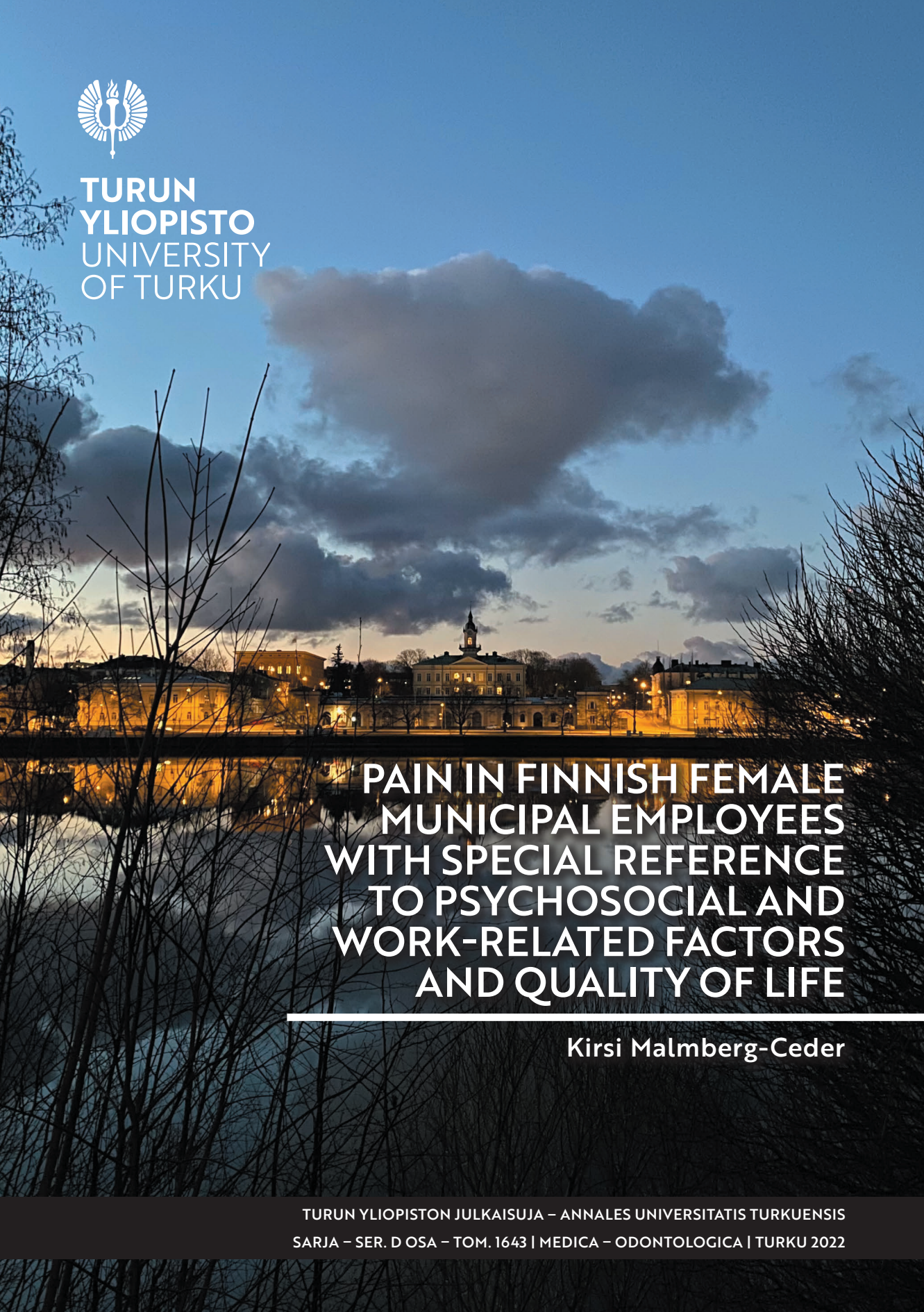

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UNIVERSITY OF TURKU

PAIN IN FINNISH FEMALE MUNICIPAL EMPLOYEES WITH SPECIAL REFERENCE TO PSYCHOSOCIAL AND WORK-RELATED FACTORS AND QUALITY OF LIFE

Kirsi Malmberg-Ceder

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University of Turku

Faculty of Medicine
Clinical Neurosciences
Doctoral Programme in Clinical Research
Satakunta Central Hospital, Pori

Supervised by

Professor (emeritus) Seppo Soinila, MD, PhD
Department of Clinical Neurosciences
University of Turku
Turku University Hospital Neurocenter
Turku, Finland

Docent Maija Haanpää, MD, PhD
Ilmarinen Mutual Pension Insurance Company
Helsinki, Finland
Department of Neurosurgery
Helsinki University Hospital
Helsinki, Finland

Reviewed by

Docent Ville Artto, MD, PhD
Department of Neurology
Helsinki University Hospital and
University of Helsinki,
Helsinki, Finland

Docent Kari-Pekka Martimo, MD, PhD
Ilmarinen Mutual Pension Insurance Company
Helsinki, Finland

Opponent

Docent Mikko Kallela, MD, PhD
Department of Neurology
Helsinki University Hospital and
University of Helsinki,
Helsinki, Finland

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To my family

UNIVERSITY OF TURKU
Faculty of Medicine, Clinical Neurosciences, Neurology
KIRSI MALMBERG-CEDER: Pain in Finnish female municipal employees with special reference to psychosocial and work-related factors and quality of life
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ABSTRACT

Pain is a major clinical, social and economic problem worldwide. Chronic pain disorders have a substantial impact on person´s life and they are a common reason for impaired work ability and disability. Musculoskeletal pain and headache are the most prevalent pain conditions and are more frequent in female population.

The aim of the present study was to evaluate the relationships between common pain symptoms, musculoskeletal pain or headache, and psychosocial factors, work ability and quality of life in working-age occupational female population.

The present study is part of the PORTAAT (PORi To Aid Against Threats) study, which comprises municipal employees of the city of Pori, Finland. This study consisted of female participants (n=732), the number of subjects included varied slightly in the four studies, depending on the availability of the data collected. The data was collected using validated questionnaires, which were filled in by the study subjects, and included Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ) (the burden of musculoskeletal pain), Headache Impact Test 6 (HIT-6) (the burden of headache), and questionnaires about psychosocial risk factors, work ability and quality of life. Among women with musculoskeletal pain psychosocial factors significantly correlate with work engagement, while the pain itself does not. Because work engagement associates positively with work ability, occupational health care should pay special attention on the psychosocial aspects in female employees with musculoskeletal pain to improve their work well-being and maintain their work ability. This study also confirmed that the HIT-6 questionnaire has good construct validity and it describes reliably and independently the impact of headache without interference of psychosocial factors in this kind of population. Recurrent headache and the burden of headache, measured by HIT-6, were clearly associated with presenteeism, but not with absenteeism. Recurrent headache has a significant negative impact on both health-related and general quality of life, also in this study population, in which anxiety and depressive symptoms scores were low.

This study shows that musculoskeletal pain and headache are common among Finnish municipal female employees. Concerning musculoskeletal pain the psychosocial risk factors are more relevant in association with work well-being than the pain itself. Recurrent headache is correlated with substantial presenteeism and lowers quality of life broadly.

KEYWORDS: musculoskeletal pain, headache, work ability, work engagement, psychosocial risk factor, quality of life

TURUN YLIOPISTO
Lääketieteellinen tiedekunta, Kliiniset neurotieteet, Neurologia
KIRSI MALMBERG-CEDER: Kunta-alalla työskentelevien naisten kipu – mielenkiinnon kohteina psykososiaaliset riskitekijät, työhyvinvointi ja elämänlaatu
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TIIVISTELMÄ

Kipu on huomattava kliininen, sosiaalinen ja taloudellinen haaste maailmanlaajuisesti. Kroonisen kivun vaikutus yksilön elämään on merkittävä sekä heikentyneen toiminta- ja työkyvyn yleinen syy. Tuki- ja liikuntaelinperäinen kipu ja päänsärky ovat yleisimmät kipuoireet erityisesti naisilla.

Tutkimuksen tavoitteena oli selvittää tavanomaisten kipuoireiden, tuki- ja liikuntaelinperäisen kivun ja päänsäryn sekä psykososiaalisten riskitekijöiden, työkyvyn ja elämälaadun välisiä suhteita työikäisillä naisilla.

Tutkimus on osa PORTAAT tutkimusta, johon osallistui Porin kaupungin työntekijöitä. Tämä alatutkimukseen kohdistettiin naisiin (n= 732), osallistujien määrä vaihteli eri osatutkimuksissa riippuen käytettävissä olevien tietojen saatavuudesta. Osallistujat täyttivät validoidut kyselylomakkeet, mm koskien tuki- ja liikuntaelinperäisen kivun (Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ)) ja päänsäryn (Headache Impact Test 6 (HIT-6)) aiheuttamaa haittaa, psykososiaalisia riskitekijöitä, työkykyä ja elämänlaatua. Tuki- ja liikuntaelinperäistä kipua kokevilla naisilla psykososiaaliset tekijät korreloivat koettuun työn imuun, mutta itse kipuoireet eivät. Koska työn imu korreloi positiivisesti työkykyyn, on työterveyshuollossa syytä kiinnittää erityistä huomiota tuki- ja liikuntaelinperäistä kipua kärsivien naisten kohdalla psykososiaalisiin tekijöihin työhyvinvoinnin ja työkyvyn parantamiseksi. Tutkimuksemme vahvisti, että HIT-6 päänsärkykysely kuvaa luotettavasti päänsäryn aiheuttamaa haittaa eivätkä psykososiaaliset tekijät vaikuta tulokseen tämänkaltaisessa aineistossa. Toistuva päänsärky ja sen aiheuttama, HIT-6 kyselyn kuvaama taakka assosioitui presenteismiin (heikentynyt työkyky, mutta työntekijä on työssä), muttei absenteismiin (työstä poissaolo). Toistuva päänsärky heikensi selvästi sekä terveyteen liittyvää että yleistä elämänlaatua, myös tämänkaltaisessa populaatiossa, jossa ahdistuneisuutta ja depressiivisiä oireita oli vähän.

Tutkimuksessa todettiin, että tuki- ja liikuntaelinperäinen kipu ja päänsärky ovat erittäin yleisiä suomalaisilla kunta-alalla työskentelevillä naisilla. Tuki- ja liikuntaelinperäistä kipua kokevilla psykososiaaliset riskitekijät olivat merkityksellisempiä työhyvinvoinnin kannalta kuin kipu sinänsä. Toistuva päänsärky (esim. migreeni, lihasjännityspäänsärky) heikentää selkeästi työkykyä, lisää erityisesti sairaana työskentelyä sekä huonontaa merkittävästi elämänlaatua.

AVAINSANAT: tuki- ja liikuntaelinperäinen kipu, päänsärky, työkyky, työn imu, psykososiaaliset riskitekijät, elämänlaatu

Table of Contents

Abbreviations

AUDIT-C	Alcohol Use Disorders Identification Test
BBI-15	Bergen Burnout Indicator 15-item scale
BMI	Body mass index
EQ-5D	EuroQoL-5D
ESSI	ENRICHD short social support instrument
EUROHIS-8	The short EUROHIS-QOL 8-item index
GAD-7	Generalized anxiety disorder 7-item scale
HIT-6	Headache Impact Test -6
HRQoL	Health related quality of life
IASP	The International Association for the Study of Pain
CGRP	Calcitonin gene related peptide
LTPA	Leisure-time physical activity
MDI	Major depressive inventory
MIDAS	Migraine disability assessment
OR	Odds ratio
PORTAAT	PORi To Aid Against Threats
QoL	Quality of life
SD	Standard deviation
TTH	Tension-type headache
UWES	Utrecht Work Engagement Scale
WAI	Work Ability Index
WAS	Work Ability score
WHOQOL	WHO Quality of Life Questionnaire
ÖMPSQ	Örebro Musculoskeletal Pain Screening Questionnaire

List of Original Publications

This dissertation is based on the following original publications, which are referred to in the text by their Roman numerals:

I Malmberg-Ceder, K., Haanpää, M., Korhonen, P. E., Kautiainen, H., & Soinila, S. (2017). Relationship of musculoskeletal pain and well-being at work - Does pain matter?. *Scandinavian journal of pain*, *15*, 38–43.

II Malmberg-Ceder, K., Haanpää, M., Korhonen, P. E., Kautiainen, H., Veromaa, V., & Soinila, S. (2019). The role of psychosocial risk factors in the burden of headache. *Journal of pain research*, *12*, 1733–1741.

III Malmberg-Ceder, K., Vuorio, T., Korhonen, P. E., Kautiainen, H., Soinila, S., Haanpää, M. (2020). The Impact of Self-Reported Recurrent Headache on Absenteeism and Presenteeism at Work Among Finnish Municipal Female Employees. *Journal of pain research*, *13*, 2135–2142.

IV Malmberg-Ceder, K., Soinila, S., Korhonen, P. E., Kautiainen, H., & Haanpää, M. (2021). Headache and quality of life in Finnish female municipal employees. *Scandinavian journal of pain*, 10.1515/sjpain-2021-0109. Advance online publication.

1 Introduction

Pain is a major clinical and social problem worldwide and appears to have the most negative impact on person´s life. Pain also has an enormous economic impact and globally the annual costs due to pain are greater than the costs of heart diseases or cancer (Gaskin & Richard, 2012; Henschke et al., 2015). Musculoskeletal pain and headache are the most prevalent pain conditions, majority of people experience them during lifetime and they are more frequent in female population (GBD 2016 Neurology Collaborators, 2019; McDonald et al., 2011; Stovner et al., 2007;). Chronic forms of these pain disorders are a common reason for disability and impaired work ability (Jensen & Rasmussen, 2004; McDonald et al., 2011; Miranda et al., 2010; Rasmussen et al., 1992; Stewart et al., 2010). Also occasional or frequent headache, even though it is not fatal or does not cause permanent or objective disability, is debilitating for relatively large proportion of the affected people (GBD 2016 Neurology Collaborators, 2019).

Most of the people with pain continue to work (Blyth et al., 2003; Breivik et al., 2006). Personal and work-related factors, rather than the pain itself, may have significant impact on perceived work ability and work performance (de Vries et al. 2012 (a); de Vries et al. 2012 (b); de Vries et al., 2013). Work engagement, a quite new concept of well-being at work, has been suggested to be a predictor of maintained work ability among people with chronic pain (Karoly et al., 2013), but it is seldom included as an endpoint in pain studies.

Chronic headache is associated with psychosocial risk factors (e.g. anxiety, depression), impaired work ability and health-related quality of life (Andlin-Sobocki et al., 2005; Duru et al., 2004; Saunders et al., 2008; Stewart et al., 2010; Zwart et al., 2003). Less is known about the burden of headache in general and occupational populations, which are more likely to be mildly affected compared to patients attending specialist clinics. A recent large, global epidemiological study showed that headache disorders, migraine particularly, are important causes of disability in working-age population worldwide (GBD 2016 Neurology Collaborators, 2019).

The present thesis was undertaken to investigate the common pain symptoms, musculoskeletal pain and headache, and their correlation with psychosocial factors, work ability and quality of life in working-age occupational female population.

2 Review of the Literature

2.1 General aspects of pain

The International Association for the Study of Pain (IASP) defines pain as "an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage" (IASP). According to IASP, the six key notes concerning pain are:

1) Pain is always a personal experience and is influenced to varying degrees by biological, psychological, and social factors.
2) Pain and nociception are different phenomena and pain cannot be inferred solely from activity of sensory neurons.
3) An individual learns the concept of pain through life experiences.
4) A person's report of an experience as pain should be respected.
5) Pain usually serves an adaptive role, but it may have adverse effects on function and social and psychological well-being.
6) Verbal description is only one of several behaviors to express pain and inability to communicate does not eliminate the possibility of pain experience.

Hence pain can be described as the result of a complex interaction between signaling systems, modulation from higher centers and the unique perception of the individual.

Pain is almost always accompanied by suffering, which includes more than mere sensory symptoms and can be only an emotional feeling, sometimes not even directly related to pain. Pain and suffering, are inseparable parts of human life and connected in complex ways to the individual´s life span, culture and social context. While acute pain is protective in nature, chronic pain is a more complex phenomenon sometimes "continuing beyond the expected period of healing" (Turk & Okifuji, 2001).

2.2 Physiology of pain

Pain can be classified into two main categories, based on physiological changes associated with or resulting from disease or injury, nociceptive and neuropathic pain (IASP). Nociceptive pain is caused by ongoing or imminent injury of non-neural tissue and is initiated by activation of nociceptors and mediated either by somatosensory or visceral pain pathways. Neuropathic pain results from a lesion or disease of the somatosensory nervous system (IASP). Chronic pain may be in transition from nociceptive to neuropathic pain and present characteristics of both, and therefore may be considered as mixed pain. A third class of chronic pain, nociplastic pain, has been recently introduced involving clinically established, yet controversial conditions, such as fibromyalgia, which do not fulfill the diagnostic criteria of nociceptive or neuropathic pain, but which may involve dysfunction of the central nervous system (Kosek et al., 2016; Kosek et al., 2021).

Nociceptors are receptors on sensory neurons, structurally characterized as free, uncapsulated peripheral nerve endings, activated by painful stimuli. They constitute the first chain in the ascending pain pathway (Steeds, 2016). Their cell bodies reside in the dorsal root ganglion or in the trigeminal ganglion, and the peripheral nerve endings are located in the skin, joint capsules, deep fascia, meningi, blood vessels or in the viscera. The peripheral ending of the primary sensory neuron is sensitive to noxious stimuli, transduces the sensation into an electrical signal, and the afferent nerve fiber transmits it to the central nervous system along ascdending sensory pathway (Figure 1). There are several types of nociceptors: mechanoreceptors (responding to physical deformation caused by pressure, such as sharp or dull compression), pain-sensitive thermoreceptors (responding to temperatures exceeding or falling below the pain threshold), chemoreceptors (responding to a number of substances, either physiological inflammatory mediators (e.g. prostaglandins, leukotrienes, hydrogen ions and 5-hydroxytryptamine) or external irritants, such as acids) and polymodal nociceptors (responding to multiple types of stimuli).

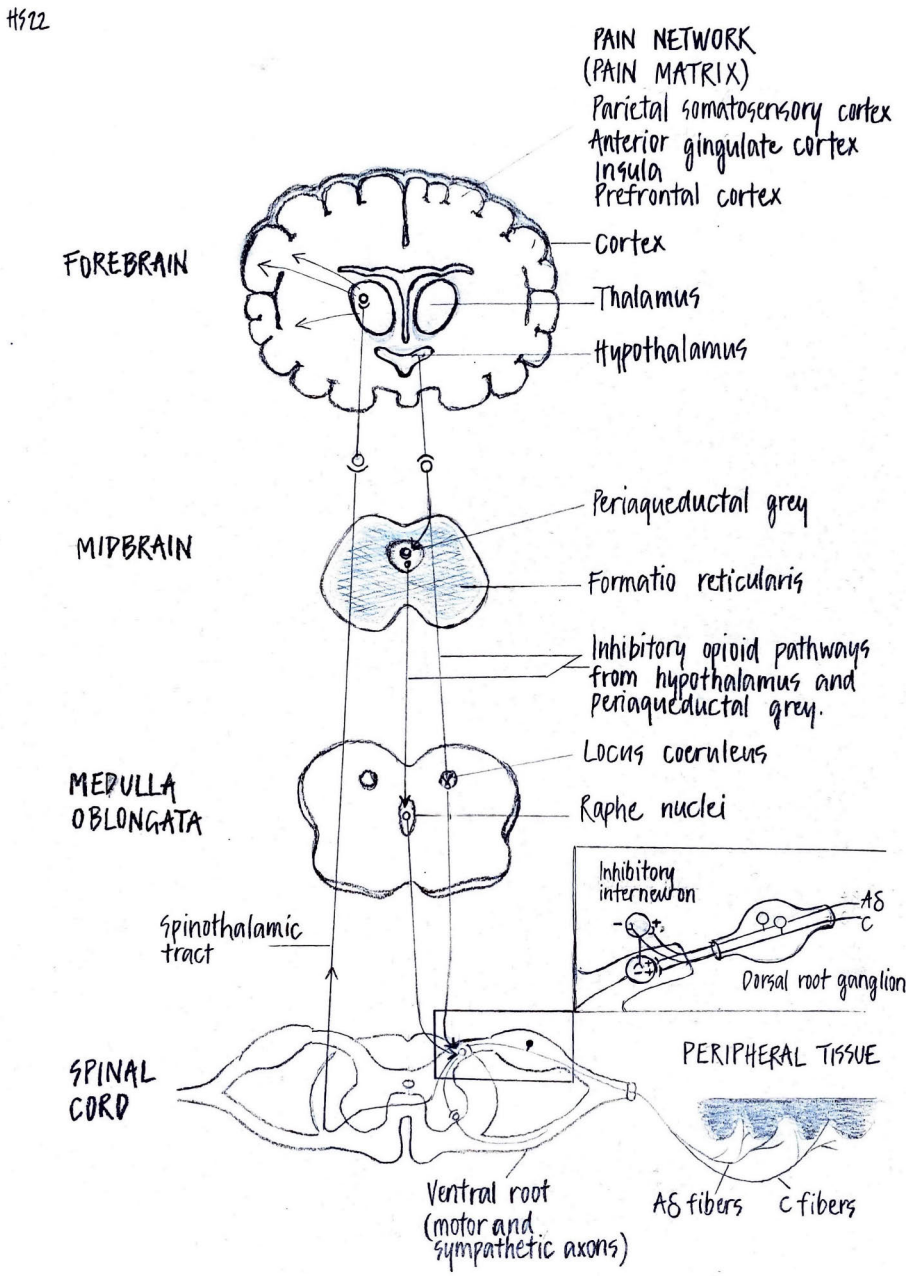

Figure 1. Schematic presentation of the nociceptive system. Nociceptive free nerve endings are located in peripheral tissues (e.g. skin, blood vessel, synovial tissue). Afferent nerve fibers synapse in the dorsal horn of the spinal cord with projection neurons, the axons of which constitute the spinothalamic tract ascending to the thalamus. Pain signal is modified by inhibitory interneurons (insert). Central pain network (pain matrix) and inhibitory descending pathways modulate the pain sensation. The nociceptive circuitry is also projected into motor and sympathetic reflex pathways. (Drawing by Hanna Sulonen, 2022).

The nerve fibers of the first-order neurons transmitting nociceptive signals are of two types, Aδ and C fibers. The central fibers of the primary nociceptors terminate in the dorsal horn of the spinal cord and synapse with second-order neurons projecting to the thalamus. In the dorsal horn complex interactions between the primary pain pathway and excitatory and inhibitory interneurons modulate the pain signal. Spinal modulation is under inhibitory control by higher centers, activity in Aδ collaterals and segmental modulation by e.g. endogenous opioid and cannabinoid systems. Central inhibitory mechanisms and activity of non-nociceptive collaterals act by "closing the gate" and hindering the onward transmission of C fiber activity. This is called gate-control theory and was introduced initially by Melzack and Wall (Melzack & Wall, 1965). They postulated that inhibitory interneurons in spinal cord can be activated by stimulation of non–noxious thick, myelinated sensory afferents from the skin (Aβ fibers) and that this suppresses transmission in small unmyelinated (C fiber) afferents and inhibits the painful signal (Melzack & Wall, 1965). This explains, why rubbing the painful area can relieve the pain, and this is also the theory behind the transcutaneous electrical nerve stimulation in clinical pain treatment.

Second-order neurons ascend through contralateral spinothalamic and spinoreticular tracts in anterolateral spinal white matter and project to the thalamus and hypothalamus via nuclei of reticular formation in brain stem and some fibers project diffusely to the cerebral cortex. The most important center processing ascending somatosensory information is the thalamus, in which the axons of spinothalamic tract connect with neurons projecting to the primary and secondary somatosensory areas in cortex and further connect to the insular cortex, anterior cingulate and prefrontal cortex. Those areas have connections with other parts of brain, e.g. the hippocampus, cerebellum, basal ganglia and the autonomic centers in the hypothalamus. These connections form the pain matrix, a central network processing ascending pain sensation into pain perception. Recent evidence suggests that this network, rather than being specific for pain processing, is partially shared by other sensory processes, which thus may modify the pain experience (Meijer et al., 2021).

Visceral pain refers to pain arising from internal organs and, unlike somatic pain, it is only crudely localized. This is explained by lower density of nociceptors on viscera and vague cortical mapping of afferent fibers Pain transmission from viscera is organized in the same way as that for somatic pain. Autonomic afferent fibers include nociceptive Aδ and C fibers and share the same ascending spinal pathway used by the somatic pain system. This is why visceral pain may be referred to the corresponding somatic area even quite far away, e.g. noxious stimuli in diaphragm can cause pain felt in the ipsilateral shoulder. Another feature of visceral pain is often its colicky nature, perhaps accompanied by nausea and

autonomic disturbances. While stimulus causing somatic pain is typically cutting or crushing, visceral structures subjected to such stimuli do not produce pain. Instead, the viscera respond painfully to distension, ischemia and inflammation (Steeds, 2016).

Neuropathic pain is caused by a lesion or disease of the somatosensory nervous system (IASP). In chronic neuropathic pain it is often difficult to define the exact localization of the injury as central or peripheral, because the symptoms and signs can be the same for central and peripheral neuropathic pain. In clinical practice patients with neuropathic pain commonly report spontaneous pain without an obvious stimulus. Neuropathic pain is often described as “burning”, “shooting”, “tingling”, or as “numb” sensation. Neuropathic pain is often associated with characteristic, usually painful or unpleasant sensations: hyperalgesia (increased pain from a stimulus that normally provokes pain), allodynia (pain due to a stimulus that does not normally provoke pain), paresthesia (an abnormal sensation, whether spontaneous or evoked), dysesthesia (an unpleasant abnormal sensation, whether spontaneous or evoked) and hyperpathia (painful syndrome characterized by an abnormally painful reaction to a stimulus, especially a repetitive stimulus, as well as an increased threshold) (IASP).

