Back complaints in older adults

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Chapter 1

General introduction

BACK PAIN

The back is the most common pain site of the musculoskeletal system. Back pain can be divided into 1) low back pain, which is often defined as pain below the costal margin and above the inferior gluteal folds[1], and 2) upper back pain or thoracic back pain. In the Netherlands, the point prevalence of low back pain is around 27%, and of thoracic back pain around 9%.[2] In the total Dutch population, about 20-30% of those with back pain have at some time visited their general practitioner (GP), which makes the GP the health-care provider that is most visited for back pain, followed by the physical therapist.[3-5] In the Netherlands, GP care is mainly based on the clinical guidelines of the Dutch College of General Practitioners (NHG). GP guidelines are available for non-specific low back pain and the lumbosacral radicular syndrome (LRS).[6-7] The recommendations presented in these Dutch GP guidelines are consistent with other international guidelines.[8-9]

These clinical guidelines recommend to focus on the identification of 'red flags' (e.g. age at onset <20 or >55 years, significant trauma as cause, unexplained weight loss or neurological changes) in order to determine whether the patient is suffering from non-specific back pain or whether there is a suspicion of serious pathology. The GP is advised to initially treat patients with non-specific back pain and LRS conservatively, which includes informing the patients about the expected course and recommending that the patient remain as active as possible. If pain medication is necessary, acetaminophen is recommended as step 1, non-steroidal anti-inflammatory drugs (NSAIDs) as step 2, and step 3 is the prescription of an opioid (e.g. tramodol) or the combination of an NSAID with codeine. In the LRS guideline, if step 3 does not provide adequate pain relief, administration of morphine is described as the following step. Supervised exercise therapy is recommended for subacute and chronic back pain. Referral to a medical specialist (such as a neurologist, orthopedic surgeon, or neurosurgeon) is only recommended when there is suspicion of serious pathology or persistent back pain (i.e. insufficient recovery after at least 6-8 weeks of conservative treatment).[6-7]

COURSE OF BACK PAIN

In their review Pengel et al. described that, in acute back pain patients, the pain usually rapidly decreases in the first month and then more slowly in the following months.[10] Between 21-76% of the patients report recovery from their back pain at 3 months follow-up and between 25-83% of the patients at 12 months follow-up.[11-16] However, of the patients who are recovered, 66-84% experiences a recurrence of back pain within 12 months.[10] The differences in the percentage of recovered back pain patients reported in

various studies can probably be explained by the different study populations and the different outcomes used to define recovery.[17]

The course of back pain and the probability of patients reporting recovery within a certain time period could be influenced by various demographic and clinical characteristics. There are several articles written about prognostic factors for an unfavorable outcome for back pain patients.[10,12,15,17] An unfavorable outcome can be defined as poor recovery, experience of back pain or disability, or has not returned to work. Some factors are often reported to be predictive for an unfavorable outcome. These include: patient characteristics (older age, poor general health, increased psychological or psychosocial stress), characteristics of the complaint (high back pain severity, high disability, presence of sciatica) and/or work-related factors (social support at work, physically heavy work and the presence of work compensation).[17-18] Because the method and design of studies investigating the prognosis of back pain patients are often very different (e.g. different prognostic factors and outcomes measured), it is difficult to make a direct comparison of these studies. Therefore the Multinational Musculoskeletal Inception Cohort Study (MMICS) statement was developed to improve the quality of research on back pain prognosis by recommending a standardized design and a core set of measurements.[19]

BACK PAIN IN OLDER ADULTS

Prevalence of both low back pain and thoracic back pain tends to peak around the age of 45-65 years, but the prevalence of back pain in older adults remains high[20-22] with a prevalence of low back pain reported to range from 13-49%.[20] Because life expectancy continues to increase, the number of older adults will also substantially increase[23-24] with a related increase in the number of older adults with back complaints. Although back pain is highly prevalent in older adults, research has mainly focused on the working population aged 18-65 years. However, findings in a younger population can not necessarily be generalized to older back pain patients.[25] For example, differences in the course of back pain between the working (younger) population and older aged population could be possible for the following reasons: 1) higher age is often reported as a prognostic factor for poor recovery,[17-18] 2) older age is a red flag for pathologies such as malignity and osteoporotic spine fracture,[6,8] and 3) older people more often have internal body changes which could influence the course of back pain, such as (lumbar) disc degeneration, osteoarthritis and osteoporosis.[21,26] Information on the presence of spinal deviations, such as (lumbar) disc degeneration and symptoms of several diseases (such as musculoskeletal pain and morning stiffness) are being collected in the Rotterdam study, a large population-based cohort study including people aged ≥ 55 years living in the city of Rotterdam.[27] Associations between spinal deviations and symptoms,

such as back pain and morning stiffness can be examined with data emerging from this study. Information on the course of older back pain patients and prognostic factors for recovery can be investigated in a new cohort study which includes older adult back pain patients.

Other differences between younger and older adult back pain patients may occur in treatment management. Although the GP guidelines on back pain do not distinguish between different age categories, the GP might act differently because older adults have more co-morbidities[28] and older adults may more often have serious adverse reactions to medication, such as NSAIDs.[29] In addition to the GP, in primary care, physical therapists also treat many back pain patients. In the Netherlands, since January 2006 referral from a physician is no longer necessary for a patient to visit a physical therapist: direct access is now available. Earlier research on the total Dutch population indicated that older adults in general were less likely to use direct access for physical therapy.[30] It is unknown whether this is also the case for older back pain patients, and how many back pain patients use direct access. The Netherlands Institute for Health Services Research (NIVEL) manages several registration databases which could be used to answer these questions. The National Information Network of General Practitioners database register all patient contacts and information of 92 participating general practices[31] and the National Information Service for Allied Health Care database includes data of 82 participating physical therapists and their patients.[32] These registration databases may help to answer questions about possible variations in the management of back pain patients of different age categories.

AIM OF THESIS

The overall aim of this thesis was to gain insight into: 1) the course of back pain in older adults in general practice, 2) the characteristics of these patients and their back pain, 3) prognostic factors for poor recovery of older adults with back pain, 4) the association between perceived lumbar stiffness and lumbar disc degeneration (LDD) as assessed on X-ray, and 5) the medical consumption of back pain patients.

CONTENT OF THESIS

Chapter 2 presents the results of a systematic review of the literature on the course of back complaints in older adults. **Chapter 3** describes the design of the BACE study, a prospective cohort study of back pain patients aged >55 years, and the outline of the BACE consortium. Chapters 4 and 5 describe the first results of the Dutch BACE cohort study.

In **Chapter 4** the characteristics of back pain patients aged >55 years in general practice are described and these characteristics are compared for different age categories. The objective of **Chapter 5** is to determine the 3-month course of back pain in patients aged >55 years and to identify prognostic factors for poor recovery at 3 months follow-up. To gain further insight into back pain in older adults, in **Chapter 6** we focused on lumbar disc degeneration (a common degenerative process of the spine of older adults) and examined the association between spinal morning stiffness and lumbar disc degeneration. In **Chapter 7** differences between medical consumption of back pain patients of different age categories are assessed and **Chapter 8** presents data on the frequency and characteristics of back pain patients who directly accessed physical therapy or were referred. In conclusion, **Chapter 9** discusses the main results of this thesis and presents implications for clinical practice and further research.

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Chapter 2

Course of back complaints in older adults: a systematic literature review

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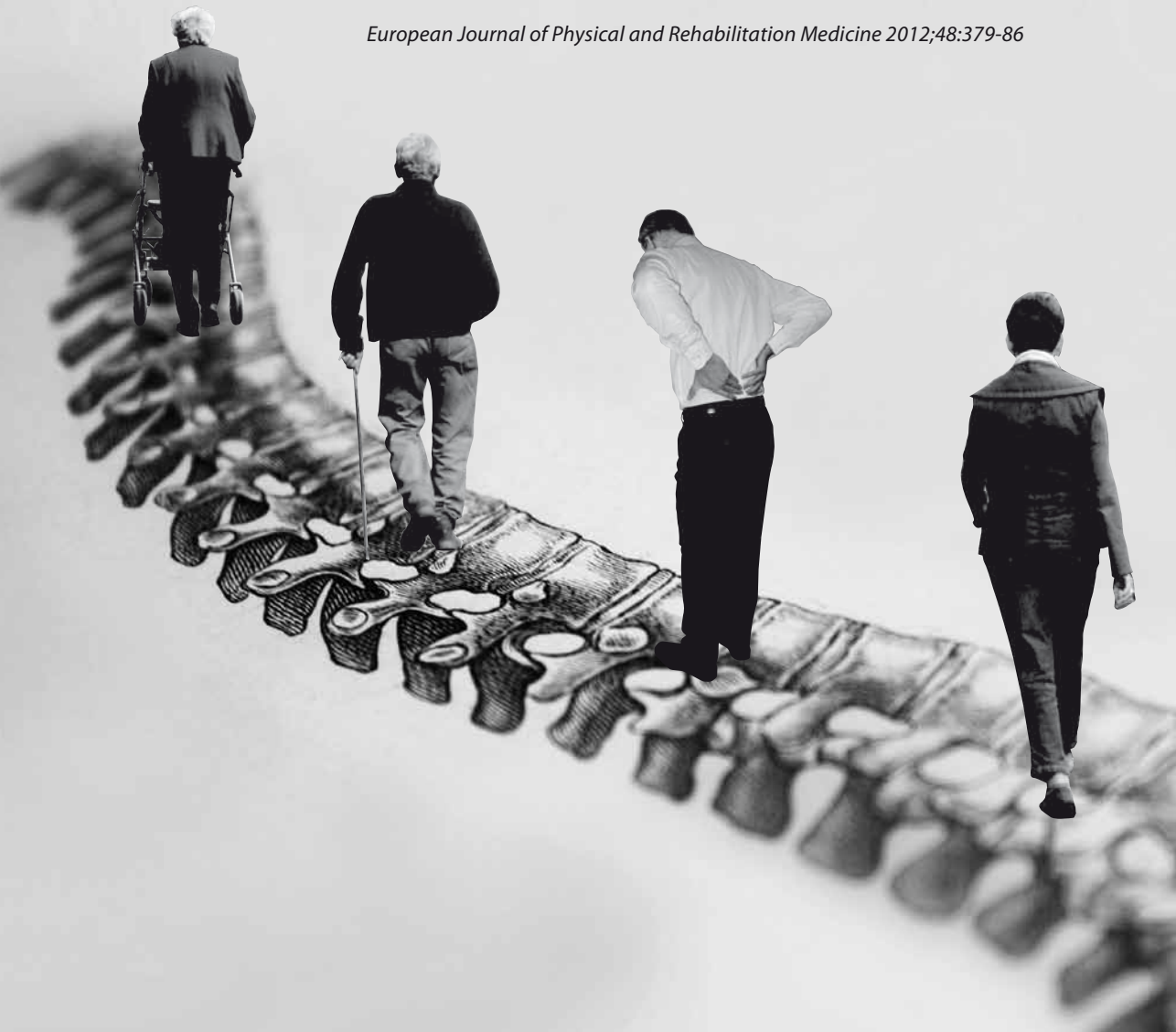

ABSTRACT

Background: Back pain is a common musculoskeletal complaint seen in older people. It is important to get an insight in the course of back complaints and to identify factors associated with a chronic course.

Aim: To describe the course of acute and subacute back complaints in older people (≥ 45 years) and to identify prognostic factors for developing chronic back complaints.

Design: Systematic review of the literature.

Methods: A database search was conducted in MEDLINE, EMBASE, Cochrane library, CINAHL, PsycINFO and PEDro. Cohort studies or randomized controlled trials reporting on the course of acute or subacute back complaints in older people were included. The percentage of patients that developed chronic back complaints was calculated, if possible.

Results: The search yielded 9,293 potentially relevant articles. Of these, 5 studies met all inclusion criteria. At 3 months follow-up 37-40% of the patients still had back complaints. At 12 months follow-up, the percentage ranged from 26-45%.

Older age was frequently reported as a prognostic factor for developing chronic back complaints of the whole study population. No prognostic factors could be retrieved for patients aged 45 years and older.

Conclusions: At 3 and 12 months follow-up, about 40% of the older people still reported back complaints. However, the heterogeneity of the studies made comparisons difficult. In order to get a clear insight in the course of back complaints in the older adult patients and to indentify prognostic factors for developing chronic back complaints in older people, high quality prospective cohort studies are needed.

Clinical rehabilitation impact; More than one-third of the older patients with back pain still experience complaints after 3 and 12 months.

Key Words: Back pain, adult, prognosis, systematic review

INTRODUCTION

Back pain is a common musculoskeletal complaint seen in general practice. In the Dutch population the point prevalence was 26.9% for low back pain and 9.1% for thoracic back pain.[1] Because of the heterogeneity of the patient population and definition used in different studies 1 year prevalence of different studies ranges from 0.8% to 82.5%.[2] It is believed that back pain prevalence increases with increasing age, with peak prevalence around age 50-60 years; however, findings on prevalence are contradictory.[3-4] Some studies suggest that older people report less frequent benign or mild pain but experience a higher prevalence of severe back pain and/or disabling episodes.[4-5] Information on the general course of back pain is required to determine the duration of an episode and the severity in terms of pain and disability. Several reviews are written about the course of back pain,[6-8] but they did not distinguish between different age categories.

Insight into the course and prognostic factors for developing chronic back complaints in older people is important because the prevalence of disability is high, especially older patients with back pain.[9-10] Older people with back pain has more difficulty with activities of daily living such as lifting of objects, housework, climbing stairs and walking than older patients without pain.[11-12] There are several reasons why the course of back pain in older people may differ from the course of back pain in the younger population: age is reported as a prognostic factor for developing chronic back complaints,[13] older people may be more likely to develop chronic back complaints, and the prevalence of osteoarthritis, disc degeneration, osteoporosis and spinal stenosis are known to increase with increasing age.[4,14] All these factors may also influence the course of back complaints.

Therefore, we conducted a systematic review of the literature to examine the course of back complaints in older people with acute or subacute back pain and to identify prognostic factors for developing chronic back complaints.

MATERIALS AND METHODS

Literature Search

Studies were identified searching the databases Medline, Embase, Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, Cumulative Index to Nursing and Allied Health Literature (CINAHL), PsycINFO, and Physiotherapy Evidence Database (PEDro), from their inception until April 2010. Keywords used were back pain (or low back pain or backache), cohort studies (or cohort or longitud* or prospect* or retrospect*), Randomized Controlled Trial (or controlled clinical trial), pain, disability or chronic*. The reference lists of all relevant reviews and articles were also screened for eligible studies.

A study was included when it fulfilled all of the following criteria: patients had acute or subacute back pain (back pain lasting less than 12 weeks); patients were 45 years or older; the design was a cohort study (prospective as well as retrospective) or a randomized controlled trial; the study design was observational or the treatment was non-surgical; the follow-up period was at least 3 months; the course of the back pain was described in terms of back pain, disability or percentage of patients with chronic back pain; the article was written in English, Dutch, German or French. The authors of this article choose to include patients with back pain of 45 years and older because this age category is often used in the literature.[1]

Methodological quality assessment

The methodological quality of the selected studies was independently assessed by two reviewers (BK and JS) using the criteria list designed by Scholten-Peeters et al.,[15] adjusted for back pain (Table 1).

This criteria list assessed 5 domains: study population, follow-up, prognostic factors, outcome and analysis. The list consists of 16 items, which can be answered with 'yes'/ 'no'/ 'don't know'. The total quality score was computed by counting the number of positive scores. Higher scores indicate higher methodological quality. Disagreements between the two reviewers in assessment of the methodological quality were resolved by discussion and consensus of the two reviewers. The quality assessment will be used to gain insight in the possible biases of the included studies.

Table 1: Criteria list for the methodological quality assessment.

Study population
a) Inception cohort
b) Description of source population
c) Description of relevant inclusion and exclusion criteria
d) Participants selected by random selection or as consecutive cases
Follow-Up
e) Follow-up at least 3 months
f) Drop-outs/loss to follow-up <20%
g) Information completers versus loss to follow-up/drop-outs
h) Prospective data collection
Prognostic factors
i) Clinical relevant potential prognostic factors
j) Standardized or valid measurements
k) Data presentation of most important prognostic factors
Outcome
l) Clinical relevant outcome measures
m) Standardized or valid measurements
n) Data presentation of most important outcome measures
Analysis
o) Appropriate univariate crude estimates
p) Appropriate multivariate analysis techniques

Data extraction

Study characteristics extracted from the included studies were: characteristics of the study population (setting, age, type of back pain), design, sample size, duration of follow-up, and outcome measures. Extracted outcome data were: pain, disability and outcome measures related to chronic back pain. When available, prognostic factors for developing chronic back complaints and corresponding measures of association were also extracted.

Data synthesis

Kappa statistics was used to calculate agreement between the reviewers regarding the quality assessment (<0.5 = poor level of agreement, 0.5-0.7 = moderate level of agreement, above 0.7 = high level of agreement).[16]

Chronic back pain is often defined as back pain lasting more than 3 months.[17-18] Therefore, when possible, we computed the percentage of patients with chronic back complaints using the reported outcomes of the studies.

Study outcomes were statistically pooled if the studies were considered homogeneous.

If studies were heterogeneous, we refrained from pooling and described the outcomes of the included studies.

RESULTS

Study characteristics

The flow chart of the review is presented in figure 1. The search strategy resulted in 9,293 potentially relevant articles. After reviewing titles and abstracts, 60 potentially eligible articles were identified. After reviewing the full text, 7 articles met the inclusion criteria. This review includes 7 articles [19-25] describing 5 different studies. Two articles [21-22] describe different follow-up measurements for the same study population. In another two cohort studies, [19,25] both the study populations were derived from the same cross-sectional population survey, but the articles described different outcome measures. Table 2 presents the characteristics of the 5 included studies.

All studies were cohort studies, 4 prospective [19,21-25] and 1 retrospective.[20] The follow-up period ranged from 3 months to 18 years. The patient populations were recruited in primary [19,21-23,25] or secondary care.[20,24] Different types of back pain were reported: low back pain,[19,21-23,25] degenerative spondylolisthesis [24] and back pain caused by a specific incident resulting in low back injury.[20] Only one study included only older adult patients (aged 69-85 years) with back complaints.[24] The other four studies included patients aged ≥ 18 years with back complaints, but described the course of back complaints in

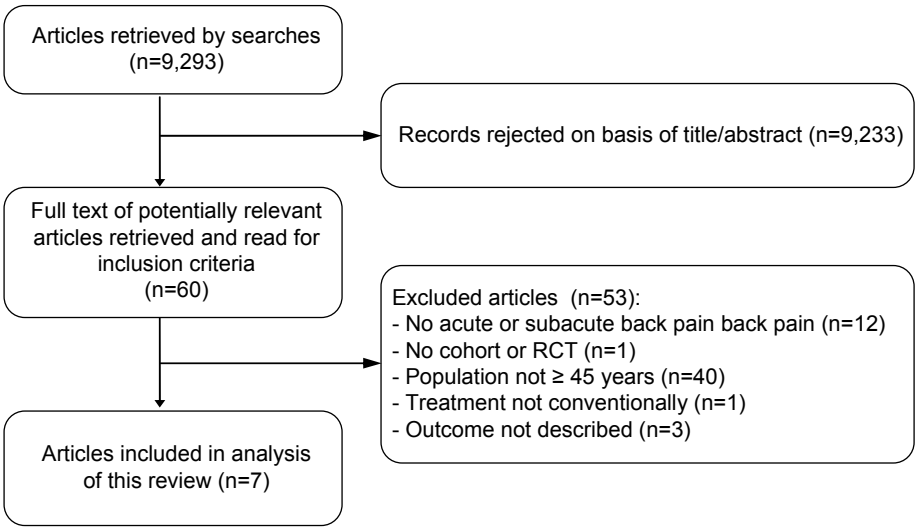

Figure 1: Flow chart of the review.

different age categories.[19-23,25] The study of Croft et al. and Thomas et al. described the same age categories of 45-59 years and 60-75 years, because their study population was derived from the same cross-sectional population survey,[19,25] Greenough et al. had a subgroup aged 46-65 years,[20] Jones et al. described the age categories of 48-56 years and 56-65 years [23] and Grottle et al. made a subgroup of patients aged 45-60 years.[21-22]

All studies used different outcome measures to describe the course of back complaints in older adults (Table 2). One study used two different outcome measures: an objective outcome measurement, i.e. consultations for back complaints after the index consultation [19] and a combination of pain intensity and disability scale.[25] The combination of pain intensity and disability scale was also used by another study.[23] Another study used the Roland Morris Disability Questionnaire (RMQ).[21-22] One study designed an Outcome scale: this was a combination of questions about pain, activity, treatment, rest required and passive activities.[20] Another study described the duration of back pain and the experienced improvement of symptoms.[24]

Methodological quality

The Kappa value between the reviewers assessing the methodological quality was 0.69, which is considered a moderate level of agreement.[16] All disagreements were solved by consensus.

