

Study protocol

Open Access

Development of a screening tool predicting the transition from acute to chronic low back pain for patients in a GP setting: Protocol of a multinational prospective cohort study

Markus Melloh¹, Nikolaus Aebli², Achim Elfering*³, Christoph Röder⁴, Thomas Zweig⁴, Thomas Barz⁵, Peter Herbison⁶, Paul Hendrick⁷, Suraj Bajracharya¹, Kirsten Stout¹ and Jean-Claude Theis¹

Address: ¹Section of Orthopaedic Surgery, Department of Medical and Surgical Sciences, Dunedin School of Medicine, University of Otago, Private Bag 1921, Dunedin 9054, New Zealand, ²Department of Surgery and Orthopaedics, Swiss Paraplegic Centre, Guido A. Zäch Strasse 1, 6207 Nottwil, Switzerland, ³Department of Work and Organizational Psychology, Institute for Psychology, University of Berne, Muesmattstrasse 45, 3000 Berne 9, Switzerland, ⁴MEM Research Center for Orthopaedic Surgery, University of Berne, Stauffacherstrasse 78, 3014 Berne, Switzerland, ⁵Department of Orthopaedic Surgery, Asklepios Klinikum Uckermark, Auguststrasse 23, 16303 Schwedt/Oder, Germany, ⁶Department of Preventive and Social Medicine, Dunedin School of Medicine, University of Otago, PO Box 913, Dunedin 9054, New Zealand and ⁷School of Physiotherapy, University of Otago, PO Box 56, Dunedin 9054, New Zealand

Email: Markus Melloh - markus.melloh@otago.ac.nz; Nikolaus Aebli - naebli@gmail.com; Achim Elfering* - achim.elfering@psy.unibe.ch; Christoph Röder - christoph.roeder@MEMcenter.unibe.ch; Thomas Zweig - thomas.zweig@MEMcenter.unibe.ch; Thomas Barz - t.barz@asklepios.com; Peter Herbison - peter.herbison@otago.ac.nz; Paul Hendrick - paul.hendrick@otago.ac.nz; Suraj Bajracharya - suraj.bajracharya@otago.ac.nz; Kirsten Stout - kirsten.stout@otago.ac.nz; Jean-Claude Theis - jean-claude.theis@stonebow.otago.ac.nz

* Corresponding author

Published: 19 December 2008

Received: 24 November 2008

BMC Musculoskeletal Disorders 2008, 9:167 doi:10.1186/1471-2474-9-167

Accepted: 19 December 2008

This article is available from: <http://www.biomedcentral.com/1471-2474/9/167>

© 2008 Melloh et al; licensee BioMed Central Ltd.

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/2.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Abstract

Background: Low back pain (LBP) is by far the most prevalent and costly musculoskeletal problem in our society today. Following the recommendations of the Multinational Musculoskeletal Inception Cohort Study (MMICS) Statement, our study aims to define outcome assessment tools for patients with acute LBP and the time point at which chronic LBP becomes manifest and to identify patient characteristics which increase the risk of chronicity.

Methods: Patients with acute LBP will be recruited from clinics of general practitioners (GPs) in New Zealand (NZ) and Switzerland (CH). They will be assessed by postal survey at baseline and at 3, 6, 12 weeks and 6 months follow-up. Primary outcome will be disability as measured by the Oswestry Disability Index (ODI); key secondary endpoints will be general health as measured by the acute SF-12 and pain as measured on the Visual Analogue Scale (VAS). A subgroup analysis of different assessment instruments and baseline characteristics will be performed using multiple linear regression models.

This study aims to examine

1. Which biomedical, psychological, social, and occupational outcome assessment tools are identifiers for the transition from acute to chronic LBP and at which time point this transition becomes manifest

2. Which psychosocial and occupational baseline characteristics like work status and period of work absenteeism influence the course from acute to chronic LBP

3. Differences in outcome assessment tools and baseline characteristics of patients in NZ compared with CH.

Discussion: This study will develop a screening tool for patients with acute LBP to be used in GP clinics to assess the risk of developing chronic LBP. In addition, biomedical, psychological, social, and occupational patient characteristics which influence the course from acute to chronic LBP will be identified. Furthermore, an appropriate time point for follow-ups will be given to detect this transition. The generalizability of our findings will be enhanced by the international perspective of this study.

Trial registration: [Clinical Trial Registration Number, ACTRN12608000520336]

Background

Low back pain (LBP) is the most prevalent and costly musculoskeletal disease, potentially leading to permanent disability [1,2]. For economically advanced societies a lifetime prevalence of LBP of up to 80%, an annual prevalence of up to 60%, and a point prevalence of up to 40% is estimated [3]. The natural course of LBP is self-limiting whereas an estimated 10% of patients develop chronic LBP as defined by duration of more than 12 weeks [4,5]. Though chronic LBP affects only a small group of patients, it is a high socioeconomic burden exceeding the treatment of acute LBP significantly [6]. About 30% of these costs are direct costs caused by medical treatment, whereas 70% are attributable to indirect costs e.g. loss of production [2].

Hence, it is of high importance to detect patients at risk of developing chronic LBP at an early stage as well as to identify modifiable risk and protective factors [7]. Evidence and outcome-based research is needed to provide information on the appropriate assessment of patients with acute LBP. To identify these patients, prognostic factors of chronic LBP must be known. According to the biopsychosocial model the influence of various factors in addition to severity of LBP has to be taken into account [8,9].

Guidelines already exist for the management of acute LBP [10], but some of the main questions in acute LBP – which assessment tools are the best identifiers for patients at risk for the transition from acute to chronic LBP and at which time point this transition takes place – are not clearly answered. Chronic LBP is defined as LBP lasting longer than 12 weeks [11]. Furthermore, there are inconsistent findings on cross-country differences in commonly used patient outcome assessment tools and baseline characteristics [12-15].