Chronic pain may induce plasticity of neural tissue, which includes both structural and functional changes. Injured Aδ and C fibers initiate repair mechanisms, which may lead to abnormal spontaneous electrical activity. Peripheral nociceptors become sensitized leading to lower threshold for firing and hyperexcitability, and increased response to both noxious and non-noxious stimuli. Consequently, ectopic impulse generation may appear in the spinal nerve.

Central sensitization is associated with the development and maintenance chronic pain and manifests as a state of high reactivity of the brain to persistent pain. Prolonged noxious stimulus causes persistent C fiber activation, prolonged dorsal horn response and reduction in local inhibition. There is also evidence of excitotoxic cell death of inhibitory interneurons. Ectopic activity in the incoming axons and long-lasting neurochemical changes in the dorsal horn lead to increasing output to the spinothalamic tract. Expansion of pain-mediating region in the dorsal horn partly explains allodynia, i.e. sensation of light touch as pain. The result of sensitization is lowered sensory threshold for pain signaling and spread of the receptive area (Steeds, 2016).

There is evidence of reorganization in both the primary somatosensory and motor cortices and in subcortical areas as pain persists. A well-known example of central modulation is phantom limb, sensation of the presence of the amputated limb. On the other hand, lack of afferent input leads to diminished activation of the corresponding somatosensory cortex and expansion of the neighbouring cortical area. Some (but not all) patients experience severe pain located in the amputation

stump and some persistently feel the amputated limb. Apkarian with his team has elegantly studied brain alterations in patients with chronic pain using functional MRI. They conclude that brain characteristics determine propensity for chronic pain, calling it as “neurological vulnerability for pain chronicity” and describing chronic pain as a brain network disease. In long-lasting pain this results in brain atrophy significantly exceeding the loss of grey matter related to mere aging (Apkarian et al., 2011; Baliki et al., 2012; Baliki et al., 2014).

In conclusion, tissue injury causes a series of chemical and electrical events leading to sensation, perception and emotional experience of pain. Neurophysiology of nociception can be divided into four phases: transduction, transmission, modulation and perception. Activation of nociceptive receptors on the pain-sensitive nerve endings by mechanical, chemical or thermal stimuli is transduced into action potentials in afferent axons. Pain signal is transmitted to the central nervous system through spinal cord, brain stem and thalamus and finally to the cortex. Pain signal is modulated by central inhibitory mechanisms by descending projections to the dorsal horn. The final phase in sensation of pain is perception, including cognitive processing based on associative functions and memory. Perception of pain may arise even without nociception, due to lesion or disease of the pain pathway resulting in neuropathic pain. In either type of pain, perception of pain is accompanied by an emotional response, arising from the subjective feelings the pain produces and reflecting past experiences and expectations. Genetic, physiologic and psychologic factors have been shown to contribute to central modulation of pain, and reversely, psychological or behavioral responses to pain may significantly remodel the clinical presentation of pain (Baliki et al., 2014; Crofford, 2015). Thus, holistic experience of pain is affected by personal, psychological, cultural and social factors showing wide individual variation.

2.3 Musculoskeletal pain

Musculoskeletal pain is defined as pain affecting the bones, muscles, and connective tissue. The most frequent etiologies are degenerative or (post)traumatic joint or soft tissue damage in the spine and lower extremities (McDonald et al., 2011). Acute musculoskeletal pain is a classical example of nociceptive somatosensory pain caused by a tissue injury, either crush, inflammation or ischemia. When musculoskeletal pain or any other pain becomes chronic (lasting more than 3 months), it constitutes a complex sensory and emotional experience. It may include combination of nociceptive, neuropathic and central pain processes and it varies widely between people depending on the context and meaning of the pain and the psychological state of the person (Bushnell et al., 2013).

Musculoskeletal pain in its chronic forms is one of the most intractable problems faced by clinicians. It can be devastating for patient's functionality and ability to work.

The prevalence and burden of musculoskeletal disorders are high throughout the world and both increase with age (Smith et al., 2014). Among Finnish women aged 18 years and over, the life-time cumulative incidence of back pain is 76% and the prevalence of back pain experienced during the previous month is 33% and musculoskeletal disease or complaint is the principal reason for the most recent visit to a physician in 12% of Finnish adults (National Public Health Institute, 2007).

2.4 Headache

Headache, or cephalalgia in medical terminology, is a condition of pain felt in the head. Sometimes neck or upper back pain may also be interpreted by the patient as a headache. An extensive document, the International Classification of Headache Disorders (ICHD) has been created to classify and diagnose diseases presenting headache as the primary symptom. Revised third edition (ICHD-3) divides headache into three categories; I) primary headaches (e.g. tension-type headache, migraine), II) secondary headaches (e.g. headache caused by e.g. trauma, infection, stroke) and III) neuropathies, facial pains and other headaches (e.g. trigeminal neuralgia). Most common etiologies for headache are shown in Table 1. Because the primary headaches (tension type headache and migraine) are the most common etiologies for recurrent headache their pathophysiology is briefly described later in this chapter.

Table 1. Lifetime prevalence of headache Based on Rasmussen et al.,1991.

Type	Prevalence (%)
Primary headache	
Tension-type headache	78
Migraine	16
Secondary headache	
Fasting	19
Nose/sinus disease	15
Head trauma	4
Non-vascular intracranial disease (e.g. tumor)	0.5

Headache is a common disorder and a major health problem worldwide. Globally, one-year prevalence of an active headache disorder is about 47% in adult population (Stovner et al., 2007). Lifetime prevalence is even higher, 66%, and 3% of adult population have chronic headache (Stovner et al., 2007). There is considerable variation in headache prevalence between European countries (Figure 2) (Stovner et al., 2006). Most common etiologies are migraine and tension-type headache. The economic burden of migraine is mainly attributed to indirect costs, such as absence from work or reduced efficacy at work and home (presenteeism), while direct costs (e.g. medication, consultations) account only minority of the costs (Hu et al., 1999). This means that the burden of migraine mainly falls on the patients and their employers (Hu et al., 1999). The costs caused by tension-type headache have not been studied so well, but are suspected to be even greater than those of migraine (Jensen & Stovner, 2008; Rasmussen et al., 1992,).

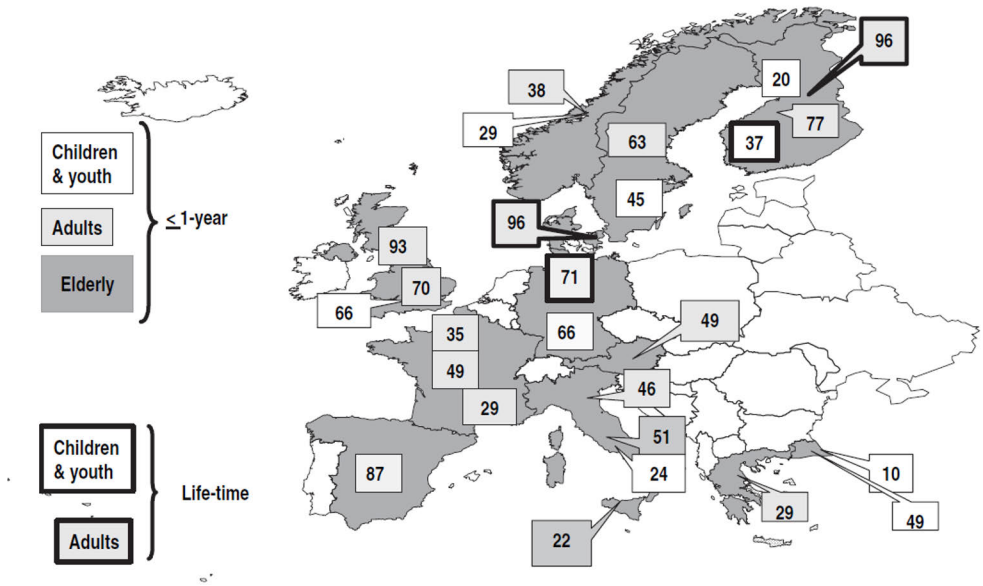

Figure 2 Prevalence of headache (%) in European countries (Stovner et al., 2006). *Copyright©JohnWileyandSons 2021.*

Headache-associated disability is considerable and most prominent among patients with chronic headache (Allena et al., 2015; Berra et al., 2015; Cassidy et al., 2003; D'Amico et al., 2015; Wiendels et al., 2006). Also the interictal burden of episodic headache is significant (Lampl et al., 2016). Comorbidities are common in headache subjects, and they might have substantial additional effect on disability and quality of life (Breslau et al., 2003; Jensen & Stovner, 2008; Korolainen et al.,

2019; Saunders et al., 2008; Smitherman et al., 2013; Wiendels et al., 2006). Recent studies have also brought to light the stigma headache patients experience, mainly because of disability due to headache (Parikh & Young, 2019; Young et al., 2013).

Migraine bears a substantial genetic component. Over 120 gene mutations have been described in genome-wide analyses and epigenetic factors seem to affect gene expression in migraine patients. Alterations in ion channels, brain excitability, connectivity and sensory processing have been detected in migraineurs. Between attacks migraine patients have been found to have reduced habituation of responses evoked by repetitive noxious or non-noxious stimuli (Sand & Vingen, 2000; Valeriani et al., 2003). Researchers conclude that migraine involves dysregulation of normal coordination between the activity of the thalamus and the cortex (de Tommaso et al., 2014). Throbbing pain, a typical character of migraine attack, has traditionally been considered as a sign of vascular mechanisms initiating the attack. The current concept is that the migraine generator, the site of initial disturbance in migraine attack, resides in diencephalon and brain stem (Schulte & May, 2016) and reflects slow oscillations in cellular activity in the thalamus or brain stem (Ferrari et al., 2020). Hypothalamus evidently plays a role in the premonitory phase of migraine. This phase precedes the aura and pain and presents multiple symptoms: light sensitivity, neck pain, fatigue, yawning, gustatory desires, mood change and polyuria. These symptoms are related to central autonomic functions regulated by multiple hypothalamic peptides, which may represent novel targets for therapies and better attack prevention (Holland & Goadsby, 2007).

Serotonin (5-hydroxytryptamine) plays a central role in migraine pathogenesis by multiple known mechanisms. Migraine patients probably have low levels of serotonin between attacks, which may increase the liability to migraine. Serotonin system is an important therapeutic target (Ferrari et al., 2020). Calcitonin gene-related peptide (CGRP) also plays an essential role in the pathophysiology of migraine. CGRP released from the peripheral terminals initiates a cascade of events that include increased synthesis of nitric oxide and sensitization of the trigeminal nerve and also can lead to central sensitization and drive the progression of episodic migraine to chronic migraine (Iyengar et al., 2019). A new therapeutic era has opened by blocking the function of CGRP in the in the peripheral trigeminal system.

The exact pathophysiology of tension-type headache (TTH) is still poorly understood. Episodic and chronic TTH comply with different underlying pain process. Episodic form is linked to increased peripheral pain perception accompanied by increased muscle tone, while chronic TTH represents disturbed control of central pain processing (Sohn et al., 2013). Typical clinical finding in TTH is the tenderness of pericranial myofascial tissues and appearance of

myofascial trigger points, often at constant sites. The reason for local peripheral sensitization in not known. Sensitization of pain pathways in the central nervous system due to prolonged nociceptive stimuli from pericranial myofascial tissues seems to be responsible for the conversion of episodic to chronic TTH (Bendtsen & Fernández-de-la-Peñas, 2011; Chen, 2009).

Often different etiologies of headache coexist, e.g. migraine increases the tension in neck and head muscles and muscle tension sensitizes to migraine symptoms (Merikangas et al., 2011). That is why distinctions between discrete headache subtypes may not always capture the true nature of headache in the clinical practice, although diagnostic criteria are an important ground for diagnostic and treatment decisions and necessary instrument in clinical science.

Questionnaires are available to be used in clinical practice to evaluate the impact of headache on patient´s life and to measure the response to treatments. Widely used ones are the validated questionnaires Migraine disability assessment (MIDAS), ID-Migraine and Headache Impact Test -6 (HIT-6) (Kosinski et al., 2003; Lipton et al., 2003 (a); Stewart et al., 2001; Stewart 2003 (a)).

2.5 Factors modifying the experience of pain

2.5.1 Gender

Many pain conditions are more common among women than men. The research about pain and gender has increased especially during last 30 years. Most population-based studies have found higher prevalence of pain in women (Fillingim et al., 2009; Ruiz et al., 1997; Unruh, 1996; Unruh et al., 1999). Experimental models have demonstrated that women exhibit lower pain threshold and tolerance than men (Riley et al., 1998). A comprehensive review about gender and pain has concluded that the prevalence of most common forms of pain, for example headache, back pain and fibromyalgia, is higher among women than men and women are more sensitive to most forms of experimental pain (Fillingim et al., 2009).

There is also difference in responses to pain treatment among genders. Use of analgesics, both prescribed and nonprescribed, is significantly higher among women than men (Eggen, 1993; Fernandez-Liz et al., 2008; Isacson & Bingefors, 2002), but still women are at greater risk for undertreatment of pain (Hoffmann & Tarzian, 2001). The relationship between sex and pain is not simple, for according to earlier studies also the care-giver´s gender has relevance in pain treatment. Coll et al showed that care provider´s own pain and patient´s gender alter the assessment of pain and also caregivers gender may affect the recommended treatment (Coll et al., 2012). A recent study showed that female caregivers

recommend psychosocial treatments for chronic pain more likely for female than for male patients (Hirsh et al., 2014).

The reasons for sex differences in pain are to some extent unknown. Multiple biological and psychosocial processes are involved and complexly joined together. Such dualistic conceptualization of biological and psychological etiology is questioned by some researchers, because neurobiological factors inevitably influence our sex roles and can also directly affect nociceptive responses (Fillingim et al., 2009).

Many earlier studies confirm that both administration and withdrawal of estrogens increase the risk for pain, although some reports did not verify this conclusion (Aloisi et al., 2007; Lichten et al., 1996; Macfarlane et al., 2002; Ockene et al., 2005; Wise et al., 2000). Migraine is often used as an example of hormonal contribution to pain: prepubertal incidence of migraine is approximately equal among sexes, but after puberty migraine is three times more prevalent in females (Lipton et al., 2001). Many women show variation in severity of pain symptoms across the menstrual cycle (Alonso et al., 2004; Arjona et al., 2007; Heitkemper et al., 2003). Interestingly, a study of transsexuals undergoing hormonal treatment revealed a change in response to pain (Aloisi et al., 2007). One-third of the male-to-female subjects developed chronic pain, whereas about half of the female-to-male subjects reported a significant improvement of the chronic headache present before the start of the testosterone therapy. In experimental studies hormonal influences on pain sensitivity have been reported, but the associations are highly variable and the underlying mechanisms poorly understood (Fillingim et al., 2009). The gonadal hormones, especially estrogen, have both peripheral and central effects, which are very complex and not completely understood (Fillingim et al., 2009).

Differences in the endogenous opioid system also reflect the sex-related differences in pain, as pain-related activation of brain mu-opioid receptors show distinct differences between men and women (Zubieta et al., 2002). Gonadal hormones interact with the opioidergic system and this may also partly explain sex-differences in pain sensitivity (Smith et al., 2006). Genotype may also be a contributing factor to different pain sensitivity (Fillingim et al., 2005; Mogil et al., 2003; Olsen et al., 2012). Still, the specific modulatory effect of sex hormones on pain requires further exploration.

It should also be kept in mind that words matter: sex and gender are not equivalent terms; while sex is only a biological feature mainly defined on the basis of the subject´s reproductive organs and structure, gender refers to a socially based phenomenon including the behavioral, cultural and psychological traits typically associated with one´s sex (Peterlin et al., 2011). Several psychological and social factors can play a substantive role in gender-related pain difference (Smitherman &

Ward, 2011). Women tend to use more psychological coping strategies to manage pain, for example social support, positive self-statement and palliative behaviors (Unruh, 1999). Psychological constructs proven to be important determinants of pain responsiveness are catastrophizing and self-efficacy. Catastrophizing, meaning propensity to consider a situation as much worse or much more serious than it really is, is associated with pain and pain-related disability, and is more common among women than in men (Cambridge Dictionary; Forsythe et al., 2011).

Catastrophizing expresses sex differences in pain responsiveness, but personality factors might modulate its effect to pain more than gender (Racine et al., 2012). Low self-efficacy has been associated with experience of high pain intensity. Some studies show that men report greater self-efficacy than women, which also might be one factor to explain gender differences in pain (Somers et al., 2012; Jackson et al., 2002). Social and cultural factors can also affect the pain responses. Beliefs about femininity and masculinity can alter the behavior as expected. A meta-analysis showed that individuals, regardless of sex, who consider themselves more masculine and less sensitive to pain, had higher pain thresholds and pain tolerance (Alabas et al., 2012). Pain expressions among women are generally more acceptable than among men and this might affect the ways how people report pain (Wise et al., 2002). Also cultural variability, beliefs and susceptibility to early traumatic and stressful events play some role in gender differences concerning pain (Defrin et al., 2009; Fillingim & Edwards, 2005).

2.5.2 Lifestyle factors

Many factors associated with pain favor chronicity (van Hecke et al., 2013). Some of them are non-modifiable (age, sex, genetic factors), but many lifestyle factors can be affected, at least in theory, such as smoking, alcohol consumption, obesity, physical activity and sleep behavior.

Studies show that smoking is more common in pain populations than in general population (Vogt et al., 2002, Weingarten et al., 2008), but cessation of smoking rarely happens among patients attending pain clinics (Hooten et al., 2009). This is thought to result from patients´ motivation to smoke as a way to manage pain-related emotional distress. It is an unanswered question whether smoking cessation improves pain. In a large population-based cross-sectional study association between headache and smoking was found, but the causal relationship remained obscure, e.g. whether smoking relieves headache or the stress related to headache (Aamodt et al., 2006). Smoking correlates to high incidence of low back pain (Shiri et al., 2010 (a)).

From ancient times alcohol has been used to self-medicate pain, an effect which occurs when alcohol is consumed at high doses (Riley & King, 2009).

Withdrawal from chronic alcohol use often increases pain sensitivity, which motivates continued drinking (Brennan et al., 2005). According to a Danish population-based study subjects suffering from chronic pain were less likely to drink alcohol and among opioid users alcohol consumption was further reduced (Ekholm et al., 2009). Negative correlation was also observed between migraine and alcohol consumption and is probably explained by the headache-precipitating properties of alcohol (Aamodt et al., 2006).

The correlation between obesity and chronic pain may be related to increased strain on joints, reduced physical activity and overall poor physical condition (Hitt et al., 2007). Yet, the association is known to be more complex, genetic and environmental factors also making significant contributions (Wright et al., 2010). Obesity is associated to increased risk of low back pain and ischialgia (Shiri et al., 2007; Shiri et al., 2010 (b)). Association of weight loss with improved pain outcomes has been suggested in some studies, but the strength of the relationships varies by study depending on the etiology and type of pain (van Hecke et al., 2013). Some evidence suggests that weight loss improves pain outcomes even after controlling for depression, maybe attributing to improved self-esteem and pain perception (Shapiro et al., 2005). Obesity is associated with both episodic and chronic migraine and the risk of migraine increases with increasing obesity (Chai et al., 2014). The correlation of increasing headache frequency with obesity has not been determined, but those individuals with episodic headache who were obese, were in a greater risk of headache chronification compared to non-obese patients with episodic headache (Chai et al., 2014).

In the past the treatment choice for chronic pain included recommendations for rest and inactivity, but currently the benefits of exercise in reducing the severity of chronic pain are emphasized, as well as more general benefits associated with improved overall physical and mental health and physical functioning. However, studies on benefits of physical activity in patients with chronic pain are incongruent, because study materials are very heterogenic, methodology is of varying quality, studies often focus specifically to certain pain conditions and lack clear definitions as to the exact form of exercise used (van Hecke et al., 2013). In musculoskeletal pain, general advice with additional specific advice about exercise and functional activities tailored to the patient was found to be more effective in improving the pain and disability compared to non-specific advice alone (Liddle et al., 2007).). In Finnish Current Care, the national, evidence-based treatment recommendation, the benefits of different exercise are well documented and physical activity is recommended in the treatment of chronic low back pain and osteoarthrosis of hip and knee joint. Gradually increasing therapeutic exercise decreases pain and improves functionality in non-acute low back pain (Chou et al., 2007; Hayden et al., 2005; Oesch et al., 2010; Oosterhuis et al., 2014). Muscle

strength training, aerobic and guided aquatic exercise are beneficial for subjects with hip and/or knee arthrosis improving functionality and relieving pain (Fransen et al., 2014; Fransen et al., 2015).

In a large Norwegian population study low physical activity was associated with high prevalence of both migraine and non-migraine headache (Varkey et al 2008). The results indicated that individuals with headache were physically less active than those without headache and that among headache-free individuals lower physical activity was a risk factor for non-migraine headache.

Sleep problems are well-known comorbidities of chronic pain. A prospective survey from Norway involving only females showed that disrupted sleep was a risk factor for chronic pain and predictive for pain persistence (Nitter et al., 2012). Another prospective study suggested that treating sleep problems of chronic pain patients decreases the risk of developing depression, which in turn is associated with poorer coping with pain (Campbell et al., 2013). Sleep and headache have a complex relationship; primary headache, such as migraine and cluster headache can be triggered by sleep, while chronic morning headaches can be caused by sleep disorders, such as sleep apnea and insomnia (Alberti, 2006). An elegant study assessing the relationship of stress and poor sleep showed that headache risk was increased when high stress and low sleep occurred concurrently during the preceding days (Houle et al., 2012). Pregabalin has shown to improve the sleep quality in neuropathic pain patients (Boyle et al., 2012; Roth et al., 2010)

2.5.3 Psychosocial risk factors

The term “psychosocial risk factors” implies all social, mental and individual processes and means, which can impair person´s physical and/or mental well-being or health. Social factors include general factors at the level of human society concerning social structure and social processes that impinge on the individual (Stansfeld & Rasul, 2007). The most common social risk factors are stressful working conditions, and economical and domestic problems. Psychological risk factors include individual-level processes and meanings that influence negatively the person´s mental states, such as depression, anxiety, hostility or type D personality. The term “psychosocial” is not only a shorthand term for the combination of psychological and social, but it also describes the connection between social and psychological processes (Stansfeld & Rasul, 2007). Psychosocial risk factors are linked to many health problems and they cause, modify and perpetuate the symptoms (Albus, 2010; Piepoli et al., 2016). Concerning cardiovascular risk, some studies show that psychosocial factors can cause even more substantial risks for adolescents and women than for men

(Korkeila et al., 2010; Nabi et al., 2010). Psychosocial risk factors are a well-known companion in many pain disorders.

In this thesis, we assessed psychosocial risk factors, namely anxiety, depressive symptoms and stress, and in addition hostility, type D personality and social isolation.

By definition anxiety is "an aversive state of worry, fear, uneasiness, or apprehension resulting from feeling of being unable to predict, control or obtain desired outcomes in regards to a specific situation, but can also be nebulous" (Barlow, 2000; Nicholson et al., 2007). Anxiety and fear of pain commonly coexist in chronic pain patients (Asmundson & Katz, 2009; Asmundson & Taylor, 1996). In clinical practice anxiety and stress are often used interchangeably, because these mental states are highly correlated (Nash & Thebarge, 2006). Anxiety-related neurobiological changes in the brain have been widely studied. Typical finding is hyperactivity in limbic regions, particularly the amygdala, and the inability of higher cortical executive areas to normalize the limbic response to stimuli (Martin et al., 2009). Several neurotransmitters (gamma-aminobutyric acid, serotonin, norepinephrine) are involved creating the neuropharmacological basis for treatment options. There are many questionnaires to assess anxiety and they are commonly used in clinical practice (Rose & Devine., 2014). Which method is chosen varies, nevertheless those instruments provide valid and reliable assessments of anxiety. It is problematic that all instruments provide different scores, making intuitive interpretation, communication and comparison of studies difficult.

Depression in general communication means despondency, a state of low spirit or lack of positive mood. In medical terminology, depression is a clinical syndrome described by feelings of despair, sadness, emptiness and loss of interest or pleasure occurring nearly every day for more than two weeks (American Psychiatric Association, 2013). Depression occurs most commonly as a secondary consequence of unfavorable events or circumstances, and the individual, social and economic burden of depression is substantial. In Finland depression is a major cause for sick leave. During 2019 about 45.000 persons, of whom 30.000 were women, received daily sick allowance because of depressive disorder (Kela, 2020). On the other hand, depressive symptoms or dysphoric feelings are experienced by everyone at times, and are inevitably part of human life. Pain and depression are closely correlated from the perspectives of both brain regions and the neurological functional system. One of the important causes for chronic pain leading to depression appears to be the common neuroplasticity changes on development of the pain and depression explaining the efficacy of the antidepressive drugs in treatment of chronic pain (Sheng et al., 2017). Many instruments are available providing valid assessment of depression and they are in regular use in clinical work.

Stress is mental strain resulting from unusually demanding circumstances and has different connotations, depending on whether it is due to an adverse, negative event or to an exhaustive effort in desired activities. The manifestations of stress are both psychological, such as increased vigilance and alertness, and biological, such as activation of the hypothalamic-pituitary-adrenal axis. Both dimensions of stress are useful in acute situations, but may turn harmful, if prolonged without subsequent recovery period. The physiological processes, by which stress modulates chronic pain disorders, are not well understood, but presumably stress has direct impact on pain generation and its modulation at central and peripheral levels through HPA (Godfrey et al., 2017; Vitetta et al., 2005;). Questionnaires to evaluate stress symptoms are available, but they are seldom used in clinical practice, possibly except for psychiatric care (Schneider et al., 2020).

