Quality of life and its health and occupational determinants among hospital-based nurses during the COVID-19 pandemic

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Abstract.

BACKGROUND: Nurses worldwide were exposed to increased levels of occupational stress during the COVID-19 pandemic which could have hindered their level of health-related quality of life (HRQoL).

OBJECTIVES: This project investigated HRQoL level in nurses during the COVID-19 pandemic and its health and occupational predictors.

METHODS: A cross-sectional design was adopted and targeted full-time nurses in Jordan. Study collected data included demographics, 12-item Short Form health survey (SF-12) to measure HRQoL, Nordic Musculoskeletal Questionnaire (NMQ), nurses' evaluation of work conditions during COVID-19, and Depression Anxiety Stress Scale (DASS21). Data was analyzed descriptively to summarize main outcome measures and using multiple linear regression model to identify factors significantly associated with HRQoL.

RESULTS: In total 245 nurses successfully completed the survey, 39.6% were males with a mean age of 35 ± 6 years. Participant SF-12 scores were 65.94 ± 17.85 for physical component and 50.09 ± 19.36 mental component. The statistical model significantly explained 53.2% of variance in HRQoL ($r^2 = 0.534$, $F = 57.849$, $p < 0.001$). Better sleep quality self-evaluation was significantly associated with higher HRQoL levels, while increased levels of depression, musculoskeletal pain, and financial burden on family were significantly associated with worse HRQoL level.

CONCLUSION: Jordanian nurses' HRQoL level was relatively low during COVID-19. Sleep quality, mental health status, musculoskeletal health status, and financial status were identified as factors possibly influenced HRQoL among nurses during the COVID-19 pandemic. Nurses' quality of life along with their mental and physical health should be considered by healthcare administrators in the remaining period of COVID-19 and in future similar emergencies.

Keywords: Quality of life, occupational health, COVID-19, depression, stress, musculoskeletal pain

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1. Introduction

With the world's exposure to many health pandemics in recent decades; the awareness of the possibility of sudden occurrence of pandemics, added to that their devastating effects on various levels, was noted [1]. In 2003 the awareness was increased among the public due to the SARS pandemic. Healthcare professionals played a vital role in dealing with SARS [1]. However, nurses were the largest group exposed to infection because the direct contact with the affected patients. This warranted nurses to apply high standards of infection control processes; in which, they are daily spending hours applying and removing protective equipment which add more stress and job load, making their working environment and conditions even more stressful [2].

It is not an easy task to state what the occupational health determents are in a specific work environment for any profession. However, previous studies targeted nurses claimed that this is a multifactorial issue could be influenced by many factors related to occupational health. These potential influencing factors include (but do not exclude) musculoskeletal health, mental health, lifestyle, age and gender, cultural and health beliefs factors, physical activity level, sleep quality, diet, and work environment policies and factors such as work shift and safety precautions [3–8].

The mental disorder that is most related to pandemics is the posttraumatic stress disorder and was previously addressed in the literature [1, 2, 9]. Furthermore, depression, insomnia, stress, low mood, and irritability might be noticed during health pandemics [10]. Many health problems and challenges among nurses have been reported worldwide [11–13]. About more than 50% of European nurses have suffered from musculoskeletal disorders and about 19% have mental disorders [14]. Several reviews targeted nurses have related the mental health factors to work-related musculoskeletal disorders (WMSDs) with a significant linkage [15, 16].

Studies show a relationship between psychosocial factors with low back and neck pain. Psychosocial factors like: low social support, elevated levels of stress, anxiety, along with signs of depression. In addition, other stressors such as time burden, low job control, and unsuitable work shifts were statistically linked with higher levels of nurses' WMSDs [5]. A study conducted on Hong Kong nurses using: Depression, Anxiety, Stress Scale 21 (DASS21), reports overall prevalence of depression as (35.8 %), while anxiety has a comparable percentage of (37.3%) and (41.1%) is the prevalence of stress. Their results show a higher percentage of female nurses with mental health symptoms as compared to males [17]. This increased levels of stress might be work-related as nurses usually work in high-stress settings and environments. Nurses worldwide are facing serious occupational and non-occupational stressors that might negatively impacted their HRQoL and well-being [18]. Out of pandemic situations, studies reported that hospital-based nurses have relatively low HRQoL level, which tended to statistically associate with many demographical and occupational factors [11]. Previous studies suggested that nurses are subjected to high levels of mental health challenges (such as depression, stress, and anxiety), work related musculoskeletal disorders, and sleep quality deficits that might hinder nurses' wellbeing [12, 13, 19].

