

**The impact of a
change in work posture on
work-related musculoskeletal disorders among
sewing-machine operators,
managed within a
physiotherapy and ergonomics programme**

by

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Summary

Title	The impact of a change in work posture on work-related musculoskeletal disorders among sewing-machine operators, managed within a physiotherapy and ergonomics programme
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When implementing a managed healthcare intervention among a working population, evidence-based healthcare is critical. In the current study, the change of work posture of sewing-machine operators from seated to stand-up (the intervention) was managed within a physiotherapy and ergonomics programme (programme) in Johnson Controls Automotive S.A. (Pty) Ltd (company) without local evidence to guide the postural transition.

The management of the intervention, implemented over a period of 4.5 years, presented the opportunity for a retrospective longitudinal study. The study determined the impact of the change in work posture on the incidence of work-related musculoskeletal disorders (WRMSDs) from June 2004 to January 2009 (period). The role of the physiotherapist in the programme was to deliver manual therapy to all sewing-machine operators with WRMSDs, and to provide a clinical - ergonomics service, as a member of a multidisciplinary team, to the company.

The population of sewing-machine operators (n=123) was described in terms of personal factors (e.g. age, medical history, musculoskeletal history, and body mass index (BMI)), ergonomic risk factors (e.g. work posture, force and duration) and overall incidence of WRMSDs. The associations of risk factors (personal and ergonomic) with WRMSDs, and work posture with WRMSDs among sewing-machine operators were statistically determined.

The majority of the population (97.6%) was female, with mean age 42.3 ± 8 years. At baseline, 17.9% were hypertensive, 3.3% had arthritis, 6.5% were diabetic, and the mean BMI was 29.7 kg/m^2 (22% of BMIs was normal). The largest proportion of the sewing-machine operators were sewing cloth and leather (79.7%) (compared to sewing cloth and vinyl), and the remainder performed forceful precision stitching (20.3%), including headrest covers, airbags and top stitching on the final product. Job rotation took place between forceful precision stitching and straight stitching (for 36.6% of the sewing-machine operators).

The intervention was implemented within the study period. At baseline 100% of sewing-machine operators were sewing in the seated work posture. Early in the study, 17.9% of them changed their work posture from seated to stand-up, 30.1% changed to the stand-up work posture in January 2007, and 34.9% a year later. The last 17.1% remained seated till the last year of the study period. From July 2008, 100% of the sewing-machine operators were sewing in the stand-up work posture.

The results indicated two strong associations of risk factors and a change in work posture with WRMSDs. Obesity (specifically morbid obesity) was a personal risk factor for upper limb disorders and working in the stand-up work posture was protective for spinal disorders, compared to working in the seated work posture. Furthermore, the results indicated a high incidence of disorders (specifically of the spinal area and upper limb) during the first three months of the programme, as well as an increased incidence of lower leg disorders for the first and consecutive month of the change in work posture from seated to standing up. Lower limb disorders were specifically associated with obesity.

The increase of lower limb disorders during the postural adaptation phase was temporary, and was addressed within the programme with proper shoe wear, silicone innersoles, supportive stockings and exercises. The combination proved to be effective in preventing and/or managing lower limb disorders.

The outcome of the current study provided evidence on the incidence of WRMSDs, and associations between risk factors and work posture, and WRMSDs among sewing-machine operators managed within the programme.



Keywords

Standing

Sedentary

Work-related musculoskeletal disorders

Spinal disorders

Work-related upper extremity musculoskeletal disorders

Lower limb disorders

Sewing-machine operators

Physiotherapy

Ergonomics

Occupational health

Opsomming

Titel	Die impak van die verandering van werkspostuur op werksverwante muskuloskeletale versteurings in naaimasjienoperateurs, terwyl dit binne 'n fisioterapie en ergonomika program hanteer is
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Bewysgebaseerde gesondheidsorg is van kardinale belang tydens die implementering van 'n bestuurde gesondheidsorgingreep in 'n werkende bevolking. In hierdie studie, is die verandering van werkspostuur van naaimasjienoperateurs van sit na staan (intervensie), binne 'n fisioterapie-en-ergonomika program (program) in Johnson Controls Automotive S.A. (Pty) Ltd (die maatskappy) hanteer sonder plaaslike bewyse om die posturale oorgang te bestuur.

Die hantering van die intervensie, wat oor 'n tydperk van 4.5 jaar geïmplementeer is, het die geleentheid vir 'n terugwerkende longitudinale studie geskep. Die studie het die impak van die werkspostuurverandering op die voorkoms van werksverwante muskuloskeletale versteurings (MSV) vanaf Junie 2004 tot Januarie 2009 (tydperk) bepaal. Die rol van die fisioterapeut in die program was om manuele terapie aan al die beseerde naaimasjienoperateurs te lewer en ook, as lid van 'n multi-dissiplinêre span, 'n kliniese ergonomiese diens aan die maatskappy te lewer.

