Self-Reported Health and Pain Sensitivity in Low Back Pain

Differences between Individuals with and without Pain Radiation to Lower Limbs

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Abstract

**Background:** Low back pain (LBP) is the leading cause of disability and is often accompanied with a back-related leg pain (around 60%), where those with radiating pain show worse overall clinical outcomes. Previous studies comparing these two groups have involved individuals with chronic LBP. It is not known if subjects who currently have LBP differ in pain sensitivity from those who have currently LBP accompanied with pain radiation to lower limbs.

**Aim:** The aim of this study was to investigate whether there are differences in self-reported health and pain sensitivity between individuals currently having LBP with and without pain radiation to lower limbs.

**Method:** Individuals with LBP (n=100) aged 40 to 70 years participated in this study. According the first question of STarT Back Pain Screening Tool about the pain radiation to leg(s), individuals were divided into two groups: radiation group (RG, n=36) and no radiation group (noRG, n=64). To gain the information about self-reported health, following questionnaires were used: Roland-Morris Disability Questionnaire, Fear-Avoidance Beliefs Questionnaire and Hospital Anxiety and Depression Scale. Pressure pain thresholds (PPTs) were measured with algometer (6 sites and 4 points of 'lower body': gluteal and knee points). Mann-Whitney U-test was used to calculate differences on group and gender level. A logistic regression analyses was calculated (crude model), where belong to RG or not was the dependent variable and all self-reported data and PPTs were independent variables, all data were controlled for gender and age.

**Results:** The RG reported worse disability (p=0.017), higher fear-avoidance beliefs (FAB) about physical activity (p=0.003), worse score in anxiety (p=0.002) and depression (p=0.001), and increased pain sensitivity (p=0.043) in 6 sites PPTs compared to the noRG. Higher score of disability, FAB (physical activity and work), anxiety and depression were associated with an increased risk of belonging to the RG (OR 1.05-1.50, 95% CI 1.01-1.94), controlled for gender and age.

**Conclusion:** Individuals with LBP and pain radiation to lower limbs showed worse self-reported disability and fear-avoidance beliefs about physical activity than those with LBP only. Further, those with pain radiation were more sensitive to pain in general. Worse scores of all studied self-reported data were associated with an increased risk of belonging to the groups with pain radiation. To study gender differences larger sample sizes are needed. Individuals with LBP and pain radiation to lower limbs showed worse outcomes and therefore should receive a different treatment approach than those who have only LBP.
List of Abbreviations

FAB – fear-avoidance beliefs
FABQ – fear-avoidance beliefs questionnaire
FABQpa – subscale Physical Activity of FABQ
FABQw – subscale Work of FABQ
HADS – Hospital Anxiety and Depression Scale
HADSa – subscale Anxiety of HADS
HADSD – subscale Depression of HADS
LBP – low back pain
noRG – no radiation group
PPTs – pressure pain thresholds
RG – radiation group
RMDQ – Roland-Morris Disability Questionnaire
# Table of Contents

List of Abbreviations ............................................................................................................. 4  
Introduction ............................................................................................................................ 1  
1 Background .......................................................................................................................... 2  
1.1 Low Back Pain .................................................................................................................. 2  
1.2 Pain Radiation to Lower Limbs ......................................................................................... 3  
1.2.1 Intervertebral Disc ...................................................................................................... 4  
1.3 Disability .......................................................................................................................... 5  
1.4 Fear-Avoidance Beliefs ..................................................................................................... 6  
1.5 Anxiety and Depression .................................................................................................... 6  
1.6 Pain Sensitivity ................................................................................................................ 7  
1.6.1 Pressure Pain Thresholds .............................................................................................. 7  
1.7 Treatment of Low Back Pain ............................................................................................ 8  
1.8 Knowledge Gaps .............................................................................................................. 9  
1.9 Aim .................................................................................................................................. 10  
1.9.1 Research Questions ..................................................................................................... 10  
2 Methods ................................................................................................................................. 11  
2.1 Study Design and Subjects ............................................................................................... 11  
2.2 Questionnaires ................................................................................................................. 12  
2.2.1 STarT Back Pain Screening Tool .................................................................................. 12  
2.2.2 Roland-Morris Disability Questionnaire ......................................................................... 13  
2.2.3 Fear-Avoidance Beliefs Questionnaire ......................................................................... 13  
2.2.4 Hospital Anxiety and Depression Scale ......................................................................... 14  
2.2.5 Pain Mannequin ........................................................................................................... 14  
2.3 Pressure Pain Thresholds .................................................................................................. 14  
2.4 Ethical and Social Considerations ................................................................................... 16  
2.5 Statistical Analyses .......................................................................................................... 16  
3 Results .................................................................................................................................. 18  
3.1 Disability .......................................................................................................................... 19  
3.2 Fear-Avoidance Beliefs ..................................................................................................... 19  
3.3 Anxiety and Depression .................................................................................................... 19  
3.4 Pressure Pain Thresholds .................................................................................................. 20  
3.5 Logistic Regression Analyses ........................................................................................... 21  
4 Discussion ............................................................................................................................ 23  
4.1 Disability .......................................................................................................................... 23
4.2 Fear-avoidance Beliefs ................................................................................................................. 23
4.3 Anxiety and Depression ................................................................................................................. 24
4.4 Pain Sensitivity .............................................................................................................................. 25
4.5 Method Discussion ......................................................................................................................... 25
4.6 Future Studies ................................................................................................................................. 26
5 Conclusion ......................................................................................................................................... 27
6 References .......................................................................................................................................... 28
7 Appendices ........................................................................................................................................ 35
    Appendix 1 ...................................................................................................................................... 35
    Appendix 2 ...................................................................................................................................... 37
    Appendix 3 ...................................................................................................................................... 38
Introduction

Due to our sedentary behavior and stressful lives, it is not striking, that back pain incidence rises and millions of people are affected each year. The most common is low back pain (LBP) which is nowadays the leading cause of disability in all, low-, middle- and high-income countries. Between the years 1995 and 2015, the disability caused by LBP rose by 54% globally (Hartvigsen et al., 2018).

However, LBP is not a disease but symptom, which can be defined as perceiving pain, discomfort, muscular tension or stiffness in the area of lower back, and related leg(s) pain may occur with or without neurological signs. It is a result of various possible etiologies and affects a wide spectrum of the population. During a lifetime, around 60 to 80% of the population experience a LBP at some point. Overall, females have higher prevalence of LBP in all age groups compared to males (Wáng et al., 2016).

Continuous exposure to pain for longer than three months represents chronic pain. The prevalence of moderate to severe chronic noncancer pain in Sweden is 18%, for chronic LBP (CLBP) it is 26.4% for women and 19% for men in the Swedish population (Harker et al., 2012). Radiating pain from the lower back following a dermatomal pattern to lower limbs is probably the most common cause of neuropathic pain, which is a great contributor to CLBP. Patients experiencing this pain type were observed with decreased physical and mental health, compared to other kinds of chronic pain (Freynhagen & Baron, 2009).

LBP is often accompanied with a leg pain, around 60% of patients with LBP in primary care report back-related leg pain, either with or without nerve root impairment, and report worse overall clinical outcomes compared to patients with only LBP (Konstantinou et al., 2017). Even though the leg pain in LBP is a poor prognostic indicator, there is an association with more severe pain and longer work absence, thus LBP patients with leg pain may receive different treatment approach in practice (Hill et al., 2011).
1 Background

1.1 Low Back Pain

The experience of LBP is highly individual. One can describe it as simply pain/discomfort, and neurological symptoms and/or different level of disability may be observed. Problems can have origin in muscles, intervertebral discs (IVDs), facet joints, ligaments or spinal nerves. A contributing factor for LBP is aging, which negatively modifies structures, injury risk is increased with higher age, and joint problems occur (mostly in sixth decade of life). Further, with age increases the incidence of radiating LBP lasting more than 30 days (Shiri et al., 2010).