A limited number of studies have investigated nurses' quality of life along with their associated factors through COVID-19, particularly in Jordan and its adjacent countries. However, most of these studies have either focused on a specific nursing department or have not directly focused on nurses HRQoL level and predictors [20, 21].

This study aimed to study the level of HRQoL in hospital based nurses in Jordan in COVID-19 pandemic. Additionally, the study aimed to identify significant HRQoL predictors out of the collected study variables that included occupational, health, and demographic variables. A secondary aim of this study was to characterize Jordanian nurses' physical and mental health status along with their work-related stress during the COVID-19 pandemic. This study seems warranted and might help in better healthcare planning and management during the remaining period of COVID-19 and other similar future pandemics.

2. Methods

2.1. Design and sample

This study utilized a cross sectional design that was based on an online-survey. The study targeted nurses working as full-time nurses at various hospitals types (governmental and non-governmental) in Jordan. An online survey was prepared and sent as a link to all potential subjects. The online survey via Google forms provides ease in distribution, as responders can respond to it using their smart devices. The

survey started with an introduction about the concept, its importance, and the study consent form.

2.2. Inclusion/exclusion criteria

Inclusion criteria were being a hospital-based nurse in Jordan, aged less than 60 years (nurses' official retirement age at targeted country is 60 years old), and working at least three shifts per week during the pandemic. Exclusion criteria included nurses who being with extended shifts, term use of analgesic medications, and a history of severe mental or physical disorders.

Sample size calculations using G*power software assuming having 15 predictors in the initial multiple linear regression model (before applying the stepwise function), indicated the need of sample of at least 139 to guarantee statistical power of 80% [22]. A total of 245 nurses completed the survey in this study.

2.3. Procedures

The Institutional Review Board (IRB) at Jordan University of Science and Technology reviewed the study for ethical considerations (approval number 127/132/2020). IRB informed consent forms were signed by all participants and no participants received any form of compensation for participating.

2.4. Outcome measures

The questionnaire developed for this study had a section on sociodemographic data included gender, age, smoking, health self-evaluation, diet self-evaluation, work experience, and hospital type. The second section included data on life-style and work stress during COVID-19 collected via a Likert scale specifically designed for this study. Questions in this scale were answered based on a Likert scale from 1 to 5, in which 1 means strongly disagree and 5 means strongly agree. Cronbach's alpha in this study (0.844) indicated high internal consistency for this study. The third section consisted of the study's health outcome measures.

The following outcome measures made up the third section of this study:

Medical Outcomes Study Short Form (SF-12): An assessment tool commonly used for evaluating HRQoL level among various healthy or unhealthy groups. The measure is consisted of a physical component score (PCS) out of 100, and a mental component score (MCS) out of 100 where higher scores suggest better quality of life status [23]. This assessment is considered valid and reliable and widely used in the literature [24].

Depression Anxiety Stress Scale (DASS21): An assessment evaluating presence and severity of mental health symptoms of depression, stress, and anxiety. The tool has 3 sub-scores where the higher the scores, the worse mental symptoms are. After multiplying by 2, scores range between 0 and 42 and the measure cut-off points of mild symptoms are 10 for depression, 8 for anxiety, and 15 for stress. DASS21 proved to be a strongly valid scale and a reliable as Cronbach's alpha coefficients were 0.88 for depression subscale, 0.91 for anxiety subscale, and 0.87 for stress subscale [25, 26].

Nordic Musculoskeletal Questionnaire (NMQ): This is wildly used measure of musculoskeletal disorders (MSDs) and its associated functional deficits in various upper and lower body segments and trunk. The measure captures pain complaints in nine different joints during the past year and the past week along with their functional limitations. The measure can be used in the various occupational groups and has shown good validity and reliability [27].

Finally, pain intensity was assessed using Visual Analog Scale (VAS). This valid and reliable measure scores range between 0 (no-pain) and 10 (the most intense pain) [28].