The quality scores of two articles [19,25] were combined because their study population was derived from the same cross-sectional population survey. Table 3 presents data on the methodological quality assessment of the 5 studies. The overall quality score ranged

Table 2: Characteristics of the 5 studies described in 7 articles.

Author (year)	Participants	Design	Age (n)	Type of back pain	Follow-up	Outcome	Results			% chronic back complaints
1a. Croft (1998)[19]	Patients from 2 GP practices in Manchester, England	Prospective cohort study	18-75 years (490) Subgroup: 45-59 years (129) 60-75 years (91)	Low back pain	6 months	LBP consultation pattern in primary care	45-59 year No repeat consultation: Repeat <3 months: Repeat >3 months: 60-75 year No repeat consultation: Repeat <3 months: Repeat >3 months:		n (%) 65 (50) 50 (39) 14 (11) 49 (54) 36 (40) 6 (6)	3 months 45-59 year: 11% 60-75 year: 6%
1b. Thomas (1999)[25]	Patients from 2 GP practices in Manchester, England	Prospective cohort study	18-75 years (180) Subgroup: 45-59 years (61) 60-75 years (44)	Low back pain	1 week, 3 and 12 months	Persistent low back pain: ≥20 mm on VAS (pain) and <75% on Hanover	45-59 years: 60-75 years:		n 23 20	12 months 45-59 years: 38% 60-75 years: 45%
2. Greenough (1993)[20]	Patients treated non-surgically by a orthopaedic surgeon in Adelaide, Australia	Retrospective cohort study	18-65 years (300) Subgroup: 46-65 year (50)	Back pain caused by a specific incident, which resulted in a low back injury	1,2,3,4 or 5 year	Outcome score: This scale is scored from 0-75 and transformed to 0-100	At follow-up: Compensation: Noncompensation:		n-med(range) 32-32(16-74) 18-52(27-72)	Not possible to compute.
3. Grottle (2005 &2007)[21, 22]	Patients from GP practices in Fredrikstad, Norway	Prospective cohort study	18-60 years (123) Subgroup: 45-60 years (31)	Low back pain with and without radiation, lasting <3 weeks	3 and 12 months	Recovery: Score ≤4 on the RDQ at follow-up	3 months: Recovered: Not recovered: 12 months: Recovered: Not recovered:		n 19 12 21 8	3 months 45-60 years: 40% 12 months 45-60 years: 26%
4. Jones (2006)[23]	Patients from GP practices in Cheshire, England	Prospective cohort study	18-65 years(974) Subgroup: 48-56 years (86) 56-65 years (85)	Low back pain	3 months	Persistent low back pain: ≥20 mm on VAS (pain) and ≥5 on RDQ	48-56 years: 56-65 years:		n (%) 86 (37.2) 85 (37.1)	3 months: 48-56 years: 37.2% 56-65 years: 37.1%
5. Matsunaga (2000)[24]	Patients treated non-surgically at the Department of Orthopaedic Surgery, Kagoshima, Japan	Prospective cohort study	Average age at initial examination: 58,6 years. Age range at the end of the study: 69-85 years (145)	Degenerative spondylolisthesis	10-18 years (mean 15.8 years)	- Duration of LBP - Improvement of symptoms	- Mean duration of LBP: 3.2 months (range 1.5-6.8 months) - 77% experienced improvement			Not possible to compute

Table 3: Methodological quality scores of the 5 included studies.

	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	score
Croft (1998), Thomas (1999)[19,25]	+	+	-	+	+	+	+	+	+	+	+	-	+	+	+	+	14
Greenough (1993)[20]	+	+	+	-	+	+	-	-	+	+	+	+	-	+	-	+	11
Grottle (2005,2007)[21,22]	+	+	+	-	+	+	-	+	+	+	+	+	+	+	+	+	14
Jones (2006)[23]	+	+	-	-	+	+	+	+	+	+	+	+	+	+	+	+	14
Matsunaga (2000)[24]	+	+	-	+	+	-	-	+	+	?	+	-	?	-	-	-	7

+ means 'yes', - means 'no', ? means 'don't know'
Criteria list: a) Inception cohort, b) Description of source population, c) Description of relevant inclusion and exclusion criteria, d) Participants selected by random selection or as consecutive cases, e) Follow-up at least 3 months, f) Drop-outs/loss to follow-up <20%, g) Information completers versus loss to follow-up/drop-outs, h) Prospective data collection, i) Clinical relevant potential prognostic factors, j) Standardized or valid measurements, k) Data presentation of most important prognostic factors, l) Clinical relevant outcome measures, m) Standardized or valid measurements, n) Data presentation of most important outcome measures, o) Appropriate univariate crude estimates, p) Appropriate multivariate analysis techniques.

from 7-14 points. One study [24] scored ≤ 50% of the maximum attainable score; to a large extent this can be attributed to lack of information on the prognostic factors.

Course of back pain

Due to differences in reported outcomes and outcome measurements it is difficult to combine the results of the studies. The percentage of patients developing chronic complaints (back complaints after 3 months follow-up) ranged from 6-40%. Croft et al. reported a much lower percentage of patients developing chronic low back pain than the other studies: 11% in the age category 45-59 years and 6% in the age category 60-75 years.[19] However, Croft et al. used medical consumption (i.e. consultations for back complaints) as an outcome, whereas the other studies used back pain and/or disability scores.[22-23] The proportion of patients developing chronic back complaints in these latter studies ranged from 37.1-40%.

Two studies reported the proportion of patients with back complaints at 12 months follow-up [21,25]. One study reported a proportion of chronic back complaints of 38% in the age category 45-59 years and 45% in the age category 60-75 years, at 12 months follow-up.[25] The other study reported a somewhat lower proportion of patients with back complaints after 12 months follow-up: 26%.[21] Grottle et al. reported the proportion of patients with chronic back pain at 3 and 12 months follow-up; they found a 14% decrease in the proportion of patients with chronic complaints after 12 months follow-up period compared to the 3 months follow-up period.[21-22] All the studies described above had a methodological quality score of 14, indicating high quality.

In the studies of Greenough et al. [20] and Matsunaga et al. [24] it was not possible to compute the percentage of patients with chronic complaints at follow-up measure-

ments. Matsunaga et al. reported a mean duration of low back pain of 3.2 (range 1.5-6.8) months, and that 77% of the patients experienced improvement of their symptoms during a 10-18 year follow-up period.[24] Greenough et al. designed the outcome scale to describe the function of back pain patients (The Outcome scale ranges from 0-100, with higher scores indicating better functioning). The mean outcome score was 32 (range 16-74) at follow-up for patients receiving workers' compensation and 52 (27-72) at follow-up for patients who did not receive workers' compensation.[20]

Differences between age categories

Three studies [19,23,25] compared different age categories and reported different results (Table 2). One study found that the percentage of patients consulting their general practitioner (GP) at 3 months follow-up decreased from 11% in the category 45-59 years to 6% in the category 60-75 years.[19] Another study found no difference in the proportion of patients with persistent back pain between the age categories 48-56 years and 56-65 years.[23] A third study reported a slight increase in the percentage of patients with chronic back complaints in the older age category, after comparing the age category 45-59 years (38% of patients with chronic back complaints) with the age category 60-75 years (45% of patients with chronic back complaints).[25]

Prognostic factors for developing chronic back complaints

We could not retrieve any prognostic factor for developing chronic back complaints specifically for patients aged 45 years and older. Four studies [19-23,25] described prognostic factors of the entire study population (patients aged ≥18 years), but did not report prognostic factors specifically for patients aged ≥45 years. Older age was reported as a prognostic factor for developing chronic back complaints at 3 and 12 months follow-up in 3 of these 4 studies which described prognostic factors.[20-22,25] The other fourth study [23] found no association between age and chronic back complaints.

DISCUSSION

Using a systematic approach, we summarized the results of the available studies to describe the course of acute or subacute back complaints in older people. At 3 months follow-up, 37.1-40% of the older adults continued to experience back pain or disability complaints. At 12 months follow-up, the percentage of patients with back complaints ranged from 26-45%. The percentage of patients consulting their GP at 3 months follow-up was 6-11%. This indicates that not all patients return to their GP because of their persisting back complaints.

Unfortunately all 5 included studies used different outcomes, i.e. disability and/or pain scales or a self-devised outcome scale. We computed the percentage of chronic complaints at 3 and 12 months follow-up using the reported outcomes in the studies; this was possible for 3 of the 5 studies. Although we used the different outcomes, the computed ranges were similar to those reported in other reviews [6,8] which described the course of back complaints in adult patients (≥ 18 years). One review reported that 66-75% of all primary care patients with back pain continued to experience at least mild back pain or discomfort at 1 month follow-up; at 1 year follow-up, 33% still experienced back complaints of at least moderate intensity.[8] This is consistent with our conclusions. Another review reported that 62% (range 42-75%) of the patients still experienced pain at 12 months follow-up.[6] The computed percentage of chronic back complaints at 12 months follow-up ranged from 26-45% in our review. The wide range of percentages could be due to the heterogeneity of the studies.

We found conflicting results regarding the course of back complaints in the different age categories. One study found no difference in the percentage of patients with chronic back complaints between the age categories (48-56 versus 56-65 years),[23] whereas another study found that the percentage of patients with chronic back complaints increased by 7% in the older age category (45-59 years versus 60-75 years).[25] Another study found a decrease in patients consulting their GP again for back complaints after 3 months in the age group 60-75 years compared to the age group of 45-59 years; however, they measured the back pain consultation rate instead of the severity in terms of back pain and disability.[19] Almost all the studies which were included in this review studied the total population and divided the population in different age categories. Therefore the younger age categories of these studies (< 45 years) could be compared to the age categories described in this review. Most of the studies described that there is a higher percentage of patients with chronic back pain in the age categories >45 years than in the younger age categories, indicating that the course of older back pain patients differs from the younger population.[19,21-22]

One of our aims was to identify prognostic factors for developing chronic back complaints in older people. Unfortunately, none of the studies described prognostic

factors for patients aged 45 years and older. Most of the studies investigated prognostic factors for the total population, without specifying factors for older people. However, in most studies older age was reported as a prognostic factor for developing chronic back complaints.[20-22,25] According to one review (which is a review of reviews written on prognostic factors for developing chronic back complaints), older age is one of the prognostic factors that was frequently reported.[13]

One limitation of the present study is the heterogeneity of the studies, particularly the different outcomes used in the selected studies. For this reason we refrained from pooling. Therefore, it remains uncertain whether the same results would have emerged if the studies used the same (or comparable) outcome measure. The patient groups were also heterogeneous. Although most studies included patients with low back pain, not all studies specified the characteristics of the low back pain (e.g. with or without radiation, non-specific back complaints or specific back complaints). One study included only patients with degenerative spondylolisthesis, and this was the only study which included only older adult patients.[24] In the other studies, the population was divided into different age categories, resulting in small numbers of patients per category.

The age category used in this study (>45 years) is somewhat arbitrary. We choose age >45 years because it is often used in back pain literature and known absence of information about the course of back pain in elders. We described the different age categories (>45 years) reported by the included studies, if applicable. Because the number of older people will increase in the next years, it is important to have information about the course of back complaints in older adults.

CONCLUSION

This review shows that there are only a few (heterogeneous) studies written on the course of back pain in older adults, which indicates the need for further research. Prospective cohort studies, including only elderly patients, are needed to better describe the course of back complaints and to identify prognostic factors for developing chronic back complaints in this patient group.

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Chapter 3

Back Complaints in the Elders (BACE); design of cohort studies in primary care: an international consortium

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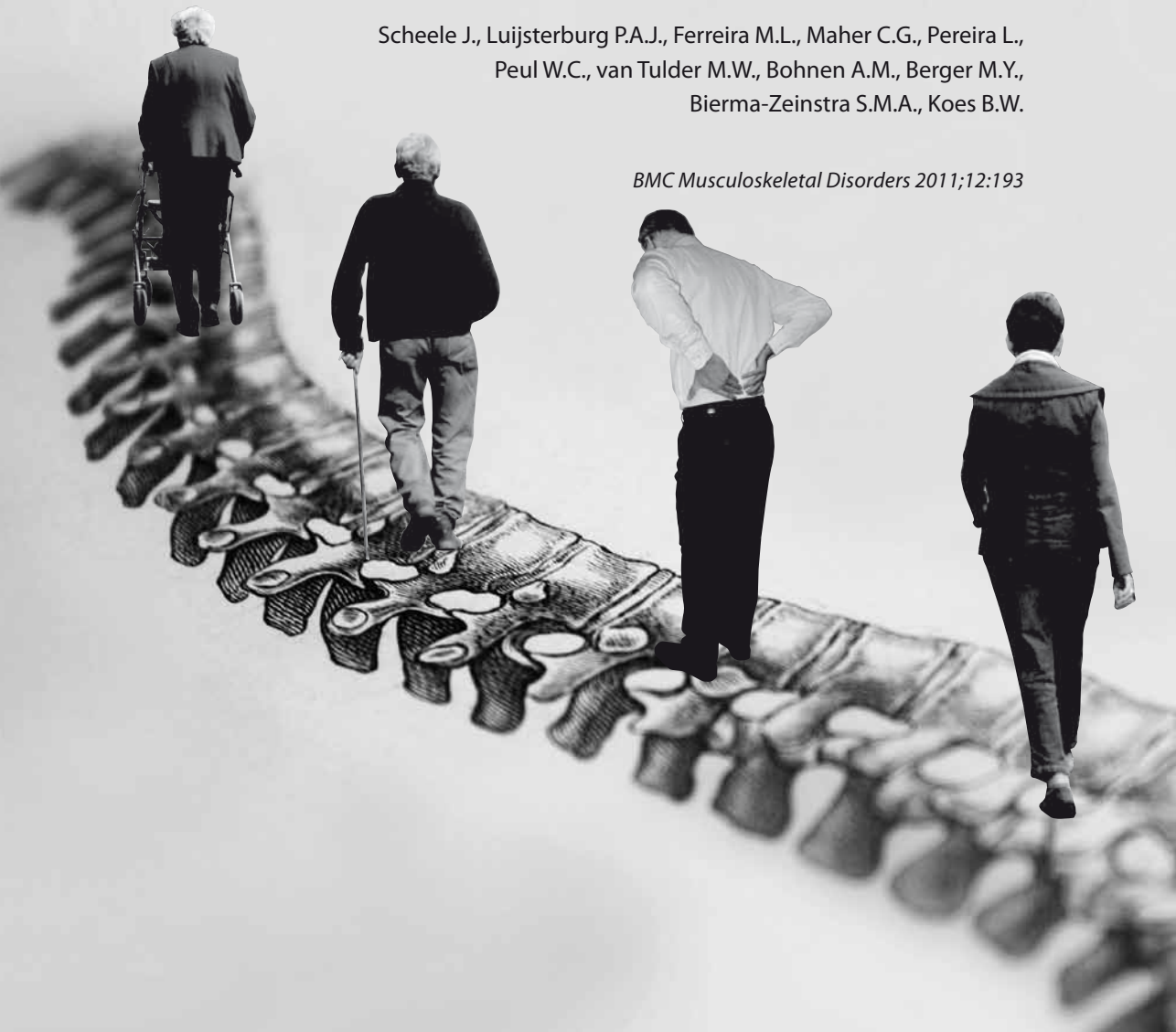

ABSTRACT

Background: Although back complaints are common among older people, limited information is available in the literature about the clinical course of back pain in older people and the identification of older persons at risk for the transition from acute back complaints to chronic back pain. The aim of this study is to assess the course of back complaints and identify prognostic factors for the transition from acute back complaints to chronic back complaints in older people who visit a primary health care physician.

Methods/design: The design is a prospective cohort study with one-year follow-up. There will be no interference with usual care. Patients older than 55 years who consult a primary health care physician with a new episode of back complaints will be included in this study. Data will be collected using a questionnaire, physical examination and X-ray at baseline, and follow-up questionnaires after 6 weeks and 3, 6, 9 and 12 months. The study 'Back Complaints in the Elders' (BACE) will take place in different countries: starting in the Netherlands, Brazil and Australia. The research groups collaborate in the BACE consortium. The design and basic objectives of the study will be the same across the studies.

Discussion: This consortium is a collaboration between different research groups, aiming to provide insight into the course of back complaints in older people and to identify prognostic factors for the transition from acute back complaints to chronic back complaints in older persons. The BACE consortium allows to investigate differences between older people with back complaints and the health care systems in the different countries and to increase the statistical power by enabling meta-analyses using the individual patient data. Additional research groups worldwide are invited to join the BACE consortium.

BACKGROUND

Back pain is the most common musculoskeletal complaint seen in primary care. A systematic review of prevalence studies on low back pain found a point prevalence ranging from 12% to 33%.[1] According to van der Windt et al. 22.4% of the people with back complaints consults their general practitioner (GP).[2] Studies including older people also show that back pain is a major problem in this population.[3-5] The most important features of back complaints are pain and disability. Older people with back complaints report difficulty with activities of daily living such as housework, shopping, walking and lifting objects.[5-6] Because of the high prevalence and consequences in terms of disability, health care costs associated with back pain are considerable. The total treatment costs of patients with back complaints in Australia exceed US$ 1 billion per year.[7] In the Netherlands, these costs range from €3.5 to 4.3 billion per year.[8] Between 1990 and 2020, it is estimated that the number of people aged 65 years and older will increase by 71% in most developed countries, implying that health care costs of older patients with back pain will increase substantially.[9]

Although there are reports on the course of acute or subacute back complaints, few studies distinguished between younger adults and older persons.[10-12] Even when different age categories are compared, older people are under-represented and some studies explicitly exclude patients aged ≥ 60 or 65 years.[11-12] Therefore, little is known about the course of back complaints in older people, even though back complaints are a major health issue in this age group. A similar problem concerns with the identification of prognostic factors for the transition from acute back complaints to chronic back complaints in older people. Several studies have reported on prognostic factors, but the results are often contradictory[13] and none assessed these factors specifically in older patients.

It is important to assess the course of back complaints in older adults, because older age is frequently reported as a prognostic factor for the transition from acute back complaints to chronic back complaints.[13] This may indicate that older persons are more likely to have chronic back complaints. The prevalence of osteoarthritis, disc degeneration, osteoporosis and spinal stenosis are known to increase with increasing age,[14-15] which can influence the course of back complaints. Older people also have more co-morbidity, which may influence the transition to chronic (back) pain. Prognostic research can help clinicians to identify patients at risk for chronic back complaints. Information on the course and prognosis is not only valuable for clinicians, but also informative for the patient. Mallen et al. reported that 82% of older people, visiting their GP with musculoskeletal pain found it important to be informed about the prognosis of their complaint by their GP.[16]

If patients seek medical care for their back complaints, this usually takes place in a primary care setting. The GP evaluates the patient and decides whether further diagnostics and referral to secondary care or other health care providers are required. The diagnostics are, as recommended by several guidelines, mostly based on the presence of the 'red flags' as indicators of possible underlying pathology [17]. However, few studies have examined the diagnostic accuracy of these red flags. Henschke et al.[18] conducted a large cohort study to determine the presence of serious pathology when red flags were identified in people with an acute episode of back pain; they found that red flags usually present a high false-positive rate and only a few red flags (prolonged use of corticosteroids, age >70 years and significant trauma) were predictive for detecting fractures. No research on red flags and diagnostic interventions has been undertaken specifically in the older adult population. Before recommendations for use in clinical practice can be made, further evaluation of the red flags and diagnostic interventions is needed. In summary, there is a need to study the clinical course of back pain in the elders and to identify older people at risk for chronic back pain.