Although screening instruments are not routinely used in medical practice they can help to detect prognostic factors in the course of LBP. They should consist of internationally accepted core outcome measures e.g. as recom-

mended by the MMICS Statement and should be validated on a multinational level [16]. A recent review on screening instruments for the identification of prognostic factors for chronicity in patients with LBP reported that psychological and occupational factors have the highest reliability in predicting an unfavourable outcome [17]. Therefore, in this study protocol we focus on these factors in the design of a new comprehensive screening instrument.

Methods

Research plan

Objectives

This study aims to identify outcome assessment tools of patients with acute LBP which includes defining patient characteristics at baseline to allow the identification of patients at risk of developing chronic LBP [7,18-28] and at which time the chronicity becomes manifest [29-33]. This study will be undertaken in cohorts of patients in both New Zealand (NZ) and Switzerland (CH) to establish any similarities and differences between them [12-15].

Hypotheses

Three hypotheses will be examined:

1. Specific biomedical, psychological, social, and occupational outcome assessment tools are identifiers for the transition from acute to chronic LBP at a time point between 3 and 12 weeks.

2. Specific psychosocial and occupational baseline characteristics like work status and period of work absenteeism influence the course from acute to chronic LBP.

3. There are differences in patient outcome assessment tools and baseline characteristics between patients in NZ and CH, e.g. in disability compensation systems.

Study design

In this two arm cohort study, patients will be recruited from GP clinics in NZ and CH. Participants will be assessed directly after attending their GP for LBP treatment for the first time or for recurrent LBP after a pain free period of at least 6 months (T0) with follow-up at 3, 6, and 12 weeks, and at 6 months (T1-4). 6 months are the cut-off point in follow-up as longer follow-ups may incorporate additional errors affecting the identification of predictors.

The study protocol has been approved by the Lower South Regional Ethics Committee (LRS/08/03/008).

Inclusion and exclusion criteria

We defined broad inclusion criteria to ensure that the spectrum of patients represents the spectrum seen in routine settings: consecutive patients attending a GP clinic for acute LBP in Otago and Waikato districts, NZ and German speaking CH for a first time or after a pain free period of at least 6 months; a minimum age of 18 years at the time visiting a GP; a maximum age of 65 years; a good understanding of English or German; and a signed consent, are required.

Exclusion criteria are: chronic LBP (defined as LBP continuing for more than 12 weeks at time of first visit to GP) [11,30]; specific LBP (infection, tumour, osteoporosis, ankylosing spondylitis, fracture, deformity, inflammatory process, cauda equina syndrome) [10]; comorbidity that determines overall well-being (e.g. painful disabling arthritic hip joints); pregnancy; expected loss to follow-up (e.g. due to moving from the district); and unwillingness to complete questionnaires (Table 1).

Outcome assessment

Demographic and baseline characteristics

The following demographic, biomedical, psychological, social, and occupational factors will be assessed at baseline according to the recommendations of the MMICS Statement:

- Gender [34,35]
- Age [32,36-38]

- BMI
- Ethnicity
- ODI [39,40]
- Acute SF-12 [41]
- Quality and intensity of LBP (SF-McGill including VAS) [42-44]
- LBP history (duration and recurrence) [45-48]
- Radiating leg pain below the knee
- Lifestyle factors (exercise, smoking, alcohol consumption) [49-52]
- Depression (modified self-rating depression scale by Zung ZUNG) [53,54]
- Somatisation (Modified Somatic Perceptions Questionnaire MSPQ) [55]
- Fear avoidance beliefs (Fear Avoidance Beliefs Questionnaire FABQ) [56-58]
- Pain catastrophizing (Pain Catastrophizing Scale PCS) [59]
- Marital/relationship status
- Social support
- Educational status
- Employment/work status
- Job satisfaction [35,60-62]
- Job control [35,63]
- Work stress factors [61,62,64-67]
- Belief that work has caused LBP [68-70]

Table 1: Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
1. Patients attending GP clinic with acute LBP	1. Chronic LBP
2. Age 18–65 years	2. Specific LBP
3. Good understanding of English (NZ) or German (CH)	3. Comorbidity determining overall well-being
4. Written consent	4. Pregnancy
	5. Expected loss to follow-up
	6. Unwillingness to complete questionnaires

- Duration of work-absenteeism [9,71-73]
- Reasons for not working
- Disability compensation status [74-79]
- Patients' expectations on return to work [80-82].

Outcome measures

ODI, acute SF-12, and VAS pain score are among the most frequently used outcome assessment measurements of LBP. All of them are valid and reliable. In this study of outcome predictors, the primary endpoint for chronicity is ODI. Key secondary endpoints are acute SF-12 and VAS pain score.

Other secondary outcomes that will be collected by patient self-assessment as recommended by the MMICS Statement are: reduction in normal activities due to LBP; health care utilization including treatment received and referral as provided by the Accident Compensation Corporation (ACC) and GPs; medication [83]; modified self-rating depression scale by Zung (ZUNG); Modified Somatic Perceptions Questionnaire MSPQ (MSPQ); Fear Avoidance Beliefs Questionnaire (FABQ); Pain Catastrophizing Scale (PCS); patient satisfaction with condition and care; return to work (RTW); and sick leave over the last week.

Data management

Database

Patient data will be stored at a central database at the University of Otago (UoO), Dunedin, in strictly anonymised fashion. Data will be analysed in cooperation with a statistician in the Department of Preventive and Social Medicine, Dunedin School of Medicine. Data will be double entered and cleaned before use.

Statistical analysis

Multivariate identification of predictors for chronicity

Changes in primary and secondary endpoints between baseline data and different time points of follow-up will be analysed by multiple linear regression models. Patients with chronic LBP at 6 months follow-up will be compared with patients without chronic LBP at the same time point.