Anger is described as a feeling of displeasure ranging in intensity from mild irritation to intense fury as a response to stimulus and there is substantial individual variability in the level of emotional intensity when expressing anger (Fernandez & Turk, 1995; Smedslund, 1993). Hostility means behavioral occasion when someone is unfriendly or shows that he/she does not like something (anger expression), and it differs from anger, which is a pure feeling. Hostility questionnaires are used almost solely in scientific studies, on rare occasions in clinical work. How anger is expressed has impact on disease course (Burns et al., 1998). Researchers have identified two different ways by which persons express anger: anger-in and anger-out. The former means that the anger is not objectively visible, although it increases the person´s internal arousal, and the latter involves physical acts or verbal expression (Nicholson et al., 2007). Studies show that in those persons, who are able to express their anger, the negative impact of anger on emotional and physical functions is weaker (Kerns et al., 1994). Pain severity modulates the relationship between expression of anger and physical signs of depression. In a population of patients from pain clinic, the relationship between inhibition of anger and depression was strong in patients with severe pain, while no relationship was observed in subjects with less severe pain (Estlander et al., 2008).

Loneliness is the distressing feeling of being alone, but social isolation means lack of social contacts and people to interact with. This means that one can live alone, but not feel lonely or socially isolated, or one can feel lonely while being with other people. Several studies show that many forms of pain, including headache, cause tendency to isolate, because pain-induced emotions, e.g. anxiety, depressive symptoms and even anger may not be socially tolerated (Nicholson et al., 2007; Parikh & Young, 2019; Young et al., 2013). Smith et al showed in a population-based study that people, who experience chronic musculoskeletal pain, are at greater risk of being lonely, but at lesser risk of being socially isolated (Smith et al., 2019). In reverse, social isolation has impact on pain. The intensity of

pain is reduced in individuals, who perceive a greater engagement with others (Karayannis et al 2019). Like hostility, social isolation is mainly assessed in studies, not in clinical practice.

2.5.3.1 Psychosocial risk factors and headache

Compared to headache-free persons, depression and anxiety are more frequently observed in headache population, as shown by several large population-based studies (Saunders et al., 2008; Song et al., 2016; Zwart et al., 2003). Also stress, hostility and isolation are more common in headache patients (Bag et al., 2005; Lampl et al., 2016; Nash & Thebarge, 2006; Schramm et al., 2015). Psychological factors affect headache in many ways; emotional status, self-efficacy and particular negative affects, such as anxiety, depression and anger, can alter the triggering threshold of a headache attack, the severity of headache pain, the treatment response and role functioning of the headache patient (Lake et al., 2005; Nicholson et al., 2007) and thus influence the impact of headache (Perozzo et al., 2005; Zwart et al., 2003). The relationship of depression and/or anxiety with headache is thought to be bidirectional especially in migraine patients. Breslau et al reported that patients with more frequent headaches are prone to depression, and in reverse, depressed patients are prone to have more headaches (Breslau et al., 2003). Psychological factors have been considered relevant only when significant psychopathology is present, but recent growing evidence suggests their importance also in more common forms of headache. The term “biopsychosocial framework” has been brought out to describe various aspects of headache more comprehensively, both in the context of research and treatment.

Anxiety is more prevalent among headache patients than persons without pain, and among headache patients it is more common than depression (Lanteri-Minet et al., 2005; Rasmussen, 1993). Anxiety increases pain intensity of headache patients and is associated with poorer quality of life and greater disability (Bishop et al., 2001; Lanteri-Minet et al., 2005; Nash et al., 2006). Increased headache-related disability and avoidance behavior have been attributed to the fear for headache attack (Norton & Asmundson, 2004). Anxiety is thought to increase pain sensitivity, so that an anxious person reacts fearfully to innocuous bodily sensations, and this may lead to sympathetic activation, catastrophic beliefs and create a vicious circle (Asmundson & Taylor, 1996; Norton & Asmundson, 2004).

Many studies show that depressive symptoms and dysphoric feelings are more frequent among persons with headache, especially chronic headache, compared to headache-free persons (Materazzo et al., 2000; Nicholson et al., 2003; Venable et al., 2001). Depressive symptoms increase the likelihood that stress triggers headache. They also increase headache-related disability and are a negative

prognostic factor for treatment response (Lipton et al., 2003b; Marcus, 2000; Stewart & Lipton, 2002;). In headache patients referred to specialist clinic depression is highly associated with disability and heavy burden of headache, as measured by HIT-6 (Jelinski et al., 2007). In the prospective study by Breslau et al the risk of first-onset major depression in persons with pre-existing migraine was over fivefold compared to persons without headache, and in turn, the risk of first-onset migraine in persons with pre-existing major depression was threefold compared to persons without depression in their history (Breslau et al., 2003). Because in that study the association of depression was only observed with migraine, not with other severe headaches, the authors discuss the possibility of shared etiology for the two disorders, based on hormonal factors, neurotransmitter systems or genetic susceptibility (Breslau et al., 2003). However, depression and anxiety are also frequent in tension-type headache population (Crystal & Robbins, 2010; Song et al., 2016). In a large population-based study, the association of headache with anxiety was stronger than its association with depression (Zwart et al., 2003). The prevalence of both anxiety and depression increase with frequency of headache in migraine, as well as in non-migraine headache population. Anxiety, hostility and depression are more frequent in subjects suffering from recurrent migraine symptoms or chronic tension-type headache compared to patients having only occasional headache (Bag et al., 2005).

Anger is supposed to be related to anxiety and depression in persons with headache (Abbate-Daga et al., 2007, Venable et al., 2001). Headache patients seem to hold in their anger more than controls, even after controlling for depression and anxiety (Nicholson et al., 2003). Failure to express pain may lead to increased disability (Duckro et al., 1995; Wade et al., 1990). On the other hand, studies concerning chronic low back pain show that high tendency to express anger increases pain sensitivity and disability (Bruehl et al., 2002). So, too much or too little expression of anger may have a negative effect on pain experience and its management. Negative effects managed inadequately raise the risk for increased headache frequency, pain intensity and headache-related disability.

Headache and stress are closely related in multiple ways; stress can be an important predisposing factor for the onset of headache disorder (Nash & Thebarge, 2006). It can exacerbate headache episodes and accelerate transformation of headache from episodic to chronic. In migraine patients maladaptive coping mechanisms are speculated to associate with migraine and stress (Maleki et al., 2012). Schramm et al reported association between increasing stress and increasing headache frequency in a longitudinal study on population-based cohort in Germany (Schramm et al., 2015). Stress also worsens independently headache-related disability and quality of life (Nash & Thebarge, 2006). Severity of headache appears to be the major determinant of disability and it

correlates with depression and emotional stress (Magnusson & Becker, 2003). However, pain intensity and headache frequency do not fully explain the interpersonal variability in adjusting to the pain.

In population studies isolation experienced by headache patients is usually evaluated as part of quality of life. High headache frequency and headache-related burden are associated with social impairment (Cassidy et al., 2003). Migraine, and also other painful syndromes, lead to isolation from social, emotional and behavioral aspects of life, and migraine has a great impact on these even between attacks (Boardman et al., 2005). A large cross-sectional survey consisting of adult population from several European countries assessed interictal burden of headache among many other aspects related to headache (costs, disability, quality of life, psychiatric comorbidities) (Lampl et al., 2016). In this study a third of persons with migraine and a quarter of persons with tension-type headache reported reluctancy to tell others of their headaches. Approximately 10 % of persons with either disorder felt that their families and friends did not understand their headaches, and almost 12 % of subjects with migraine reported that their employers and colleagues did not understand their situation (Lampl et al., 2016).

Reduced functionality, lower quality of life and psychiatric comorbidities all impair adaptation to the headache. Personality characteristics (hostility, optimism, neuroticism), psychiatric comorbidities (anxiety, depression), coping resources, presence of social support and socioeconomic status are all significant factors that affect coping with the headache disorder (Nash & Thebarge, 2006; Nash et al., 2006; Stewart et al., 2003 (b)). Two main psychological factors associated with poor adjustment to headache and impaired functionality seem to be the perception that factors affecting the pain are outside one´s own control and low self-efficacy (perceived inability to control the factors affecting the pain) (French et al., 2000; Martin et al., 1990).

Clinical implication of psychosocial risk factors in headache

The headache patients in general and occupational practice are more likely to be mildly affected as compared to patients attending specialist clinics. Yet, psychosocial risk factors are common in both populations, and it is important to consider mental and social factors when assessing the burden of headache and designing the treatment. Earlier studies show that psychological flexibility is associated with improved functionality independent of headache severity or gender (Foote et al., 2016). Important factors reducing the impact of headache in migraine patients are proper medication, changes in life-style, relaxed coping, reduction of stress, and social support (family, general practitioner, headache society) (Vos & Passchier, 2003). So the goal in clinical practice should be to find optimal and

personalized treatment for each patient. This aim includes measures to hinder transformation to chronic headache and to increase quality of life by improving sense of self-efficacy by patient education.

2.6 Pain and measures of occupational outcome

2.6.1 Work related factors to measure well-being and work ability

Numerous factors, both directly and indirectly related to work, affect employees´ well-being. Selected work-related factors studied in the present thesis are presented here in general terms.

Work engagement

Work engagement is defined as "a positive, fulfilling, work-related state of mind that is characterized by vigor, dedication and absorption" (Schaufeli et al., 2002). Work engagement is independent of profession or vocation. It describes a positive psychological construct and a continuous state and it is not affected by any particular behavior, event, individual or object. Conceptually, work engagement comprises three dimensions. Vigor denotes "high level of energy and mental resilience while working, the willingness to invest effort in one´s work, and persistence even in the face of difficulties". Dedication is "sense of significance, enthusiasm, inspiration, pride, and challenge". Absorption means "being fully concentrated and deeply engrossed in one´s work, whereby time passes quickly and one has difficulties with detaching oneself from work" (Schaufeli et al., 2002). As a result of good work engagement the employees are hardworking (vigor), deeply involved in (dedicated) and absorbed by their work.

Work-related factors, both physical and especially psychosocial ones, have profound effect on employees' health. Low levels of stress, anxiety and depression are associated with high work engagement (Hakanen & Lindbohm, 2008; Hakanen & Schaufeli, 2012; Shimazu et al., 2012). Work engagement has also a positive influence on work ability (Airila et al., 2012; Airila et al., 2014). Work engagement is associated with the work ability and occupational satisfaction the employee experiences (Airila et al., 2012). In chronic pain work engagement is one predictor of maintained work ability (Karoly et al., 2013). Work engagement also correlates with the risk of depression (Imamura et al., 2016).

Work engagement is a relatively new term and is evaluated by the Utrecht Work Engagement Scale (UWES-9) (Schaufeli et al., 2002). The questionnaire is not yet widely used in clinical practice.

Absenteeism

A broad meaning of absenteeism is “the practice of regularly staying away from work or school without good reason” (Oxford Learner´s Dictionary of English). Sickness absenteeism indicates that a person is away from work because ill health. Sickness absenteeism has a substantial effect in society, especially economically and controlling absenteeism is of utmost importance to any organization to minimize the impact on work efficiency (McEwan, 1991).

The most common way to measure absenteeism is to count the number of the sick leave days per year, which is widely used by occupational health, as well as by employer organizations and insurance companies.

Presenteeism

Presenteeism is a relatively new concept and it has two definitions in the literature (Ishimaru et al., 2020). Mainly in European studies presenteeism refers to “sickness presenteeism” (employees still showing up at their jobs despite ill health) (Aronsson et al., 2000). The other definition, frequently used in studies in North America, refers to “impaired work function” (reduced performance at work, besides illness) focusing on the consequences of illness showing as loss of productivity (Lerner et al., 2000). Earlier studies indicate that presenteeism is a risk factor for absenteeism, and the economic costs of presenteeism probably even exceed those of absenteeism (Aronsson et al., 2000; Collins et al., 2005; Skagen & Collins, 2016).

2.6.2 Musculoskeletal pain and work ability

Chronic illness is a strong risk factor for sickness absence (absenteeism) and decreased productivity (presenteeism) at work (Aronsson et al., 2000; Skagen & Collins, 2016; Sundstrup et al., 2017). A number of studies have described absenteeism associated with different pain symptoms and even more significant impairment in productivity at work (Stewart et al., 2003b; Stewart et al., 2008). Musculoskeletal pain is a common symptom in all sociodemographic cohorts and a major health problem having far-reaching consequences for heath, work and use of health care (Breivik et al., 2006; Picavet & Schouten, 2003). It significantly decreases quality of life and productivity, even when the pain is not chronic (Majlesi, 2019; McDonald et al., 2011). Chronic pain is independently associated to low self-rated health in general population (Mäntyselkä et al., 2003). In a European study 19 % of adult population in Europe suffered from moderate or severe pain (Breivik et al., 2006). In this extensive study the mean age of pain sufferers was 49,9 (SD 17,4) years and pain was somewhat more prevalent in

females. Of responders with pain 44% were employed and 22% unemployed (Breivik et al., 2006). In 32% of study subjects work affected their pain, one fifth had previously been diagnosed with depression because of their pain and 40% of responders reported inadequate pain control (Breivik et al., 2006).

The mean working time lost due to pain was 7,8 days in the last six months, 55% had lost no days at all and 13% had lost at least 16 days. The country-specific data showed markedly greater number of lost work days in Finland compared to other European countries, almost 20 days during the last six months (Figure 3). Factors affecting this difference in the amount of pain symptoms and sickness absenteeism in relation to other European countries might include comprehensive occupational health care, social support network and employment security contracts in Finland.

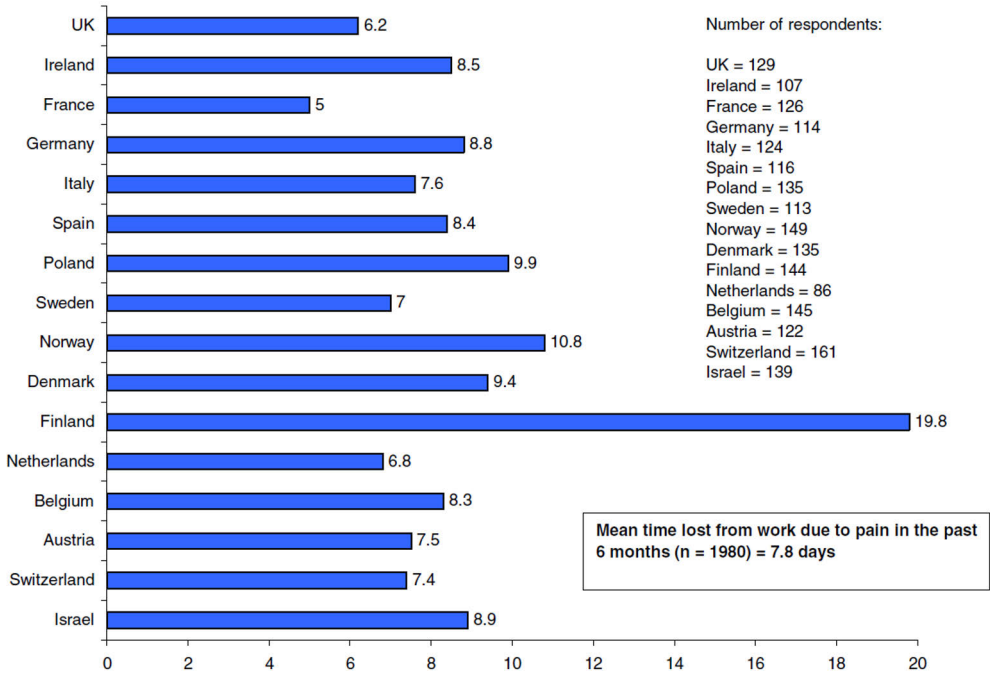

Figure 3. Mean number of lost days from work because of pain in the last six months in 16 European countries (Breivik et al., 2006). *Copyright©JohnWileyandSons 2021.*

A large population study showed substantial variation between European countries in the prevalence of musculoskeletal pain, which may be partly explained by socioeconomic differences between countries, high prevalence corresponding to lower risk of poverty or social exclusion (Farioli et al., 2014). In that study Finland had the highest prevalence in neck and upper limb pain (Farioli et al., 2014). Pain

is a common reason for visiting a doctor in general practice. Low back pain was found to be the fifth most common reason for physician appointments in the United States in 1990, accounting for 3% of the visits (Hart et al., 1995). That amount has changed little since the early 1990s (Deyo et al., 2006). In a Finnish study 40% of the visits to a general practitioner were made due to pain and by far the most common complaint was musculoskeletal pain (Mäntyselkä et al., 2001). It is noteworthy that a quarter of the working-age pain patients received sick leave.

Multiple factors play significant roles concerning the risk of musculoskeletal pain and its chronification (Coggon et al., 2013). Both physical and psychosocial risk factors at work may increase the risk for musculoskeletal disorder (Devereux et al., 1999; Freimann et al., 2016; Herin et al., 2014; Linton, 2001). Also high physical workload, low to moderate physical activity and obesity are associated with increased risk for musculoskeletal pain (Haukka et al., 2012).

Biopsychosocial framework is important in assessing work ability of patients with chronic musculoskeletal pain. Unrecognized psychiatric comorbidities are common, when chronic musculoskeletal disabilities cause need for long-term sick-leaves (Olaya-Contreras & Styf, 2013). Psychiatric symptoms may lead to prolongation of the sick-leave, because the mental comorbidity is not recognized or treated. In a study among Estonian university hospital nurses prevalence of musculoskeletal pain was high and psychological risk factors, especially tendency to somatization, somatic stress symptoms and work-related psychosocial risk factors had a significant impact on the occurrence of musculoskeletal pain (Freimann et al., 2013; Freimann et al., 2016). Thibodeau et al established that sensitivity to anxiety increases pain tolerance, but depression was not associated to altered pain perception in either sex in this study (Thibodeau et al., 2013). Burns et al showed that the degree of criticism and hostility from spouse correlated significantly with pain intensity experienced by females and that marital interaction affects perceived pain symptoms (Burns et al., 2013). Work-family conflicts are associated with poor work ability in females with chronic musculoskeletal pain (Bethge & Borngräber, 2015).

Many studies have demonstrated that comorbidities affect the work ability in musculoskeletal pain. In a Finnish population chronic pain with or without long-standing co-occurring illness contributes strongly to disability retirement and particularly to retirement due to musculoskeletal diseases (Saastamoinen et al., 2012). Combination of multisite musculoskeletal pain and older age are strong risk factors for perceived poor work ability and disability retirement (Haukka et al., 2015; Miranda et al., 2010; Neupane et al., 2011).

A meta-analysis found that low self-efficacy associates strongly with impaired work ability and high self-efficacy is a protective factor for maintained functionality in chronic pain (Jackson et al., 2014). In a population of workers on

sick leave due to musculoskeletal complaints for 2 to 6 weeks, self-perceived ability to return to work was strongly associated with pain and explained a considerable part of the variance in these outcomes (van Duijn et al., 2004). Emotional distress, poor coping style and perceived disability are associated with sick leave after controlling for pain parameters and sociodemographic variables. The strongest predictors of disability were symptoms of burnout and posttraumatic stress reactions (Grossi et al., 1999).

In a prospective study of pain patients, mostly suffering from musculoskeletal pain, self-efficacy beliefs were important determinants of pain behaviors and high self-efficacy predicted reduced avoidance behavior (Asghari & Nicholas, 2001). In a later study Asghari and Nicholas concluded that personality traits, except for neuroticism in some patients, are only weakly associated with pain variables, but may be significant in some patients at risk of poor adjustment to chronic pain (Asghari & Nicholas, 2006).

Resilience has clear association with good coping, pain attitudes, social responses and utilization of heath care/medication (Karoly & Ruehlman, 2006). Assessment of predictors of work ability after multidisciplinary rehabilitation established that emotional distress, cognitive function and overall health correlate with perceived work ability in musculoskeletal pain patients (Lillefjell et al., 2006).

To find the subjects with musculoskeletal pain who are at risk of chronicity and long term disability Linton et al created an instrument, Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ) (Table 2), which is a self-administered questionnaire to measure the burden of musculoskeletal pain (Linton & Boersma, 2003). It involves several factors in addition to the pain itself, which all contribute the cumulative burden index. To increase usefulness of the questionnaire, the authors created a short version, including ten questions, two assessing the pain itself, and the rest pertaining to emotional stress and functional ability (Linton et al., 2011).

Table 2. The short 10-item version of Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ) (Linton et al., 2011).

	Item	*Concept Area*	*Scoring**
1	How long have you had your current pain problem?	Pain	1-10
2	How would you rate the pain that you have had during the past week?	Pain	0-10
3	Please circle the one number that best describes your current ability to participate in each of these activities I can do light work for an hour.	Self-perceived function	0-10 reversed scoring
4	Please circle the one number that best describes your current ability to participate in each of these activities I can sleep at night.	Self-perceived function	0-10 reversed scoring
5	How tense or anxious have you felt in the past week?	Distress	0-10
6	How much have you been bothered by feeling depressed in the past week?	Distress	0-10
7	In your view, how large is the risk that your current pain may become persistent?	Return to work expectancy	0-10
8	In your estimation, what are the chances you will be working your normal duties in 3 mo?	Return to work expectancy	0-10 reversed scoring
9	An increase in pain is an indication that should stop what I´m doing until the pain decreases.	Fear avoidance beliefs	0-10
10	I should not do my normal work with my present pain.	Fear avoidance beliefs	0-10

*Higher scores indicate higher levels of estimated risk for developing pain-related disability. Score may range from 1 to 100.

Despite chronic musculoskeletal pain, many people with pain continue to work, even effectively (Blyth et al., 2003). Personal factors, such as age, general health, self-efficacy, as well as physical and psychosocial work-related factors, rather than the pain itself, determine the perceived work ability and work performance (de Vries et al., 2013; Lee et al., 2015). Psychosocial factors, often work-related, seem to be crucial in avoiding impaired work ability. Psychosocial intervention has been established to be more effective than conventional treatment in back pain (Linton et al., 2016). A literature review concluded that lack of modifications at work and lack of the employee´s autonomy concerning his/her work predicted disability in chronic pain patients (Teasell & Bombardier, 2001). Subjects with chronic musculoskeletal pain, who had low levels of emotional stress and who perceived their physical disability, preserved their work ability (de Vries et al., 2012 (a)). Workers who stayed at work despite musculoskeletal pain, compared to those on sick leave, had lower levels of fear avoidance, pain catastrophizing, perceived

workload, and higher pain acceptance, better life control and pain self-efficacy. In contrast, the study groups did not differ in their physical activity levels, active coping or work satisfaction (de Vries et al., 2012 (b)). To retain work ability despite chronic musculoskeletal pain, the most important factors are personality characters, self-management and motivation to work (de Vries et al., 2011). Still, the interrelationships between musculoskeletal pain, work well-being and work ability are complex and not easy to study. Further studies are needed in order to design individualized treatments and adjustment measures for employees with chronic pain to retain better daily functioning at and outside work.

2.6.3 Headache and work ability

The burden of headache arises from wide-ranging factors including personality, family, employer, work community and society. The association of headaches with disability, and hence with work ability, is complex and affected by many elements, of which psychosocial factors have an important role, as described in Chapter 2.5.3. Headache is more frequent among females during work years, and females also have more comorbidities, both somatic and mental, in association with headache. For these reasons the burden of headache is significant, especially for women (Bingefors & Isacson, 2004).

Correlation of absenteeism with headache, especially with migraine, has been studied extensively, and despite the differences in methods used and in employment and economical contexts of study subjects, the results are fairly consistent (Lipton et al., 2001; Michel et al., 1999; Rasmussen et al., 1992; Rasmussen, 2001). Linde and Dahlöf found that 65% of migraineurs report some degree of absence from work or school during the previous year (Linde & Dahlöf, 2004). In a population-based study, subjects with headache missed the equivalent of 4,2 work days per year, and 70% of the subjects reported presenteeism, i.e. impaired effectiveness at work (Schwartz et al., 1997). In that study employees with migraine were more likely to lose work days, whereas persons suffering from tension-type or other types of headache accounted for a large proportion of decreased work effectiveness (Schwartz et al., 1997). In a Danish widely cited study of general population, 43% of employed subjects with migraine (5% of the population) and 12% of those with tension-type headache (9% of the population) had had one or more days off work in the preceding year because of their headache (Rasmussen et al., 1992). In the same study, the total number of work days lost per year in the general employed population was estimated to be 270 per 1000 persons for migraine, and the corresponding number for tension-type headache was 820. Women had higher rates of absence caused by headache (Rasmussen et al., 1992). In a US population-based study of tension-type headache 8,3% of the subjects with

episodic headache reported work days lost because of their headache, and 43,6% reported lost productivity at work, home or school (Schwartz et al., 1998). In that study absenteeism and presenteeism were clearly higher for subjects, whose headache was chronic (Schwartz et al., 1998). Linde and Dahlöf concluded that the estimates of absence days caused by headache have been quite constant between studies from different countries, ranging from 2 to 6 days per year among headache patients in general, and from 1,5 to 4,2 days per year in migraine population (Linde & Dahlöf, 2004). An interesting study from the US demonstrated that better access to health care was significantly associated with increased likelihood of absenteeism in migraineurs, and migraine severity, co-existing depression and use of health care services were significant explanatory variables (Lofland & Frick, 2006).

Saunders et al showed that majority of headache subjects (83% of migraineurs and 79% of persons with other severe types of headache) had some type of comorbidity (Saunders et al., 2008). Migraineurs and non-migraine headache subjects had significantly more mental disorders (OR 3.1/2.0), other pain conditions (OR 3.3/3.5) and physical diseases (OR 2.1/1.7) compared to headache-free controls. Also significant role disability was observed in both headache groups, and comorbid conditions explained 65% of the migraineurs´ role disability and all of that associated with other severe headaches (Saunders et al., 2008). An earlier prospective study of Michel et al had achieved similar results, indicating that sickness-related absenteeism was higher in migraineurs compared to headache-free subjects. Also in this study the reason for absenteeism was the presence of comorbidities, not headache, and the researchers noted that migraineurs avoided reporting headache as the reason of the sick leave (Michel et al., 1999). One reason for that can be the social stigma of migraine, not justifying the headache as an acceptable reason for sick leave (Young, 2018; Parikh & Young, 2019). Significance of comorbidities is complex, as shown in a previous study, reporting that migraineurs with low back pain are more prone to miss work days than patients with mere low back pain without migraine, and patients with low back pain without migraine used more specialist consultations and complementary examinations than those having migraine on top of their low back pain (Dartigues et al., 1998).

