Tampereen ammattikorkeakoulu

Individualized Assessment of Patients with Non-Specific Low Back Pain

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TIIVISTELMÄ

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PAUKKUNEN, MAIJA:
Alaselkäkipupotilaan yksilöllinen arvio

Opinnäytetyö 58 sivua, joista liitteitä 17 sivua
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Opinnäytetyön tavoitteena oli kehittää ammattilaisille suunnattu koulutusmateriaali alaselkäkipupotilaan yksilöllisestä arvioinnista työterveyshuollossa ja selvittää koulutukseen osallistuneiden työfysioterapeuttien kokemuksia biopsykososiaalisesta lähestymistavasta. Potilasaineistosta (n=674) tutkimme, miten alaselkäkipupotilaat jakautuivat matalan, kohtalaisen ja korkean riskin luokkiin Örebron lyhyen kipukyselyn (ÖMPSQ-lyhyt) ja Start selkäkyselyn (SBT) perusteella sekä selvitimme, onko potilaiden koulutusalojen välillä eroja kipuun liittyvien psykososiaalisten tekijöiden esiintymisessä.

Terveydenhuollon ammattilaiset rekrytoivat tutkimuksen potilasaineiston kahteen käynnissä olevaan kliinisen tutkimukseen liittyen. Potilaat vastasivat webropolkyselyihin (SBT; ÖMPSQ-lyhyt) ja heiltä kerättiin perustiedot (ikä, sukupuoli, ammatti).

SBT luokitteli 46 % miehistä matalan riskin, 38 % kohtalaisen riskin ja 16 % korkean riskin ryhmiin. Naisista vastaavasti 39 %, 57 % ja 15 %. ÖMPSQ-lyhyt luokitteli 50 % miehistä matalan, 22 % kohtalaisen ja 28 % korkean riskin ryhmään ja naisista vastaavasti 50 %, 21 % ja 29 %. Riskiryhmien jakautumisessa ei ollut tilastollisesti merkitsevää eroa potilaiden koulutusalojen välillä (SBT $p=0.081$; ÖMPSQ-lyhyt $p=0.091$).

Pelko-välttämiskäyttäytyminen oli yleisempää tekniikan alalla ($p = 0.015$) ja palvelualalla ($p = 0.038$) kuin muissa ammateissa. Terveys- ja hyvinvointialan ammateissa toimivilla oli vähiten fyysiseen aktiivisuuteen liittyvää pelkoa ($p = 0.025$). Kipuun liittyvä katastrofointi oli yleisempää tekniikan aloilla kuin muissa ammateissa ($p = 0.028$) ja vähäisempää terveys- ja hyvinvointialojen ammateissa ($p = 0.001$).

Kehitetty koulutusmateriaali helpotti ammattilaista potilaan yksilöllisen psykososiaalisen riskiprofiilin arvioimisessa ja auttoi kommunikoimaan työkyvyttömyyden riskitekijöistä validoivaa vuorovaikutusta hyödyntäen. Luottamuksellinen koulutusmateriaali on poistettu opinnäytetyön julkisesta raportista.

Tulevaisuudessa sähköiset seulontakyselyt mahdollistavat hoidon kohdentamisen nykyistä paremmin haittaavan ja pitkittyvän alaselkäkivun riskissä oleville. Ammattilaiset tarvitsevat kuitenkin lisäkoulutusta alaselkäkipupotilaan yksilöllisen riskin arviointiin sekä biopsykososiaalisen työotteen käyttämiseen.

Asiasanat: työkyky, alaselkäkipu, seulonta, biopsykososiaalinen

ABSTRACT

Tampereen ammattikorkeakoulu
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PAUKKUNEN, MAIJA:
Individualized Assessment of Patients with Non-Specific Low Back Pain

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The objective was to develop learning material of individualized assessment of patients with non-specific low back pain (LBP) and investigate how occupational physiotherapists experienced the biopsychosocial approach. Among patients with LBP (n=674), the aim was to investigate whether patients' occupational education is associated with pain-related psychological factors according to two screening instruments.

The health care professionals of two ongoing clinical trials recruited the patients. The patients answered to webropol questionnaires related to demographic data (gender and age); socioeconomic status including occupation; pain-related factors (the short form of the Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ-short) and the STarT Back Tool (SBT)).

The results indicated that the fear of physical activity was greatest in technical fields of occupation ($p = 0.015$) and services ($p = 0.038$), while patients working in health and welfare had least fear towards physical activity ($p = 0.025$). Pain catastrophizing was highest in technical fields of occupation ($p = 0.028$) and lowest in occupations of health and welfare ($p = 0.001$).

The learning material described how to identify psychosocial risk factors for disabling LBP and helped occupational physiotherapists in communicating with patients belonging to high-risk group. The learning material is confidential and is not attached to the public document of thesis report.

In the future, electronic screening will offer a potential to target better disabling LBP. However, professionals will need further education in biopsychosocial approach.

Key words: work ability, low back pain, screening, biopsychosocial

CONTENTS

ABBREVIATIONS AND TERMS

BPS	Biopsychosocial
CFT	Cognitive functional therapy
COHERE Finland	Council for Choices in Health Care in Finland
ICF	The International Classification of Functioning, Disability and Health
LBP	Low back pain
MRI	Magnetic Resonance Imaging
SBT	STarT Back Tool
WHO	World Health Organization
ÖMPSQ	Örebro Musculoskeletal Pain Screening Questionnaire
ÖMPSQ-short	Short form of the Örebro Musculoskeletal Pain Screening Questionnaire

1 INTRODUCTION

Low back pain (LBP) is a complex condition in which biological, psychological, and social factors impact on both the experience of back pain and associated disability. LBP is a leading cause of disability throughout the world. (Hartvigsen et al. 2018.) No cost-effective or widely available preventive LBP interventions have yet been developed (Foster et al. 2018). For over 90% of patients with LBP no specific or serious cause can be found and thus it is called as non-specific pain. The natural course of non-specific LBP is typically benign. Predictors of persistent LBP-related disability include symptom-related factors such as previous LBP episodes, pain intensity and the presence of leg pain and multisite pain; lifestyle factors such as overweight/obesity, smoking and physical inactivity; psychological factors such as depression, catastrophizing and fear-avoidance beliefs; and social factors such as education, physical workload and work satisfaction. In addition, genetic factors play a major role. (Hartvigsen et al. 2018, Coggon et al. 2019.)

Early identification of patients who are at the highest risk of developing a prolonged or persistent pain problem is important (Foster et al. 2018). Magnetic resonance imaging (MRI) does not help in recognizing patients at risk. A systematic review showed inconsistent associations between MRI findings and future episodes of LBP. (Steffens et al. 2014.) In fact, imaging in LBP may be associated with higher medical costs, increased healthcare utilization and more absence from work (Lemmers et al. 2019).

In Finnish population, 44% of men and 48% of women reported LBP during previous 30 days. In the end of 2018, approximately 17 000 Finns were retired because of back pain. Cost of these pensions were approximately 245 million euros. In 2018, sickness absence costs due to LBP were over 94 million euros. (Koponen et al. 2019.) The burden of LBP is global. It is growing alongside the increasing and ageing population and it cannot be separated from social and economic factors and personal and cultural beliefs about back pain. Current clinical practice has failed to effectively manage LBP and disability due to back pain has risen by more than 50% since 1990. (Buchbinder et al, 2018). Attention should be drawn

to the complexity of the condition and the contributors to LBP, such as psychological, social and biophysical factors (Hartvigsen et al. 2018). There is a need for effective early tailored intervention strategies to address these risk factors (Shaw et al. 2006).

The Council for Choices in Health Care in Finland (COHERE Finland) recommends on which examination, treatment and rehabilitation methods should be included in healthcare services financed from public funds in Finland. The council issues recommendations on including or excluding health technologies in range of public health services. For patients the service choices mean that their health conditions are examined, treated, prevented and rehabilitated using safe and effective methods. The council issued 1.11.2018 that biopsychosocial (BPS) rehabilitation in prolonged or recurrent back pain is included to services that are financed from public funds in Finland. If back pain is prolonged and the patient is at risk of developing a chronic back pain condition, his or her situation should be assessed individually, taking account of BPS factors and the patient's whole life situation. Rehabilitative measures to maintain and improve patients' functional capacity and work ability should be planned within six weeks from the beginning of the symptoms. (Recommendation by the Council for Choices in Health Care in Finland (COHERE Finland) 1.11.2018.) However, BPS interventions are not commonly used in Finnish primary care.

The practice for systematical screening for psychosocial risk factors in LBP is widely recommended (Koes et al. 2010), but it is found challenging for most physiotherapists and physicians. Many studies have reported that lack of knowledge about psychosocial issues and interventions is one of the barriers to implementing this perspective in physiotherapy practice (Foster and Delitto 2011, Main and George 2011, Nielsen et al. 2014, Singla et al. 2014). Currently, training on LBP interventions with BPS approach and use of screening tools to identify individuals with psychosocial risk factors are not included in the physiotherapy degree programs. While the scientific evidence on risk factors for long-term problems has increased, the knowledge is underutilized in practice, and this creates a need for further education and learning materials for physiotherapists and other healthcare professionals treating patients with LBP.

The learning material created for occupational physiotherapists is based on the knowledge of evidence-based LBP research and my clinical experience of BPS approach in occupational health care. I have participated approximately 120 hours of further education in BPS approach conducted by world leading pain psychologist professor Steven Linton from University of Örebro, professor of musculoskeletal physiotherapy Peter O´Sullivan from Curtin University Australia and specialist in musculoskeletal physiotherapy Kasper Ussing from Denmark. Our research team in Finland is led by professor of Physical and Rehabilitation Medicine Jaro Karppinen from University of Oulu and Finnish Institute of Occupational Health. I have had the honor of being involved with the training of physiotherapists and physicians of the two ongoing trials with Finnish research team MD Anna-Sofia Simula, physiotherapist Msc Riikka Holopainen and physiotherapist OMT Mikko Lausmaa. The thesis and the learning material is checked and approved by professor Jaro Karppinen and the research team in Finland.

2 ASSESSMENT OF PATIENTS WITH NON—SPECIFIC LOW BACK PAIN

2.1 The Dilemma in Low Back Pain Care

LBP is a symptom not a disease, and can result from several different known or unknown abnormalities or diseases. It is defined by the location of pain, typically between the lower rib margins and the buttock creases. LBP is commonly accompanied by pain in one or both legs and some people with LBP have associated neurological symptoms in the lower limbs. It is a complex condition with multiple contributors to both the pain and associated disability, including psychological factors, social factors, biophysical factors, comorbidities, and pain-processing mechanisms. (Hartvigsen et al. 2018).

The management of LBP consists, after exclusion of serious pathological causes, of education and reassurance, analgesics when needed, and exercise therapy and cognitive-behavioral therapy based on needs of individual patients. Patient education and exercise can be effective in prevention and treatment of LBP. (Foster et al. 2018). Recent systematic reviews show promising effects for multidisciplinary BPS interventions in patients with chronic LBP. There is moderate-quality evidence that a BPS intervention is more effective than education/advice for reducing disability and pain in the short, medium, and long term among patients with LBP. BPS interventions with a clear focus on psychosocial factors (understanding pain, unhelpful thoughts, coping styles, and goal setting) seem most promising. (van Erp et al. 2019.) For persistent LBP, interventions that consist of non-pharmacological treatments such as exercise therapy and cognitive-behavioral therapy should be considered for routine use (Foster et al 2018).

2.2 Risk Factors of Persistent and Disabling Low Back Pain

Most people with new episodes of LBP recover quickly; however, recurrence is common and in a small proportion LBP becomes persistent and disabling. In fact, approximately half of patients recover within one to three months, approximately one third have a fluctuating disease course, while 20% have persistent disabling

pain. (Kongsted et al. 2016.) An Australian case-crossover study found that awkward postures, heavy manual tasks, feeling tired or being distracted during an activity were all associated with incidence of an episode of LBP (Steffens et al. 2015). Lifestyle factors such as smoking, obesity, and low levels of physical activity that relate to poorer general health are also associated with occurrence of LBP episodes, although independent associations remain uncertain (Hartvigsen et al. 2018).

Initial high pain intensity, psychological distress and accompanying pain at multiple body sites increases the risk of persistent disabling LBP (Hartvigsen et al. 2018). Risk factors for poor prognosis of LBP include high pain intensity, adverse subjective belief of long-lasting pain, low pain self-efficacy (confidence to get on with life despite the pain), passive coping strategies, high catastrophizing and fear avoidance beliefs, depression, sleep problems, psychological distress, low education and social class and unemployment (Campbell et al. 2013, Wertli et al. 2014a, Wertli et al. 2014b Maher et al. 2017). In a British population-based longitudinal study risk factors for persistent disabling pain included passive coping, perceived lack of control over their (patients') pain, low expectations of recovery, negative beliefs and low social class (Chen et al 2018).

2.3 Work Disability

Workers' poor functioning ability, including work participation, is an emerging challenge in occupational health care. The International Classification of Functioning, Disability and Health (ICF) defines disability as an umbrella term for impairments, activity limitations and participation restrictions. Disability is the interaction between individuals with a health condition and personal and environmental factors (e.g. negative attitudes, inaccessible transportation and public buildings, and limited social supports). Work disability is a function of whether the person can perform specific work-related tasks and of external factors. ICF is a classification of health and health-related domains but as the functioning and disability of an individual occurs in a context, ICF also includes a list of environmental factors. (WHO, 2018).

How a society defines and treats persons with a limitation in ability or disability has roots in many different cultures. Disability is not just a health problem. It is a complex phenomenon, reflecting the interaction between features of a person's body and features of the society in which he or she lives. From the point of view of the measurement of work disability, it is useful to distinguish between the degree of difficulty a person has in carrying out an activity and the other factors (such as barriers in the environment, attitudes of employers or coworkers, and other restrictions) that might prevent the performance of that activity in daily life. (WHO, 2019).