Patients with chronic LBP in this study are defined as patients with an ODI score without improvement by a Minimal Clinically Important Difference (MCID) of 10 ODI points between T0 (attending the GP for the first time or after a pain free period of at least 6 months) and T4 (6 months follow-up) [84-87].

An analysis of different assessment instruments and baseline characteristics will be performed to find appropriate

scores or patient characteristics to identify patients at risk to develop chronic LBP. Different patient assessment tools will be allocated to the following four groups: demographic-biomedical, psychological, social, and occupational risk group [88]. We aim to detect at least one assessment instrument in each group which identifies patients at risk.

Identification of time of chronicity

In a second step, a subgroup analysis on patients without chronic LBP will be performed to identify the time of follow-up (TX) where this patient group shows an improvement in ODI by at least the MCID. As patients with chronic LBP by definition of their condition don't show an improvement at TX, this follow-up is the most appropriate time point for detecting the transition from acute to chronic LBP in patients at risk.

Sample size/power calculation

Sample size considerations

Sample size considerations in clinical studies start from what is considered a MCID. In studies of chronic LBP, the ODI is commonly used as the main outcome measure, and a difference in 10 ODI points is considered clinically relevant. We will consider the sample size and power according to the MCID of ODI.

A minimum of 10 patients with chronic LBP are needed to produce stable estimates for each predicting variable. We will collect data on e.g. 20 potential predictive factors and screen these by logistic regression. If assuming we select four of these predictors for regression modelling, looking for an independent effect, then at least 40 patients with chronic LBP will be needed, 10 patients for each predictor.

We considered a series of scenarios for sample size calculations which resulted in an array of sample sizes between 200 and 800 patients necessary to ensure 80% power at a two-sided p of 0.05. If 5% of patients with acute LBP develop chronic LBP, 800 patients will have to be analysed. However, if 10% or 20% develop chronic LBP at 6 months follow-up only 400 and 200 patients respectively will be needed. Trends from our pilot study including 20 patients in Otago district, NZ show that an even smaller sample size might be sufficient – due to a rate of chronic patients of up to 30% in the pilot sample.

Feasibility of the study

Patient recruitment

Patients in NZ will be recruited consecutively and prospectively in collaboration between the Department of Orthopaedic Surgery at Dunedin Hospital, UoO, and Best Practice Advocacy Centre Incorporated (BPAC Inc), Dunedin. GPs cooperating with BPAC Inc will ask patients who meet the study eligibility criteria to give their consent

to be contacted by the research group at the UoO to participate in our study. Patients who give their consent may be given a detailed information sheet by their GPs about the study including contact details of the study coordinator. On the same day, contact details (telephone number, postal and email address) of these patients will be electronically forwarded in an automated fashion from the GP clinics to the research group at the UoO.

Patient assessment at different time points in our study will be conducted by research nurses at the UoO. At baseline a short screening interview on the telephone will be performed following a structured questionnaire. This interview will check the eligibility for enrolment (see inclusion criteria, Table 1). When a patient is classified as eligible, a document stating their signed consent and a first set of questionnaires (T0) will be sent out by post on the same day. At follow-up times (T1-4) research nurses will collect these patient-derived questionnaires and enter them into the central database. If not returning the questionnaire a first reminder will be sent out after one and a second after two weeks.

To optimise the number of completed questionnaires patients will be able to choose between a \$NZ10 fuel, supermarket or book voucher as compensation for their expenditure of time after return of each of the five questionnaires. This level of compensation will not encourage unwilling participation. GPs will be compensated with the same choice of voucher for every referred patient.

Patients in CH will be recruited consecutively and prospectively at the realHealth Centre, Nottwil. Patient assessment and follow-ups will be conducted in parallel to the study arm in NZ by a research group headed by NA.

Data collection

2220 patients will be assessed for eligibility in NZ and CH respectively (Figure 1). It can be assumed that 75% of these screened patients will be found eligible for enrolment. Out of these 1650 patients it is estimated that 990 (60%) will agree to participate in this study. Up to 20% of the patients can be expected to be lost to follow-up, in the worst case scenario, so that an estimated 792 patients will be analysed.

The expected duration of the data collection phase of the study will be two years, comprising one and a half years of patient recruitment overlapping with two years of follow-up.

Discussion

Scientific significance

LBP is by far the most prevalent and most costly musculoskeletal problem in our society today [6,10,89,90].

Despite numerous previous studies, to our knowledge there has not been an attempt to comprehensively assess all potential factors which lead to the transition from acute to chronic LBP and the point in the disease progression when this occurs [7].

This study will assess a core set of outcome assessment tools for patients with acute LBP in a GP setting to assess which factors predict whether these patients are at risk of developing chronic LBP [91,92]. In addition, biomedical, psychological, social, and occupational baseline characteristics will be identified which may be found to influence the course from acute to chronic LBP. Furthermore, an appropriate time for follow-ups will be given to increase the likelihood of detecting this transition.

The international perspective of this study of patients in NZ and CH will be an asset in terms of generalizability and validation of our findings for use by others.

Social and economic significance

The knowledge about the ideal assessment of predicting factors will help GPs to prevent patients from developing chronic LBP [90,93-98]. This might result in saving treatment and rehabilitation costs of chronic LBP for the benefit of health care providers and consumers [99].

