LUND UNIVERSITY
Faculty of Medicine
Master programe in Medical Science

Thesis

2017-04-27
1-30 higher education credits

# Inter-rater reliability testing of Health surveillance under adverse ergonomics conditions – lower back

**Author:**
Physiotherapist
Linnea Wireklint

**Supervisor**
Dr Med Sc/ Ergonomist
Inger Arvidsson
Occupational and Environmental medicine, Lunds university

**Examiner**:
Professor in Physiotherapy
Gunvor Gard

## Abstract:

BACKGROUND: Low back pain is a significant cause of absence from work and early retirement with disability pension. The occupational health services need methods that are valid, reliable and cost-efficient to identify work places with high prevalence of work – related musculoskeletal disorders. Health surveillance under adverse ergonomics conditions (HECO lower back) is a new screening protocol for work – related low back pain, containing a screening part and diagnosing part.

OBJECTIVE: To perform inter – rater reliability test of the HECO lower back protocol and to measure the prevalence of diagnoses in two groups of workers with contrasting physical workload.

METHODS: Fifty-five females (26 assistant nurses and 29 desk clerks) were examined according to the HECO-lower back protocol by two examiners, and their observed agreement were analysed with Cohen´s Kappa (Ƙ). Further, the prevalence of diagnoses in the lower back among 30 assistant nurses and 30 desk clerks was calculated.

RESULTS: Moderate observed agreement of one or more diagnosed disorders (Ƙ 0.56). In specific diagnoses of HECO-lower back the observed agreement differed from moderate (Ƙ 0.49) to very good (Ƙ 1.0). There were only minor differences in prevalence of lower back diagnoses between the assistant nurses and the desk clerks (20% and 23% respectively).

CONCLUSIONS: The HECO – lower back protocol has, in this inter-rater reliability testing, shown moderate to very good observed agreement of the diagnoses lumbago, sciatica and lumbar nerve compression that makes it usable in the screening of low back pain in the workplace contexts of healthcare personnel and office workers.

Keywords: physical examination; OHS; back; lower back; HECO

# 1. Introduction

## 1.1 Low back pain

Pain in the lower back is one of the most common conditions managed in the primary care, and has been shown to lower quality of life among the patients (Dahm, Brurberg, Jamtvedt, & Hagen, 2010). Low back pain is defined as pain and discomfort, localized below the costal margin and above the inferior gluteal folds, with or without referred leg pain (Airaksinen et al., 2006). Low back pain is reported four times more frequently than mid-back pain (Schaafsma, Anema, & van der Beek, 2015). The mean overall prevalence of low back pain, which was defined as all prevalence regardless of prevalence period, was showed in a review to be 31,0%. In the same review the 1-year prevalence was 38%. The highest prevalence was among females and in those aged 40-80 (Hoy et al., 2012). The lifetime prevalence of low back pain has varied between different studies. In a systematic review article (Walker, 2000), of 30 articles of high quality, the variation was 11- 84%.

## 1.2 Work related low back pain

Low back pain is a significant cause of absence from work and early retirement with disability pension (Dahm, Brurberg, Jamtvedt, & Hagen, 2010). Nonspecific low back pain and sciatica are prevalent diseases among working adults and have become a worrying occupational health issue because it often affects continuation or resumption of employment. Disorders in the lower back are usually more prevalent among workers exposed to cumulative lumbar load such as manual handling, awkward postures of the trunk and whole-body vibrations (Petit, & Roquelaure, 2015). Women who have working assignments which includes walking and heavy lifting has a 30% higher risk of chronic low back pain (Heuch, Heuch, Hagen, & Zwart, 2017). In Sweden women report back problems to a greater extent than men according to Swedish work environment authority (report of work-related disorders, 2016). The 1-year prevalence of low back pain in the female dominated working group of nurses was 40-50% in a review (Hignett, 1996) and 77.1% in a Turkish study with 660 participating nurses (Karahan, Kav, Abbasoglu, & Dogan, 2009). The 1-year prevalence of low back pain in a study amongoffice workers, (with 1428 participants), was 34% (Janwantanakul, Pensri, Jiamjarasrangsri, & Sinsongsook, 2008) and in a study with 2588 participating computer workers 23% had experienced low back pain for more than 8 days during the last 12 months (Juul-Kristensen, Sogaard, Stroyer, & Jensen, 2004).

To prevent work-related musculoskeletal disorders there is a need for methods that can identify both workplaces where the number of musculoskeletal disorders is high as well as individuals who are in an early phase of developing disorders. The occupational health services need methods that are valid, reliable and cost-efficient (Jonker, Gustafsson, Rolander, Arvidsson, & Nordander, 2015).

### 1.3 Health surveillance in adverse ergonomics conditions – lower back (HECO – lower back)

A health surveillance protocol for work-related upper-extremity musculoskeletal disorders called Health Surveillance in Adverse Ergonomics Conditions (HECO), was created to be used in occupational health services as a cost-efficient, valid and reliable screening instrument. It was validated by comparing the results with a reference protocol (Jonkers, Gustavsson, Rolander, Arvidsson, & Nordander, 2015). A new HECO protocol has been created for screening for lower back pain (HECO – lower back, in swedish MEBA – ländrygg) by ergonomists working in the division for occupational and environmental health in Lund, Göteborg, Uppsala and Umeå. It is important to test the instrument for errors of measurement and make sure it is reliable and valid. This study will include the inter-rater reliability testing.