Almost all studies concerning headache, mostly migraine, show that headache causes absenteeism, but the relationship between headache and lost productivity is more complex (Lipton et al., 2001). In a large population-based US study, self-reported loss of productive time in work for subjects with frequent or severe headaches was 1,8 hours per week for headache and 2,8 hours for all health related causes, and 76,5% of lost productive time related to headache was explained by reduced performance in work (presenteeism) (Stewart et al., 2008). The authors conclude that the impact of chronic or frequent episodic migraine to work ability

will be underestimated, if the employment status is not taken into account (Stewart et al., 2010).

Pransky et al found that severity of episodic headache is a more important factor explaining lowered work performance than specific headache diagnosis (Pransky et al., 2005). In that study, in which the number of study subjects was quite small, the work ability assessed by self-report was much lower than the working efficiency measured objectively (8 vs 20%), and the researchers concluded that workers with even relatively severe headache can find ways to cope with the pain and maintain their working capacity (Pransky et al., 2005). A number of other studies report that migraine affects productivity more profoundly than other headaches (D'Amico et al., 2004; Durham et al., 1998; Michel et al., 1997). A study of university students indicates that subjects with migraine show significantly higher impairment in productivity than those with episodic tension-type headache and the latter group shows higher impairment than controls without headache (Bigal et al., 2001). Michel et al assessed occupational cohort in France and reported that the number of workdays lost (absenteeism) was not statistically different between the migraine, other headache and headache-free groups after adjustments for age, sex, and number of health impairments other than headaches, but work performance was greatly reduced (presenteeism) among migraineurs (Michel et al., 1997). Presenteeism is known to be independently related to both the severity (pain intensity) and frequency (number of headache days) of headache (Stewart et al., 2008). In accordance, frequent headaches are associated with poor mental and physical work ability but not with sickness absence (Hedenrud et al., 2014). Lyngberg et al assessed changes in consultation rates, medication use and work absence due to migraine in Denmark comparing years 1989 and 2001 (Lyngberg et al., 2005). Medical consultation rates and use of acute prescription medication increased, but no improvement in absence rate was observed.

Working conditions can affect the headache (Scaratti et al., 2018), and work demands and psychosocial aspects are important factors for work ability in employees with headache. Recent study from the Netherlands indicated that job resources and demands have considerable affect to work ability of employees with chronic headache compared to subjects without any chronic disease (van der Doef & Schelvis, 2019). Among headache patients high emotional demands contributed to exhaustion and the length of sick leave, whereas high autonomy was related to low rate of emotional exhaustion. These employees with chronic headache did benefit strongly from supervisor support, and support given was associated with lower amount of sick leaves. A prospective population-based study from Norway estimated that 27% of moderate or severe headache cases during the previous month were attributable to work-related psychosocial and organizational factors (Tynes et al., 2013). That study indicated that the most prevalent work-related

predictors of headache were role conflict, poor social climate and bullying/harassment at work.

The socioeconomic costs of absenteeism and presenteeism in headache population are substantial (Andlin-Sobocki et al., 2005; Jensen & Rasmussen, 2004; Linde et al., 2012; Rasmussen et al., 1992; Stewart et al., 2003b). Most of the costs related to headache are indirect costs, due to lost work days and reduced efficiency (presenteeism) at work. Several studies reveal that the direct costs, such as those caused by consultation, diagnostic investigations, treatments and hospital admissions, usually account for less than 30% of the total costs (Berg, 2004). In a Swedish study, 25% decrease in working efficiency due to headache was estimated to cause costs compared around 10 normal working days and 1,4 billion euros per year (Raak & Raak, 2003). In a European study, the total annual cost of headache among working-age adults was estimated to be €173 billion, of which migraine caused €111 billion (64%), tension-type headache €21 billion (12%), medication overuse headache €37 billion (21%) and other headaches €3 billion (2%). Most studies concerning the cost of headache focus on migraine, and there are large variations in the amount of calculated costs, probably due to methodological differences and differences in social security systems. Nevertheless, it is clear that headache causes a huge economic burden for societies, especially for the patients and their employers. (Linde et al., 2012).

2.7 Pain and quality of life

2.7.1 General aspects of quality of life

WHO defines Quality of Life (QoL) as an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. QoL is also determined as the "physical, psychological and social domains of health, seen as distinct areas that are influenced by a person's experiences, beliefs, expectations and perceptions" (Testa & Simonson, 1996). The main characteristics of the concept of QoL are as follows: subjective (the individual him/herself is the only reliable source of evaluating one´s QoL), phenomenological (QoL is like a photograph of the current situation), multidimensional (QoL contains different domains, which widely describe the person´s life), evaluative (QoL does not reflect any facts, but rather consists of the person´s judgements and evaluations), dynamic (QoL is sensitive to changes in the person´s state) and quantifiable (QoL can be assessed and compared across time points or across individuals) (Niv & Kreitler, 2001). Since QoL includes subjective values concerning life as a whole, it is more

than just functional status. In practice, this means that personal judgements and preferences have significant influence on QoL.

Several validated instruments are available to measure Qol in general or health-related quality of life (HRQoL), often used in medical contexts. HRQoL is defined as the "physical, psychological and social domains of health, seen as distinct areas that are influenced by a person's experiences, beliefs, expectations and perceptions" (Testa & Simonson, 1996). Also many disease-specific HRQoL instruments have been validated (Bagley et al., 2012; Bennett et al., 2009). Although QoL and HRQoL are used interchangeably in the literature, each has its own emphasis. QoL is a broader concept than HRQoL, which focuses on the effects of illness and assessment of the impact of treatment on QoL. HRQoL is a useful tool for medical professionals to understand the distinction between multiple aspects of life related to health.

There are several validated questionnaires to measure HRQoL. Most commonly used are WHO Quality of Life Questionnaire (WHOQOL), EUROHIS-8 (short version from WHOQOL questionnaire), 36-Item Short Form Health Survey and HRQoL EQ-5D (Power, 2003; Rabin & de Charro, 2001; The WHOQOL Group, 1998 (a); The WHOQOL Group, 1998 (b); Ware et al., 1993). Disease-specific questionnaires include for example Migraine Specific Quality of Life Questionnaire, Fibromyalgia Impact Questionnaire and Quality of Life in Depression Scale (Bagley et al 2012; Burckhardt et al 1991; Hunt & McKenna, 1992; Wagner et al 1996).

Although QoL is an important factor in individual's life, it is seldom assessed in daily practice. Recently the importance of QoL has been emphasized and increasing number of studies have defined QoL as one of the end points in clinical trials as an important outcome.

2.7.2 The effect of pain on quality of life

The effect of pain on quality of life is widespread (Breivik et al 2006; Reid et al., 2011). Not surprisingly, a great number of studies show that pain has a significant impact on QoL, and it impairs QoL more than many other disorders (Arnold et al 2000; Becker et al 1997). One of the lowest scores of QoL among different medical conditions is observed among patients suffering from chronic non-malignant pain (Becker et al 1997). Reasons for the profound effect of pain on QoL might be its nature as all-embracing suffering and many coincident symptoms frequently associated with pain, e.g. anxiety, depression, physical dysfunction, social isolation and poor sleep (Becker et al 1997).

The foremost features of pain having relevance to QoL are duration and intensity; the longer the duration or higher the intensity of the pain, the greater the

impact on QoL (Lipton et al 2000). The association of pain duration with QoL is clearly shown by a study, in which four study groups with increasing amount of pain were assessed during a two-week period (Skevington, 1998). Even such a short timeline showed that the QoL reduced linearly in relation to increasing pain intensity. Pain intensity has independent negative impact even after adjustments for many different aspects, such as treatment, diagnosis or depression (Lipton et al., 2000; Niv & Kreitler, 2001). Widespread pain impairs QoL more than regional pain (Niv & Kreitler, 2001). A study among elderly people revealed that comorbidities also increase the impact of pain on QoL, even when the additional disease is not related to pain (Cuijpers et al 1999).

According to Becker et al pain affects most of the dimensions of QoL, except for spirituality, religion and personal beliefs (Becker et al., 1997). The domains affected by pain represent physical condition, psychological well-being, level of independence, environmental health and services, but also role-functioning, both physical and emotional, are interfered (Becker et al., 1997). Pain seems to affect most strongly physical domain, followed by the emotional, social and cognitive domains of QoL. People suffering from chronic pain seem to perceive and experience many aspects of life differently compared to pain-free persons, because pain affects QoL so broadly and influences crucial areas of well-being and functionality (Niv & Kreitler, 2001). It is, however, noteworthy that not all QoL domains are affected by pain, and helping patients to focus on those areas of life, may help them cope with the pain and consequently improve their QoL.

It is important to understand that the level of pain does not necessarily correlate with QoL. Person´s functional status has a profound effect on QoL, meaning that pain remaining constant, QoL may improve parallel with improvement of functional status (Skevington, 1998). On the other hand, QoL does not always change, as the level of pain changes. Although pain is one important component determining QoL, it is not always the most important factor. Also patient´s expectations with regard to pain may affect QoL, depending on the disease and the meaning the pain has for the individual (Niv & Kreitler, 2001). The effect of pain on QoL is modulated by several factors, such as the person´s interpretation of the meaning of the pain, which depends on culture-dependent contexts, understanding the warning function of pain, and accepting pain as a temporary sign of successful treatment (Bush et al., 1995; Strang, 1997; Turk et al., 1993).

QoL should be used, and is increasingly used as a measure in evaluation of treatment outcomes. Attention must be paid not only on reduction of pain, but also on improvement of QoL by the treatment. Naturally, effective treatment of pain correlates positively with QoL, although sometimes improvement of QoL expected to follow pain relief is diluted or hindered by side-effects (Aparasu et al., 1999).

2.7.3 Headache and quality of life

A large number of studies show that migraine and chronic headache have substantial impact on patient's life (Abu Bakar et al., 2016; Jensen & Rasmussen, 2004). This is particularly significant, because headache is so prevalent in the population, especially among working-age females. Earlier studies show that different types of headache affect different domains of HRQoL, and when headache becomes chronic, the overall HRQoL decreases significantly (Abu Bakar et al., 2016). Studies concerning quality of life in headache populations comparable to our study population are shown in Table 3.

Table 3. Studies concerning headache-related disability and QoL in working-age community populations. Modified from Abu Bakar et al., 2016, (only population-based studies assessing combination headache types are included to this table).

Author	Study subjects	QoL and other instruments used	Results
Duru et al (2004)	416 migraine, 464 migrainous disorder, 151 chronic daily headache, 355 episodic headache, not specified	QVM MIDAS MIGSEV	Patients with chronic daily headache had the poorest HRQoL, followed by those with migraine and those with other episodic headache. QoL scores correlated to headache severity, frequency, headache-related disability and treatment failure.
Michel et al (1997)	989 migraine, 1001 other headaches, 1757 non-headache subjects	SF-36 Spielberger anxiety scale	Subjects with migraine had poorer QoL compared to non-headache group
Sokolovic et al 2013	1192 employees with migraine, TTH or both	MIDAS	Migraineurs had higher disability scores compared to those with TTH
D'Amico et al (2004)	250 responders including 36 migraine and 10 TTH subjects	Own self-answering questionnaire	Headache-related disability was higher in migraine compared to TTH. Productivity of migraineurs was reduced by at least 15% (presenteeism)
Saunders et al (2008)	5484 population, including 236 migraine and 313 non-migraine subjects	WHO-DAS II	Migraineurs had increased psychiatric comorbidity and increased risk for other pain conditions and physical disorders compared to controls and their role disability was higher than in non-migraine headache and headache-free study groups.

QVM: Qualite´ de Vie et Migraine; MIDAS: Migraine Disability Assessment Scale; MIGSEV: Migraine Severity Scale; SF-36: 36-Item Short Form Health Survey; WHO-DAS II: World Health Organization Disability Assessment Schedule.

Chronic headache and migraine even at asymptomatic times significantly impair HRQoL (Lipton et al., 2000; Lipton et al., 2003b; Terwindt et al., 2000; Duru et al., 2004; Michel et al., 1997; Bigal et al., 2001; Cavallini et al., 1995; Dahlöf & Dimenäs, 1995; Lampl et al., 2016; Lanteri-Minet et al., 2011). Migraine patients have lower QoL even during pain-free intervals, because of more or less constant fear of migraine attack (Blau, 1984). People with migraine have significantly lower HRQoL compared to healthy controls, but as compared to patients with chronic musculoskeletal pain, they have better HRQoL (Terwindt et al., 2000). Considering various domains of QoL, migraine seems to deteriorate especially the patient´s mental health and emotional and social functionality, as compared to patients with hypertension, diabetes or osteoarthritis (Osterhaus et al., 1994; Solomon et al., 1993). A study of chronic headache patients demonstrated that the affective and evaluative components of pain are those affecting most profoundly the QoL: the higher the emotional burden of pain, the lower the QoL, especially in the domains of social isolation and physical mobility (Passchier et al., 1996).

Also patients with tension-type headache, both episodic and chronic, report lower HRQoL compared to controls (D´Amico et al., 2004, Kim et al., 2013; Silva et al., 2004). The intensity, duration and frequency of headaches were confirmed to be significant predictors of impaired HRQoL (Lipton et al., 2000). No significant differences were found when comparing HRQoL in patients with episodic migraine and tension-type headache (Passchier et al., 1996). Maybe the higher intensity of pain in migraine is counterbalanced by the longer duration of tension- type headache (Passchier et al., 1996). There are only few studies about QoL in episodic tension type-headache and cluster headache populations (Abu Bakar et al., 2016).

Comorbidities, especially mental disorders, impair QoL of headache patients more than that of persons without headache (Jensen & Stovner, 2008; Lipton et al., 2000; Saunders et al., 2008). These findings, however, are not unanimous, namely a large population-based study showed that the role functioning of headache patients without comorbidities was comparable to that of headache-free persons without comorbidities (Saunders et al., 2008). Previous studies undeniably prove that migraine and chronic headache impair HRQoL and particularly psychiatric comorbidities play a crucial role. A population-based study from Sweden showed that comorbidities were more frequent among women than men, and psychological dimensions of HRQoL were affected to a greater extent in females (Bingefors & Isacson, 2004).

Finally, a great number of studies on the relation of pain and QoL have been performed, but comparison of these studies is difficult, because so many different variables, populations, pain disorders and QoL scales have been used. Nevertheless, it can be concluded that pain affects the whole person, and as a phenomenon pain is not equal to QoL. Pain does have a substantial impact, in most

cases a negative one, on QoL. This impairment is strong and exists despite differences in the type of pain, diseases, cultures and individuals. Excessive medical, social and financial resources are spent because of pain, not to forget the individual suffering. The most important goal in treatment should be the patient´s holistic well-being, which is a very subjective and self-determined experience. When the pain is chronic or recurrent, the effectiveness of the treatment should be assessed broadly by considering also effects on QoL.

3 Aims

The aim of this thesis is to evaluate the relationships between pain, psychosocial risk factors and work ability in Finnish working-age female population. The aims in detail are the following:

1) To analyze how musculoskeletal pain relates to work well-being. Do pain-related risk of disability and/or psychosocial risk factors have relationship with work engagement?

2) To assess the relation of individual HIT-6 items with psychosocial factors, anxiety, depression, stress, social isolation and hostility, in a female working-age population.

3) To examine, whether headache has an impact on work ability. Do occasional or recurrent headache and corresponding HIT-6 score associate with absenteeism and/or presenteeism?

4) To study, whether headache relates to the quality of life and to compare two instruments, the general EUROHIS-8 and health-related EQ-5D as measures of quality of life in this population?

4 Materials and Methods

4.1 Study population

The subjects for this study were enrolled from the PORTAAT (PORi To Aid Against Threats) survey, which is a longitudinal study accomplished in the years 2014-2015. The PORTAAT study comprises municipal employees of the city of Pori (83,497 inhabitants in 2014) in Southwest Finland. The study population includes workers from 10 out of 30 work units, which were selected by the chief of the welfare unit. The selected work units were the Unit of Social Services and Healthcare, Unit of Day-care Centers, Unit of Libraries, Occupational Health Care of Satakunta, Pori Sinfonietta, Museum of Satakunta, Museum of Art, the Centre of Culture, Unit of Traffic Warden and the School of Art. The main selection criterion was that the work unit had not been involved in any other health-promoting program during the past 10 years except for the routine occupational health care. The managers of the work units sent the invitation and study information as email attachment to the employees, and information sessions about the flow of the study were organized for potential study participants. The selected work units included altogether 2570 employees, of which 836 (104/369 males, 732/2201 females) consented to participate in the study. Participation rate of the study was 33%. An appointment with the study nurse was arranged for all respondents.

There were no exclusion criteria. We analysed data of the 732 female employees (mean age 48 +/- 10 years) (Figure 4). They worked in libraries (n=22), museums (n=33), technical management (n=80), social services (n=196), and health care units (n=401). Because headache, musculoskeletal pain symptoms and psychosocial risk factors are present differently in males and females, and because the number of men (n=104) was so limited in the PORTAAT study population, we included only female employees in this thesis. The number of women included varied slightly in the four studies, depending on the availability of the data collected.

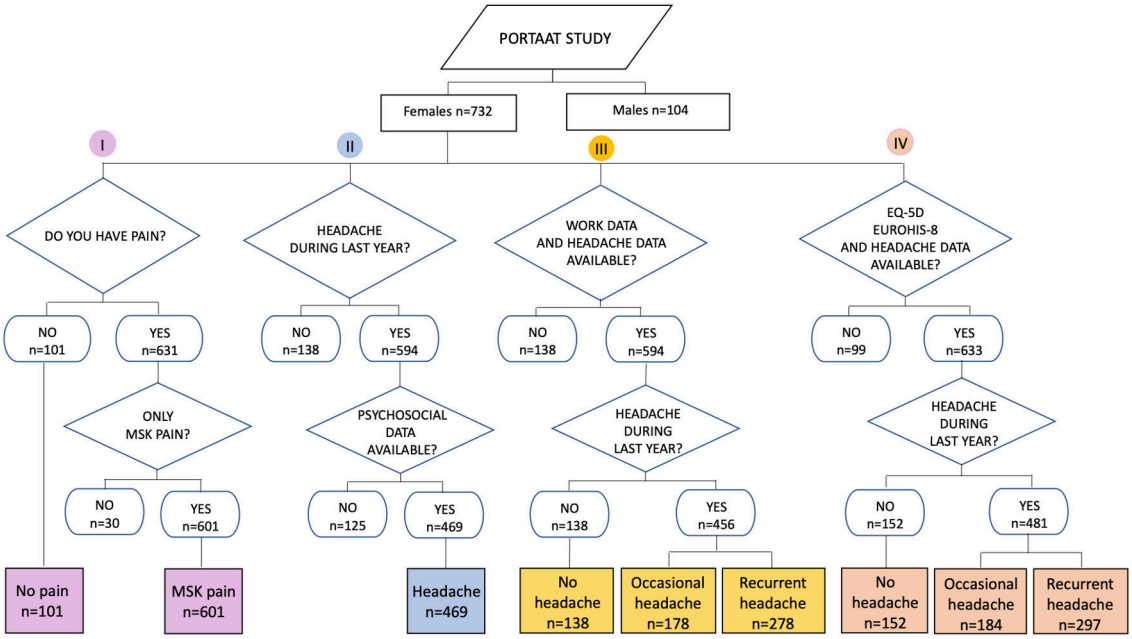

Figure 4. Flow chart of the patient selection in studies I-IV. MSK = musculoskeletal.

4.2 Methods

4.2.1 Demographics and physical examination

At the first appointment in 2014 the trained nurse gathered written informed consent to participate in the study. Blood pressure, height and weight were measured and body mass index (BMI) was calculated as weight (kg) divided by the height squared (m^2). The medical records and the previous disease history were obtained from the health care units used by the participant.

Data were collected using self-administered questionnaires, comprehensiveness of which was tested in a group of volunteers. The questionnaires included issues about diseases diagnosed by a physician, medication used regularly, years of education, working hours per week, the role of shift work, marital status (cohabiting or not), quality of sleep (good or not good) and alcohol consumption (the 3-item Alcohol Use Disorders Identification Test (AUDIT-C)) (Bush et al., 1998). Financial satisfaction was assessed with the question "Do you have to spare expenditures?"(yes or no). Smoking status was assessed and non-smoking was defined as having never smoked or having quit smoking >12 months ago. Leisure-time physical activity (LTPA) was classified as follows: high: LTPA for ≥30 min at a time for four or more times a week; moderate: LTPA for ≥30 min at a time for

two to three times a week; low: LTPA for ≥30 min at a time for maximum of once a week. Questions were asked as regards using self-administered questionnaires.

At the second appointment in 2015 blood pressure and BMI were measured by the study nurse and recent medical history was updated. The same self-administered questionnaires as at the first visit were accomplished supplemented by the HIT-6 questionnaire and self-reported work ability questions.

4.2.2 Measurement of the pain, psychosocial risk factors and work-related factors

4.2.2.1 Pain

4.2.2.1.1 Musculoskeletal pain

To assess the musculoskeletal pain we used the short version of the Örebro Musculoskeletal Pain Screening Questionnaire (Table 2) (Linton et al., 2011). ÖMPSQ has been developed to identify subjects with musculoskeletal pain, who are at risk for chronicity and long-term disability. Score may range from 1 to 100; the higher the score, the higher the risk of disability.

We divided our study population into four groups: those without pain and the groups of musculoskeletal pain with low (I), medium (II) or high (III) risk of long-term disability due to musculoskeletal pain determined by tertiles of the ÖMPSQ score. In our study work engagement tertiles were 1; <4.5, 2; 4.6–5.2 and 3; >5.3.

4.2.2.1.2 Headache

The burden of headache was measured using the HIT-6 questionnaire at the second study visit in 2015. Participants, who had headache (answered 'yes' to question "Did you have headache during the past year?") were advised to fill in the HIT-6 questionnaire. The question "Has your headache been recurrent?" divides the headache population into two groups, those with occasional headache and those with recurrent headache during the previous one-year period.

The HIT-6 is a six-item, self-administered questionnaire including three questions assessing headache during the past four weeks and three questions about headaches with no time limit (Kosinski et al., 2003*)*. The construct validity of the HIT-6 questionnaire is good, and it has also been found to have good internal consistency (Cronbach's α =0.90) and test-retest reliability (Cronbach's α =0.78) (Kosinski et al., 2003*)*. HIT-6 questions concern the following items: (1) frequency of severe pain; (2) ability to do usual daily activities; (3) need to lie down; (4)

tiredness; (5) irritation; and (6) ability to concentrate (Kawata et al., 2005). The HIT-6 is scored by giving a value for each question (never=6, rarely=8, sometimes=10, very often=11 and always=13). The total score is the sum of the scores on all six questions. On the basis of the total score, the HIT-6 categorizes patients into four levels of headache impact: little or no impact (<50), some impact (50–55), substantial impact (56–59) and very severe impact (≥60). The study subjects filled in the new Finnish version of the HIT-6 questionnaire, which was produced by the forward-backward translation process (Gandek et al., 2003). A new Finnish translation was done, because of problems in the earlier Finnish version of HIT-6 (Martin et al., 2004*)*. Translation from English into Finnish was first performed by five native speakers of Finnish fluent in English. A native English speaker fluent in Finnish and previously unfamiliar with the HIT-6 translated this Finnish translation back into English. This translation was compared to the original English HIT-6 for conceptual equivalence. The new Finnish translation was performed with a retroactive license issued by OptumInsight Life Sciences (QualityMetrics).

4.2.2.2 Psychosocial risk factors

Because the PORTAAT study was mainly focused on analyses of cardiovascular risk factors, the psychosocial risk factors were selected according to the European guidelines on cardiovascular disease prevention in clinical practice and assessed at the first appointment by the study nurse using the corresponding core questions (Table 4) (Perk et al., 2012). At the second study visit psychosocial risk factors including anxiety, depression, social isolation, hostility, work stress and type D personality were assessed using standardized self-administered questionnaires.

Table 4. The core questions of psychosocial risk factors according to Perk et al (Perk et al., 2012).

Work and family stress	Do you have enough control over how to meet the demands at work? Is your reward appropriate for your effort? Do you have serious problems with your spouse?
Social isolation	Are you living alone? Do you lack a close confidant?
Depression	Do you feel down, depressed and hopeless? Have you lost interest and pleasure in life?
Anxiety	Do you frequently feel nervous, anxious, or on edge? Are you frequently unable to stop or control worrying?
Hostility	Do you frequently feel angry over little things? Do you often feel annoyed about habits other people have?
Type D personality	In general, do you often feel anxious, irritable or depressed? Do you avoid sharing your thoughts and feelings with other people?

4.2.2.2.1 Anxiety

Anxiety was assessed by the Generalized Anxiety Disorder 7-item (GAD-7) scale (Seo & Park, 2015; Spitzer et al., 2006). The total score ranges from 0 to 21; 0-4= no or little anxiety, 5-9= some anxiety, 10-15= substantial anxiety and 16-21= severe anxiety; score of 10 or more has 89% sensitivity and 82% specificity for generalized anxiety (Spitzer et al., 2006).

4.2.2.2.2 Depressive symptoms

The Major Depression Inventory (MDI) was used to assess depressive symptoms (Bech et al., 2001). MDI is a self-rated questionnaire consisting of 10 items. It measures depressive symptoms during the past two weeks on a 6-point Likert-type scale (0= never; 1= some of the time; 2= slightly less than half the time; 3=slightly more than half the time; 4= most of the time; 5= all the time). Total score ranges from 0 to 50, high score indicating high amount of depressive symptoms and optimal cut-off score of 26 indicating clinically significant (moderate to severe) depression.

4.2.2.2.3 Social isolation

Social isolation was studied using the ENRICHD Short Social Support Instrument (ESSI) (Mitchell et al., 2003; Vaglio et al., 2004). ESSI is composed of 6 items estimating the amount of received social support with 5-point Likert-type scale (in PORTAAT Study 0=never; 1= seldom; 2= sometimes; 3=often; 4=always). The total score range is 0 to 24, low scores indicating high level of social isolation.

