Prevalence of Work-Related Musculoskeletal Disorders among Nurses in Kakamega County, Kenya

Micky Oloo Olutende[1], Anthony Muchiri Wangui[1], David Kaniaru[2], Elizabeth Mse[1]

[1]Department of Health Promotion and Sports Science, Masinde Muliro University of Science and Technology, Webuye, Kenya
[2]Department of Health Professions Education, Masinde Muliro University of Science and Technology, Webuye, Kenya
Email: micky.oloo.mf@gmail.com

Abstract

The objective of the study was to establish the prevalence of work-related musculoskeletal disorders (WRMSD) on nurses' productivity in Kakamega County. The study was a descriptive cross-sectional study and quantitative methods were adopted. The study was carried out in hospitals in Kakamega county Kenya. A self-administered questionnaire (The standardized Nordic questionnaire) was used to gather information from randomly selected nurses (n = 130). Data were presented using descriptive statistics in the form of frequencies and percentages for categorical variables and means and standard deviations for quantitative variables. The Chi-square test of independence analysis was used for the assessment of quantitative variable interrelationships. Significance was considered at p ≤ 0.05. Sociodemographic data and prevalence of work-related musculoskeletal disorders. The majority of nurses were female (76.9%). The average age of the nurses was 35 years and a standard deviation of 8.076 (35 ± 8.07). The majority of nurses was above forty years old (40%) and had a time of employment of between one to five years (49%). The prevalence of body pains investigated was 70.8% in total, 53.8% of the nurses had experienced pain in their necks, 47.7% of the nurses in this study admitted to having experienced pain in their upper back, 38.5% of the nurses agreed that they had pain in both of their hips, thighs or buttocks, 48.5% experienced pain in both of their ankles and feet. The highest prevalence of 12 months period of WMSD in nurses according to body sites in this study was the low back (79.9%), followed by the neck (53.8%), then ankles/feet (48.5%), upper back (47.7%), wrist/hands (46.9%), buttocks and elbow (38.5%) and (30.8%), respectively. Analysis of the region of the body and the pains using the Chi-square test shows that there was a statistically significant association (p < 0.05). All the p-values are 0.00 showing that there is a

strong relationship between all the pains and the effects on work performance among the nurses in the study. The study concludes that over seventy percent of nurses took part in the study reported cases of WRMSD at any of the body parts in the 12 months prevalence. The study recommends changing their working technique, using lifting equipment, interchanging tasks regularly, reducing the excessive number of patients treated in one day, taking breaks, and avoiding awkward cramp positions, repetitive work and strenuous tasks.

Subject Areas

Anatomy & Physiology

Keywords

Prevalence, Work Related Musculoskeletal Disorders, Nurses, Injuries, Occupational Health, Kakamega County, Kenya

1. Introduction

Many people in both developed and developing countries suffer from a variety of work-related musculoskeletal diseases (WRMSDs) (IDCs). When it comes to occupational injuries, IDCs have a particularly acute challenge. Poor working conditions and the lack of an effective program to avoid work-related injuries have resulted in an extremely high prevalence of WRMSD in IDCs (Smith *et al.*, 2004) [1]. Workplace activities such as heavy lifting, repetitive chores, and uncomfortable working postures are established risk factors for WRMSDs; demographic features and psychological factors are also key predictors (Aptel *et al.*, 2002) [2]. The lower back, neck, and shoulders are the most often afflicted body parts by WRMSDs (Leijon *et al.*, 2009) [3]. A majority of workers including nurses, experienced back discomfort, neck pain, and shoulder pain as a consequence of their daily duties (World Health Organization [WHO], 2007) [4]. The WRMSDs are a significant source of impairment in the workplace and a frequent health concern for employees across the globe (WHO, 2007) [4]. Significant human misery and productivity losses are blamed on the WRMSDs. As a consequence, WRMSDs may cause pain, difficulties in executing tasks, and absence from work, among other things. Reduced productivity, increased expenditures on medical care, disruptions to everyday life, and early retirement from the profession are just a few of the other side consequences (Smith *et al.*, 2004 [1]; Leijon *et al.*, 2009 [3]; Holder *et al.*, 2009 [5]).

