



Risk Factors for Work-Related Musculoskeletal Disorders among Nurses in Kakamega County Kenya

Micky Olutende¹, Issah W. Kweyui¹, Maximilla Wanzala², Elizabeth Mse¹

¹Department of Health Promotion and Sports Science, Masinde Muliro University of Science and Technology, Kakamega, Kenya

²Department of Public Health, Masinde Muliro University of Science and Technology, Kakamega, Kenya

Email: micky.oloo.mf@gmail.com

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Abstract

Work related musculoskeletal disorders (WRMSDs) are injuries affecting the connective tissues of the body. They are leading causes of occupational injury and disability in the world. In Kenya, nurses are exposed to work-related musculoskeletal disorders because of long hours of static work with awkward postures, heavy load lifting and repetitive movement. The objective of the study was to investigate the risk factors for work-related musculoskeletal disorders among nurses 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 was used to gather information from randomly selected nurses ($n = 130$). Data was presented using descriptive statistics in the form of frequencies and percentages for categorical variables and means and standard deviations for quantitative variables. Chi-square test of independence analysis was used for the assessment of quantitative variable interrelationships between Sociodemographic data and risk factors for work-related musculo-skeletal disorders. Significance was considered at $p \leq 0.05$. Majority of nurses were female (76.9%). The average age of the nurses was 35 years and standard deviation of 8.076 (35 ± 8.07). Majority of the nurses were above forty years old (40%) and had a time of employment of between one to five years (49%). Findings showed that only 3.1% of the nurses had no problem when performing the same task over and over, 76.9% had major problems when attending to high number of patients and performing manual orthopedic technique. In addition, 81.5% had major problem when they did not have a pause or break. On poor and cramped positions, 1.5% of the nurses in the study had no problem when working in awkward and cramped position. Regarding work schedule, only 26.9% of the nurses had minimal or moderate problems when work schedule (overtime, irregular shifts and length of

workday) was extended. There was significant association between not having enough breaks or pauses during working hours and the WRMSD among the study participants. There was significant association between working in awkward and cramped position and the WRMSD among the study participants. There was significant association between working while injured or hurt and the WRMSD among the study participants ($p < 0.05$). On working while injured or hurt, 6.2% of nurses had no problem when continuing to work while injured or hurt. The study concludes that working in the same positions for long periods, treating a high number of patients and carrying or transferring dependent patients were risk factors of WRMSD identified. The study recommends change on their working technique, using lifting equipment, interchange task regularly, to reduce the excessive number of patients treated in one day, take breaks, and avoid awkward cramp position, repetitive work and strenuous tasks.

Subject Areas

Global Health, Public Health

Keywords

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

1. Introduction

The nursing profession is a very demanding job, both physically and emotionally. Nurses are exposed to poor working condition for instance, stressful posture as a result of the chairs used in the selected hospitals that are not ergonomically designed and hence exposing the nurses to body problems for instance back ache among other body pains. Work-related musculoskeletal disorder (WRMSD) is a disorder that affects the tendons, muscles, joints, peripheral nerves, intervertebral discs and vascular system, resulting from work activities which are frequent and repetitive, or activities with awkward postures. Poor working conditions and the absence of an effective work injury prevention program in high income countries have resulted in a very high rate of WRMSD (Holder *et al.*, 2009) [1]. Risk factors of WRMSDs are known to include workplace activities such as heavy load lifting, repetitive tasks and awkward working postures, while demographic characteristics and psychosocial factors are also known to be important predictive variables. Exposure to risk factors for WRMSDs is likely to result from patient care activities that include lifting patients, transferring patients and the performance of manual therapy. Each activity involves the application of relatively high levels of force and each activity may have to be performed in hazardous postures. Patient handling has been consistently associated with WMSD in nurses and biomechanical studies have demonstrated very high associated loads. Nurses have one of the highest rates of nonfatal occupational

musculoskeletal injuries (Hoskins, 2004) [2]. The need to improve working posture has been documented in a number of studies which have shown a relation between stressful postures at work and functional disturbance or pain in various parts of the musculoskeletal system. The effect of poor postures will continue unless proactive steps are taken to evaluate and reduce the problem. More suitable working postures may have a positive effect on workers' musculoskeletal systems and may allow for more effective control of work performance and reduction in the number of occupational injuries (Trinkoff *et al.*, 2009) [3].