4.2.2.2.4 Hostility

Hostility was measured using the cynical distrust self-administered questionnaire (cynical distrust scale) consisting of 8 items rated on a 5-point Likert scale from completely disagree (1) to completely agree (5) (Julkunen et al., 1994). The total score range is 8 to 32, low score indicating a high level of hostility.

4.2.2.2.5 Work stress

Bergen Burn-out indicator (BBI-15) measures work stress and work-related burnout and has been shown to be valid in research and occupational health contexts (Näätänen et al., 2003; Salmela-Aro et al., 2011). Burn-out consists of emotional exhaustion, cynicism and reduced efficacy in profession (Maslach et al, 2001).

BBI-15 includes 15 questions, and the answers are given using Likert-type scales from 1 to 6 (1 = completely disagree to 6 = completely agree), that are summed up to score from 15 to 90, high score indicating high level of work stress.

4.2.2.2.6 Type D personality

Type D personality was detected by the core questions (Table 4) at the first study visit (Study I).

4.2.2.3 Work-related measures

4.2.2.3.1 Absenteeism and presenteeism

The exact data concerning sickness absence days and daytime or shift-work during the two-year period of 1.1.2014-31.12.2015 was obtained from the records of the employer, City of Pori. Days absent because of taking care of a sick child at home were not included in the study data. The diagnoses for sick leave were not available due to data protection regulations.

That is why in studies I and II the participants´ own estimate on the amount of sick leave was obtained by question "How many days of work have you missed (sick leave) because of pain during the past 12 months".

Presenteeism at work was assessed with a question and by visual analogue scale 0-10 with the instruction: "If you had work days during the past month, evaluate how much your ill health has affected your work performance while working" (from 0=no problems to 10=completely hindered my work performance).

4.2.2.3.2 Work ability

Work ability was evaluated with the question: "What is your current work ability compared to lifetime best?" The question is the first item of the widely used Work Ability Index (WAI) (Tuomi et al., 1998) named as Work Ability score (WAS). It has a 0-10 response scale, where 0 represents "completely unable to work" and 10 "work ability at its best". Reference values for WAS are suggested as for WAI; poor (0-5 points), moderate (6-7), good (8-9), excellent (10). WAS has a strong association with WAI and is accurate in evaluating work ability (Ahlstrom et al., 2010; El Fassi et al., 2013).

4.2.2.3.3 Physical and mental workload

Physical workload was assessed with the question "How strenuous is your work physically?" and mental workload with the question "How strenuous is your work mentally?". Answers were given on visual analog scale 0 - 10 (0=very light to 10=very hard).

4.2.2.3.4 Work engagement

Work engagement was evaluated with the Utrecht Work Engagement Scale (Table 5). It consists of three sub-scales focusing on vigor, dedication and absorption, which were rated on a 7-point Likert scale ranging from 0 (strongly disagree) to 6 (strongly agree). Items were summed and divided by the number of items in each scale. The higher each item was rated, the higher the overall work engagement. In our study work engagement tertiles were 1; <4.5, 2; 4.6-5.2 and 3; >5.3.

Table 5. The 9-item Utrecht Work Engagement Scale (UWES-9) (Modified from Schaufeli et al., 2002).

UWES-9	Vigor	Dedication	Absorption
1. At my work, I feel bursting with energy	x		
2 At my job, I feel strong and vigorous	x		
3 I am enthusiastic about my job		x	
4 My job inspires me		x	
5 When I get up in the morning, I feel like going to work	x		
6 I feel happy when I am working intensely			x
7 I am proud of the work that I do		x	
8 I am immersed in my job			x
9 I get carried away when I am working			x

4.2.2.4 Quality of life

To assess the HRQoL widely, we used two questionnaires; the EUROHIS-QoL 8-item questionnaire and the health issues emphasising EQ-5D.

4.2.2.4.1 EUROHIS-8

EUROHIS-8 is a shortened version of the WHOQOL-BREF scale, developed on the basis of the WHO definition of the quality of life (Power, 2003; The WHOQOL Group, 1998 (a); The WHOQOL Group 1998 (b)). It has been recommended for

use in public health research, and it has good reliability, validity and internal consistency [Schmidt et al., 2006). EUROHIS-8 measures QoL broadly: the four domains measured are psychological, physical, social, and environmental, and each domain is represented by two items. Each item is answered on a five-point Likert scale ranging from 1 (very poor) to 5 (very good). The overall QoL score is formed by summing up the scores of the eight items and divided by 8 to get the EUROHIS-8 mean; hence the theoretical range of the EUROHIS-8 is from 1.00 to 5.00. Higher scores indicate better quality of life. In the Finnish general female population (>30 years old) the mean score for EUROHIS-8 is 4.00 (Saarni et al., 2012).

4.2.2.4.2 EQ-5D

The EQ-5D is a generic instrument for measuring HRQoL and is applicable on a wide range of conditions (Rabin & de Charro 2001). The EQ-5D score comprises five dimensions of health: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Each dimension is assessed on a 3-point scale; level 1 (no problems), level 2 (some problems), and level 3 (extreme problems) and the EQ-5D total score is derived from the health state code, which is the combination of levels from each of the 5 dimensions. The score is a continuous range from − 0.59 to 1.00, with 1.00 signifying full health and 0 signifying death. Negative scores indicate a health state considered worse than death.

4.2.3 Statistical analysis

The data analyses were carried out using the STATA 14.1 (study I) or 15.0 (studies II-IV) statistical package (StataCorp LP, College Station, TX, USA), and the data are presented as means with SDs, as medians with IQR or as counts with percentages. Statistical significance was set a priori at $p<0.05$.

In study I, the statistical comparisons between groups were performed using the t-test, the chi-square test, or Fisher's exact test, when appropriate. When adjusting for confounding factors, analysis of covariance (ANCOVA) with an appropriate contrast was applied. The bootstrap (10 000 replications) method was used when the theoretical distribution of the test variables was unknown or in the case of violation of the assumptions (e.g., non-normality). To determine characteristics associated with work engagement, univariate and multivariate forward stepwise (probability for entry 0.05; probability for removal 0.10) ordered logistic regression analyses were applied; because of prominent negatively skewed distribution, the results of work engagement were concentrated at high values. We evaluated multicolinearity using the variance inflation factor (VIF) diagnostic.

In study II, internal consistency was estimated by calculating Cronbach's alpha internal consistency with bias-corrected bootstrap and 95% CI. An exploratory factor analysis with the iterated principal factor method for factoring and promax-rotated factor loadings on polychoric correlation matrix was performed to identify related items in the HIT-6 questionnaire. Promax rotation is an alternative nonorthogonal rotation method. The strategies used to extract the number of factors were: the Kaiser criteria, which determine that components with eigenvalues lower than one should be excluded, and the screen test of Cattell criteria. Item analysis of the HIT-6 scales (study II) was performed by analyzing item discriminating power (corrected item correlation) and item difficulty (item mean) depicted by the exploratory data analysis. Corrected item correlation was estimated using polyserial correlations. Adjusted correlation (partial) coefficients of HIT-6 and psychosocial factors were calculated by the Pearson method, using Sidak adjusted probabilities.

Judgement of the strength of correlation was based on correlation coefficients: less than 0.20 very weak, between 0.20 and 0.39 weak, between 0.40 and 0.59 moderate, between 0.60 and 0.79 strong, and above 0.79 very strong (Evans, 1996). Multivariate regression analyses were used to identify the psychosocial factors of the HIT-6 using standardized regression coefficients beta (β). The β value measures, how strongly each predictor variable influences the criterion (dependent) variable. The β value is measured in units of standard deviation. Cohen's standard for β values above 0.10, 0.30 and 0.50 represent small, moderate and large relationships, respectively. The floor and ceiling values representing the percentages of the subjects, who obtained the lowest or highest scores, were calculated for each HIT-6 item separately. The floor and ceiling effects are considered to be present, if more than 15% of the respondents achieve the lowest or highest possible scores (Terwee et al., 2007).

Statistical significances for the unadjusted hypothesis of linearity across categories of headache frequency in study III and study IV were evaluated using the Cochran-Armitage test for trend, the Cuzick test and analysis of variance with an appropriate contrast. Adjusted hypothesis of linearity (orthogonal polynomial) was evaluated using bootstrap-type analysis of covariance with age, education and number of comorbidities as covariates in both studies. The bootstrap method is significantly helpful, when the theoretical distribution of the test variable is unknown or in the case of violation of the assumptions. Hochberg's procedure was applied to correct levels of significance for multiple testing. The normality of the variables was tested using the Shapiro-Wilk W test. Correlations were estimated by Spearman's correlation coefficient method.

4.2.4 Ethical issues

The study protocol and consent forms were reviewed and approved by the Ethics Committee of the Hospital District of Southwest Finland. All participants signed a written informed consent to participate in the project and subsequent medical research.

5 Results

5.1 Characteristics of the participants

The total number of female employees evaluated in PORTAAT study was 732 with a mean age of 48 (SD 10) years. The number of study subjects in these sub-studies varied depending on the study design as explained below in Figure 4 in Methods section.

5.2 Musculoskeletal pain and work engagement (I)

After exclusion of subjects with pain other than musculoskeletal (17 women) and those who did not answer the pain questionnaire (13 women), total of 702 female employees (females with only musculoskeletal pain or without any pain) formed the study cohort. Characteristics of the cohort are presented in Table 6. The mean (SD) age was 48 (10) years. Of the subjects, 601 (86 %) had suffered from musculoskeletal pain over the past 12 months, whereas 101 (14 %) reported no pain at all.

Table 6. Baseline characteristics of study subjects. Significant differences between subjects with and without musculoskeletal pain are shown in bold.

	Musculoskeletal pain		
	Not present N=101	**Present N=601**	**p-value**
Age, years, years mean (SD)	46 (10)	49 (10)	**0.014**
Body Mass Index, kg/m^2 mean (SD)	25.2 (4.7)	27.0 (4.8)	**<0.001**
Smoking, n (%)	10 (10)	79 (13)	0.36
Living with spouse, n (%)	71 (70)	473 (79)	0.057
Financial satisfaction, n (%)	72 (71)	371 (62)	0.066
Education years, mean (SD)	14.3 (2.7)	13.8 (2.7)	0.13
Sick leave (days ≥3) due to pain last 12-month period, n (%)	11 (11)	158 (26)	**<0.001**
Leisure time physical activity, (%)			0.45
Low	31 (31)	158 (26)	
Moderate	37 (37)	259 (43)	
High	33 (32)	184 (31)	
Good sleep quality, n (%)	86 (85)	410 (68)	**<0.001**
AUDIT-C score, mean (SD)	2.96 (1.78)	2.89 (1.73)	0.73
Psychosocial risk factors, n (%)	49 (49)	399 (66)	**<0.001**
Depression	8 (8)	123 (20)	**0.003**
Type D personality	16 (16)	168 (28)	**0.010**
Work and family stress	26 (26)	195 (32)	0.18
Social isolation	19 (19)	103 (17)	0.68
Anxiety	15 (15)	208 (35)	**<0.001**
Hostility	11 (11)	136 (23)	**0.007**
Work ability (NRS), mean (SD)	8.7 (1.0)	8.1 (1.3)	**<0.001**
Weekly working hours, mean (SD)	40.8 (3.4)	41.7 (4.1)	**0.044**
Morbidity, n (%)			
Diabetes	2 (2)	23 (4)	0.56
Hypertension	8 (8)	104 (17)	**0.017**
Thyreoid disorder	5 (5)	60 (10)	0.11
Coronary heart disease	0 (0)	2 (1)	0.56
Asthma	5 (5)	34 (6)	0.77
Depression	3 (3)	13 (2)	0.62
Cancer	1 (1)	10 (2)	0.61
Musculoskeletal disorder	3 (3)	113 (19)	**<0.001**
Gastrointestinal disorder	5 (5)	44 (7)	0.39
Headache	2 (2)	37 (6)	0.090
Medication for pain n (%)			
NSAID	0 (0)	26 (4)	**0.023**
Paracetamol	0 (0)	7 (1)	0.60
Opioid	0 (0)	5 (1)	0.99
Tricyclic antidepressant	3 (3)	30 (5)	0.38
Gabapentin or pregabalin	0 (0)	9 (2)	0.22
Antidepressant for mood disorder, n (%)	3 (3)	31 (5)	0.34
Benzodiazepines, n (%)	3 (3)	9 (2)	0.29

Abbreviations: SD; standard deviation, AUDIT-C; Alcohol Use Disorders Identificaton Test, NRS; numeric rating scale, NSAID; non-steroidal anti-inflammatory drug. (Study I: Malmberg-Ceder K, et al. Relationship of musculoskeletal pain and well-being at work – Does pain matter? Scand J Pain. 2017 Apr;15 pp. 38-43. Copyright © DeGruyter 2017. doi:10.1016/j.sjpain.2016.11.018)

Chronic pain (duration at least 3 months) was reported by 465/601 (77 %) subjects. Work engagement measured by UWES-9 was similar in women without pain and in those with musculoskeletal pain (4.96 vs. 4.79; p = 0.091) in crude analysis. After adjustments (age, education years, BMI, working hours, financial satisfaction) the difference between the groups became statistically significant (p= 0.036), even though there was still no difference between the groups of no-pain and low risk of disability due to pain (p=0.21, after adjustment). Work engagement was significantly lower in the groups of medium (p=0.024, after adjustment) and high (p<0.001, after adjustment) risk of disability. Linearity across the Linton tertiles was significant (p<0.001) (Fig. 5).

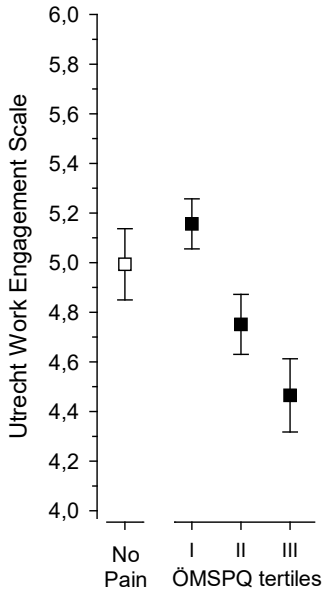

Figure 5. Work engagement (95% confidence intervals) as a function of the burden of pain and no pain. The level of burden of pain is based on the ÖMPSQ tertiles (I <59, II 59-81, III >81). (*Study I: Malmberg-Ceder K, et al: Relationship of musculoskeletal pain and well-being at work – Does pain matter? Scand J Pain. 2017 Apr;15 pp. 38-43. Copyright © DeGruyter 2017. doi:10.1016/j.sjpain.2016.11.018)*

In univariate and multivariate ordered logistic regression analyses BMI (p=0,005), financial satisfaction (p=0.032), the amount of persons having over 3 sick leave days due to pain (p<0.001), high leisure time physical activity (p<0.001), type D personality (p=0.008) and work and family stress (p=0.003) were entered into the forward ordered logistic regression model as significant explanatory variables for work engagement (Table 7). BMI, financial satisfaction and high leisure time physical activity correlated positively with work engagement and negative

correlation was detected with the amount of persons having over 3 sick leave days due to pain, type D personality and work and family stress.

Table 7. Ordered logistic regression analysis for relationships between work engagement and study variables.

	Univariate		Multivariate[a]	
Variables	**OR (95% CI)**	**p-value**	**OR (95% CI)**	**p-value**
Musculoskeletal pain	0.83 (0.56 to 1.23)	0.35		
Age	1.00 (0.99 to 1.02)	0.82		
Body Mass Index	1.02 (0.99 to 1.05)	0.098	1.04 (1.01 to 1.07)	**0.005**
Smoking	1.18 (0.78 to 1.81)	0.43		
Financial satisfaction	1.60 (1.20 to 2.12)	**<0.001**	1.38 (1.03 to 1.86)	**0.032**
Education years	0.97 (0.92 to 1.02)	0.28		
Sick leave (days ≥3) due to pain last 12-month period	0.54 (0.39 to 0.75)	**<0.001**	0.57 (0.41 to 0.79)	**<0.001**
Weekly working hours	1.03 (1.00 to 1.07)	0.078		
Leisure time physical activity		**<0.001[b]**		**<0.001[b]**
Low	1 (reference)		1 (reference)	
Moderate	1.28 (0.92 to 1.79)		1.25 (0.89 to 1.76)	
High	2.09 (1.45 to 3.01)		2.08 (1.42 to 3.04)	
AUDIT-C score	0.95 (0.88 to 1.03)	0.21		
Depression	0.45 (0.31 to 0.65)	**<0.001**		
Type D personality	0.49 (0.36 to 0.68)	**<0.001**	0.64 (0.46 to 0.89)	**0.008**
Work and family stress	0.50 (0.37 to 0.67)	**<0.001**	0.62 (0.45 to 0.85)	**0.003**
Social isolation	0.74 (0.51 to 1.07)	0.11		
Anxiety	0.56 (0.42 to 0.75)	**<0.001**		
Hostility	0.60 (0.43 to 0.84)	**<0.001**		
Good sleep quality	1.40 (1.03 to 1.89)	**0.027**		

a Forward stepwise selection. Only those variables are shown that entered the model.
b P for linearity.
(*Study I: Malmberg-Ceder K, et al: Relationship of musculoskeletal pain and well-being at work – Does pain matter? Scand J Pain. 2017 Apr;15 pp. 38-43. Copyright © DeGruyter 2017. doi:10.1016/j.sjpain.2016.11.018)*

5.3 Headache and psychosocial risk factors (II)

In this study we evaluated 469 female employees, who had suffered from headache during the past year. The baseline characteristics of the subjects are shown in Table 8. The distribution of the HIT-6 scores in the study population is shown in Figure 6. The mean (SD) of the HIT-6 score was 48 (8), median 47, range 36-68.

Table 8. Characteristics of the 469 study subjects.

Variable	Measures
Age, years, mean (SD)	48 (10)
Body mass index (BMI), kg/m^2, mean (SD)	26.8 (5.0)
Smoking, n (%)	42 (9)
Living with spouse, n (%)	435 (93)
Satisfied with financial situation, n (%)	331 (71)
Education years, mean (SD)	14.0 (2.7)
Sick leave days due to pain during the last 12 months, median (IQR)	2 (0, 8)
Leisure-time physical activity, n (%)	
Low	98 (21)
Moderate	204 (43)
High	167 (36)
Quality of life (EQ-5D), mean (SD)	0.86 (0.14)
Good sleep quality, n (%)	354 (75)
Alcohol consumption (AUDIT-C score), mean (SD)	2.7 (1.6)
Psychosocial risk factors, mean (SD)	
Anxiety (GAD-7)	3.1 (3.4)
Depressive symptoms (MDI)	5.4 (5.6)
Social isolation (ESSI)	21 (3)
Hostility (CDS)	22 (6)
Work stress (BBI-15)	32 (11)
Blood pressure, mmHg, mean (SD)	
Systolic	131 (7)
Diastolic	84 (10)

Abbreviations: SD; standard deviation, IQR; interquartile range, EQ-5D; EuroQoL-5d, AUDIT-C; Alcohol Use Disorders Identification Test, GAD-7; Generalized Anxiety Disorder 7-item scale, MDI; Major Depression Inventory, ESSI; the ENRICHD Short Social Support Instrument, CDS; Cynical Distrust Scale, BBI-15; Bergen Burnout Indicator (*Study II: Malmberg-Ceder K, et al.* The role of psychosocial risk factors in the burden of headache. *J Pain Res*. 2019;12:1733-1741. Copyright© Dovepress 2019. *https://doi:10.2147/JPR.S165263).*

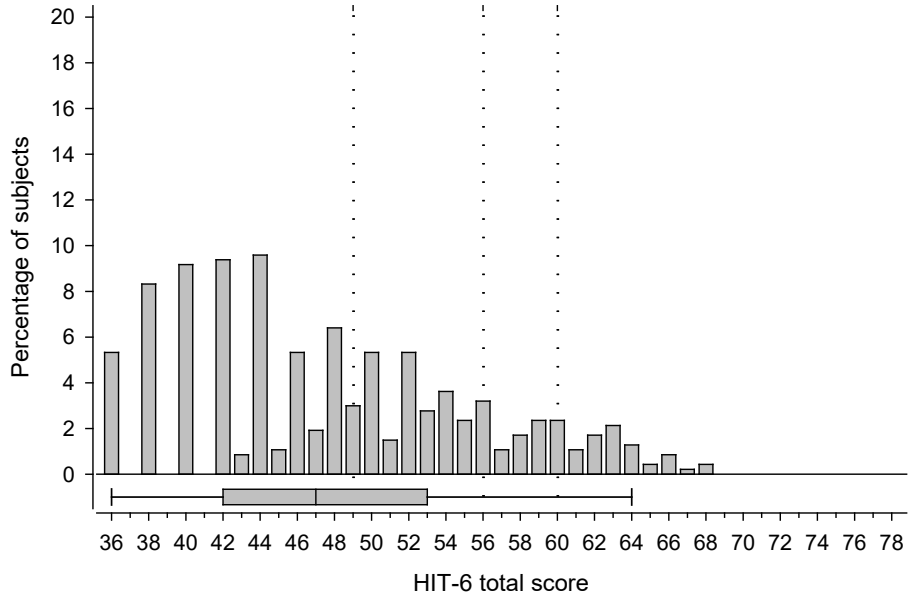

Figure 6. Histogram of the HIT-6 total scores in the study population. Box-and-whiskers plot shows median and interquartile range, and whiskers indicate 5th and 95th percentiles. Dotted lines show the HIT-6 categories (headache impact): little or no impact (score <50), some impact (50-55), substantial impact (56-59) and severe impact (≥60). (*Study II: Malmberg-Ceder K, et al.* The role of psychosocial risk factors in the burden of headache. *J Pain Res*. 2019;12:1733-1741. Copyright© Dovepress 2019. *https://doi:10.2147/JPR.S165263).*

Table 9 shows the mean scores (SD) of the HIT-6 items and the floor and ceiling effects. Considerable floor effect (> 15% proportion of subjects obtaining the best possible value) was present in all HIT-6 items and it was most distinct in the questions concerning the impact of headache on the quality of life (items 4 to 6). No floor effect was observed in total HIT-6 score. No ceiling effects (>15% proportion of subjects obtaining the worst possible value) were observed.

Table 9. Mean scores (SD) of the HIT-6 items in study population and floor and ceiling effects. The floor and ceiling values representing the percentages of females, who obtained the lowest or highest scores, were calculated for each HIT-6 item separately. (*Study II: Malmberg-Ceder K, et al.* The role of psychosocial risk factors in the burden of headache. *J Pain Res*. 2019;12:1733-1741. Copyright© Dovepress 2019. *https://doi:10.2147/JPR.S165263).*

HIT-6 Item	Mean (SD)	Floor* %	Ceiling† %
1	8.7 (1.7)	16.8	0.6
2	8.0 (1.6)	30.5	0.2
3	9.0 (1.9)	17.3	5.3
4	7.4 (1.6)	50.1	0.2
5	7.3 (1.6)	54.5	0.4
6	7.5 (1.6)	46.7	0.6
Total HIT-6	48 (8)	5.3	0.0

*Best possible value of the item. †Worst possible value of the item.

The exploratory factor analysis of the HIT-6 scores revealed two factors; Factor 1 (items 4 to 6) describes quality of life and psychological aspects affected by headache, and Factor 2 (items 1 to 3) describes severity of headache and functional decline (Table 10). These factors explained 95% of the total variance, and significant positive correlation was detected between Factor 1 and Factor 2 [r=0.58 (95% CI: 0.51 to 0.64)].

Table 10. Exploratory factor analysis with promax-rotated factor loadings of the HIT-6 items. Coefficients with values <0.40 were considered non-significant and are not shown.

HIT-6 item	Factor 1	Factor 2
Item 1		0.63
Item 2		0.86
Item 3		0.76
Item 4	0.77	
Item 5	0.88	
Item 6	0.85	

HIT-6; Headache Impact Test. (*Study II: Malmberg-Ceder K, et al.* The role of psychosocial risk factors in the burden of headache. *J Pain Res*. 2019;12:1733-1741. Copyright© Dovepress 2019. *https://doi:10.2147/JPR.S165263).*

All the HIT-6 items had a good overall item correlation in item analysis (Figure 7) and internal consistency of the HIT-6 (Cronbach's α coefficient) was 0.87 (95% CI: 0.85 to 0.89). Items 1 and 3 (severity of headache and functional decline) showed the highest mean values.

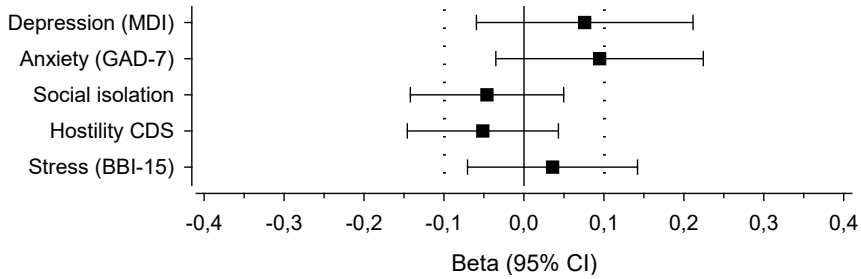

Figure 7. Item analysis for the HIT-6 items. The line denotes total mean of all items. Numbers indicate corresponding items in the HIT-6. HIT-6; Headache Impact Test. (Study II: Malmberg-Ceder K, et al. The role of psychosocial risk factors in the burden of headache. J Pain Res. 2019;12:1733-1741. Copyright© Dovepress 2019. https://doi:10.2147/JPR.S165263).

In multivariate analysis, there were no statistically significant relationships between the total HIT-6 score and psychosocial factors (Figure 8), but significant correlations were noted after adjustments for age and education as shown in Table 11. Correlations between the HIT-6 Factor 1, HIT-6 Factor 2 and psychosocial factors adjusted for age and education years are shown in Table 11.

