

# An Exercise Rehabilitative Solution to Work-Related Musculoskeletal Lower Back Pain among Nurses

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**How to cite this paper:** Paul, Y., Ellapen, T.J., Swanepoel, M., Hammill, H.V., Barnard, M. and Qumbu, B.T. (2018) An Exercise Rehabilitative Solution to Work-Related Musculoskeletal Lower Back Pain among Nurses. *Open Journal of Orthopedics*, 8, 322-330.

<https://doi.org/10.4236/ojo.2018.88035>

**Received:** March 22, 2018

**Accepted:** August 14, 2018

**Published:** August 17, 2018

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## Abstract

The attrition of professional nurses is a sad reality. Work-related musculoskeletal lower back pain (WRMLBP) among nurses has been cited as a factor of increased sick leave and poor health. Occupational predisposing factors of lower back pain are strenuous physical stresses of nursing, obesity and poor physical conditioning. Regular stretching and strengthening exercises dissipate lower back pain. This commentary's objectives are to explain the association between obesity and lower back pain and the exercise mechanism that dissipates this pain, thereby concluding that nurses should consider regular exercise as a therapeutic option.

## Keywords

Nurses, Lower Back Pain, Exercise

## 1. Introduction

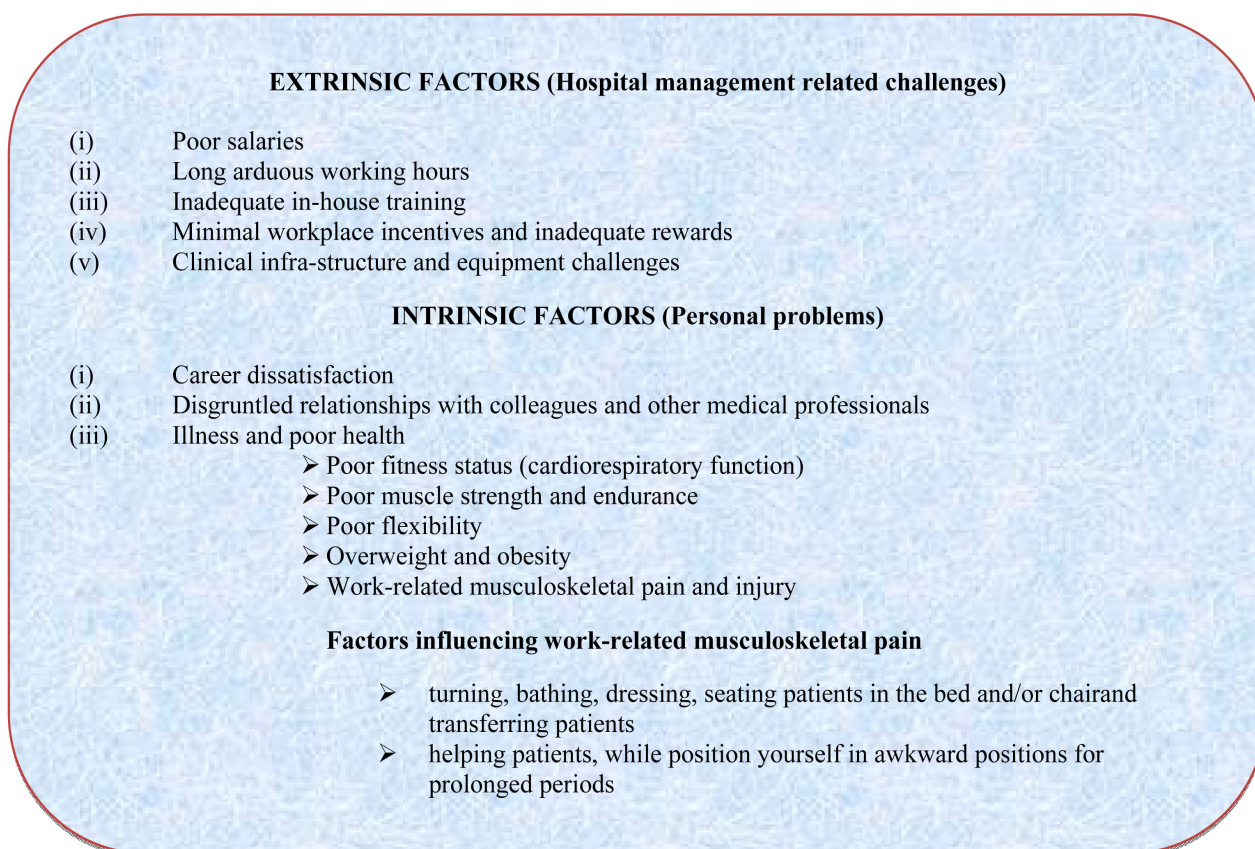
The attrition of professional nurses is a sad reality, estimated to be ranging at 24% biennially [1]. Literature has indicated that the leading factors of premature termination of service are poor salaries, long arduous working hours, inadequate in-house training, minimal workplace incentives and rewards, clinical infra-structure and equipment related challenges and personal problems (career dissatisfaction, disgruntled relationships with colleagues and other medical professionals and illness and poor health) [2] [3] [4]. Many of the aforementioned predisposing factors influencing the attrition of nurses are extrinsic in nature, being regarded as hospital management related challenges. This commentary