Hazards are best eliminated at the source. This is a fundamental principle of occupational health and safety. In the case of WMSDs, the prime source of hazard is the repetitiveness of work. Other components of work such as the applied force, fixed body positions and the pace of work requiring repetition of the same movements over and over again, are also contributing factors to WMSDs. Therefore, the main effort to protect workers from WMSDs should focus on avoiding repetitive patterns of work through job design which may include mechanization, job rotation, job enlargement and enrichment or teamwork (NIOSH, 2007) [4]. Where elimination of the repetitive patterns of work is not practical, prevention strategies involving workplace layout, tool and equipment design as well as work practices should be considered. One way to eliminate repetitive tasks is to mechanize the job (Inyang, 2007) [5]. Where mechanization is not feasible or appropriate, other alternatives should be explored as much as possible when available. Job rotation is one possible approach. It requires workers to move between different tasks, at fixed or irregular periods of time. But it must be a rotation where workers do something completely different (Retsas *et al.*, 2009) [6]. Different tasks must engage different muscle groups in order to allow recovery for those already strained. However, job rotation alone will not be effective in reducing WMSDs if not combined with the proper design of workstations. And it will not be effective while the high pace of work persists (NIOSH, 2007 [4]; Retsas *et al.*, 2009 [6]). Considering the significance of WRMSDs as a common problem in the nursing profession, the negative impact on nurses and the major role the nurses' play in hospitals. Therefore, the purpose of the study was to investigate the risk factors for work related musculoskeletal disorders among nurses in Kakamega county.

2. Methods

A descriptive cross-sectional research design was used in this study. This is because the research was a fact-finding survey and this type of research design is the most recommended (Wiegmann *et al.*, 2007) [7]. Nurses working at selected private and public hospitals in Kakamega County took part in the study. Participants were excluded because of an incomplete questionnaire and others due to lack of a consent form. The purpose of the study and the procedures of the questionnaire were explained to the participants. Those who agreed to participate completed an informed consent form and the questionnaire. The participants completed the questionnaires in person enabling them to ask questions or with-

draw from the study at any time during the data collection.

2.1. Participants and Sampling Design

Bartlett, Kotrlik, & Higgins (2001) [8] table was used to determine the sample size. Categorical data which assume alpha levels of 0.10, 0.05, or 0.01 was used in this study. The margins of error used in the table are 0.05 (Bartlett, Kotrlik, & Higgins (2001) [8]), hence from the table a sample size of 130 nurses participated in the study. The study was based in both private and public hospitals and targeted the nurse's population. The target population was the nurses working in both private and public hospitals in the County. Identification of the hospitals in which to carry out the research was identified using purposive sampling. Stratified sampling method was used in this study; whereby the selected hospitals each made a stratum, then nurses were picked randomly from each hospital to participate in the study. In each hospital different number of nurses was selected to participate in the study depending on the total population of nurses per stratum. Nurses were assigned roman numbers randomly and those who picked odd numbers were selected until the required sample size per site was achieved. A ratio was used to get the sample size for each hospital guided by the sample size determined for each hospital. No incentive was provided to participants. All study protocols and the survey instrument were approved by the University Human Research Ethics committees and conducted in accordance with the ethical principles of the Declaration of Helsinki.

2.2. Protocol

A self-administered questionnaire was distributed randomly to individual nurses and then collected immediately after completion. The following information were gathered; Personal data; age, sex, and duration of employment. The questionnaire also had a section that assessed risk factors for WRMSD.

2.3. Statistical Analysis

Data from returned surveys was entered into, and analyzed, using SPSS V25 (SPSS Inc, USA) and Excel. Data was presented using descriptive statistics in the form of frequencies and percentages for categorical variables and means and standard deviations for quantitative variables. Chi-square test of independence analysis was used for the assessment of quantitative variable interrelationships. Significance was considered at $p \leq 0.05$.

3. Results

Majority of nurses were female (76.9%) while male nurses were few (23.1%) (Table 1). The average age of the nurses was 35 years and standard deviation of 8.076 (35 ± 8.07). Majority of the nurses were above forty years old (40%) and had a time of employment of between one to five years (49%). Table 1 below shows a summary of the findings.