This cohort study will be set-up and conducted in different countries. Therefore, we established the BACE consortium to standardize methods regarding eligible patients and measurements. The consortium will allow us to compare the course and prognostic factors of back pain across different countries, and investigate the influence of healthcare systems on the treatment of back complaints. Meta-analysis using individual patient data will lead to more precise estimates of associations and opens the possibility to study outcomes in pre-defined subgroups of older patients with back pain.

The primary objectives of the cohort study are:

1) To determine the duration, severity and clinical course of back pain in older people who visit the GP with a new episode of back pain.
2) To identify possible prognostic factors for the transition from acute back complaints to chronic back complaints in older people.

Secondary objectives are:

1) To determine the level of functional disability, quality of life and productivity loss present in older people visiting their GP with back pain.
2) To establish the diagnostic value of the 'red flags' examined at baseline.
3) To determine the prevalence and prognostic value of the separate signs of vertebral degeneration and osteoporotic fractures in older people with back pain.
4) To determine the prevalence of underlying pathology (infection, tumor, fracture, radiculopathy, spondylarthritis) identified by the GP, in older people with back pain.
5) To determine the medical consumption of older people with back complaints, visiting their GP.

Additional objectives BACE consortium:

1) To identify differences regarding the course and prognostic factors of older people with back complaints visiting a GP in the different countries joining the BACE consortium.
2) To determine the impact of the different healthcare systems on the management of back complaints in older people.
3) To determine if prognostic factors found by national BACE studies can be validated in the BACE consortium.
4) To determine if meta-analysis using individual patient data of the different BACE studies leads to more precise estimates of associations.
5) To identify subgroups of older people with back complaints.

METHODS/DESIGN

Design

This study will be a prospective cohort study with a follow-up period of one year. Data will be collected using questionnaires, physical examinations and X-ray examination. This study will be observational, meaning that there will be no interference with the care given by the GP or other healthcare providers with respect to advice, diagnostics or treatment. Before starting the study, the research protocol needs to be approved by the appropriate ethics committee of the different research groups joining the BACE consortium. This protocol has already received ethical approval from the Medical Ethics Committee of the Erasmus Medical Center, the Netherlands and the Ethic Committee in Research of Federal University of Minas Gerais, Brazil. Figure 1 presents a flow chart of this cohort study.

Inclusion and exclusion criteria

Patients aged >55 years will be included in the BACE cohort when they consult a GP for a new episode of back complaints. All back complaints, defined as pain in the region from the top of the shoulder blades to the first sacral vertebra, will be included. An episode is considered 'new' if the patient has not visited a GP during the preceding 6 months for the same back complaint.

Patients who are unable to fill in the questionnaires as a result of language problems or a cognitive disorder will be excluded from the study, as are patients unable to undergo the physical examination (e.g. wheelchair-bound patients). An anonymous record will be kept of the number of patients who choose not to participate, as well as the number of the excluded patients and the reason for exclusion.

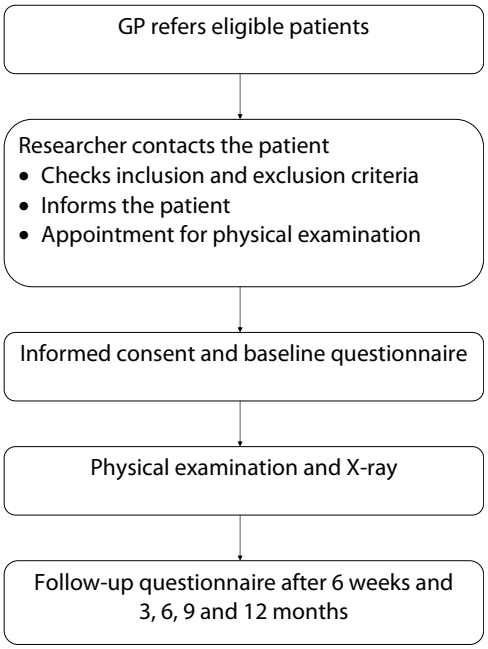

Figure 1: Flow chart of the BACE study.

Inclusion procedure

Participating GPs will be asked to refer all patients with a new episode of back pain, aged >55 years, to the BACE study. They will inform patients either during consultation or in writing within 2 weeks of their consultation. The GP will ask for the patient's permission to sent his/her contact information to the researchers. The researchers will contact the patients, answer any questions of the patient and make an appointment for the physical examination of those who verbally consent to participate. The informed consent procedure will be completed during the physical examination. The appointment for the X-ray examination will be made after the physical examination.

Physical examination

A standardized protocol for the physical examinations has been developed by the researcher (JS) and two senior researchers with ≥ 10 years of experiences in both physiotherapy and research (SB-Z and PL). Trained research assistants will conduct the physical examination. Standardization of the examinations among the research assistants will be accomplished by a series of training sessions before commencing recruitment and will be repeated during the recruitment period. An instruction video and protocol will be available to ensure standardization between the different research groups joining the BACE consortium. The physical examination will be conducted as close to the GP consultation date as possible. During the physical examination some of the red flags will

be measured. Other red flags will be assessed in the baseline questionnaire. Recorded red flags are based on the literature [19-23] and are summarized in Table 1.

The examination will consist of the following parts: 1) history taking e.g. pain location, severity of the pain, radiation of the pain and history of back pain, 2) inspection of the body e.g. palpation, neuropathic pain diagnostic questionnaire (DN4), ankle tendon reflex, knee tendon reflex and hypesthesia or hypalgesia of the foot and toes, 3) range of motion and additional diagnostic tests, e.g. test of Lasègue, finger-floor distance, muscular strength of the quadriceps muscle and the bone quality of the heel, measured with a quantitative ultrasound system (the Lunar Achilles InSight).[24-25] Table 2 presents details of the physical examination. The patients will be blinded for the outcomes of the physical examination. If the information gathered during the physical information is important for the health of the patient, the GP will be informed (e.g. low bone quality or high C-reactive protein level). The physical examination will be performed only at baseline, to establish the characteristics of the complaints and to collect data on potential prognostic factors.

Table 1: Red flag conditions indicating possible underlying spinal pathology or nerve root problems that will be recorded.

Red flag	Possible underlying pathology
Previous history of cancer	Cancer
Age at unset <20 or >55 years	Cancer
Unexplained weight loss	Cancer
Pain at rest	Cancer
Non-mechanical pain	Cancer, vertebral infection
Systematically unwell	Cancer, vertebral infection
Increased C-reactive protein level	Cancer, vertebral infection
Fever	Vertebral infection
Urine tract infection or skin infection	Vertebral infection
Recent bacterial infection e.g. urinary tract or skin infection	Vertebral infection
Age >70 years	Fracture
Trauma as cause of the back complaint	Fracture
Sudden decrease in height	Fracture
History of osteoporosis	Fracture
Urinary retention	Cauda equina syndrome
Acute onset of urinary retention or incontinence	Cauda equina syndrome
Morning stiffness	Inflammatory disorder
Pain improves with physical activity	Inflammatory disorder
Pain in the leg worse than back pain	Lumbosacral radicular syndrome

Table 2: Item list for physical examination.

History taking	Inspection	Range of motion and additional diagnostic tests
- Pain location - Radiation of the pain - Severity of pain (11-point numeric rating scale) - Leg pain > back pain - Paraesthesia of the foot and toes - Non-mechanical pain - Neuropathic pain questions (DN4) [46] - History of back pain - Pain and activity - Pain during coughing or sneezing - Weight loss - Comorbidity: e.g. urinal problems, obstipation, diagnosis of osteoporosis	- Standing posture - Scars or other abnormalities - Heberden's and Bouchard's nodules - Palpation of the paravertebral muscles - Palpation spinous processes and sacroiliac joint - Ankle tendon reflex - Knee tendon reflex - Hypesthesia or Hypalgesia of the foot and toes - Neuropathic pain tests (DN4) [46]	- Standing on heels and toes - Finger-floor distance and the presence of flexion pain - Latero-flexion: range and pain (yes/no) - Upper body rotation: range and pain - Muscular strength of the m. quadriceps - Test of Lasègue [47-48] - Crossed test of Lasègue [47-48] - Exo- and endorotation of the hip: range and pain - Bone quality of the heel - Timed Up and Go test [49] - C-reactive protein level (blood sample)

X-rays

An X-ray will be made of the lumbar spine from both the anterior-posterior view and the lateral view. If patients have complaints of the thoracic spine, both X-rays will also be made of the thoracic spine. The X-rays and the radiologic report(s) will be requested at the hospital. The X-rays will be scored on the following features:

1) Disc degeneration will be evaluated using the grading system proposed by Lane et al.,[26] based on the presence and severity of osteophytes and vertebral narrowing. In this grading system, grade 0 = none; grade 1 = mild; grade 2 = moderate; and grade 3 = severe.
2) Spondylolysthesis will be scored if the intervertebral sliding is >2 mm.[27]
3) Osteoporotic fractures will be evaluated using the system designed by Genant et al. Using this system, fractures are subdivided into 3 grades depending on the percentage of height reduction of the vertebrae: grade1 = mild, grade 2 = moderate and grade 3 = severe.[28] All fractures are confirmed by an expert radiologist.
4) Degenerative scoliosis will be defined as a lateral spinal curvature with a Cobb angle of 10° or more.[29]

Questionnaires

The baseline questionnaires will be filled in by patients before or just after the physical examination. The follow-up questionnaires will be sent (by e-mail or postal) at 6 weeks and at 3, 6, 9, and 12 months after the patient completed the baseline questionnaire. The questionnaires include outcome measures and prognostic factors, and are based on the recommendations presented in the Multinational Musculoskeletal Inception Cohort Study (MMICS) Statement.[30] Table 3 shows the measurements in the BACE study.

Outcome measures

The outcome measures included in the study will be global perceived effect, severity of back pain, recurrence of the back complaint, disability, quality of life, productivity loss

Table 3: Content of the patient questionnaires.

	Baseline	6 weeks	3 months	6 months	9 months	12 months
Demographics						
Age	X					
Gender	X					
Ethnicity	X					
Educational level	X					
Marital status	X					
Outcome measures						
Global Perceived Effect (GPE)[31-32]	X	X	X	X	X	X
Severity of pain (11-point numeric rating scale)[33]	X	X	X	X	X	X
Recurrence of back pain		X	X	X	X	X
Disability: Roland Disability Questionnaire (RDQ)[36]	X		X	X	X	X
Health-related quality of life: Short Form-36 (SF-36)[38]	X		X	X	X	X
PRodisq and DISease Questionnaire (PRODISQ)[39]	X		X	X	X	X
Back medication: name, frequency and prescription/over-the-counter *	X		X	X	X	X
Consultation to health care professionals*	X		X	X	X	X
Health care satisfaction*[50]	X		X	X	X	X
Prognostic factors						
Duration, onset of symptoms, frequency, radiation, numbness, weakness[51]	X	X	X	X	X	X
McGill pain drawing[52]	X					
Morning stiffness of the back (subscale of the WOMAC)[53]	X	X	X	X	X	X
Pain response to activity and position (PRAP)[54]	X					
Physical activity: International Physical Activity Questionnaire (IPAQ)[55]	X		X	X	X	X
Smoking (pack years)	X					
Alcohol use: AUDIT-C Questionnaire[56]	X					
Comorbidity: Self-administered Comorbidity Questionnaire (SCQ)[57]	X					
Quality of sleep, subscale of the Pittsburgh Sleep Quality Index (PSQI)[58]	X					
Kinesiophobia: Fear Avoidance Beliefs Questionnaire (FABQ)[59]	X					
Pain Catastrophizing: Pain Catastrophizing Scale- Dutch Version (PCS-DV)[60]	X					
Back Beliefs Questionnaire (BBQ)[61]	X		X	X	X	X
Expectations of recovery: 5-point Likert scale; completely pain free/more pain than ever.	X		X	X	X	X
Satisfaction with the current physical condition[50]	X		X	X	X	X
Emotional well-being: CES-D [62]	X					
Job Satisfaction: 7-point Likert scale; extremely unsatisfied/extremely satisfied	X					
Co-workers support (subscale of Job Content Questionnaire (JCQ))[63]	X					
Physical workload: Dutch Musculoskeletal Questionnaire (DMQ)[64]	X					

* These measures are also prognostic factors

during follow-up, medical consumption, and final diagnosis given by the GP.

Global perceived effect (GPE) will be measured on a 7-point scale, ranging from 'completely recovered' to 'worse than ever'.[31-32] Severity of back pain will be measured on an 11-point numerical rating scale (NRS)[33] in which 0 represents 'no pain' and 10 represents 'the worst pain ever'. We will measure the severity of back pain twice: for the moment of filling in the questionnaire and average back pain in the last week.

Different measurements will be used to gain insight into the recurrence of back complaints: the duration of the complaint (in days) and the duration of the pain-free period (in days). To define recurrence of back pain the definitions proposed by Stanton et al. and De Vet et al. are used:[34-35] a return of back pain lasting at least 24 h with a pain intensity of >2 on an 11-point NRS (>20 mm on a 100 mm VAS) following a period of at least 30 days pain free.

The level of disability will be measured using the Roland Disability Questionnaire (RDQ), in which the patient's score can range from 0 (no disabilities) to 24 (severe disability).[36] Quality of life will be measured with the Short-Form 36 (SF-36). The SF-36 measures 8 dimensions: physical function; role-physical; bodily pain; general health; vitality; social function; role-emotional; and mental health. Each dimension is scored from 0 to 100; a higher score representing better health.[37-38]

All patients with a paid job will also complete the Productivity and DISease Questionnaire (PRODISQ),[39] which includes questions about their job, work absenteeism and loss of productivity. To determine medical consumption, we will record back pain medication and the number of consultations with different healthcare professionals. To determine the presence of serious pathologies, which can become apparent over time, GPs are asked to fill in a short questionnaire about the diagnosis of the back complaints at one-year follow-up.

Prognostic factors

The following potential prognostic factors will be measured in the questionnaires: 1) demographic characteristics e.g. age and gender, 2) characteristics of the compliant e.g. duration of the complaint, the perceived cause, pain response to activity and position, 3) baseline functional disability (RDQ), 4) lifestyle e.g. smoking and alcohol use, 5) comorbidity (Self-administered Comorbidity Questionnaire), 6) psychological factors e.g. kinesiophobia, pain catastrophizing, back beliefs, expectations of recovery, emotional well-being, 7) work-related factors e.g. physical workload, job satisfaction and co-workers' support and 8) received treatment due to the back complaints e.g. medication and number of consultations. We will also measure characteristics of the national health system of the different countries joining the BACE consortium (e.g. insurance form, present guidelines, availability off direct access to medical facilities).

Sample size

Based on the literature, 26-45% of the older adult population with acute low back pain will develop chronic persistent back complaints.[11-12,40-41] Therefore, it is estimated that at least 30% of the older adults that visit the GP with a new episode of back complaints will have chronic persistent complaints.

To identify prognostic factors by means of multivariate regression analysis, 750 older adults with a new episode of back pain need to be included. This group consists of about 225 patients (0.3 * 750) that will have chronic back complaints. A minimum of 10 patients with chronic back complaints are needed to produce stable estimates for each prognostic factor. The estimated size of 225 subjects with chronic complaints, allows for multivariate regression analysis including 22 variables. These sample size calculations concern the individual national BACE studies. Combining the cohort data will obviously increase the statistical power of the analysis.

Statistical analyses

Insight into the duration, severity and clinical course of back pain in the elders will be provided using descriptive statistics. Furthermore, descriptive statistics will provide insight into the level of functional disability, quality of life, productivity loss, medical consumption and prevalence of underlying pathology and X-ray findings. To evaluate the diagnostic value of the 'red flags', the sensitivity and specificity of the red flags will be calculated.

To identify prognostic factors for the transition from acute back complaints to chronic back complaints, we will first assess which factors of the baseline questionnaire and the physical examination are associated with chronic back complaints. A binary logistic regression analysis will be performed with these factors. Chronic back complaints are defined as back complaints lasting more than 3 months.[42-43] Global perceived Effect (GPE) will be used to determine whether the patient has recovered. This variable will be dichotomized because this allows estimating odds ratios (OR), which are easier to interpret in clinical practice. The scores 'somewhat improved', 'stayed the same', 'somewhat worsened', 'strongly worsened', 'worse than ever' will be defined as 'not recovered'. The scores 'completely recovered' and 'strongly improved' will be defined as 'recovered'. Factors with $p < 0.1$ in the univariate logistic regression analysis will be included in the multivariate logistic regression analysis.

Consortium

The BACE study will be conducted in different countries: starting in the Netherlands, Brazil and Australia. The aims of this collaboration are: to perform individual patient data meta-analyses, to validate prognostic models, to investigate the effects of cultural, economic and health care system differences on the clinical course of back pain, and to investigate cross-cultural differences in the treatment of back complaints in older people.

The design will be the same across the studies, and a common set of outcome measures and possible prognostic factors will be used. The physical and X-ray examinations will be standardized. Same recruitment strategies will be implemented and the same inclusion and exclusion criteria will be used. All statistical analyses will be performed with the data of the different research groups separately and, if applicable, also together.

The BACE study in the Netherlands (BACE-D [Dutch]) started recruiting patients in 2009 and plans to end recruiting in September 2011. The Brazilian study (BACE-B) has been funded and is currently in preparation and starts recruitment of patients in September 2011. The Australian study (BACE-A) is applying for research funding.

The Consortium aims to assist other international research groups in the use of this proposed protocol to allow further cross-cultural comparisons and increase statistical power by enabling meta-analyses using individual patient data.

Additional national objectives within the consortium

Falling in older people

A recent Australian cross-sectional study described that older people reporting pain and pain-related disability were more likely to have fallen in the past 12 months than people not reporting pain.[44] Therefore the BACE-A study will also include questions about the level of independence, number of falls, frailty and fear of falling. For that reason, the follow-up duration is set at two years. The same approach will be used in the BACE-B study.

The additional objectives are:

1) To establish the two-year incidence of falls, loss of independence, hospitalization, and institutionalization in back pain patients.
2) To identify prognostic factors for falls, loss of independence, hospitalization and institutionalization in back pain patients.

Long-term follow-up (5-years)

The BACE-D study will extend the follow-up period to five years. The additional long-term follow-up questionnaires will be sent at the 2, 3, 4 and 5-year follow-ups and will be the same as the 12-month questionnaire. After 5 years of follow-up anterior-posterior and lateral X-rays will be made of the lumbar spine. X-rays of the thoracic spine will only be made if the patient has complaints in the thoracic spine at follow-up; these will be scored in the same way as the baseline X-rays.

DISCUSSION

This cohort study will provide insight into the course of back complaints in older people visiting their GP and aims to identify prognostic factors for the transition from acute back complaints to chronic back complaints in the elders. Research groups in the Netherlands, Australia and Brazil already collaborate in the BACE consortium. This collaboration will allows to investigate cross-cultural differences between older people with back complaints and to increase the statistical power by enabling meta-analyses using the individual patient data. It will also allow us to investigate the influence of the national health care systems on the course and treatment of patients with back complaints. People's health can be influenced by several factors such as guidelines, availability of health care, form of insurance and insurance costs.[45] We invite other research groups worldwide to join the BACE consortium, if interested.