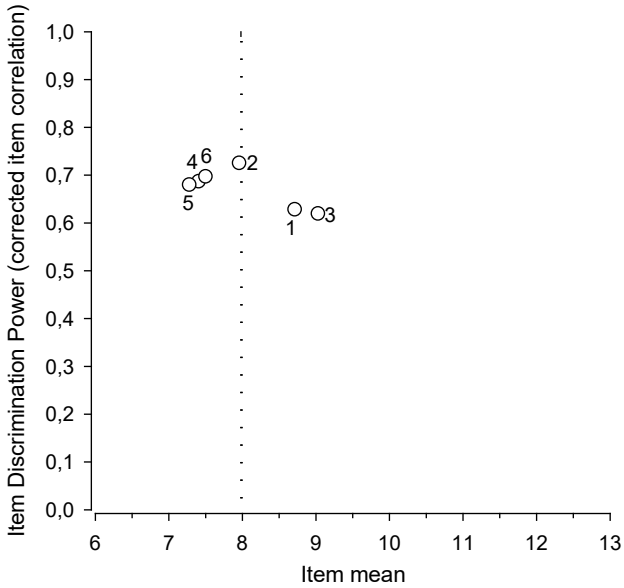

Figure 8. Multivariate relationships between the total HIT-6 score and psychosocial factors (β-values with 95% confidence intervals). Dotted lines delimit small effect size (Beta ±0.10). HIT-6; Headache Impact Test, MDI; Major Depression Inventory, GAD-7; Generalized Anxiety Disorder 7-item scale, CDS; Cynical Distrust Scale, BBI-15; Bergen Burnout Indicator (Study II: Malmberg-Ceder K, et al. The role of psychosocial risk factors in the burden of headache. J Pain Res. 2019;12:1733-1741. Copyright© Dovepress 2019. https://doi:10.2147/JPR.S165263).

Table 11. Correlations between the HIT-6 and psychosocial factors (adjusted for age and education years).

	HIT-6 Factor		HIT-6
	1	2	total
Depression (MDI)	0.19*** (0.09 to 0.29)	0.13* (0.03 to 0.23)	0.18*** (0.08 to 0.28)
Anxiety (GAD-7)	0.19*** (0.09 to 0.27)	0.13* (0.03 to 0.22)	0.17** (0.06 to 0.26)
Social isolation (ESSI)	-0.15** (-0.23 to -0.06)	-0.10 (-0.19 to -0.02)	-0.14* (-0.23 to -0.05)
Hostility (CDS)	-0.10 (-0.19 to -0.02)	-0.09 (-0.18 to -0.01)	-0.10 (-0.20 to -0.02)
Stress (BBI-15)	0.10 (0.01 to 0.19)	0.17*** (0.08 to 0.26)	0.15** (0.06 to 0.24)

* p < 0.05, ** p < 0.01, *** p < 0.001; Sidak-adjusted (multiplicity adjustment) probabilities. 95% confidence interval obtained by bias-corrected bootstrapping (5000 replications) for multiplicity adjustment. HIT-6; Headache Impact Test, MDI; Major Depression Inventory, GAD-7; Generalized Anxiety Disorder 7-item scale, ESSI; the ENRICHD Short Social Support Instrument, CDS; Cynical Distrust Scale, BBI-15; Bergen Burnout Indicator (Study II: Malmberg-Ceder K, et al. The role of psychosocial risk factors in the burden of headache. J Pain Res. 2019;12:1733-1741. Copyright© Dovepress 2019. https://doi:10.2147/JPR.S165263).

5.4 Headache and work ability (III)

The study population consisted of 594 female employees of whom 456 (77%) reported headache symptoms during the last year. Self-reported headache was recurrent in 178 (39%) subjects. The characteristics of the study subjects are shown in Table 12. Recurrence of headache was related to age, AUDIT-C, health-related quality of life, BMI, self-rated work ability, depressive symptoms and work stress (p for linearity < 0.001). The highest mental workload was observed among those with recurrent headache (p=0.042), and the highest work engagement among those without headache (p=0.038).

The mean number of absenteeism days and the mean level of presenteeism are presented in Table 13 both as crude results (model I) and after adjustments (models II-IV). The number of absenteeism days was highest in the recurrent headache group both as crude results (model I) and after adjustments (models II-IV), but the relation was statistically significant only in models I and II (i.e. crude results and when adjusted for age, BMI and education years). Presenteeism showed a significant positive association with headache recurrence (p <0.001).

There was no statistically significant difference in absenteeism days between the headache groups, when adjusted for confounding variables as shown in Table 13. The recurrence of headache was associated with presenteeism (p for linearity < 0.001). Presenteeism and the HIT-6 score were significantly associated in the recurrent headache group (P=0.009) (Figure 9).

The number of absenteeism days and the level of presenteeism by HIT-6 categories in the occasional and recurrent headache groups using model IV

(adjusted for age, BMI, education years, smoking, AUDIT-c score, LTPA, MDI, BBI, daytime work and number of chronic illnesses) are presented in Figure 9. In the recurrent headache group categories of HIT-6 were positively associated with presenteeism (p=0.009) but not with absenteeism (p=0.36). In the occasional headache group neither absenteeism (p=0.29) nor presenteeism (p=0.71) was associated with the HIT-6 categories.

Table 12. Characteristics of study subjects according to categories of self-reported headache recurrence.

	Self-reported recurrence of headache			P-value for linearity
	No N=138	Occasional N=278	Recurrent N=178	
Sociodemographic factors				
Age, years, mean (SD)	51 (9)	49 (10)	47 (10)	**<0.001**
Education years, mean (SD)	13.6 (2.2)	13.8 (2.1)	13.8 (2.1)	0.46
Financial satisfaction, n (%)	105 (76)	203 (73)	125 (70)	0.24
Cohabiting, n (%)	109 (79)	224 (81)	146 (82)	0.50
Lifestyle factors				
Smoking, n (%)	14 (10)	23 (8)	16 (9)	0.77
AUDIT-C, mean (SD)	3.1 (1.5)	2.8 (1.5)	2.5 (1.6)	**<0.001**
Good quality of sleep, n (%)	111 (80)	212 (76)	132 (74)	0.20
Leisure time physical activity, n (%)				0.44
Low	25 (18)	56 (20)	39 (22)	
Moderate	64 (46)	120 (43)	80 (45)	
High	49 (36)	102 (37)	59 (33)	
Health-related factors				
Quality of life (EQ-5D), mean (SD)	0.90 (0.12)	0.88 (0.12)	0.81 (0.17)	**<0.001**
Depressive symptoms (MDI), mean (SD)	4.1 (5.8)	5.1 (5.8)	6.1 (5.4)	**0.001**
BMI, kg/m^2, mean (SD)	26.2 (4.3)	26.6 (4.8)	27.2 (5.4)	**0.002**
Number of chronic illnesses, mean (SD)	1.1 (1.1)	1.0 (1.1)	1.3 (1.4)	0.079
Musculoskeletal	28 (20)	55 (20)	43 (24)	0.37
Cardiovascular	32 (23)	47 (17)	34 (19)	0.42
Mental	3 (2)	11 (4)	10 (6)	0.12
Pulmonary	9 (7)	22 (8)	16 (9)	0.42
Gastroenterological	10 (7)	21 (8)	18 (10)	0.33
Neurological	4 (3)	9 (3)	4 (2)	0.70
Diabetes	10 (7)	6 (2)	6 (3)	0.10
Malignancy	2 (1)	3 (4)	5 (3)	0.56
Work-related factors				
Work engagement (UWES-9 score), mean (SD)	5.0 (0.9)	4.8 (1.0)	4.8 (0.9)	**0.038**
Work Ability score, NRS, mean (SD)	8.6 (1.3)	8.5 (1.1)	8.1 (1.3)	**<0.001**
Physical workload, mm, mean (SD)	33 (28)	27 (26)	30 (27)	0.54
Mental workload, mm, mean (SD)	59 (21)	57 (22)	63 (22)	**0.042**
Work stress (BBI-15), mean (SD)	29 (11)	32 (10)	33 (11)	**<0.001**
Daytime work, n (%)	94 (68)	201 (72)	132 (74)	0.25

SD; standard deviation, AUDIT-C; Alcohol Use Disorders Identification Test, EQ-5D; EuroQol-5d, MDI; Major Depression Inventory, BMI; Body Mass Index, UWES-9; Utrecht Work Engagement Index, NRS; numeric rating scale, BBI; Bergen Burnout Indicator. *(Study III: Malmberg-Ceder K et al. The Impact of Self-Reported Recurrent Headache on Absenteeism and Presenteeism at Work Among Finnish Municipal Female Employees. J Pain Res. 2020 Aug 21;13:2135-2142. Copyright© Dovepress 2020 doi: 10.2147/JPR.S24603)*

Table 13. The mean number of absenteeism days and the mean level of presenteeism (VAS 0-100) according to the self-reported headache recurrence categories.

Headache recurrence	Absenteeism days		Presenteeism, VAS
	Mean (95% CI)	Ratio (95% CI)	Mean (95% CI)
Model I			
No	19.3 (14.1 to 24.6)	1 (Reference)	10.7 (7.2 to 14.1)
Occasional	19.0 (15.4 to 22.6)	0.98 (0.70 to 1.37)	13.3 (10.8 to 15.7)
Recurrent	27.3 (20.7 to 33.8)	1.41 (0.98 to 2.02)	21.6 (18.6 to 24.6)
	P for linearity = 0.047		P for linearity **<0.001**
Model II			
No	18.1 (13.3 to 22.9)	1 (Reference)	10.7 (7.3 to 14.1)
Occasional	17.2 (14.0 to 20.3)	0.94 (0.69 to 1.31)	13.3 (10.9 to 15.7)
Recurrent	25.5 (19.6 to 31.5)	1.41 (0.99 to 2.00)	21.3 (18.3 to 24.3)
	P for linearity = 0.039		P for linearity **<0.001**
Model III			
No	18.3 (13.3 to 23.2)	1 (Reference)	10.4 (7.0 to 13.9)
Occasional	17.2 (14.0 to 20.4)	0.94 (0.68 to 1.31)	13.4 (11.0 to 15.8)
Recurrent	24.9 (18.9 to 30.8)	1.36 (0.94 to 2.97)	21.5 (18.5 to 24.6)
	P for linearity = 0.076		P for linearity **<0.001**
Model IV			
No	16.1 (12.0 to 20.3)	1 (Reference)	12.2 (9.0 to 15.4)
Occasional	17.0 (13.9 to 20.0)	1.05 (0.77 to 1.44)	13.4 (11.1 to 15.6)
Recurrent	21.7 (16.7 to 26.7)	1.35 (0.94 to 1.92)	19.7 (16.8 to 22.5)
	P for linearity = 0.089		P for linearity **<0.001**

Model I crude; Model II adjusted for age, BMI and education years; Model III adjusted for variables in model II+ smoking, AUDIT-C and LTPA; Model IV adjusted for variables in model III+ MDI, BBI, daytime work and number of chronic illnesses. VAS; visual analog scale, BMI; Body Mass Index, AUDIT-C; Alcohol Use Disorders Identification Test, LTPA; leisure time physical activity, MDI; Major Depression Inventory, BBI; Bergen Burnout Indicator. *(Study III: Malmberg-Ceder K et al. The Impact of Self-Reported Recurrent Headache on Absenteeism and Presenteeism at Work Among Finnish Municipal Female Employees. J Pain Res. 2020 Aug 21;13:2135-2142. Copyright© Dovepress 2020 doi: 10.2147/JPR.S24603).*

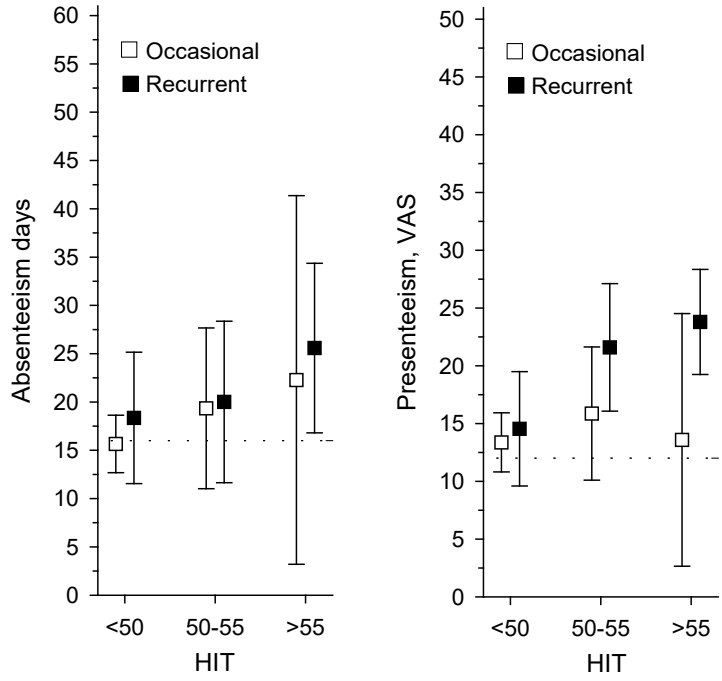

Figure 9. The mean number of absenteeism days and the level of presenteeism (VAS 0-100) by HIT-6 categories in the self-reported occasional and recurrent headache groups. Error bars are for 95% confidence intervals. Dashed lines indicate mean values of absenteeism days and presenteeism in the whole study population. Data was adjusted using model IV (adjusted for age, BMI, education years, smoking, AUDIT-C score, LTPA, MDI score, BBI score, daytime work, and number of chronic illnesses). Presenteeism associated significantly with the HIT-6 score in the recurrent headache group (p=0.009). VAS; visual analog scale, BMI; Body Mass Index, AUDIT-C; Alcohol Use Disorders Identification Test, LTPA; leisure time physical activity, MDI; Major Depression Inventory, BBI; Bergen Burnout Indicator, HIT; Headache Impact Test-6 total score. *(Study III: Malmberg-Ceder K et al. The Impact of Self-Reported Recurrent Headache on Absenteeism and Presenteeism at Work Among Finnish Municipal Female Employees. J Pain Res. 2020 Aug 21;13:2135-2142. Copyright© Dovepress 2020 doi: 10.2147/JPR.S24603).*

5.5 Headache and quality of life (IV)

The study population in study IV consisted of 633 female employees (mean age 48 ± 10 years) of whom 76% (n= 481) had experienced headache during the past year and of them, 184 (38%) had recurrent headache. Table 14 shows the baseline characteristics of the study subjects. Age, financial satisfaction, quality of sleep, and alcohol consumption were lowest in the recurrent headache group and highest in the study group without headache. In the recurrent headache group mean scores of anxiety, depressive symptoms and work-related stress were highest and lowest among those without headache. All these psychological risk factor scores were

generally low in all study groups. The prevalence of diabetes was highest in the non-headache group (Table 14).

Table 14. Characteristics of the 633 study subjects.

	Headache			
	No N=152 (24%)	**Occasional N=297 (47%)**	**Recurrent N=184 (29%)**	**P-value***
Age, years, mean (SD)	51 (10)	49 (10)	46 (10)	**<0.001**
Body mass index, kg/m^2, mean (SD)	26.3 (4.2)	26.5 (4.7)	27.3 (5.4)	0.055
Current smoking, n (%)	12 (8)	27 (9)	16 (9)	0.81
Cohabiting, n (%)	121 (80)	237 (80)	151 (82)	0.56
Financial satisfaction, n (%)	117 (77)	217 (73)	124 (67)	**0.048**
Education years, mean (SD)	13.9 (2.7)	13.9 (2.8)	14.3 (2.6)	0.16
Leisure time physical activity, n (%)				0.35
Low	30 (20)	61 (21)	41 (22)	
Moderate	64 (42)	130 (44)	82 (45)	
High	58 (38)	106 (36)	61 (33)	
Good quality of sleep, n (%)	123 (81)	229 (77)	131 (71)	**0.035**
AUDIT-C score, mean (SD)	3.1 (1.6)	2.8 (1.5)	2.4 (1.6)	**<0.001**
GAD-7 score, mean (SD)	2.1 (2.6)	2.9 (3.5)	3.7 (3.3)	**<0.001**
MDI score, mean (SD)	4.0 (5.7)	5.0 (5.8)	6.2 (5.5)	**<0.001**
BBI-15 score, mean (SD)	29.0 (10.2)	31.7 (10.4)	32.9 (10.9)	**<0.001**
Number of chronic diseases, mean (SD)	1.1 (1.2)	1.0 (1.2)	1.3 (1.4)	0.17
Diabetes mellitus, n (%)	11 (7)	8 (3)	5 (3)	**0.039**
Musculoskeletal disorder, n (%)	32 (21)	58 (20)	43 (23)	0.57
Hypertension, n (%)	30 (20)	46 (15)	25 (14)	0.13
Psychiatric disease, n (%)	6 (4)	12 (4)	12 (7)	0.25
Pulmonary disease, n (%)	9 (6)	22 (7)	16 (9)	0.34
Malignancy, n (%)	1 (1)	5 (2)	3 (2)	0,48

* P for linearity. SD; standard deviation, AUDIT-C; the 3-item Alcohol Use Disorders Identification Test, GAD-7; Generalized Anxiety Disorder 7-item scale, MDI: Major Depression Inventory, BBI-15; Bergen Burnout Indicator *(Study IV: Malmberg-Ceder K et al. Headache and quality of life in Finnish female municipal employees. Scand J Pain. 2021 Oct 22. doi: 10.1515/sjpain-2021-0109.Copyright © DeGruyter 2021)*

Figure 10 shows the mean scores of the EQ-5D and the scores of EUROHIS-8 items and the total EUROHIS-8 scores for the two headache categories adjusted for age, education years and number of comorbidities. The mean EQ-5D score was lowest in the recurrent headache group (0,811; SD 0,177) compared to the no headache group (0,889; SD 0,135) and the occasional headache group (0,884; SD 0,120) (p for linearity < 0.001) (Figure 10). The mean EUROHIS-8 total score was lowest in the recurrent headache group: no headache 4,2 (SD 0,5), occasional headache 4,1 (SD 0,5) and recurrent headache 3,9 (SD 0,5) (p for linearity < 0.001). Compared to the general working-age female population in Finland the

total EUROHIS-8 score was higher in the groups having no headache or occasional headache, but lower in the recurrent headache group (Saarni et al., 2012). On every EUROHIS-8 item (except for conditions of living place, item 6) persons with recurrent headache had lower QoL than subjects without headache.

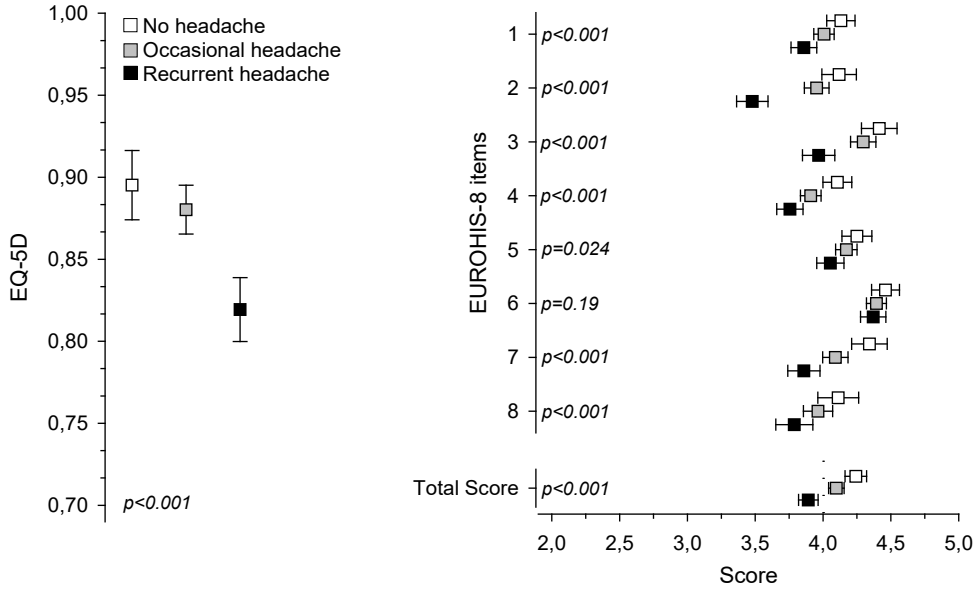

Figure 10. The EQ-5D index score (mean) and the EUROHIS-8 items and the total score (mean) in the groups of headache frequency, adjusted for age, education years and number of comorbidities. Whiskers show the 95% confidence intervals. The dotted line shows the mean score of the EUROHIS-8 item index in the general Finnish female population aged >30 years. Hochberg's procedure was applied to correct levels of significance for multiple testing. P-values indicate linearity. EUROHIS-8 items: 1) quality of life; 2) health; 3) daily activities; 4) yourself; 5) relationships; 6) living place; 7) energy; 8) money. *(Study IV: Malmberg-Ceder K et al. Headache and quality of life in Finnish female municipal employees. Scand J Pain. 2021 Oct 22. doi: 10.1515/sjpain-2021-0109. Copyright© DeGruyter 2021)*

Figure 11 shows the proportion of study subjects in each headache group experiencing problems in the five dimensions of EQ-5D. The problems were in linear relationship with severity of headache, and were most frequent in the recurrent headache group, except for self-care.

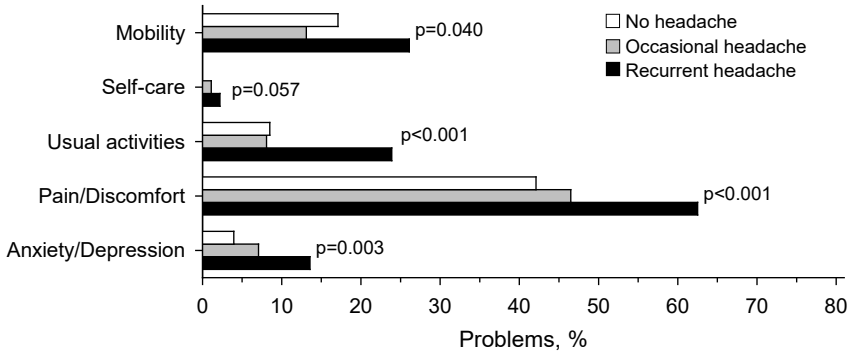

Figure 11. The percentage of study subjects reporting problems in five dimensions of EQ-5D. (*Study IV: Malmberg-Ceder K et al. Headache and quality of life in Finnish female municipal employees. Scand J Pain. 2021 Oct 22. doi: 10.1515/sjpain-2021-0109. Copyright© DeGruyter 2021)*

6 Discussion

6.1 Study population

This study consists of wide-ranging data from a representative sample of the Finnish female employees in municipal sector and these study subjects are typical patients in occupational health care with typical health problems.

This thesis assessed the common pain symptoms, musculoskeletal pain and headache and their correlation with psychosocial factors, work ability and quality of life. The results show that pain symptoms even in a relatively healthy working population have a substantial negative impact on their life.

The study material was collected from work units of a relatively large Finnish municipal employer, the organization and working conditions of which are similar to those in other Finnish communities. The educational level of the participants and the mean age follow the typical distribution. Even though the participation rate of female employees was fairly low, 33% (732/2201), the absolute number of participants is sufficient to be representative of the total work force. Therefore, we believe the results and conclusions can be generalized for Finnish female employees.

The PORTAAT study had no exclusion criteria. To prevent the possibility of two coincident health-related studies being performed in the same work unit only those units that had not participated in any health-promoting program in the last decade were chosen to the present study. All workers in the units chosen were encouraged to participate. No subgroup analyses based on profession or work unit were performed, wherefore no significant selection bias was considered to affect the conclusions drawn. No power analysis was considered necessary, since this study did not include any interventions.

6.2 Comments on the study methods

6.2.1 Assessment of pain symptoms

Several biological, psychological and social factors are involved in chronic pain and contribute to the cumulative burden of pain. The present thesis focuses on the two most common types of pain among working-age persons.

The burden of musculoskeletal pain was assessed using the short version of the ÖMPSQ containing 10 items. It has been developed from the longer version to enable easy identification of people at risk of chronification of musculoskeletal pain and increased disability, and it is designed to be used in clinical practice. In the short version most of the questions pertain to emotional stress and functional ability, while only two questions assess the pain itself. ÖMPSQ is validated and widely used (Linton & Boersma, 2003; Linton et al 2011).

In this study the participants with musculoskeletal pain were divided into four groups: no pain and pain indicated by the pain burden score, which was divided into tertiles based on the actual distribution observed in this study. Tertile I included scores <59 and tertile III scores >81. The ÖMPSQ tertiles I to III correlate with low, medium or high risk of disability in the future, respectively. According to the original scoring instructions, the total score over 50 indicates high estimated risk for future work disability (Linton et al., 2011), which means that some subjects in tertile I may have high future risk of disability. We found no difference in work engagement between the groups of no pain and low risk of disability due to musculoskeletal pain (tertile I).

To assess the burden of headache, we used HIT-6. It is a self-administered, brief and well-validated questionnaire assessing headache severity and headache-related disability (Kawata et al., 2005; Kosinki et al., 2003; Sauro et al., 2010). The questions include items illustrating pain intensity, social functioning, role functioning, vitality, cognitive functioning and psychological stress (Kosinski et al., 2003). HIT-6 is easy to use and suitable for daily practice and fit for identification of patients with high burden of headache, who need attention regarding treatment (Nachit-Ouinekh et al., 2005). It has been validated in various headache populations (Nachit-Ouinekh et al., 2005; Rendas-Baum et al., 2014; Yang et al., 2011) and is also used to measure treatment response (Castien et al., 2012; Smelt et al., 2014). According to earlier studies, the HIT-6 score correlates with severity of depression and it has also been used as a reference in validation of anxiety questionnaires (Jelinski et al., 2007; Seo & Park, 2015).

6.2.2 Psychosocial risk factors

In study I concerning musculoskeletal pain and work engagement, psychosocial risk factors were assessed by core questions according to European 2012 guidelines (Perk et al., 2012). These questions can be used as a preliminary assessment within clinical interview and, even though not validated, they indicate the possibility of psychosocial risk factor (Perk et al., 2012). In studies II, III and IV, dealing with headache subjects, psychosocial risk factors were assessed using validated self-

administered questionnaires. This is the first study to use ESSI, cynical distrust scale and BBI-15 in a headache population.