Literature review and research team collaboration was used to safeguard content validity of the study survey. At the beginning, the preliminary survey version was examined by the stud expert panel and then was evaluated in a pilot study recruited a sample of 10 nurses. All of feedback related to the survey in this pilot study was positive with no difficulties in responding to the survey sections.

2.5. Statistical analysis

Collected data was treated statistically using SPSS software version 23.0 [29]. Mean and standard deviation or frequencies and proportion were used to describe the study main outcome measures. Bivariate correlations (Pearson Correlation) between HRQoL measured by SF12 total scores and potential factors described in the study methods were tested. Only factors with *P* value, constituting the correlation, of less than 0.15 with SF12 total score were included in the regression model. This study employed multiple variable linear regression analysis to spot factors that significantly predict HRQoL level measured by SF12 total score, using a stepwise technique.

Before running the regression analysis, normality and collinearity of the distribution of the collected data were inspected. Normally distributed sample and lack of collinearity are the two conditions to use regression analysis modality; they can be investigated by the variance inflation factor (VIF). In the statistical analysis, $p < 0.05$ was considered a statistically significant point.

3. Results

3.1. Participants' characteristics

Table 1 demonstrates participants' most important demographics and health characteristics. A total of 245 nurses successfully completed the survey; they were 39.6% males with a mean age of 35 ± 6. The distribution across Jordanian work palace types was 35.1% in ministry of health hospital, 19.9% military hospitals, 32.7%, university hospitals, 15.5% private hospitals 14.7% and 2% nongovernmental organization. Jordanian geographical region representations were 53.9% for north, 40.8% for middle, and 5.3% for south.

The total SF-12 score was 56.26 ± 15.95, with a PCS score of 65.94 ± 17.85 and an MCS score of 50.09 ± 19.36, representing borderline physical and mental health problems. The overall depression mean score was 12.29 ± 9.29, anxiety mean score was 8.07 ± 7.61 and stress mean score was 15.4 ± 9.82. According to NMQ, about 52.7% of participant suffered neck pain, 75.5% low back pain and 49% knee pain. While 86.5% complained joint pain that lasted seven days and 62.9% had activity daily living limitation that lasted twelvemonth.

3.2. Nurses' lifestyle during the COVID-19 pandemic

Table 2 shows lifestyle changes during the COVID-19 pandemic. The overall mean working hours before the pandemic was 37 ± 12. Participants agreed that COVID-19 increased the burden of teaching their kids at home with a score of 4 on 5-point Likert scale and about 24.9% reported an increase in the time dedicated for kids' education time. About 37.6 % of participants reported significant weight change during the pandemic. Moreover, 88.2% had irregular or tiring sleeping patterns. Participants slightly agreed

Table 1
Participants' demographics and health characteristics

Characteristic		Mean (±SD) or n (%)
Age in years		35 (±6)
Gender	Male	97 (39.6%)
	Female	148 (60.4%)
Total members at household		5 (±2)
Social status	Single	59 (24.1%)
	Married	186 (75.9%)
Type of employer	Governmental	166 (67.8%)
	Non-governmental	79 (32.2%)
Work place (Jordanian geographical regions)	North	132 (53.9%)
	Middle	105(40.8%)
	South	13 (5.3%)
Smoking cigarette	No	191 (78.8%)
	Yes	54 (22%)
Major	Nurses	204 (85.4%)
	Midwife	35 (14.6%)
Highest degree	Community college	53 (21.6%)
	BCs	177 (72.2%)
	Graduate	15 (6.1%)
VAS body pain		4.41 (±2.75)
DASS21 Depression score		12.29 (±9.29)
DASS21 Anxiety score		8.07 (±7.61)
DASS21 Stress score		15.4 (±9.82)
Total SF-12		56.26 (±15.95)
PCS		65.94 (±17.85)
MCS		50.09 (±19.36)

VAS: Visual Analog Pain Scale, DASS21: Depression Anxiety Stress Scale, SF-12:12-item Short-Form Health Survey, MCS: Mental Component Summary, PCS: Physical Component Summary, BCs: Bachelor of Science.