Pain is the most common symptom associated with WMSDs. In some cases, there may be joint stiffness, muscle tightness, redness, and swelling of the affected areas (Tinubu *et al.*, 2010) [6]. Some workers may also experience sensations of "pins and needles", numbness, skin colour changes and decreased sweating of the hands. The WMSDs may progress in stages from mild to severe. Aching and tiredness of the affected limb occur during the work shift but disap-

pear at night and during days off work. These symptoms are experienced in the first stage and this does not lower the work performance. Aching and tiredness occur early in the work shift and persist at night are felt in the intermediate stage, which reduces the capacity for repetitive work. Aching, fatigue and weakness persisting at rest are felt in the last stage and result in the inability to sleep and perform light duties. Not everyone goes through these stages in the same way (Tinubu *et al.*, 2010) [6]. In fact, it may be difficult to say exactly when one stage ends and the next begins. The first stage of pain is a signal that the muscles and tendons should rest and recover. Otherwise, an injury can become longstanding and sometimes, irreversible. The earlier people recognize symptoms, the quicker they should respond to them (Silverstein *et al.*, 2010) [7].

According to Hoskins (2004) [8], nurses have the greatest prevalence of non-fatal occupational musculoskeletal injuries. According to a number of studies, working in a stressful position at work may lead to musculoskeletal dysfunction or discomfort in a wide range of areas of the body. Negative effects of bad posture will remain unless action is made to identify and correct them. The musculoskeletal systems of employees may benefit from better working postures, which might lead to better management of work output and a decrease in occupational injuries (Trinkoff *et al.*, 2009) [9]. The objective of the study was to establish the prevalence of work-related musculoskeletal disorders (WRMSD) on nurses' productivity in Kakamega County.

2. Methods

This study employed a descriptive cross-sectional research approach. As a fact-finding survey, this is the most preferred sort of research design (Wiegmann *et al.*, 2007) [10]. The study's participants were nurses from private and public hospitals in Kakamega County. Due to a lack of a permission form, several participants were eliminated from the study. All of the participants were made aware of the goal of the research and how to fill out the questionnaire. The informed consent form and questionnaire were completed by those who consented to participate. The surveys were completed in person, allowing participants to ask questions or withdraw from the research at any moment.

Participants and sampling design

In order to establish the sample size, the table of Bartlett *et al.* [11] was employed. This research made use of categorical data assuming alpha values of 0.10, 0.05, or 0.01. According to the chart, a sample size of 130 nurses participated in the research since the margins of error utilized are 0.05. Nurses were the primary focus of this research, which was conducted in both private and public institutions. Nurses at both private and public hospitals in the County were the focus of the study. Purposive sampling was used to identify the hospitals where the study would take place. Randomly chosen nurses from each of the participating hospitals were then surveyed as part of this study's stratified sample procedure. Each hospital had a varied number of nurses engage in the research based on the total

number of nurses in each strata. Only those nurses who chose odd Roman numerals were kept on until the requisite sample size was met at each location. The sample size for each hospital was derived using a ratio based on the sample size for each hospital. Participants received no compensation for their time. To ensure that the research was done in compliance with ethical standards, the University Human Research Ethics Committees approved all study methods and survey instruments.

Protocol

A self-administered questionnaire was delivered randomly to individual nurses and then collected immediately after completion. The following information were acquired; Personal data; age, sex, and length of work. The standardized Nordic questionnaire consists of a general questionnaire and a more detailed body-part-specific questionnaire. The general questionnaire depicts a body map divided into nine anatomic regions and asks about the presence of physical disorders including ache, pain and discomfort, for the past 12 months and in each of the body areas.

Statistical Analysis

SPSS V25 (SPSS Inc., USA) and Excel were used to input and analyze the results of the returned surveys. In the form of frequencies and percentages for categorical variables, as well as means and standard deviations for quantitative variables, descriptive statistics were used. Analyzing quantitative variable interrelationships was done with the Chi-square test of independence. A p-value of 0.05 was judged significant.

3. Results

The vast majority (76.9%) of nurses was female, with only 23.1% being male (Table 1). It was found that nurses were on average 35 years old, with a standard deviation of 8.076 years (35 divided by 8.07). 40 percent of the nurses were over the age of 40 and had worked at the facility for one to five years (49 percent). Here is a breakdown of the results in Table 1.