### 1.4 Aim of study

The aim of the study is to test the inter – rater reliability between two examiners using the HECO – lower back protocol among females in an occupational health setting. The other aim of the study is to examine any difference in prevalence of lower back diagnosis between two occupational groups with contrasting physical workload (assistant nurses, and desk clerks).

## 2. Material and Methods

### 2.1. Study population

During the autumn, winter and spring of 2015 and 2016 two occupational groups were examined with HECO – lower back. The two occupational groups, assistant nurses and desk clerks, were chosen for the study because of their contrasting workload. Walking, heavy lifting and strenuous work, which is common in the work of assistant nurses, are all known to higher the risk of chronic low back pain, compared to sedentary work, such as the work of desk clerks (Heuch, Heuch, Hagen, & Zwarts, 2017). Data were collected in female-dominated occupations to obtain the best conditions to investigate the concurrent inter-rater

reliability, because it is known that the working Swedish female population reports more work-related back disorders than men (Swedish work authority, 2016). The first group that was offered to participate in the study were 59 female assistant nurses from two wards at a hospital in the south of Sweden. In ward number one 18 female assistant nurses out of 18 was examined by examiner A for the prevalence part of the study. In ward number two 12 female assistant nurses out of 41 was examined by examiner A for the prevalence part of the study. The frequency of participation in the group was 51%. The assistant nurses´ mean age was 40 years, (range 21 – 66). The group had a mean of 10 years and 2 months of working with similar working assignments. Both groups of assistant nurses worked with patient handling in their daily work. The work sometimes included awkward working postures and heavy lifting when, for example, assisting the patients in mobilization, both in their beds and out of the bed, helping the patients with their personal hygiene and making the patients´ beds. The assistant nurses were examined continuously during autumn, winter and spring of 2015/2016.
The second group that was offered to participate included 50 female desk clerks, working for the southern county of Sweden. 30 out of the 50 desk clerks were examined, which makes the frequency of participation 60%. Their mean age was 39 years, (range 27 – 66). The group had a mean of 17 years and 6 months of working with similar working assignments. The desk clerks had desk jobs, working with computers. They had adjustable desks and could work both sitting and standing. All desk clerks were examined in two days in the spring of 2016. Because of the working schedules of the participants and schedule of the study, 55 of the 60 examined participants for the prevalence part of the study were examined by examiner A and examiner B and included in the inter-reliability part of the study. All 60 were included in the prevalence part of the study and examined by examiner A.

## 2.2 Examination procedure

Fifty – five women were examined twice in one working day, with a four-hour time interval. The choice of using a four – hour interval was made to ensure that possible pain that may have been provoked by the first examination should have eased to the second examination. This procedure was created to give as correct results as possible and at the same time provoke as little amount of pain in the lower back of the examined participants. The examinations were conducted using the HECO – lower back protocol by three different examiners during the study. Examiner A was a physiotherapist with limited experience in occupational health, but with several years of working experience as a physiotherapist. Examiner B1 and B2 were experienced occupational healthcare physiotherapists. All three examiners had the same

amount of training, at a practicing seminar, using the HECO – lower back protocol. The results of examiner B1 and B2 were put together as one examiner, Examiner B. Haft of the participants were randomly examined by examiner number A first and half were randomly examined by examiner B1 or B2 first.
The three examiners were blinded to each other's findings. During the examination, the results were noted manually on a form by the examiners themselves. The examined were instructed not to provide the second examiner with any information regarding the first examination. The examiners did not discuss their findings with the examined during the examination.

### 2.2.1 HECO – lower back

The HECO – lower back protocol consisted of two parts, a screening part and a more detailed physical examination part. The detailed physical examination part was only performed if the screening part indicated symptoms the last seven days or during active basic motions in the examination.

#### 2.2.1.1 The screening part

The screening part consisted of interview questions about symptoms and a basic physical examination. The examined were asked about perceived symptoms in the lower back during the past 7 days and the past 12 months according to the Nordic Questionnaire (Kuorinka, Jonsson, Kilbom, Vinterberg, & Biering-Sorensen, 1987). The symptoms that were asked for, in the interview questions, were pain and discomfort, its frequency and intensity the last 7 days. The basic physical examination included a simple examination of mobility and pain during mobility testing of the lower back (i.e. flexion, extension, lateral flexion and rotation of the back).
If the examined reported pain, radiating or not, weakness, tingling or numbness during the last 7 days, or if pain during mobility or pronounced reduced mobility was elicited in the basic examination, or in case of doubt, the examiner continued with the detailed physical examination. Otherwise only the screening part of HECO – lower back was performed (Figure 1). The screening part took about 10 minutes to perform.