Predictors of short-term work disability include e.g. adverse lifestyle factors (Airaksinen et al. 2017, Kanerva et al. 2018), while predictors of long-term disability included e.g. depression, sex, age, socioeconomic position, previous sickness absences, number of chronic diseases, smoking, shift work, working night shift and sleep disturbance (Airaksinen et al. 2018). Among women with musculoskeletal pain, psychosocial and lifestyle factors significantly correlated with work engagement, while the pain itself did not (Malmberg-Ceder et al. 2016). Additionally, multisite pain predicted sickness absence in a Finnish longitudinal population-based study with a 7-year follow-up (Haukka et al. 2013).

Problem solving at workplace is in key role to prevent back disability and persistent work impairment due to LBP. Workplace-interventions that are combined with screening of BPS factors and focused on supervisors have shown benefits for reducing disability outcomes and are likely cost-effective (Shaw et al. 2013, Linton et al. 2016). There is evidence that cognitive-behavioral preventive interventions reduce the risk of long-term work impairment (Nicholas et al. 2011, Linton et al. 2005, Bergbom et al. 2014, Hill et al. 2011). De Brower et al. (2017) showed that prevention of long-term sickness absence is effective with a strategy involving screening and structured early consultation. The implementation of this preventive strategy has proven difficult. Factors hindering implementation to the occupational physicians were difficulties in communicating the risk of future sick leave, prioritization of other tasks, maintaining a reactive approach due to work pressure, preference for prevention at the level of the work environment, privacy issues related to labeling workers to have mental or psychosocial issues, and the biomedical model being the preferred model in use. (de Brower et al. 2017.)

2.4 Biopsychosocial Model

In 2005, a multidimensional BPS-orientated approach to assessment and management in LBP was proposed (O'Sullivan 2005). BPS approach focuses on personalized pain education, fear reduction, functional activation and adapting healthy lifestyle behaviors when serious pathology has been ruled out. The magnitude of the intervention is tailored according to the patient presentation and response to treatment intervention. (O'Sullivan & Lin 2014.) This cognitive functional approach (Figure 1) has been shown to demonstrate superior outcomes compared with the best evidence-based usual care, consisting of manual therapy and exercises, at the 12-month follow-up (Vibe Fersum et al. 2013).

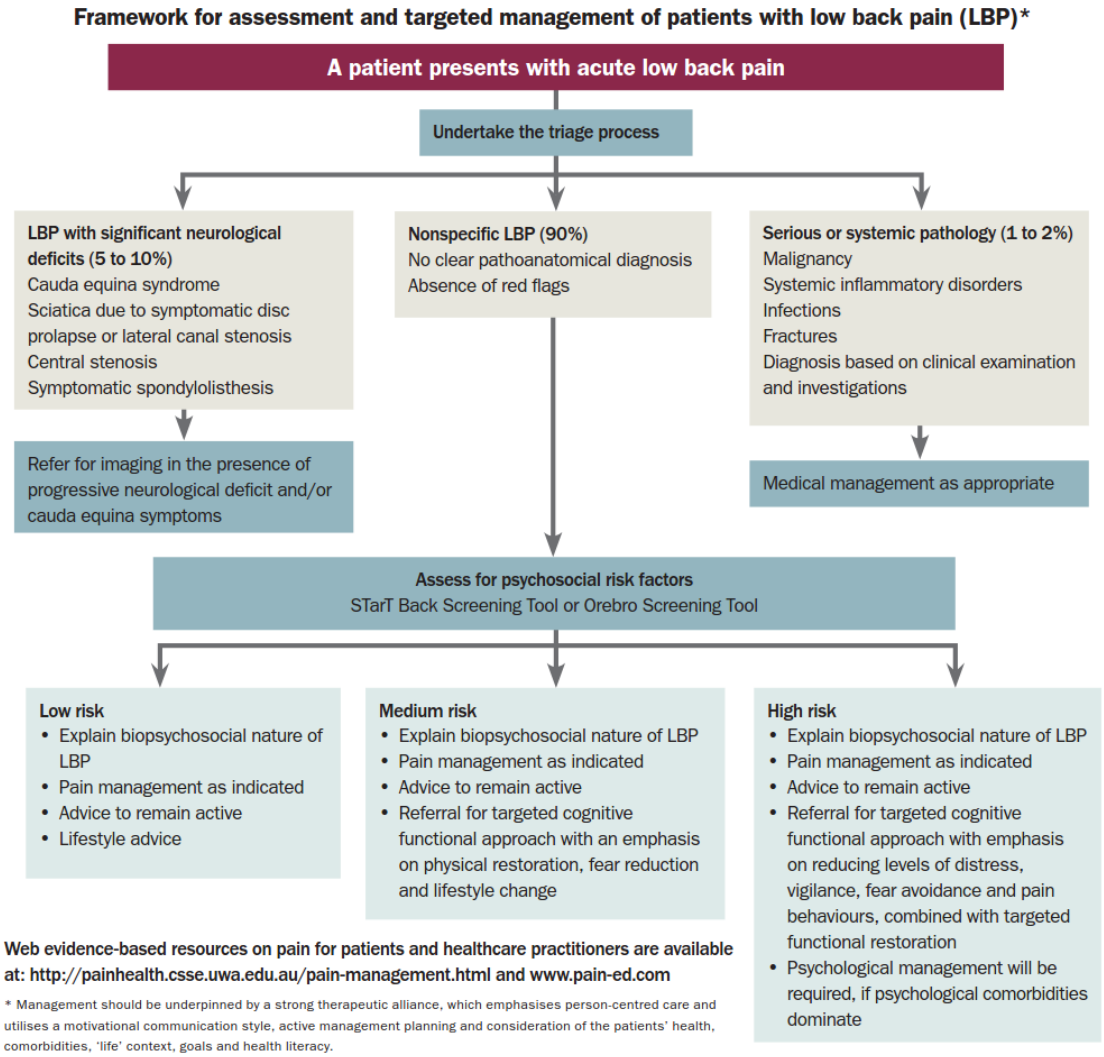

FIGURE 1. Biopsychosocially oriented management of patients with low back pain (O'Sullivan & Lin 2014).

All major guidelines on the management of LBP recommend a BPS management approach (Koes et al. 2010, NICE 2016), but translation of research findings into clinical practice is a widely recognized problem. To improve the effectiveness of healthcare, care processes need to take these factors into account individually and systematically (Foster et al. 2018).

2.5 How to Identify Patients at High-Risk

It is important to identify the patients at high risk for prolonged disabling pain problem at early stage especially in occupational health care. In addition to symptom-related factors, lifestyle factors, psychological factors and social factors should be individually evaluated in order to describe facilitators and barriers to recovery and return to work.

A current trend in health care services is to use brief risk prediction methods such as the short-form of Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ-short, Linton et al. 2011) and the Keele STarT Back Tool (SBT, Hill et al. 2008, Hill et al. 2011) to identify patients with an increased likelihood of delayed recovery and individualize care for these patients from day one (rather than waiting for prolonged disability, work absenteeism or failure of first-line care). These methods can also help the clinician to better understand the reasons for potentially poor prognosis and thereby target interventions according to individual risk profile (Hill et al. 2010, Karran et al. 2017). Targeted individualized care can offer potential to optimize treatment benefits, reduce harms and maximize healthcare efficiency.

Screening Instruments

The ÖMPSQ-short and SBT have been developed for the easy and systematic identification of predictive psychosocial and symptom-related factors (ÖMPSQ, Linton et al. 2011; SBT, Hill et al. 2008, Hill et al. 2011). Both SBT and ÖMPSQ have shown to be valid instruments for identifying people at a higher risk of prolonged disabling pain problems or pain-related adverse effects such as work disability (Hill et al. 2010, Karran et al. 2017). Moreover, a recent Finnish study found

that both the SBT and ÖMPSQ-short are able to detect individuals with accumulated risk factors for prolonged disability among working-age people with LBP (Simula et al., in press).

Start Back Tool (SBT)

The SBT was developed to identify subgroups of patients with non-specific LBP in order to determine which kind of treatment each patient would benefit. It consists of nine items. Cut-off scores divide patients into low-, medium- and high-risk groups to enable targeted treatment. (Hill et al. 2008.) SBT has been validated into Finnish (Piironen et al. 2016). Using SBT as a screening method for the classification-based approach has shown to improve the efficiency of primary care for patients with back pain (Hill et al. 2011).

Karran's (2017) meta-analysis evaluated the performance of LBP screening instruments for determining risk of poor outcome in adults with LBP of less than 3 month's duration. Five studies investigated the SBT: performance for discriminating pain outcomes at follow-up was 'non-informative' (pooled AUC = 0.59 (0.55–0.63), n =1153) and 'acceptable' for discriminating disability outcomes (pooled AUC = 0.74 (0.66–0.82), n = 821). SBT was designed for stratified approaches aiming to match patients to the most appropriate care pathways on the basis of their presentation. Studies in the meta-analysis were not excluded on the basis of how the instrument was developed, or the primary intention of the instrument. SBT was developed to include only 'modifiable' prognostic factors and was specifically intended for the purpose of matching subgroups of patients to stratified care pathways. (Karran et al. 2017, Hill et al. 2008.)

Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ)

The 10-item ÖMPSQ-short was developed from the original 25-item longer version for short and easy clinical utility and has shown to be appropriate for clinical and research purposes (Linton et al. 2011). The ÖMPSQ and ÖMPSQ-short focus specifically on the psychosocial risk factors of chronic pain such as depressive symptoms and fear-avoidance beliefs, and thus enable the identification of workers at a higher risk of work disability (Linton et al. 2003, Boersma et al. 2005, Linton et al. 2016). A cut-off score is primarily used to identify patients at high risk

(Linton et al. 2011) but it can also be used to differentiate between low-risk and medium-risk groups (Hill et al. 2010, Ruokolainen et al. 2016).

A meta-analysis (Karran et al. 2017) had seven studies that investigated the ÖMPSQ: performance was ‘poor’ for discriminating pain outcomes (pooled AUC = 0.69 (0.62–0.76), n = 360), ‘acceptable’ for disability outcomes (pooled AUC = 0.75 (0.69–0.82), n = 512), and ‘excellent’ for absenteeism outcomes (pooled AUC = 0.83 (0.75–0.90), n = 243). ÖMPSQ performed well at predicting return to work outcomes but has little value on predicting likely pain outcomes. Again, the instrument was not designed to predict pain. (Karran et al. 2017, Linton et al. 2003.)

2.6 Why Education of Health Care Professionals is Needed

Clinical assessment and reasoning is not a reliable way to identify patients’ psychological features and professionals are not confident that they can identify which patients will develop prolonged problems - and which will not (Beales et al. 2016, Linton et. al 2002). Hill´s study (2011) showed that the patients with low-risk and good prognosis are often overtreated (as they recover well in any case), while the high-risk patients who need a more extensive volume of physiotherapy are undertreated (Hill et al. 2011). Furthermore, healthcare professionals seem to under-evaluate the amount of patients’ fear and avoidance behavior due to pain (Beales et al. 2016, Jellema et al. 2007). Both screening instruments offer prognostic information for the purpose they are intended: SBT for ‘stratified care’ (Hill et al. 2011) and ÖMPSQ, with ‘excellent’ performance for discriminating workers’ risk of prolonged work absenteeism, for work disability regardless of country and across varied clinical settings (Karran et al. 2017). Nonetheless, these screening tools are underutilized in everyday practice.

For most people, psychological features are present at the start (Shaw et al. 2013) and it is ideal to use screening questionnaires at first clinical appointment (Linton 2018). If health care professionals are not confident to ask patient’s conceptions, worries and fears about pain and if patient feels hurried, interrupted and rushed during the interview, it is not easy for the patient to bring these issues to

discussion. A screening questionnaire is a tool for professional to start conversation about pain-related psychological features that may prevent or delay recovery. Holopainen et al. (2018) studied conceptions of patients with LBP about their encounters in the health care. Having professionals who are consistent and know patient´s whole story was considered to be important in order to find appropriate clinical pathway. Patients found it unhelpful when health care professionals gave scary information, did not consider their expectations, overtreated them unnecessarily, provided information they did not understand, did not give them clear explanation for their pain, blamed them for their problem, and gave inconsistent information. Patients' conceptions about their encounters in the health care was that professionals did not in many cases provide them clear treatment plan, the patients were not involved in their own rehabilitation plan and there was no follow-up for them. (Holopainen et al. 2018.)

Setchell (2017) found that majority of patients indicated that their understanding of why their LBP is persistent or recurring came from health care professionals. The findings of the 'course of LBP as very negative' were often closely linked with the understanding of the body as 'a machine that can break' and as 'permanent'. Potentially harmful biomechanical and biomedical statements in use include for example "When you feel low back pain, it is a sign of a danger or damage. The muscles are weak, you need to protect your back and tense your core. It is not safe to use your back, bend or lift weights until the pain is gone. Your back needs to be fixed". These beliefs are transferred from health care professionals to patients. Encouragingly, if LBP was perceived as normal rather than biomedical or structural (something to 'fix'), potentially harmful beliefs and their negative implications, such as avoidance of activities, might be avoided. (Setchell et al. 2017.) A positive interaction with health care provider can have a life-changing effect on patient´s way of life. Patients found it helpful when professionals were empathetic and supportive, made them feel safe and build their confidence, took time to listen their worries, concerns and fears and understood their goals and life circumstances. Patients perceived it as extremely important that health care provider explained why they have pain using simple language and provided them long-term plan that is flexible and adopted to their lives. (Holopainen et al. 2018). Consequently, the training of health care professionals is important.

2.7 Association of Occupation and Pain-related Psychosocial Features

A cross-sectional study among British primary care LBP patients evaluated head-to-head comparison of the SBT and ÖMPSQ (Hill et al. 2010). In the study, the SBT allocated 25% of primary care patients with LBP into the high-risk group and the ÖMPSQ 38% (Hill et al. 2010). Finnish study (Simula et al., in press) compared the distribution of risk groups by using both of the screening instruments in a large population-based sample (n = 3079). By using SBT, 86.2% of men were classified to low-risk, 10.1% to moderate-risk and 3.8% to high-risk group. Among women, the corresponding percentages were 87.4%, 9.4% and 3.3%, respectively. By using ÖMPSQ-short, 85.1% of men were classified to low-, 8.4% to moderate- and 6.5% to high-risk. Among women, the corresponding percentages were 80.1%, 11.3% and 8.6%, respectively. (Simula et al., in press). In the English study respondents had current LBP, while the Finnish population-based sample included respondents that had had (or had) LBP during the past year. The distribution of low-, medium- and high-risk groups among Finnish patients with LBP according to occupational status is not known.