Abbreviations

ACC: Accident Compensation Corporation; Acute SF-12: acute version of short form 12 questionnaire; BPAC Inc: Best Practice Advocacy Centre Incorporated; BMI: Body Mass Index; CH: Switzerland; FABQ: Fear Avoidance Beliefs Questionnaire; GP: General practitioner; LBP: low back pain; MCID: Minimal clinically important difference; MMICS: Multinational Musculoskeletal Inception Cohort Study; MSPQ: Modified Somatic Perceptions Questionnaire; NZ: New Zealand; \$NZ: New Zealand dollar; ODI: Oswestry Disability Index; PCS: Pain Catastrophizing Scale; RTW: return to work; UoO: University of Otago; VAS: Visual Analogue Scale; ZUNG: modified self-rating depression scale by Zung.

Competing interests

NA is a member of realHealth International, Hitzkirch, Switzerland, providing assessment and treatment for patients with acute LBP in Switzerland by order and for account of health insurance companies. All other authors declare that they have no competing interests.

Authors' contributions

MM is the principal investigator. He designed the study and is responsible for the protocol. NA is the team coordinator of the Swiss study arm. Together with MM he developed the key idea underlying this study. AE is MM's supervisor on psychology who structured the ideas about

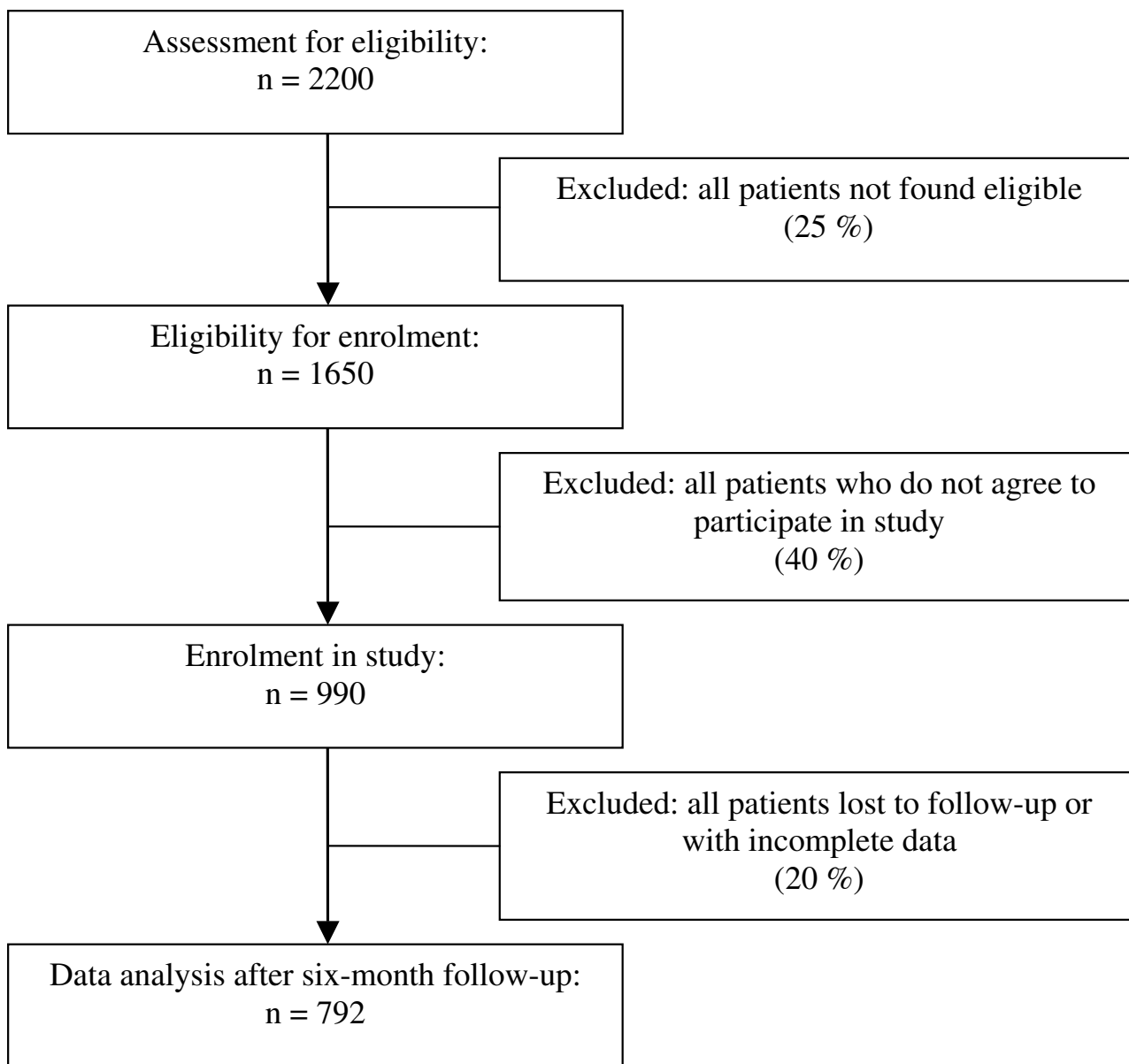


Figure 1
Recruitment and data collection.

psychological, social, and work-related factors of LBP and significantly contributed to the selection of appropriate assessment instruments. The assessment of occupational factors is based on previous research by AE. CR, TZ, PaH, and SB contributed to the content of baseline and follow-up assessment. TB is the supervising spine surgeon of MM and contributed to the design of the biomedical assessment. PeH is responsible for the sample size and power calculation and for the design of the statistical analysis and the evaluation of the database. KS is responsible for the development of the documentation system and the

data management. JCT is the project leader for NZ and overall supervisor of MM. All authors participated in the study design as well as read and approved the final manuscript.

Acknowledgements

This study is funded by realHealth International, Hitzkirch, Switzerland. MM is funded by a scholarship awarded by the University of Otago. Further funding has been received by the Dunedin School of Medicine (research equipment grant), Lottery Health Research, Wellington (research project grant), the Wishbone Trust of New Zealand, Wellington (research project grant), the Bruce McMillan Trust, Dunedin (research project grant), and the

University of Berne (grant for article processing charges; travel grant for AE).