The leading sources of CLBP are sacroiliac joints (20%, pathology is unknown), zygapophysial joints (10-15%) and IVDs (40%, disruption/prolaps) (Borestein & Calin, 2012; Adams et al., 2006). In CLBP, nociceptive and neuropathic pain mechanisms may be involved, and lately is it actually understood as a mixture of these two. The inflammation, biomechanical stress or tissue damage lead to nociceptor activation (or nerve impairment), which innervate muscles, fascia, tendons, ligaments and joints. When a nerve root, which innervates the spine and lower limbs is affected directly, it is considered as a neuropathic pain (Baron et al., 2016).

In chronic pain, increased pain sensitivity may be present, because such a pain causes negative modifications in nerve cell receptors, membrane thresholds and interactive pathway. Further, this pain type has effects on the brain areas responsible for mood and emotions, thus these are affected as well, and can result in stress, anxiety or even depression (Borestein & Calin, 2012). A fear related to pain belongs to one of the important mechanisms which are responsible for developing and maintaining chronic pain. Such a fear impair physical performance and in acute LBP is predictive of future disability (de Jong et al., 2005).

LBP is a general term covering a wide range of issues, and should not be taken as a homogenous condition, but based on clinical findings and symptoms, subgrouping should be used for improving the outcomes (Brennan et al., 2006). One example is distinguishing between localized LBP and LBP with pain radiation to lower limbs.

The current study distinguishes individuals with LBP based on present/not present pain radiation to lower limbs, and does not further subgrouping those with radiation according the
range of pain areas in legs or present/not present neurological signs. The study is focused on the difference between having simply LBP and having LBP with pain radiation to lower limbs (self-reported), thus ‘pain radiation’ is understood as a general issue and involves all subgroups with various etiologies.

1.2 Pain Radiation to Lower Limbs

Pain radiation to lower limbs can have lots of possible causes, because many structures are able to evoke such a pain, therefore indicating the primary pathology may be challenging. It is a predictor for chronicity of LBP and can also indicate the severity of a disorder (Borenstein & Calin, 2012).

A lot of terms such as referred pain, sciatica, radicular pain and radiculopathy can be seen in relation to the pain radiation, however mostly are used inconsistently and refer to different meanings (Stynes et al., 2016). Considering this issue generally, when nerve root is involved (inflammation/compression), radicular pain is presented with neurological signs such as weakness, numbness, or loss of reflex. When other structures such as ligaments, joints or IVDs (not involved spinal nerve root) are included, it is recognized as referred (non-specific/somatic) pain without neurological signs (Stynes et al., 2016; Borestein & Calin, 2012). In radiculopathy, loss of motor/sensory function is observed in the spinal nerve distribution area. However, the pain does not need to be present, pain occurs when radiculopathy is accompanied with radicular pain (Bogduk, 2009). According the International Associations for the Study of Pain (IASP), the term ‘sciatica’ should not be used, because its description fails in differentiating the types of radiating leg pain and/or symptoms. Sciatica only refers to pain, which appears along the sciatic nerve (Lin et al., 2014).

Further, many authors divided back-related pain radiation into subgroups based on different aspects. A division suggested by Schäfer et al. (2009) includes four subgroups based on the main cause of back-related leg pain: central sensitization (positive symptoms, f.e. hyperalgesia), denervation (axonal damage, sensory/motor deficit), peripheral nerve sensitization (enhanced nerve trunk mechanosensitization), musculoskeletal (somatic referred pain, from non-neural structures-IVDs, facet joints). This division helps with diagnosis and setting of treatment, but one has to be aware of an overlapping between these classifications (Schäfer et al., 2009).
Comparing self-reported scores of physical activity, psychological and social indicators between patient with LBP alone and those who have LBP with a pain radiation, both above and below the knee, the group with radiation shows poorer outcomes (Hill et al., 2011). Patients with LBP and pain radiation to lower limbs further appear with decreased quality of life and increased disability, pain and health care usage compared to those with LBP only (Konstantinou et al., 2013). In general practice, only one visit to the general practitioner/doctor specialist was observed in 50% of patients with radiating LBP, but when the radiculopathy was established, the number of consultations was significantly higher (Spijker-Huiges et al., 2015). Radiculopathy is not a rare condition, there are probably as many cases of non-specific radiating LBP as clinically diagnosed radiculopathy in the general practice (Spijker-Huiges et al., 2015).

1.2.1 Intervertebral Disc

Regarding the common involvement of an IVD in the issue of radiating LBP, it is important to present a short overview about it and about possible consequences of its damage/degeneration. Generally, IVD is not fully innervated, the outer 1/3 of anulus fibrosus has rich amount of nerve fibers, the middle third has fewer, and the inner one with the nucleus pulposus has none. It has also poor blood supply, because no arteries are located inside the disc, the only supply is from the external anulus surface - the arteries that also supply the nearby vertebrae. This concludes that IVD itself can be a pain source, but only if the outer 1/3 of anulus is compromised, and this is known as a discogenic pain (Adams et al., 2006).

IVDs experience a great load every day, and aging, injury or simple use and tear lead to loss of elasticity of anulus and nucleus getting stiffer. The nucleus is a liquid substance, which may leak out of its place through the laminas of anulus and can even reach the spinal canal. If the nuclear substance still remains before the outermost wall of the anulus, it is considered as disc protrusion or bulging, and when this wall is teared and spinal canal is reached, it is known as a disc herniation or extrusion (Adams et al., 2006).

The spinal nerve or its root may be affected by disc degenerations, and lancinating or shooting pain is radiated to legs usually with present neurological signs. Nerve could be affected not only by compression of nerve root (blood supply) by bulging, but also by microscopic damage of nerve root and inflammation. Inflammatory response is due to contact of nerve root with nuclear substance (herniation) and results in loss of reflex, weakness, numbness or pain. After couple of months the leaked substance can be resorbed and the normal functions may return. Many
times a surgical intervention is required, but more than 80% of patients with herniation do not undergo the operation, but use other treatments (f. e. drugs or physical therapy) (Borenstein & Calin, 2012).

1.3 Disability

According World Health Organization (WHO), the disability covers terms such as impairment or activity limitation. Problem in body function or in structure is an impairment and difficulty to perform task or action refers to activity limitation (World Health Organization, 2018).

More women than men are disabled in most of the developed countries, especially among elderly people, and that is due to f. e. lower muscle strength, lower bone density or higher rates of sedentary lifestyle and obesity in women (Leveille, et al., 2000). More studies about gender differences in the issue of disability caused by LBP are required. In addition none have been done comparing men and women with radiating LBP.

Even though the radiating leg pain is a poor indicator, there is an association with more serious disability (Hill et al., 2011). Functional disability is related to pain intensity, depression and anxiety and is contributed by anxiety and intensity of pain in patients with lumbar disc herniation (Kim et l., 2006).

Limited physical activity (established based on (RMDQ) Roland-Morris Disability Questionnaire) was observed on more severe levels in LBP patients with referred pain to lower limbs, either below or above knee, compared to patient with local LBP, and the most severe limitations were observed in those with nerve root involvement (Kongsted et al., 2012). Even if the group with neurological signs improved the most in activity limitations in one year among other groups, its score in RMDQ remained still higher (worse disability) compared to other groups (Kongsted et al., 2013).