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Chapter 4

Characteristics of older patients with back pain in general practice: BACE cohort study

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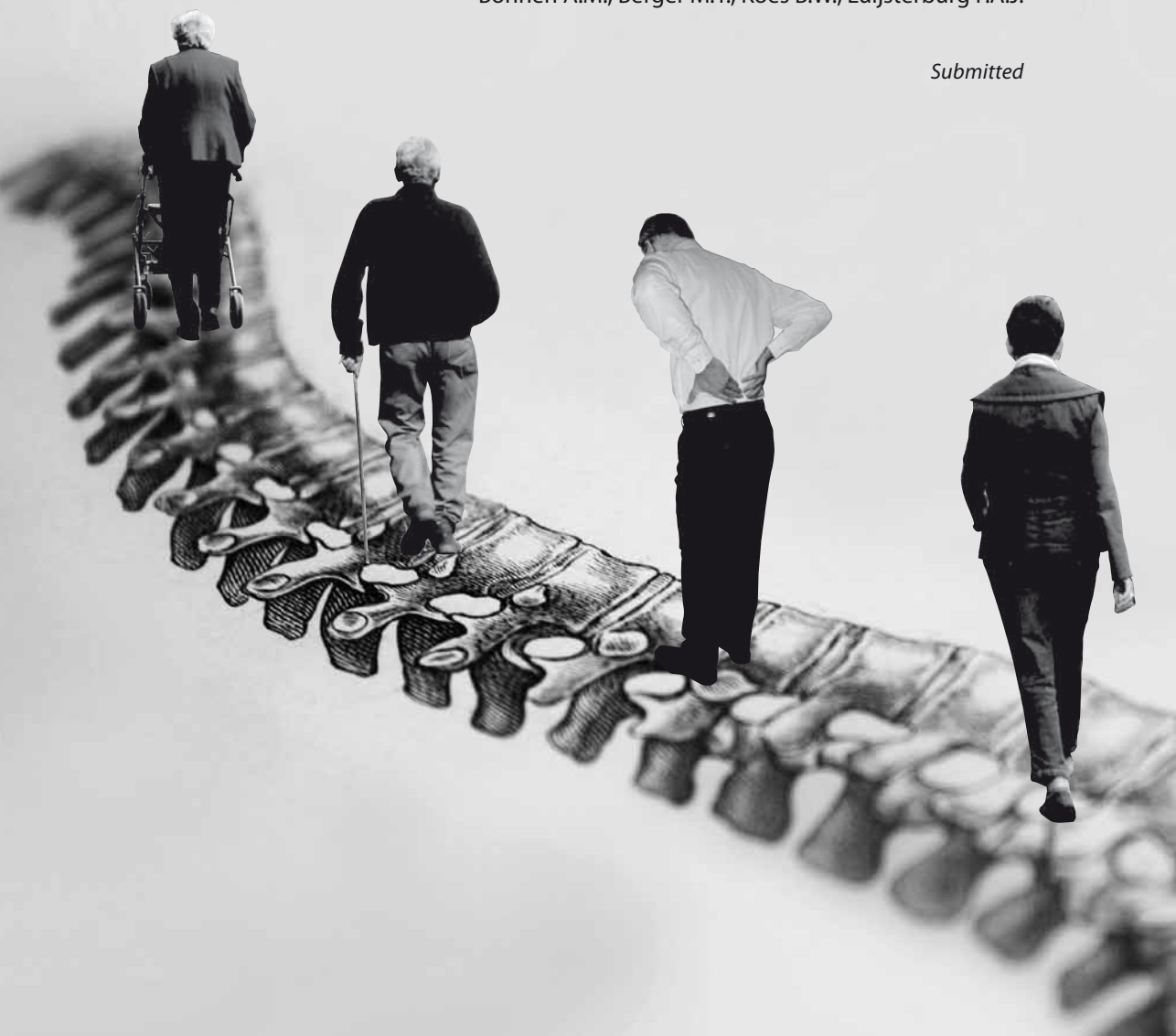
Submitted



ABSTRACT

Study Design: Prospective cohort study (BACE study).

Objective: To describe the characteristics of older back pain patients in general practice and investigate whether these characteristics differ between age categories >55-74 years and ≥75 years.

Summary of Background: Although back pain is common among older people, limited information is available about the characteristics of these patients in primary care. Earlier research suggests that the severity of back symptoms increases with older age.

Methods: Patients aged >55 years visiting a general practitioner with a new episode of back pain were included in the BACE study. Information on patients' characteristics, characteristics of the complaint, and physical examination were derived from the baseline measurement. Cross-sectional differences between patients aged >55-74 years and ≥75 years were analysed using an unpaired t-test, Mann-Whitney U-test or a chi-square test.

Results: A total of 675 back pain patients (41% male) were included in BACE, with a median age of 65 (interquartile range (IQR) 60-71) years. Patients aged >55-74 years had a mean disability score (measured with the Roland Disability Questionnaire) of 9.4 (SD 5.8) compared with 12.1 (SD 5.5) in patients aged ≥75 years ($p \leq 0.01$). The older group reported more additional musculoskeletal disorders and more often had low bone quality (based on ultrasound measurement of the heel) than patients aged >55-74 years. Average back pain severity over the previous week showed no difference ($p=0.11$) between the age groups, but severity of back pain at the moment of filling in the questionnaire was higher ($p=0.03$) in the older age group.

Conclusions: In this study, older back pain patients reported more disabilities and comorbidity. However, the clinical relevance of these differences for the course of the back pain episode in older patients remains a subject for further research.

INTRODUCTION

Although back pain is a common health problem in older adult patients, back pain research focus mainly on the working-age population. Patients aged >60 or 65 are often excluded from studies. [1-3] It is suggested that older patients have a lower prevalence of back pain compared with the working population.[4-5] Some studies suggest that the prevalence of mild back pain decreases with increasing age, but that the prevalence of severe back pain increases with increasing age.[4] However, back pain in the older population remains the most common musculoskeletal disorder.[5] In the Netherlands, most back pain patients who seek medical care visit the general practitioner (GP), back pain without radiation is the sixth most prevalent complaint for which patients visit their GP, with a prevalence of 39.7 per 1000 registered patients per year.[6]

Because back pain is a prevalent musculoskeletal complaint, also in older adults, it is important to gain insight into the characteristics of these patients. Although there are reports on the characteristics of back pain patients visiting their GP, information on older adults is lacking.[7-8] Compared with younger adults, the characteristics of back pain in older patients might differ because: 1) because older people have more co-morbidities,[9] 2) older people with musculoskeletal pain more often report difficulty in activities of daily living,[10-11] and 3) older persons might have more severe back complaints.[4,12] Use of different age categories within the same study population enables to compare older and younger back pain patients on several patient and complaint characteristics. Information on patient characteristics and their complaints in a relevant setting is important for back pain management and may help identify factors that can influence the course or treatment response of these back pain patients.

Therefore, the aim of the present study is to describe the patient characteristics and characteristics of the complaint, of back pain patients aged >55 years in general practice. The aim of the present study is also to investigated whether these characteristics differ between the age categories >55-74 years and ≥75 years.

METHODS

Patient selection

The BACE study is a prospective observational cohort. Details of the study protocol are described elsewhere.[13] Patients aged >55 years were invited to participate in the BACE study if they consulted their GP with a new episode of back pain. An episode is considered 'new' if the patient had not visited a GP during the preceding 6 months for the same back complaint. All back complaints (defined as pain located in the region from the top of the shoulder blades to the first sacral vertebra) were included. Patients

were excluded if they were unable to fill in the questionnaire due to a language problem or cognitive disorders, or unable to participate in the physical examination (wheelchair-bound patients). Patients were invited by their GP during the consultation or in writing within 2 weeks after the consultation. The study protocol was approved by the Medical Ethics Committee of the Erasmus Medical Center, Rotterdam, Netherlands.

Data collection

Baseline measurements included a questionnaire and a physical examination. The questionnaire and history taking during physical examination included questions on

1) patient characteristics: age, gender, education level, body mass index (BMI), marital status, employment status, smoking, measured as pack years (number of packs per day x years of smoking) and hazardous drinking, measured with the Alcohol Use Disorders Identification Test (AUDIT-C),[14-15] 2) characteristics of the back complaint: duration of the current complaint, severity of back pain averaged during the previous week, and severity of back pain at the moment of filling in the questionnaire measured on an 11-point numerical rating scale (NRS 0-10)[16], disability measured with the Roland Disability Questionnaire (RDQ scale 0-24)[17], location of the back pain, cause of the back pain, history of back pain, back surgery in the past, radiating pain in the legs below the knee, severity of leg pain if present measured on a NRS (scale 0-10)[16] and morning stiffness of the back, 3) medical consumption: use of pain medication for back pain and care from a physical therapist, 4) psychological factors: quality of life measured with the Short-Form 36, physical summary scale (SF-36 range 0-100)[18], depressive symptoms measured with the Center for Epidemiologic Studies Depression Scale (CES-D, range 0-60)[19], kinesiophobia (Fear-Avoidance Beliefs Questionnaire (FABQ), physical activity subscale range 0-28)[20], pain catastrophizing (Pain Catastrophizing Scale (PCS), range 0-52)[21], and attitude and beliefs about back pain (Back Beliefs Questionnaire (BBQ), range 9-45),[22] and 5) comorbidity, measured with the Self-Administered Comorbidity Questionnaire (SCQ).[23]

The physical examination included: 1) general examination of the body, such as pain during palpation of the paravertebral muscles, pain during palpation of the spinous processes and sacroiliac joint and Heberden's or Bouchard's nodules, 2) range of motion of the back and hip; anteflexion (finger-floor distance) and difference between left and right-sided lateroflexion, left and right-sided rotation of the upper body, left and right-sided hip joint exorotation and endorotation, 3) additional diagnostic tests: knee tendon reflex, difference in quadriceps strength, test of Laseque[24], difference in sensation between left and right foot, timed up and go test[25], increased C-reactive protein (CRP) level (indicated as CRP level >10 mg/l), and bone quality measured with the Lunar Achilles InSight (quantitative ultrasound measurement of the heel).[26] The bone quality is presented as a T-score, which is a comparison between the individual's bone quality index and a reference population mean, and expressed in standard deviation (SD)

units difference. Low bone quality is defined as a T-score of >-2.5, which means that the patients bone quality score is more than 2.5 SD lower than the population mean.[27]

Data analysis

First, we described the study population with descriptive characteristics and compared the two inclusion methods. Patients included direct during consultation were compared with those included in writing within two weeks of consultation on the following characteristics: age, gender, duration of current complaint, severity of back pain, level of disability, and duration between consultation and baseline measurements. Levene's test was used to assess the equality of variance for each variable. The chi-square test was used to compare categorical variables and an unpaired t-test to compare numerical variables. The Mann-Whitney U-test was used instead of the unpaired t-test for variables for which the p-value of the Levene's test was <0.01.

Second, patients in the age category >55-74 years were compared with those aged ≥75 years on information from the baseline questionnaire and physical examination. For this analysis, the chi-square test was used to compare the categorical variables and an unpaired t-test or Mann-Whitney U-test was used to compare the numeric variables. All analyses were performed using the SPSS version 17.0.

RESULTS

Population characteristics and selection

Of the 1402 back pain patients invited by 103 GPs to participate in this cohort study, 675 patients (48%) were included and 727 patients were excluded. Reasons for exclusion were: not willing to participate (n=291), not meeting the inclusion criteria (n=118), or the patient did not respond (n=318). Of the 675 included back pain patients, 105 were included during the consultation and 570 after they received a written invitation within 2 weeks after their consultation. Of these patients, 669 patients (99%) filled in the baseline questionnaire and 670 patients (99%) completed the physical examination. Patient selection is described in Figure 1. The study population consisted of 274 men and 401 women, median age was 65 (interquartile range (IQR) 60-71) years and 479 (71%) were married. At baseline, median duration of back pain was 35 (IQR 20-100) days, and 156 (23%) patients had back pain lasting >3 months. Pain radiation in the legs below the knee was reported by 205 (30%) patients.

Comparison of patients included during consultation and after the consultation revealed some significant differences. Patients included after a written invitation had slightly less severe back pain (mean 4.9; median 7; IQR5-8) compared with those invited direct during the consultation (mean 6.5; median 5; IQR3-7); also, they had a lower level

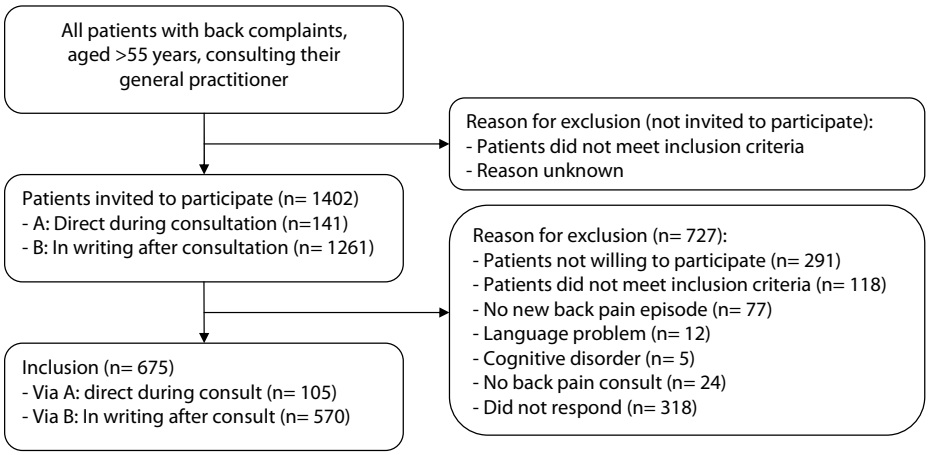


Figure 1: Flow chart of the study

of disability as measured with the RDQ (mean 9.5 and 11.3, respectively). However, these differences between the groups might be attributed to the difference in the (mean) number of days between consultation and completing the baseline measurement (the physical examination): i.e. 26 days for those with a written invitation and 8 days for those invited direct during consultation (Table 1).

Table 1: Comparison of the inclusion methods.

	A: Direct during consultation (n=105) n (%)	B: In writing after consultation (n= 570) n (%)	Total (n=675) n (%)
Number of days between consultation and baseline measurements: median (IQR)	8 (6-13)	26 (20-33)	23 (16-31)**
Patient characteristics			
Age in years: mean ± SD	66.8 ± 7.3	66.3 ±7.7	66.4 ±7.6
Male	50 (48)	224 (39)	274 (41)
Low education level	43 (41)	236 (41)	279 (41)
Married	70 (67)	409 (72)	479 (71)
Paid job	24 (23)	153 (27)	177 (26)
Characteristics of the complaint			
Duration of back pain >3 months	32 (31)	124 (22)	156 (23)
Severity of back pain (NRS average previous week): mean ± SD	6.5 ± 2.1	4.9 ± 2.7	5.2 ± 2.7**
Radiating pain in the legs below the knee	27 (26)	178 (31)	205 (30)
Disability (RDQ): mean ± SD	11.3 ± 5.7	9.5 ± 5.8	9.8 ± 5.8**

** p< 0.01

IQR: interquartile range (presented as 25%-75% IQR), SD: standard deviation, NRS: numeric rating scale, RDQ: Roland Disability Questionnaire

Age groups: patient and complaint characteristics

Table 2 presents the patient and complaint characteristics per age category. Significantly more patients aged ≥75 years had a lower education level compared to the younger group (58% and 38%, respectively). The older group had a lower percentage of smokers (5% and 21%, respectively) and of hazardous drinking (32% and 53%, respectively) than patients in the age category >55-74 years. However, these differences might be explained by the healthy survival effect, whereby those with a healthy lifestyle live longer than those with an unhealthy lifestyle.

In 67% of the patients the back pain was located in the lumbar spine. The (mean) severity of back pain in the previous week showed no significant differences between the two groups: 5.1 (SD 2.7) for patients aged >55-74 years and 5.6 (SD 2.5) for patients aged ≥75 years. In contrast, (mean) back pain severity at the moment of filling in the baseline questionnaire was significant different between the groups ($p<0.05$); (mean) 4.5 (SD 2.5) for patients aged >55-74 years and 5.1 (SD 2.5) for patients aged ≥75 years. There was a significant difference in disability between the two groups: 9.4 (SD 5.8) for the younger patients and 12.1 (SD 5.5) for patients aged ≥75 years, indicating that older patients experienced more disability due to back pain. Regarding medical consumption, 483 (72%) of all patients took pain medication for their back pain, with no significant difference between the two groups. Patients aged ≥75 years reported lower quality of life, more depressive symptoms, more fear and avoidance beliefs, and more negative thoughts about back pain compared with patients aged >55-74 years.

Physical examination

Table 3 presents the results of the physical examination tests. Pain during palpation was more often present with palpation of the paravertebral muscles (34%) than with palpation of the spinous processes and sacroiliac joint (19%). Differences between left and right knee tendon reflex was found in 21% of the back pain patients, and a positive test of Lasegue in 15%. Only 4% of the patients had an increased CRP level. A significant difference was found between the two groups in lateroflexion: 44% of the patients aged ≥75 years had differences between lateroflexion to the left and right compared to 34% in the younger group. The older group took longer to complete the timed up and go test (median 13.0, IQR 10.2-17.1 sec.) compared with the younger group (median 9.9, IQR 8.5-11.9 sec.). The older group more often had low bone quality, indicating a higher risk for fractures: 29% of patients aged ≥75 years compared with 8% of patients aged >55-74 years.

Co-morbidity

Table 4 presents the patients' self reported co-morbidity. The musculoskeletal disorders occurring most frequently were neck/shoulder complaints (52% of all patients), knee

Table 2: Characteristics of the back pain patients (n=675).

	>55-74 years (n=566) n (%)	≥ 75 years (n=109) n (%)	Total (n=675) n (%)
Number of days between consultation and baseline measurements: median (IQR)	23 (17-31)	23 (15-29)	23 (16-31)
Patient characteristics			
Male	237 (42)	37 (34)	274 (41)
Education level:			
Low	216 (38)	63 (58)	279 (41)**
Middle	246 (44)	29 (27)	275 (41)
High	98 (17)	16 (15)	114 (17)
Body mass index: mean ± SD	27.6 ± 4.7	27.1 ± 4.5	27.5 ± 4.7
Marital status: married	426 (75)	53 (49)	479 (71)**
Paid job	177 (31)	0 (0)	177 (26)**
Smoking	117 (21)	5 (5)	122 (18)**
Hazardous drinking (AUDIT-C)	298 (53)	35 (32)	333 (49)**
Characteristics of the complaint			
Duration of back pain			
<1 week	55 (10)	7 (6)	62 (9)
1 week-6 weeks	229 (40)	44 (40)	273 (40)
6 weeks-3 months	94 (17)	10 (9)	104 (15)
> 3 months	129 (23)	27 (25)	156 (23)
Average back pain previous week (NRS): mean ± SD	5.1 ± 2.7	5.6 ± 2.5	5.2 ±2.7
Disability (RDQ): mean ± SD	9.4 ± 5.8	12.1 ± 5.5	9.8 ± 5.8**
Pain location			
Only thoracic	34 (6)	9 (8)	43 (6)
Only lumbar	382 (67)	68 (62)	450 (67)
Thoracic and lumbar	91 (16)	20 (18)	111 (16)
Perceived cause: accident or trauma	20 (4)	8 (7)	28 (4)
History of back pain	493 (87)	86 (79)	579 (86)
Back surgery in the past	46 (8)	10 (9)	56 (8)
Radiating pain in the leg below the knee	170 (30)	35 (32)	205 (30)
Severity of leg pain (NRS): mean ± SD[a]	4.0 ± 2.8	4.0 ± 2.8	4.0 ± 2.8
Morning stiffness of the back	418 (74)	80 (73)	498 (74)
Medical consumption			
Use of pain medication for back pain	403 (71)	80 (73)	483 (72)
Care from a physical therapist	251 (44)	48 (44)	299 (44)
Psychological factors			
Quality of life (SF-36) physical summary scale: mean ± SD	43.8 ± 8.7	40.0 ± 9.5	43.2 ± 8.9**
Depressive symptomatology (CES-D): mean ± SD	9.7 ± 7.8	11.8 ± 7.6	10.0 ± 7.8*

Kinesiophobia (FABQ) physical activity subscale: mean ± SD	13.2 ± 5.7	14.6 ± 6.1	13.4 ± 5.8*
Pain catastrophizing (PCS): mean ± SD	13.9 ± 10.6	15.5± 10.5	14.1 ± 10.6
Attitude and beliefs about back pain (BBQ): mean ± SD	26.8 ± 7.1	24.5 ± 7.5	26.4 ± 7.2**

* p< 0.05, ** p< 0.01 [a] Means and SD computed only with the patients which reported leg pain (n=375)
IQR: interquartile range (presented as 25%-75% IQR), SD: standard deviation, AUDIT-C: Alcohol Use Disorders Identification Test, NRS: numeric rating scale (range 0-10), RDQ: Roland disability questionnaire (range 0-24), SF-36: Short Form-36, physical summary scale (range 0-100), CES-D: Center for Epidemiologic Studies Depression Scale (range 0-60), FABQ: Fear avoidance beliefs questionnaire, physical activity subscale (range 0-28), PCS: Pain Catastrophizing Scale (range 0-52), BBQ: Back beliefs questionnaire (range 9-45)

Table 3: Results of the physical baseline examination.