The prevalence and impact of WMSD on nurses' productivity

The prevalence of body pains investigated was 70.8% in total. The following were the body parts where pain was investigated in the study; neck pain, shoulder pain, elbow pain, wrists/ hands, upper back, lower back, hips, thighs or buttocks, ankles and feet. Regarding Neck Pain, 53.8% of the nurses had experienced pain in their necks compared to 46.2% who affirmed that they had not experienced pain in their necks. Regarding shoulder pain, 48.5% of the nurses in the study had shoulder pains while 51.5% did not experience shoulder pains. Regarding wrist/Hand pains, 46.9% of the nurses in the study agreed that they had pain in their wrists/hands while 53.1% disagreed that they had had pain in their wrists/ hands (Table 2).

Regarding upper back pain, 47.7% of the nurses in this study admitted to having experienced pain in their upper back while 52.3% denied having experienced pain (Table 2). From this study, 76.9% of the nurses agreed that they

Table 1. Sociodemographic characteristics of the respondents.

Demographics		Frequency	Percent
	Male	30	23.1%
Gender	Female	100	76.9%
	Total	**130**	**100%**
	1 - 5 years	64	49.2
	>5 - 10 years	20	15.4
	>10 - 15 years	13	10.0
Time in employment	>15 - 20 years	13	10.0
	>20 years	20	15.4
	Total	**130**	**100%**
	<30 years	29	22.0
	>30 - 35 years	25	19.0
	>35 - 40 years	25	19.0
Age	>40 years	51	40.0
	Total	**130**	**100%**

Table 2. Prevalence of WMSD in the different body regions of the nurses.

Work activities and pain in different body parts	Yes (%)	No (%)	Total (%)
Taking breaks between attending to patients	30 (23.1)	100 (76.9)	130 (100)
Working in a field other than nursing that can cause WMSD	9 (6.9)	121 (93.1)	130 (100)
Diagnosed with any MSDs such as arthritis	0 (0)	130 (100)	130 (100)
Pain experienced in the neck	70 (53.8)	60 (46.2)	130 (100)
Shoulder pain	63 (48.5)	67 (51.5)	130 (100)
Elbow pain	40 (30.8)	90 (69.2)	130 (100)
Wrist/hands	61 (46.9)	69 (53.1)	130 (100)
Upper back	62 (47.7)	68 (52.3)	130 (100)
Lower back	100 (76.9)	30 (23.1)	130 (100)
Both hips/thighs/buttocks	50 (38.5)	80 (61.5)	130 (100)
Both Ankles/feet	63 (48.5)	67 (51.5)	130 (100)

had pain in their lower backs compared to 23.1% who disagreed to having experienced pain in their lower backs. Regarding Hips, Thighs or Buttocks pains, 38.5% of the nurses agreed that they had pain in both of their hips, thighs or buttocks while 61.5% disagreed of having experienced pain in these parts of their

bodies. Nurses who agreed that they had had pain in both of their ankles and feet were 48.5% while those who disagreed were 51.5% (Table 2).

Response on WRMSD and pain control/prevention

According to this study all (100.0%) the nurses who had experienced pain in their necks during and after work took analgesics drugs (Table 3). In general, the 12 months prevalence of work related muscular skeletal disorder among nurses was 70.8% across all the age categories had; neck, shoulder, elbow, wrists, hands, upper back, lower back, hips, thighs, buttocks, ankles and feet pains while 29.2% had not experienced pains in these areas. The highest prevalence of 12 months period of WMSD in nurses according to body sites in this study was the low back (79.9%), followed by the neck (53.8%) then ankles\feet (48.5%), upper back (47.7%), wrist\hands (46.9%), buttocks and elbow (38.5%) and (30.8%), respectively. Analysis of the region of the body and the pains using Chi square test shows that there was statistically significant association ($p < 0.05$). All the p-values are 0.00 showing that there is a strong relationship between all the pains and the effects on work performance among the nurses in the study (Table 3).