When comparing patients having localized LBP, with pain above knee, below knee and below knee with neurological signs, the last group had the highest disability (Hartvigsen et al., 2017). The four above mentioned subgroups divided according Schäfer et al. (2009) were established and compared in practice, and group of ‘peripheral nerve sensitization’ showed higher disability (Oswetry Disability Index) than the other three groups (central sensitization, denervation, musculoskeletal) (Walsh et al., 2009).

Disability goes hand in hand with a fear-avoidance, they act as a vicious circle and are strongly correlated (Vlaeyen & Linton, 2000).
1.4 Fear-Avoidance Beliefs

Fear-avoidance is characterized as avoiding of movements or physical activities based on fear of pain (Vlaeyen & Linton, 2000). High fear-avoidance beliefs (FAB) in LBP are associated with the amount of sick-leave days, and high FAB refers to prolonged work absence in healthcare workers with LBP (Jensen et al., 2010).

Subjects with back-related leg pain of the ‘peripheral nerve sensitization’ group showed higher FAB about physical activity (FABQpa) than the ‘central sensitization’ and ‘denervation group’ (see subgrouping in ‘Radiating Pain to Lower Limbs’) (Walsh et al., 2009). Compared to LBP only, radiated pain with neurological signs has greater fear-avoidance of movement (Kongsted et al., 2012).

There is lacking knowledges about gender differences in FAB in LBP, regarding the fact, the studies have not done comparison on gender level when comparing LBP and pain-free subjects, or when comparing subgroups of LBP with pain radiation.

Experimental as well as clinical studies revealed that not only fear but also anxiety influence the experience of (chronic) pain (Vlaeyen & Linton, 2000).

1.5 Anxiety and Depression

In chronic pain, women report higher depression than men (Munce & Steward, 2007), and on the other hand men showed more anxiety related to pain (Frot et al., 2004). Anxiety and depression are associated with developing persistent LBP (Dunn & Croft, 2004), and are observed as a common results of pain in CLBP patients (Gore et al., 2012). Higher than a normal level of anxiety and depression was observed also in newly diagnosed LBP patients, and showed positive medium correlation (r=0.47) with the pain intensity (Mok & Lee, 2008). Higher levels of depression and anxiety occurred also in patients with lumbar disc herniation compared to healthy subjects (Kim et l., 2006).

Depression symptoms were found more often in patients with radiating LBP to lower limbs with neurological signs, than in those with the absence of neurological symptoms (Kongsted et al., 2012). Completing the Hospital Anxiety and Depression Scale (HADS), among the 4 back-related leg pain subgroups suggested by Schäfer et al. (2009), the ‘central sensitization’ and the ‘peripheral sensitization’ ended in the borderline abnormal range in HADS anxiety and ‘peripheral sensitization’ also in HADS depression subscale, whereas the other subgroups were assigned to normal range of both, the anxiety and the depression (Walsh et al., 2009).
1.6 Pain Sensitivity

Definition of pain as ‘an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such a damage’ is the definition according IASP (International Association for the Study of Pain), which is accepted and widely used (Merskey, 1979). IASP further distinguish neuropathic, nociceptive and nociplastic pain. Lesion or disease of the somatosensory nervous system is considered as neuropathic pain. When nociceptors are activated due to threatened or actual damage of non-neural tissue, it is understood as a nociceptive pain. Nociplastic pain is new term, and according to IASP it is ‘pain that arises from altered nociception despite no clear evidence of actual or threatened tissue damage causing the activation of peripheral nociceptors or evidence for disease or lesion of the somatosensory system causing the pain’ (International Association for the Study of Pain [IASP], 2018). Every human being experiences pain individually and each may describes it very differently.

The same noxious stimuli in different subjects can be attributed to the entire visual analogue scale (self-reported intensity of pain on the scale where 0 is no pain and 100 is the worst imaginable pain), some may have decreased or increased pain sensitivity. In the case of the first one, belated or not correct diagnoses could be set, and the second case is usually observed with sensibility to chronic pain conditions (Diatchenko et al., 2004). Even individuals with the same diagnosed disease report different levels of pain, which can be caused by different severity and/or different pathological development of disease. Divergences in self-reported pain could be also due to individual interpretation of the pain. Further, from the twin studies is known, that pain variance is also genetically mediated (Nielsen et al., 2008).

One way to gain assessment of the pain sensitivity is using the induced controlled pain stimuli in laboratory setting. Modalities such as cold, heat, pressure or chemical (f. e. capsaicin) stimuli are commonly used in experimental pain studies (Nielsen et al., 2009). The pressure was used for the purpose of the current study.

1.6.1 Pressure Pain Thresholds

Pressure pain threshold (PPT) is characterized by the minimal pressure that induces pain, and can be used to assess the pain sensitivity (Fisher, 1987). An algometer, measuring pressure, is the commonly used device in pain studies to evaluate PPTs in both, subjects with pain and pain-free individuals. Lower values of PPTs mean higher sensitivity to pain and vice versa.
Regardless the age, males obtain higher PPTs compared to females. (Bek et al., 2002). Females with CLBP present lower PPTs, tested in 6 sites bilaterally, compared to females without pain (Giesbrecht & Battié, 2005). Studying pain topography, no differences between left and right m. trapezius, and between cervicothoracic and lumbar area in the same gender were detected, only differences between gender (lower values in women) occurred (Binderup et al., 2010). PPT values from myotomes and dermatomes of L1-S3 segments in CLBP patients were shown lower bilaterally compared to healthy individuals (Imamura et al., 2013). In patients with herniation and leg pain, lower PPTs were observed on the side of herniation compared to the contralateral side (Hirayama et al., 2006).

1.7 Treatment of Low Back Pain

On account of high prevalence of LBP, many clinical practice guidelines were developed in the management of LBP. These include recommendations for optimizing the care of patients and improving the health outcomes. The aim of guidelines is also to lower the research-clinical practice gap and help with decisions that influence the population. However, systematic reviews on clinical practice guidelines concluded that some have methodological limitations and this may lead to not effective interventions (Wong et al., 2016).

To identify prognostic indicators, subgroups patients or allocate them to an equivalent treatment in primary care is the purpose of back pain screening tools (Hill et al., 2008). Those commonly used in LBP are f. e. Örebro Musculoskeletal Pain Screening Questionnaire or STarT Back Pain Screening tool. The latter one was used in this study (please see 2.2.1 STarT Back Pain Screening Tool).

As it was mentioned before, revealing the primary pathology of LBP can be difficult in many cases. When the cause is unknown, we talk about non-specific LBP. Guidelines for such a LBP contain interventions that can be divided into education and self-care, non-pharmacological therapy, pharmacological therapy, interventional therapies and surgery. In an early management, advices about staying active and education about LBP should be provided. To non-pharmacological treatment belong exercise therapy, spinal manipulation, massage, cognitive behavioral therapy, etc. Paracetamol, NSAIDs, myorelaxants or opioids are used in pharmacological therapy. In patients with herniated disc with radiculopathy, the epidural glucocorticoid injection can be applied as an interventional therapy. When all mentioned therapies fail, the surgery is required in many cases. Discectomy is done in herniated disc with
radiculopathy, laminectomy in symptomatic spinal stenosis and spinal fusion for non-radicular LBP with degenerative disc findings (Foster et al., 2018).

Commonly used treatments for back-related leg pain are prescribed medications, injections or even surgery, but lack of evidence supports the routine use of those. Conservative treatments, such as exercise or spinal manipulation are more favorable options for patients, however, research about these options are very limited in the management of back-related leg pain (Maiers et al., 2016).