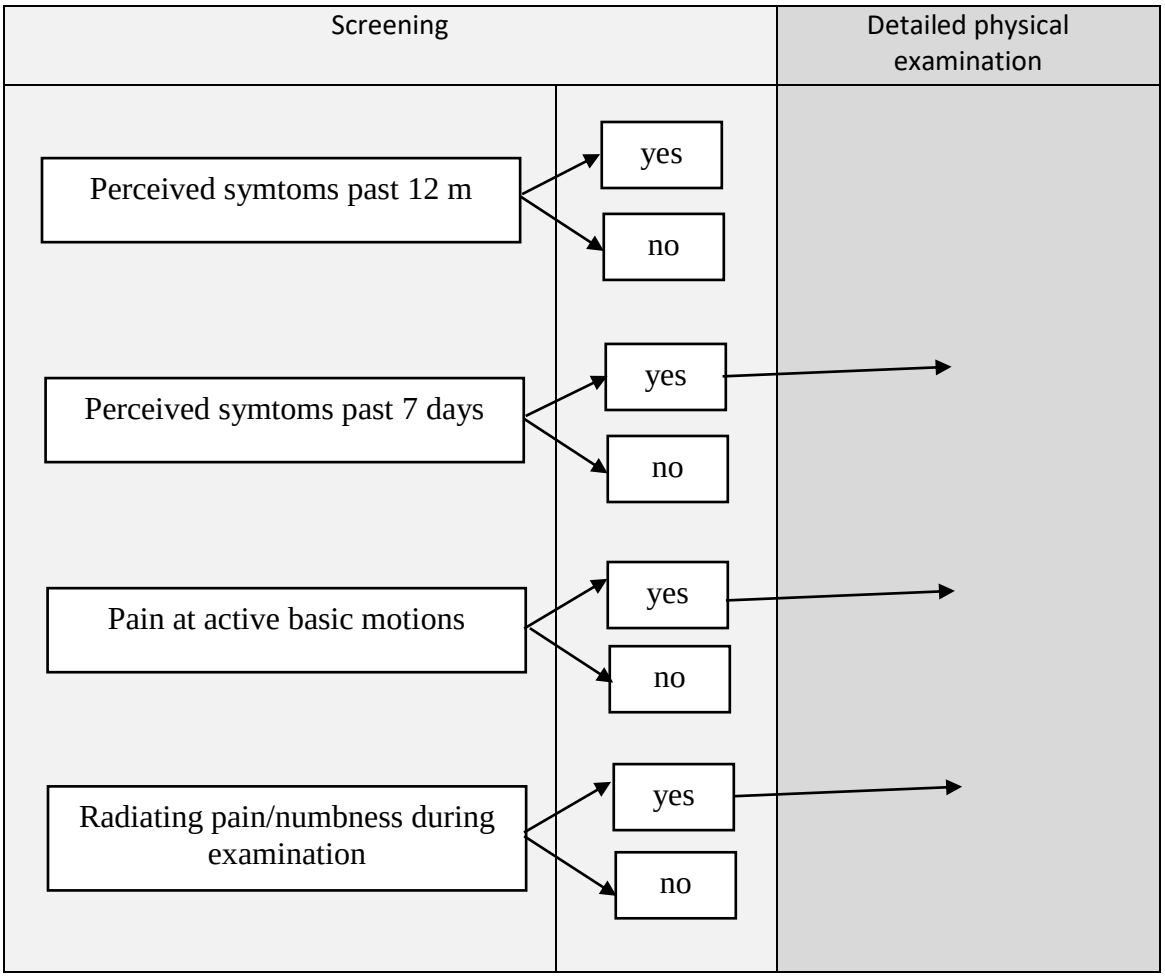


Figure 1. Flow chart for screening procedure in HECO lower back. The figure is modified from Jonker et al 2015.

2.2.1.2 The detailed physical examination part

The detailed physical examination consisted of further questions about ongoing symptoms at the day of the examination. A modified Schober testing (Williams, Binkley, Bloch, Goldsmith, & Minuk, 1993) was made if the examination of flexion mobility was negative in the screening part to ensure that the examined had an adequate mobility. A neurological examination of muscle strength, sensibility and nerve provocation was also made. The nerve provocation was made in form of the slump test (Majlesi, Togay, Unalan, & Toprak, 2008). For those who were examined with the detailed examination, an assessment of symptoms was made and compared to the criteria for the three predefined diagnoses (Table 1).

Table 1. Criteria for three predefined diagnoses in the lower back

| Diagnosis | Criteria |
|---|---|
| One or more diagnosed disorder | Receiving one or more of the lower – back diagnoses defined below. |
| Lumbago | Lower back pain the day of testing.<br>Motion induced pain (in at least one out of six directions).<br>Limited mobility in at least one out of six directions or in Modified Schober testing (Bardini, King, & Maher, 2017, Suzuki et al., 2016). |
| Sciatica | Radiating pain from lower back (positive Slump test) to one or both legs, past the knee.<br>Radiating pain, tingling or numbness in one or both legs the last seven days (Bardini, King, & Maher, 2017, Allegri et al, 2016) |
| Lumbar nerve root compression | Radiating pain from lower back to one or both legs within a specific dermatome (L4, L5, S1) in Slump test or anamnesis including pain, tingling or numbness past the knee on the front side of the leg (L4 – dermatome) the day of testing.<br>Limited strength or sensibility according to dermatome (L4, L5, S1) (Bardini, King, & Maher, 2017, Allegri et al., 2016) |

Note: All symptoms and findings were required

## 2.4 Data analysis

The observed agreement, Inter-rater reliability, of examiner one and two was calculated with Cohen´s kappa analysis (Ƙ) for categorical variables (Streiner, 2008). Kappa analysis is a measurement in concurrence of two categorical variables. Kappa is declared as a decimal numeral and can be 1 at the highest (Björk, 2010). To assess the kappa values Altman´s criteria was used. According to these criteria 0.0-0.02 is considered to be poor agreement, 0.21-0.4 is fair, 0.41-0.6 is moderate, 0.61-0.8 is good and 0.81-1.0 is a very good agreement. Kappa can only be counted when one of the examiners have diagnosed at least one of the participants with one of the specific diagnose that is included in HECO – lower back. (Altman, 1991). All statistical calculations were performed using SPSS (Chicago, IL, USA, version 24).