6.2.3 Work ability and well-being at work

To evaluate work ability we used a single question, the first item in the WAI, defined as the WAS, which is an accurate indicator of work ability (Ahlstrom et al., 2010). Physical and mental workload were also assessed by one question and using a visual analog scale. Information of work schedule (daytime or shift-work) and the number of absence days were obtained from official records of the employer. Absenteeism included also the absence days without doctor´s certificate. To evaluate work stress and work engagement, validated questionnaires, the BBI-15 and the UWES-9 were used (Hakanen, 2009; Näätänen et al., 2003; Schauffeli et al., 2002). These questionnaires are valid and reliable and available in Finnish.

BBI-15 measures work stress and is mainly used to evaluate burnout as a consequence of long-term work stress, and therefore this questionnaire may underestimate work stress in the current study population.

Work engagement is a relative new and popular concept to describe positive states related to work. At the moment UWES-9 is the only questionnaire measuring it and is also validated in Finnish.

6.2.4 Quality of life

Both EUROHIS and EQ-5D are commonly used questionnaires to measure QoL in various populations. EQ-5D measures especially health-related quality of life and has been used in migraine populations (Hjalte et al., 2019; Vo et al., 2018; Wang et al., 2013). EUROHIS-QoL is an 8-item questionnaire (EUROHIS-8) recommended for use in public health research, because it assesses quality of life broadly, and population-based mean values of EUROHIS-8 have been assigned in Finland in a national survey (Saarni et al., 2012; Schmidt et al., 2006). Only few studies have used EUROHIS-8 in headache population (Nielsen et al., 2019). We used it to measure QoL broadly, not only health-related dimensions.

6.3 Comments on the results

6.3.1 Musculoskeletal pain and well-being at work in females (I)

This study demonstrates that musculoskeletal pain is a very common complaint among municipal female employees, as six out of seven subjects report

musculoskeletal pain over the last year and 77 % experience chronic pain. This finding is congruous with earlier studies, although differences in socioeconomic factors, health care systems and data collection strategies cause uncertainties, when comparing our results with those published from all over the world. The prevalence of musculoskeletal pain among working-age population has been reported to vary between European countries (Farioli et al., 2014). Results comparable to our findings were obtained in an Estonian study, in which the prevalence of musculoskeletal pain was 84% over the past year in a female nurse population (Freimann et al 2013).

Work engagement is a concept for quantitative characterization of well-being at work and has been shown to associate with perceived work ability (Airila et al., 2012). Work engagement is affected by both person- and work-related factors, such as personality and personal situation including health (Bakker et al 2011). Surprisingly musculoskeletal pain *per se* did not enter in the statistical model to explain work engagement in multivariate ordered logistic regression analysis, although work engagement, as expected, showed significant negative correlation with burden of pain as measured by ÖMPSQ.

High work engagement was associated with moderate and high physical activity at leisure time, high BMI and financial satisfaction. High physical leisure time activity reflects a good physical health and probably also otherwise healthy lifestyle and often also good work ability.

Type D personality, work and family stress and duration of sick leave correlated with low work engagement. As for type D personality, D stands for "distressed", tendency towards negative affectivity, e.g. worry, irritability, and social irritation, e.g. lack of self-assurance. Type D personality has also been described as tendency to experience a coincident occurrence of negative affectivity and social inhibition (Denollet, 2005). Therefore, type D personality and stressful situation in family and/or in work all represent features opposite to positive attitude towards work tasks, the key definer of high work engagement, which well explains the correlation observed. The negative correlation between work engagement and duration of sick leave can be bidirectional; when one is sick, the joy of work and also other activities in daily living are decreased, and if the work engagement is low, the threshold to stay on sick leave may be lower.

In the current female study population, certain psychosocial risk factors, namely anxiety, depression, type D personality and hostility were significantly more common in females with musculoskeletal pain, as compared to those without pain, while others, such as social isolation and stress, were equally observed regardless of musculoskeletal pain. The association of chronic pain with anxiety and depression is well established in earlier studies, and can even be demonstrated in brain imaging by functional MRI (Baliki et al., 2006; Turk & Okifuji, 2002).

Persistent long-lasting back pain intensity was strongly related to MRI activity specifically in the medial prefrontal cortex, the brain region known to associate with response to conflict, negative emotions and with relation to the self upon sensing unfavourable outcomes (Baliki et al., 2006). Functional MRI studies have implicated a salient role of the emotional component of pain in chronic pain suggesting that susceptibility of chronification of pain is a brain network disorder (Apkarian et al., 2013; Baliki et al., 2014).

Type D personality is a known risk factor for many health problems, although its association with pain is less clear (Barnett et al., 2009; Mols & Denollet, 2010). Type D personality associates with overall musculoskeletal pain in adolescents and with high pain interference in adult patients with upper extremity musculoskeletal illness (Condén et al., 2013; Talaei-Khoei et al., 2018). Increased risk of back pain in cancer survivors has been reported to associate with type D personality (Mols et al., 2012). Chronic pain patients with type D personality have been found to be more prone to anxiety, depression and social discomfort (Barnett et al., 2009). In the present study the incidence of type D personality was higher among females with musculoskeletal pain compared to women without any pain symptoms. To our knowledge, no previous studies have exclusively addressed the relationship of type D personality and unspecified musculoskeletal pain in female working-age population.

Hostility is defined as "antagonistic attitudes and cynical expectations regarding others´ motives" and typical characteristics of hostility are extensive experience of anger, mistrust and rage together with tendency to engage in aggressive, maladaptive social relationships (Piepoli et al., 2016). Several studies have shown its correlation with increased risk of cardiovascular diseases (Everson-Rose & Lewis, 2005; Everson-Rose et al., 2014; Piepoli et al., 2016). There are only few studies on hostility in relation to chronic pain in general (Barnett et al., 2009; Burns et al., 2013). Interestingly spousal criticism or hostility may affect the pain experience and contribute to maintenance and even worsening of chronic pain (Burns et al., 2013). In cross-sectional studies hostility correlates positively with pain (Burke et al., 2015; Burns, 1997). The correlation between pain and hostility has recently been shown in pain intensity (Boggero et al., 2019), but is not well known, how patient´s hostility affects the experience of pain or the risk of pain chronification. Although hostility is considered as a personality trait, it even has neurophysiological correlations in EEG response to pain in male population (Everson-Rose & Lewis, 2005). In our study hostility correlated negatively to work engagement (a positive attitude), which is not surprising considering the typical negativity in a hostile person.

High self-efficacy correlates to low absenteeism in workers with chronic musculoskeletal pain (de Vries et al., 2013.) Another study of de Vries confirms

that for people with musculoskeletal pain, perceived low physical disability, low emotional distress, good flexibility in making personal adjustments and workplace interventions are significant factors improving work ability (de Vries et al., 2012). Our study demonstrates that the burden of musculoskeletal pain, measured by ÖMPSQ, does not associate with work engagement. We report additional variables in relation to work engagement: high physical activity at leisure time, financial satisfaction and low number of sick leaves correlated positively and work or/and family stress and type D personality correlated negatively with work engagement. We have considered hostility and social isolation as factors contributing to the burden of pain. It is possible that these factors may also be consequences of chronic pain.

Our results are in line with a previous study of musculoskeletal pain in females, showing that communication between employees and their supervisors and consecutive problem solving result in significantly fewer health care visits and sick leaves due to pain (Linton et al., 2016). Thus, it may be concluded that organizational contributions focusing on psychosocial factors may lead to reinforcement of musculoskeletal pain patients´ own estimation of maintained work ability and thus strengthen work engagement, improve work well-being and maintain work ability despite lowered functional capacity.

6.3.2 The role of psychosocial risk factors in the burden of headache in working-age females (II)

An important feature of the present study population, consisting of females with preserved work ability, is that there was no substantial psychological burden or substantial impairment in quality of life. Our study demonstrated that the correlations of the HIT-6 total score with all measured psychosocial risk factors (except for hostility) were weak, although statistically significant, implying specificity of HIT-6 for the burden caused by headache in female working-age population. Exploratory factor analysis is the statistical method to uncover the underlying structure of a relatively large set of variables and in this study indicated that the HIT-6 questionnaire can be divided into two related groups of variables (factors), one factor describing the psychological stress and impaired quality of life and the other expressing the intensity of headache and the physical deterioration caused by it. Considering the factorial nature of the HIT-6 questionnaire, which became evident in the item analysis, the item discriminatory power of HIT-6 turned out to be good.

The floor effect, distribution of over 15% of subjects in the lowest HIT-6 score, was observed for both factors. This is quite feasible for the factor describing psychological effects and impaired quality of life, since the study population

consisted of females with well-preserved work ability and without prominent problems or functional decline caused by headache. Floor effect was less notable for the factor describing the pain itself, due to large variety of pain intensity and impairment of functionality caused by headache.

HIT-6 is easy to use also in general practice (Nachit-Ouinekh et al., 2005). According to our study, this new Finnish version of HIT-6 reliably measures the burden of headache. Anxiety, depression and stress are common in headache patients and increase the burden of headache and impair daily functioning (Nicholson et al., 2007). Correlation of HIT-6 with psychological risk factors has been studied, but to our knowledge the present study is the first to assess the relation of the individual HIT-6 items with psychological risk factors (Cassidy et al., 2003; Jelinski et al., 2007; Rendas-Baum et al., 2014; Sauro et al., 2010).

Earlier studies show that high HIT-6 scores are correlated with high depression scores (Jelinski et al., 2007; Sauro et al., 2010). Correlation between migraine and depression is bidirectional meaning that patients with more migraine pain are predisposed to depression and depressed patients are prone to have more headache (Breslau et al., 2003). Relationship between other headaches and depression has also been documented in specialist clinic population (Jelinski et al., 2007).

Our study population consists of females without major psychological or social problems, which may explain the weak correlation between HIT-6 score and psychosocial factors. We conclude that in the type of population studied, the HIT-6 focuses on the burden caused by headache *per se* and therefore helps to select appropriate treatment options.

In the present study, hostility was the only psychosocial factor lacking correlation with the HIT-6 items. Hostility has been primarily defined for research purposes, not routinely used in clinical evaluation of headache patients. Thus, the clinical significance of this result remains unclear.

6.3.3 The impact of headache on absenteeism and presenteeism at work among female employees (III)

This study demonstrates that self-reported recurrent headache in this female population is associated with presenteeism but not with absenteeism, even after multiple adjustments (age, BMI, education years, smoking, AUDIT-C, LTPA, depressive symptoms, works stress, daytime work and number of chronic illnesses). In females with recurrent headache presenteeism was significantly associated with the burden of headache measured by HIT-6. To our knowledge, this study is the first to assess the correlation of the HIT-6 score with presenteeism in a working-age female population. The overall prevalence of headache in this

study population was approximately of the same magnitude as in previous Scandinavian studies (Stovner et al 2007).

The risk of absenteeism depends on the etiology of headache. Migraine and other frequent headaches, not to mention chronic headache, are well-known causes of decreased work ability (Allena et al., 2015; Burton et al., 2002; Buse et al., 2012; Linde et al., 2012 Rasmussen et al., 1992; Stewart et al., 2010).

Population-based studies have demonstrated that presenteeism, a known risk factor for absenteeism, is frequent in headache population, especially among episodic headache subjects, and is more substantial than absenteeism (Hedenrud et al., 2014; Stewart et al., 2008). It is estimated that presenteeism is responsible for two thirds of migraine–related indirect costs (Linde et al., 2012). Reason for high prevalence of presenteeism in episodic headache population might be that the persons suffering from headache tend to consider sick-leave an excessive measure and go to work, if headache is mild or moderate or is even partially alleviated by acute medication (which according to general clinical experience is the case for most migraine patients). Also migraine-related stigma may lead to avoidance of sick leave due to headache (Young et al., 2013). In the present study, presenteeism was most frequent in the recurrent headache group, as expected, and this finding underlines the importance of recognizing the employees with recurrent symptoms but still working. We encourage using the HIT-6 questionnaire in everyday clinical practice to identify the workers with high burden of headache and hence being at increased risk for presenteeism. Successful prevention of chronification of headache is of utmost importance for the employee, employer and society at large, as a way to avoid impaired functionality and work ability and consequent costs not to mention individual suffering. This emphasizes the importance of identifying risky situations (where HIT-6 can be helpful), prescribing good acute treatment and preventive medication, as well as providing psychosocial support when needed.

The questionnaire used in this study addresses the effect of health problems on work ability without regard to specific causes of the problem. The possibility remains that musculoskeletal pain may have affected the results on presenteeism. Time difference between data collection concerning presenteeism and headache may also affect the results.

In the present study, there was no association between HIT-6 score and absenteeism, probably due to the characteristics of the study population. Absenteeism was highest in the recurrent headache group, as was shown with no or minor adjustments, but after adjusting for several lifestyle and health-related variables the correlation between absenteeism and self-reported headache recurrence disappeared. In earlier studies comorbidities, especially mental disorders have been noticed to play a substantial role in absenteeism among headache population (Michel et al., 1999; Saunders et al., 2008). Female workers

in the present study were quite healthy employees with only mild mental symptoms, which explains the low absenteeism observed in this study.

6.3.4 Headache and quality of life among female employees (IV)

Our results show that headache symptoms are common in female municipal employees; three out of four women reported headache during the past year, and 38% of women suffering from headache had experienced recurrent headaches. These figures are in line with previous studies in Finland (Nikiforow 1981; Korolainen et al., 2019). The only difference in comorbidities between the groups was greater prevalence of diabetes in the headache-free group, maybe reflecting slightly older age of those subjects.

The HRQoL correlated with headache; the more frequent the headache, the lower the HRQoL measured by either the more health-related EQ-5D or the general quality of life instrument, EUROHIS-8. Interestingly, in the groups having no headache or occasional headache the QoL was higher than QoL in Finnish working-age female population on average (Saarni et al., 2012). Several explanations may be proposed. Evidently, this study population consisted of working-age women with healthy lifestyle and relatively good overall health; most of them are physically active, sleep well and have no economic burden. On the contrary, among females suffering from recurrent headache, HRQoL was lower than that in the Finnish female population on average. This cannot be explained by psychological factors, since the mean scores of depressive symptoms, anxiety and work-related stress were low also in the recurrent headache group, not exceeding the cut-off for therapeutic intervention or other corrective measures. Impaired QoL is therefore exclusively associated with the pain and thus our results underline the impact of headache in person´s everyday well-being and the importance of diagnosing and treating that common symptom.

Our results are congruent with previous studies; the more frequently one has headache, the lower the quality of life. The prevalence of headache is quite the same as in female populations in earlier studies (Allena et al., 2015; Sokolovic et al., 2013; Stovner et al., 2007). The EUROHIS-8 questionnaire measures quality of life broadly, referring to the fact that recurrent headache affects most factors contributing to a person´s well-being. The pain dimension in EQ-5D was expectedly the most affected one in the recurrent headache group, but also the females with no headache felt most problems in the pain domain, probably relating to the fact that musculoskeletal pain is very frequent in Finnish working aged population (Kaila-Kangas, 2007; Malmberg-Ceder et al., 2017).

Globally, it is estimated that the prevalence of headache in the general population is 47%, and the prevalence of chronic headache is 3% (Jensen & Stovner, 2008; Stovner et al., 2007). In working-age female population one-year prevalence of headache is 58% and that of chronic headache is 5% (Stovner et al., 2006). Previous studies have also shown that headaches are more frequent in the female population (Bingefors & Isacson, 2004; Stovner et al., 2007). The higher incidence of headache in our study may be explained by the nature of our study population consisting of only working-age women, since the prevalence of headache decreases with age (Jensen & Stovner, 2008). Furthermore, our criterion for occasional headache (answer "no" to question "Has your headache been recurrent") allows women with only mild and incidental headache to be included in that headache group. And finally, headache is common, often neglected and underdiagnosed symptom. This might be a consequence of patient´s own or health care systems ignorance or sometimes also represent cultural stigma related to the pain symptom.

6.4 Strengths and limitations

The strength of this thesis is a well characterized and relatively large cohort of female employees. The questionnaires used to measure the burden of pain, psychosocial risk factors, work engagement and quality of life are valid and reliable. The new translation of the Finnish HIT-6 questionnaire was produced according to proper recommendations. The data of sick-leave days were gathered from an official register in Study III. In studies I and II the participants´ own estimate on the amount of sick leave was obtained to detect the sick leave days because of pain.

The following reservations should be kept in mind in generalization of the present results. Comprehensive statistical adjustments were made, because numerous other health-related, work-related and sociodemographic factors might have affected the results. Our study population represents selected municipal work units of one Finnish city carrying out widely varying tasks consisting of employees having a relatively homogeneous cultural background. The data were collected from a cohort recruited for a study on cardiovascular risk factors. The participants received equitable salaries according to their tasks, their working conditions were regulated by the same collective agreement, their employment status was stable, and they shared a uniform occupational healthcare system. Only female employees were included in this thesis, because the total number of males in the original source population (PORTAAT study) was relatively low from the beginning and, secondly, only a few men reported headache. Exclusive enrollment of female participants devotes to homogeneity of the study population and reliability of the

results. This is important because psychosocial risk factors and pain (musculoskeletal pain and headache) characteristics are different in women and men (Herin et al., 2014; Thibodeau et al., 2013). A relative limitation is that it exclusively consists of female participants, whose jobs are not physically particularly strenuous. Working conditions in public and private sectors may differ, and previous evidence indicates that in Finland the amount of sick leaves in the former is greater (Leinonen et al., 2018).

Another limitation is the cross-sectional design, which prevents us from assessing any causality between pain, psychosocial risk factors, work related factors and quality of life. A limitation is also the fact that we are not able to report the exact participation rate for the study. This is because some employees may have ignored the study invitation and the information letter sent by e-mail notifications. Further limitations may be caused by self-reported physical activity and smoking status, which may be unreliable, although validated questionnaires and standardized procedures were used to overcome this bias. Due to the study design, we did not know the exact headache diagnoses, headache frequency (headache days/month, prevalence of chronic headache) or exact treatment of headache. This should not significantly affect our results or conclusions, since the questionnaires are not diagnose-specific and have been validated in many different populations. Because of this limitation, the term “self-reported headache” was used. The results might be skewed, and the impact of psychosocial factors may remain underestimated because of inclusion criteria, which allows females with only few headaches in the past year and probably few females with chronic headache (long sick leave) to be included in the study. Probably most females in the recurrent headache group have a primary headache, such as migraine or tension-type headache, while the occasional headache group may include females with primary or secondary (e.g. infection, hypertension, lack of sleep, etc.) headache.

6.5 Future research prospectives

The present thesis raises the following topics for future research.

In this study population further assessment concerning headache frequency (days/month) and specific diagnoses would be of interest and would allow studying the impact of interventions on pain itself (headache frequency and intensity), and would provide deeper understanding of the burden of headache, work ability and quality of life.

The association of pain symptoms with work ability and quality of life is complex. Musculoskeletal pain was very frequent in this study population and it would be relevant to further study its impact on work ability and quality of life,

particularly the association of ÖMPSQ score, future absenteeism and work engagement.

Also the effect of psychosocial factors, e.g. social isolation and hostility on pain symptoms and pain-associated impaired functionality need further study.

More broadly there is a need for knowledge of interactions between pain and health, and especially of salutogenic factors contributing to improved quality of life and work ability in subjects with pain regardless of gender. We need more studies with prospective design and adequate measurement of factors to allow evidence-based conclusions of risks and prognosis of pain patients. In clinical practice, the extensive impact and subjective nature of pain symptoms require individual implementation of easy-to-use assessment methods to improve treatment of pain patients.

7 Summary/Conclusions

This thesis addresses the significance of the most common entities of pain among Finnish female municipal employees, musculoskeletal pain and headache. The issue is approached in three distinct dimensions: pain and psychosocial factors (Studies I-IV); pain and work (Studies I and III); pain and quality of life (Studies II and IV).

The following detailed conclusions can be drawn:

1. Among women with musculoskeletal pain psychosocial and lifestyle factors significantly correlate with work engagement, while the pain itself and its risk of disability measured by ÖMPSQ, does not. In occupational health care, special attention should be paid to the psychosocial aspects in female employees with musculoskeletal pain to improve work well-being and maintain work ability.
2. The HIT-6 questionnaire has good construct validity and it describes reliably and independently the impact of headache without interference of psychosocial factors in general working-age female population. HIT-6 items can be divided into two factors, which describe separate categories of headache impact: the pain itself and its psychological impact.
3. Self-reported recurrence of headache was not related to absenteeism, but it was clearly associated with presenteeism in this working-age female population. Increased headache burden measured by the HIT-6 was related to presenteeism, but not to absenteeism.
4. Self-reported recurrent headache is common among Finnish women belonging to active work force and it has a significant negative impact on both health-related and general quality of life. Recurrent headache, even when the subjects have low anxiety and depressive symptoms scores, is associated with low HRQoL in working-age females.

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Appendices

ID_____

Kyselykaavakkeiden tarkoituksena on kerätä tietoja voinnistasi ja tottumuksistasi. Tiedot käsitellään luottamuksellisesti ja kaikilla tietojasi käsittelevillä tutkijoilla on salassapitovelvollisuus.

Vastaa rastittamalla seuraavista kysymyksistä Sinun tilannettasi kuvaava ruutu tai kirjoita vastaus viivalle. Palauta kaavakkeet tullessasi tutkimushoitajan vastaanotolle.

Onko Sinulla viimeksi kuluneen vuoden aikana todettu uusia lääkärin toteamia sairauksia?

☐ Ei ☐ Kyllä, mitä:

_____

_____

Käytätkö säännöllisesti jotain lääkitystä? ☐ En ☐ Kyllä, minkä nimisiä:

_____

_____

_____

Arvioi, kuinka paljon sairautesi ja vaivasi ovat vaikuttaneet kotona tarvittavien töiden ja askareiden suorittamiseen viimeksi kuluneen kuukauden aikana. Merkitse pystyviiva kohtaan, joka vastaa tilannettasi kahden äärivaihtoehdon suhteen.

Ei lainkaan |——————————————————| Estänyt täysin

Millainen terveytesi on ollut viimeksi kuluneen kuukauden aikana?

☐ Erittäin hyvä ☐ Hyvä ☐ Kohtalainen

☐ Huono ☐ Erittäin huono

Millainen mielialasi on ollut viimeksi kuluneen kuukauden aikana?

☐ Erittäin hyvä ☐ Hyvä ☐ Kohtalainen

☐ Huono ☐ Erittäin huono

1

Millainen virkeytesi ja tarmokkuutesi on ollut viimeksi kuluneen kuukauden aikana?

☐ Hyvin virkeä, energinen ja täynnä tarmoa

☐ Kohtalaisen virkeä ja energinen

☐ En osaa sanoa, olenko virkeä vai uupunut

☐ Kohtalaisen uupunut ja väsynyt

☐ Hyvin uupunut ja väsynyt; olen ollut kykenemätön suoriutumaan tehtävistäni

Kuinka monta työpäivää Sinulla oli tai olisi ollut viimeksi kuluneen kuukauden aikana?
Älä vähennä luvuista työtä poissaolopäiviä.
_____päivää

Kuinka monta työpäivää olit poissa työstäsi sairautesi tai vaivojesi vuoksi viimeksi kuluneen vuoden aikana? Merkitse 0, jos et ollut poissa.

_____päivää

Jos Sinulla oli työpäiviä viimeksi kuluneen kuukauden aikana, arvioi kuinka paljon sairautesi ja vaivasi vaikuttivat työsuoritukseesi työssä ollessasi.
Merkitse pystyviiva kohtaan, joka vastaa tilannettasi kahden äärivaihtoehdon suhteen.
Jos Sinulla ei ollut yhtään työpäivää, älä vastaa tähän kysymykseen.

Ei lainkaan |——————————————————| Estänyt täysin

Arvioi, kuinka paljon sairautesi ja vaivasi vaikuttavat työsuoritukseesi seuraavan työkuukauden aikana? Merkitse pystyviiva kohtaan, joka vastaa tilannettasi kahden äärivaihtoehdon suhteen.

Ei lainkaan |——————————————————| Estää täysin

Mikä on ammattisi? _____

Kuinka monta vuotta olet käynyt kouluja? Laske koulu- ja opiskeluvuodet perus- tai kansakoulun 1. luokasta alkaen.

☐ Ei loppuun suoritettua koulutusta ☐ Kansakoulu

☐ Peruskoulu tai keskikoulu ☐ Lukio

Mikä alla olevista vaihtoehdoista kuvaa parhaiten tilannettasi tällä hetkellä? Valitse vain yksi.

☐ Ansiotyössä, keskimääräinen työaika viikossa _____ tuntia. ☐ Työtön

☐ Täydellä eläkkeellä ☐ Osittain eläkkeellä (_____% eläkkeellä, _____% työssä)

☐ Opiskelija ☐ Kotona (esim. hoitaen lapsia tai muita läheisiä)

Mikä on nykyinen elämäntilanteesi?

☐ Asun yksin ☐ Parisuhde ☐ Yksinhuoltaja ☐ Eronnut ☐ Leski ☐ Muu

Miten luonnehtisit taloutesi tulojen ja menojen yhteyttä tällä hetkellä?

☐ Rahat riittävät tarpeisiimme ☐ Joudumme tinkimään kulutuksessa jonkin verran

Mikä seuraavista kuvaa parhaiten nykyistä työaikamuotoasi?

☐ Päivätyö ☐ Kaksivuorotyö ☐ Kolmivuorotyö ☐ Osa-aikatyö

☐ Säännöllinen iltatyö ☐ Säännöllinen yötyö

STRESSI- JA MIELIALAKYSELY

Rastita tilannettasi parhaiten kuvaa ruutu Kyllä/Ei.

