in the following regions: neck (r_s= 0.26, p= 0.004), upper arm (r_s= 0.20, p= 0.02), lower back (r_s=0.32, p<0.000), forearm (r_s= 0.23, p= 0.01), wrist (r_s= 0.31, p<0.000), and thigh (r_s= 0.23, p= 0.01). The duration of teaching hours significantly correlated with lower back pain (r_s= 0.21, p= 0.02). Frequency of exercise was seen to be correlated negatively with hip/buttocks pain (r_s= -0.21, p= 0.023).

Predictors of musculoskeletal discomfort. Significantly correlated factors were placed in a regression equation. MSD during the pandemic lockdown was used as the dependent variable (DV), while participants' characteristics, current work-related conditions, and pre-pandemic MSD were used as independent variables (IV). When >2 factors were found to significantly correlate, a multiple regression analysis was computed. All regions were analyzed except for the upper back, knee, and lower leg, which did not show significant change in pain scores from pre-pandemic and during the pandemic.

Neck Discomfort. Multiple linear regression found statistically significant predictive results (R^2= 2.22, F(3,116)= 13.260, p<0.000), with neck pain before the pandemic contributing statistical significance to the prediction (p<0.000, 95% CI[0.38,0.80]).

Shoulder discomfort. Gender and pre-pandemic shoulder pain were found to have significant predictive factors (R^2= 0.31, F(2,117)= 25.949, p<0.00) with shoulder discomfort before the pandemic contributing statistical significance to the prediction (p<0.000, 95%CI [0.76,1.42]).

Upper arm discomfort. Five factors (gender, weight, BMI, years teaching, hours in front of the computer , and pre-pandemic upper arm pain) were found to significantly predict the IV (R^2= 0.24, F(6,113)= 5.87, p<0.000), with gender (p= 0.05, 95% CI [0.00,3.68]) and pre-pandemic upper arm discomfort (p<0.000, 95% CI [0.32,0.98]) contributing significantly.

Lower back discomfort. Results show that being female, hours in front of the computer, teaching hours, and pre-pandemic lower back pain significantly predicted the DV (R^2= 0.24, F(3,116)= 12.09, p<0.000), with hours in front of the computer (p=0.01, 95% CI [0.80,6.37]) and pre-pandemic lower back discomfort (p<0.000, 95% CI [0.49,1.08]) contributing significantly.

Forearm discomfort. This study factored in gender, hours in front of the computer during the pandemic lockdown, and pre-pandemic symptoms of forearm pain and found significant predictive abilities of these IV (R^2= 0.18, F(3,116)= 8.358, p<0.000), with statistically significant contributions from participant's gender (p= 0.02, 95% CI [0.35,3.74) and pre-pandemic forearm discomfort (p<0.000, 95% CI [0.25,0.84]).

Wrist discomfort. Multiple regression analysis showed that being female, hours in front of the computer during the pandemic lockdown, and pre-pandemic wrist pain had significant predictive abilities (R^2= 0.31, F(3,116)= 17.13, p<0.000), with hours in front of the computer during the pandemic lockdown (p= 0.003, 95% CI [0.66,3.13]), and pre-pandemic wrist pain (p<0.000 [0.55,1.19]) contributing significantly.

Hip/buttocks discomfort. Multiple linear regression showed the association of hip/buttocks discomfort from the participant's gender, years of teaching, frequency of exercise during the pandemic lockdown, and pre-pandemic reported hip/buttocks discomfort, and found statistically significant predictive results (R^2= 0.13, F(4,115)= 4.05, p= 0.02). Only pre-pandemic reported hip/buttocks discomfort (p<0.002, 95% CI [0.22, 0.99]) contributed significantly.

Thigh discomfort. Gender, years of teaching, hours in front of the computer during the pandemic lockdown, and pre-pandemic thigh

pain were predictor variables for thigh pain. The results indicate that these are significant predictive factors (R^2= 0.46, F(4,115)= 23.961, p<0.000), with gender (p= 0.03, 95% CI [0.11,2.23]) and pre-pandemic thigh discomfort (p<0.000, 95% CI [0.7,1.20]) contributing with statistical significance.

DISCUSSION

The shift from face-to-face to online teaching was a sudden transition for which most faculty members were unprepared. The house suddenly became a workplace where any table and chair available was used during online teaching. Although it was a solution to ensure continuity of education, online teaching has caused negative effects on academic professionals' health, including increasing prevalence of musculoskeletal disorders and psychological stress.[6] Our study showed that almost all regions of the body except for the upper back, knee, and leg increased in pain scores during the pandemic. This is similar to several studies stating more areas of the body experienced musculoskeletal discomfort as compared to pre-pandemic.[4,5,6,7] The most significant factors that predict musculoskeletal pain are pre-pandemic discomfort in the same region, being female, and hours in front of the computer.