### 2.5 Ethic Consideration

Written informed consent was obtained by the participants of the project. They were told that they could refuse participation and withdraw from the data sampling anytime they wanted. Oral and written information explaining the purpose of the project was given to every participant before entering.

Because of the thorough examination of the lower back there was a risk that the examination would induce lower back pain to the participants during or after the measurements. The participants were informed about this before entering the study. There were a four – hour interval between examination one and two to enable the possible back pain the first examination had caused the participants, to ease.

The first group of assistant nurses, that were examined, worked at the same ward as the author. This could have had an impact on the assistant nurses in a way that they felt obligated to participate in the study.

The collected data were coded. The data was locked in during the writing of the master project and will be destroyed after the master thesis has been approved to secure the confidentiality of the participants (Kjellström, 2012)

## 3. Results

### 3.1 Inter-rater reliability testing

#### 3.1.1 Screening procedure

During the screening part of the HECO – lower back, examiner A and B had a very good observed agreement to the question “Have you experienced any pain or discomfort the last 12 months”, Kappa 0.92. The observed agreement to the question “Have you felt tired, felt any weakness or stiffness in the lower back the last 7 days” was very good, Kappa 0.81. To the question “Have you experienced any radiating pain, tingling or numbness in one or both legs the last 7 days” the observed agreement was very good, Kappa 0.81. Examiner A and B had a good observer agreement to the question “Have you experienced any pain or discomfort the last 7 days”, Kappa 0.67 (Table 2).

Table 2. Observed agreement of question in screening part of HECO – lower back

| Question | Observed agreement K |
|---|---|
| Have you experienced any pain or discomfort the last 12 months. | 0.92 |
| Have you felt tired, felt any weakness or stiffness in the lower back the last 7 days. | 0.81 |
| Have you experienced any radiating pain, tingling or numbness in one or both legs the last 7 days. | 0.81 |
| Have you experienced any pain or discomfort the last 7 days. | 0.67 |

The results for observed agreement in the part of pain at active basic motion varied between fair to moderate (Table 3). Examiner A did detailed physical examinations in 39 out of the 55 participants, in comparison to examiner B who did 37 out of 55. They had a moderate observed agreement (Kappa 0.58) of going further with the detailed physical examinations after screening the participants.

Table 3. Pain in active basic motion

| Pain in active basic motion | Observed agreement K |
|---|---|
| Flexion | 0.31 |
| Extension | 0.58 |
| Lateralflexion right side | 0.24 |
| Lateralflexion left side | 0.47 |
| Rotation right side | -0.53[a] |
| Rotation left side | 0.29 |

Note: [a] Examiner A and B had no matching positive observation in rotation right side

### 3.1.2 Specific diagnoses of the lower back

Both the statistical analysis of the diagnosis “Lumbar nerve root compression right side” and of the diagnosis “Lumbar nerve root compression left side” gave a very good observer agreement with Kappa 1.0. There was a good observed agreement in the diagnosis “Sciatica right side” between examiner A and B, Kappa 0.66. “One or more diagnosed disorder”, which includes all diagnoses, the diagnosis “Lumbago” and the diagnosis “Sciatica left side” gave moderate observed agreement between examiner A and B. Kappa varying from 0.49-0.56 (Table 4).

Table 4. Inter – rater reliability testing of HECO – lower back. Examination of 55 female workers by examiner A and B.

| | Examiner A/ Examiner B[a] | | | | | |
|---|---|---|---|---|---|---|
| Diagnosis | -/- | -/+ | +/+ | +/- | Percentage agreement | Κ |
| One or more diagnosed disorder | 37 | 5 | 9 | 4 | 84% | 0.56 |
| Lumbago | 40 | 4 | 7 | 4 | 85% | 0.55 |
| Sciatica right side | 53 | 0 | 1 | 1 | 98% | 0.66 |
| Sciatica left side | 52 | 2 | 1 | 0 | 96% | 0.49 |
| Lumbar nerve root compression right side | 54 | 0 | 1 | 0 | 100% | 1.0 |
| Lumbar nerve root compression left side | 54 | 0 | 1 | 0 | 100% | 1.0 |

Note: Observed agreement in percentage and the kappa coefficients (Κ) are given. [a] - /-, no diagnosis with either examiner; -/+, no diagnosis with examiner A, positive diagnosis with the examiner B; +/+, positive diagnosis with both examiners; +/-, positive diagnosis both examiner A, negative diagnosis with examiner B.