Risk Factors Contributing to Development of WMSD

On performing same task repeatedly, 3.1% of the nurses had no problem when performing the same task over and over, 23.1% had minimal or moderate problem while 73.8% had major problem when doing that (**Figure 1**)

The study showed that, 3.8% of the nurses were found to be having no problem, 19.2% had minimal or moderate problem while 76.9% had major problems when attending to high number of patients and performing manual orthopedic technique, respectively in a single day (**Table 2**).

Table 1. Sociodemographic characteristics of the respondents.

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

Table 2. Treating high number of patients/performing manual orthopedic technique.

Factors contributing to development of WMSD	N P (%)	M or M (%)	M P (%)	p-value
Treating excessive number of patients in one day	5 (3.8)	25 (19.2)	100 (76.9)	0.00
Performing manual orthopedic technique	6 (4.6)	52 (40.0)	72 (55.4)	

Key: NP- No problem, M or M-Minimum or Moderate problem, M P- Major problem.

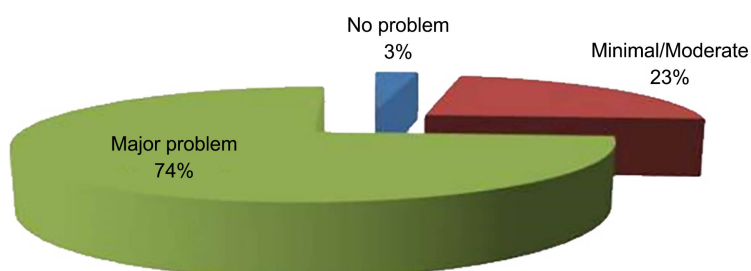


Figure 1. Performing the same task over and over again.

Regarding pausing or having enough breaks during working hours, 18.5% of the nurses in the study had minimal or moderate problem when they did not have enough breaks or pause during working hours while 81.5% had major problem when they did not do that (pause or break) as shown in **Table 3**. There was significant association between not having enough breaks or pauses during working hours and the WMSD among the study participants ($p < 0.05$). On poor and cramped positions, 1.5% of the nurses in the study had no problem when working in awkward and cramped position, 23.1% had minimal or moderate problem while 75.4% had major problem when doing that (**Table 3**). There was significant association between working in awkward and cramped position and the WMSD among the study participants ($p < 0.05$). Of the nurses who participated in the study, 4.6% of them had no problem when bending or twisting their back in awkward way on the line of their duties, 26.2% had minimal or moderate problem while 69.2% had major problem when doing that (**Table 3**).

On working while injured or hurt, 6.2% of nurses had no problem when continuing to work while injured or hurt, 26.2% had minimal or moderate problem while 67.6% had major problem when doing that (**Table 4**). The injury can extend depending on the nature of the work and its position in the body. There was significant association between working while injured or hurt and the WMSD among the study participants ($p < 0.05$). Regarding fall or unanticipated sudden movement of patients, 3.1% of the nurses had no problem, 26.2% had minimal or moderate problems while 70.8% had major problems when these events occurred (**Table 4**). There was statistically significant association between unanticipated sudden movements or fall of patients and development of WMSD among the nurses ($p = 0.00$). Of those assisting patients during gait activities, 3.1% of the nurses had no problem, 26.2% had minimal or moderate problems while 70.8% had major problems when these events occurred (**Table 4**). There was statistically significant association between assisting patients during gait activities and development of WMSD among the nurses ($p = 0.00$).

Regarding work schedule, 26.9% of the nurses had minimal or moderate problems when work schedule (overtime, irregular shifts and length of workday) was extended while 73.1% had major problems when these long work schedules (**Table 5**). There was significant association between irregular work schedule and job satisfaction among the study participants ($p < 0.05$). Regarding training on injury preventions, 1.5% of the nurses had no problem with inadequate training on injury prevention, 5.4% had minimal or moderate problems while 93.1% had major complain that they had little knowledge on injuries prevention techniques because most of them were not trained on injury prevention measures at work place. There was significant association between inadequate training on injury preventions and the WMSD among the study participants ($p < 0.05$).

Table 3. Factors contributing to development of WRMSD.