1.8 Knowledge Gaps

Many studies have been done on comparing social, physical or psychological indicators of pain-free subjects with LBP patients (Bener et al., 2013; del Pozo-Cruz et al., 2013). If only pain subjects were studied, also duration, type and severity of pain were involved. Couple of studies compared LBP subgroups with the pain radiation to legs (Hartvigsen et al., 2017; Kongsted et al., 2013; Kongsted et al., 2012; Walsh et al., 2009; Kim et al., 2006). Not only self-reported data were used, but mostly clinically supported. However, mostly patients with CLBP participated in almost all studies, and it is possible that during collection of data, they did not experience an actual pain ‘attack’ period, so the reports may be biased. The current pain can possibly contribute to unbiased answers when filling out the questionnaires about various health-related aspects.

It is known, that patients with (C)LBP appear to have lower PPTs compared to healthy subjects (Imamura et al., 2013; Giesbrecht & Battié, 2005), and those with pain radiation to legs reported more severe pain compared to LBP only (Konstantinou et al., 2013). Yet is it not known if subjects who currently have LBP differ in pain sensitivity from subjects who also have currently LBP, but also experience a pain radiation to legs. Further, it is unknown if self-reported radiation based on one question can be a usable tool to distinguish between these patients, considering the fact, that most studies used clinically supported information about radiation.
1.9 Aim

The purpose of this study was to investigate whether there are differences in self-reported health and pain sensitivity between individuals currently having LBP with and without pain radiation to lower limbs.

1.9.1 Research Questions

- Is there a difference in self-reported disability, fear-avoidance, depression and anxiety between individuals currently having LBP with and without pain radiation to lower limbs in total, and are there gender differences?
- Is there a difference in pressure pain thresholds between individuals currently having LBP with and without pain radiation to lower limbs in total, and are there gender differences?
- In a logistic regression analysis, are self-reported data and pressure pain thresholds associated with an increased risk of having LBP with the pain radiation to lower limbs?
2 Methods

2.1 Study Design and Subjects

This cross-sectional study, is a sub-study of the Epipain Study, a longitudinal study initiated in 1995, aimed to study prevalence, risk factors and effects of pain on health in the general population in regions of Halmstad and Laholm (Bergman, 2001). So far, four follow-ups were done based on this cohort (1998, 2003, 2007 and 2016). For the purpose of this study, the data from the 2016 questionnaire (n=1832) were used.

From the total sample of 2016 follow-up study, 1184 (64.6%) subjects (40-70 years) reported chronic pain in the last year. Only those with chronic pain in the area of lower back were of our interest (n=176, 14.9%) and further invited for a clinical visit. A total of 141 (80.11%) participants agreed to the clinical visits. Another six of the participants were recruited from a primary health care center where they had made appointments to see a doctor or a physiotherapist due to a back pain, please see Figure 1. These six patients filled out the questionnaires but did not undergo the pain threshold measurements. Since the aim of this study was to focus on current LBP, only participants reporting to have pain in the lower back at time of their clinical visit were selected (n=100, 95 Epipain subjects and 5 primary care patients). The participants were then allocated into two groups, a group indicating radiation (RG) or a group without radiation to lower limbs (noRG), according to the answer of the very first question of STarT Back Pain Screening Tool: ‘My back pain has spread down to my leg(s) at some time in the past 2 weeks’.
176 subjects with reports of CLBP in the last 12 months
** 100 = 95 Epipain subjects, 5 recruited patients from primary health care

Figure 1. Flow of subjects from the 2016 follow-up to the sample involved in the study.

2.2 Questionnaires

Individuals apart from being tested for PPTs, filled out several well used questionnaires, where scores and information from STarT Back Pain Screening Tool (SBT), Roland-Morris Disability Questionnaire (RMDQ), Fear-Avoidance Beliefs Questionnaire (FABQ) and Hospital Anxiety and Depression Scale (HADS) were used for the study purpose. For some supplementary information, we looked also on the information from the Pain Mannequin (Appendix 3).

2.2.1 STarT Back Pain Screening Tool

The first question (My back pain has spread down to my leg(s) at some time in the past 2 weeks: agree/disagree) of SBT was used as a criterion for a group division (RG vs. noRG), but subjects have completed the whole questionnaire. The general purpose of this questionnaire is to investigate, whether there is a risk of developing persistent LBP. SBT with its 9 questions, refers to physical (questions 1-4) and psychosocial (questions 5-9) risk factors. Subjects could tick 'agree’ (1 point) or 'disagree’ (0 point) to questions 1 to 8, the 9th question is about rating how bothersome the back pain has been in overall during passed 2 weeks, and has 5-points
Likert scale scoring (not at all – 0; slightly – 0; moderately – 0; very much – 1; extremely – 1) (Betten et. al., 2015).

Further, based on the obtained score in SBT, patients with LBP could be assign into three different subgroups: low, medium and high-risk group, referring to the risk of developing persistent LBP. The allocation to the medium and high-risk group is lead by the psychosocial subscale (questions 5-9) what points on the importance of psychosocial indicators in LBP patients. In addition, allocation of patients into these subgroups supports choosing the right therapy. SBT is a validated tool for subgrouping non-specific LBP primary care patients (Hill et al., 2008). Characteristics of STB risk subgroups can be seen in Table 1.

For descriptive information we assigned subjects to three SBT risk subgroups based on their obtained scores in this questionnaire.

Table 1. STarT Back Pain Screening Tool Risk Subgroups (Hill et al., 2008)

<table>
<thead>
<tr>
<th>Risk Subgroup</th>
<th>Score</th>
<th>Prognosis</th>
<th>Treatment Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Risk</td>
<td>3 or less</td>
<td>Few negative prognostic indicators</td>
<td>Primary care</td>
</tr>
<tr>
<td></td>
<td>4 or more</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium Risk</td>
<td>(3 or less points from questions 5-9)</td>
<td>Unfavorable prognosis</td>
<td>Physiotherapy</td>
</tr>
<tr>
<td>High Risk</td>
<td>4 or more</td>
<td>Very unfavorable prognosis</td>
<td>Physical + Cognitive-behavioral Approaches</td>
</tr>
<tr>
<td></td>
<td>(4 or more points from questions 5-9)</td>
<td></td>
<td></td>
</tr>
</tbody>
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2.2.2 Roland-Morris Disability Questionnaire

Self-reported disability caused by LBP is the purpose of RMDQ. It consists of total 24 questions (points: yes – 1, no – 0). The higher the score, the higher level of pain-related disability (Stratford & Riddle, 2016). RMDQ was tested for validity and reliability and has shown an excellent test-retest reliability, and acceptable value of construct validity (correlated with Oswetry Disability Index) (Stevens et al., 2016).

2.2.3 Fear-Avoidance Beliefs Questionnaire

FABQ was developed to assess fear-avoidance beliefs (FAB). It contains 16 items and two subscales, first about physical activity (FABQpa) and second about work (FABQw). A Likert scale of 7 points is given for each question (0 – completely disagree, 6 – completely agree). Four questions are related to FABQpa, and maximal possible score is 24. FABQw has 7 questions with a maximal score of 42. Remaining 5 questions are involved only in the overall FABQ score. The higher score, the higher FAB. FABQ and its subscales are valid and reliable. An excellent test-retest reliability was shown for the total score of FABQ, and high in its
An acceptable construct validity in subscales was found when correlated with Tampa Scale of Kinesiophobia (Williamson, 2006). In our statistical analyses, the score of subscales FABQpa and FABQw were used as numerical scales, we did not used the overall FABQ score.