	>55-74 years (n=566) n (%)	≥ 75 years (n=109) n (%)	Total (n=675) n (%)
General examination			
Pain during palpation of the paravertebral muscles	193 (34)	34 (31)	227 (34)
Pain during palpation of the spinous processes and sacroiliac joint	105 (19)	22 (20)	127 (19)
Heberden's or Bouchard's nodules	131 (23)	30 (28)	161 (24)
Range of motion			
Anteflexion (finger-floor distancem in cm): mean ± SD	10.6 ± 12.0	12.2 ± 11.4	10.9 ± 11.9
Lateroflexion[a]	194 (34)	48 (44)	242 (36)*
Rotation upper body[a]	133 (24)	23 (21)	156 (23)
Hip external rotation[a]	68 (12)	14 (13)	82 (12)
Hip internal rotation[a]	86 (15)	16 (15)	102 (15)
Additional diagnostic tests			
Knee tendon reflex[a]	117 (21)	25 (23)	142 (21)
Quadriceps strength[a]	67 (12)	11 (10)	78 (12)
Positive Laseque	87 (15)	13 (12)	100 (15)
Sensation of the foot[a]	101 (18)	18 (17)	119 (18)
Timed up and go test, in sec: median (IQR)	9.9 (8.5-11.9)	13.0 (10.2-17.1)	10.2 (8.6-12.6)**
Low bone quality	45 (8)	32 (29)	77 (11)**
CRP level >10 mg/l	20 (4)	6 (6)	26 (4)

* p< 0.05, ** p< 0.01
SD: standard deviation, IQR: interquartile range (presented as 25%-75% IQR), CRP: C-reactive protein
[a] Difference between left and right side of the body

Table 4: Reported co-morbidity (n=675).

	>55-74 years (n=566) n (%)	≥ 75 years (n=109) n (%)	Total (n=675) n (%)
Heart disease	72 (13)	32 (29)	104 (15)**
High blood pressure	197 (35)	54 (50)	251 (37)**
Lung disease	55 (10)	14 (13)	69 (10)
Diabetes	62 (11)	18 (17)	80 (12)
Ulcer or stomach disease	50 (9)	12 (11)	62 (9)
Kidney disease	14 (3)	10 (9)	24 (4)**
Liver disease	4 (1)	1 (1)	5 (1)
Anemia or other blood disease	7 (1)	6 (6)	13 (2)**
Cancer	22 (4)	5 (5)	27 (4)
Depression	46 (8)	9 (8)	55(8)
Hip or knee osteoarthritis	161 (28)	40 (37)	201 (30)
Hand osteoarthritis	113 (20)	24 (22)	137 (20)
Rheumatoid arthritis	25 (4)	8 (7)	33 (5)
Neck/shoulder complaints	302 (53)	50 (46)	352 (52)
Hip complaints	236 (42)	40 (37)	276 (41)
Knee complaints	266 (47)	47 (43)	313 (46)
Headache/migraine	89 (16)	16 (15)	105 (16)
Feet problems	155 (27)	37 (34)	192 (28)
Gout	20 (4)	7 (6)	27 (4)
Neurological problems	21 (4)	7 (6)	28 (4)
Osteoporosis	75 (13)	23 (21)	98 (14)*

* $p < 0.05$, ** $p < 0.01$

complaints (46%) and hip complaints (41%). There were no significant differences between the two age groups for the prevalence of these complaints. Several other disorders were more often present in patients aged ≥75 years than in the younger group: high blood pressure (50 vs. 35%), heart diseases (29 vs. 13%), osteoporosis (21 vs. 13%), kidney disease (9 vs. 3%), and anemia or other blood disease (6 vs. 1%). There was no significant difference in the prevalence of the following complaints between patients aged >55-74 and ≥75 years:

hip/knee osteoarthritis which was 28% and 37%, respectively; rheumatoid arthritis which was 4% and 7%, respectively; and depression which was 8% and 8%, respectively.

DISCUSSION

The present study reports the characteristics of 675 patients aged >55 years visiting their GP for back pain. Back pain severity, level of disability and duration between consultation and baseline measurement were somewhat higher for patients who were invited to join the study direct during the consultation compared to those included in writing within two weeks after the consultation. Comparison of patients aged >55-74 years and ≥75 years shows a significant difference in disability (RDQ score 9.4 and 12.1, respectively). Patients aged ≥75 years reported significantly higher pain severity at the moment of filling in the questionnaire, but the magnitude of the difference (0.6) was small and no difference was found between the two groups for average back pain severity in the previous week. Patients aged ≥75 years more often reported other musculoskeletal complaints, as well as high blood pressure, heart diseases, osteoporosis, kidney diseases and anemia or other blood diseases. Also, the older group more often had lower bone quality than the younger patients.

The review of Pengel et al. describes the course of acute back pain patients.[8] The baseline pain scores of the studies range from ± 12 to 65 (on a 100-point scale for pain) and a similar range was found for disability scores, making comparison with our results difficult.[8] Although we found a significant difference between our two age groups for back pain severity and disability, the difference is very small. Proposed clinically meaningful changes for back pain patients on an 11-point NRS scale were 2 points and 5 points for the RDQ.[28] The differences between our age groups were smaller, indicating no clinically relevant differences, but it is unknown whether these differences will increase in case of a greater age difference between the study groups.

Our study population has a higher percentage of patients with a history of back pain compared with other back pain study populations.[7,29] The age difference between the various study populations is a likely explanation for this finding. Other studies conducted among the general population comparing different age categories also found some similar differences, e.g. older patients in general, and older patients with musculoskeletal complaints, experienced more disability than younger patients.[12,30-31] Increased age and multimorbidity were significantly associated with lower quality of life.[32-33] The number of comorbidities increases with increasing age and patients with comorbidity used healthcare services more often than patients with one health problem.[9,34] Bone density and bone mass decrease with older age, especially in women.[35-36] All these differences between age categories might influence the course of back pain and should be taken into account when GPs consider their treatment approach. Prognostic research should examine whether these characteristics are predictors for recovery.

A limitation of the present study is that patient inclusion was accomplished either through invitation direct during consultation or in writing within 2 weeks of the con-

sultation. This resulted in small baseline differences between these groups in back pain severity and disability. This is probably due to the difference in the number of days between consultation and baseline measurement. Nevertheless, because mean age is similar in both groups this enables comparison between the age groups within the total population. Another limitation is that, due to the workload of the participating GPs, not all consecutive eligible patients were referred to the study during consultation. However, when recruiting patients in writing after the consultation, all consecutive eligible back pain patients were invited to participate.

In summary, the older patients reported more severe disabilities and co-morbidity. However, the clinical relevance of these differences for the course of the back pain episode in these older patients remains a topic for further research.

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Chapter 5

Course and prognosis of older patients with back pain in general practice: a prospective cohort study

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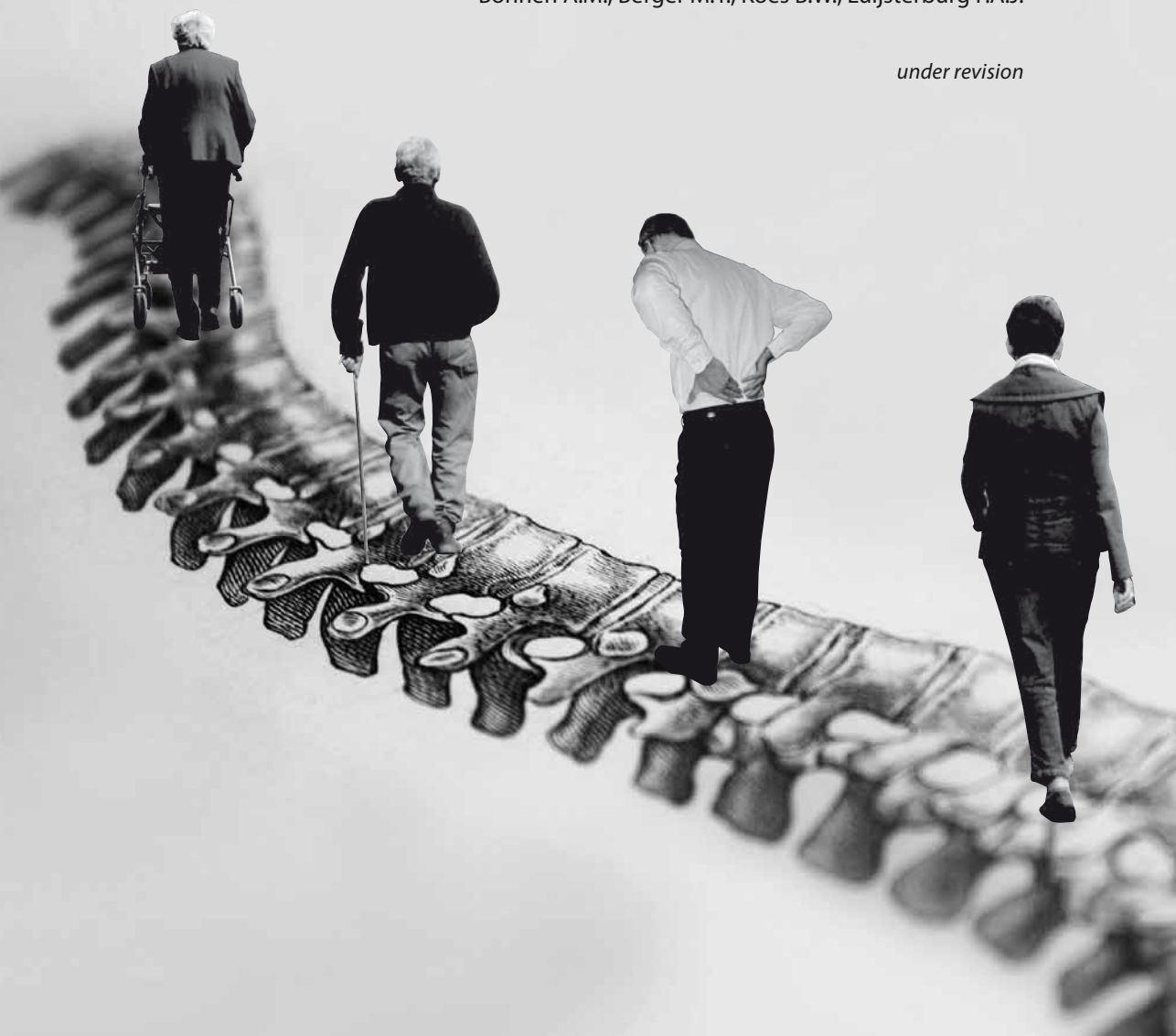
under revision



ABSTRACT

Study Design: Prospective cohort study.

Objective: To determine the course of back pain in older patients and identify prognostic factors for poor recovery at 3 months follow-up.

Summary of Background Data: Data on the course and prognosis of back pain are helpful for clinicians to inform their patients, but information about older patients is lacking in the literature.

Methods: Patients aged >55 years visiting a general practitioner (GP) with a new episode of back pain were included in the BACE study in the Netherlands. The course of back pain was described in terms of self-perceived recovery, pain severity, disability, pain medication and GP visits at 6 weeks and 3 months follow-up. Prognostic factors for poor recovery at 3 months follow-up were derived from the baseline questionnaire and physical examination. Variables with a prognostic value were identified with multivariable logistic regression analysis (method backward), and an area under the receiver operating curve (AUC) was calculated for the prognostic model.

Results: A total of 675 back pain patients (mean age 66.4 years (SD 7.6)) participated in the BACE cohort study. At 6 weeks follow-up 64% of the patients indicated poor recovery from back pain. At 3 months follow-up 61% still reported poor recovery, but only 26% of these patients had revisited the GP in this time period. Long duration of back pain, a history of back pain, absence of radiating pain in the leg below the knee, number of co-morbidities, patients' expectation of poor recovery, and longer duration of the timed 'Up and Go' test were significantly associated with poor recovery in a multiple regression model (AUC 0.79).

Conclusions: At 3 months follow-up, 61% of older patients visiting their GP because of back pain reported poor recovery. We identified baseline characteristics that were associated with poor recovery at 3 months follow-up. This information can help GPs identify older back pain patients at risk for poor recovery.

INTRODUCTION

In clinical guidelines the course of back pain is often described as favorable for most patients, although it is also often emphasized that recurrence of back pain is common.[1-3] Recovery rates vary widely between studies due to different study populations and outcomes.[4-5] The course of back pain may also differ between patients, because individual factors (e.g. age, duration of back pain or general health) can influence the course.[6-7]

Information on the course and prognostic factors for poor recovery of back pain is helpful for clinicians to better inform their patients. It might also be useful to select (effective) treatment when modifiable prognostic factors for poor recovery are found. Hayden et al., reported that many inconsistent findings exist between reviews on prognostic factors for back pain.[4] Variables consistently reported as prognostic factor for different unfavorable outcomes were older age, poor general health, increased psychological or psychosocial stress, poor relations with colleagues, physically heavy work, worse functional disability at baseline, sciatica, and the presence of work compensation.[4] Although older age is frequently reported as a prognostic factor for poor recovery,[6,8] information on demographic and clinical factors associated with poor recovery during follow-up for older back pain patients is lacking.[9] The course of back pain and factors associated with poor recovery might differ between younger and older adults, because older age is often reported as a prognostic factor for poor recovery. Older age is also considered a 'red flag' in patients with back pain, i.e. indicating possible underlying spinal pathology[1,10] and older people have more co-morbidities.[11]

Therefore, the aim of the present study is to describe the course of back pain patients aged >55 years recruited in general practice, and to identify prognostic factors for poor recovery of back pain in these patients at 3 months follow-up.

MATERIALS AND METHODS

Study design

This is a prospective cohort study including back pain patients aged >55 years consulting their general practitioner (GP) with a new episode of back pain (the BACE study). An episode was defined as 'new' if the patient had not visited a GP during the preceding 6 months for the same back complaint. Back pain was defined as pain in the region from the top of the shoulder blades to the first sacral vertebra. Exclusion criteria were language problems, cognitive disorders, or being unable to complete the physical examination (e.g. wheelchair-bound patients). Eligible back pain patients were invited to participate in the BACE study by their GP either directly during consultation, or in writing within two weeks after consultation. After inclusion in the BACE study and having signed informed consent, the baseline measurements included a questionnaire and a physical examination of the

back. The follow-up period of this study was 3 months, with two follow-up measurements: at 6 weeks and at 3 months. The study protocol was approved by the local Medical Ethics committee. The BACE study design is described in detail elsewhere.[12]

Measurements

The questionnaires are based on the Multinational Musculoskeletal Inception Cohort Study (MMICS) statement.[13] This is a consensus statement designed to improve the quality of back pain prognosis research by recommending a core set of measurements. The baseline questionnaire and physical examination included measurements of potential prognostic factors for poor recovery. Follow-up questionnaires at 6 weeks and 3 months included the following outcome measurements: 1) self-perceived recovery measured with the Global Perceived Effect (GPE) on a 7-point scale ranging from 'completely recovered' to 'worse than ever',[14] 2) average severity of back pain during the previous week measured on an 11-point numeric rating scale (NRS) ranging from 0 'no pain' to 10 'worst pain ever' [15], 3) disability, measured with the Roland Disability Questionnaire (RDQ), ranging from 0 points (no disabilities) to 24 points,[16] 4) medication used for back pain: a dichotomous variable asking if the patient took pain medication in the 3 months preceding the follow-up questionnaire, and 5) a GP visit in the 3 months preceding the follow-up questionnaire (yes/no).

The potential prognostic factors for (poor) recovery selected for this study were those factors which were identified as prognostic factors in the previous literature and/or deemed clinically relevant. These factors were divided into two categories:

1) History taking: including patients' characteristics and characteristics of the back disorder. The following patient characteristics were included: age, sex, education level, body mass index (BMI), patients' expectation of recovery, quality of life; physical and mental summary scales of the Short Form-36 (SF-36),[17] depressive symptomatology measured with the Center for Epidemiologic Studies Depression Scale (CES-D),[18] kinesiophobia measured with the Fear-Avoidance Beliefs Questionnaire (FABQ) physical activity subscale,[19] pain catastrophizing measured with the Pain Catastrophizing Scale (PCS),[20] co-morbidity of musculoskeletal symptoms (neck, shoulder, knee or hip symptoms) and the number of co-morbidities measured with the Self-Administered Comorbidity Questionnaire (SCQ),[21] and complemented by the musculoskeletal symptoms. The following characteristics of the back disorder were included: duration of the back pain at baseline, severity of back pain at baseline measured on an 11-point NRS, baseline disability measured with the RDQ, history of back pain, the presence of radiating pain in the leg below the knee, and perceived cause of the back pain.

2) Physical examination: including anteflexion (finger-floor distance in cm), difference in quadriceps strength between the right and left leg, test of Lasègue,[22] timed 'Up and Go' test,[23] and bone quality measured with the Lunar Achilles InSight (quantitative

ultrasound measurement of the heel).[24] Low bone quality is defined as a score of >2.5 standard deviations (SD) lower than the population mean.

Statistical analysis

Descriptive analysis was used to report the characteristics of the participants and the course of back pain over the 3-month follow-up period.

To identify prognostic factors, an unfavorable outcome was defined as poor recovery, i.e. a score of 'somewhat improved', 'stayed the same', 'somewhat worsened', 'strongly worsened' or 'worse than ever' on the GPE scale. Recovery was defined as a score of 'completely recovered' or 'strongly improved'. Imputation of missing data of the baseline prognostic variables was carried out by multiple imputation, creating five imputed databases.[25] Bivariate logistic regression analysis was performed to gain insight into the association between the baseline variables and outcome. A multivariate logistic regression analysis (method backward, entry $p<0.05$, removal $p>0.10$) was first performed with the history taking variables on all five imputed databases. If a variable was selected in at least three of the five imputed databases in the multivariate analysis, it was included in the final model (method enter). To determine the discriminative ability of the model, the area under the receiver operating curve (AUC) was calculated. An AUC of 0.5-0.7 is considered as moderate discrimination, and an AUC of ≥ 0.7 as good. After selection of these variables, the same analysis of the multivariate (backwards) regression analysis was performed with the variables of the physical examination added to the history taking model in order to examine the additional value of the physical examination. Sensitivity analysis was performed for the method of patient recruitment in the study.

RESULTS

Population characteristics

The flow chart of the study is presented in Figure 1. A total of 675 back pain patients participated in the study. During follow-up, 639 (95%) patients returned the 6-week follow-up questionnaire and 626 (93%) patients returned the 3-month follow-up questionnaire. The baseline characteristics of the study population are presented in Table 1. The mean age of the patients was 66.4 years (SD 7.6; range 56-91 years). 41% of the patients were male. Of all patients, 41% had a low level education, 26% had a paid job and 71% was married. The median duration of the back pain at baseline was 35 days (IQR 20-100) days; 23% of the patients reported back pain lasting ≥ 3 months. 30% of the patients had pain radiating in the leg below the knee.

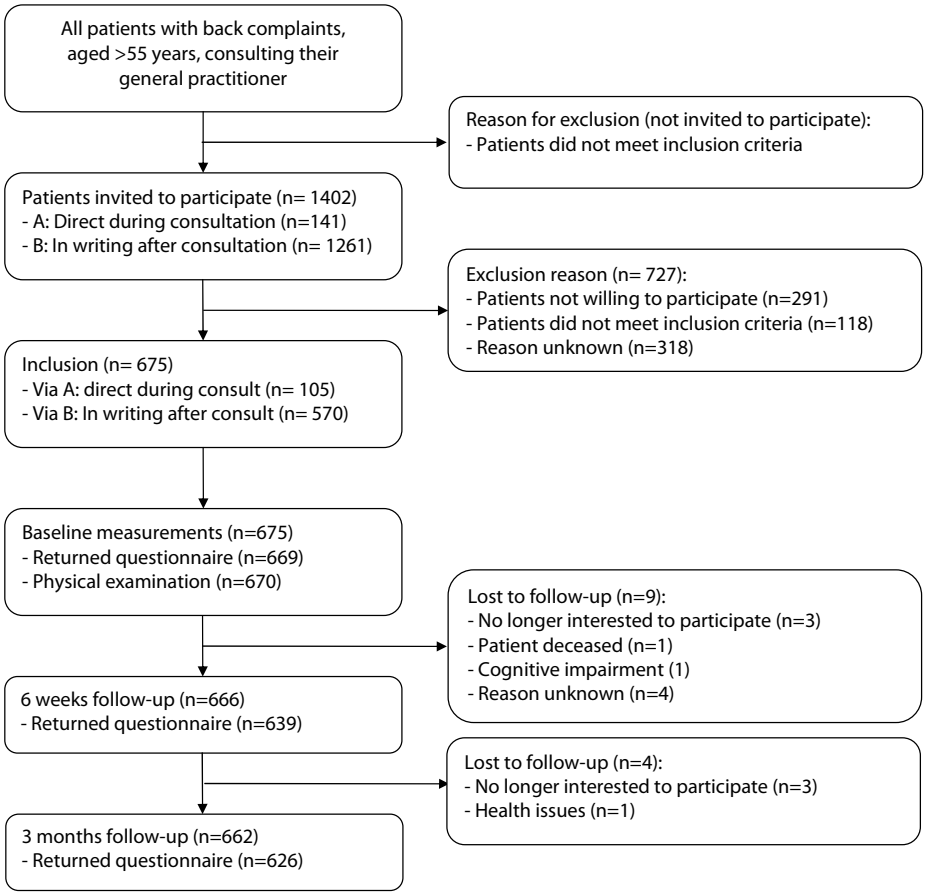


Figure 1: Flow chart of the study population.