We know that psychological factors are present in most of patients with pain, but the amount of these factors varies individually (Dunn & Croft 2006). In addition, disabling LBP is over-represented among people with low socioeconomic status (Hartvigsen et al. 2018). To the authors´ knowledge, it has not been investigated the association of patients' occupation or field of education with psychosocial factors of pain.

We hypothesize that patients who are professionally inclined to a biomechanical conception (e.g. engineers, teachers, doctors, nurses) can be easily identified with SBT and ÖMPSQ instruments. We are interested to know, whether patient's occupation is associated with psychological pain-related features.

3 OBJECTIVES AND AIMS OF THE STUDY

The objective of the study is to develop a learning material for occupational physiotherapists on individualized assessment of patients with non-specific LBP. The purpose of the developmental part of the thesis is to describe how to identify psychosocial risk factors for disabling LBP in order to prevent development of prolonged problems and work absence. The aim of the learning material is to help health care professionals in communicating to patients with LBP belonging to high-risk group, using the short form of Örebro Musculoskeletal Pain Screening Questionnaire, and using a validation method for establishment of therapeutic alliance. This learning material is confidential and therefore it is not attached to the public document of thesis report.

The secondary purpose is to investigate the distribution of the SBT and ÖMPSQ-short risk groups and individual questions of these questionnaires among patients with LBP in occupational and primary health care and the association of the screening instruments with patients' occupational education.

Research Questions

The following research question will be addressed: "Is there a difference in the distribution of risk profiles, based on the two screening instruments, according to patients' occupational education?" Furthermore, we want to evaluate: "Are individual questions of the two screening instruments, SBT and ÖMPSQ-short, associated with patients' occupational education?"

For the learning material of BPS approach, the research question is: "How do occupational physiotherapists experience biopsychosocial approach and identification of pain-related psychosocial risk factors?"

4 METHODS

4.1 Study Population

The study population belongs to the studies “Effectiveness of biopsychosocially orientated management of low back pain in occupational health care” and “Classification-based approach for low back pain in the primary care”. Health care professionals recruited the patients related to two ongoing clinical trials. The study population included all patients 18-65 years of age contacting heath care due LBP with or without radicular pain. The exclusion criteria were suspicion of a serious cause for LBP or LBP requiring urgent care. In the primary care study, additionally, first patient-reported contact with health care due to LBP and episode lasting less than 2 weeks. Patients received written information about the study. Health care professionals from the intervention units of the cluster randomized clinical trial recruited the patients from 09/2017 until 11/2018. Professionals consisted of occupational physiotherapists and physicians from 28 occupational health care units in Finland: Mehiläinen (Helsinki, Turku, Oulu, Kokkola, Espoo, Jyväskylä, Kuopio), Attendo (Vantaa, Oulu Nuottasaari, Oulu, Kemi, Kempele, Imatra, Valkeakoski, Loimaa, Haukipudas, Liminka, Rovaniemi), municipal health care units (Työterveys Virta Oulu, Työterveys Virta Lakeus, Työterveys Virta Rehapolis, Työplus Kokkola), Pohjolasairaala (Oulu) and Terveystalo (Oulu, Tampere, Varkaus, Kouvola, Lahti). The primary health care study population belongs to the study “Classification-based approach for low back pain in the primary care” and is recruited from three primary health care regions in Finland (Etelä-Savo Social and Health Care District (Essote), South Karelia Social and Health Care District (Eksote) and Rovaniemi primary health care). Data were collected by webropol surveys at baseline, three months, one year and three years, but in this study, only baseline data is used.

The patients answered to questionnaires related to lifestyle factors such as smoking, level of physical activity, weight and height; musculoskeletal symptoms, psychological characteristics; demographic data such gender and age; socioeconomic status including occupation, and country of birth. These were considered as possible confounders or effect modifiers. Patients answered to SBT and

ÖMPSQ-short. The study nurse ensured that patients responded to questionnaires. She collected patient consent forms and evaluated the quality and completeness of input data.

4.2 Screening Tools

We used the previously validated Finnish version of the SBT (Piironen et al. 2016). The SBT (Appendix 1.) consists of nine independent prognostic indicators of the persistence of disabling LBP, and covers eight constructs: bothersomeness, referred leg pain, comorbid pain, disability (two questions), catastrophizing, fear, anxiety, and depressive symptoms. The response alternatives to Items 1–8 were ‘‘agree= 1 point’’ or ‘‘disagree = 0 point’’. Item 9 had five options, of which the two highest responses counted as one point. Thus, the maximum total score range was 0–9. In addition, the psychosocial subscale was derived from Questions 5–9 (range 0–5). Based on the score, the following risk groups were formed: 1) low-risk (total score of 3 or less); 2) medium-risk (total score 4 or more and psychosocial subscale score of 3 or less); and 3) high-risk (total score and psychosocial subscale score of 4 or more).

We used a ten-item short version of the validated Finnish version of the ÖMPSQ (Ruokolainen et al. 2016). The ÖMPSQ-short questionnaire (Appendix 2.) includes items about 1) the duration of pain(s), 2) pain rating, 3) the ability to do light work, 4) the ability to sleep at night, 5) anxiety feelings, 6) depressed feelings, 7) the perceived risk of pain becoming chronic, 8) self-estimate of return to work and 9–10) fear-avoidance beliefs. Items were scored from 0 to 10, 0 being the absence of impairment and 10 severe impairments. For Questions 3, 4 and 8, reverse scoring was used. The scores were summed up and the respondents were divided into three groups according to the total score: 1) low-risk (0–39 points), 2) medium-risk (40–49 points) and 3) high-risk (50–100 points).

4.3 Occupational and Educational Characteristics

We enquired occupation and classified participants into 12 classes based on field of industry. Our educational variable follows the field of education used by Statistics Finland, which in turn is based on the Finnish National Agency for Education and International Standard Classification. National field of education (2016) consisted 12 classes: 1) generic programmes and qualifications, 2) education, 3) arts and humanities, 4) social sciences, journalism and in-formation, 5) business, administration and law, 6) natural sciences, mathematics and statistics, 7) information and communication technologies (ict), 8) engineering, manufacturing and construction, 9) agriculture, forestry, fisheries and veterinary, 10) health and welfare, 11) services and 12) unknown.

Educational level was classified according to national recommendation used by Statistics Finland, which is based on international classification. National level of education 2016 consisted of 10 classes: 1) early childhood education, 2) primary education, 3) lower secondary education, 4) upper secondary education, 5) post-secondary non-tertiary education, 6) short-cycle tertiary education, 7) bachelor's or equivalent level, 8) master's or equivalent level, 9) doctoral or equivalent level and 10) not elsewhere classified. We classified participants by educational level into four subgroups: 1) vocational education (lower than bachelor’s level), 2) bachelor’s or equivalent level, 3) master´s level or higher 4) not classified.

4.4 Statistical Methods

Baseline characteristics were analyzed by descriptive statistics. We used the Chi-square test to analyze the risk groups (SBT and ÖMPSQ-short) according to occupation. The association of individual SBT questions with occupation were evaluated using Fisher’s exact test. The association of individual ÖMPSQ-short questions with occupation were evaluated using Mann-Whitney U-test because of the skewed distribution of the responses. The association of individual SBT and ÖMPSQ-short questions were analysed in occupational fields with individuals ≥ 5% of the total study population. The level of statistical significance was set at $p<0.05$. The analyses were carried out using SPSS version 25.

5 RESULTS

5.1 Characteristics of the Study Population

In total, the study population included 674 participants (410 women (60.8%) and 264 men (39.2%); Figure 2). Mean age was 44.3 (range 18 - 67). Education level (Figure 3) was lower among men (64% of men had vocational, 21% bachelor's or equivalent level and 5% master's level or higher education) than among women (57%, 24% and 12%, respectively).

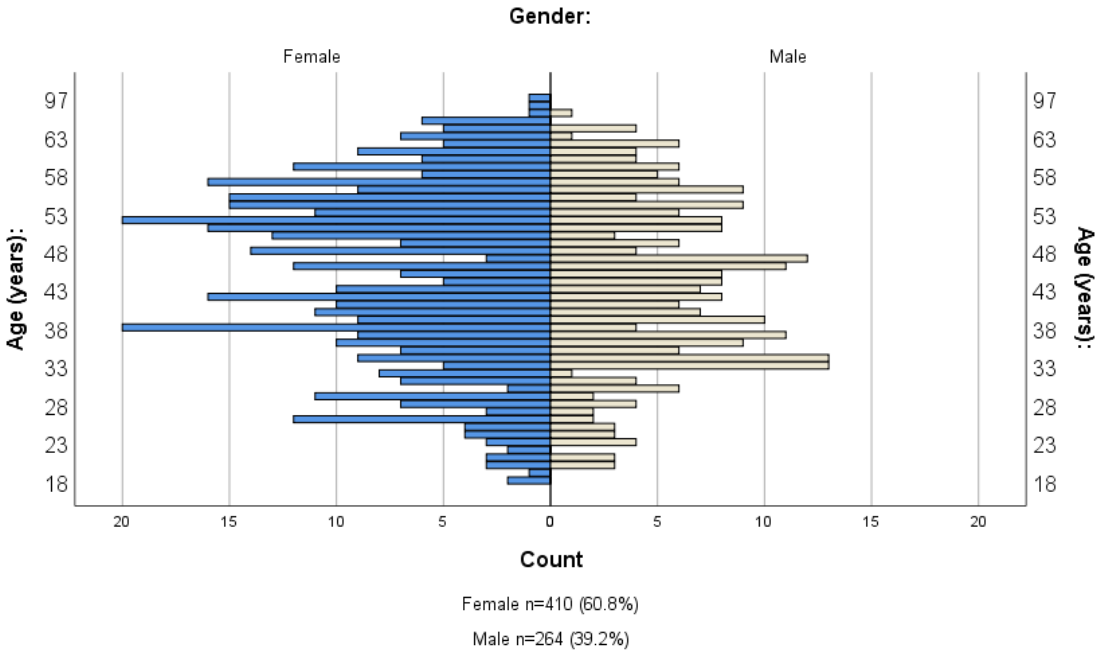

FIGURE 2. Age distribution of the study population by gender (n).

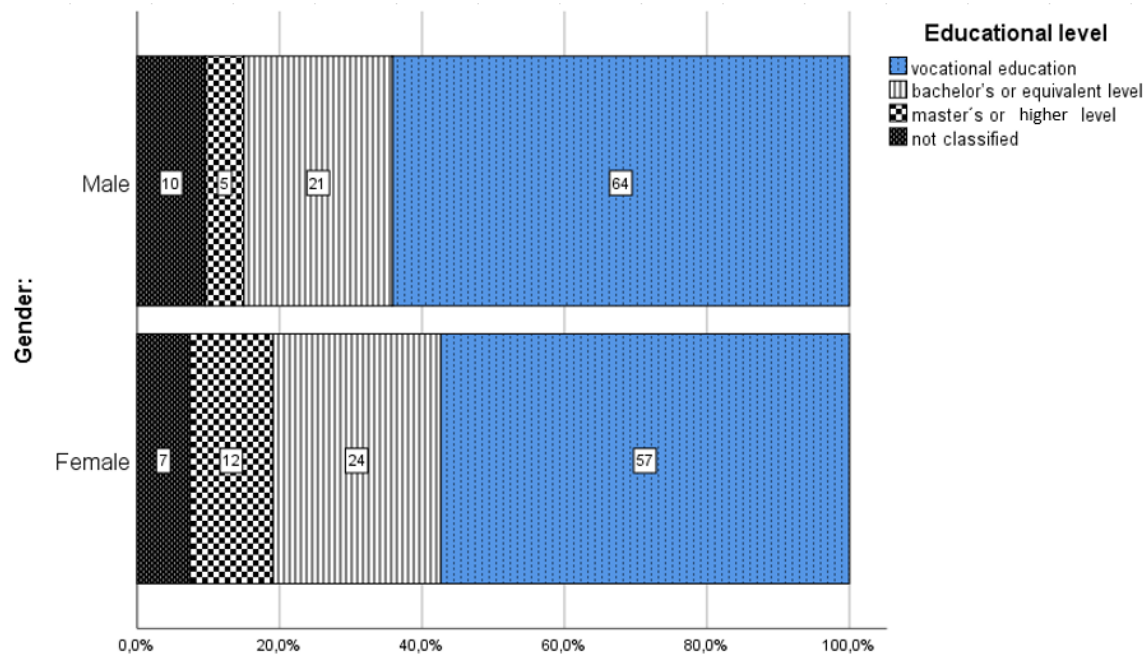

FIGURE 3. Educational level of the study population by gender (%).

5.2 Risk Classification of the Study Population

We classified the study population into risk groups with SBT and ÖMPSQ-short. By using SBT, 46% of men were classified to low-risk, 38% to moderate-risk and 16% to high-risk group. Among women, the corresponding percentages were 39%, 47% and 15%, respectively. There was no statistically significant difference between genders (p=0.097). Figure 4 in Appendix 3 presents classification of the study population into risk groups using SBT.

Figure 5 (Appendix 3) presents classification of the study population into risk groups using ÖMPSQ-short. Among men, 50% were classified to low-risk, 22% to moderate-risk and 28% to high-risk group. Among women, the corresponding percentages were 50%, 21% and 29%, respectively. There was no statistically significant difference between genders (p = 0.842).

Because of no significant gender interaction in the risk groups, the analyses on the association of occupation with SBT and ÖMPSQ-short risk groups and their individual questions are performed for the whole study population (i.e. men and women were combined).