Table 2
Nurses' lifestyle during COVID-19 pandemic

Lifestyle		Mean (SD) or n (%)
Average sport activity hours per week		1 ($\pm$2)
COIVD-19 increased the financial burden on my family*		3 ($\pm$1)
COVID-19 increased the burden of teaching family kids*		4 ($\pm$1)
COVID-19 is associated with occupational shifts*		3 ($\pm$1)
COVID-19 associated weight change	No change	153 (62.4%)
	Increased	56 (22.9%)
	Decreased	36 (14.7%)
COVID-19 associated change in family care time	No change	62 (25.3%)
	Increased	109 (44.5%)
	Decreased	74 (30.2%)
COVID-19 sleep self-evaluation	Irregular or tiring	216 (88.2%)
	Comfortable	29 (11.8%)
COVID-19 diet self-evaluation	Unhealthy	26 (10.6%)
	Sort of healthy	202 (82.4%)
	Healthy	17 (6.9%).
COVID-19 nursing work was stressful*		3.26 ($\pm$0.86)

*Likert scale: strongly disagree: 1, disagree: 2, neutral: 3, agree: 4, strongly agree: 5.

Table 3
Multivariable regression analysis of health-related quality of life associated factors

Factor	β coefficient	95% Confidence interval		P-value
DASS21 depression score	–0.98	–1.16	–0.81	<0.001
Body pain measured by VAS	–1.14	–1.76	–0.52	<0.001
Sleep self-evaluation	6.71	2.07	11.36	0.005
Financial burden on family	–2.06	–3.54	–0.58	0.007

DASS21: Depression, Anxiety, Stress Scale; VAS: Visual Analog Pain Scale.

(3.26 out of 5) that COVID-19 increased their work stress.

3.3. Nurses HRQoL associated factors

Table 3 shows nurses' HRQoL associated factors during pandemic period. The study regression model explained that 53.4% of variance in quality of life factors ($r^2 = 0.534$, $F = 57.849$, $p < 0.001$).

4. Discussion

This study aimed to identify level of HRQoL along with its associated factors among nurse working in Jordan during the COVID-19 pandemic. Furthermore, the study descriptively demonstrated Jordanian nurses' occupational health determining factors (such mental and musculoskeletal health) along with lifestyle variables (such as sleep and physical activity) in addition to other stressors (financial and work-related) during COVID-19. Overall, participating nurses demonstrated a relatively low level of HRQoL measured by SF-12. Despite HRQoL was never investigated in Jordanian nurses, this

study nurses' HRQoL level COVID-19 is comparatively low considering its level among the adult population worldwide [30]. Furthermore, this current study participants have also showed high levels of adverse musculoskeletal pain, mental health symptoms, work-related and life-style stressors as well.

It is not an easy task to identify hospital based nurses' health and occupational safety determents. However, our previous studies and similar studies in the countries have revealed similar high levels of stressors influenced mental and physical health of various occupational groups in Jordan [10, 31–33]. These physical and mental stressors appeared to have influence when investigating medical professions' occupation groups in Jordan during the COVID-19 pandemic [9, 34].

Consistent with the literature, this study participants' MCS and PCS HRQoL levels were statistically associated with depression, body pain measured by VAS, sleep self-evaluation, and financial burden on nurses' families. These stressors were heavily connected with lower levels of HRQoL out of COVID-19 crisis and were not surprising to be associated with lower levels of HRQoL in our study during the COVID-19 pandemic. Identifying these associ-

ated factors may help to increase understanding of healthcare providers' wellbeing under stressful societal situations similar to COVID-19, which might enhance future emergencies-related healthcare services planning. Up to our knowledge, this is the first in Jordan and probably worldwide investigating HRQoL level among nurses and its predictors during COVID-19.

The current health emergency related to COVID-19 imposes extreme physical and mental stress on many occupational groups [31, 32]. Current COVID-19 reports similarly demonstrated increased mental health stress impacting nurses, physicians, and many other hospital-based personnel [9, 35]. Previously published systematic reviews suggested that physical and psychological factors along with individual factors were statistically linked with increased level of stress among nurses [36]. Furthermore, cultural factors and health beliefs, like fear-avoidance beliefs are also associated with increased levels of stress among nurses [37]. This might suggest having different results across different countries.