### 2.2.4 Hospital Anxiety and Depression Scale

HADS was developed to detect anxiety and depression states in outpatients. Fourteen questions are given, corresponding to two subscales - anxiety (HADSa) and depression (HADSd), 7 and 7 items, respectively. Each question has 4 options (a Likert scale ranging from 0 to 3 points). Scores of each subscale range between 0-21 points, a higher score indicates a worse state of anxiety/depression. Up to 7 points refers to normal cases, 8 to 10 points borderline abnormal cases, meaning possible presence of respective state. Obtaining 11 or higher score of either subscale is understood as probable presence of mood disorders (Snaith, 2003; Zigmond & Snaith, 1983). HADS’ subscales are reliable, outcoming with high values of correlations, HADSa correlated with Clinical Anxiety Scale, HADSd with Montgomery-Asberg rating scale for depression (Upadhyaya & Stanley, 1993). The state of anxiety and depression here are however self-reported and not stated diagnoses by doctor specialist. For the statistical analyses, the scores of HADSa and HADSd subscales were used separately and as a numerical scale.

### 2.2.5 Pain Mannequin

The Pain Mannequin (Appendix 3) is used for self-reported distribution of chronic widespread pain experienced in the last twelve months. The pain lasted for more than three months in last twelve months is considered as chronic. When pain is experienced in both sides of body (left, right) and both halves of the body (above and below waist) it is defined as widespread (Wolfe et al., 1990). The mannequin is divided into 18 different areas, and one can tick a box(es) attributable to the area of experiencing chronic pain in the last year (Bergman et al., 2001). In this study, only information concerning pain in the areas of lower back, both buttocks and thighs were of interest.

### 2.3 Pressure Pain Thresholds

To gain the values of individuals’ pressure pain thresholds, the AlgoMed Computerized Pressure Algometer FPIX (Medoc Ltd. Advanced Medical Systems, Israel) was used. Usage of the algometer was evaluated as a valid and reliable method for measuring PPTs by Kinser et al. (2009) who tested it for reliability and construct validity, where the correlation between maximum force readings of the algometer and the force plate was excellent.
Testing PPTs was conducted at FoU Spenshult in Halmstad. Before the PPTs measurements, test leaders participated together on training sessions, thus they were able to give uniform instructions to every participants and perform the measurements in a similar way. Pain thresholds were taken from 8 different points (Figure 2), 6 equivalent with fibromyalgia pressure points and 2 extra added (gluteal): bilaterally m. trapezius (pars descendens), bilaterally m. gluteus maximus (lateral cranial quadrant, horizontal line with spina iliaca posterior superior), bilaterally medial femoral condyle (medial patellofemoral ligament), third intercostal lateral of sternum (right), 2 cm distal from lateral humeral condyle (near m. extensor carpi radialis longus/brevis insertion, right arm) (Wolfe et al., 1990). Two measurements were done on every point with an interval of one minute, the speed of increasing pressure was 40kPa/second. The moment, when the subject started to perceive pressure as a pain, he/she pushed a stop button, and the current value was recorded as the pain threshold. Data from the second-time measurement was taken, the mean of 6 fibromyalgia points (6 sites) was calculated of each individual and further used for the statistical analyses. Regarding the fact that we studied a pain radiation to lower limbs, we calculated also mean of 4 points of 'the lower body' PPTs (left/right gluteal points, left/right knee points).

Figure 2. The layout of taken pressure pain thresholds. Red: 6 fibromyalgia pressure points, green: 2 extra added gluteal points.
2.4 Ethical and Social Considerations

The ethical vetting was done on the Epipain study, as well as on the clinical study, and was approved by Regional Ethic Review Board in Lund, Dnr 2016/786, Dnr 2016/132. All the information concerning the participation in the study was given to each participant (Appendix 1), in understandable and clear way, and an informed consent was filled out (Appendix 2). Individuals were familiar with the fact, that they could leave in any part of the study, no explanation was required. No personal information is presented in the paper, and sensitive information are stored on a hard drive. Laboratory process of measuring thresholds was done in not-harming meaning, led by experienced examiners. The guideline of the Declaration of Helsinki was followed.

Learning about LBP is an ongoing process. An accurate diagnosis is essential for setting the proper treatment/therapy. Knowledge about the main cause leads to most likely successful choices of treatment process. Considering that symptoms, especially pain, are meaningful in this matter, a closer understanding is desirable. Every patient requires an individual approach, however, subgrouping helps practitioners with diagnosis. Patients in the same subgroups may have similar pain etiology and psychological status. Revealing the differences in pain sensitization and psychological aspects in patients with LBP, between those who has and has not the pain radiation to lower limbs, could show the importance to distinguish these two types of patients, and can bring benefit in clinical diagnostics, because more appropriate approach of treatment is chosen. This may lead to reduction of disability period and decrement in healthcare costs.

2.5 Statistical Analyses

Data was analyzed with the statistics program IMB SPSS Statistics (IBM SPSS Statistics for Windows, Version 24.0). A p-level < 0.05 was consider as statistically significant. Testing variables for normal distribution (Kolmogorov-Smirnov test) showed most of the data was not normally distributed, thus non-parametric tests were applied. Means and standard deviation (SD) are presented for the possibility to compare our results with previous studies.

The Mann-Whitney U-test was applied to investigate, whether there is a difference in disability, fear-avoidance beliefs (physical activity and work), anxiety and depression between RG and noRG, between men and women in each group, and finally between men (women) of RG and noRG. The same approach was followed with the PPTs variables (mean of 6 points, mean of 4
points of the lower body), in the purpose to compare the pain sensitivity between groups, gender inside the groups and equal gender between groups.

A logistic regression was used to study the association of belonging to the RG or not (dependent variable) with independent variables: self-reported disability, fear-avoidance beliefs (physical activity and work), anxiety, depression and pain intensity (mean of 6 points, mean of 4 points of the lower body). The independent variables were inserted into analyses separately, with the purpose to see how each factor affects the risk of belonging to RG or not (crude model), all data were controlled for gender and age. We present odds ratio (OR) and 95% confidence interval (CI).
3 Results

Of total 147 individuals, 100 (38 men, 62 women) reported current LBP and was further involved in this study. Based on the first SBT question (*My back pain has spread down to my leg(s) at some time in the past 2 weeks: agree/disagree*) subjects were divided into two group: no radiation group (noRG) (n=64; 28 men, 36 women) and radiation group (RG) (n=36; 10 men, 26 women). The mean age between the noRG and RG did not differ (p=0.931), 59.2 years (8.9) and 59.7 years (6.6), respectively. Please see Table 2.

Table 2. Descriptive data of the no radiation group (noRG) and the radiation group (RG), n=100.