focuses on work-related illness and poor health, more specifically WRMLBP.

WRMLBP is responsible for the increased number of annual sick days and poor health, which contributes to premature retirement of nursing staff [5] [6]. The lower back has been identified as the most susceptible anatomical site of musculoskeletal pain, followed by the shoulders and neck respectively [5] [6]. WRMLBP has high occurrence ranging between 58% and 79% among nursing personnel [6] [7] [8]. Occupational predisposing risk factors cited were awkward habitual working positions unremitting for prolonged periods during patient transfer, strenuous physical stresses of the nursing profession, their poor health and fitness conditioning status as well as obesity [4] [6] [7] [9] (Figure 1).

There has been numerous systematic reviews published concerning WRMLBP among nurses [4] [8] [10] [11] [12]. Yassi and Lockhart and Schlossmacher and Amaral identified a casual association between nursing tasks and WRMLBP [9] [10]. Ellapen and Narsigan's systematic review described the kinesiology of prolonged vertebral flexion adopted by nurses during patient transfer activities that precipitates lower back pain [12]. Smedley *et al.* identified the gynoid somato-type (obesity) as a primary intrinsic predisposing risk factor of lower back pain among nurses [13].

Several empirical investigations examined the efficacy of the different intervention strategies to curb WMSP among nurses [14]. Smedley *et al.* and Warming