Factors contributing to development of WMSD	N P (%)	M or M (%)	M P (%)	p-value
Not enough breaks or pause during working hours	0 (0)	24 (18.5)	106 (81.5)	0.00
Awkward and cramped position	2 (1.5)	30 (23.1)	98 (75.4)	
Working in the same position	0 (0)	14 (10.8)	116 (89.2)	
Bending or twisting your back in awkward way	6 (4.6)	34 (26.2)	90 (69.2)	

Key: NP- No problem, M or M-Minimum or Moderate problem, M P- Major problem.

Table 4. Working while injured, assisting/transferring patients and carrying heavy equipment.

Factors contributing to development of WMSD	N P (%)	M or M (%)	M P (%)	p-value
Continuing to work while injured or hurt	8 (6.2)	34 (26.2)	88 (67.6)	0.00
Lifting or transferring dependent patient	0 (0)	28 (21.5)	102 (78.5)	
Heavy material/equipment	2 (1.5)	22 (16.9)	106 (81.5)	
Sudden movement or fall of patient	4 (3.1)	34 (26.2)	92 (70.8)	
Assisting patient during gait activities	2 (1.5)	42 (32.3)	86 (66.2)	

Key: NP- No problem, M or M-Minimum or Moderate problem, M P- Major problem.

Table 5. Inadequate training and work schedule contributing to WRMSD.

Factors contributing to development of WMSD	N P (%)	M or M (%)	M P (%)	P value
Sudden movement or fall of patient	4 (3.1)	34 (26.2)	92 (70.8)	0.00
Work schedule	0 (0)	35 (26.9)	95 (73.1)	
Inadequate training on injury prevention	2 (1.5)	7 (5.4)	121 (93.1)	

Key: NP- No problem, M or M-Minimum or Moderate problem, M P- Major problem.

4. Discussion

The objective of the study was to investigate the risk factors for work-related musculoskeletal disorders among nurses in Kakamega county. The study found that 73.8% had major problem while performing same task repeatedly. This clearly indicates that performing a given task over and over again is a major cause of WRMSD among nurses. Preventative measure needs to be put in place to reduce the risk of this disorder such as job rotation and taking breaks between shifts. Nurses usually perform their daily task for instance, carrying out injection procedures, taking weights and body measurements doing it over and over as observed in this study. These are related to WMSD especially if it done in an awkward/poor posture. Lifting patients in bed, transferring patients out of bed and lifting patients from the floor were the job activities most commonly re-

ported as sources of back pain among nurses (Smedley *et al.*, 2008) [9]. The study showed that, 76.9% had major problems when attending to high number of patients and performing manual orthopedic technique, respectively in a single day. There was significant association between treating excessive number of patients and performing manual orthopedic technique. Treating excessive number of patients is a risk factor exposing nurses to WRMSD. It is the responsibility of the hospitals to ensure that they employ adequate number of nurses to serve the increasing number of patients. Most hospitals especially public hospitals attend to a large number of patients in the county. In contrary to that, the number of nurses employed in these hospitals is usually very low and hence nurses are forced to work for long shifts seeing a lot of patients at the end of a single day. Performing manual orthopedic technique was a risk factor exposing nurses to WRMSD. Manual orthopedic technique usually take long hours and it involve a lot of bending and awkward postures to carry out these procedures hence prone to causing WRMSD among the nurses. Patients are often at some degree of dependence and can offer limited, if any, levels of assistance in moving themselves (Nelson, 2003) [10] or may have limited ability to comprehend instructions and to cooperate hence predisposing nurses to WRMSD. These findings are consistent with previous reports indicating manual patient handling, transferring or moving as important predictors of musculoskeletal disorders and low back pain among nurses (Smith & Leggat, 2004 [11]; Yip, 2001 [12]). Almost on daily basis a nurse has to lift and transfer patients manually and this is the leading cause of LBP among the nurses. Lack of equipment like hoists and mechanical lifts forced the nurses to lift the patients manually. Garg *et al.* (1991) [13] and Daynard *et al.* (2001) [14] also concur that the availability of mechanical devices has a positive impact on the health of the worker. High risk patient handling tasks vary according to clinical settings. Wilkinson *et al.* (1992) [15] implicated lifting patients especially the confused ones as the most common mechanism for musculoskeletal disorders among nurses because they are unable to support themselves.