Course of back pain

The baseline assessment and outcomes at 6 weeks and 3 months follow-up are presented in Table 2. At baseline, the mean back pain severity was 5.2 (SD 2.7), at 6 weeks this had decreased to a mean of 3.7 (SD 2.8) and at 3 months follow-up to a mean of 3.6 (SD 2.8). The average disability score, measured with the RDQ, was 9.8 (SD 5.8) at baseline and was 7.8 (SD 6.2) at 3 months follow-up. At 6 weeks, 409 patients (64%) reported poor recovery and at 3 months 61% of these patients still reported poor recovery. In total 39% of the back pain patients reported use of pain medication for their back pain in the 3 months after baseline measurement; whereas only 26% of the patients reported that they had re-visited their GP in these 3 months.

Table 1 Baseline characteristics of the study population.

	Study population n=675
Number of days between consultation and baseline physical examination: median (IQR)	23 (16-31)
History taking	
Age in years: mean ± SD	66.4 ± 7.6
Male: n (%)	274 (41)
body mass index: mean ± SD	27.5 ± 4.7
Education level low: n (%)	279 (41)
Marital status married: n (%)	479 (71)
Employed (paid job): n (%)	177 (26)
Patients' expectation to recover of back pain: n(%)	291 (43)
Quality of life: SF-36 Physical summery scale: mean ± SD	43.2 ± 8.9
Quality of life: SF-36 Mental summery scale: mean ± SD	49.6 ± 10.3
Depressive symptomatology (CES-D): mean ± SD	10.0 ± 7.7
Kinesiophobia (FABQ): mean ± SD	13.4 ± 5.8
Pain catastrophizing (PCS): mean ± SD	14.1 ± 10.6
Co-morbidity musculoskeletal complaints: n (%)	519 (77)
Co-morbidity (number of other complaints): mean ± SD	2.3 ± 1.9
Duration of back pain in days: median (IQR)	35 (20-100)
Duration of back pain >3 months: n (%)	156 (23)
Severity of back pain (NRS): mean ± SD	5.2 ± 2.7
Pain radiating in the leg below the knee: n (%)	205 (30)
Disability: (RDQ): mean ± SD	9.8 ± 5.8
History of back pain: n (%)	579 (86)
Perceived cause: accident or trauma: n (%)	28 (4)
Physical examination	
Finger-floor distance (in cm): mean ± SD	10.9 ± 11.9
Quadriceps strength difference: n (%)	78 (12)
Positive test of Lasègue: n (%)	100 (15)
Timed 'Up and Go' test (in sec): mean ± SD	11.1 ± 3.9
Low bone quality: n (%)	77 (11)

IQR: interquartile range (presented as 25%-75% IQR), SD: standard deviations, SF-36: Short Form-36 (range 0 'low quality of life' -100 points), CES-D: Center for Epidemiologic Studies Depression Scale (range 0 'no depressive symptomatology ' – 60 points), FABQ: Fear-Avoidance Beliefs Questionnaire (physical act. subscale) (range 0 'no fear and avoidance beliefs'-28 points), PCS: Pain Catastrophizing Scale (range 0 no pain catastrophizing -52 points), NRS: numeric rating scale (range 0 'no pain'-10 'worst pain ever'), RDQ: Roland disability questionnaire (range 0 no disabilities – 24 points).

Table 2: Outcomes at 6 weeks and 3 months follow-up of older back pain patients in general practice.

	Baseline (n=675) n(%)	6 weeks follow-up (n=639) n(%)	3 months follow-up (n=626) n(%)
Poor recovery (GPE)[a]	-	409 (64)	380 (61)
Severity of back pain (NRS)	5.2 ± 2.7	3.7 ± 2.8	3.6 ± 2.8
Disability (RDQ); mean ±SD	9.8 ± 5.8	-	7.8 ± 6.2
Taking pain medication for back pain	483 (72)	-	246 (39)
Re-visiting GP within 3 months	-	-	161 (26)

GPE: Global Perceived Effect, NRS: numeric rating scale (range 0 'no pain'-10 'worst pain ever'), SD: standard deviations, RDQ: Roland disability questionnaire (range 0 no disabilities – 24 points)
[a] GPE 7-point Likert scale, dichotomized in 1,2: recovered, 3-7: poor recovery.

Prognostic factors for poor recovery

Table 3 shows the pooled bivariate associations between baseline characteristics and poor recovery at 3 months follow-up. The characteristics which were associated with poor recovery in the bivariate regression analysis were: older age, male sex, low education, patients' expectation of poor recovery, low quality of life, physical and mental summary score, depressive symptoms, kinesiophobia, pain catastrophizing, the number of co-morbidities and musculoskeletal co-morbidities, longer duration of the back pain, higher back pain severity, more disabilities, history of back pain, difference in quadriceps strength, a positive test of Lasègue and longer completing duration of the timed 'Up-and Go' test.

Table 4 shows the pooled multivariate associations between baseline characteristics and poor recovery. The history taking model was calculated with all variables of the categories patients' characteristics and characteristics of the back disorder. The variables remaining in the final history taking model were: patients' expectations of poor recovery, low quality of life, physical summary score of the SF-36, the number of co-morbidities, longer duration of the back pain (6-12 weeks or >3 months), higher severity of back pain, history of back pain, and absence of radiating pain in the leg below the knee. This model had a discriminative ability of AUC of 0.78.

When the variables of the physical examination were added to this model, the AUC remained quite similar (0.79) and the variables associated with poor recovery were: patients' expectation to recover [odds ratio (OR) 0.4; 95% confidence interval (CI): 0.3-0.6], number of co-morbidities (OR 1.2; 95% CI: 1.1-1.4), duration of the back pain 6-12 weeks (OR 1.8; 95% CI: 1.1-3.0), duration of the back pain >3 months (OR 4.3; 95% CI: 2.5-7.5) (0-6 weeks as reference category), severity of back pain (OR 1.2; 95% CI: 1.1-1.3), history of back pain (OR 1.8; 95% CI: 1.0-3.2), radiating pain in the leg below the knee (OR 0.7; 95% CI: 0.4-1.0), and timed 'Up and Go' test (OR 1.1; 95%: CI 1.0-1.2).

We performed an exploratory sensitivity analysis on the method of patient recruitment. We divided the patient population in two groups: the patients who were invited to participate direct during consultation and the patients who were invited in writing.

Table 3: Pooled bivariate association between baseline characteristics and poor recovery at 3-months follow-up (n=619).

	Poor recovery	
	OR (95% CI)	p value
History taking		
Age	1.0 (1.0-1.1)	0.02
Male sex	0.6 (0.4-0.8)	<0.01
Low education	1.7 (1.2-2.4)	<0.01
Body mass index	1.1 (1.0-1.1)	<0.01
Patients' expectation to recover	0.3 (0.2-0.4)	<0.01
Quality of life: SF-36 Physical summery scale	0.9 (0.9-1.0)	<0.01
Quality of life: SF-36 Mental summery scale	1.0 (1.0-1.0)	0.06
Depressive symptomatology (CES-D)	1.1 (1.0-1.1)	<0.01
Kinesiophobia (FABQ, physical act. subscale)	1.1 (1.0-1.1)	<0.01
Pain catastrophizing (PCS)	1.0 (1.0-1.0)	<0.01
Co-morbidity musculoskeletal complaints	2.6 (1.8-3.9)	<0.01
Co-morbidity (number of other complaints)	1.4 (1.3-1.5)	<0.01
Duration of the back pain:		
0-6 weeks	Reference cat.	
6-12 weeks	1.7 (1.1-2.6)	0.02
>3 months	5.5 (3.4-9.1)	<0.01
Severity of back pain (NRS)	1.2 (1.2-1.3)	<0.01
Disability (RDQ)	1.1 (1.1-1.1)	<0.01
History of back pain (yes)	1.8 (1.1-2.9)	0.02
Radiating pain in the leg below the knee	1.2 (0.8-1.7)	0.34
Perceived cause: accident or trauma	1.4 (0.6-3.5)	0.43
Physical examination		
Finger-floor distance (in cm)	1.0 (1.0-1.0)	0.42
Quadriceps strength difference	1.8 (1.1-3.1)	0.03
Positive test of Lasègue	1.6 (1.0-2.6)	0.05
Timed 'Up and Go' test (in sec)	1.1 (1.1-1.2)	<0.01
Low bone quality	1.1 (0.7-1.9)	0.64

SF-36: Short Form-36 (range 0 'low quality of life' -100 points), CES-D: Center for Epidemiologic Studies Depression Scale (range 0 'no depressive symptomatology ' – 60 points), FABQ: Fear-Avoidance Beliefs Questionnaire (physical act. subscale) (range 0 'no fear and avoidance beliefs'-28 points), PCS: Pain Catastrophizing Scale (range 0 no pain catastrophizing -52 points), NRS: numeric rating scale (range 0 'no pain'-10 'worst pain ever'), RDQ: Roland disability questionnaire (range 0 no disabilities – 24 points).

The multiple regression analysis (method enter) for the last model (the history taking and physical examination model) was performed for both groups. This hardly changed the magnitude of the associations.

Table 4: Multivariable association between baseline characteristics and poor recovery at 3 months follow-up (n=619).

	Poor recovery		
	Pooled OR (95% CI)	p value	AUC
History taking			0.78
Patients' expectation to recover	0.4 (0.3-0.6)	<0.01	
Quality of life: SF-36 Physical summery scale	1.0 (0.9-1.0)	0.03	
Co-morbidity (number of other complaints)	1.2 (1.1-1.4)	<0.01	
Duration of the back pain:			
0-6 weeks	ref. category		
6-12 weeks	1.9 (1.2-3.1)	0.01	
>3 months	4.4 (2.5-7.7)	<0.01	
Severity of back pain (NRS)	1.2 (1.1-1.3)	<0.01	
History of back pain (yes)	1.7 (1.0-3.0)	0.06	
Radiating pain in the leg below the knee	0.6 (0.4-1.0)	0.05	
History taking and physical examination			0.79
Patients' expectation to recover	0.4 (0.3-0.6)	<0.01	
Co-morbidity (number of other complaints)	1.2 (1.1-1.3)	<0.01	
Duration of the back pain:			
0-6 weeks	ref. category		
6-12 weeks	1.8 (1.1-3.0)	0.02	
>3 months	4.3 (2.5-7.5)	<0.01	
Severity of back pain (NRS)	1.2 (1.1-1.3)	<0.01	
History of back pain (yes)	1.8 (1.0-3.2)	0.04	
Radiating pain in the leg below the knee	0.7 (0.4-1.0)	0.06	
Timed 'Up and Go' test (in sec)	1.1 (1.0-1.2)	0.01	

SF-36: Short Form-36 (range 0 'low quality of life' -100 points), NRS: numeric rating scale (range 0 'no pain'-10 'worst pain ever').

DISCUSSION

This study presents the 3-months course of back pain in older patients visiting their GP and identifies factors associated with poor recovery at 3 months follow-up. The mean age of the population was 66.4 years (SD 7.6), range 56-91 years. Pain severity of this BACE population decreased from a mean of 5.2 (SD 2.7) at baseline to 3.6 (SD 2.8) at 3 months follow-up. At 3 months follow-up 61% of the back pain patients reported poor recovery. Using a multiple backwards regression model, baseline variables associated with poor recovery at 3 months follow-up were: longer duration of the back pain, history of back pain, absence of radiating pain in the leg below the knee, number of co-morbidities, patients' expectation of poor recovery, and a longer duration of the timed 'Up and Go' test (AUC 0.79).

In their review, Pengel et al. reported that the level of pain decreased rapidly in the first month and continued to decrease, but more slowly, until 3 months follow-up.[7] A similar pattern was found in the present study, i.e. pain severity mainly decreased during the first 6 weeks and then only slightly between 6 weeks and 3 months. The studies reviewed by Pengel et al. reported a pain reduction of 12-84% from baseline to 1 month follow-up.[7] In the present study there was a 15% decrease in pain during the first 6 weeks, which is less than the pain reduction reported by most of the studies described in the review.[7] This difference might be because Pengel et al. only reviewed those studies that included patients with back pain lasting less than 3 weeks.[7] Acute back pain patients have a more favorable prognosis than patients with pain of longer duration [6] however, the differences in pain decrease may also be attributed to the fact that our study population was older.

To our knowledge, this is the first study that examined prognostic factors for poor recovery of older back pain patients. Most of the variables which were described in literature to be prognostic factors for poor recovery were also bivariately associated with poor recovery at 3 months in this study (the work-related variables were not relevant for our study population).[4,8] Although age is often reported to be a prognostic factor, and older age was associated with poor recovery in the bivariate regression analysis, it was not a predictor in our multiple regression model. In patients aged >55 years, age might lose its predictive power. Factors reported as prognostic factors in the literature, but not significantly associated with the outcome in our population, were perceived cause of back pain accident/trauma, and finger-floor distance. Low bone quality was included in the analysis because we hypothesized that this variable could be clinically relevant; however, it was not associated with poor recovery at 3 months follow-up in our study population. Furthermore the AUC of the multiple regression model remained quite similar when the variables of the physical examination were added to the history

taking multiple regression model. This indicates that the additional value of the physical examination with regard to the discriminative value of the model was small.

A limitation of the study is the missing data in some baseline prognostic variables, but imputation is a valid method to address this issue. The summary scores of questionnaires (e.g. the FABQ and CES-D) and the total number of co-morbidities had the highest percentage of missing values (3.0-16.4%) because this value was already missing when one of the items of these questionnaires was not completed. Therefore, we imputed the separate items of the questionnaire (percentage missing 1.0-5.3%) instead of the summary scores, in order to obtain most of the patients' information. Besides these summary scores, the only variable with a missing percentage of >5% was 'duration of the back pain' (11.9% missing). A second limitation is that patients were either included directly during the GP consultation, or in writing within two weeks after the consultation. The time between the consultation and baseline measurement was longer in the group of patients that were invited in writing. Therefore we performed a sensitivity analysis including these latter patients, but no large differences in associations were found.

This present study identified prognostic factors which were associated with poor recovery at 3 months follow-up in older back pain patients. Validation in another group of older back pain patients is the next step before these results can be implemented in GP practice. Validation is possible in other studies of the BACE consortium; this is a collaboration between different research groups which perform cohort studies with the same methods and design as used in the present study.

In summary, 61% of these older back pain patients reported poor recovery at 3 months follow-up. Baseline characteristics associated with poor recovery have been identified. This information could serve as a guideline for GPs to better inform back pain patients about their prognosis. However, additional studies are needed to validate our results before implementation in GP practice is possible.

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Chapter 6

Association between spinal morning stiffness and lumbar disc degeneration: the Rotterdam Study

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ABSTRACT

Objective: To explore the associations between spinal morning stiffness and lumbar disc degeneration (LDD).

Design: Data from a cross-sectional general-population-based study (Rotterdam Study-I) were used. Intervertebral disc spaces and osteophytes of people aged ≥55 years were scored on lumbar lateral radiographs (L1-2 through L5-S1 was scored). Logistic regression analysis was used to explore associations between spinal morning stiffness and two definitions of LDD (i.e. 'narrowing' and 'osteophytes'). Spinal morning stiffness combined with low back pain and its association with LDD was also analyzed. Similar analyses were performed for knee and hip pain, morning stiffness in the legs, and radiographic knee and hip osteoarthritis (OA) in order to compare these associations with those of LDD. All analyses were adjusted for age, gender, and body mass index (BMI)**.**

Results: Lumbar lateral radiographs were scored for 2819 participants. Both definitions of LDD were associated with spinal morning stiffness: adjusted odds ratio (aOR)1.3;95% confidence interval (CI):1.1-1.6 for 'osteophytes' and aOR1.8;95%CI:1.4-2.2 for 'narrowing'. Both the odds ratios increased when spinal morning stiffness was combined with low back pain: aOR1.5;95%CI:1.1-2.0 for 'osteophytes' and aOR2.5;95%CI:1.9-3.4 for 'narrowing'. When morning stiffness in the legs was combined with knee or hip pain, the associations with radiographic knee or hip OA were: aOR3.0;95%CI:2.1-4.1 for knee OA and aOR3.1;95%CI:1.9-5.0 for hip OA.

Conclusions: Reported spinal morning stiffness is associated with LDD. The associations increased when we combined spinal morning stiffness with low back pain. The magnitude of the association for the definition 'narrowing' is similar to the association between morning stiffness in the legs and knee or hip OA.

INTRODUCTION

Low back pain is a major health problem, also in the elderly. It is the most reported pain site of all musculoskeletal complaints.[1] Low back pain is often defined as pain possibly with muscle tension or stiffness, localized below the costal margin and above the inferior gluteal folds, with or without radiating leg pain.[2] Since patients with non-specific low back pain are not only a large but also a very heterogeneous group regarding etiology, prognosis and susceptibility to treatment, it is important to identify sub-groups within this population. Low back pain patients with symptoms due to lumbar disc degeneration (LDD) or lumbar osteoarthritis (OA) could be such a subgroup, and clinical symptoms associated with radiographic LDD may help identify those with symptoms due to LDD or lumbar OA in clinical practice.

An association between radiographic LDD and low back pain has been reported in several studies.[3-7] The study of de Schepper et al. compared associations between different definitions of LDD and low back pain.[3] They found an association for the definition based on the presence of disc space narrowing, as well as for the definition based on the presence of osteophytes.[3]

Although there are no official classification criteria for LDD, it is often characterized by narrowing of the disc space and the presence of osteophytes, seen at the lumbar radiograph.[4] Disk degeneration is associated with and often precedes facet joint OA.[8-10] Although LDD cannot be defined as real OA because the facet joints are the only synovial joints in the spine, LDD is often used as a proxy for OA of the spine, in particular when imaging (preferably with magnetic resonance imaging) of the synovial joints is not available. OA of the knee and hip already has clinical classification criteria, described by the American College of Rheumatology (ACR). The ACR criteria describe that, besides pain, morning stiffness is an important criteria for hip and knee OA.[11-12]

Therefore, the present study explores the association between: 1) spinal morning stiffness and LDD, and 2) spinal morning stiffness in combination with low back pain and LDD, cross-sectional in a large general population study. These associations are also compared with the associations between morning stiffness in the legs, and knee or hip OA.