4. Discussion

The objective of the study was to establish prevalence and the impact of work-related musculoskeletal disorders on nurses' productivity in Kakamega County. The following were the body parts where pain was investigated in the study; neck pain, shoulder pain, elbow pain, wrists/ hands, upper back, lower back, hips, thighs or buttocks, ankles and feet. The impacts of WMSD on different body parts due to repetitive activities, awkward postures, long working hours, treating excessive number of patients, lifting or transferring dependent patients and inadequate training on injury prevention may lead to pain in different regions of the body. The results of this study concur with a study done in Nigeria which showed that 84.4% of the respondents reported that they had experienced work-related musculoskeletal pain or discomfort at some time in their occupational lives. The respondents reported a 12-month prevalence rate of WMSDs at anybody region to be 78% (Tinubu *et al.*, 2010) [6]. Findings revealed that over half of the nurses had experienced pain in their necks. This shows that neck pain is a very common problem among nursing professionals. Work-related musculoskeletal disorders (WRMSD) of the neck and shoulders are common among nursing personnel and are the second most common WRMSD after low back pain (WHO, 2007) [4]. They make a major contribution to the cost of work-related illness in developed countries in USA, Europe and Australia (Smedley *et al.*, 2008) [12]. Neck WRMSD rate was 36.9% which was almost similar to a United States study (35.1%) (Trinkoff, 2009) [9], but lower than those reported among European and Asian nurses with rates between 40% and 71.6% respectively (Smith 2004) [1]. Akello (2013) [13] in his study at KNH reported that 20.4% suffered from neck and shoulder pains while Tinubu *et al.* (2010) [6] reported a prevalence of 28.0% of neck pain among the nurses.

Table 3. Analysis of pain experienced 3 or more times in the last 12 months.

Pain	Experienced	How did these pains affect your work	Yes (%)	No (%)	p-value
Pain experienced in the neck	Yes	Had to take analgesics	100.0	54.5	0.00
		Had to visit a physiotherapist	0.0	0.0	
		Had had difficulty sleeping	0.0	45.5	
Shoulder pain	Yes	Had to take analgesics	100.0	24.1	0.00
		Had to visit a physiotherapist	0.0	41.4	
Elbow pain	Yes	Had to take analgesics	100.0	57.7	0.00
		Had to visit a physiotherapist	0.0	23.1	
		Had difficulty sleeping	0.0	19.2	
Wrist/hands	Yes	Had to take analgesics	100.0	29.0	0.00
		Had to visit a physiotherapist	0.0	38.7	
		Had difficulty sleeping		32.3	
Upper back	Yes	Had to take analgesics	100.0	26.7	0.00
		Had to visit a physiotherapist	0.0.	40.0	
		Had difficulty sleeping	0.0.	33.3	
Lower back	Yes	Had to take analgesics	76.1	100.0	0.00
		Had to visit a physiotherapist	13.0	0.0.	
		Had difficulty sleeping	10.9	0.0	
Both hips/thighs/buttocks	Yes	Had to take analgesics	100.0	47.6	0.00
		Had to visit a physiotherapist	0.0.	28.6	
		Had difficulty sleeping	0.0	23.8	
Both Ankles/feet	Yes	Had to take analgesics	100.0	24.1	0.00
		Had to visit a physiotherapist	0.0	41.4	
		Had difficulty sleeping	0.0	34.5	
Experienced any of the above in the last 12 months 3 times or more	Below 30 years		100.0	95.0	0.00
	30 - 35 years		100.0	0.0	
	35 - 40 years		100.0	0.0	
	Over 40 years		0.0	5.0	

From the findings, 48.5% of the nurses in the study had shoulder pains. Nurses usually suffer from shoulder pain because of the nature of their work, which involve a lot of lifting of heavy loads, such as transferring patient from one bed to another one. Nurses needs to be train on proper ways of lifting patients or use machinery to reduce these injuries. Popa *et al.* (2010) [14] reported a very low prevalence (12.2%) of shoulder pain among nurses under investigation. The prevalence of elbow pain among the nurses in this study was very low