### 3.1.3 Comparison in observed agreement – examiner A, B1, and B2

The observed agreement between examiner A and examiner B1 is moderate in "any diagnosis" and in three specific diagnoses. In "Lumbar nerve root compression left side" the observed agreement was very good. Kappa could not be counted in two of the diagnoses. The observed agreement between examiner A and examiner B2 is moderate in "any diagnosis" and in one specific diagnosis. There was very good observed agreement in two specific diagnoses. Kappa could not be counted in two of the diagnoses (Table 5).

Table 5. Observed agreement between examiner A and examiner B1/examiner B2

| Examiner | | | B1 Κ | B2 Κ |
|---|---|---|---|---|
| A | Diagnosis | One or more diagnosed disorder | 0.54 | 0.59 |
| | | Lumbago | 0.66 | 0.45 |
| | | Sciatica right side | .[a] | 1.0 |
| | | Sciatica left side | 0.65 | .[a] |
| | | Lumbar nerve root compression right side | .[a] | 1.0 |
| | | Lumbar nerve root compression left side | 1.0 | .[a] |

Note:[a] Kappa value can only be calculated in those cases where one or both of the examiners diagnosed one or more of the participants with one of the specific diagnosis in HECO – lower back.

3.2 Prevalence

3.2.1 Prevalence in two occupational groups

In the screening part of the HECO – lower back 90% of the assistant nurses and 83% of the desk clerks gave positive answers to the question “Have you experienced any pain or discomfort the last 12 months”. 50% of the assistant nurses and 56% of the desk clerks gave positive answers to the question “Have you experienced any pain or discomfort the last 7 days”. In the group of assistant nurses 20% were diagnosed with “one or more diagnosed disorders”, compared to 23% of the desk clerks. The most common specific diagnosis, in both groups was “Lumbago”, which 13 % of the assistant nurses and 23% of the desk clerks received. One in each group was diagnosed with “Sciatica right side”.

Out of the fifty-five participants, only one was diagnosed with “Lumbar nerve root compression right side” (in the group of desk clerks), No one was diagnosed with “Lumbar nerve root compression left side”, in the group of assistant nurses, and “Sciatica left side”, in the group of assistant nurses.

# 4. Discussion

4.1 Summary

The questions about symptoms in the screening part of the protocol received very good observed agreement in comparison to the poor to fair results of the pain in active motions. The observed agreement of the specific diagnoses was very good in two diagnoses, good in one diagnose and moderate in two.

The prevalence of diagnoses was similar in the groups, 20% and 23% in “one or more diagnosed disorders”. The prevalence of pain and discomfort the last 12 months, 90% and 83%, and the last 7 days, 50% and 57%, were also quite similar.

4.2 Methodological discussion

4.2.1 Examination procedure

The method of inter-rater reliability testing is in some literature that the participants are examined by the two or more examiners as soon after one another as possible to ensure that the participant isn´t exposed to anything that could change the results in between examinations (Tidstrand &, Horneij, 2009, Jensen, Callesen, Nielsen, & Ellingsen, 2013). A four – hour interval was used in this study to lower the risk that the probable pain caused in the first examination should affect the results in the second examination. The fact that the

participants worked during the four hours between the examinations created a possible risk that they developed pain or that their pain got worse during the day because of the workload. To avoid this compromising the inter – rater reliability testing half was measured by examiner A during the afternoon and half was examined by examiner B during the afternoon. If the examinations would have been done with longer intervals, say days, to measure at the same time of the day, there would be a risk that the participants' leisure activities, would affect the results. Gardening, exercising or even taking care of grand children could have a negative effect on the lower back. The participants leisure activities could induce lower back pain in the participants and therefore it can´t be said that the participants leisure activities hasn´t affected the study. There could also be a problem of exposure if one examiner should have examined a participant on a Monday, directly after a weekend rest, and the other later in the week when the participant would have worked for a couple of days and perhaps show more positive results.

### 4.2.2 Number of examiners

In the study, there was three different persons who examined the participants. The fact that examiner B consisted of two different persons (Examiner B1 and examiner B2) could weaken the inter-reliability testing if the observed agreement between examiner A and B1 differs from the observed agreement of examiner A and B2. Except from the "any diagnosis", with moderate observed agreement for both examiner B1, (kappa 0.54), and B2, (kappa 0.59), in comparison to examiner A, there is only one diagnosis, "Lumbago", that has a calculated observed agreement for both examiner B1 and B2. The observed agreement between examiner A and B1, was good (kappa 0.66) and between examiner A and B2 it was moderate (kappa 0.49). In the other diagnoses the observed agreement was quite similar, good to very good for both examiner B1 and B2, in comparison to examiner A, which strengthens the fact that the number of examiners didn't affect the inter – rater reliability testing.