METHOD

Study population

This study used data from the Rotterdam Study, a general population prospective cohort study of people aged 55 years and older living in Rotterdam (The Netherlands). All inhabitants of Ommoord, a district of the city Rotterdam, aged 55 years and older (n= 10,215) were invited to participate in this study. In total, 7983 adults participated in the

baseline measurements (78% of the invited inhabitants).[13] The detailed study design has been described elsewhere.[13-14] The present study used the baseline measurements (RS I-1) which were collected in 1990-1993, and included a home interview and radiographs made in a research center in the participant's district. The Medical Ethics Committee of Erasmus Medical Center approved the protocol of the Rotterdam Study. The present study consisted of a random selection of 2819 participants with spinal radiographs available at both baseline and at 6.6 years follow-up, as described in a previous study.[3]

Radiographs

The lumbar spine levels L1-2 through L5-S1 were scored on the lateral lumbar radiograph for the presence and severity of osteophytes (anterior) and disc space narrowing, using the system of Lane et al.[15] This system grades both osteophytes and disc space narrowing on a scale from 0-3, in which 0 = none, 1 = mild, 2 = moderate, and 3 = severe. The Lane atlas contains lumbar radiograph in which the different grades of osteophytes and narrowing are illustrated. Disc space narrowing was scored if the height between the lumbar vertebrae was different from the normal progression of the spine. The Lane atlas is one of the systems recommended in a recent review on existing grading scales.[16]

All spinal radiographs were scored by a single reader [EdS], who was trained to score the radiographs and blinded to the participants' clinical data. A random selection of spinal radiographs (140; 5%) was evaluated by another trained reader to obtain the interobserver reproducibility. The intraclass correlation coefficient (ICC) was 0.83 for scoring osteophytes and 0.77 for scoring disc space narrowing, which indicates a good reproducibility.[3]

An earlier report of the Rotterdam Study[3] analyzed the association between different radiographic features of LDD and low back pain. They concluded that the association increased after excluding level L5-S1 from the analysis, and when disc space narrowing or osteophytes were present at two or more vertebral levels.[3] Disc space narrowing of the lumbosacral disc is also more difficult to score due to its narrow height and because the variable height of a normal disc at this level makes it difficult to establish pathology.[17-18] We used the two different definitions of LDD proposed in the study of de Schepper et al., i.e. 'narrowing' and 'osteophytes'. 'Narrowing' is defined as disc space narrowing (grade ≥1) at two or more vertebral levels (L1-2 through L4-L5), and 'osteophytes' as the presence of osteophytes (grade ≥2) at two or more vertebral levels (L1-2 through L4-L5).[3]

From the 2819 participants of this study, available weight-bearing anterior-posterior radiographs of right/left knees and the pelvis, were scored for knee and hip OA. Radiological knee and hip OA was assessed using the original description of the Kellgren and Lawrence (K&L) grading system.[19-21] Radiographic knee OA was present if the right and/or left knee had a K&L score of ≥ 2. If one of the joints was replaced, the score of the other knee was used in the analyses. The participant was excluded from the analysis if both

knees had undergone joint replacement. The same definitions were used for the hip joints. The knee and hip radiographs were scored by several trained readers, who were also blinded to all clinical data of the participants.[20,22]

Pain and morning stiffness

Questions about pain and morning stiffness were asked during an extensive home interview as part of the baseline measurements. The interviewer asked if joint complaints were present during the last months. If the participants answered yes, the interviewer asked whether the pain was present in the following sites: low back, left knee, right knee, left hip, and/or right hip. The participant had to answer the question for each site separately; it was possible to have complaints at several sites. Knee pain or hip pain was positive if pain was present on the left and/or right side. Back pain was positive if the participant had pain in the lower back during the last month.

The interviewer also asked about the presence, duration and location of morning stiffness. If morning stiffness was present, the interviewer asked what its duration was (possible answers were: less than half an hour, half an hour to 1 h or more than 1 h), and where it was located. The location of the stiffness was divided in: 1) legs, 2) arms, 3) back and/or neck, and 4) legs and arms and back. Spinal morning stiffness was present if the participant answered that the morning stiffness was located at '3' or '4'. Morning stiffness in the legs was defined as stiffness in location '1' or '4'.

Statistical analysis

Multivariable logistic regression analysis was used to explore the associations between morning stiffness and the different radiological features.

First, we explored the association between the duration of spinal morning stiffness, a categorical variable, and the two different definitions of LDD (earlier described). Second, we explored the associations between the two definitions of LDD and 1) the presence of spinal morning stiffness, and 2) spinal morning stiffness in combination with low back pain. Third, we assessed whether the association of morning stiffness and LDD was independent of back pain. Finally, we analyzed the association between the two definitions of LDD and morning stiffness lasting < 1 h. Participants with spinal morning stiffness lasting >1 h were excluded from this analysis. All analyses were adjusted for age, gender, and body mass index (BMI) because earlier studies already reported an association between LDD and these variables.[3,18,23] The results of the second and fourth analyses were also presented without adjustment for these variables.

The same four analyses were also used to explore the associations between radiographic knee or hip OA and 1) morning stiffness in the legs, and 2) morning stiffness in the legs in combination with knee or hip pain, respectively.

Table 1: Characteristics of the study population.

	Men (n =1204) n (%)	Women (n =1615) n (%)	All (n =2819) n (%)
Age: mean ± SD	65.3 ± 6.4	65.9 ± 6.8	65.7 ± 6.6
BMI: mean ± SD*	25.9 ± 2.9	26.6 ± 3.8	26.3 ± 3.5
Pain last month			
Low back pain	173 (14.4)	326 (20.2)	499 (17.7)
Knee pain	154 (12.8)	362 (22.4)	516 (18.3)
Hip pain	84 (7.0)	244 (15.1)	328 (11.6)
Morning stiffness			
Spinal morning stiffness§	210 (17.4)	426 (26.4)	636 (22.6)
Morning stiffness in legs§	197 (16.4)	424 (26.3)	621 (22.0)
Radiographic features			
'osteophytes'	429 (35.6)	410 (25.4)	839 (29.8)
'narrowing'	162 (13.5)	363 (22.5)	525 (18.6)
Knee K&L ≥2†	126 (10.5)	324 (20.1)	450 (16)
Hip K&L ≥2‡	84 (7.0)	109 (6.7)	193 (6.8)
Bilateral knee replacement	0 (0)	0 (0)	0 (0)
Bilateral hip replacement	6 (0.5)	18 (1.1)	24 (0.9)

'Osteophytes': the presence of osteophytes (grade ≥2) at two or more vertebral levels on lateral lumbar radiographs.
'Narrowing': disc space narrowing (grade ≥1) at two or more vertebral levels on lateral lumbar radiographs.
* BMI was missing for 12 participants; seven men and five women.
§ Location of morning stiffness was missing for eight participants; four men and four women.
† Knee Kellgren & Lawrence (K&L) score was missing for 169 participants; 58 men and 111 women.
‡ Hip K&L score was missing for seven participants; two men and five women.

RESULTS

Population characteristics

Table 1 presents the characteristics of the study participants. The population comprised 1204 men and 1615 women with a mean age of 65.7 years. Low back pain was reported by 499 participants: 173 men and 326 women. Knee pain was reported by 516 participants and hip pain by 328 participants. Spinal morning stiffness was more often present (22.6%) than morning stiffness in the legs (22.0%). When comparing men and women, men showed a higher prevalence of osteophytes (35.6% vs. 25.4%) and a slightly higher percentage of radiographic hip OA (7% vs. 6.7%). Lumbar intervertebral disc space narrowing and radiographic knee OA were more often present in women than in men: 22.5% of the women met the definition of narrowing compared with 13.5% of the men, and 20.1% of the women had radiographic knee OA compared to 10.5% of the men.

Table 2: Associations regarding different durations of spinal morning stiffness and LDD.

	'Osteophytes'			'Narrowing'		
	Absent n	Present n	aOR (95% CI)	Absent n	Present n	aOR (95% CI)
No spinal morning stiffness	1549	626	Ref. category	1816	359	Ref. category
Spinal morning stiffness lasting <0.5 h	351	156	1.2 (1.0-1.5)	383	124	1.7 (1.3-2.1)**
Spinal morning stiffness lasting ≥0.5 to ≤ 1 h	55	36	1.7 (1.1-2.7)*	60	31	2.3 (1.4-3.7)**
Spinal morning stiffness lasting >1 h	19	16	2.4 (1.2-4.8)*	26	9	1.9 (0.9-4.3)

'Osteophytes': the presence of osteophytes (grade ≥2) at two or more vertebral levels on lateral lumbar radiographs.
'Narrowing': disc space narrowing (grade ≥1) at two or more vertebral levels on lateral lumbar radiographs.
aOR: adjusted odds ratio; adjusted for age, gender and BMI.
* P< 0.05; ** P< 0.01.

LDD and spinal morning stiffness

Table 2 shows the associations between the different durations of spinal morning stiffness and both definitions of LDD. The definition 'narrowing' was more strongly associated than the definition 'osteophytes' for the categories spinal morning stiffness <0.5 h, and spinal morning stiffness ≥0.5 h to ≤1 h. The category spinal morning stiffness >1 h was more strongly associated with 'osteophytes' than with 'narrowing'.

The associations between the dichotomous variable spinal morning stiffness and both definitions of LDD were statistically significant. The association with 'narrowing' was stronger than the association with 'osteophytes': adjusted odds ratio (aOR) 1.8; 95% confidence interval (CI): 1.4-2.2 and aOR 1.3; 95% CI: 1.1-1.6, respectively. When we also adjusted the analyses for back pain, the association became somewhat lower, but stayed statistically significant: aOR1.3;95% CI: 1.0-1.5 for the definition 'osteophytes' (p-value <0.05) and aOR1.5;95% CI: 1.2-1.9 for the definition 'narrowing' (p-value < 0.01). The strength of the associations increased when spinal morning stiffness was combined with low back pain: aOR 2.5 95% CI: 1.9-3.4 for 'narrowing' and aOR 1.5; 95% CI: 1.1-2.0 for 'osteophytes'. The association did not increase when analyzing the associations between spinal morning stiffness < 1 h and LDD. All associations are presented in table 3.

The associations decreased when we included only those participants with back pain (n=499) in the analysis: aOR 1.4; 95% CI: 1.0-2.1 for the association between morning stiffness and 'narrowing'and aOR 1.2; 95% CI: 0.8-1.8 for the association between morning stiffness and 'osteophytes'.

Table 3: Associations between spinal morning stiffness, low back pain and LDD.

	'Osteophytes'				'Narrowing'			
	Absent n	Present n	OR (95% CI	aOR (95% CI)	Absent n	Present n	OR (95% CI	aOR (95% CI)
No spinal morning stiffness	1549	626	Ref. category	Ref. category	1816	359	Ref. category	Ref. category
Spinal morning stiffness	426	210	1.2 (1.0-1.5)*	1.3 (1.1-1.6)*	472	164	1.8 (1.4-2.2)**	1.8 (1.4-2.2)**
No spinal morning stiffness	1549	626	Ref. category	Ref. category	1816	359	Ref. category	Ref. category
Spinal morning stiffness without low back pain	264	123	1.2 (0.9-1.5)	1.2 (1.0-1.8)	305	82	1.4 (1.0-1.8)*	1.3 (1.0-1.8)*
Spinal morning stiffness in combination with low back pain	162	87	1.3 (1.0-1.8)*	1.5 (1.1-2.0)**	167	82	2.5 (1.9-3.3)**	2.5 (1.9-3.4)**
No spinal morning stiffness	1549	626	Ref. category	Ref. category	1816	359	Ref. category	Ref. category
Spinal morning stiffness lasting <1 h[§]	406	192	1.2 (1.0-1.4)	1.3 (1.0-1.6)*	443	155	1.8 (2.4-2.2)**	1.8 (1.4-2.2)**
No spinal morning stiffness	1549	626	Ref. category	Ref. category	1816	359	Ref. category	Ref. category
Spinal morning stiffness lasting <1 h without low back pain	254	117	1.1 (0.9-1.6)	1.2 (1.0-1.5)	292	79	1.4 (1.0-1.8)*	1.4 (1.0-1.8)*
Spinal morning stiffness lasting <1 h in combination with low back pain[§]	152	75	1.2 (0.9-1.6)	1.4 (1.0-1.9)*	151	76	2.5 (1.9-3.40**	2.6 (1.9-3.5)**

'Osteophytes': the presence of osteophytes (grade ≥2) at two or more vertebral levels on lateral lumbar radiographs.
'Narrowing': disc space narrowing (grade ≥1) at two or more vertebral levels on lateral lumbar radiographs.
aOR: adjusted odds ratio; adjusted for age, gender and BMI.
* P<0.05; ** P<0.01.
[§] Participants with spinal morning stiffness >1 h are excluded from this analysis.

Table 4: Associations between different durations of morning stiffness in the legs and radiographic knee or hip OA.

	Knee K&L ≥2			Hip K&L ≥2		
	Absent n	Present n	aOR (95% CI)	Absent n	Present n	aOR (95% CI)
No morning stiffness in the legs	1751	304	Ref. category	2033	139	Ref. category
Morning stiffness in the legs lasting <0.5 h	366	120	1.6 (1.2-2.1)**	460	44	1.4 (1.0-2.0)
Morning stiffness in the legs lasting ≥0.5 ≤1 h	51	22	1.9 (1.1-3.3)*	68	7	1.2 (0.5-2.8)
Morning stiffness in the legs lasting >1 h	24	1	0.2 (0.0-1.6)	23	2	1.4 (0.3-5.9)

aOR: adjusted odds ratio; adjusted for age, gender and body mass index.
*P < 0.05; **P < 0.01.

Radiological knee and hip OA and morning stiffness in the legs

Table 4 presents data on associations between the different durations of morning stiffness in the legs and radiographic knee and hip OA. The associations between morning stiffness in the legs, and both knee and hip K&L score, were moderate and only statistically significant for knee OA: aOR 1.6; 95% CI: 1.2-2.0 for knee OA, and aOR 1.4; 95% CI: 1.0-1.9 for hip OA. When we also adjusted the analyses for knee/hip pain, the association became somewhat lower and the association between morning stiffness in the legs and knee OA was no longer statistically significant: aOR1.2; 95% CI:0.9-1.6 for radiographic knee OA and aOR1.1; 95% CI:0.8-1.6 for radiographic hip OA.The strength of the associations increased when morning stiffness in the legs is combined with knee or hip pain. When individuals had both morning stiffness as well as pain in the knee, the association with radiographic knee OA was aOR 3.0; 95% CI: 2.1-4.1. The association between morning stiffness in the legs in combination with hip pain and radiographic hip OA was aOR 3.1; 95% CI: 1.9-5.0. The strength of the associations did not increase much when replacing morning stiffness in the legs with morning stiffness in the legs with a short duration in the analysis (morning stiffness <0.5 h for the analysis of knee OA and morning stiffness <1 h for the analysis of knee OA defined according to the ACR criteria[11-12]). Table 5 presents the associations between morning stiffness in the legs, knee/hip pain and knee/hip K&L score.

Table 5: Associations between morning stiffness in the legs, knee pain and radiographic knee OA.

	Knee K&L ≥2			Hip K&L ≥2		
	Absent n	Present n	aOR (95% CI)	Absent n	Present n	aOR (95% CI)
No morning stiffness in the legs	1751	304	Ref. category	2033	139	Ref. category
Morning stiffness in the legs	444	144	1.6 (1.2-2.0)**	555	53	1.4 (1.0-1.9)
No morning stiffness in the legs	1751	304	Ref. category	2033	139	Ref. category
Morning stiffness in the legs without knee/hip pain	315	64	1.0 (0.7-1.3)	433	28	0.9 (0.6-1.4)
Morning stiffness in the legs in combination with knee/hip pain	129	80	3.0 (2.1-4.1)**	122	25	3.1 (1.9-5.0)**
No morning stiffness in the legs	1751	304	Ref. category	2033	139	Ref. category
Short morning stiffness in the legs §†	366	120	1.6 (1.2-2.1)**	528	51	1.4 (1.0-2.0)
No morning stiffness in the legs	1751	304	Ref. category	2033	139	Ref. category
Morning stiffness in the legs with a short duration, without knee/hip pain	264	52	1.0 (0.7-1.4)	415	27	0.9 (0.6-1.4)
Morning stiffness in the legs with a short duration, in combination with knee/hip pain§†	102	68	3.1 (2.2-4.4)**	113	24	3.2 (2.0-5.3)**

aOR: adjusted for age, gender and BMI.

* P<0.05; ** P<0.01.

§ Morning stiffness in the legs with a short duration, was defined as <0.5 h for the analysis of the knee and <1 h for the analysis of the hip.

† Participants with morning stiffness in the legs >0.5 h were excluded from the analysis of the knee and participants with morning stiffness in the legs >1 h were excluded from the analysis of the hip.

DISCUSSION

This study investigated the associations between morning stiffness and different radiological features: LDD, hip K&L score and knee K&L score. We found a moderate association between both definitions of LDD and spinal morning stiffness. The association showed to be independent of back pain, but increased when spinal morning stiffness was combined with low back pain. The definition 'narrowing' was more strongly associated with spinal morning stiffness, and the combination of spinal morning stiffness and low back pain, than was the definition 'osteophytes'. These associations for LDD were similar compared to the associations found for radiographic knee and hip OA. To the best of our knowledge, this is the first study investigating the association between spinal morning stiffness and low back pain with LDD.

Earlier, de Schepper et al. analyzed the association between LDD and low back pain in this same population, reporting an association of odds ratio (OR) 2.1 for the definition 'narrowing' and OR 1.4 for 'osteophytes'.[3] When comparing these associations for back pain with the results of the present study, both associations were higher when spinal morning stiffness was combined with low back pain, compared with the associations for back pain alone. Another study analyzing the association between low back pain and LDD also compared disc space narrowing with the presence of osteophytes[6]. Both

these studies found a stronger association between low back pain and LDD for adults with narrowing of the spine than adults with osteophytes.[3,6] This is consistent with our results, which show a stronger association for 'narrowing' than for 'osteophytes' when analyzing the relation with spinal morning stiffness.

Our results indicated that there is a moderate association between spinal morning stiffness and LDD. This might indicate that spinal morning stiffness is one of the symptoms that clinicians could use for sub-grouping low back pain patients with symptoms due to LDD. However, the association was lower when we only included participants with back pain in the analysis. This might indicate that the presence of morning stiffness is less discriminative in people with back pain. More studies with back pain patients are needed to confirm our association, and to explore whether treatment response or prognosis differs between patients with pain and morning stiffness, and other patients with non-specific low back pain. In this population, a receiver operating characteristic (ROC) curve could be made to examine accuracy of the selection.

Earlier studies of patients with knee pain also reported a similar moderate association between morning stiffness and radiographic knee OA.[24-25] According to Duncan et al., the relation became stronger when the severity of morning stiffness increased.[25] Reijman et al. also analyzed the associations between different definitions of radiographic hip OA and clinical symptoms, such as pain and morning stiffness, in the Rotterdam Study; they found a moderate association between hip pain and hip K&L score ≥ 2 and a similar association between morning stiffness and hip K&L score ≥ 2.[20]

We expected to find a difference between the associations of (1) morning stiffness, and (2) morning stiffness with a short duration, with the radiographic features LDD, knee or hip OA, because morning stiffness in the knee <0.5 h or hip <1 h is an ACR criterion for knee or hip OA[11-12] and spinal morning stiffness >1 h is one of the criteria for ankylosing spondylitis[26-27] however, no such a difference was found. It must be noted, however, that power for this stratified analysis was limited, and so no final conclusion can be drawn from this result.

Our study had a few limitations which might influence the results. First, only lateral radiographs of the lumbar spine were assessed. Therefore, single-sided disc space narrowing and lateral osteophytes may have been missed. Second, because only lateral radiographs of the lumbar spine were available, we could not score the facet joints, which are the only synovial joints in the spine. Therefore we could not examine if the presence of facet joint OA is responsible for the association between spinal morning stiffness and LDD or whether LDD is associated with morning stiffness independently of facet joint OA. A third limitation is that, for another study purpose, only baseline radiographs of participants with baseline and 6.6 years follow-up measurements were scored. On average, participants who were available for 6.6-years follow-up measurements were younger and healthier during baseline than those participants who were

not available for follow-up measurements. This caused some selection bias in our study sample. The fourth limitation is that the location of morning stiffness was described as 'spinal morning stiffness' and 'morning stiffness in the legs' without distinction between the precise locations. Therefore we are unable to differentiate between morning stiffness in the hip/knee, or morning stiffness in the cervical, thoracic or lumbar spine. When we analyzed the association between morning stiffness in the legs and radiographic OA in the lower body (hip and/or knee OA), it did not result in a much higher association: aOR 1.6; 95% CI: 1.3-2.0. Another limitation related to the location of morning stiffness is that participants who indicated that the morning stiffness was located in the arms, spine, and the legs (location 4) had a positive score for both spinal morning stiffness and morning stiffness in the legs. If we had more precise information about the location of the morning stiffness and radiographic information of the facet joint, the associations might have been different.

In conclusion, spinal morning stiffness is frequently reported in this study population. According to our analyses, there appears to be a small association between spinal morning stiffness and LDD. The magnitude of the association was higher when spinal morning stiffness was combined with low back pain.