compared to other WRMSD. Those who had experienced elbow pains were 30.8% while 69.2% had not experienced elbow pains. Tinubu *et al.* (2010) [6] reported a very low prevalence (7.1%) of elbow pain among nurses under investigation. In agreement with the above assertions, sleeping problems and somatic symptoms such as headache and stomach ache also occurred among Swedish emergency care personnel. These psychosomatic disorders among emergency nurses have been attributed to work-time demands (Adriaenssens *et al.*, 2011) [15]. Regarding wrist/Hand pains, 46.9% of the nurses in the study agreed that they had pain in their wrists/hands while 53.1% disagreed that they had had pain in their wrists/hands (Table 2). The results of this study do not concur with that of Inyang *et al.* (2007) [16] who reported a very low prevalence (16.2%) of wrists/Hand pain among nurses under investigation. Wrist/ hands are used to perform almost all function by nurses, for instance carrying out injection procedures, dressing, transferring and lifting of patients from one bed and many others and hence the nurses are likely to experience this pain though. Regarding upper back pain, 47.7% of the nurses in this study admitted to having experienced pain in their upper back. Since nurses carry out most of their work procedures with twisted motion and poor posture doing it over and over, this is the leading cause of upper back pain. It is very common for a nurse to injure their upper back when carrying patients, bending or twisting. The study observed that the nurses were assuming twisted and poor posture while carrying out their duties. Sitting at a poor designed chair for a prolonged time can cause upper back muscles to tighten and become stiff, which is very common for nurses since they are not provided with ergonomically designed chairs to suit their work as observed in the current study.

From this study, 76.9% of the nurses agreed that they had pain in their lower backs. The high incidence of Low Back Pain (LBP) may be caused by nurses spending long periods of time standing, lifting and moving of patients. Work related musculoskeletal disorders and in particular low back pain (LBP), pose a major health and socioeconomic problem in modern society (WHO, 2007) [4]. It has been shown that 60% - 80% of the general population suffers from LBP at some time during their lives. Among nurses the lifetime prevalence was found to be slightly higher, varying between 56% and 90% (Knibbe, 1996) [17]. Low Back Pain (LBP) is a regular occupational problem for nurses worldwide and has been previously reported at rates between 45% in England (Smedley *et al.*, 2008) [12], 63% in Australia (Lusted, 2009) [18] and 64% in Sweden (Josephson, 1997) [19]. Research from Hong Kong and China has also shown that LBP may affect between 40.6% (Yip, 2001) [20] and 56% (Smith, 2004) [1] respectively. African studies report LBP rates between 44.1% and 79.4% (Fabunmi, 2008 [21]; Tinubu, 2010 [6]). Regarding Hips, Thighs or Buttocks pains, 38.5% of the nurses agreed that they had pain in both of their hips, thighs or buttocks. Sitting on poorly designed chairs might be the leading cause of hips, thighs or buttocks. Lockley *et al.* (2007) [22] in their study reported a very low prevalence (3.4%) of Hips, Thighs or Buttocks pains. According to this study all the nurses who had expe-

rienced pain in their necks during and after work took analgesics drugs. A similar study by Lambert, (2009) [23] showed that of all the respondents with WMSDs, only 30.3% reported that they had treated themselves or had sought treatment from other health practitioners for WMSDs. Fabunmi (2008) [21] in another study showed that the respondents who reported WMSDs, a variable number reported having visited a health practitioner for treatment, with 40% of those with shoulder, 60.0% of those with upper back, 40.4% of those with low back, 50.0% of those with wrists/hands, 25.0% of those with knees, and 25.0% of those with ankles/feet problems respectively (Fabunmi, 2008) [21]. Workers performing strenuous work are often advised to prevent problems and to cope with musculoskeletal symptoms by changing their working technique, using lifting equipment, taking breaks and avoiding strenuous work tasks (King, 1993 [24]; Lambert, 2009 [23]; Vilkari, 1997 [25]). This is also similar to the submission of Linton *et al.* (2011) [26] on methods for fostering effective coping strategies of WMSD among nurses.

Findings revealed that the 12 months prevalence of work related muscular skeletal disorder among nurses was seventy percent across all the age categories had; neck, shoulder, elbow, wrists, hands, upper back, lower back, hips, thighs, buttocks, ankles and feet pains. Compared to another study which was carried out in Nigeria by Tinubu *et al.* (2010) [6] the 12-months prevalence rate of WMSD at anybody region was 78%. The WMSD occurred mostly in low back (44.1%), neck (28.0%) and knees (22.4%). The results of this study shows clearly that majority of nurses had experience WMSD and this is an indication that urgent measures of prevention need to be put in place to reduce the high prevalence of the disorder. It also reveals that WMSD is major challenge affecting nurses in Africa (WHO, 2007). The highest prevalence of 12 months period of WMSD in nurses according to body sites in this study was the low back (79.9%), followed by the neck (53.8%) then ankles\feet (48.5%), upper back (47.7%), wrist\hands (46.9%), buttocks and elbow (38.5%) and (30.8%), respectively. Previous studies conducted in other countries have revealed various rates of work-related low back pain (LBP) in nurses, for instance in Nigeria 79.4%, Sweden 64.0%, Australia 59.0%, England 45.0%, France 41.1%, USA 29.0% and Korea 19.8% (Knibbe, 2009) [17].