We gratefully acknowledge realHealth International for their essential financial, technical, and organizational support of the study. Especially, we acknowledge the contributions by Jörg Krebs (project management), Ruedi Fischli (questionnaire design), and Jan Paška (IT consulting and realisation).

Furthermore, we want to thank BPAC Inc, Dunedin for giving us the opportunity to use their *bestpractice* Decision Support tool to contact patients in a GP setting. Special thanks go to Petros Nitis and Murray Tilyard for their assistance establishing the contact to GPs in Otago and Waikato districts.

Last but not least, we would like to thank Mark Walton and Michael Jennings for critical comments on the draft of our manuscript and ACC and all participating GPs for providing us with patient treatment and referral data.

References

- Melloh M, Röder C, Elfering A, Theis JC, Müller U, Staub LP, Aghayev E, Zweig T, Barz T, Kohlmann T, et al.: **Differences across health care systems in outcome and cost-utility of surgical and conservative treatment of chronic low back pain: a study protocol.** *BMC Musculoskelet Disord* 2008, **9**:81.
- Gobel H: **[Epidemiology and costs of chronic pain syndromes exemplified by specific and unspecific low back pain].** *Schmerz* 2001, **15(2)**:92-98.
- Schmidt CO, Kohlmann T: **[What do we know about the symptoms of back pain? Epidemiological results on prevalence, incidence, progression and risk factors].** *Z Orthop Ihre Grenzgeb* 2005, **143(3)**:292-298.
- Abbot JH, Mercer SR: **The natural history of acute low back pain.** *NZ Journal Physiother* 2002, **30(3)**:8-16.
- Schultz IZ, Crook J, Berkowitz J, Milner R, Meloche GR: **Predicting return to work after low back injury using the Psychosocial Risk for Occupational Disability Instrument: a validation study.** *J Occup Rehabil* 2005, **15(3)**:365-376.
- Katz JN: **Lumbar disc disorders and low-back pain: socioeconomic factors and consequences.** *J Bone Joint Surg Am* 2006, **88(Suppl 2)**:21-24.
- Hilfiker R, Bachmann LM, Heitz CAM, Lorenz T, Joronen H, Klipstein A: **Value of predictive instruments to determine persisting restriction of function in patients with subacute non-specific low back pain. Systematic review.** *Eur Spine J* 2007, **16(11)**:1755-1775.
- Heneweer H, Aufdemkampe G, van Tulder MW, Kiers H, Stappaerts KH, Vanhees L: **Psychosocial variables in patients with (sub)acute low back pain: an inception cohort in primary care physical therapy in The Netherlands.** *Spine* 2007, **32(5)**:586-592.
- Steenstra IA, Verbeek JH, Heymans MW, Bongers PM: **Prognostic factors for duration of sick leave in patients sick listed with acute low back pain: a systematic review of the literature.** *Occup Environ Med* 2005, **62(12)**:851-860.
- van Tulder M, Becker A, Bekkering T, Breen A, del Real MT, Hutchinson A, Koes B, Laerum E, Malmivaara A: **Chapter 3. European guidelines for the management of acute nonspecific low back pain in primary care.** *Eur Spine J* 2006, **15(Suppl 2)**:S169-191.
- van Tulder MW, Koes B, Malmivaara A: **Outcome of non-invasive treatment modalities on back pain: an evidence-based review.** *Eur Spine J* 2006, **15(Suppl 1)**:S64-81.
- Billis EV, McCarthy CJ, Oldham JA: **Subclassification of low back pain: a cross-country comparison.** *Eur Spine J* 2007, **16(7)**:865-879.
- Carron H, DeGood DE, Tait R: **A comparison of low back pain patients in the United States and New Zealand: psychosocial and economic factors affecting severity of disability.** *Pain* 1985, **21(1)**:77-89.
- Hadler NM: **The disabling backache. An international perspective.** *Spine* 1995, **20(6)**:640-649.
- Sanders SH, Brena SF, Spier CJ, Beltrutti D, McConnell H, Quintero O: **Chronic low back pain patients around the world: cross-cultural similarities and differences.** *Clin J Pain* 1992, **8(4)**:317-323.
- Pincus T, Santos R, Breen A, Burton AK, Underwood M: **A review and proposal for a core set of factors for prospective cohorts in low back pain: a consensus statement.** *Arthritis Rheum* 2008, **59(1)**:14-24.
- Melloh M, Elfering A, Egli Presland C, Röder C, Barz T, Rolli Salathé C, Tamcan O, Müller U, Theis JC: **Identification of prognostic factors for chronicity in patients with low back pain: A review of screening instruments.** *Int Orthop* 2009 in press.
- Elfering A, Mannion AF: **Epidemiology and risk factors of spinal disorders.** In *Spinal disorders – Fundamentals of diagnosis and treatment* Edited by: Boos N, Aebi M. Berlin: Springer; 2008:153-73.
- Gatchel RJ, Polatin PB, Mayer TG: **The dominant role of psychosocial risk factors in the development of chronic low back pain disability.** *Spine* 1995, **20(24)**:2702-2709.
- Waddell G, Burton AK, Main CJ: **Screening to identify people at risk of long-term incapacity for work.** London: Royal Society of Medicine Press Ltd; 2003.
- Heymans MW, Ford JJ, McMeeken JM, Chan A, de Vet HC, van Mechelen W: **Exploring the contribution of patient-reported and clinician based variables for the prediction of low back work status.** *J Occup Rehabil* 2007, **17**:383-397.
- Du Bois M, Donceel P: **A screening questionnaire to predict no return to work within 3 months for low back pain claimants.** *Eur Spine J* 2008.
- Klenerman L, Slade PD, Stanley IM, Pennie B, Reilly JP, Atchison LE, Troup JD, Rose MJ: **The prediction of chronicity in patients with an acute attack of low back pain in a general practice setting.** *Spine* 1995, **20(4)**:478-484.
- Soucy I, Truchon M, Cote D: **Work-related factors contributing to chronic disability in low back pain.** *Work* 2006, **26(3)**:313-326.
- Valat JP, Goupille P, Vedere V: **Low back pain: risk factors for chronicity.** *Rev Rhum Engl Ed* 1997, **64(3)**:189-194.
- Wahlgren DR, Atkinson JH, Epping-Jordan JE, Williams RA, Pruitt SD, Klapow JC, Patterson TL, Grant I, Webster JS, Slater MA: **One-year follow-up of first onset low back pain.** *Pain* 1997, **73(2)**:213-221.
- Kendall NAS, Linton SJ, Main CJ: **Guide to assessing psychosocial yellow flags in acute low back pain: risk factors for long-term disability and work loss.** Wellington, New Zealand: ACCat/NZG Group; 2004.
- Linton SJ, K H: **Risk factors and the natural course of acute and recurrent musculoskeletal pain: developing a screening instrument.** In *8th World Congress on Pain: 1996* Vancouver: IASP Press; 1996.
- Von Korf M: **Studying the natural history of back pain.** *Spine* 1994, **19(18 Suppl)**:2041S-2046S.
- Airaksinen O, Brox JI, Cedraschi C, Hildebrandt J, Klüber-Moffett J, Kovacs F, Mannion AF, Reis S, Staal JB, Ursin H, et al.: **Chapter 4. European guidelines for the management of chronic nonspecific low back pain.** *Eur Spine J* 2006, **15(Suppl 2)**:S192-300.
- Pengel LH, Herbert RD, Maher CG, Refshauge KM: **Acute low back pain: systematic review of its prognosis.** *BMJ* 2003, **327(7410)**:323.
- Cassidy JD, Cote P, Carroll LJ, Kristman V: **Incidence and course of low back pain episodes in the general population.** *Spine* 2005, **30(24)**:2817-2823.
- Carey TS, Garrett JM, Jackman AM: **Beyond the good prognosis. Examination of an inception cohort of patients with chronic low back pain.** *Spine* 2000, **25(1)**:115-120.
- Schmidt B, Kolip P, Greitemann B: **[Gender-specific aspects in chronic low back pain rehabilitation].** *Rehabilitation (Stuttg)* 2001, **40(5)**:261-266.
- Sandmark H: **Work and family: associations with long-term sick-listing in Swedish women – a case-control study.** *BMC Public Health* 2007, **7(287)**:.
- Schmidt CO, Raspe H, Pflingsten M, Hasenbring M, Basler HD, Eich W, Kohlmann T: **Back pain in the German adult population: Prevalence, severity, and sociodemographic correlates in a multi-regional survey.** *Spine* 2007, **32(18)**:2005-11.
- Hartvigsen J, Christensen K, Frederiksen H: **Back pain remains a common symptom in old age. a population-based study of 4486 Danish twins aged 70–102.** *Eur Spine J* 2003, **12(5)**:528-534.