5.3 Association of Occupational Education and Educational Level with Risk Groups

We investigated if there were association between fields of occupational education and risk groups according to SBT and ÖMPSQ-short. Figure 6 in Appendix 4 presents fields of occupational education according to SBT risk groups. In the whole study population, no statistically significant difference was observed (p= 0.081). Figure 7 (Appendix 4) presents fields of occupational education according to ÖMPSQ-short risk groups, and again no statistically significant difference was observed (p=0.091).

Association between educational level and risk groups according to SBT and ÖMPSQ-short and was not found in this study population. Figures 8 - 9 in Appendix 5 presents SBT and ÖMPSQ-short risk groups according to educational level. SBT risk groups were not associated significantly with educational level (p=0.063, Figure 8) while ÖMPSQ-short risk groups were associated with educational level (p=0.022, Figure 9). However, the latter analyses become non-significant when patients with unknown level of education were excluded.

5.4 Association Between Occupational Characteristics and the Individual Questions of STarT Back Tool

Questions 1 - 4 in Start Back Tool investigate symptom related factors: referred leg pain (question 1), comorbid pain (question 2), and difficulties in walking (question 3) and dressing (question 4). Questions 5 – 9 identify predictive psychosocial factors: fear of physical activity (question 5), anxiety (question 6), pain catastrophizing (question 7), depressive mood (question 8) and overall impact of pain (question 9). (Piironen et al. 2016). There were no differences between occupational characteristics and questions 1, 3, 4, 6, 8 and 9. We found statistically significant association between SBT questions 2, 5 and 7 (Appendix 6).

Question 2 shows that comorbid pain was common among patients with LBP. Patients working in field of services had less shoulder or neck pain than other

occupations (59.5% of patients working in services had neck pain during the last 2 weeks vs. 73.4% in other occupations; p = 0.003).

Fear of physical activity was greatest in occupations in the technical fields (i.e. engineering, manufacturing and construction) (22.8% vs. others 13.6%; p = 0.015) and services (21.4% vs. others 13.7%; p = 0.038). Question 5 shows that LBP patients working in health and welfare had least fear towards physical activity (9.0% vs. others 16.8%; p = 0.025).

In question 7 pain catastrophizing was highest in technical fields of occupational education (31.6% vs. others 21.4%; p = 0.028) and lowest in occupations of health and welfare (13.2% vs. others 25.8%; p = 0.001).

5.5 Association Between Occupational Characteristics and the Individual Questions of Örebro Musculoskeletal Pain Screening Questionnaire

ÖMPSQ-short investigates psychosocial and other factors related to pain and disability: the duration of pain(s) (question 1), pain rating (question 2), the ability to do light work (question 3), the ability to sleep at night (question 4), anxiety feelings (question 5), depressed feelings (question 6), the perceived risk of pain becoming chronic (question 7), self-estimate to return to work (question 8) and fear-avoidance beliefs (questions 9 - 10). Tables 1 - 10 (Appendix 7) shows the association between occupational characteristics and individual questions of ÖMPSQ-short.

ÖMPSQ-short identified that patients with occupational field of business, administration and law were most optimistic on their opportunities to return to work (p = 0.007) compared to other fields of occupations (question 8). Patients with occupational field of business, administration and law (p = 0.004) and education (p = 0.036) had most positive attitudes on continuing with normal duties at work or at home despite of their pain (question 10).

5.6 Occupational Physiotherapists´ Experiences of Biopsychosocial Approach

I presented the learning material for 100 Finnish occupational physiotherapists at 8.2.2019 in Helsinki, Finland. Learning material provided information how to use BPS approach in physiotherapy practice and screen for pain-related psychosocial factors among working-age LBP patients. It consisted of 42 pages in PowerPoint and included practical advices for physiotherapist's first appointment, how to use validation method for establishment of therapeutic alliance, identify barriers for recovery, evaluate psychosocial factors by using ÖMPSQ-short and plan the treatment for low-, medium- and high-risk patients. This learning material is confidential and therefore is not attached to thesis.

The feedback workshop consisted of two questions: 1) What is the potential in biopsychosocial approach? 2) Are there obstacles to implement the approach to practice? The occupational physiotherapists shared their experiences in small groups and discussions were summed together. The feedback was processed to written summary and send to author by organizer of the training. Statements were translated into English by author.

The occupational physiotherapists found the new approach more time demanding in clinical practice but offered them a chance to truly listen to the patient. They found multidimensional approach to bring a more extensive aspect to their clinical practice, which they found rewarding. Potentially, patient starts to manage self his/her pain and takes control of lifestyle issues when physiotherapist avoids medicalization (emphasize the structural findings) of patient's pain problem. Physiotherapists' role is more couching than before. Physiotherapists found that BPS approach is suitable for all patients with pain problems. They saw possibilities to increase co-operation with psychologists, occupational nurses and physicians. However, physiotherapists were doubtful that the language professionals use is currently not coherent.

Physiotherapist should be active in utilizing multiprofessional teamwork and guide the patient to psychologist when needed. The physiotherapists feared that there is a risk of their own mental exhaustion when patients bring out psychological issues and they hoped for professional guidance and support. They also

acknowledged that majority of patients reports contain biomedical information that is not accurate or essential, can possibly be harmful and even may worsen patient's prognosis. They found important that physicians have enough knowledge of BPS approach. They called for educational materials for all professionals encountering LBP patients (nurses, physicians and other rehabilitation personnel).

6 DISCUSSION

6.1 Evaluation of the Results

The hypothesis that patients with LBP who are professionally inclined to a biomechanical conception can be easily identified with SBT and ÖMPSQ instruments was supported by the current findings. We found that individual questions of SBT and ÖMPSQ were related to certain fields of occupational education. In SBT-questions related to fear of physical activity and pain catastrophizing, patients in technical fields of occupation (i.e. engineering, construction and manufacturing) had more fear-avoidance beliefs and negative conceptions towards physical activities (fear of pain) than other fields of occupations, whereas patients working in health and wellbeing sector had less pain catastrophizing and had most positive attitudes towards staying physically active with pain. In two fields of education (business, administration and law; education) a few responses to single ÖMPSQ questions were more positive (i.e. better conception of own work ability and self-estimation to return to work) compared to the whole study population. There were no significant differences in distributions of SBT- or ÖMPSQ-short risk groups in relation to fields of occupational education. To the author's knowledge, no previous studies about the role of occupation on distribution of SBT and ÖMPSQ risk groups and their individual questions have been published.

In previous studies initial high pain intensity, psychological distress and accompanying pain at multiple body sites have proven to be risk factors of persistent disabling LBP (Hartvigsen et al. 2018, Coggon et al. 2019). In addition, disabling LBP is over-represented among people with low socioeconomic status (Hartvigsen et al 2018). In this study, 65 - 78% of individuals had referred leg pain, 59 – 78 % comorbid pain and 50 – 65 % anxiety and 54 – 65 % depressive mood. These were common among LBP patients in all occupational educations. With the insight provided by this research, accumulation of health issues (e.g. comorbid pain; psychological distress; adverse lifestyle factors) should be considered when programming preventive and treatment measures to patients with increased risk of pain becoming chronic.

A British primary care study compared head-to-head of the SBT and ÖMPSQ evaluation with LBP patients. The SBT allocated 25% of patients with LBP into the high-risk group and the ÖMPSQ 38%. (Hill et al. 2010.) In a large Finnish general population study (Simula et al., in press), the percentages of persons belonging to the medium and high-risk groups were smaller. In this study SBT allocated 16% of men and 15% of women to high-risk group and ÖMPSQ-short 29% and 28%, respectively. In the current study, the distribution of low-, medium- and high-risk groups among Finnish patients with LBP was also evaluated according to occupational status. Our results suggest that occupational differences do exist in attitudes towards staying active despite of pain with technical fields being more negative and health sector more positive. However, the variation between individual patients with LBP was much larger than the variation observed according to occupations. Thus, these results accord with the existing concept that highlights an individualized assessment of psychosocial factors among patients with LBP – occupation *per se* does not suggest that a worker has a poorer prognosis.

The findings of occupational differences with pain-related psychosocial factors could help professionals to design better preventive interventions for work communities in different fields of industries. Both questionnaires found significant associations between occupation and individual questions. We found differences in field of occupational education and individual questions according to comorbid pain, self-estimate to return-to-work, fear for physical activity, pain catastrophizing and fear-avoidance beliefs. The majority of differences found between occupational fields are explained with psychosocial pain-related factors - and not with other factors, evaluated using SBT and ÖMPSQ-short questionnaires, such as symptom-related factors, referred leg pain, difficulties in walking and dressing, the duration of pain(s), pain rating, the ability to do light work, the ability to sleep at night, anxiety feelings, depressed feelings, the perceived risk of pain becoming chronic or overall impact of pain. In this study, the differences of the physical demands and the gender distribution between the occupations are not known. People with physically demanding jobs, physical and mental comorbidities, smokers, and obese individuals are at greatest risk of reporting LBP (Hartvigsen et al. 2018). Simula et. al (in press) found that individuals in high-risk groups of

ÖMPSQ-short and SBT accumulate more negative health issues, including adverse lifestyle factors such as smoking and obesity, and the instruments are able to detect individuals with accumulated risk factors for prolonged disability (Simula et al., in press). From previous studies we also know that the two questionnaires pick partly different respondents to high-risk groups complementing thereby each other (Hill et al. 2010; Simula et al., in press). We suggest that this might be explained with the difference of the goals the instruments were designed for and therefore the formulation of the questions used in the screening tools. In ÖMPSQ, respondents choose the answer from a scale of 1-10 and in SBT respondents choose agree/not agree for an answer. Some respondents might have avoided answering extreme scores in ÖMPSQ-short in this study, as it did not identify negative associations between occupational fields and individual questions as well as SBT.

The previous studies have shown that clinical assessment and reasoning is not a reliable way to identify patients' psychological features and professionals are not confident that they can identify which patients will develop prolonged problems - and which will not (Beales et al. 2016, Linton et. al 2002). Health care professionals also seem to under evaluate the amount of patients' fear and avoidance behavior due to pain (Beales et al. 2016, Jellema et al. 2007). Our results suggest that patients that had occupational education in health and wellbeing fields had less pain catastrophizing and most positive attitudes towards staying physically active with pain, whereas patients with technical fields of occupation had more fear-avoidance believes and negative conceptions towards physical activities (fear of pain) than other fields of occupations. It is an interesting question whether health care professionals can identify fear-avoidance behavior and patients' worry as they should give to patients enough understanding and support to alleviate pain catastrophizing? Setchell et al. (2017) found that professionals tend to give information that can cause more fear to patients. Harm is done when people might modify their behavior in a manner that may worsen their LBP prognosis.

There is considerable evidence to suggest that beliefs in the anatomical causes of persistent pain are related to greater likelihood of beliefs in physical disability

and avoidance of activities, low perception of controllability of LBP and poor clinical outcomes (Setchell et al 2017, Walsh & Radcliffe 2002, Foster et al. 2008). In this study, occupational physiotherapists experienced that all health care professionals encountering patients with LBP should be trained to evaluate and treat patients with psychological problems. Therefore, training of health care students (including physicians) should be performed in a BPS context.

This thesis was originally designed to concentrate on an area of wellbeing technology and remote rehabilitation services for patients with LBP. At the same time as I started my major studies 2016, I participated on a study “Individually stratified care for low back pain” as a study physiotherapist. This educational intervention changed my mental (biomedical) model of prevention and treatment of recurrent and prolonged LBP. Eyes-opening experience led to realization that the patients with acute, fluctuating and chronic pain have had the same instructions. Furthermore, the patients with different risk profiles have had similar treatment plans. Often professionals do not have enough time to listen to patients’ story and assess patients´ resources individually taking account of BPS factors and whole life situation along with identification of biomechanical stress factors, giving advice and instructions and adjusting work conditions and work tasks. Therefore, we are trying to solve the multidimensional problem with singular intervention (muscle or motor control exercises, stretching advice, ergonomics, quick fixes of manual therapy). Individualized assessment should be done according to requirements coming from patients´ environment and target BPS rehabilitation measures individually to support patients´ whole life situation (Recommendation by the Council for Choices in Health Care in Finland (COHERE Finland, 1.11.2018). This may require longer appointments than before but it is in essential in preventing chronic LBP. The cause of LBP is by far not always clear (Hartvigsen et al. 2018) but thoughts, talk and practices relating to patients’ chances to recover have impacts on whether patients will develop chronic LBP or not (Recommendation by the Council for Choices in Health Care in Finland (COHERE Finland, 1.11.2018). For example, use of direct access to physiotherapists in primary and occupational health care is one step in improving non-pharmacologic treatment pathways for all pain patients.

The developmental part of my thesis consists of learning material for occupational physiotherapists. I have described how to identify psychosocial risk factors for disabling LBP in order to prevent development of prolonged problems and work absence in early stage. The learning material aims to help health care professionals in communicating to patients with LBP belonging to ÖMPSQ-short high-risk group at first clinical appointment. However, the educational material is valid also for high-risk group patients obtained using SBT classification tool. Moreover, the learning material enables therapeutic alliance formation among other pain patients (than those with LBP) as ÖMPSQ is a perfect instrument to be used for work disability evaluation for all pain patients.

Combining the knowledge that I have learned from pain research and the education of well-being technology, the digital health services could provide an option to give better individualized, evidence-based pain management strategies to all patients and ongoing support for those that need it. On the contrary, they can be also misleading for patients at high-risk and psychological distress. Examples of the latter are wearable shirts that are supposed to maintain the straight posture, apps which document patient's detailed pain diary (so well that patient will not think about anything else but pain) and websites that give harmful, frightening information that increases pain catastrophizing rather than alleviates it. Holopainen et al. (2018) study introduced patients' conceptions about their encounters in health care system and brought out that the information given to patients is inconsistent and unhelpful. Patients perceived it as crucial to have support: a clear treatment plan and clear goals by a health care professional who is responsible for the whole clinical process. (Holopainen et. al. 2018.) Therefore, information technology should be used to support the treatment plan and patient´s active living, empowerment and participation by overcoming fear of pain by instructing patients to think positively and encouraging them to active life instead of avoiding activities and left alone. Technology enables the screening for high-risk patients at early stage and makes it possible to design premeditated care pathways without delays in access to multiprofessional care.