Results of multiple regression showed pre-existing musculoskeletal discomfort as a significant predictor of all the regions with MSD pain. This is in accordance with the study of Gupta et al., where its association with the current musculoskeletal disorder was X^2 (1, N=276) = 88.99, p= 0.01.[5] Pre-pandemic MSD may cause an increase in pain sensitivity, which might be explained by impairment of the inhibitory systems of the central nervous system and peripheral or central sensitization. Peripheral sensitization produces hyperresponsiveness of the nociceptive system in response to chemical mediators released by nociceptors and non-neuronal cells .[15,16] While central sensitization is an increased responsiveness of the nociceptive neurons in the central nervous system to normal or subthreshold input.[16]

Our study showed that being female is associated with all regions with musculoskeletal pain but is a predictor of musculoskeletal pain in the upper arm and forearm region, similar to the study of Gupta et al. and Yorulmaz et al.[5,6] Generally, females have lesser physical strength and less robust endogenous opioid system compared to males. Furthermore, women are more willing to report pain compared to males.[19,20]

Hours spent in front of the computer is associated with MSD in all regions but are a predictor of musculoskeletal pain in the lower back. Inactivation of lumbar muscles happens when the trunk remains in flexion during prolonged sitting. The deepest core muscles are the multifidus and transversus abdominis, which provide stability of the spine. With muscle inactivation, shearing forces can increase and cause low back pain. Furthermore, muscle inactivation predisposes the lumbar ligaments and intervertebral to more load.[21]

Involvement of exercise and having breaks were not significant factors associated with MSD. In our study, a decrease in exercise involvement was observed; however, no statistical differences were found before and during the pandemic. Increased frequency of breaks during the pandemic was observed, but statistical difference was not seen. In a meta-analysis by Shiri et al., any form of exercise, strengthening, stretching, aerobic, coordination exercises, or a combination of exercises, performed 2 -3 times per week, decreased the risk of low back pain with a relative risk of 0.67 (95% CI: 0.53, 0.85).[22] A systematic review by Waongenngarm et al. showed that active breaks with postural change and/or exercise had a positive impact on low back pain reduction.[23] This was not demonstrated in our study. A possible reason is that 56.7%(n=68) of the participants only had passive breaks where they stood up, left the work area, or sat somewhere. Only 4.2%(n=5) and 15.8% (n=19) performed exercises while sitting or standing.

Limitations. Height and weight were self-determined and could have been underreported. More importantly, only musculoskeletal discomfort was evaluated. The questionnaires did not investigate reasons for the discomfort and psychological stress. Psychological distress

during the pandemic increases the risk of developing musculoskeletal pain. Psychological factors can enhance somatic awareness, anxiety, depression, perceived stress, and catastrophizing.[15] A study by Sutarto et al. showed that lower levels of psychological well-being among 406 Indonesians during the pandemic due to reduced work-life balance led to more upper and lower back symptoms in Indonesia.[17] While a study on 1941 Japanese workers showed that increased psychological stress (adjusted OR 2.16, 95% CI: 1.64–2.84) was associated significantly with pain augmentation.[18]

CONCLUSION

Pain score before and during the pandemic was compared, revealing the prevalence of MSD in the neck, shoulder, and upper back. Factors associated with increased MSD were female gender, longer computer use, and pre-pandemic MSD history, with pre-existing pain being the most common predictor. Although universities are already conducting face-to-face education, some faculty members might still opt to conduct online teaching. They should be made aware of the increased probability of musculoskeletal disorders and university administrators should provide guidelines and policies that will mitigate its occurrence. It will also provide information to other workforce sectors, which still allows a work-from-home set-up even after the COVID-19 pandemic.

Supplementary Files

Supplementary File A. Strobe Checklist

Supplementary File B. Frequency, discomfort, and interference score from Cornell Musculoskeletal Discomfort Questionnaire(CMDQ) of different regions before and during the COVID-19 pandemic

Supplementary File C. Factors associated with MSK-related pain during the COVID-19 pandemic

Individual Author's Contributions

All authors contributed equally.

Disclosure Statement

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Conflicts of interest

The authors CGS and INBG are part of the editorial board of PJAHS.

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