**Figure 1.** Factors influencing premature termination of professional nursing careers.

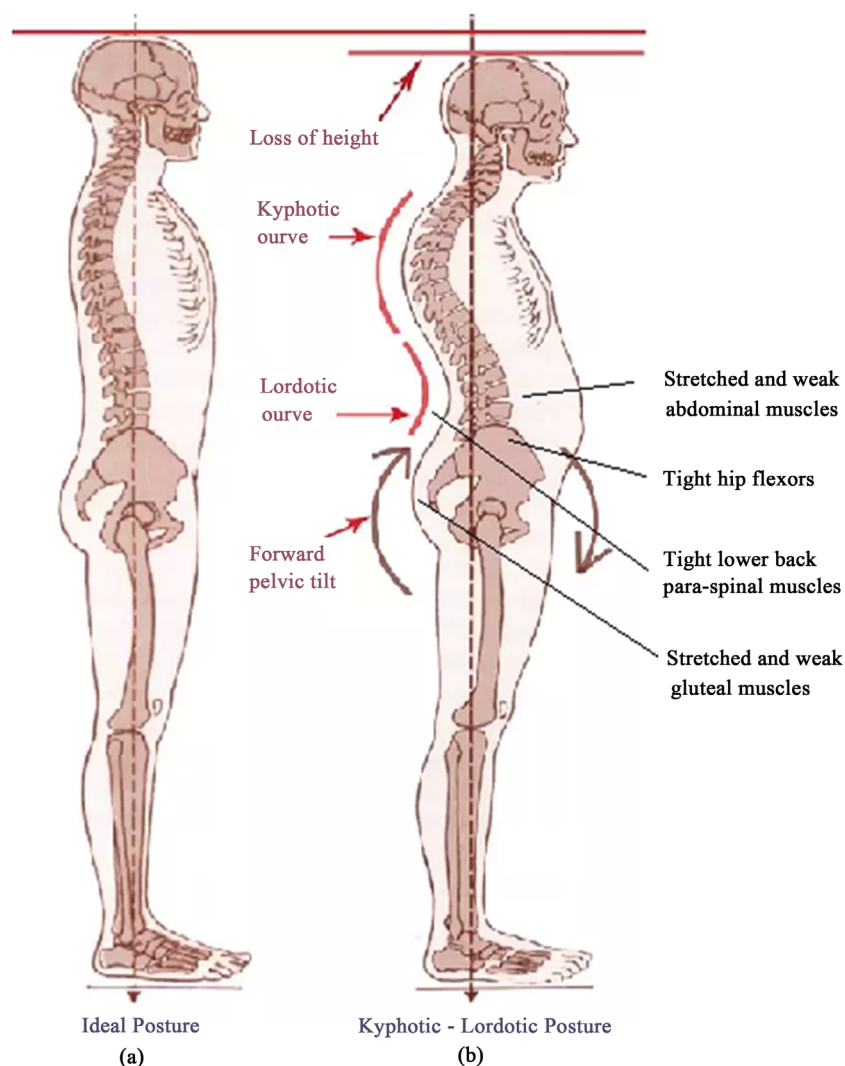
*et al.* reported that teaching nurses the proper lifting technique during patient transfer reduces lower back pain [13] [15]. Proper *et al.* and Yuan *et al.* demonstrated that regular adherence to exercise and physical activity curbs the lower back pain among nurses [16] [17]. Regular flexibility exercises stretch the tight para-spinal muscles of the lower back which, elongates muscle contractures, whilst facilitating the decompression of intervertebral discs and dissipating muscle spasms [18]. Specific strengthening exercise will shorten lax muscles and increase their strength and endurance when these muscles act as agonists, synergists, fixators and neutralizers to prevent unwanted muscle movement producing lower back pain when performing strenuous physical tasks [18]. Exercise therapists have been prescribing strengthening and stretching exercises to effectively dissipate lower back [18] [19].

Nelson *et al.* reported that the primary limitation that prevents nurses from adhering to physical activity programmes is their busy work schedules [5]. This paper briefly reviews the kinesiological association of obesity and WRMLBP. Thereafter an exercise therapeutic intervention has been prescribed to assist in resolving the pain. The authors' intention is to gently encourage nurses to engage in regular physical activity to curb the incidence of lower back pain.

### **1.1. Aetiology of Lower Back Pain in Association to Obesity**

The association of WRMLBP and obesity entails the comprehension of both global and local musculature's abnormal force couple relationships. A hallmark characteristic of female obesity is the gynoid somatotype; increased accumulation of body fat around the waist and hip [13]. Obese nurses have an anteriorly tilted pelvis (short arc pelvis on femur hip flexion) and lumbar lordosis that produces lower back pain (Figure 2) [20]. The anterior rotation of the pelvis is instigated by the habitual concentric contraction of the strong hip flexors (iliopsoas, rectus femoris), which eccentrically lengthen the hip extensors (gluteus medius, minimus and maximus) producing an abnormal force couple relationship (Figure 2) [19] [21]. Habitual eccentric loading of the hip extensors leads to muscle strains that precipitate lower back pain [17].