5. Conclusion & Recommendation

The study concludes that nurses who took part in the study generally reported cases of WRMSD at various body parts in the 12 months, with the low back pain leading. This shows that nursing as a profession is a risk factor for WRMSD although there could be confounders. For the sake of preventing accidents, the researchers say that nurses should be given instruction on how to properly carry and move patients and other objects. It's also a good idea to keep things fresh by switching up their working methods, making frequent shifts between different activities, and cutting down on the number of patients they see in a single day.

Conflicts of Interest

The authors declare that they have no competing interests.

Authors & Contributions

Micky Olutende Oloo, Anthony Muchiri and Dr. David Kaniaru conceived the paper, designed and performed the study. Micky Olutende Oloo contributed to the analysis software and analyzed the data. Dr. Elizabeth Mse was the paper's peer reviewer. All authors read and approved the final manuscript.

Disclaimer

The findings and conclusions presented in this manuscript are those of the authors and do not necessarily reflect the official position of Masinde Muliro University.

References

[1] Smith, D.R., Wei, N., Kang, L., and Wang, R.S. (2004) Musculoskeletal Disorders among Professional Nurses in Mainland China. *Journal of Professional Nursing*, **20**, 390-395. https://doi.org/10.1016/j.profnurs.2004.08.002

[2] Aptel, M., Aublet-Cuvelier, A. and Cnockaert, J. (2002) Work Related Musculoskeletal Disorders of the Upper Limb. *Joint Bone Spine*, **69**, 546-555. https://doi.org/10.1016/S1297-319X(02)00450-5

[3] Leijon, M., Hensing, G. and Alexanderson, K. (2009) Gender Trends in Sick Listing with Musculoskeletal Symptoms in a Swedish County during a Period of Rapid Increase in Sickness Absence. *Scandinavian Journal of Social Medicine*, **24**, 56-68.

[4] WHO (2007) Global Goals for Occupational Health and Safety. Federation Health Safety Internationale. *International Archives of Occupational and Environmental Health*, **32**, 74-77.

[5] Holder, N., Clark, J., Di Blasio, J., Hughes, C., Schrpf, J., Harding, L. and Shepard, K. (2009) Cause, Prevalence, and Response to Occupational Musculoskeletal Injuries Reported by Physical Therapists and Physical Therapist Assistants. *Physical Therapy*, **79**, 45-52. https://doi.org/10.1093/ptj/79.7.642

[6] Tinubu, M.S., Bolanle, C.E., Mbada, A.L., Oyeyemi and Ayodele, A.F. (2010) Work-Related Musculoskeletal Disorders among Nurses in Ibadan, Southwest Nigeria: A Cross-Sectional Survey. *BMC Musculoskeletal Disorders*, **11**, Article No. 12. https://doi.org/10.1186/1471-2474-11-12

[7] Silverstein, B.A., Fine, L.J. and Armstrong, T.J. (2010) Occupational Factors and Carpal Tunnel Syndrome. *American Journal of Industrial Medicine*, **11**, 343-358. https://doi.org/10.1002/ajim.4700110310

[8] Hoskins, A. (2004) Occupational Injuries, Illnesses, and Fatalities among Nursing, Psychiatric, and Home Health Aides, 1995-2004.

[9] Trinkoff, A.M., Lipscomb, J.A., Geiger-Brown, J. and Storr, C.L. (2009) Musculo-Skeletal Problems in Registered Nurses. *American Journal of Preventive Medicine*, **24**, 270-275. https://doi.org/10.1016/S0749-3797(02)00639-6

[10] Wiegmann, D.A., Thaden, T.L.V. and Gibbons, A.M. (2007) A Review of Safety Culture Theory and Its Potential Application to Traffic Safety. https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.170.2219&rep=rep1&typ

e=pdf

[11] Bartlett, J.E., Kotrlik, J.W. and Higgins, C.C. (2001) Organizational Research: Determining Appropriate Sample Size in Survey Research. *Learning and Performance Journal*, **19**, 43-50.