From the findings, almost all procedures carried out by nurses in Hospitals involve carrying, lifting or moving heavy materials or equipment. For instance, transferring patients or changing dependent patients. It is very difficult for nurses with low weight to lift heavy weight patients or equipment. At the end of the shift nurse will have used a lot of energy and strain their bodies. Nurses routinely perform activities that require lifting heavy loads, lifting patients, working in awkward postures, and transferring patients out of bed and from the floor. These work tasks put nurses at high risk for acute and cumulative WRMSDs (Silverstein *et al.* 2010) [16]. Munabi *et al.* (2014) [17] reported that pushing and pulling of heavy load mostly affected the neck, elbows and the lower back. This differed with Smedley *et al.* (2003) [18] who observed that pushing/pulling seemed to be harder on subjects' shoulders than on their backs. Regarding pausing or having enough breaks during working hours, 81.5% had major problem when they did not pause or break. This risk factor contributes to high pre-

valence rate of WRMSD among nurses and hence is mandatory for hospitals administrator to introduce tea, lunch and nap break during night shift. There was significant association between not having enough breaks or pauses during working hours and the WRMSD among the study participants. Breaks also improve nurses' concentration while carrying out their procedures and reduce the level of making errors during operations. Since majority of nurses have a lot work load to cover and seeing a lot of patients in a single long shift, because of under staffing this contribute to high incidence rate of WRMSD among nurses in Kakamega County. In a similar study number of hours per week and daily breaks in direct patient care had no significant association with WMSD among the nurses ($p = 0.262$) (Stubbs 2004) [19]. There was significant association between working in awkward and cramped position and the WRMSD among the study participants. Almost all procedure carried out by nurses involves awkward and cramped position for instance, dressing of wounds and assisting mothers to give birth. These positions contribute much to causing WMSD among nurses in this study. Working in the same position with awkward postures contribute also to high rate of WRMSD among nurses. For instance, when carrying out orthopedic procedures. Silverstein *et al.* (2010) [16] reported repetitious movement, awkward postures and high force levels as the three primary risk factors that have been associated with WRMSDs.

Findings showed that 69.2% of the respondents had major problem when bending or twisting their back in an awkward way on the line of their duties. There was significant association between bending or twisting the back in awkward/poor postures and the WRMSD among the study participants. Bending or twisting once back in poor postures contributes to high incidence rate of LBP among nurses especially while performing long procedural work (WHO, 2007) [20]. Smedley *et al.* (2008) [9] in their studies reported that the nurse population working for long periods in a slightly bent position remained significant after adjusting for all the other variables. Nurses sometimes are forced by circumstances to work in poor/awkward posture in order to be able to reach the specific body part and in the process, they have to bend or twist their body. This normally put them at risk of developing WMSD, for instance when carrying out episiotomy procedure (Lambert & Lambort 2008) [21]. On working while injured or hurt, 67.6% had major problem when continuing to work while injured or hurt. The injury can extend depending on the nature of the work and its position in the body. There was significant association between working while injured or hurt and the WMSD among the study participants. This exposes them to WMSD since they cannot work properly. Ando *et al.* (2000) [22] also suggested that musculoskeletal pain among hospital nurses may have associations with some actual tasks and items related to work postures, work control and work organization as well as working while injured. Regarding fall or unanticipated sudden movement of patients, 70.8% had major problems when these events occurred. There was statistically significant association between unanticipated sudden movements or fall of patients and development of WMSD among the nurses.

Unanticipated sudden movement or fall of patients cause the nurses to bend or twist their bodies and if done over and over will automatically cause WRMSD. Most hospitals do not have patient lifting equipment therefore patients have to either be lifted or be pushed on mal-functioning trolleys to and from theatre, emergency and in between other hospital departments. Of those assisting patients during gait activities, 70.8% had major problems when these events occurred. There was statistically significant association between assisting patients during gait activities and development of WRMSD among the nurses. Nurses usually play a major role in the rehabilitation process of patient affected with severe injuries, for instance they assist patient who were had broken their limbs to walk again. In this process the nurse may hurt themselves or strain their bodies a lot and in the process put them at high risk of suffering from WRMSD.