Getting exposed to multiple stress related risk factors might increase the risk of developing mental or physical stress among nurses. The profession of nursing is identified in the literature as one of the top stressful jobs [38]. Also, it is possibly one of most professions with highest levels of mental health and emotional stress. This might be explained by working a stressful environment [39]. One study reported that about 35.9% of their nurses participants were found under high-stress level [40]. Another study cited a high prevalence of depression, anxiety, and stress among nurses which were 35.8 % for depression, 37.3% for anxiety, and 41.1% for stress, with prevalence among female higher than male [17]. Whereas, the percentages are lower in the study by Hegney et al. as they reported a percentage of (11.4%) Australian nurses suffered stress, (15.2%) of them suffered from anxiety and (13.6 %) were depressed [38]. A study conducted in Malaysia reports a prevalence of 80% for anxiety with score 16.2, 40.5% for depression with score of 22, and 37.8% for stress with score of 21 [41].

Sleep quality deficits were statistically linked in the literature with many factors related to the environment and several pathological conditions [19, 42]. Factors might be related to sleep disruption included demographics, job demands, and health status [43]. High rate of mental health problem such as affective disturbance or sleep problem have been frequently described [44]. Previous studies have also suggested that sleep quality deficits in nurses might also adversely impact nurses' work performance [45]. Finally, consistent with this study, previous studies showed that fear of infection at healthcare workplace was significantly related to levels of insomnia, stress, and depression [46]. The job stress has the strongest negative effect on nurses HRQoL [14].

Many factors are thought to impact nurses' health and well status; of these are: the personal factors, the factors specific to the job requirements, the factors dictated by the work place and system regulations [47]. Healthcare facilities' administrators, particularly managing nursing workforce, should carefully mentor their nursing staff psychological and physical well-being and attempt reducing burnout related to nursing occupational stress. COVID-19 is an ongoing crises and its potential adverse effects on nurses' well-being might last for long period. Healthcare administrations need to increase adoption of therapeutic interventions aiming at improving nurses' physical and mental health status.

Healthy life-style strategies including improving quality of sleep, level of physical activity, diet quality may enhance nurses physical and mental wellbeing and contribute in a better HRQoL level [48].

The results of this study might be informative to reduce work-related stress challenging hospital-based nurses during similar pandemics and regular circumstances [9, 12, 13, 19]. Musculoskeletal pain challenging nurses might be managed using proper manual handling and ergonomic training and by consulting rehabilitation professionals [49, 50]. A study targeted group of surgeons found that quality of life level was moderate and significantly associated with musculoskeletal pain complaints in health care workers [51]. Mental health symptoms might be managed through providing psychological support interventions [52].

4.1. Limitations and future directions

A larger sample size and a better representation of targeted country nurses could have improved the study. Furthermore, a longitudinal design could have revealed the progressive nature of COVID-19 pandemic related stress imposed on nurses. Adopting an online survey might have impacted the generalizability of this current study results. Furthermore, most of this study data was self-reported. However, the questionnaire was filled out anonymously without imposing any positive or negative consequences on participants. Additionally, the outcome measure-

ments tools were self-reporting. Future studies are advised to suggest and inspect the efficacy of therapeutic interventions aiming at to improving HRQoL among Jordanian hospitals nurses.

5. Conclusion

A relatively low level of HRQoL was identified in full-time Jordanian nurses demonstrated by both physical and mental components scores of SF-12. Furthermore, participating nurses were experiencing high prevalence mental health (depression, anxiety, and stress measured by DASS21) and musculoskeletal pain symptoms measured by NMQ and VAS in COVID-19 pandemic. Furthermore, participating nurses reported high levels of work-related stress during the COVID-19 pandemic. These complaints percentages were high, but not all were significantly associated with participants HRQoL. The study demonstrated that levels depression, body pain measured by VAS, sleep self-evaluation, and financial burden on nurses' families were significantly associated with HRQoL levels among Jordanian nurses during the pandemic. COVID-19 pandemic crisis is the current global health of most concern and studies related to alleviating its negative effects are encouraged. Nursing departments administrators should take the results of this study in their concern to optimize their working environment reducing revealed work-related stressors during future similar pandemics. Experimental studies establishing the efficacy of potential interventions targeting nurses well-being are encouraged in the future.