Concentric strengthening of hip extensors is needed, to reverse the anterior tilt to a neutral aligned pelvis. Mansfield and Neumann recommended closed kinetic chain exercise (CKCE), strengthening of the gluteal muscles, which counternutates the sacrum and subsequently posteriorly rotates the anteriorly tilted pelvis to a neutral pelvis, by drawing the muscle's origin to its insertion [19]. Habitual concentric contraction of hip flexors produces hip flexor contractures and shortening of the iliofemoral and pubiofemoral ligaments, which needs to be statically stretched to regain a neutral aligned pelvis [18]. Figure 2 shows the alteration in pelvic alignment that produces weak elongated abdominal and gluteal muscles in contrast to the shortened para-spinal and flexor muscles associated with obesity. This biomechanical mechanism explains the association between obesity and lower back pain.



**Figure 2.** Association between obesity and lumbopelvic orientation [21].

### 1.2. Intervertebral Segment Instability due to Abnormal Force-Couple Relationship of the Local Intervertebral Muscles

The global hip flexor/extensor abnormal force-couple relationship of the lumbopelvis precipitates further intervertebral segment misalignment [18] [19]. The anteriorly tilted pelvis pulls the sacral promontory forward away from the lumbar vertebrae increasing the sacro-horizontal angle at the lumbosacral junction and producing lordosis [19]. Lumbar lordosis eccentrically lengthens the transverse abdominis (TA) and anterior longitudinal ligament whilst concentrically shortening the multifidus, rotators, interspinalis, intertransversarius, ligamentum flavum, posterior longitudinal and interspinous ligaments. Abdominal obesity further exacerbates the aforementioned pathomechanics [21]. This creates a local abnormal force-couple relationship between the sacral promontory and the lumbar vertebra muscles. Mansfield and Neumann reported that the altered lumbosacral junction may perpetuate into anterior spondylolisthesis [19]. In an

attempt to maintain an erect posture the person adopts a kypolordotic posture that hyperextends the lumbar vertebrae, producing abnormal local force-couple relationships between each successive lumbar vertebral segment [19] [21]. Chronic alteration of the sacro-horizontal angle and lumbar lordosis produce transversospinal muscle contracture. Therefore, intervertebral segmental stabilization is required to strengthen the TA and eccentrically lengthen the posterior transversospinal muscle contractures.

### **1.3. How Does the Strenuous Physical Tasks of Nursing Causes Lower Back Pain?**

Nurses comply with various strenuous physical tasks that require them to position their bodies in awkward positions for prolonged situations. These nurse-patient interaction tasks include turning, bathing, dressing, seating patients in the bed and/or chair and transferring patients [6] [7] [14] [22]. Transferring albeit overweight and obese patients may be from the bed onto a wheelchair or stationary chair, or stretcher or onto the toilet [14]. In addition the nurses are also responsible for the reverse transfers as well.

Unfortunately these above-mentioned strenuous tasks do contribute to the WRMLBP among nurses [6] [7] [22]. All the above tasks require nurses to adopt abnormal positions that must be held statically or move very slowly [6] [7]. When nurses are transferring patients they would have flexed their hips (long arc pelvis on femur hip flexion) and hold this position for an indefinite time, eliciting concentric and eccentric contractions of the anterior and posterior lumbopelvic muscles respectively [19]. The anterior lumbopelvic muscles are initially concentrically contracted and then maintained in this shortened state for an indefinite time. Meanwhile the posterior lumbopelvic muscles are eccentrically lengthened and maintained in this state for a prolonged period. This abnormal hip flexion position exasperates the condition of nurses whose hip flexor contractures are precipitating further WRMLBP. Further, the para-spinal muscles are eccentrically lengthened for an indefinite period of time as patients are slowly lowered from bed to chair, which increases the risk of further muscle strains escalating the lower back pain [19]. Exercise therapy has successfully resolved lower back pain relating to the aforementioned predisposing mechanism of injury through the prescription of specific stretching and strengthening exercises [18].