[12] Smedley, J., Egger, P., Cooper, C. and Coggon, D. (2008) Manual Handling Activities and Risk of Low Back Pain in Nurses. *Occupational and Environmental Medicine*, **52**, 160-163. https://doi.org/10.1136/oem.52.3.160

[13] Akello, J.M. (2013) Analysis of Musculoskeletal Disorders amongst Nurses: A Case Study of Kenyatta National Hospital. Master of Science in Occupational Safety and Health in the Jomo Kenyatta University of Agriculture and Technology.

[14] Popa, F., Raed A. and Purcarea, V. (2010) Occupational Burnout Levels in Emergency Medicine: A Nationwide Study and Analysis. *Journal of Medicine and Life*, **3**, 207-215.

[15] Adriaenssens, J., De gucht, V., Dan der doef, M. and Maes, S. (2011) Exploring the Burden of Emergency Care: Predictors of Stress-Health Outcomes in Emergency Nurses. *Journal of Advanced Nursing*, **6**, 1317-1328. https://doi.org/10.1111/j.1365-2648.2010.05599.x

[16] Inyang, M. (2007) Health and Safety Risks amongst the Municipal Solid Waste Collectors in Port Harcourt Metropolis of the Niger Delta Region of Nigeria. *International Conference Waste Management, Environmental Geotechnology and Global Sustainable Development*, Ljubljana, 28-30 August 2007, 57.

[17] Knibbe, J. and Friele, R. (2009) Prevalence of Back Pain and Characteristics of the Physical Workload of Community Nurses. *Ergonomics Journal*, **39**, 186-198. https://doi.org/10.1080/00140139608964450

[18] Lusted, M.J., Carrasco, C.L., Mandryk, J.A. and Healey, S. (2009) Self-Reported Symptoms in the Neck and Upper Limbs in Nurses. *Applied Ergonomics*, **27**, 381-387. https://doi.org/10.1016/S0003-6870(96)00030-0

[19] Josephson, M., Lagerstrom, M., Hagberg, M. and Wigaeus, H.E. (1997) Musculoskeletal Symptoms and Job Strain among Nursing Personnel: A Study over a Three Year Period. *Occupational and Environmental Medicine*, **54**, 681-685. https://doi.org/10.1136/oem.54.9.681

[20] Yip, Y.B. (2001) A Study of Work Stress, Patient Handling Activities and the Risk of Low Back Pain among Nurses in Hong Kong. *The Australian Journal of Advanced Nursing*, **36**, 796-804. https://doi.org/10.1046/j.1365-2648.2001.02037.x

[21] Fabunmi, A.A., Oworu, J.O. and Odunaiya, N.A. (2008) Prevalence of Musculoskeletal Disorders among Nurses in University College Hospital, Ibadan. *West African Journal of Nursing*, **19**, 21-25.

[22] Lockley, S.W., Barger, L.K., Ayas, N.T., Rothschild, J.M., Czeisler, C.A. and Landrigan, C.P. (2007) Effects of Health Care Provider Work Hours and Sleep Deprivation on Safety and Performance. *Joint Commission Journal on Quality and Patient Safety*, **33**, 7-18. https://doi.org/10.1016/S1553-7250(07)33109-7

[23] Lambert, V.A. (2009) Nurses' Workplace Stressors and Coping Strategies. *Indian Journal of Palliative Care*, **14**, 38-44. https://doi.org/10.4103/0973-1075.41934

[24] King, P.M. (1993) Back Injury Prevention Programs: A Critical Review of the Literature. *Journal of Occupational Rehabilitation*, **3**, 145-158. https://doi.org/10.1007/BF01078284

[25] Viikari, J.E. (1997) The Scientific Basis for Making Guidelines and Standards to Prevent Work-Related Musculoskeletal Disorders. *Ergonomics*, **40**, 1097-1117.

https://doi.org/10.1080/001401397187630

[26] Linton, S.J., Kamwendo, K. and Lambert, C.E. (2011) Low Back Schools: A Critical Review. *Physical Therapy*, **67**, 1375-1383. https://doi.org/10.1093/ptj/67.9.1375