### 4.2.3 Choice of groups to examine

The desk clerks, who participated in this study had a sedentary work. In an article of Hartvigsen, Leboeuf-Yde, Lings, & Corder, (2000), it was said that sedentary work has not shown to be a risk factor for low back pain. A contradicting fact is given in a three-year prospective study of juvenile low back pain, showing results that sitting in school provokes low back pain in adolescents (Sjolie, 2004). The participating group of assistant nurses were, prior to the study, believed to have higher prevalence in the diagnoses of HECO - lower back

because of their strenuous work load (Cinar-Medeni, Elbasan, & Duzgun, 2016). A review of Roffey, Wai, Bishop, Kwon, and Dagenaise (2010), that contradicts these prior expectations, found that causal association between workplace manual handling or assisting patients, which is common in the work assignments of assistant nurses, and low back pain, was not supported. The assistant nurses working in a university hospital might not be the group of assistant nurses who has the heaviest work load which could explain the small number of diagnoses in low back pain. According to the statistics of Swedish work environment authority there were 122 reported working injuries due to ergonomic work load in the specialized health care in the year of 2016, in comparison to 207 in long time care facilities for elderly the same year (Swedish work environment authority 2016). Assistant nurses working in long time care facility and in the home healthcare have shown to have high prevalence of back pain (Cohen-Mansfield, Culpepper, & Carter, 1996).

## 4.3 Discussion of results

### 4.3.1 Inter – rater reliability testing

During the screening part of the HECO – lower back protocol there were good to very good observed agreement of the question about symptoms (pain, radiating pain, tiredness, weakness, stiffness, tingling and numbness) from the lower back the last 7 days. Which is important because it is one of the items that leads to the detailed physical examination which could lead to a diagnosis.

The observed agreement of examiner A and B in the specific diagnoses was moderate in two diagnoses, good in one and very good in two, which are all in the better half of the Altman´s assessment of kappa scale (Altman, 1991). Two diagnoses that got very good observed agreement, lumbar nerve root compression right and left side has only been diagnosed in one person per diagnosis. It would be interesting to test it in a group with higher prevalence of the specific diagnoses.

The observed agreement of pain at active motions showed to be the weaker point of the HECO – lower back reliability with results that were poor to moderate. This can explain why the observed agreement for going further with the detailed physical examination was moderate (kappa 0.58), when pain at active motions leads further to a detailed physical examination. In further education, done by the environmental and occupational medicine of the occupational health services, it is important to specify the questions around the pain in active motion so that it is clear for the examiners how the question should be asked and for the participant what is asked for in this part of the protocol.

One of the persons who Examiner B made a detailed physical examination on, and Examiner A did not, received the diagnose Lumbago. The examined participant gave contradicting answers to Examiner A and B to the question "Have you experienced any pain or discomfort the last 7 days", where the answer yes leads to a detailed physical examination and the answer no does not. This shows the sensitivity of the questions in the screening part of the instrument. Missing out on one positive answer can lead to missing out of a diagnosis.
This study had results of observed agreement of the specific diagnoses of HECO – lower back with Kappa-values moderate to very good (0.49-1.0). The percentage of observed agreement was 84% - 100% in this study. In comparison to an inter-rater reliability testing of three standardized functional tests in patients with low back pain, (Tidstrand, & Horneij, 2009), where the observed agreement was good to very good in five out of the six testings, Kappa varying from 0.61-1.0, and the last moderate, Kappa 0.47, this study has equivalent results but with the advantage of the 55 participants in comparison to 19 in Tidstrand & Horneij.
In the validation study by Jonker et al (2009) of the observed agreement between HECO – protocol (the original for neck/shoulder diagnoses) and a standard protocol, the observed agreement in percentage varied 90%-100%, compared to this study that had observed agreement in percentage varying 84%-100%.

### 4.3.2 Prevalence of the two groups

The prevalence of the HECO-lower back diagnoses was quite similar in the occupational groups, assistant nurses and desk clerks, 20% and 23% in "one or more diagnosed disorders". The prevalence of pain and discomfort the last 12 months, 90% and 83%, and the last 7 days, 50% and 57%, were also quite similar. The prevalence of these occupational groups varies in literature. A Turkish study shows results of 77,1% prevalence the last 12 months in nurses (n=660) (Karahan, Kav, Abbasoglu, & Dogan, 2009). In a German comparative prevalence study of low back pain and lumbago-sciatica in nurses (n=2176), with a reference group of clerks (n=1176), the point prevalence in general low back pain was shown to be 61,2% in the group of nurses respectively 41.5% in the groups of clerks. In the same study the point prevalence in lumbago-sciatica in the two groups was 13.4% respectively 4.6% (Hofmann, Stössel, Michaelis, Nübling, & Siegel, 2002). The 12 months prevalence of low back pain in a study of self-reported musculoskeletal symptoms among office workers, (with 1428 participants), was 34% (Janwantanakul, Pensri, Jiamjarasrangsri, & Sinsongsook, 2008). Another study reported that 23% out of 2588 responding computer workers had experienced

low back pain for more than 8 days during the last 12 months (Juul-Kristensen, Sogaard, Stroyer, & Jensen, 2004).

To be able to draw a conclusion about the results of prevalence of the two groups there should be a high examination rate of the work place/population/group. In first examined group, the whole group of assistant nurses at ward number one was examined (18 out of 18), whilst at number two 11 of 41 assistant nurses were examined. The low rate of examination in ward number two can be explained first with a low interest in the working group and second difficulties to administrate two examinations in the same day because of scheduling of the assistant nurses in both the ward and in the operation room. In group number two 30 desk clerks (office workers) out of 50 were examined. The fact that the dropout rate is quite high in both groups lowers the chance to make any kind of statement about the results. The two groups are quite small which gives every diagnosis a large impact, one person with one diagnosis equals 3%. There is a risk that those who applied for the study, in ward number two or in the group of desk clerks, were those with low back pain and therefore wanted to be part of the study of that reason. Though the large dropout rate in both groups could have reduced the differences between the groups, and therefor reduced the risk that those who applied were those with low back pain. Because of the low participation rates the results must be interpreted with caution.