6.2 Reliability and Credibility

The thesis has been conducted in accordance with good scientific practice and applied ethically sustainable information gathering, research and evaluation methods. The used references are current, reliable and original. Methods are appropriate, justified and reproducible based on the description. The thesis is implemented by the open nature of scientific knowledge. The author will disseminate the new information established in the thesis through a scientific article.

The strengths of the current study include a large sample size of primary care patients with LBP. Furthermore, both used questionnaires (SBT and ÖMPSQ-short) have been translated and validated into Finnish and have shown to be valid instruments for identifying people at a higher risk of prolonged disabling pain problems or pain-related adverse effects such as work disability (Hill et al. 2010, Karran et al. 2017). A limitation is that the sample size was however not sufficient for evaluation of individual occupations and the gender distribution between the fields of occupational education and individual questions.

Strengths of the developmental part of the thesis are that the learning material provides evidence-based education for professionals treating patients with non-specific LBP. The references are up-to-date and informed about the latest developments of qualified, high-level LBP research. The study contributes to an internationally relevant issue. The synthesis for theoretic bases of thesis and the learning material is made systematically and critically creating new information for occupational physiotherapists. However, considerably more implementation work needs to be done to increase the knowledge of health care professionals of multidimensional, BPS approach to LBP.

6.3 Ethical Aspects

Health care professionals of two clinical trials recruited the patients. Both intervention studies were approved by the Ethical Committee of the Northern Ostrobothnia Hospital District (79/2017 for the occupational health care intervention and 109/2016 for the primary health care). Both studies followed the principles of

the Declaration of Helsinki. All patients took part on a voluntary basis and signed their informed consent. All personal details were replaced by identification codes so that it was impossible to recognize any individual from the data. This provided full anonymity for all the participants. The occupational physiotherapists took part to the educational intervention on a voluntary basis.

6.4 Future Developments

We are interested to know, whether patient's profession is associated with psychological pain-related features in a larger study population. With population-based cohort, it could be possible to evaluate if psychosocial factors and accumulation of comorbidities are associated with individual occupations and the differences between genders. It could be interesting to follow healthcare pathways of patients belonging to different risk-groups, targeted treatments and participation to work (short -and long-term). It has not been evaluated how patients' pain-related beliefs affect professional's clinical decision making. For example, do health care professionals use imaging (radiographs, MRI's) for the purpose of medical diagnostics for patients that are inclined to biomedical model (patients who seek for mechanical explanation for their pain) more often than for other LBP patients?

The findings of this study support and add to other studies on shifting from biomedical approach towards a more multidimensional approach. LBP must be understood beyond biological causes to a complex entity consisting of biological, psychosocial, cultural and institutional factors. In the future, implementation of screening instruments into electrical patient management systems offers a potential to target better disabling LBP. Currently, BPS approach and the screening of psychosocial factors due to musculoskeletal pain is not systematically used. Even though patient management systems are ready for electrical screening questionnaires, they are not commonly used to screen for risk patients, pain-related psychosocial factors and work ability in physiotherapy practices. However, professionals will need further education and support for designing stratified interventions with multidimensional approach.

We hope that this study encourages professionals of health and well-being technology to develop processes with indicators for risk identification. There is a need for artificial intelligence-based tools that utilize evidence-based screening and medical reports, and alert if patients suffer from recurrent LBP or if their functional capacity and work ability are compromised due to pain. There is potential to design novel and modern preventive strategies and reduce costs arising from sickness allowances and disability pensions. Patients would benefit from targeted BPS rehabilitation supported with ongoing contact opportunity when needed, for example by the aid of apps designed to support individualized treatments in order to manage patients with unique, multidimensional non-specific LBP.

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APPENDICES

Appendix 1. STarT Back Tool (SBT)

Thinking about the last 2 weeks tick your response to the following questions:	*disagree*	*agree*
1. Has your back pain spread down your leg(s) at some time in the last 2 weeks?	*0*	*1*
2. Have you had pain in the shoulder or neck at some time in the last 2 weeks?	*0*	*1*
3. Have you only walked short distances because of your back pain?	*0*	*1*
4. In the last 2 weeks, have you dressed more slowly than usual because of back pain?	*0*	*1*
5. Do you think it's not really safe for a person with a condition like yours to be physically active?	*0*	*1*
6. Have worrying thoughts been going through your mind a lot of the time?	*0*	*1*
7. Do you feel that your back pain is terrible and it's never going to get any better?	*0*	*1*
8. In general have you stopped enjoying all the things you usually enjoy?	*0*	*1*

9. Overall, how bothersome has your back pain been in the last 2 weeks?				
Not at all 0	*Slightly 0*	*Moderately 0*	*Very much 1*	*Extremely 1*

For questions 1–8, disagree is calculated as 0 point and agree is calculated as 1 point. For Question 9, the responses very much or extremely are calculated as 1 point. The total score is the sum of all nine questions, the sub score sum of Questions 5–9.

Appendix 2. Short form of the Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ-short)

1. How long have you had your current pain problem? Tick (√) one. 0–1 weeks [1] 1–2 weeks [2] 3–4 weeks [3] 4–5 weeks [4] 6–8 weeks [5] 9–11 weeks [6] 3–6 months [7] 6–9 months [8] 9–12 months [9] over 1 year [10]
2. How would you rate the pain that you have had during the past week? Circle one. 0 1 2 3 4 5 6 7 8 9 10 No pain Pain as bad as it could be
For Items 3 and 4, please circle the one number that best describes your current ability to participate in each of these activities.
3. I can do light work (or home duties) for an hour. 0 1 2 3 4 5 6 7 8 9 10 Not at all Without any difficulty
4. I can sleep at night. 0 1 2 3 4 5 6 7 8 9 10 Not at all Without any difficulty
5. How tense or anxious have you felt in the past week? Circle one. 0 1 2 3 4 5 6 7 8 9 10 Absolutely calm and relaxe As tense and anxious as I've ever felt
6. How much have you been bothered by feeling depressed in the past week? Circle one. 0 1 2 3 4 5 6 7 8 9 10 Not at all Extremely
7. In your view, how large is the risk that your current pain may become persistent? 0 1 2 3 4 5 6 7 8 9 10 No risk Very large risk
8. In your estimation, what are the chances you will be working your normal duties (at home or work) in 3 months 0 1 2 3 4 5 6 7 8 9 10 (10-) No chance Very Large Chance
9. An increase in pain is an indication that I should stop what I'm doing until the pain decreases. 0 1 2 3 4 5 6 7 8 9 10 Completely disagree Completely agree
10. I should not do my normal work (at work or home duties) with my present pain. 0 1 2 3 4 5 6 7 8 9 10 Completely disagree Completely agree
Add all the scores to obtain the total score (For Items 3, 4, and 8 the score is 10 minus the number circled).

Appendix 3. Risk Classification of the Study Population

FIGURE 4. Classification of the study population into risk groups (%) using STarT Back Tool (SBT). The results are presented stratified by gender.

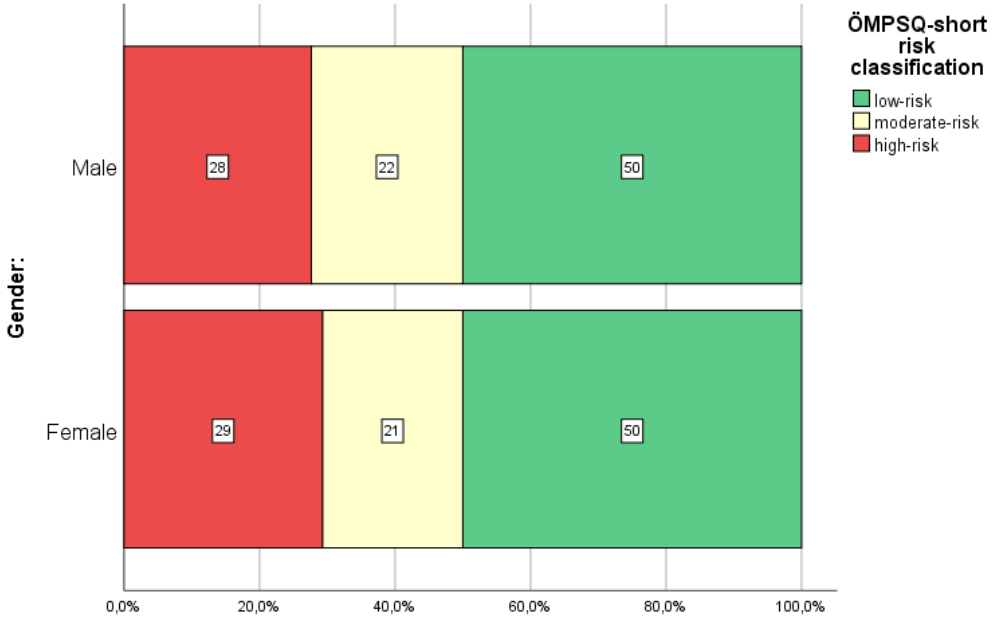


FIGURE 5. Classification of the study population into risk groups (%) using short form of Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ-short). The results are presented stratified by gender.

Appendix 4. Association Between Occupational Education and Risk Groups

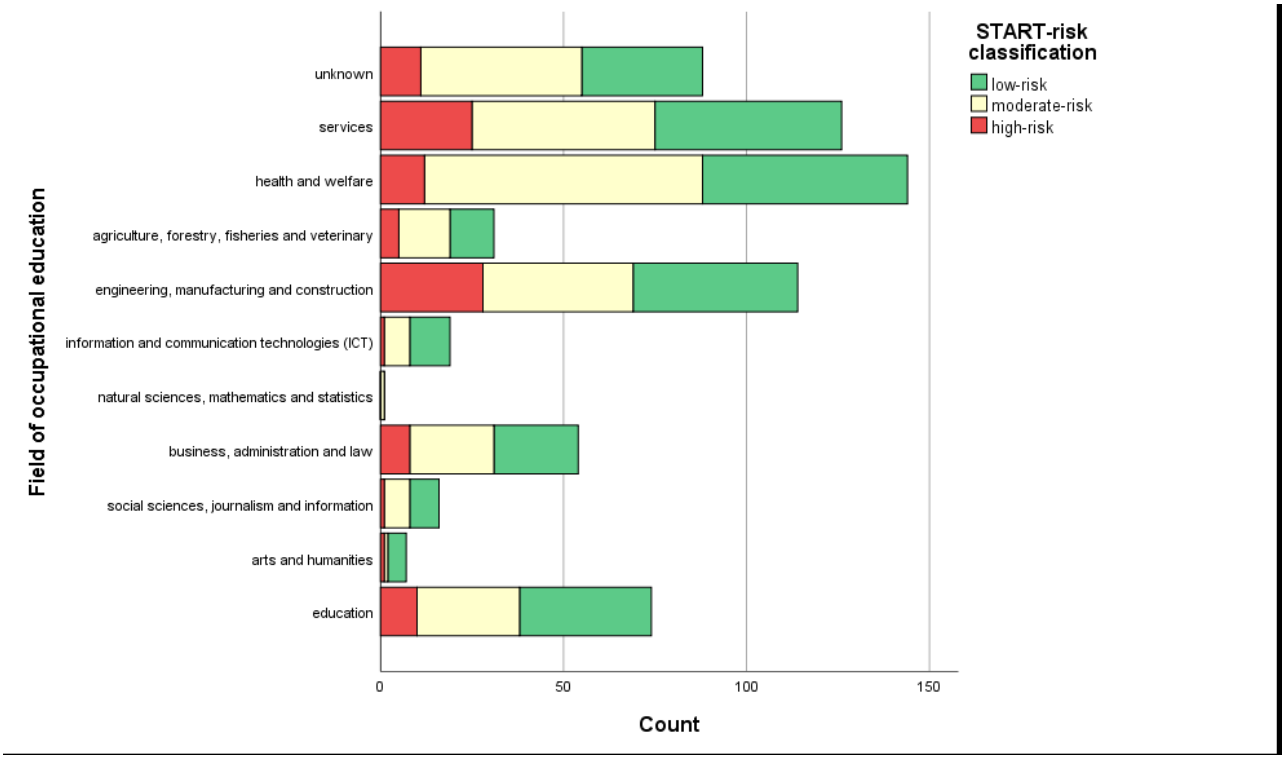


FIGURE 6. Fields of occupational education (n) according to STarT Back Tool (SBT) risk groups.

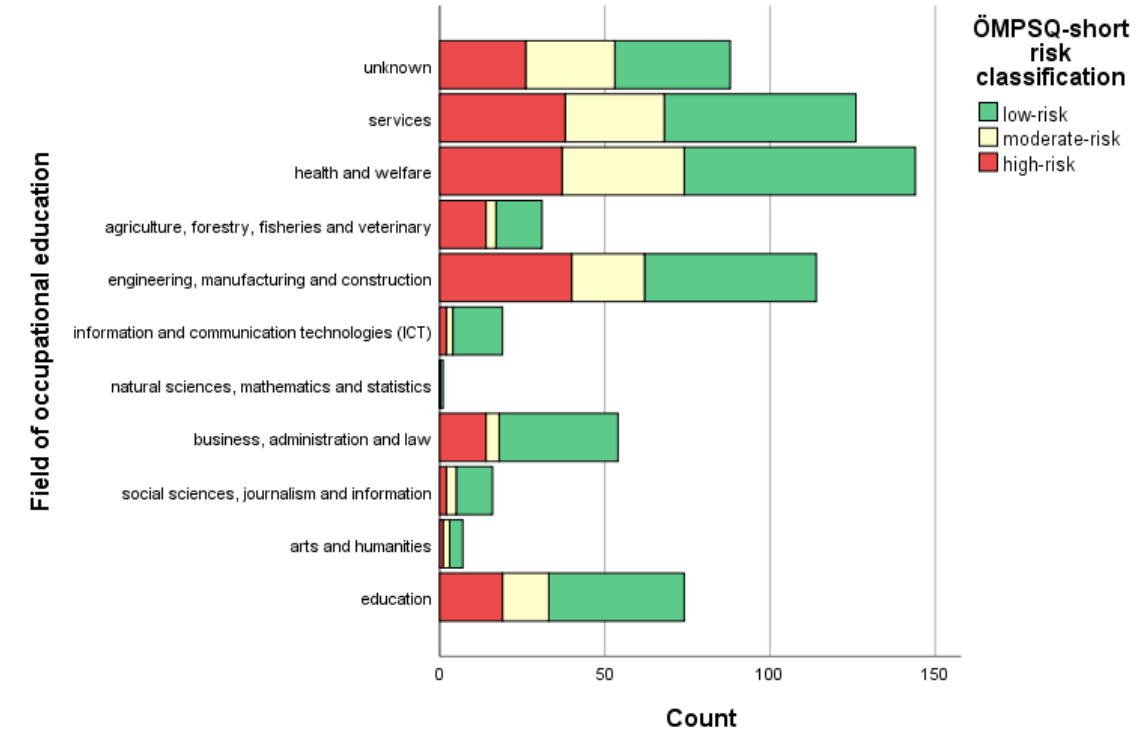


FIGURE 7. Fields of occupational education (n) according to ÖMPSQ-short risk groups.