Ethics statement

All procedures performed in this study were in accordance with the Declaration of Helsinki. The study was approved by the institutional review board of Jordan University of Science and Technology (Approval number 127/132/2020). Written informed consent was obtained from all participants prior to participation.

Conflict of interest

The authors declare no conflict of interest.

References

[1] Marjanovic Z, Greenglass ER, Coffey S. The relevance of psychosocial variables and working conditions in predicting nurses' coping strategies during the SARS crisis: an online questionnaire survey. International Journal of Nursing Studies. 2007;44(6):991-8.

[2] Liu X, Kakade M, Fuller CJ, Fan B, Fang Y, Kong J, et al. Depression after exposure to stressful events: lessons learned from the severe acute respiratory syndrome epidemic. Comprehensive Psychiatry. 2012;53(1):15-23.

[3] Nyantumbu B, Kielkowski D, Rees D. Musculoskeletal disorders in nurses from two hospitals in South Africa: a CUPID study. Occup Environ Med. 2011;68(Suppl 1):A70-A70.

[4] Vargas-Prada S, Serra C, Martínez JM, Ntani G, Delclos GL, Palmer KT, et al. Psychological and culturally-influenced risk factors for the incidence and persistence of low back pain and associated disability in Spanish workers: findings from the CUPID study. Occup Environ Med. 2013;70(1):57-62.

[5] Choobineh A, Movahed M, Tabatabaie SH, Kumashiro M. Perceived demands and musculoskeletal disorders in operating room nurses of Shiraz city hospitals. Industrial Health. 2010;48(1):74-84.

[6] Trinkoff AM, Le R, Geiger-Brown J, Lipscomb J, Lang G. Longitudinal relationship of work hours, mandatory overtime, and on-call to musculoskeletal problems in nurses. American Journal of Industrial Medicine. 2006;49(11):964-71.

[7] Nilsson A, Lindberg P, Denison E. Predicting of pain, disability, and sick leave regarding a non-clinical sample among Swedish nurses. Scandinavian Journal of Pain. 2010;1(3):160-6.

[8] da Costa BR, Vieira ER. Risk factors for work-related musculoskeletal disorders: a systematic review of recent longitudinal studies. American Journal of Industrial Medicine. 2010;53(3):285-323.

[9] Almhdawi KA, Alrabbaie H, Arabiat A, Alhammouri AT, Hamadneh M, Obeidat D, et al. Physicians' Health-Related Quality of Life and Its Associated Factors During COVID-19 Pandemic in Jordan: A Cross-Sectional Study. Evaluation & The Health Professions. 2022;45(1):76-85.

[10] Malkawi SH, Almhdawi K, Jaber AF, Alqatarneh NS. COVID-19 Quarantine-Related Mental Health Symptoms and their Correlates among Mothers: A Cross Sectional Study. Maternal and Child Health Journal. 2020:1-11.

[11] Oyama Y, Fukahori H. A literature review of factors related to hospital nurses' health-related quality of life. J Nurs Manag. 2015;23(5):661-73.

[12] Almhdawi KA, Alrabbaie H, Kanaan SF, Oteir AO, Jaber AF, Ismael NT, et al. Predictors and prevalence of lower quadrant work-related musculoskeletal disorders among hospital-based nurses: A cross-sectional study. J Back Musculoskelet Rehabil. 2020.

[13] Almhdawi KA, Alrabbaie H, Kanaan SF, Alahmar MR, Oteir AO, Mansour ZM, et al. The prevalence of upper quadrants work-related musculoskeletal disorders and their predictors among registered nurses. Work. 2021;68(4):1035-47.

[14] Oyama Y, Fukahori H. A literature review of factors related to hospital nurses' health-related quality of life. Journal of Nursing Management. 2015;23(5):661-73.

[15] Ariëns GA, van Mechelen W, Bongers PM, Bouter LM, van der Wal G. Psychosocial risk factors for neck pain: a systematic review. American Journal of Industrial Medicine. 2001;39(2):180-93.

[16] van der Windt DA, Thomas E, Pope DP, de Winter AF, Macfarlane GJ, Bouter LM, et al. Occupational risk factors for shoulder pain: a systematic review. Occupational and Environmental Medicine. 2000;57(7):433-42.