	Kyllä	Ei
Tuntuvatko työsi vaatimukset hallitsemattomilta?		
Tuntuvatko työstäsi saadut hyödyt riittämättömiltä työpanokseesi nähden?		
Onko Sinulla vaikeita ongelmia parisuhteessasi?		
Asutko yksin?		
Puuttuuko Sinulta läheinen ystävä?		
Oletko viimeisen kuukauden aikana usein ollut huolissasi kokemastasi alakulosta, masentuneisuudesta tai toivottomuudesta?		
Oletko viimeisen kuukauden aikana ollut usein huolissasi kokemastasi mielenkiinnon puutteesta tai haluttomuudesta?		
Tunnetko olevasi usein hermostunut, ahdistunut tai "kireä"?		
Onko Sinun vaikea lopettaa tai hallita huolestumistasi asioista?		
Suututko usein pikkuasioista?		
Harmittavatko toisten ihmisten tavat Sinua usein?		
Oletko usein huolestunut, ärtynyt tai masentunut?		
Vältätkö jakamasta ajatuksiasi ja tunteitasi muiden ihmisten kanssa?		

4

ELÄMÄNLAATU **EQ-5D**

Mikä väitteistä kuvaa parhaiten terveydentilaasi tänään:

Liikkuminen

☐ Minulla ei ole vaikeuksia kävelemisessä

☐ Minulla on jonkin verran vaikeuksia kävelemisessä

☐ Olen vuoteenomana

Itsestään huolehtiminen

☐ Minulla ei ole vaikeuksia huolehtia itsestäni

☐ Minulla on jonkin verran vaikeuksia peseytyä tai pukeutua itse

☐ En kykene peseytymään tai pukeutumaan itse

Tavanomaiset toiminnot (esim. ansiotyö, opiskelu, kotityö, vapaa-ajan toiminnot)

☐ Minulla ei ole vaikeuksia suorittaa tavanomaisia toimintojani

☐ Minulla on jonkin verran vaikeuksia suorittaa tavanomaisia toimintojani

☐ En kykene suorittamaan tavanomaisia toimintojani

Kivut/vaivat

☐ Minulla ei ole kipuja tai vaivoja

☐ Minulla on kohtalaisia kipuja tai vaivoja

☐ Minulla on ankaria kipuja tai vaivoja

Ahdistuneisuus/masennus

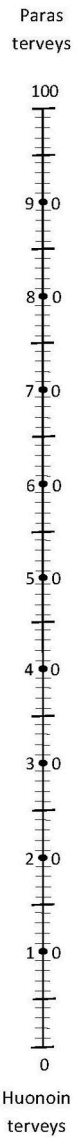
☐ En ole ahdistunut tai masentunut

☐ Olen melko ahdistunut tai masentunut

☐ Olen erittäin ahdistunut tai masentunut

5

Osoita viereisen lämpömittarin avulla, millainen terveytesi on mielestäsi tänään. Vedä lämpömittarin asteikolle viiva siihen kohtaan, joka osoittaa, miten hyvä tai huono terveydentilasi on tänään. Parasta terveydentilaa, jonka voit kuvitella, merkitään 100:lla ja huonointa 0:lla.



6

Kuinka usein koet työssäsi seuraavien väittämien kaltaisia tuntemuksia tai ajatuksia?
Ympyröi se vaihtoehto (0-6), joka parhaiten kuvaa kokemuksiasi.

	En koskaan	Muutaman kerran vuodessa	Kerran kuussa	Muutaman kerran kuussa	Kerran viikossa	Muutaman kerran viikossa	Joka päivä
Tunnen olevani täynnä energiaa, kun teen työtäni.	0	1	2	3	4	5	6
Tunnen itseni vahvaksi ja tarmokkaaksi työssäni.	0	1	2	3	4	5	6
Olen innostunut työstäni.	0	1	2	3	4	5	6
Työni inspiroi minua.	0	1	2	3	4	5	6
Aamulla herättyäni minusta tuntuu hyvältä lähteä töihin.	0	1	2	3	4	5	6
Tunnen tyydytystä, kun olen syventynyt työhöni.	0	1	2	3	4	5	6
Olen ylpeä työstäni.	0	1	2	3	4	5	6
Olen täysin uppoutunut työhöni.	0	1	2	3	4	5	6
Kun työskentelen, työ vie minut mukanaan.	0	1	2	3	4	5	6

Oletetaan, että työkykysi on parhaimmillaan saanut 10 pistettä. Minkä pistemäärän antaisit nykyiselle työkyvyllesi asteikolla 0-10? Ympyröi sopivin numero.

0 1 2 3 4 5 6 7 8 9 10

työkyvytön työkyky parhaimmillaan

7

LIIKUNTA JA HARRASTUKSET

Kuinka usein harrastat vapaa-ajan liikuntaa vähintään puoli tuntia kerrallaan niin, että ainakin lievästi hengästyt ja hikoilet?

☐ Päivittäin ☐ 4-6 kertaa viikossa ☐ 2-3 kertaa viikossa ☐ Kerran viikossa

☐ 2-3 kertaa kuukaudessa ☐ Muutaman kerran vuodessa tai harvemmin

Kuinka kauan kävelet tai pyöräilet työmatkoillasi? (laske yhteen meno- ja paluumatkaan käytetty aika)

☐ Kuljen työmatkani kokonaan moottoriajoneuvolla

☐ Alle 15 minuuttia päivässä ☐ 15-29 minuuttia päivässä

☐ 30-59 minuuttia päivässä ☐ 1-2 tuntia päivässä ☐ Yli 2 tuntia päivässä

Kuinka paljon kaiken kaikkiaan liikut viikoittain? Laske yhteen kaikki säännöllinen liikunta, joka kestää vähintään 10 minuuttia kerrallaan. Voit valita useamman vaihtoehdon.

☐ Ei juuri mitään säännöllistä liikuntaa joka viikko

☐ Rauhallista kestävyysliikuntaa (ei hikoilua tai hengästymistä, esim. rauhallinen kävely)
_____ päivänä viikossa, yhteensä _____ tuntia _____ minuuttia viikossa

☐ Reipasta kestävyysliikuntaa (jonkin verran hikoilua tai hengästymistä, esim. reipas kävely)
_____ päivänä viikossa, yhteensä _____ tuntia _____ minuuttia viikossa

☐ Rasittavaa kestävyysliikuntaa (voimakasta hikoilua tai hengästymistä, esim. juoksu)
_____ päivänä viikossa, yhteensä _____ tuntia _____ minuuttia viikossa

☐ Lihaskuntoharjoittelua (esim. kuntopiiri tai kuntosaliharjoittelu)
_____ päivänä viikossa, yhteensä _____ tuntia _____ minuuttia viikossa

☐ Tasapainoa edellyttävää liikuntaa (esim. tanssi, pelit)
_____ päivänä viikossa, yhteensä _____ tuntia _____ minuuttia viikossa

Kuinka monta tuntia tavallisen arkipäivän aikana istut?

Työpäivän aikana	_____ tuntia _____ minuuttia päivässä
Kotona televisiota tai videoita katsellen	_____ tuntia _____ minuuttia päivässä
Kotona tietokoneen ääressä	_____ tuntia _____ minuuttia päivässä
Kulkuneuvossa (auto, juna,...)	_____ tuntia _____ minuuttia päivässä
Muualla	_____ tuntia _____ minuuttia päivässä

8

Kuinka usein harrastat seuraavia asioita?

Ympyröi se vaihtoehto (5-1), joka parhaiten kuvaa tilannettasi.

	Useimpina päivinä	1-2 kertaa viikossa	1-2 kertaa kuukaudessa	1-2 kertaa vuodessa	Harvemmin tai ei koskaan
Kerho- tai yhdistystoimintaa	5	4	3	2	1
Elokuvissa, teatterissa, konserteissa, urheilukilpailuissa, näyttelyissä tms. käymistä	5	4	3	2	1
Kirkossa tai muissa uskonnollisissa tilaisuuksissa käymistä	5	4	3	2	1
Puutarhanhoitoa, kalastusta, metsästystä, vaellusta tms. luonnossa liikkumista	5	4	3	2	1
Käsitöitä, soittamista, laulamista, valokuvausta, maalaamista, keräilyä tms.	5	4	3	2	1
Kirjallisuutta	5	4	3	2	1
Opiskelua	5	4	3	2	1

UNIKYSELY

Kuinka paljon unta olet yleensä saanut öisin viimeisen kuukauden aikana?

_____tuntia

Millaiseksi arvioisit unen laadun kaiken kaikkiaan viimeisen kuukauden ajalta?

☐ erittäin hyvä ☐ melko hyvä ☐ melko huono ☐ erittäin huono

Miten usein olet ottanut lääkettä helpottaaksesi nukkumista viimeisen kuukauden aikana (resepti- tai käsikauppalääkkeitä)?

☐ Ei lainkaan ☐ Harvemmin kuin kerran viikossa

☐ Kerran tai kaksi kertaa viikossa ☐ Kolme kertaa tai useammin viikossa

Työpäivinä

Menen vuoteeseen kello _____
Kello _____ päätän alkaa nukkua
Tarvitsen _____ minuuttia nukahtaakseni
Herään kello _____ ☐ herätyskellon avulla ☐ ilman herätyskelloa
Nousen vuoteesta _____ minuutin kuluttua

Jos otettaisiin huomioon vain Sinun oma "parhaalta tuntuu" -rytmisi,

mihin aikaan nousisit aamuisin, jos voisit täysin vapaasti suunnitella päiväsi?

kello ☐ 05 ☐ 06 ☐ 07 ☐ 08 ☐ 09 ☐ 10 ☐ 11 ☐ 12

mihin aikaan menisit illalla nukkumaan, jos voisit täysin vapaasti suunnitella iltasi?

kello ☐ 20 ☐ 21 ☐ 22 ☐ 23 ☐ 24 ☐ 01 ☐ 02 ☐ 03

11

ELÄMÄNLAATU II

Arvioi elämääsi kahden viime viikon aikana. Rastita se vaihtoehto (5-1), joka parhaiten kuvaa tilannettasi.

	Erittäin hyväksi	Hyväksi	Ei hyväksi eikä huonoksi	Huonoksi	Erittäin huonoksi
Millaiseksi arvioit elämänlaatusi?	5	4	3	2	1

	Erittäin tyytyväinen	Melko tyytyväinen	Ei tyytyväinen eikä tyytymätön	Melko tyytymätön	Erittäin tyytymätön
Kuinka tyytyväinen olet terveyteesi?	5	4	3	2	1
Kuinka tyytyväinen olet kykyysi selviytyä päivittäisistä toiminnoistasi?	5	4	3	2	1
Kuinka tyytyväinen olet itseesi?	5	4	3	2	1
Kuinka tyytyväinen olet ihmissuhteisiisi?	5	4	3	2	1
Kuinka tyytyväinen olet asuinalueesi olosuhteisiin?	5	4	3	2	1

	Täysin riittävästi	Lähes riittävästi	Kohtuullisesti	Vähän	Ei lainkaan
Onko Sinulla riittävästi tarmoa arkipäivän elämääsi varten?	5	4	3	2	1
Onko Sinulla tarpeeksi rahaa tarpeisiisi nähden?	5	4	3	2	1

KIPUKYSELY

Jos Sinulla on kipuja tai särkyjä, vastaa väittämiin rastittamalla oikea ruutu.

Missä kipusi sijaitsee? Valitse kaikki kehon alueet, missä Sinulla on kipuja.

☐ Niska ☐ Olka-hartiaseutu ☐ Selän yläosa ☐ Selän alaosa ☐ Jalat

☐ Muu, mikä?_____

Kuinka monta päivää olet ollut sairaslomalla kipuoireittesi takia viimeisen 12 kk:n aikana?

☐ 0 päivää ☐ 1-2 päivää ☐ 3-7 päivää ☐ 8-14 päivää

☐ 15-30 päivää ☐ 31-60 päivää ☐ 61-90 päivää ☐ 91-180 päivää

☐ 181-365 päivää ☐ yli 365 päivää

Kuinka kauan olet kärsinyt nykyisistä oireistasi?

☐ 0-1 viikkoa ☐ 2-3 viikkoa ☐ 4-5 viikkoa ☐ 6-7 viikkoa ☐ 8-9 viikkoa

☐ 10-11 viikkoa ☐ 12-23 viikkoa ☐ 24-35 viikkoa ☐ 36-52 viikkoa ☐ yli 52 viikkoa

Ympäröi seuraavista kysymyksistä oikea vastaus asteikolla 1-10:

Onko työsi raskasta tai yksitoikkoista?

0 1 2 3 4 5 6 7 8 9 10
ei lainkaan erittäin paljon

Kuinka paljon Sinulla on ollut kipua viimeisen viikon aikana?

0 1 2 3 4 5 6 7 8 9 10
ei lainkaan erittäin paljon

Kuinka kipeä olet ollut keskimäärin viimeisen kolmen viikon aikana?

0 1 2 3 4 5 6 7 8 9 10
en lainkaan erittäin kipeä

Kuinka usein Sinulla on ollut kipua keskimäärin arvioituna viimeisen kolmen kuukauden aikana?

0 1 2 3 4 5 6 7 8 9 10
ei lainkaan erittäin usein

13

Ajattele tavallista päivääsi ja miten selviät siitä kipusi kanssa. Kuinka suuret mahdollisuudet Sinulla on itse vähentää kipuasi?

0	1	2	3	4	5	6	7	8	9	10
en pysty itse lainkaan vähentämään kipua										pystyn itse täysin vähentämään kipuni

Kuinka jännittyneeksi tai stressaantuneeksi olet tuntenut itsesi <u>viimeisen viikon</u> aikana?

0	1	2	3	4	5	6	7	8	9	10
en tuntenut stressiä									olin erittäin stressaantunut	

Missä määrin masentuneeksi olet tuntenut itsesi <u>viimeisen viikon</u> aikana?

0	1	2	3	4	5	6	7	8	9	10
en lainkaan								hyvin masentuneeksi		

Kuinka todennäköistä oman käsityksesi mukaan on, että nykyinen vaivasi jää pitkäaikaiseksi?

0	1	2	3	4	5	6	7	8	9	10
ei todennäköistä								erittäin todennäköistä		

Kuinka suureksi arvioit mahdollisuutesi jatkaa työssäsi tai palata siihen <u>seuraavien kuuden kuukauden</u> kuluessa?

0	1	2	3	4	5	6	7	8	9	10
ei mitään mahdollisuuksia									erittäin suuri mahdollisuus	

Kuinka tyytyväinen olet työhösi, kun otat huomioon työtehtäväsi, työn johtamistavan, palkan, kehittymismahdollisuutesi työssä ja työkaverisi?

0	1	2	3	4	5	6	7	8	9	10
erittäin tyytymätön								erittäin tyytyväinen		

14

Alla on muiden ihmisten kokemuksia ja kuvauksia kivustaan. Arvioi jokaisen väittämän kohdalla, missä määrin se vastaa omia kokemuksiasi.

Kipu lisääntyy fyysisen toiminnan myötä.

0 1 2 3 4 5 6 7 8 9 10

ei pidä lainkaan paikkaansa — pitää täysin paikkansa

Kivun lisääntyminen on merkki siitä, että minun on lopetettava senhetkinen toimintani, kunnes vaiva helpottuu.

0 1 2 3 4 5 6 7 8 9 10

ei pidä lainkaan paikkaansa — pitää täysin paikkansa

Minun on vältettävä normaaleja askareitani tai töitäni silloin, kun tunnen kipua.

0 1 2 3 4 5 6 7 8 9 10

ei pidä lainkaan paikkaansa — pitää täysin paikkansa

Alla on kuvattu muutamia arkitoimintoja. Ympyröi numero, joka kuvaa parhaiten Sinun tämänhetkistä kykyäsi osallistua näihin toimintoihin.

Kevyen työn tekeminen tunnin ajan

0 1 2 3 4 5 6 7 8 9 10

en voi tehdä kivun takia — voin tehdä ilman kipuongelmia

Käveleminen tunnin ajan

0 1 2 3 4 5 6 7 8 9 10

en voi kävellä kivun takia — voin kävellä ilman kipuongelmia

15

Tavallisten kodinhoitoon liittyvien töiden tekeminen

0 1 2 3 4 5 6 7 8 9 10

en voi tehdä kivun takia — voin tehdä ilman kipuongelmia

Viikoittaisten kauppaostosten hoitaminen

0 1 2 3 4 5 6 7 8 9 10

en voi hoitaa kivun takia — voin hoitaa ilman kipuongelmia

Nukkuminen

0 1 2 3 4 5 6 7 8 9 10

en voi nukkua lainkaan kivun takia — voin nukkua ilman kipuongelmia

16

ALKOHOLINKÄYTTÖ

Kuinka usein juot olutta, viiniä tai muita alkoholijuomia?

☐ En koskaan ☐ Noin kerran kuussa tai harvemmin ☐ 2–4 kertaa kuussa

☐ 2–3 kertaa viikossa ☐ 4 kertaa viikossa tai useammin

Kuinka monta annosta alkoholia yleensä olet ottanut niinä päivinä, jolloin käytät alkoholia? Yksi annos on pullo (33 cl) keskiolutta tai siideriä; lasi (12 cl) mietoa viiniä; pieni lasi (8 cl) väkevää viiniä; ravintola-annos (4 cl) väkeviä.

☐ 1–2 annosta ☐ 3–4 annosta ☐ 5–6 annosta ☐ 7–9 annosta ☐ 10 tai enemmän

Kuinka usein olet juonut kerralla kuusi tai useampia annoksia?

☐ En koskaan ☐ Harvemmin kuin kerran kuussa ☐ Kerran kuussa

☐ Kerran viikossa ☐ Päivittäin tai lähes päivittäin

TUPAKOINTI

☐ En ole koskaan tupakoinut säännöllisesti

☐ Olen lopettanut tupakoinnin vuonna _____

☐ Tupakoin nykyisin _____ savuketta päivässä

Jos tupakoit nykyisin, kuinka pian herättyäsi poltat ensimmäisen savukkeen?

☐ yli 1 tuntia ☐ 31–60 minuuttia ☐ 6–30 minuuttia ☐ alle 6 minuuttia

17

SOSIAALISUUS **ENRICH**

Seuraavat kysymykset koskevat lähipiiriäsi.
Ympyröi se vaihtoehto (0-4), joka parhaiten kuvaa tilannettasi.

	Ei koskaan	Harvoin	Joskus	Useimmiten	Aina
Onko Sinulla lähipiirissäsi joku, jonka tiedät kuuntelevan, kun haluat puhua?	0	1	2	3	4
Onko lähipiirissäsi joku, joka voi antaa Sinulle hyviä neuvoja ongelmatilanteissa?	0	1	2	3	4
Onko lähipiirissäsi joku, joka osoittaa Sinua kohtaan rakkautta ja kiintymystä?	0	1	2	3	4
Onko lähipiirissäsi joku, joka voi auttaa Sinua päivittäisissä toimissa?	0	1	2	3	4
Onko lähipiirissäsi joku, jonka voit luottaa tukevan Sinua ongelmissa tai vaikean päätöksen tekemisessä?	0	1	2	3	4
Voitko olla niin usein kuin haluat yhteydessä henkilöön, jonka tunnet läheiseksi, johon voit luottaa ja jolle voit uskoutua?	0	1	2	3	4

HUOLET **GAD-7**

Kuinka usein seuraavat ongelmat ovat vaivanneet Sinua edeltävän kahden viikon aikana?
Ympyröi se vaihtoehto (0-3), joka parhaiten kuvaa omaa tilannettasi.

	Ei lainkaan	Useana päivänä	Useimpina päivinä	Lähes joka päivä
Hermostuneisuuden, ahdistuneisuuden tai kireyden tunne	0	1	2	3
En ole voinut lopettaa tai hallita huolestumistani	0	1	2	3
Liiallinen huolestuneisuus erilaisista asioista	0	1	2	3
Vaikeus rentoutua	0	1	2	3
Niin levoton olo, että on vaikea pysyä aloillaan	0	1	2	3
Taipumus harmistua tai ärsyyntyä helposti	0	1	2	3
Pelko siitä, että jotakin kauheaa saattaisi tapahtua	0	1	2	3

18

MIELIALA **MDI**

Seuraavat kysymykset koskevat vointiasi viimeisen 2 viikon aikana.
Ympyröi se vaihtoehto (0-5), joka parhaiten kuvaa omaa tilannettasi.

	Ei lainkaan	Jonkin aikaa	Vähän alle puolet ajasta	Vähän yli puolet ajasta	Suurimman osan ajasta	Koko ajan
Oletko tuntenut itsesi masentuneeksi tai surulliseksi?	0	1	2	3	4	5
Oletko menettänyt kiinnostuksesi päivittäisiin askareisiisi?	0	1	2	3	4	5
Oletko kärsinyt voimien ja energian puutteesta?	0	1	2	3	4	5
Onko itseluottamuksesi ollut aiempaa heikompi?	0	1	2	3	4	5
Onko Sinulla ollut huono omatunto tai syyllisyyden tunteita?	0	1	2	3	4	5
Onko Sinusta tuntunut, ettei elämä ole elämisen arvoista?	0	1	2	3	4	5
Onko Sinulla ollut keskittymis-vaikeuksia esim. lehteä lukiessa tai TV:ta katsellessa?	0	1	2	3	4	5
Oletko tuntenut itsesi hyvin levottomaksi?	0	1	2	3	4	5
Oletko tuntenut itsesi vaiteliaammaksi?	0	1	2	3	4	5
Onko Sinulla ollut vaikeuksia saada unta yöllä?	0	1	2	3	4	5
Onko ruokahalusi vähentynyt?	0	1	2	3	4	5
Onko ruokahalusi lisääntynyt?	0	1	2	3	4	5

19

IHMISET **CH**

Mitä mieltä olet seuraavista väittämistä? Ympyröi mielipidettäsi parhaiten kuvaava vaihtoehto.

	Täysin samaa mieltä	Jokseenkin samaa mieltä	Ei samaa eikä eri mieltä	Jokseenkin eri mieltä	Täysin eri mieltä
Useimmat ihmiset ovat valmiita valehtelemaan oman etunsa vuoksi.	5	4	3	2	1
Useimmat ihmiset ovat rehellisiä ja kunniallisia pääasiassa kiinnijoutumisen pelosta.	5	4	3	2	1
Useimmat ihmiset ovat etuja saavuttaakseen valmiita käyttämään epärehellisiäkin keinoja, elleivät rehelliset auta.	5	4	3	2	1
Mietin usein, mitkä voisivat olla ne todelliset syyt, jotka saavat toiset tekemään jotain hyväkseni.	5	4	3	2	1
Kukaan ei välitä paljoakaan siitä, mitä toiselle tapahtuu.	5	4	3	2	1
On paras olla luottamatta keneenkään.	5	4	3	2	1
Useimmat ihmiset hankkivat ystäviä siksi, että näistä on todennäköisesti hyötyä heille.	5	4	3	2	1
Useimmat ihmiset eivät oikeastaan haluaisi nähdä vaivaa auttaakseen toisia.	5	4	3	2	1

20

PERSOONALLISUUSKYSELY **DS 14**

Alla on ilmauksia, joita ihmiset usein käyttävät kuvaillakseen itseään. Lue jokainen lause ja ympyröi vaihtoehto, joka parhaiten kuvaa Sinua asteikolla 0-4.

	Väärin	Melko väärin	Ei oikein eikä väärin	Melko oikein	Oikein
Saan helposti yhteyden ihmisiin	0	1	2	3	4
Teen usein hässäkän merkityksettömistä asioista	0	1	2	3	4
Puhun usein vieraille henkilöille	0	1	2	3	4
Tunnen itseni usein onnettomaksi	0	1	2	3	4
Olen usein ärsyyntynyt asioista	0	1	2	3	4
Tunnen itseni usein estyneeksi sosiaalisessa kanssakäymisessä	0	1	2	3	4
Näen usein asiat synkkinä	0	1	2	3	4
Minun on vaikea aloittaa keskustelua	0	1	2	3	4
Olen usein huonolla tuulella	0	1	2	3	4
Olen melko sulkeutunut henkilö	0	1	2	3	4
Pidän mielelläni etäisyyttä ihmisiin	0	1	2	3	4
Olen usein huolestunut jostakin	0	1	2	3	4
Olen usein alamaissa	0	1	2	3	4
Minun on vaikea löytää puhuttavaa ihmisten kanssa	0	1	2	3	4

21

PÄÄNSÄRKYKYSELY

Onko Sinulla ollut viimeisen kuluneen vuoden aikana päänsärkyä?

kyllä ☐ ei ☐ Jos vastasit ei, kyselykaavakkeet on osaltasi täytetty. Kiitos vastauksista!

Onko päänsärky ollut toistuvaa

kyllä ☐ ei ☐

Ympyröi taulukosta se vaihtoehto (1-5), joka parhaiten kuvaa tilannettasi.

	Ei koskaan	Harvoin	Joskus	Useimmiten	Aina
Kun Sinulla on päänsärkyä, kuinka usein kipu on ankaraa?	1	2	3	4	5
Kuinka usein päänsäryt rajoittavat kykyäsi tehdä tavallisia päivittäisiä toimiasi mukaan lukien kotityöt, ansiotyö, koulu/opiskelu tai kanssa- käyminen muiden ihmisten kanssa?	1	2	3	4	5
Kun Sinulla on päänsärkyä, kuinka usein toivoisit pääseväsi makuulle?	1	2	3	4	5
Kuinka usein viimeisen neljän viikon aikana olet päänsäryn vuoksi tuntenut olosi liian väsyneeksi tehdäksesi töitä tai suoriutuaksesi päivittäisistä toiminnoistasi?	1	2	3	4	5
Kuinka usein viimeisen neljän viikon aikana olet tuntenut olosi kyllästyneeksi tai ärtyneeksi päänsärkyjesi vuoksi?	1	2	3	4	5
Kuinka usein viimeisen neljän viikon aikana päänsäryt rajoittivat kykyäsi keskittyä työhön tai päivittäisiin toimiin?	1	2	3	4	5

Kyselykaavakkeet on nyt täytetty. Palauta lomakkeet tutkimuskäynnillä hoitajalle. Kiitos vastauksista!

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