<table>
<thead>
<tr>
<th></th>
<th>all</th>
<th>men</th>
<th>women</th>
<th>all</th>
<th>men</th>
<th>women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean(SD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>noRG</td>
<td>64 (64%)</td>
<td>28 (43.8%)</td>
<td>36 (56.3%)</td>
<td>36 (36%)</td>
<td>10 (27.8%)</td>
<td>26 (72.2%)</td>
</tr>
<tr>
<td>RG</td>
<td>59.2(8.9)</td>
<td>60.3(8.8)</td>
<td>58.4(9.2)</td>
<td>59.7(6.6)</td>
<td>57.2(6.9)</td>
<td>60.7(6.4)</td>
</tr>
<tr>
<td>Pain Mq</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>area LB</td>
<td>no</td>
<td>39 (61.9%)</td>
<td>19 (48.7%)</td>
<td>20 (51.3%)</td>
<td>8 (23.5%)</td>
<td>3 (37.5%)</td>
</tr>
<tr>
<td></td>
<td>yes</td>
<td>24 (38.1%)</td>
<td>8 (33.3%)</td>
<td>16 (66.7%)</td>
<td>26 (76.5%)</td>
<td>6 (23.1%)</td>
</tr>
<tr>
<td>n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain Mq</td>
<td>LB+buttock+thigh*</td>
<td>4 (6.3%)</td>
<td>0</td>
<td>4 (6.3%)</td>
<td>16 (47.1%)</td>
<td>0</td>
</tr>
<tr>
<td>SBT</td>
<td>Low</td>
<td>61 (98.4%)</td>
<td>28 (45.9%)</td>
<td>33 (54.1%)</td>
<td>26 (72.2%)</td>
<td>5 (19.2%)</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td>1 (1.6%)</td>
<td>0</td>
<td>1</td>
<td>8 (22.2%)</td>
<td>5 (62.5%)</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2 (5.6%)</td>
<td>0</td>
</tr>
</tbody>
</table>

Pain Mq = Pain Mannequin, LB = low back, SBT = STarT Back Pain Screening Tool risk groups
*numbers of individuals who ticked area of LB, buttock and thigh of the same side (left/right) on the Pain Mannequin

Data from the Pain Mannequin (n=97; noRG=63, RG=34) showed that in the noRG only 38.1% experienced chronic pain in the LB area during last year. On the other hand, 76.5% of subjects in RG suffered from CLBP in the last year. Reports of radiated chronic pain to one leg (left or right), including areas of LB, buttock and thigh, was observed just in women in both group (noRG 6.3% and RG 47.1%).

Based on the SBT total score, the subjects were assigned into risk groups (low, medium and high risk of developing persistent LBP) where only 1.6% of the subjects in the noRG were assigned to the medium risk group, and none to the high risk group. In the RG 22.2% were assigned to the medium and 5.6% to the high risk group. Please see Table 2.
3.1 Disability
Self-reported disability was worse in subjects who also reported radiating pain, with no gender differences. Out of 100 involved subjects, 59 completed correctly the RMDQ (when more than one question remained without the answer it was not further involved into statistical analyses as according Stevens et al. (2006)), 31 in the noRG (13 men, 18 women), and 28 in the RG (8 men, 20 women). Subjects in the RG reported worse disability (p=0.017) than those in the noRG. There were no differences in self-reported disability between men and women in the noRG (p=0.189), and also no differences between men and women in the RG (p=0.778). No differences were found when comparing men in the RG with men in the noRG (p=0.080), the same was observed in women (p=0.180). Means and SD of RMDQ score for the RG and the noRG in total, and by gender can be found in Table 3.

3.2 Fear-Avoidance Beliefs
Subscale scores (FABQpa, FABQw) of FABQ were used separately for the analyses. A total of 98 subjects filled out the FABQpa, 62 in the noRG (27 men, 35 women) and 36 on the RG (10 men, 26 women). Further, 90 subjects correctly filled the subscale FABQw, 57 in the noRG (27 men, 30 women), and 33 in the RG (9 men, 24 women).

In the subscale FABQpa differences were found between the noRG and the RG, subjects in the RG showed higher scores of this subscale than those in the noRG (p=0.003). There were not different scores in the FABQpa subscale between men and women in the RG (p=0.818) and also not in the noRG (p=0.217). Men in the RG and the noRG did not obtain different scores (p=0.103) in FABQpa, but women did (p=0.009), where women in the RG gained higher scores than women in the noRG.

In the subscale FABQw, however, no differences were found between the noRG and the RG (p=0.079), between or within gender (p>0.240). Means and SD of FABQpa and FABQw score for the RG and the noRG in total, and by gender can be find in Table 3.

3.3 Anxiety and Depression
Ninety-nine subjects got valid scores in HADSa for the statistical analyses (noRG=63, 27 men, 36 women; RG=36, 10 men, 26 women). All 100 subjects completed the subscale HADSD correctly.
In the HADSa, individuals in the RG resulted with higher score than the noRG individuals (p=0.002). Men and women did not obtain different HADSa score inside the RG and the noRG (p=0.421; p=0.966, respectively). Equal gender difference between the RG and the noRG was observed just in females (p=0.005), where females of the RG showed higher HADSa score, males came with no difference (p=0.191).

The RG obtained higher score also in the HADSd subscale (p=0.001). Inside the groups, no difference was found in the RG (p=0.559) and also the noRG (p=0.913) between gender. When comparing the same gender between groups, the difference was observed in both, men and women, p=0.029, p=0.023, respectively, where those in the RG obtained higher score. Means and SD of HADSa and HADSd score for the RG and the noRG in total, and by gender can be find in Table 3.

### 3.4 Pressure Pain Thresholds

Out of 100 subjects, a total of 94 provided valid PPTs data (noRG=61, 26 men, 35 women; RG=33, 10 men, 23 women). There was a difference between subjects in the RG vs. the noRG in the mean value of 6 points PPTs (p=0.043). The RG showed lower PPTs than the noRG, 337.1 kPA (180.7) and 423.7 kPA (203.8) respectively. On the gender level, differences were found in both groups. In the noRG, women had lower PPTs than men (p<0.001), and in the RG, women also had lower PPTs compared to men (p=0.007). When comparing women from the noRG with women from the RG, no differences were found (p=0.179), with similar findings between the men (p=0.266).

Means of 4 points of the 'lower body' were also calculated in the purpose to compare the RG and the noRG. However, no difference in lower body PPTs was observed between the RG and the noRG (p=0.088), neither were there gender differences between the groups (women p=0.249 and men p=0.377). Differences were however found between gender within groups where women showed lower PPTs in both groups compared to men (RG p=0.007 and noRG p<0.001). All means and SD of PPTs of 6 points and PPTs of lower body of both groups in total, and by gender can be found in Table 3.
**Table 3.** Scores obtained in RMDQ, FABQpa, FABQw, HADSa and HADSd and PPTs from 6 sites and from lower body in the radiation group (RG) and in the no radiation group (noRG), n = 59*1 - 100. Data are presented as mean(SD).

<table>
<thead>
<tr>
<th></th>
<th>noRG</th>
<th>RG</th>
<th>p*2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>all 64</td>
<td>men 28</td>
<td>women 36</td>
</tr>
<tr>
<td>RMDQ</td>
<td>3.8(3.6)</td>
<td>2.8(2.7)</td>
<td>4.6(3.9)</td>
</tr>
<tr>
<td>FABQpa</td>
<td>6.1(5.2)</td>
<td>7.2(5.7)</td>
<td>5.3(4.7)</td>
</tr>
<tr>
<td>FABQw</td>
<td>10.5(9.6)</td>
<td>11.0(11.4)</td>
<td>10.0(7.9)</td>
</tr>
<tr>
<td>HADSa</td>
<td>6.1(3.3)</td>
<td>6.1(3.4)</td>
<td>6.1(3.3)</td>
</tr>
<tr>
<td>HADSd</td>
<td>2.8(2.0)</td>
<td>2.8(1.8)</td>
<td>2.9(2.3)</td>
</tr>
<tr>
<td>PPTs 6 sites</td>
<td>423.7(203.8)</td>
<td>544.2(210.8)</td>
<td>334.5(145.9)</td>
</tr>
<tr>
<td>PPTs lower body</td>
<td>1804.6(889.6)</td>
<td>2449.4(848.7)</td>
<td>1325.7(559.5)</td>
</tr>
</tbody>
</table>