## **2. Recommendations**

Nurses should attempt to adopt better ergonomic practises during patient transfers and regularly perform core stabilization exercises [6]. Core stabilization exercises have been successful in decreasing lower back pain by increasing muscle strength and endurance [18]. The ergonomic practices include:

- Adjust patient's bed height to the nurse's relative hip (ASIS height), so that the nurse does not need to hyperextend her back when she is transferring the patient onto a bed height higher than her hip.



- Nurses must bend their knees when lifting patients to protect their lower back from injury.
- When lifting patients, nurses should attempt to hold the patients close to their bodies to reduce the stress on their lower back.
- Nurses are encouraged to resume an erect standing posture after continuous prolonged lumbopelvic flexion and/or patient transfers.
- Nurses must refrain from wearing high heel shoes when consulting, as it increases their anterior pelvic tilt.

Core stabilization includes strengthening and stretching exercises. Nurses should seek medical consent from a medical practitioner, exercise therapists (biokineticist and physiotherapist) before engaging in these recommended exercises. The stabilization exercises should include the following;



- All stretching should be performed statically for a minimum of 30 seconds per stretch, twice.
- Muscles that need to be stretched include the iliopsoas, rectus femoris, sartorius, lumbar erector spinae and quadratus lumborum.
- Muscles that need to be strengthened include the gluteus minimus, medius and maximus, hamstrings group and abdominal group (rectus abdominis, external and internal obliques and transverse abdominis).
- Nurses must be encouraged to walk briskly for 20 minutes daily to decrease obesity.

Patients complying with the exercise guidelines will experience a compressive sensation around their lower back (biomechanically known as force closure of the lumbopelvic hip complex), observe better posture (reduction in lordotic curve) and decrease pain sensation leading to no pain. It is important to note that subsequent exercise prescription can serve for prevention and rehabilitation of lower back pain [18] [19]. Physiotherapists and biokineticists are functional exercise therapists who will be invaluable therapeutic practitioners, who may prescribe individualized exercise rehabilitative regimes, demonstrate these exercises and monitor patient progress [12].

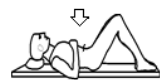


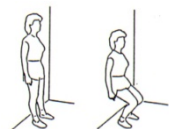
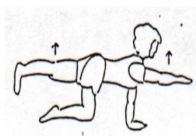
### Core stabilization programme

See **Table 1** and **Table 2**.

**Table 1.** Stretching exercises (adapted from Ellapen *et al.*) [23].

Stretching Programme					
Muscle group been stretched	Exercise	Duration	Repetitions	Goal	Picture
Quadratus lumborum, lower back muscles	Seated hip flexion	30 seconds	2	*Increased lower back flexibility *Able to bend back without pain	
Rectus femoris, iliopsoas and sartorius	Lunge	30 seconds	2	*Increased front thigh and hip flexibility	

**Table 2.** Strengthening exercises (adapted from Ellapen *et al.*) [23].

Strengthening Programme					
Muscle group been strengthened	Exercise	Sets	Repetitions	Goal	Picture
Multifidus and transverse abdominis activation	Controlled, gentle drawing in your lower abdominal wall towards your spine. Hold contraction for 10 seconds and relax. Maintain this muscle activation for all core exercises.	2	10	Increased compressive force around the waist	
Rectus abdominis	Supine, with knees bent and perform crunches.	2	10	Increased compressive force around the waist	
Gluteus and hamstrings	Hold pelvis in neutral position by activating multifidus and TA then extend the hip.	2	10	Increased compressive force around the waist	
Gluteus and hamstrings	CKCE: wall squats	2	10	Stronger gluteus and hamstrings strength and endurance	
Gluteus and hamstrings	Hold pelvis in neutral position by activate multifidus and TA. Then extend opposite arm and leg.	2	10	Stronger gluteus and hamstrings strength and endurance	

### 3. Conclusion

There is an association between obesity and lower back pain that can be resolved through core stabilization exercises. Therefore, it is recommended that nurses experiencing lower back pain should consider the option of therapeutic exercise.

### Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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