38. Karjalainen K, Malmivaara A, Mutanen P, Pohjolainen T, Roine R, Hurri H: **Outcome determinants of subacute low back pain.** *Spine* 2003, **28(23)**:2634-2640.
39. Rocchi MB, Sisti D, Benedetti P, Valentini M, Bellagamba S, Federici A: **Critical comparison of nine different self-administered questionnaires for the evaluation of disability caused by low back pain.** *Eura Medicophys* 2005, **41(4)**:275-281.
40. Roland M, Fairbank J: **The Roland-Morris Disability Questionnaire and the Oswestry Disability Questionnaire.** *Spine* 2000, **25(24)**:3115-3124.
41. Mookk J, Kohlmann T, Zwingmann C: **Patient-reported outcomes in rehabilitation research: instruments and current developments in Germany.** *J Public Health* 2006, **14**:333-342.
42. Haefeli M, Elfering A: **Pain assessment.** *Eur Spine J* 2006, **15(Suppl 1)**:S17-24.
43. Wessels T, van Tulder M, Sigl T, Ewert T, Limm H, Stucki G: **What predicts outcome in non-operative treatments of chronic low back pain? A systematic review.** *Eur Spine J* 2006, **15(11)**:1633-1644.
44. Mannion AF, Balague F, Pellissier F, Cedraschi C: **Pain measurement in patients with low back pain.** *Nature Clinical Practice Rheumatology* 2007, **3(11)**:610-618.
45. Smedley J, Inskip H, Buckle P, Cooper C, Coggon D: **Epidemiological differences between back pain of sudden and gradual onset.** *J Rheumatol* 2005, **32(3)**:528-532.
46. Waddell G: **Subgroups within "nonspecific" low back pain.** *J Rheumatol* 2005, **32(3)**:395-396.
47. Ng LC, Tafazal S, Sell P: **The effect of duration of symptoms on standard outcome measures in the surgical treatment of spinal stenosis.** *Eur Spine J* 2006, **16(2)**:199-206.
48. BenDebba M, Torgerson WS, Boyd RJ, Dawson EG, Hardy RW, Robertson JT, Sybert GW, Watts C, Long DM: **Persistent low back pain and sciatica in the United States: treatment outcomes.** *J Spinal Disord Tech* 2002, **15(1)**:2-15.
49. Feldman DE, Rossignol M, Shrier I, Abenheim L: **Smoking. A risk factor for development of low back pain in adolescents.** *Spine* 1999, **24(23)**:2492-2496.
50. Scott SC, Goldberg MS, Mayo NE, Stock SR, Poitras B: **The association between cigarette smoking and back pain in adults.** *Spine* 1999, **24(11)**:1090-1098.
51. Goldberg MS, Scott SC, Mayo NE: **A review of the association between cigarette smoking and the development of nonspecific back pain and related outcomes.** *Spine* 2000, **25(8)**:995-1014.
52. Leboeuf-Yde C: **Smoking and low back pain. A systematic literature review of 41 journal articles reporting 47 epidemiologic studies.** *Spine* 1999, **24(14)**:1463-1470.
53. Middleton P, Pollard H: **Are chronic low back pain outcomes improved with co-management of concurrent depression?** *Chiropr Osteopat* 2005, **13(1)**:8.
54. Mayr M, Hogler S, Ghedina W, Berek K: **Low back pain and psychiatric disorders.** *Lancet* 2003, **361(9356)**:531.
55. Main CJ: **The Modified Somatic Perception Questionnaire (MSPQ).** *J Psychosom Res* 1983, **27(6)**:503-514.
56. Waddell G, Newton M, Henderson I, Somerville D, Main CJ: **A Fear-Avoidance Beliefs Questionnaire (FABQ) and the role of fear-avoidance beliefs in chronic low back pain and disability.** *Pain* 1993, **52(2)**:157-168.
57. Crombez G, Vlaeyen JW, Heuts PH, Lysens R: **Pain-related fear is more disabling than pain itself: evidence on the role of pain-related fear in chronic back pain disability.** *Pain* 1999, **80(1-2)**:329-339.
58. Cleland JA, Fritz JM, Brennan GP: **Predictive validity of initial fear avoidance beliefs in patients with low back pain receiving physical therapy: is the FABQ a useful screening tool for identifying patients at risk for a poor recovery?** *Eur Spine J* 2007.
59. Sullivan MJ, SR B, Pivik J: **The Pain Catastrophizing Scale: development and validation.** *Psychol Assessment* 1995:524-532.
60. Hoogendoorn WE, van Poppel MN, Bongers PM, Koes BW, Bouter LM: **Systematic review of psychosocial factors at work and private life as risk factors for back pain.** *Spine* 2000, **25(16)**:2114-2125.
61. Davis KG, Heaney CA: **The relationship between psychosocial work characteristics and low back pain: underlying methodological issues.** *Clin Biomech (Bristol, Avon)* 2000, **15(6)**:389-406.