*1 59 subjects correctly completed RMDQ (noRG=31, RG=28)
*2 differences between noRG and RG in total

RMDQ – Roland-Morris Disability Questionnaire; FABQpa – Physical Activity subscale of Fear-Avoidance Beliefs Questionnaire; FABQw – Work subscale of Fear-Avoidance Beliefs Questionnaire; HADS – Hospital Anxiety and Depression Scale for anxiety (HADSa) and depression (HADSd); PPTs 6 sites – Pressure Pain Thresholds of 6 points equivalent with fibromyalgia pressure points; PPTs lower body – Pressure Pain Thresholds of 4 points of the lower body (left and right gluteal points, left and right knee points)

### 3.5 Logistic Regression Analyses

In the logistic regression analyses, self-reported disability was associated with belonging to the RG (OR: 1.19, 95% CI: 1.04; 1.38) therefore, obtaining one more point in RMDQ increases this risk of 19%. From the FABQ, the subscale of FABQpa showed a higher risk (OR: 1.13, 95% CI: 1.04; 1.22) than the FABQw subscale (OR: 1.05, 95% CI: 1.01; 1.09). Both, depression and anxiety were found to be associated with belonging to the RG with OR 1.50 (95% CI: 1.16; 1.94) and OR 1.35 (95% CI: 1.13; 1.62), respectively. The PPTs, both, 6 sites and lower body PPTs did not increase the risk of belonging to the RG: OR 0.998 (95% CI: 0.995; 1.00) and OR 1.00 (95% CI: 0.999; 1.00), respectively. Results from the univariate logistic regression with all independent variables can be found in Table 4, data are presented as OR and 95% CI.
Table 4. Results of the logistic regression of belonging to the radiation group (RG) or not as the dependent variable. All independent variables were entered separately into the model controlled for gender and age.

<table>
<thead>
<tr>
<th>Belonging to RG</th>
<th>Logistic regression OR (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>2.03 (0.84; 4.89)</td>
<td>0.117</td>
</tr>
<tr>
<td>Age</td>
<td>1.01 (0.96; 1.06)</td>
<td>0.771</td>
</tr>
<tr>
<td>RMDQ</td>
<td>1.19 (1.04; 1.38)</td>
<td>0.015</td>
</tr>
<tr>
<td>FABQpa</td>
<td>1.13 (1.04; 1.22)</td>
<td>0.003</td>
</tr>
<tr>
<td>FABQw</td>
<td>1.05 (1.01; 1.09)</td>
<td>0.025</td>
</tr>
<tr>
<td>HADSa</td>
<td>1.35 (1.13; 1.62)</td>
<td>0.001</td>
</tr>
<tr>
<td>HADSD</td>
<td>1.50 (1.16; 1.94)</td>
<td>0.002</td>
</tr>
<tr>
<td>PPTs 6 sites</td>
<td>0.998 (0.995; 1.00)</td>
<td>0.101</td>
</tr>
<tr>
<td>PPTs lower body</td>
<td>1.00 (0.999; 1.00)</td>
<td>0.329</td>
</tr>
</tbody>
</table>

RMDQ – Roland-Morris Disability Questionnaire; FABQpa – Physical Activity subscale of Fear-Avoidance Beliefs Questionnaire; FABQw – Work subscale of Fear-Avoidance Beliefs Questionnaire; HADS – Hospital Anxiety and Depression Scale for anxiety (HADSa) and depression (HADSd); PPTs 6 sites – Pressure Pain Thresholds of 6 points equivalent with fibromyalgia pressure points; PPTs lower body – Pressure Pain Thresholds of 4 points of the lower body (left and right gluteal points, left and right knee points)
4 Discussion

Individuals with pain radiation reported worse disability, higher fear-avoidance beliefs about physical activity, worse score in anxiety and depression, and increased pain sensitivity in 6 sites PPTs compared to those with LBP only. Differences between men and women were found only in PPTs (6 sites and lower body PPTs), where women obtained lower PPTs than men regardless the pain radiation. Women with pain radiation reported higher fear-avoidance beliefs about physical activity, worse score in anxiety and depression than women with LBP only. Men with the pain radiation obtained worse score in depression than men with LBP only. Also the logistic analyses supported these findings: higher score of disability, fear-avoidance beliefs (physical activity and work), anxiety and depression were associated with an increased risk of having pain radiation to lower limbs, controlled for gender and age.

4.1 Disability

Our results are in the line with previous studies that found worse disability in individuals with the pain radiation compared to localized LBP (Konstantinou et al., 2013; Hicks et al., 2008). Other studies found the worst disability in those with present neurological signs, however, we did not focus on this issue (Hartvigsen et al., 2017; Kongsted et al., 2012; Walsh et al., 2009). No studies so far have compared gender in this matter, but from our results, we did not find men to rate their disability differently than women regardless the pain radiation, or men (women) with the pain radiation to have worse disability than men (women) with LBP only. However, our valid sample for RMDQ was small, only 59% and this may explain not differences to be found on the gender level, thus bigger sample may reveal differences. When gender and age was controlled we found out that a higher score in RMDQ increases the risk of being allocated to the group with pain radiation. Hill et al. (2011) found radiating leg pain in LBP to be associated with more severe disability, and our findings also support this contention. In healthcare practice, this knowledge should be taken into account when setting the treatment. If LBP patients experience pain in the lower limbs, they are more likely to rate themselves as more disabled.

4.2 Fear-avoidance Beliefs

Lack of studies have been done in the issue of FAB in LBP individuals with pain radiation. Kongsted et al. (2012) however, did a comparison of LBP only with LBP and pain radiation (and neurological signs) and found that the latter one had higher fear-avoidance of movement.
The same was found in our study, but only in fear-avoidance about physical activity. An interesting finding was, that women with pain radiation reported higher fear-avoidance about physical activity than women without the pain radiation, but this was not observed in men. No difference between groups in the FABQ work subscale was revealed, therefore it could be concluded that individuals with pain radiation are not limited more in the work environment than those with LBP only as it may be expected. Little can be discussed about individuals’ work, because no information about occupational background was known for research leaders.

Relationship between FAB and disability is a vicious circle in chronic pain. They are strongly correlated and in addition fear of movement has a great influence on movement patterns (Vlaeyen & Linton, 2000). Furthermore, both FABQ subscales are more predictive for disability than are intensity and duration of pain (Crombez et al. 1999). Our results showed higher FAB about physical activity in those with the pain radiation, and adding the knowledge about above relationship, practitioners should take this fact into account in treatment of patients with the pain radiation. Further, both FABQ subscales were found to increase the risk of belonging to the group with pain radiation. Fear of movement is a big limitation for performing various exercises within physical therapy. Exercises contribute to reduction in pain and disability in LBP patients (Maher, 2004), thus solve such a fear is the cornerstone for the successful treatment.