[17] Cheung T, Yip PS. Depression, anxiety and symptoms of stress among Hong Kong nurses: a cross-sectional study. International Journal of Environmental Research and Public Health. 2015;12(9):11072-100.

[18] Nowrouzi B, Giddens E, Gohar B, Schoenenberger S, Bautista MC, Casole J. The quality of work life of registered nurses in Canada and the United States: a comprehensive literature review. International Journal of Occupational and Environmental Health. 2016;22(4):341-58.

[19] Almhdawi KA, Alrabbaie H, Obeidat DS, Kanaan SF, Alahmar MR, Mansour ZM, et al. Sleep quality and its predictors among hospital-based nurses: a cross-sectional study. Sleep & Breathing=Schlaf & Atmung. 2021.

[20] An Y, Yang Y, Wang A, Li Y, Zhang Q, Cheung T, et al. Prevalence of depression and its impact on quality of life among frontline nurses in emergency departments during the COVID-19 outbreak. Journal of Affective Disorders. 2020;276:312-5.

[21] Nie A, Su X, Zhang S, Guan W, Li J. Psychological impact of COVID-19 outbreak on frontline nurses: A cross-sectional survey study. J Clin Nurs. 2020.

[22] Faul F, Erdfelder E, Buchner A, Lang A-G. Statistical power analyses using G* Power 3.1: Tests for correlation and regression analyses. Behavior Research Methods. 2009;41(4):1149-60.

[23] Kosinski M, Keller SJB, MA: The Health Institute, New England Medical Center. SF-12: How to score the SF-12 physical and mental health summary scales. 1995.

[24] Ware Jr JE, Kosinski M, Keller SD. A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. Medical Care. 1996:220-33.

[25] Lovibond PF, Lovibond SH. The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. Behaviour Research and Therapy. 1995;33(3):335-43.

[26] Almhdawi KA, Mathiowetz V, Al-Hourani Z, Khader Y, Kanaan SF, Alhasan M. Musculoskeletal pain symptoms among allied health professions' students: Prevalence rates and associated factors. Journal of Back and Musculoskeletal Rehabilitation. 2017;30(6):1291-301.

[27] Kuorinka I, Jonsson B, Kilbom A, Vinterberg H, Biering-Sørensen F, Andersson G, et al. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. Applied Ergonomics. 1987;18(3):233-7.

[28] Jensen MP, Karoly P, Braver S. The measurement of clinical pain intensity: a comparison of six methods. Pain. 1986;27(1):117-26.

[29] IBM. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp; 2015.

[30] Mols F, Pelle AJ, Kupper N. Normative data of the SF-12 health survey with validation using postmyocardial infarction patients in the Dutch population. Quality of Life Research : An International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation. 2009;18(4):403-14.

[31] Almhdawi KA, Obeidat D, Kanaan SF, Hajela N, Bsoul M, Arabiat A, et al. University professors' mental and physical well-being during the COVID-19 pandemic and distance teaching. Work. 2021;69(4):1153-61.

[32] Almhdawi KA, Alazrai A, Obeidat D, Altarifi AA, Oteir AO, Aljammal AH, et al. Healthcare students' mental and physical well-being during the COVID-19 lockdown and distance learning. Work (Reading, Mass). 2021;70(1):3-10.

[33] Alhasan M, Abdelrahman M, Alewaidat H, Almhdawi K, Nazzal M. Work-related Stress, Musculoskeletal Disorder Complaints, and Stress Symptoms among Radiographers in the Northern Part of Jordan. Journal of Medical Imaging and Radiation Sciences. 2014;45(3):291-8.

[34] Suleiman A, Bsisu I, Guzu H, Santarisi A, Alsatari M, Abbad A, et al. Preparedness of Frontline Doctors in Jordan Healthcare Facilities to COVID-19 Outbreak. International Journal of Environmental Research and Public Health. 2020;17(9).

[35] Huang JZ, Han MF, Luo TD, Ren AK, Zhou XP. [Mental health survey of medical staff in a tertiary infectious disease hospital for COVID-19]. Zhonghua lao dong wei sheng zhi ye bing za zhi=Zhonghua laodong weisheng zhiyebing zazhi=Chinese journal of industrial hygiene and occupational diseases. 2020;38(3):192-5.