### 4.4 Practical implications

The HECO – lower back protocol could be useful for screening work places and identify work environments that could be a hazard in ergonomic sense for the lower back of the employees. It is important to remember that the HECO – lower back protocol was not developed to be used in a clinical setting for diagnostic purposes and to determine which physiotherapeutic treatment to use. It is a screening protocol that can be used to build a bank of knowledge about larger numbers occupational groups and to map out which work places has high prevalence of musculoskeletal disorders in the lower back.

### 4.5 Further research

There is a need for further inter – rater reliability testing on different workgroups, different work environment and different work sectors to secure the generalizability of HECO – lower back. Further research in prevalence in the two researched groups, assistant nurses and desk clerks, with as small dropout rate as possible, is needed.

## 5. Conclusion

The HECO – lower back protocol has, in this inter-rater reliability testing, shown moderate to very good observed agreement of the diagnoses lumbago, sciatica and lumbar nerve compression that makes it usable in the screening of low back pain in the workplace contexts of healthcare personnel and office workers.

## 6. Acknowledgements

I would like to thank all of the participating assistant nurses and desk clerks who made this study possible.

References

Airaksinen, O., Brox, J.I., Cedraschi, C., Hildebrandt, J., Klaber-Moffett, J., Kovacs, F., Mannion, A.F., Reis, S., Staal, J.B., Ursin, H., Zanoli, G., & COST B13 Working Group on Guidelines for Chronic Low Back Pain. (2006). Chapter 4 European guidelines for the management of chronic nonspecific low back pain. *European spine journal, 15*(2), 192-300. Doi: 10.1007/s00586-006-1072-1

Allegri, M., Montella, S., Salici, F., Valente, A., Marchesini, M., Compagnone, C., Baciarello, M., Manferdini M.E., & Fanelli, G. (2016). Mechanisms of low back pain: a guide for diagnosis and therapy. *F1000Research, 5,* F1000 Faculty Rev–1530. http://doi.org.ludwig.lub.lu.se/10.12688/f1000research.8105.2

Altman, D.G. (1991). *Practical statistics for medical research*. London: Chapman & Hall

Bardini, L.D., King, P., & Maher, C.G. (2017). Diagnostic triage for low back pain: a practical approach for primary care. *The Medical journal of Australia, 206*(6), 268-273. Doi: 10.5694/mja16.00828

Björk, J. (2010). *Praktisk statistik för medicin och hälsa*. (2 uppl.) Stockholm: Liber

Cinar-Medeni, O., Elbasan, B., & Duzgun, I. (2016). Low back pain prevalence in healthcare professionals and identification of factors affecting low back pain. *Journal of back musculoskeletal rehabilitation, vol. Preprint, no. Preprint,* 1-9. Doi: 10.3233/BMR-160571

Cohen-Mansfield, J., Culpepper, W.J., & Carter, P. (1996). Nursing staff back injuries. Prevalence and costs in long term care facilities. *American Association of occupational health nurses journal, 44,* 9-17. Doi: 10.1177/216507999604400106

Dahm, K.T., Brurberg, K.G., Jamtvedt, G., & Hagen, K.B. (2010). Advice to rest in bed versus advice to stay active for acute low-back pain and sciatica (review*). Cochrane database systematic review, 16*(6), 1-67. Doi: 10.1002/14651858.CD007612.pub2.

Guo, H.R. (2002). Working hours spent on repeated activities and prevalence back pain. *Occupational & Environment Medicine, 59,* 680-688. Doi: 10.1136/oem.59.10.680.

Hartvigsen, J., Leboeuf-Yde, C., Lings, S., & Corder, E. (2000). Is sitting-while-at-work associated with low back pain? A systematic, critical literature review. *Scandinavian Journal Of Public Health, 28*(3), 230-239. Doi: https://doi.org/10.1093/ptj/73.1.26

Heuch, I., Heuch, I., Hagen, K., & Zwart, J-A. (2017). Physical activity level at work and risk of chronic low back pain: A follow-up in the Nord-Trøndelag Health Study. *PLoS ONE, 12*(4), e0175086. https://doi.org/10.1371/journal.pone.0175086

Hignett, S. (1996). Work-related back pain in nurses. *Journal of Advanced Nursing, 23*(6), 1238-1246

Hofmann, F., Stössel, U., Michaelis, M., Nübling, M., & Siegel, A. (2002). Low back pain and lumbago–sciatica in nurses and a reference group of clerks: results of a comparative prevalence study in Germany. *Int Arch Occup Environ Health, 75*(7), 484-490. Doi:10.1007/s00420-002-0332-6

Hoy, D., Bain, C., Williams, G., March, L., Brooks, P., Blyth, F., Woolf, A., Vos, T., & Buchbinder, R. (2012). A systematic review of the global prevalence of low back pain. *Arthritis & rheumatism, 64*(6), 2028-2037. Doi: 10.1002/art.34347.