Appendix 5. Association Between Educational Level and Risk Groups

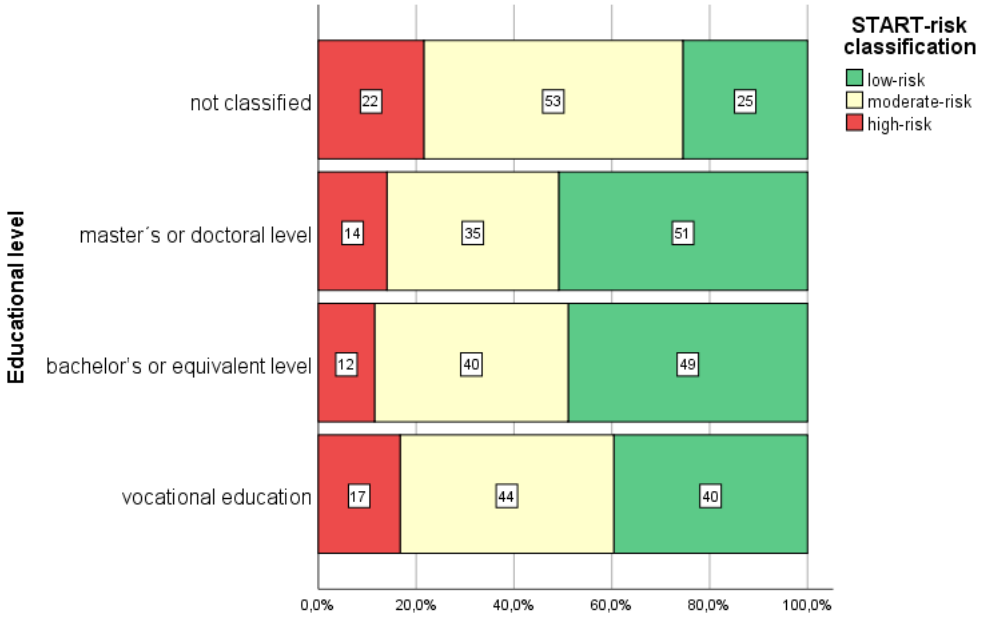


FIGURE 8. Educational level (%) according to STarT Back Tool (SBT) risk groups.

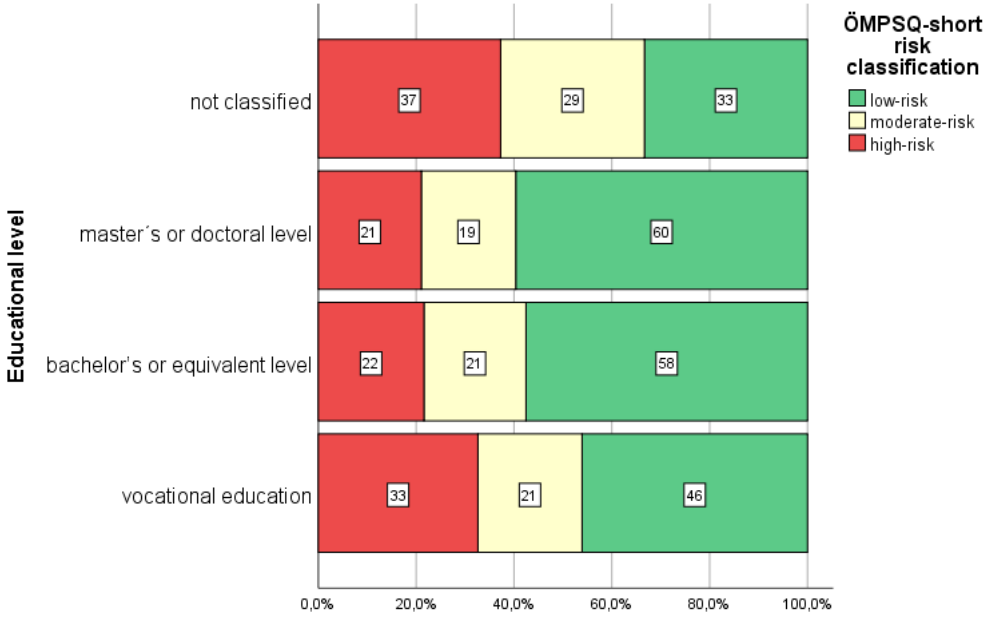


FIGURE 9. Educational level (%) according to ÖMPSQ-short risk groups.

Appendix 6. Association between Occupational Characteristics and SBT Individual Questions

1 (2)

1. Has your back pain spread down your leg(s) at some time in the last 2 weeks?			
	Disagree %	Agree %	Fisher's Exact Test (2-Sided)
education	24.3	75.7	
else	35.8	67.2	0.087
business, admistration and law	27.8	78.2	
else	32.3	67.7	0.546
services	32.5	67.5	
else	31.8	68.2	0.916
engineering, manufacturing and construction	34.2	65.8	
else	31.4	68.6	0.582
health and welfare	29.2	70.8	
else	32.6	67.4	0.481

2. Have you had pain in the shoulder or neck at some time in the last 2 weeks?			
	Disagree %	Agree %	Fisher's Exact Test (2-Sided)
education	31.1	68.9	
else	29.0	71.0	0.687
business, admistration and law	27.8	78.2	
else	29.4	70.6	0.877
services	40.5	**59.5**	
else	26.6	**73.4**	**0.003**
engineering, manufacturing and construction	30.7	69.3	
else	28.9	71.1	0.735
health and welfare	24.3	75.7	
else	30.6	69.4	0.149

3. Have you only walked short distances because of your back pain?			
	Disagree %	Agree %	Fisher's Exact Test (2-Sided)
education	63.5	36.5	
else	65.5	34.5	0.796
business, admistration and law	70.4	29.6	
else	64.8	35.2	0.459
services	61.9	38.1	
else	66.1	33.9	0.407
engineering, manufacturing and construction	65.8	34.2	
else	65.2	34.8	1.000
health and welfare	68.8	31.3	
else	64.3	35.7	0.374

4. In the last 2 weeks, have you dressed more slowly than usual because of back pain?			
	Disagree %	Agree %	Fisher's Exact Test (2-Sided)
education	60.8	39.2	
else	53.7	46.3	0.217
business, admistration and law	57.4	42.6	
else	54.2	45.8	0.672
services	54.0	46	
else	54.6	45.4	0.921
engineering, manufacturing and construction	49.1	50.9	
else	55.5	44.5	0.217
health and welfare	50.7	49.3	
else	55.5	44.5	0.345

(continues)

Appendix 6. Association between Occupational Characteristics and SBT Individual Questions

5. Do you think it's not really safe for a person with a condition like yours to be physically active?			
	Disagree %	Agree %	Fisher's Exact Test (2-Sided)
education	90.5	9.5	
else	84.2	15.8	0.171
business, admistration and law	79.6	20.4	
else	85.3	14.7	0.320
services	78.6	**21.4**	
else	86.3	13.7	**0.038**
engineering, manufacturing and construction	77.2	**22.8**	
else	86.4	13.6	**0.015**
health and welfare	91	**9**	
else	83.2	16.8	**0.025**

6. Have worrying thoughts been going through your mind a lot of the time?			
	Disagree %	Agree %	Fisher's Exact Test (2-Sided)
education	50	50	
else	38.2	61.8	0.058
business, admistration and law	40.7	59.3	
else	39.4	60.6	0.885
services	35.7	64.3	
else	40.3	59.7	0.364
engineering, manufacturing and construction	35.1	64.9	
else	40.4	59.6	0.344
health and welfare	35.4	64.6	
else	40.6	59.4	0.291

7. Do you feel that your back pain is terrible and it's never going to get any better?			
	Disagree %	Agree %	Fisher's Exact Test (2-Sided)
education	81.1	18.9	
else	76.3	23.7	0.465
business, admistration and law	81.5	18.5	
else	76.5	23.5	0.501
services	77	23	
else	76.8	23.2	1.000
engineering, manufacturing and construction	68.4	**31.6**	
else	78.6	21.4	**0.028**
health and welfare	86.8	**13.2**	
else	74.2	25.8	**0.001**

8. In general have you stopped enjoying all the things you usually enjoy?			
	Disagree %	Agree %	Fisher's Exact Test (2-Sided)
education	36.5	63.5	
else	38.8	61.2	0.800
business, admistration and law	46.3	53.7	
else	37.9	62.1	0.245
services	36.5	63.5	
else	39.1	60.9	0.614
engineering, manufacturing and construction	35.1	64.9	
else	39.3	60.7	0.460
health and welfare	37.5	62.5	
else	38.9	61.1	0.847

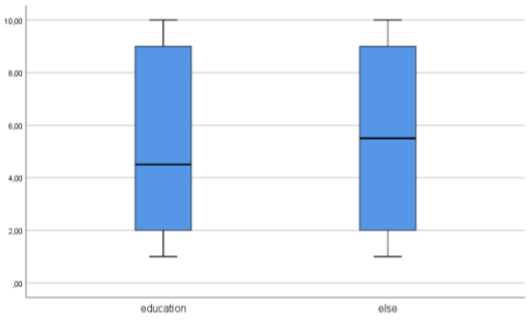
9. Overall, how bothersome has your back pain been in the last 2 weeks?			
	Not at all / Slightly / Moderately %	Very much / Extremely %	Fisher's Exact Test (2-Sided)
education	73.0	27.0	
else	67.6	32.4	0.428
business, admistration and law	66.7	33.3	
else	68.3	31.7	0.879
services	65.1	34.9	
else	68.9	31.1	0.400
engineering, manufacturing and construction	63.2	36.8	
else	69.2	30.8	0.227
health and welfare	64.6	35.4	
else	69.1	30.9	0.316

Appendix 7. Association between Occupational Characteristics and Individual Questions of ÖMPSQ-short

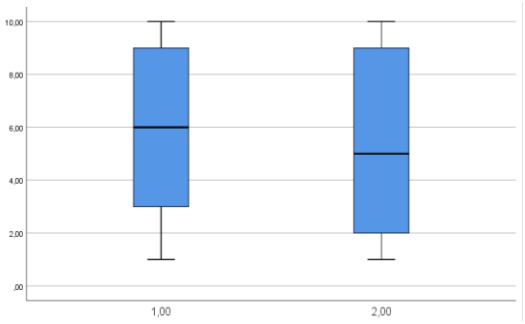
TABLE 1. Association between occupational characteristics and individual questions of ÖMPSQ-short. The results are presented stratified by the field of occupational education vs. other study population (scale 0-10).

1. How long have you had your current pain problem?

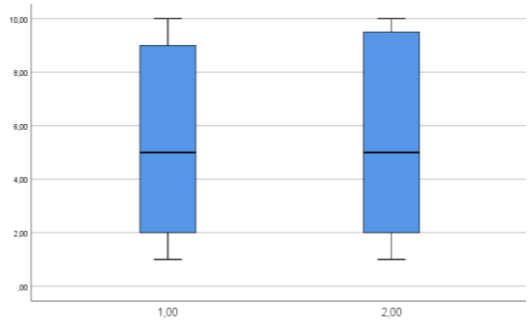
0–1 weeks [1] 1–2 weeks [2] 3–4 weeks [3] 4–5 weeks [4] 6–8 weeks
[5] 9–11 weeks [6] 3–6 months [7] 6–9 months [8] 9–12 months [9] over 1 year [10]



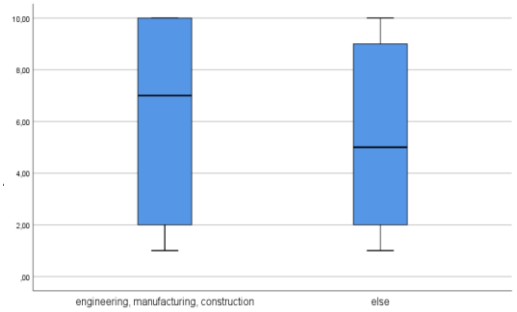
A. Education (p = 0.380)



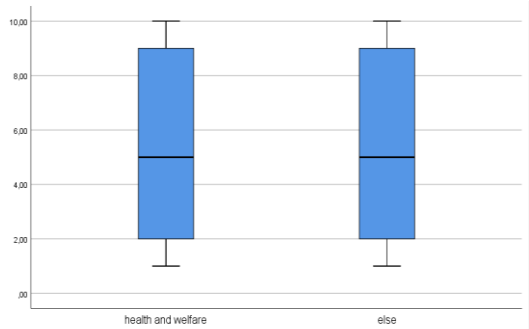
B. Business, administration and law (p = 0.475)



C. Services (p = 0.408)



D. Engineering, manufacturing and construction (p = 0.101)



E. Health and welfare (p = 0.440)

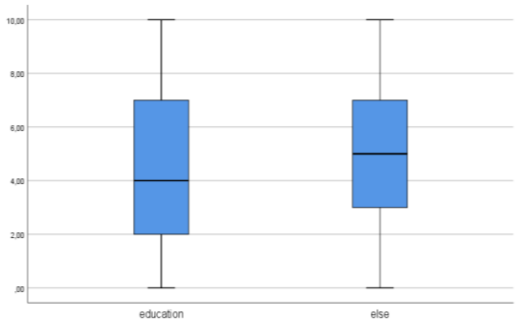
(continues)

Appendix 7. Association between Occupational Characteristics and Individual Questions of ÖMPSQ-short

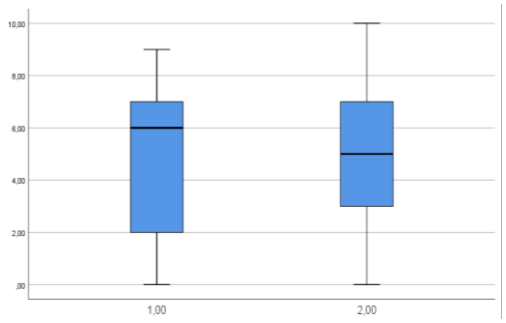
TABLE 2. Association between occupational characteristics and individual questions of ÖMPSQ-short. The results are presented stratified by the field of occupational education vs. other study population (scale 0-10).