Regarding work schedule, 73.1% had major problems when work schedule (overtime, irregular shifts and length of workday) was extended. There was significant association between irregular work schedule and job satisfaction among the study participants. Work schedule of nurses involve a lot of activities and procedures to be carried out at the end for the shift. These procedures sometimes are very strenuous and need a lot of concentration and energy. For instance, nurses working at maternity ward over and over again assist mothers to give birth. These processes involve bending and awkward postures which expose the nurses to suffer from WRMSD. Studies elsewhere noted that there has been increasing interest in the impact of resident physician and nurse work hours on patient safety. The evidence demonstrates that work schedules have a profound effect on providers' sleep and performance, as well as on their safety and that of their patients (Collins *et al.*, 2002) [23]. Nurses working shifts greater than 12.5 hours are at significantly increased risk of experiencing decreased vigilance on the job, suffering an occupational injury, or making a medical error (Evanoff *et al.*, 2003) [24]. Physicians-in-training working traditional > 24-hour on-call shifts are at greatly increased risk of experiencing an occupational sharp injury or a motor vehicle crash on the drive home from work and of making a serious or even fatal medical error (Collins *et al.*, 2003) [25]. As compared to when working 16-hours shifts, on-call residents have twice as many attentional failures when working overnight and commit 36% more serious medical errors. They also report making 300% more fatigue-related medical errors that lead to a patient's death (Lockley, 2007) [26]. Regarding training on injury preventions, 93.1% had major complain that they had little knowledge on injuries prevention techniques because most of them were not trained on injury prevention measures at work place. There was significant association between inadequate training on injury preventions and the WRMSD among the study participants. This problem is a major risk factor exposing nurses to high incidence rate of WRMSD. Poor knowledge on injury prevention and work procedure increases the chances of nurses making error and causing injuries. Furthermore, these may result in nurses using a lot of energy and over straining their body muscles especially when lifting heavy loads. In the process also they may injure their pa-

tients.

Inadequate training on injury prevention was the most job risk factor perceived by nurses to be causing WRMSD in this study, followed by working in the same positions for long periods, then carrying /lifting or moving heavy materials or equipment and not taking enough breaks or pauses during working days were also perceived to be in top three risk factors causing WRMSD. Transferring dependent patients, treating excessive number of patients, working in awkward cramped position and performing the same task over and over followed respectively. In addition the nurses who participated in the study agreed that the following factors posed the major problems to them, performing manual orthopedic technique, bending or twisting their back in awkward way on the line of their duties, Working near or at their physical limits, reaching or working away from their body, Continuing to work while injured or hurt, Working with confused or agitated patients, unanticipated sudden movements or falling of patients, assisting patients during gait activities and work schedule (overtime, irregular shifts, and length of workday). The Kenyan health system needs to train and create a culture that encourages injury and potential safety violation reporting so incidents can be prevented. Hospitals too should create a culture of safety whereby everyone in the facility is looking for ways to decrease injuries and improve safety. Nurses should report potential risks, make sure that all serious injuries are reported, and occupational health teams are formed in hospitals to improve safety. Nursing training curricula must address safe body mechanics, injury prevention, and safety improvement (Akello, 2013 [27]; Munabi, 2014 [17]).

5. Conclusion & Recommendation

The study concludes that working in the same positions for long periods, treating a high number of patients and carrying or transferring dependent patients were risk factors of WRMSD identified. There was significant association between these variables and WRMSD in this study. The study recommends that nurses need to be trained on proper handling and lifting of patients and loads, modification of work procedures to reduce injuries. In addition, change on their working technique, using lifting equipment, interchange task regularly, reduce the excessive number of patients treated in one day, take breaks, and avoid awkward cramp position, repetitive work and strenuous tasks. In addition, a prospective cohort study design with larger sample size is warranted in the future to provide more sound research evidence on WRMSDs and healthy survivor effects among nurses in Kenya.

Authors & Contributions

Micky Olutende Oloo, Dr Issah W. Kweyu and Dr. Maximilla Wanzala conceived the paper, designed and performed the study. Micky Olutende Oloo contributed 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.

Conflicts of Interest

The authors declare no conflicts of interest.

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