62. Williams RA, Pruitt SD, Doctor JN, Epping-Jordan JE, Wahlgren DR, Grant I, Patterson TL, Webster JS, Slater MA, Atkinson JH: **The contribution of job satisfaction to the transition from acute to chronic low back pain.** *Arch Phys Med Rehabil* 1998, **79(4)**:366-374.
63. Johansson G, Lundberg O, Lundberg I: **Return to work and adjustment latitude among employees on long-term sickness absence.** *Journal of Occupational Rehabilitation* 2006, **16(2)**:185-195.
64. Elfering A, Grebner S, Semmer N, Kaiser-Freiburghaus D, Lauper-Del Ponte S, Wittschi I: **Chronic job stressors and job control: Effects on event-related coping success and well-being.** *J Occup Organ Psychol* 2005, **78(2)**:237-252.
65. Elfering A, Grebner S, Semmer NK, Gerber H: **Time control, catecholamines and back pain among young nurses.** *Scand J Work Environ Health* 2002, **28(6)**:386-393.
66. Hartvigsen J, Lings S, Leboeuf-Yde C, Bakkeiteig L: **Psychosocial factors at work in relation to low back pain and consequences of low back pain; a systematic, critical review of prospective cohort studies.** *Occup Environ Med* 2004, **61(1)**:e2.
67. Linton SJ, Gross D, Schultz IZ, Main C, Cote P, Pransky G, Johnson W: **Prognosis and the identification of workers risking disability: research issues and directions for future research.** *Journal of Occupational Rehabilitation* 2005, **15(4)**:459-474.
68. Werner EL, Ihlebaek C, Skouen JS, Laerum E: **Beliefs about low back pain in the Norwegian general population: are they related to pain experiences and health professionals?** *Spine* 2005, **30(15)**:1770-1776.
69. Coutu MF, Baril R, Durand MJ, Cote D, Rouleau A: **Representations: an important key to understanding workers' coping behaviors during rehabilitation and the return-to-work process.** *Journal of Occupational Rehabilitation* 2007, **17(3)**:522-544.
70. Ihlebaek C, Eriksen HR: **Myths and perceptions of back pain in the Norwegian population, before and after the introduction of guidelines for acute back pain.** *Scand J Public Health* 2005, **33(5)**:401-406.
71. Hansson E, Hansson T, Jonsson R: **Predictors for work ability and disability in men and women with low-back or neck problems.** *Eur Spine J* 2006, **15(6)**:780-793.
72. Elfering A: **Work-related outcome assessment instruments.** *Eur Spine J* 2006, **15(Suppl 1)**:S32-43.
73. Watson PJ, Booker CK, Moores L, Main CJ: **Returning the chronically unemployed with low back pain to employment.** *Eur J Pain* 2004, **8(4)**:359-369.
74. Pransky G, Benjamin K, Hill-Fotouhi C, Fletcher KE, Himmelstein J, Katz JN: **Work-related outcomes in occupational low back pain: a multidimensional analysis.** *Spine* 2002, **27(8)**:864-870.
75. McNaughton HK, Sims A, Taylor WJ: **Prognosis for people with back pain under a No-fault 24-hour-cover compensation scheme.** *Spine* 2000, **25(10)**:1254-1258.
76. Burry HC, Gravis V: **Compensated back injury in New Zealand.** *N Z Med J* 1988, **101(852)**:542-544.
77. McBride D, Begg D, Herbison P, Buckingham K: **Low back pain in young New Zealanders.** *N Z Med J* 2004, **117(1203)**:U1099.
78. Atlas SJ, Chang Y, Keller RB, Singer DE, Wu YA, Deyo RA: **The impact of disability compensation on long-term treatment outcomes of patients with sciatica due to a lumbar disc herniation.** *Spine* 2006, **31(26)**:3061-3069.
79. Wasiak R, Young AE, Roessler RT, McPherson KM, van Poppel MNM, Anema JR: **Measuring return to work.** *J Occup Rehabil* 2007, **17**:766-781.
80. Toyone T, Tanaka T, Kato D, Kaneyama R, Otsuka M: **Patients' expectations and satisfaction in lumbar spine surgery.** *Spine* 2005, **30(23)**:2689-2694.
81. Heijbel B, Josephson M, Jensen I, Stark S, Vingard E: **Return to work expectation predicts work in chronic musculoskeletal and behavioral health disorders: prospective study with clinical implications.** *Journal of Occupational Rehabilitation* 2006, **16(2)**:173-184.
82. Heymans MW, de Vet HC, Knol DL, Bongers PM, Koes BW, van Mechelen W: **Workers' beliefs and expectations affect return to work over 12 months.** *Journal of Occupational Rehabilitation* 2006, **16(4)**:685-695.
83. Chou R, Huffman LH, American Pain S, American College of P: **Medications for acute and chronic low back pain: a review of the evidence for an American Pain Society/American College of Physicians clinical practice guideline.** *Annals of Internal Medicine* 2007, **147(7)**:505-514.