2. How would you rate the pain that you have had during the past week?

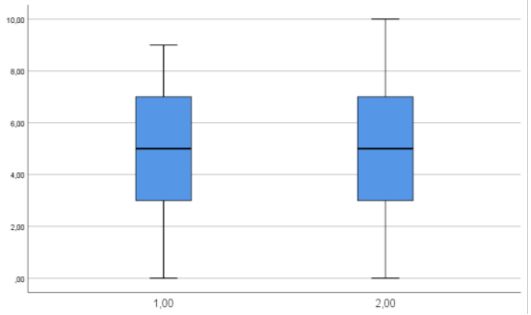
0 = No pain, 10 = Pain as bad as it could be



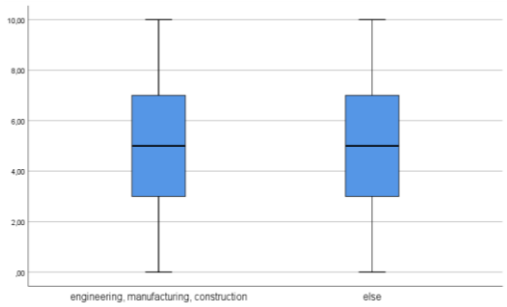
A. Education (p = 0.260)



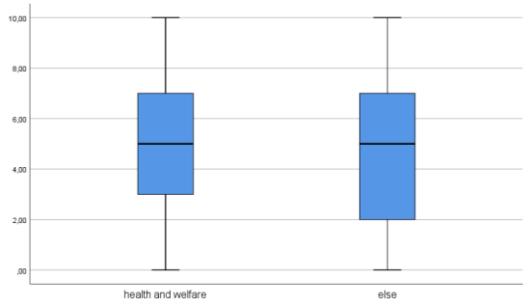
B. Business, administration and law (p = 0.942)



C. Services (p = 0.550)



D. Engineering, manufacturing and construction (p = 0.966)



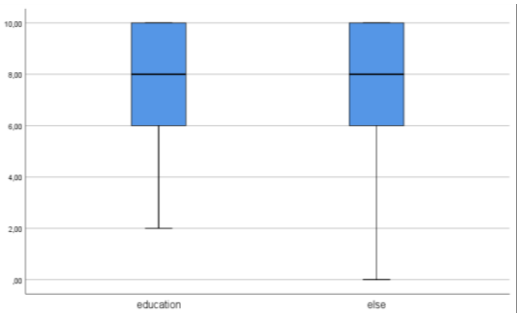
E. Health and welfare (p = 0.114)

Appendix 7. Association between Occupational Characteristics and Individual Questions of ÖMPSQ-short

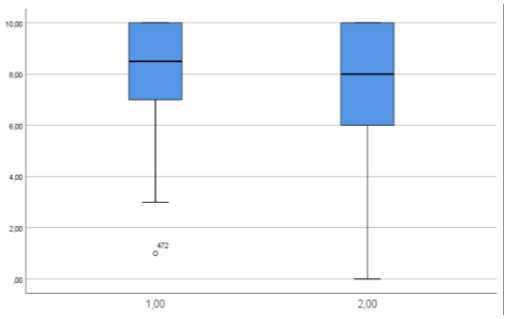
TABLE 3. Association between occupational characteristics and individual questions of ÖMPSQ-short. The results are presented stratified by the field of occupational education vs. other study population (scale 0-10).

3. I can do light work (or home duties) for an hour.

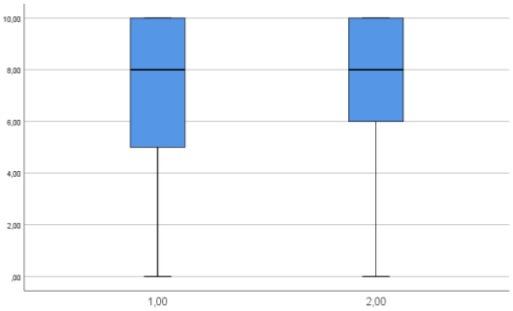
0 = Not at all, 10 = Without any difficulty (reversed scoring)



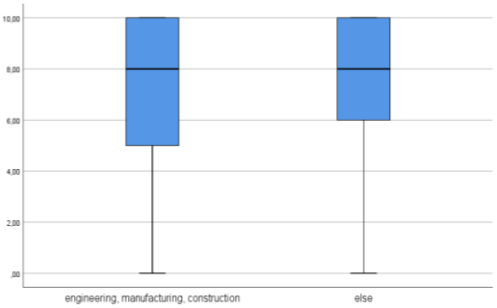
A. Education (p = 0.829)



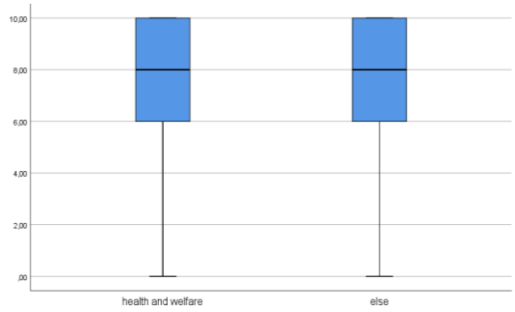
B. Business, administration and law (p = 0.094)



C. Services (p = 0.236)



D. Engineering, manufacturing and construction (p = 0.218)



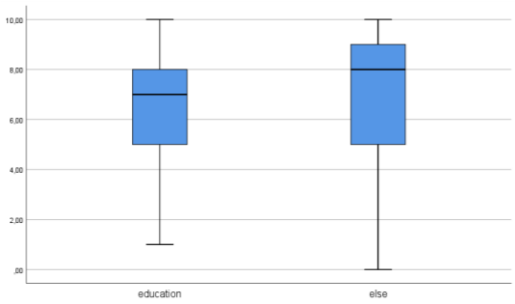
E. Health and welfare (p = 0.800)

Appendix 7. Association between Occupational Characteristics and Individual Questions of ÖMPSQ-short

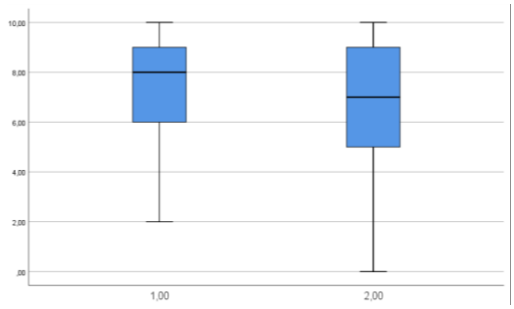
TABLE 4. Association between occupational characteristics and individual questions of ÖMPSQ-short. The results are presented stratified by the field of occupational education vs. other study population (scale 0-10).

4. I can sleep at night.

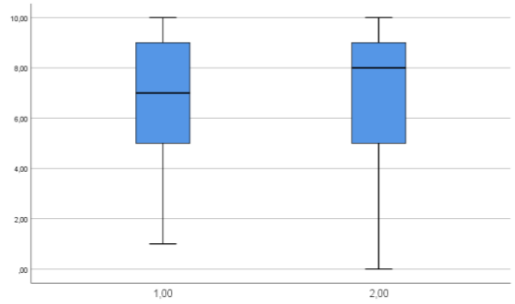
0 = Not at all, 10 = Without any difficulty (reversed scoring)



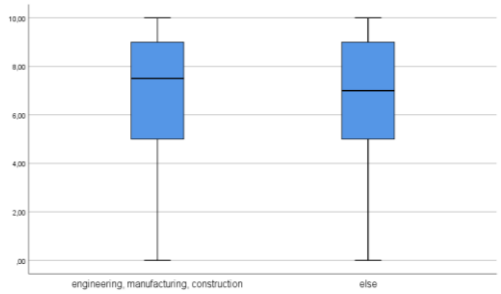
A. Education (p = 0.296)



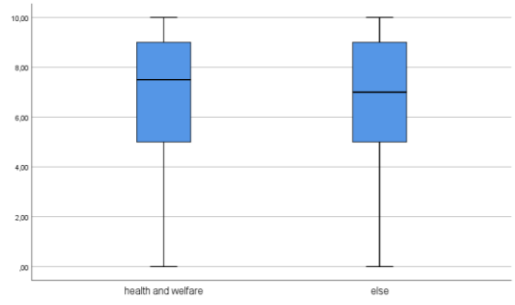
B. Business, administration and law (p = 0.345)



C. Services (p = 0.986)



D. Engineering, manufacturing and construction (p = 0.932)



E. Health and welfare (p = 0.585)

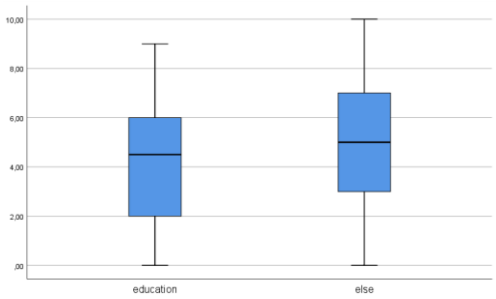
Appendix 7. Association between Occupational Characteristics and Individual Questions of ÖMPSQ-short

5 (10)

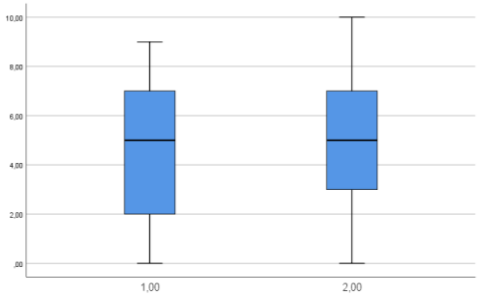
TABLE 5. Association between occupational characteristics and individual questions of ÖMPSQ-short. The results are presented stratified by the field of occupational education vs. other study population (scale 0-10).

5. How tense or anxious have you felt in the past week?

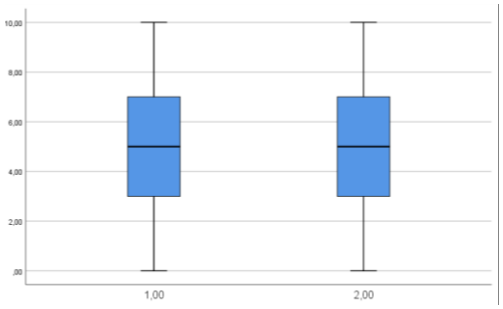
0 = Absolutely calm and relaxed, 10 = As tense and anxious as I've ever felt



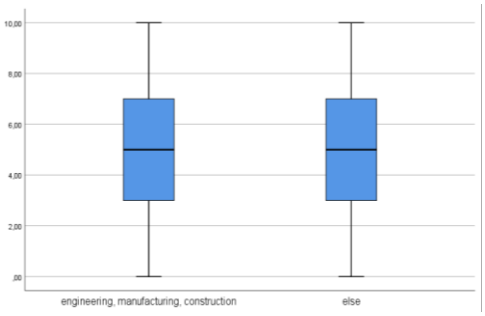
A. Education (p = 0.205)



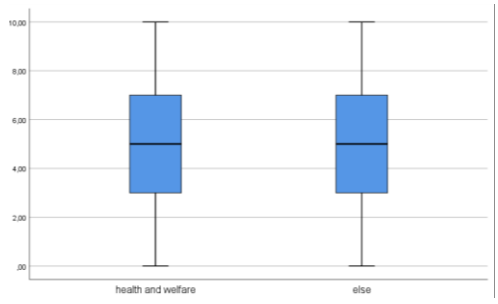
B. Business, administration and law (p = 0.735)



C. Services (p = 0.179)



D. Engineering, manufacturing and construction (p = 0.422)



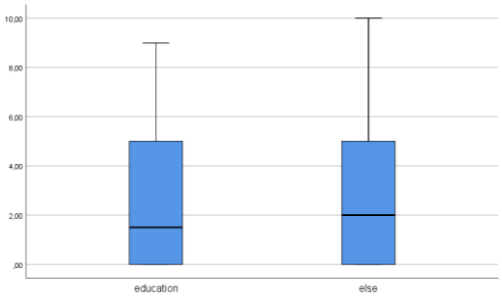
E. Health and welfare (p = 0.613)

Appendix 7. Association between Occupational Characteristics and Individual Questions of ÖMPSQ-short

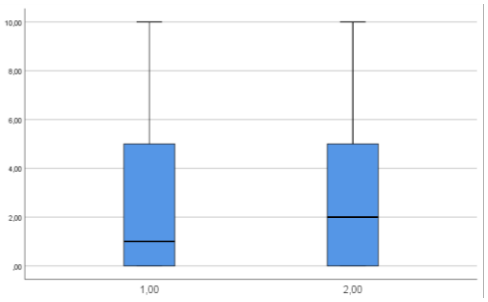
TABLE 6. Association between occupational characteristics and individual questions of ÖMPSQ-short. The results are presented stratified by the field of occupational education vs. other study population (scale 0-10).