Janwantanakul P, Pensri P, Jiamjarasrangsri W, & Sinsongsook T. (2008). Prevalence of self-reported musculoskeletal symptoms among office workers. *Occup Med, 58,*436–8. doi: 10.1093/occmed/kqn072.

Jensen, O.K., Callesen, J., Nielsen, M.G., & Ellingsen, T. (2013). Reproducibility of tender point examination in chronic low back pain patients as measured by intrarater and inter-rater reliability and agreement: a validation study. *BM J Open, 3*(2), pii: e002532. Doi: 10.1136/bmjopen-2012-002532

Jonker, D., Gustafsson, E., Rolander, B., Arvidsson, I., & Nordander, C. (2015). Health surveillance under adverse ergonomics conditions – validity of a screening method adapted for the occupational health services. *Ergonomics, 58*(9), 1519-1528. Doi: 10.1080/00140139.2015.1019575

Juul-Kristensen, B., Sogaard, K., Stroyer, J., & Jensen, C. (2004). Computer users' risk factors for developing shoulder, elbow and back symptoms. *Scand J Work Environ Health, 30*, 390–8. Doi:10.5271/sjweh.827

Karahan, A., Kav, S., Abbasoglu, A., & Dogan, N. (2009). Low back pain: prevalence and associated risk factors among hospital staff. *Journal of Advanced Nursing, 65*, 516–524. Doi:10.1111/j.1365-2648.2008.04905.x

Kjellström, S. (2012). Forskningsetik. In M Henricsson (Ed), *Vetenskaplig teori och metod – från idé till examination inom omvårdnad.* (4th ed, p.69-90). Lund: Studentlitteratur

Kuorinka, I., Jonsson, B., Kilbom, A., Vinterberg, H., & Biering-Sorensen, F. (1987). Standardised Nordic Questionnaires for the Analysis of Musculoskeletal Symptoms. *Applied Ergonomics, 18* (3), 233–237. Doi:10.1016/0003-6870(87)90010-X.

Majlesi, J., Togay, H., Unalan, H., & Toprak, S. (2008). The sensitivity and specificity of the slump and the straight leg raise tests in patients with lumbar disc herniation. *Journal of Clinical Rheumatolgy, 14*(2), 87-91. Doi 10.1097/RHU.0b013e31816b2f99

Miranda, H., Viikari-Juntura, E., Punnett, L., & Riihimäki, H. (2008). Occupational loading, health behavior and sleep disturbance as predictors of low-back pain. *Scandinavian journal of work, environment & health, 34*(6), 411-419. Doi: 10.5271/sjweh.1290

Nordander, C., Ohlsson, K., Åkesson, I., Arvidsson, I., Balogh, I., Hansson, G.A., Strömberg, U., Rittner, R., & Skerfving, S. (2009). Risk of Musculoskeletal Disorders Among Females

and Males in Repetitive/Constrained Work. *Ergonomics, 52* (10), 1226–1239. doi:10.1080/00140130903056071.

Petit, A., & Roquelaure, Y. (2015). Low back pain, intervertebral disc and occupational diseases. *International journal of occupational safety and ergonomics, 21*(1), 15-19. Doi: 10.1080/10803548.2015.1017940.

Roffey, D.M., Wai, E.K., Bishop, P., Kwon, B.K., & Dagenaise, S. (2010). Casual assessment of workplace manual handling or assisting patients and low back pain: results of a systematic review. *Spine journal, 10*(7),639-51. Doi: 10.1016/j.spinee.2010.04.028

Shaafsma, F.G., Anema, J.P., & van der Beek, A.J. (2015). Back pain: Prevention and management in the workplace. *Best practice research clinical rheumatology,.29*(3), 483-494. Doi: 10.1016/j.berh.2015.04.028

Sjolie, A.N. (2004). Persistence and change in nonspecific low back pain among adolescents: a 3-year prospective study. *Spine, 29*(21), 2452-7.

Streiner, D., & Norman, G. (2008). Health measurement scales – a practical guide to their development and use 4th edition. Oxford: Oxford university press

Suzuki, H., Kanchiku, T., Imajo, Y., Yoshida, Y., Nishida, N., & Taguchi, T. (2016). Diagnosis and Characters of Non-Specific Low Back Pain in Japan: The Yamaguchi Low Back Pain Study. *PLoS ONE 11*(8): 1-13. Doi:10.1371/journal.pone.0160454

Swedish work environment authority. (2016). Report of work-related disorders 2016, published October 2016, pages 5-167.

Tidstrand, J., & Horneij, E. (2009). Inter-rater reliability of three standardized functional tests in patients with low back pain. *BMC Musculoskeletal disorders, 10*(58), 1-8. Doi: 10.1186/1471-2474-10-58.

Walker, B.F. (2000) The prevalence of low back pain: a systematic review of the literature from 1966 to 1998. *Journal of Spinal Disorders, 13*(3), 205-17.

William, R., Binkley, J., Bloch, R., Goldsmith, C. H., & Minuk, T. (1993). Reliability of the modified-modified Schöber and double inclinometer methods of measuring lumbar flexion and extension. *Physical therapy*, *73*(1), 26-37.