Die studiegroep van naaimasjienoperateurs ($n=123$) was beskryf in terme van persoonlike risikofaktore (bv. ouderdom, mediese geskiedenis, muskuloskeletale geskiedenis, en liggaamsmassa-indeks (LMI)), ergonomiese risikofaktore (bv. werkspostuur, krag en durasie) en die oorkoepelende voorkoms van MSV. Die verbande tussen die voorkoms van risikofaktore (persoonlik en ergonomies) en MSV, asook tussen werkspostuur en MSV onder naaimasjienoperateurs is statisties bepaal.

Die meerderheid van die naaimasjienoperatorpopulasie (97,6%) was vroulik. Die gemiddelde ouderdom van die studiegroep aan die begin van die studie was 42.3 ± 8 jaar, 17.9% was hipertensief, 3.3% het artritis gehad, 6.5% was diabeties, en die gemiddelde LMI was 29.7 kg/m^2 (22% van die LMIs was normaal). Die data het weerspieël dat die grootste deel van die naaimasjienoperateurs met materiaal en leer gestik het (79.7%), in vergelyking met die stik van materiaal en vinyl. Slegs 'n klein persentasie het kragtige presisie stikwerk uitgevoer - insluitend die stik van kopstutoortreksels, lugsakke en topstiksel op die finale produk (20.3%). Werksrotasie het plaasgevind tussen kragtige presisie stikwerk en reguit stikwerk (vir 36.6% van die naaimasjienoperateurs).

Die intervensie is gedurende die tydperk van die studie geïmplementeer. By basislyn het 100% van die naaimasjienoperateurs in die sittende werkspostuur gestik. Vroeg in die studie, het 17.9% hul werkspostuur van sit na staan verander, 30.1% tydens Januarie 2007, gevolg deur 34.9% 'n jaar later. Die laaste 17.1% het in die sittende werkspostuur gewerk tot die laaste jaar van die tydperk. Vanaf Julie 2008 het 100% van die naaimasjienoperateurs in die staande werkspostuur gestik.

Die resultate het twee sterk verbande tussen risikofaktore en werkspostuurverandering, en versteurings aangedui. Vetsug (spesifiek morbiede vetsug), was 'n persoonlike risiko faktor vir die boonste ledemaat versteurings, en stikwerk in die staande werkspostuur was beskermend vir spinale versteurings, in vergelyking met stikwerk in die sittende werkspostuur. Die resultate het ook 'n hoë voorkoms van MSV (spesifiek van die spinale-areas en boonste ledemate) gedurende die eerste drie maande van die program getoon, sowel as 'n verhoogde voorkoms van onderste ledemaat versteurings

vir die eerste en opeenvolgende maande waarin die werkspostuur verander is van die sit na staan. Onderste ledemaat versteuring het veral verband gehou vetsug.

Die toename van onderste ledemaat versteurings gedurende die posturale-aanpassingsfase was tydelik van aard, en is binne die program hanteer met gemaklike skoene, silikoon binnesole, ondersteunende kouse en oefeninge. Die kombinasie blyk effektief te wees in die voorkoming en/of hantering van onderste ledemaat versteurings.

Die uitkoms van hierdie studie verskaf bewyse rakende die voorkoms van MSV, sowel as die verbande tussen risikofaktore en werkspostuur, en MSV onder naaimasjienoperateurs wat binne die program hanteer is.



Sleutel woorde

Staan

Sit

Werkverwante muskuloskeletale versteurings

Spinale versteurings

Werkverwante boonste ledemaat muskuloskeletale versteurings

Onderste ledemaat versteurings

Naaimasjien operateurs

Fisioterapie

Ergonomika

Beroepsgesondheid

Dedication

Our Heavenly Father

Declaration

I declare that the dissertation, which I hereby submit for the degree Magister in Physiotherapy (research) at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at another university.

Acknowledgements

Many people have helped to stimulate the design of this retrospective study. In particular, I would like to express my thanks to Prof Jan van Tonder for presenting a part-time course on Industrial Ergonomics at the Randse Afrikaanse Universiteit (now known as the University of Johannesburg) in 2001, as this course prepared me to participate in the implementation of the programme described in the current study, three years later.

In addition, the trust invested by Johnson Controls Automotive S.A. (Pty) Ltd in me to participate in this programme, made me aware of the need for ‘research-to-practice’ findings in South Africa. This awareness was strengthened by the need for published literature in order to equip physiotherapists to participate in similar programmes. This two-way process provided a constant reminder of the complexities of the growing need for evidence-based studies regarding managed health care interventions among working populations in South Africa.

The contributions of my study leader, Karien Mostert-Wentzel, and biostatistician, Prof. Becker, were vital in ensuring that the ‘lessons learnt’ in the current study were analysed and discussed to equip managers and physiotherapists alike in managing a change in work posture in similar programmes.

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List of abbreviations

BMI	Body mass index
CI	Confidence interval
ILBWU	International Ladies' Garment Workers Union
IRR	Incidence rate ratio
LBP	Low back pain
MSD	Musculoskeletal disorders
PEIL	Prevention early intervention list
RSI	Repetitive strain injury
SD	Standard deviation
USA	United States of America
WCPT	World Confederation for Physical Therapy
WHO	World Health Organization
WHP	Workplace Health Promotion
WRMSD	Work-related musculoskeletal disorder
WRUEMSD	Work-related upper extremity musculoskeletal disorder
EMG	Electromyogram