6. How much have you been bothered by feeling depressed in the past week?

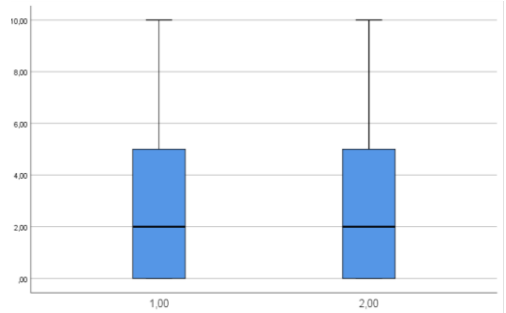
0 = Not at all, 10 = Extremely



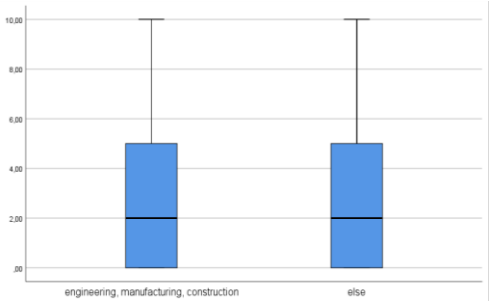
A. Education (p = 0.618)



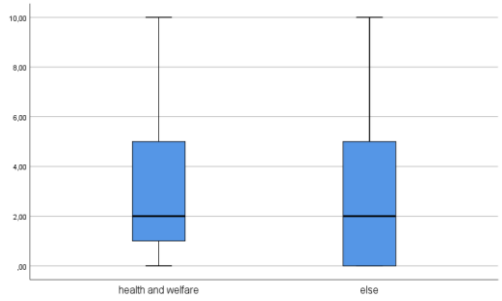
B. Business, administration and law (p = 0.160)



C. Services (p = 0.135)



D. Engineering, manufacturing and construction (p = 0.310)



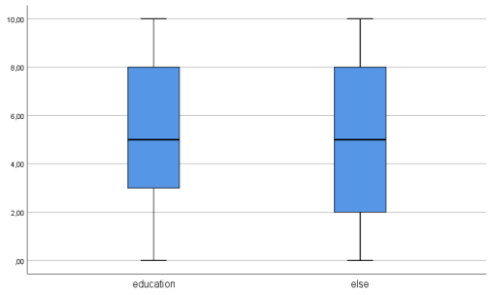
E. Health and welfare (p = 0.668)

Appendix 7. Association between Occupational Characteristics and Individual Questions of ÖMPSQ-short

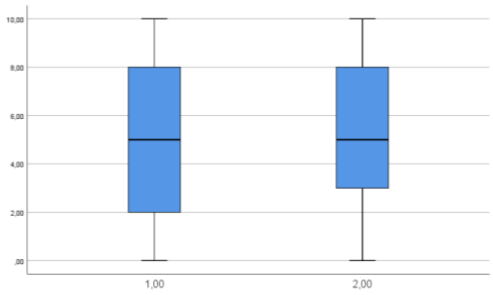
TABLE 7. Association between occupational characteristics and individual questions of ÖMPSQ-short. The results are presented stratified by the field of occupational education vs. other study population (scale 0-10).

7. In your view, how large is the risk that your current pain may become persistent?

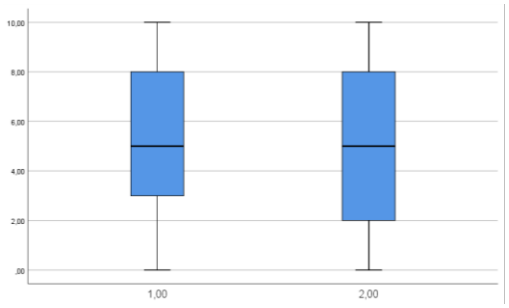
0 = No risk, 10 = Very large risk



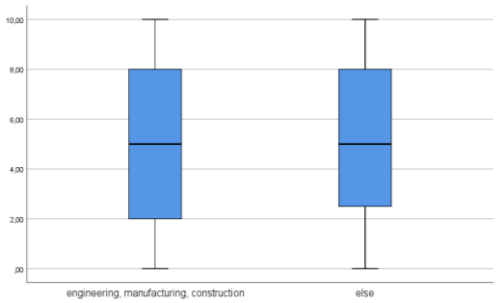
A. Education (p = 0.912)



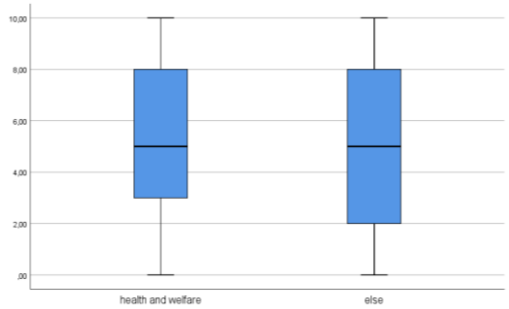
B. Business, administration and law (p = 0.403)



C. Services (p = 0.775)



D. Engineering, manufacturing and construction (p = 0.674)



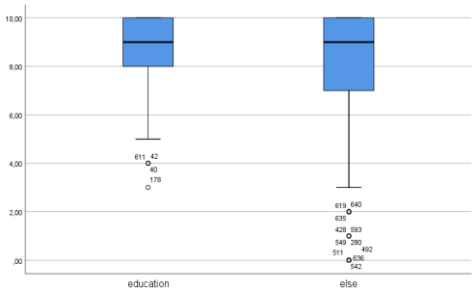
E. Health and welfare (p = 0.565)

Appendix 7. Association between Occupational Characteristics and Individual Questions of ÖMPSQ-short

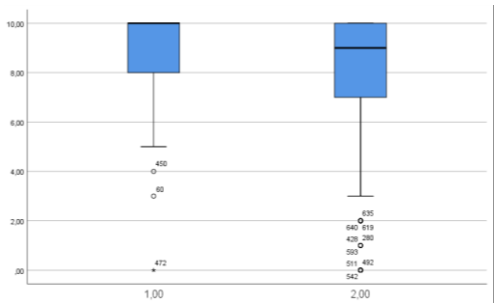
TABLE 8. Association between occupational characteristics and individual questions of ÖMPSQ-short. The results are presented stratified by the field of occupational education vs. other study population (scale 0-10).

8. In your estimation, what are the chances you will be working your normal duties (at home or work) in 3 months.

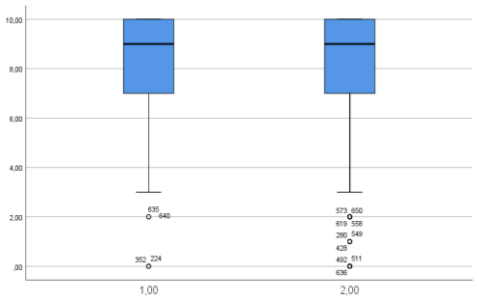
0 = No chance, 10 = Very Large Chance (reversed scoring)



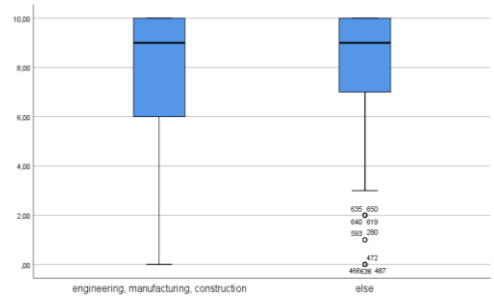
A. Education (p = 0.708)



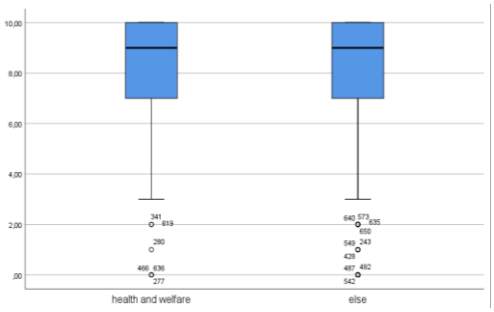
B. Business, administration and law (**p = 0.007**)



C. Services (p = 0.536)



D. Engineering, manufacturing and construction (p = 0.110)



E. Health and welfare (p = 0.582)

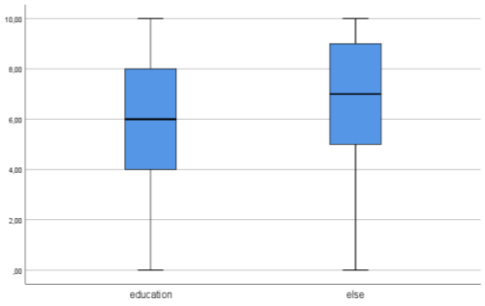
Appendix 7. Association between Occupational Characteristics and Individual Questions of ÖMPSQ-short

9 (10)

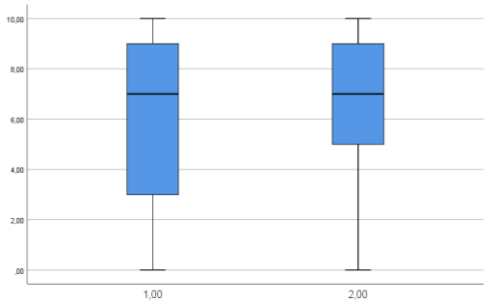
TABLE 9. Association between occupational characteristics and individual questions of ÖMPSQ-short. The results are presented stratified by the field of occupational education vs. other study population (scale 0-10).

9. An increase in pain is an indication that I should stop what I'm doing until the pain decreases.

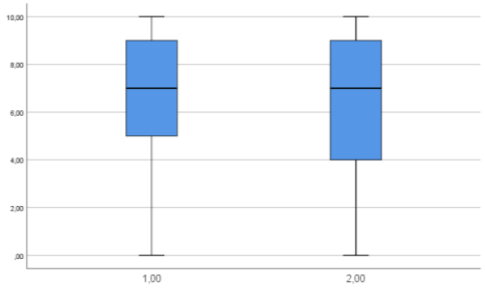
0 = Completely disagree, 10 = Completely agree



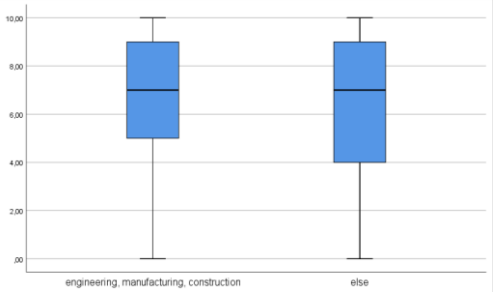
A. Education (p = 0.230)



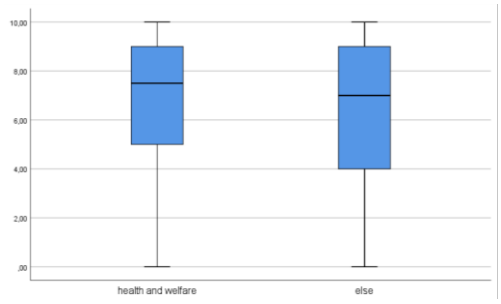
B. Business, administration and law (p = 0.327)



C. Services (p = 0.282)



D. Engineering, manufacturing and construction (p = 0.154)



E. Health and welfare (p = 0.112)

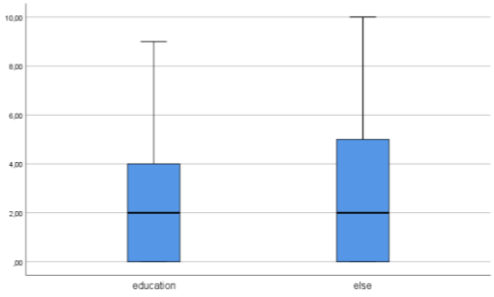
Appendix 7. Association between Occupational Characteristics and Individual Questions of ÖMPSQ-short

10 (10)

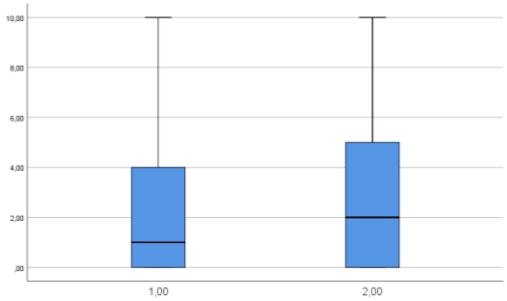
TABLE 10. Association between occupational characteristics and individual questions of ÖMPSQ-short. The results are presented stratified by the field of occupational education vs. other study population (scale 0-10).

10. I should not do my normal work (at work or home duties) with my present pain.

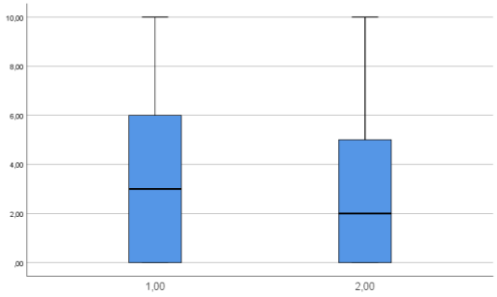
0 = Completely disagree, 10 = Completely agree



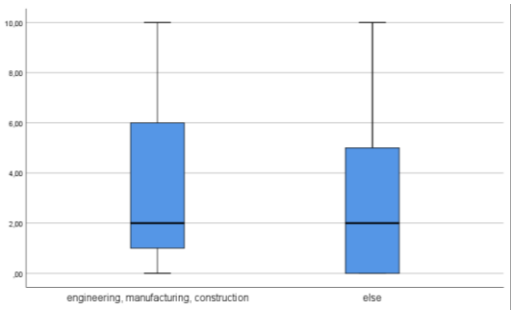
A. Education (**p = 0.036**)



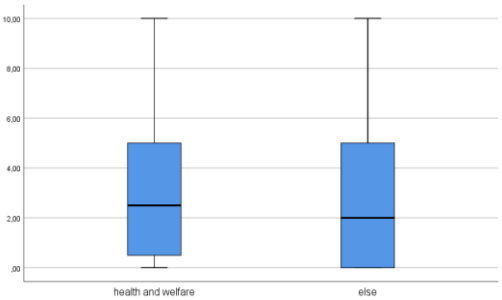
B. Business, administration and law (**p = 0.004**)



C. Services (p = 0.247)



D. Engineering, manufacturing and construction (p = 0.336)



E. Health and welfare (p = 0.372)