[36] Bernal D, Campos-Serna J, Tobias A, Vargas-Prada S, Benavides FG, Serra C. Work-related psychosocial risk factors and musculoskeletal disorders in hospital nurses and nursing aides: a systematic review and meta-analysis. International Journal of Nursing Studies. 2015;52(2):635-48.

[37] Madan I, Reading I, Palmer KT, Coggon D. Cultural differences in musculoskeletal symptoms and disability. International Journal of Epidemiology. 2008;37(5):1181-9.

[38] Hegney DG, Craigie M, Hemsworth D, Osseiran-Moisson R, Aoun S, Francis K, et al. Compassion satisfaction, compassion fatigue, anxiety, depression and stress in registered nurses in A ustralia: study 1 results. Journal of Nursing Management. 2014;22(4):506-18.

[39] Humpel N, Caputi P. Exploring the relationship between work stress, years of experience and emotional competency using a sample of Australian mental health nurses. Journal of Psychiatric and Mental Health Nursing. 2001;8(5):399-403.

[40] Sukadarin EH, Pim NU, Zakaria J, Deros BM, Syazwani NJMJoHF, Ergonomics. The Prevalence of Work-Related Musculoskeletal Disorders and Stress Level Among Hospital Nurses. 2016;1(1):40-4.

[41] Lan HK, Subramanian P, Rahmat N, Kar PC. The effects of mindfulness training program on reducing stress and promoting well-being among nurses in critical care units. Australian Journal of Advanced Nursing, The. 2014;31(3):22.

[42] Garbarino S, Lanteri P, Durando P, Magnavita N, Sannita WG. Co-morbidity, mortality, quality of life and the healthcare/welfare/social costs of disordered sleep: a rapid review. International Journal of Environmental Research and Public Health. 2016;13(8):831.

[43] Kubota K, Shimazu A, Kawakami N, Takahashi M, Nakata A, Schaufeli WB. Association between workaholism and sleep problems among hospital nurses. Industrial Health. 2010;48(6):864-71.

[44] Chong M-Y, Wang W-C, Hsieh W-C, Lee C-Y, Chiu N-M, Yeh W-C, et al. Psychological impact of severe acute respiratory syndrome on health workers in a tertiary hospital. The British Journal of Psychiatry. 2004;185(2):127-33.

[45] Feleke SA, Mulatu MA, Yesmaw YS. Medication administration error: magnitude and associated factors among nurses in Ethiopia. BMC Nursing. 2015;14(1):53.

[46] Nickell LA, Crighton EJ, Tracy CS, Al-Enazy H, Bolaji Y, Hanjrah S, et al. Psychosocial effects of SARS on hospital staff: survey of a large tertiary care institution. Cmaj. 2004;170(5):793-8.

[47] Kerr M, Laschinger H, Severin C, Almost J, Thomson D, O'Brien-Pallas L, et al. Monitoring the health of nurses in Canada. Retrieved March. 2002;20:2014.

[48] Pedisic Z, Rakovac M, Titze S, Jurakic D, Oja P. Domain-specific physical activity and health-related quality of life in university students. European Journal of Sport Science. 2014;14(5):492-99.

[49] Richardson A, McNoe B, Derrett S, Harcombe H. Interventions to prevent and reduce the impact of musculoskeletal injuries among nurses: A systematic review. Int J Nurs Stud. 2018;82:58-67.

[50] Almhdawi KA, Obeidat DS, Kanaan SF, Oteir AO, Mansour ZM, Alrabbaei H. Efficacy of an innovative smartphone application for office workers with chronic non-specific low back pain: a pilot randomized controlled trial. Clinical Rehabilitation. 2020;34(10):1282-91.

[51] Ghasemi F, Rahmani R, Behmaneshpour F, Fazli BJCP. Quality of work life among surgeons and its association with musculoskeletal complaints. 2021;8(1):1880256.

[52] Botha E, Gwin T, Purpora C. The effectiveness of mindfulness based programs in reducing stress experienced by nurses in adult hospital settings: a systematic review of quantitative evidence protocol. JBI Database of Systematic Reviews and Implementation Reports. 2015;13(10):21-9.