4.3 Anxiety and Depression
The real terms of depression should not be discussed here, because even though the differences between groups in depression were revealed, the mean score of this subscale in both groups referred to the normal state, thus no signs of depression could be concluded. On the other hand, the mean anxiety score of those with pain radiation already referred to a borderline of abnormal cases with presence of respective state, but to claim an anxiety here is debatable. In addition, higher score in both subscales of HADS increased the risk of belonging to the group with radiation of 35 to 50%. From our findings we can conclude, that patients with the pain radiation were more likely to have signs of developing anxiety than those with LBP only. For prevent further developing of anxiety, this finding should be considered in the treatment management of patients with LBP and pain radiation to lower limbs.
4.4 Pain Sensitivity

In healthy subjects (Binderup et al., 2010; Bek et al., 2002) as well as in CLBP (Imamura et al., 2013) women showed lower PPTs compared to men. The same was observed in our study, regardless the radiation women obtained lower PPTs in both, 6 sites PPTs and lower body PPTs, indicating worse pain sensitivity. Giesbrecht & Battie (2005) studied 6 sites PPTs of women with CLBP and found out that compared to healthy subjects they obtained lower PPTs. However, our study included only those with LBP, and women with LBP and radiation did not have lower PPTs compared to women with LBP only with similar findings also for men. The groups differed in 6 sites PPTs, but not in lower body PPTs. Therefore, individuals with pain radiation have higher pain sensitivity in general if we take 6 sites into account but are not more sensible in the regions of buttocks and knees. These results are in contrast to similar study of O’Neill et al. (2007) who applied pain stimuli on m. tibialis anterior bilaterally on LBP patients with lumbar disc herniation and found that PPTs were lower in these muscles compared to healthy subjects, but this observation might be due to neurological pain. Similar study was done by Giesecke et al. (2004) on CLBP and fibromyalgia patients. They monitored pain-related brain areas during the process of applying pressure pain stimuli which were applied distally from the region of pain, and found out that when the equal level of pressure was applied on both groups, they showed common patterns of neuronal activation in responsible cortical areas, but this pattern was not observed in healthy subjects. Further, they applied stimuli that induced equal pain in all subjects and each group, also controls, showed similar neuronal activation. In conclusion, there is an augmented central pain processing in patients with LBP and fibromyalgia (Giesecke et al, 2004). From our results we may hypothesize, that those with pain radiation could have even bigger amplification of central pain processing than those with localized LBP, but of course more studies are required to conclude this statement. Finally, increasing pain sensitivity was not associated in our sample with the risk of being allocated to the group with pain radiation, but the association may be revealed if bigger sample is recruited since the difference could be considered as a clinically relevant difference.

4.5 Method Discussion

Experiencing pain in the day of testing has been a positive contribution for this study regarding the fact, that individuals were asked about their psychological state by questionnaires. This may avoided bias about only remembering pain and days when experiencing pain, and thus give more appropriate answers about their disability, fear of movement etc. Furthermore, the current
pain could add to accuracy of individual pain sensitivity when measuring pressure pain thresholds.

This is a cross-sectional study so the cause and effect cannot be stated, only associations. Further, we were not familiar with all health-related information about individuals from the past (family disease, previous injuries, malignity, etc), but our sample is recruited from the big Epipain cohort, where 4 follow-ups were done and we used data from the very last one to invite patients to the clinical visit. This points on the fact, that we knew about some of the individuals’ pain-related information.

Even if well-known and validated questionnaires were used, people may understand questions differently (or not understand at all) and may can interpret them wrongly, which can bias the answers. Moreover, not every participant fulfilled each questionnaire correctly. The lowest amount of correctly fulfilled questionnaires was observed in RMDQ, where only 59% were valid and further used for the analyses.

Measuring PPTs with the algometer is a valid and widely used method to measure pain sensitivity, however some individuals may have a high fear of pain what makes them to push the stop button earlier than the actual pain occurs. All mentioned could impact the PPTs values. Further including data on physical activity could be interesting, because it is known that physical activity has an impact on PPTs values (Farasyn & Meeusen, 2003).

A great limitation of the study is, that we did not have information about present/absent neurological signs in lower limbs related to LBP and also no clinically set diagnoses, we only distinguished between having or not having a self-reported pain radiation to lower limbs. Thus, we could not further subgroup individuals based on the criteria according Schäfer et al (2009).

4.6 Future Studies

Future studies in this matter should recruit a larger sample of subjects to study also gender differences. For deeper understanding, information about occupational background and level of physical activity should be gathered. Finally, clinical tests should be performed for further subgrouping of individuals with pain radiation according the type and range of pain.
5 Conclusion

This study revealed that individuals with LBP and pain radiation to lower limbs had higher self-reported disability and fear-avoidance beliefs about physical activity than those with LBP only. Worse scores in anxiety and depression were found in individuals with LBP and pain radiation, however the mean score of these aspects did not refer to actual anxiety or depression. Further, those with pain radiation were more sensitive to pain in general, but were not more sensitive to pain in the areas of buttocks and knees than those with LBP only. Worse scores of self-reported disability, fear-avoidance beliefs about physical activity and work, anxiety and depression were associated with an increased risk of experiencing pain radiation to lower limbs in LBP. To study gender differences larger sample sizes are needed. Revealed differences from the current study should be taken into account in the treatment management of patients with LBP and pain radiation to lower limbs, regarding the fact, that they showed worse outcomes and therefore should receive a different treatment approach than those who have only LBP.
6 References


EPIPAIN 2016 – Smärta och kondition
En uppföljning av Smärta i Halland

EPIPAIN är ett forskningsprojekt om hälsa och eventuella erfarenheter av långvarig smärta i muskler och ledar. Bakgrunden till projektet är att det fortfarande saknas mycket kunskap kring varför vissa personer har en ökad risk att utveckla långvariga smärtor och annan ohälsa. Det övergripande syftet är att genom ny kunskap tidigare upptäcka och förhindra långvariga smärtstillstånd.

För tjugo år sedan var du en av 4000 personer i Halmstad och Laholm som slumpmässigt valdes ut till att delta i EPIPAIN och för några månader sedan besvarade du också vår uppföljande enkät. För att inte enbart basera våra resultat på frågeformulär gör vi nu en kompletterande klinisk uppföljning. Vi vill därför tillfråga dig om att delta in denna uppföljande studie. För att uppnå vårt syfte tillfrågas både personer med och utan erfarenheter av smärta.


Forskningsprojektet ersätter inte vanlig sjukvård. Om du har smärtor eller annan ohälsa som oroar dig bör du därför även söka din ordinarie läkare.
FoU Spenshult
Reumatologisk forskning och utveckling


Ansvarig forskningshuvudman för projektet är FoU Spenshult, som tidigare var en del av Spenshults sjukhus, men nu är en självständig stifhelsedriven forskningsinstitution. Verksamheten är belägen i anslutning till Vårdsentralen Bäckagård i Halmstad och har nära samarbete med Region Halland, patientorganisationen Reumatikerföreningen och flera universitet.

Om du har ytterligare frågor kring projektet är du välkommen att kontakta de projektansvariga forskarna Stefan Bergman eller Emma Haglund. FoU Spenshult är enligt Personuppgiftslagen ansvarig för dina personuppgifter. Du har rätt att få del av de uppgifter som vi har och även få rätt att eventuella fel. Kontaktperson för detta är vårt personuppgiftsombud Maria Andersson.

Halmstad 2016-09-27

Stefan Bergman  Emma Haglund  Maria Andersson
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Samtyckesblankett

**EPIPAIN 2016 – Smärta och kondition**

Jag har tagit del av den bifogade informationen om "Epipain 2016 – Smärta och kondition" och vet att jag när som helst kan avbryta mitt deltagande utan att behöva lämna någon förklaring.

Jag samtycker till att delta □ Ja □ Nej

________________________________________
Datum

________________________________________
Underskrift

________________________________________
Namnförtädeligande
Appendix 3

The Pain Mannequin with 18 body areas/regions (Bergman et al. 2001).
I have completed Bachelor Degree of Physiotherapy in Slovakia at the Slovak Medical University, Faculty of Healthcare and Master Degree in Exercise Biomedicine at the Halmstad University. My main interests are neurology and back pain.