84. Hagg O, Fritzell P, Nordwall A: **The clinical importance of changes in outcome scores after treatment for chronic low back pain.** *Eur Spine J* 2003, **12(1)**:12-20. Epub 2002 Oct 24.
85. Ostelo RW, de Vet HC: **Clinically important outcomes in low back pain.** *Best Pract Res Clin Rheumatol* 2005, **19(4)**:593-607.
86. Bombardier C, Hayden J, Beaton DE: **Minimal clinically important difference. Low back pain: outcome measures.** *J Rheumatol* 2001, **28(2)**:431-438.
87. Roer N van der, Ostelo RW, Bekkering GE, van Tulder MW, de Vet HC: **Minimal clinically important change for pain intensity, functional status, and general health status in patients with nonspecific low back pain.** *Spine* 2006, **31(5)**:578-582.
88. Schultz IZ, Stowell AW, Feuerstein M, Gatchel RJ: **Models of return to work for musculoskeletal disorders.** *J Occup Rehabil* 2007, **17**:327-352.
89. Frymoyer JW: **Back pain and sciatica.** *N Engl J Med* 1988, **318(5)**:291-300.
90. Borkan J, Van Tulder M, Reis S, Schoene ML, Croft P, Hermoni D: **Advances in the field of low back pain in primary care: a report from the fourth international forum.** *Spine* 2002, **27(5)**:E128-132.
91. Deyo RA, Battie M, Beurskens AJ, Bombardier C, Croft P, Koes B, Malmivaara A, Roland M, Von Korff M, Waddell G: **Outcome measures for low back pain research. A proposal for standardized use.** *Spine* 1998, **23(18)**:2003-2013.
92. Greenough CG: **Outcome assessment: recommendations for daily practice.** *Eur Spine J* 2006, **15(Suppl 1)**:S118-123.
93. Hicks GE, Fritz JM, Delitto A, McGill SM: **Preliminary development of a clinical prediction rule for determining which patients with low back pain will respond to a stabilization exercise program.** *Arch Phys Med Rehabil* 2005, **86(9)**:1753-1762.
94. van Tulder MW, Koes BW, Bouter LM, Metsemakers JF: **Management of chronic nonspecific low back pain in primary care: a descriptive study.** *Spine* 1997, **22(1)**:76-82.
95. van Tulder MW, Koes BW, Metsemakers JF, Bouter LM: **Chronic low back pain in primary care: a prospective study on the management and course.** *Fam Pract* 1998, **15(2)**:126-132.
96. Gatchel RJ, Polatin PB, Kinney RK: **Predicting outcome of chronic back pain using clinical predictors of psychopathology: a prospective analysis.** *Health Psychol* 1995, **14(5)**:415-420.
97. Bonnemann C, Bonnemann D, Hoffmann D, Lindig R, Linnenbaum FJ, Schnabel PE, Stadtmann K: **Bielefelder Rückenmodell: Stärkere Berücksichtigung personaler und sozialer Faktoren.** *Dtsch Arztebl* 2007, **104(33)**:2248-2252.
98. Gonzalez-Urzelai V, Palacio-Elua L, Lopez-de-Munain J: **Routine primary care management of acute low back pain: adherence to clinical guidelines.** *Eur Spine J* 2003, **12(6)**:589-594.
99. Loisel P, Lemaire J, Poitras S, Durand MJ, Champagne F, Stock S, Diallo B, Tremblay C: **Cost-benefit and cost-effectiveness analysis of a disability prevention model for back pain management: a six year follow up study.** *Occup Environ Med* 2002, **59(12)**:807-815.

Pre-publication history

The pre-publication history for this paper can be accessed here:

<http://www.biomedcentral.com/1471-2474/9/167/prepub>

Publish with **BioMed Central** and every scientist can read your work free of charge

"BioMed Central will be the most significant development for disseminating the results of biomedical research in our lifetime."

Sir Paul Nurse, Cancer Research UK

Your research papers will be:

- available free of charge to the entire biomedical community
- peer reviewed and published immediately upon acceptance
- cited in PubMed and archived on PubMed Central
- yours — you keep the copyright

Submit your manuscript here:
http://www.biomedcentral.com/info/publishing_adv.asp