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Chapter 7

Management of patients with back pain in general practice

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Submitted

ABSTRACT

Study Design: Longitudinal study with registration data of general practitioners (GPs).

Objective: To determine the medical consumption of patients with back pain visiting their GP and explore variations in medical consumption based on different age categories.

Summary of Background Data: Back pain is a common musculoskeletal complaint which induces high healthcare costs. Insight into the management and medical consumption of back pain patients is important and medical consumption may vary according to age category.

Methods: Data were obtained from the Dutch National Information Network of General Practitioners (LINH), a network of 92 general practices with 403,308 registered patients. Referrals and prescriptions were registered for patients visiting their GP with back pain. For additional insight, we also registered other complaints (per International Classification of Primary Care (ICPC) chapter) for which back pain patient contacted the GP. Patients were divided into the age categories 0-17, 18-34, 35-54, 55-74, and ≥75 years.

Results: Between 2006 and 2009, 53,121 patients contacted their GP for back complaints; this represents 13.2% of all patients registered in LINH. Back pain patients often contacted the GP for other complaints in the musculoskeletal ICPC chapter (ranging from 61.2-81.5%). More than 48% of the back pain patients were prescribed medication and 22% was referred to another medical health care provider. In all age categories, diclofenac was prescribed most often (51.3% of all back pain patients who received a prescription), and acetaminophen less often. Tramadol was mainly prescribed for patients aged ≥75 years. Most patients were referred to physical therapy. Elderly patients were less often referred to exercise therapy. Patients aged 35-74 years were most often referred to neurology.

Conclusions: The prescribed medication and referrals for patients with back complaints varied per age category and were largely consistent with the Dutch guidelines for GPs on the management of back pain.

INTRODUCTION

Back pain is a prevalent condition associated with high costs, especially in industrialized countries. In the Netherlands in 2007, total costs related to back pain were €3.5 billion, which is equivalent to about 0.6% of the gross national product.[1] The total cost can be divided in direct and indirect medical costs, with direct costs including those of health-care providers, medication, diagnostic testing and hospital services. In the Netherlands in 2007, direct medical costs were €474 million.[1] A systematic review evaluating low back pain costs of illness studies reported that (in various European countries) the direct medical costs of back pain ranged from €18-264 per resident of the country.[2]

In the Netherlands, back pain patients generally first visit their general practitioner (GP) and/or a physical therapist. About 30% of those with complaints due to back pain visit their GP [3-4]. GPs treat these patients mostly conservatively, prescribing pain medication, or referring them to physical or exercise therapists. The GP can decide to refer the patient to a medical specialist, such as a neurologist, orthopaedic surgeon or neurosurgeon, when the back complaint is (suspected to be) caused by a specific spinal pathology, or if the complaint is persistent. As most people visit a GP for back complaints, the GP-setting is a good starting point to examine which prescriptions and referrals are issued by GPs, as this information is lacking in the Netherlands.

It is important to investigate the medical consumption of back pain patients because it allows to: 1) gain insight into the number of prescriptions issued and referrals made due to back pain complaints by the GPs, 2) to globally compare the management of GPs with the Dutch guidelines for GPs, and 3) Information about the medical consumption of back pain patients informs GPs, physical therapists and other related medical specialists.

The guidelines for non-specific back complaints and sciatica of the Dutch College of General Practitioners (NHG) recommend acetaminophen as first step when pain medication is needed, non-steroidal anti-inflammatory drugs (NSAIDs) as step two, and step three is adding a mild opioid such as codeine or tramadol.[5-6] These recommendations are consistent with similar international guidelines.[7] When there are indications for possible serious spinal pathology (red flags are present), referral to a medical specialist is recommended. GPs are advised to refer a patient to a physical therapist if the patient does not improve their daily functioning within 2-3 weeks. Referral to the Cesar/Mensendieck exercise therapy is not advised in the acute phase (0-6 weeks).[5] Although the Dutch guideline does not specify different treatment options for different age categories, older people might receive different health care than younger patients because age (> 60 years) is a red flag symptom for several specific causes of back complaints, such as a fracture or cancer.[5,8-9] Another reason for different medication management could be that older people are more sensitive to the side-effects of medication, e.g. NSAIDs.[10] and older patients may more frequently suffer from co-morbidities which may influence their treatment for back

pain. Because the number of older people continues to increase, it is important to examine differences in medical consumption between younger and older back pain patients.

Therefore, this study was designed to determine the medical consumption of back pain patients visiting their GP, using a Dutch registration database. In addition, we explored the variation in medical consumption of back pain patients according to different age categories.

MATERIALS AND METHODS

Study population

Data from the medical records of GPs participating in the National Information Network of General Practitioners (LINH) were used. LINH is a network of 92 general practices with 403,308 registered patients. Both the GPs and patients are representative for the Dutch population.[11] GPs participating in the LINH registration study registered in their electronic registration system all patient contacts using the International Classification of Primary Care (ICPC) codes, all prescriptions using the Anatomical Therapeutic Chemical (ATC) codes, and all referrals made. The LINH database is a copy of all electronic registration systems of the participating GPs.[12]

For the present study, we selected all patients contacting their GP with back pain between 2006 and 2009. This time period was chosen because direct access to physical therapy was introduced in the Netherlands in 2006 and data were available until 2009. The consultation reason was coded by the GP using the ICPC codes.[13-14] Inclusion in the present study were all patients with the following ICPC codes: back symptoms and complaints (L02), low back complaints without radiation of pain (L03), fracture of the spine (L76.06), osteoarthritis of the spine (L84), acquired deformities of the spine (L85), or low back pain with radiation of pain (L86). LINH performed a quality check on all data retrieved from the GPs' medical records, i.e. the data were checked for completeness and internal consistency. The quality of the data was checked for prescriptions and referrals separately. Only data from those GP practices that passed the quality check for the whole year were included in this analysis.

Measurements

The following patient characteristics were collected: date of birth, sex, urbanization of the residence (on a 5-point scale from very strong urbanization to countryside), and other complaints for which the patient contacted the GP. To determine the medical consumption of patients with back pain, GPs' prescriptions and referrals to other healthcare providers, due to back pain, were registered. Prescriptions were coded using the ATC

codes. We only registered the medication and referral for back pain, selected with the ICPC codes mentioned above.

Data analysis

Descriptive analysis was used to determine patients' characteristics and medical consumption. Patients' characteristics were described for all patients registered with a LINH GP between 2006 and 2009. Registration of other complaints for which the back pain patients contacted the GP between 2006 and 2009 were presented for different chapters of the ICPC system. Within Chapter L (Musculoskeletal complaints) we distinguished between the contacts for different regions, i.e. neck, shoulder, hip, and knee complaints.

Medical consumption was determined by: 1) the total number of prescriptions and referrals, and 2) the percentage of patients that received a prescription or was referred. To determine the variation in medical consumption of back pain patients by age, the patients were divided into five age categories: 0-17 years, 18-34 years, 35-54 years, 55-74 years, and ≥75 years. Differences in the distribution of prescriptions between the age categories were tested with Pearson's chi-squared test ($p < 0.05$). Data were analyzed using SPSS version 17.0.

RESULTS

Patient characteristics

Characteristics of all patients, registered with a LINH GP between 2006-2009, are presented in Table 1. If the patient contacted a GP several times between 2006 and 2009, only the first contact is included in the analysis to describe the patient characteristics. A total of 402,308 patients contacted a LINH GP during this time period. This population consisted of 198,519 men (49.3%) and 203,789 females (50.7%).

The percentage of women was the highest in the age category ≥75 years (63.1%). Of all registered patients, 53,121 (13.2%) contacted their GP because of back complaints. The percentage of patients with back pain rises with increasing age, from 3.3% in those aged 0-17 years to 20.9% in those aged ≥75 years.

Table 2 shows the additional complaints for which the back pain patient contacted the GP between 2006 and 2009. Almost all percentages within the various ICPC chapters rose with increasing age. Complaints of Chapter K (Circulatory) are more prevalent in the older age categories; 79.2% of the patients aged ≥75 years vs. 5.1% of those aged 0-17 years. Many back pain patients had complaints of Chapter L (Musculoskeletal problems) (range 61.2-81.5% in all age categories), Chapter R (Respiratory diseases) (range 56.0-66.7%) and in Chapter S (Skin conditions) (range 62.8-73.3% in all age categories).

Table 1: Characteristics of the patients registered in the LINH between 2006 and 2009.

	0-17 years n=92,743 n (%)	18-34 years n=93,839 n (%)	35-54 years n=120,726 n (%)	55-74 years n=72,570 n (%)	≥ 75 years n=22,430 n (%)	Total n=402,308 n (%)
Gender:						
Male	47,766 (51.5)	44,906 (47.8)	61,323 (50.8)	36,260 (50.0)	8,264 (36.8)	198,519 (49.3)
Female	44,977 (48.5)	48,933 (52.1)	59,403 (49.2)	36,310 (50.0)	14,166 (63.1)	203,789 (50.7)
Level of urbanization:						
Very strong	18,439 (19.9)	29,200 (31.1)	26,185 (21.7)	13,975 (19.3)	5,560 (24.8)	93,359 (23.2)
Strong	20,087 (21.7)	21,136 (22.5)	26,998 (22.4)	16,757 (23.1)	5,803 (25.9)	90,781 (22.6)
Moderate	14,008 (15.1)	11,893 (12.7)	17,395 (14.4)	9,929 (13.7)	2,669 (11.9)	55,894 (13.9)
Little	21,129 (22.8)	17,261 (18.4)	26,528 (22.0)	16,855 (23.2)	4,267 (19.0)	86,040 (21.4)
Countryside	16,817 (18.1)	12,660 (13.5)	21,083 (17.5)	13,329 (18.4)	3,736 (16.7)	67,625 (16.8)
Back pain	3,088 (3.3)	10,596 (11.3)	21,197 (17.6)	13,550 (18.7)	4,690 (20.9)	53,121 (13.2)

LINH = National Information Network of General Practitioners

Table 2: Other complaints (ICPC chapters) for which patients with back pain contacted their general practitioner between 2006 and 2009.

	0-17 years n=3,087 n (%)	18-34 years n=10,586 n (%)	35-54 years n=21,147 n (%)	55-74 years n=13,528 n (%)	≥ 75 years n=4,684 n (%)	Total n=53,032 n (%)
Chapter B - Blood, blood forming	219 (7.1)	875 (8.3)	1,666 (7.9)	1,222 (9.0)	831 (17.7)	4,813 (9.1)*
Chapter D - Digestive	1,155 (37.4)	4,736 (44.7)	9,094 (43.0)	7,015 (51.9)	2,930 (62.6)	24,930 (47.0)*
Chapter K - Circulatory	156 (5.1)	1,762 (16.6)	7,112 (33.6)	8,449 (62.5)	3,709 (79.2)	21,188 (40.0)*
Chapter L - Musculoskeletal[a]	2,021 (65.5)	6,481 (61.2)	14,995 (70.9)	10,517 (77.7)	3,816 (81.5)	37,830 (71.3)*
Neck complaints	147 (4.8)	1,020 (9.6)	2,519 (11.9)	1,566 (11.6)	517 (11.0)	5,769 (10.9)*
Shoulder complaints	137 (4.4)	1,009 (9.5)	3,714 (17.6)	2,715 (20.1)	831 (17.7)	8,406 (15.9)*
Hip complaints	74 (2.4)	238 (2.2)	948 (4.5)	1,596 (11.8)	872 (18.6)	3,728 (7.0)*
Knee complaints	468 (15.2)	1,116 (10.5)	2,914 (13.8)	2,495 (18.4)	964 (20.6)	7,957 (15.0)*
Chapter N - Neurological	658 (21.3)	2,498 (23.6)	5,536 (26.2)	3,931 (29.1)	1,736 (37.1)	14,359 (27.1)*
Chapter P - Psychological	697 (22.6)	3,102 (29.3)	6,890 (32.6)	4,134 (30.6)	2,065 (44.1)	16,888 (31.8)*
Chapter R - Respiratory	1,849 (59.9)	6,170 (58.3)	11,835 (56.0)	8,518 (63.0)	3,126 (66.7)	31,498 (59.4)*
Chapter S - Skin	2,199 (71.2)	6,831 (64.5)	13,270 (62.8)	9,030 (66.8)	3,433 (73.3)	34,763 (65.6)*
Chapter T - Metabolic, endocrine, nutrition	256 (8.3)	1,186 (11.2)	4,244 (20.1)	5,037 (37.2)	1,981 (42.3)	12,704 (24.0)*
Chapter U - Urinary	520 (16.8)	2,446 (23.1)	4,468 (21.1)	4,392 (32.5)	2,451 (52.3)	14,277 (26.9)*

[a] All ICPC codes from Chapter L, except for the back pain codes L02, L03, L84, L85, L86. * P<0.01
Neck complaints: ICPC code L01 neck symptom/complaint or L83 neck syndrome, Shoulder complaints: ICPC code L08 shoulder symptom/complaint or L92 shoulder syndrome, Hip complaints: ICPC code L13 hip symptom/complaint or L89 osteoarthritis of hip, Knee complaints: ICPC code L15 knee symptom/complaint, L78 sprain/strain of knee, L90 osteoarthritis of knee, L96 acute internal damage knee, L97 chronic internal knee derangement.

The most frequent complaint among the musculoskeletal problems was shoulder complaints, for which 15.9% of all back pain patients contacted their GP.

Medical consumption

To determine which (pain) medication and referrals back pain patients received from their GP between 2006 and 2009, we selected all contacts of those patients who received any medication prescription (Table 3) and any referral (Table 4).

Table 3: Medication prescription issued to patients contacting their general practitioner for back pain between 2006 and 2009.

	0-17 years Npat= 409 Nrec.=571 Nrec. (%pat.)[a]	18-34 years Npat = 3,999 Nrec.=9,549 Nrec. (%pat.)[a]	35-54 years Npat = 10,881 Nrec.=39,475 Nrec. (%pat.)[a]	55-74 years Npat = 7,029 Nrec.=30,850 Nrec. (%pat.)[a]	≥ 75 years Npat = 2,358 Nrec.=13,342 Nrec. (%pat.)[a]	Total Npat = 24,676 Nrec.=93,787 Nrec. (%pat.)[a]
Acetaminophen						
Acetaminophen	3 (0.7)	76 (1.6)	232 (1.4)	438 (2.5)	834 (11.9)	1,583 (2.9)*
Acetaminophen combinations excl. psycholeptics	10 (2.2)	245 (3.4)	1,514 (4.5)	1,880 (8.1)	1,234 (15.2)	4,883 (6.8)*
NSAIDs						
Diclofenac	244 (48.1)	3,341 (57.4)	11,001 (54.0)	6,412 (42.2)	1,684 (27.3)	22,682 (51.3)*
Diclofenac combinations	8 (1.7)	201 (3.5)	1,079 (5.7)	1,161 (7.9)	399 (7.6)	2,848 (6.4)*
Meloxicam	1 (0.2)	22 (0.5)	410 (1.2)	417 (1.8)	128 (2.2)	978 (1.5)*
Ibuprofen	91 (15.6)	1,183 (16.3)	3,366 (15.5)	1,557 (10.9)	387 (8.4)	6,584 (14.8)*
Naproxen	76 (14.9)	782 (13.4)	2,598 (12.6)	1,460 (10.4)	308 (6.1)	5,224 (12.4)*
Opioids						
Morphine	3 (0.5)	44 (0.7)	573 (1.5)	435 (1.7)	152 (3.0)	1,207 (1.7)*
Oxycodone	0 (0)	124 (1.3)	809 (2.7)	700 (3.0)	393 (5.7)	2,026 (2.7)*
Codeine comb excl. psycholeptics	6 (1.5)	204 (1.9)	1,496 (3.3)	1,443 (4.6)	559 (6.3)	3,708 (3.9)*
Fentanyl	0 (0)	24 (0.2)	351 (0.5)	344 (1.3)	551 (4.6)	1,270 (1.1)*
Tramadol	13 (1.2)	703 (7.8)	3,908 (11.1)	2,551 (12.6)	1,278 (16.5)	8,453 (12.0)*
Tramadol combinations	10 (1.2)	143 (1.7)	532 (2.2)	679 (3.5)	455 (6.7)	1,819 (3.2)*
Other						
Diazepam	20 (4.6)	827 (12.8)	3,436 (16.4)	1,902 (11.3)	266 (4.4)	6,451 (13.9)*
Amitriptyline	4 (0.5)	80 (0.8)	441 (1.2)	331 (1.4)	216 (1.9)	1,072 (1.3)*
Omeprazole	15 (2.9)	503 (7.5)	2,099 (10.2)	2,202 (15.9)	930 (18.1)	5,749 (12.6)*
Lactulose	2 (0.5)	47 (0.8)	192 (1.0)	187 (1.5)	171 (4.5)	599 (1.5)*

[a] Nrec.= number of prescriptions per age category, %pat.= percentage of patients receiving prescriptions per age category.
* P<0.01

Medication prescription

Table 3 presents an overview of the prescriptions issued for back pain per age category. Of the 51,071 back pain patients, 24,676 (48.3%) received medication for back pain from a GP between 2006 and 2009. Of patients aged 0-17 years 13.9% received medication, of patients aged 18-34 years 39.4%, of patients aged 35-54 years 53.4%, of patients aged 55-74 years 53.6%, and of patients aged ≥75 years 52.5% received medication for their back complaints.

In all age categories, the medication most often prescribed was the NSAID diclofenac. The percentage of patients with a prescription for diclofenac ranged from 57.4% of the back pain patients with a prescription (age group18-34 years) until 27.3% (≥75 years). For age 0-17 years and 18-34 years, the second most often prescribed drug was the NSAID ibuprofen. This was prescribed for 15.6% of the back pain patients aged 0-17 years with a prescription and for 16.3% in the age group 18-34 years. NSAIDs were more often prescribed for younger patients than older patients. The most prescriptions for acetaminophen were issued to patients aged ≥75 years. The percentage of prescriptions for opioids also rises with increasing age. Tramadol was the most frequently prescribed opioid, i.e., with percentages ranging from 1.2-16.5% of patients in the different age categories. The most frequently prescribed proton-pump inhibitor was omeprazol. Omeprazol was prescribed for 18.1% of the prescribed patients in the age category ≥75 years. Whereas 27.3% of back pain patients aged ≥75 years with a prescription received diclofenac.

Table 4: Referrals made for patients contacting their general practitioner for back pain between 2006 and 2009.

	0-17 years Npat= 479 Nref= 1,217 Nref. (%pat.)[a]	18-34 years Npat = 1,547 Nref= 4,975 Nref. (%pat.)[a]	35-54 years Npat = 3,100 Nref= 12,428 Nref. (%pat.)[a]	55-74 years Npat = 1,763 Nref= 7,886 Nref. (%pat.)[a]	75+ years Npat = 483 Nref= 2,112 Nref. (%pat.)[a]	Total Npat = 7,372 Nref= 28,618 Nref. (%pat.)[a]
Physical therapy	379 (52.2)	1,823 (71.5)	4,562 (74.5)	2,626 (77.2)	715 (79.5)	10,105 (73.4)**
Manual therapy	10 (1.9)	38 (1.9)	136 (3.0)	74 (2.5)	7 (1.0)	265 (2.5)**
Cesar therapy	140 (24.0)	226 (12.0)	223 (5.2)	86 (3.6)	12 (1.4)	687 (7.2)**
Mensendieck therapy	97 (15.9)	156 (7.3)	184 (3.7)	75 (2.5)	8 (1.0)	520 (4.8)**
Orthopaedics	142 (21.1)	295 (11.1)	889 (16.7)	715 (24.6)	211 (25.1)	2,252 (18.3)**
General surgery	34 (5.8)	152 (6.7)	428 (9.4)	315 (12.0)	80 (11.0)	1,009 (9.3)*
Neurology	48 (5.2)	459 (17.1)	1,642 (28.2)	913 (28.5)	153 (20.9)	3,215 (24.0)**
Rheumatology	7 (1.0)	37 (1.6)	149 (3.2)	113 (3.7)	13 (2.1)	319 (2.8)**
Neurosurgery	0 (0)	18 (0.5)	69 (1.2)	33 (1.0)	5 (0.6)	125 (0.9)*

[a]Nref.= number of referrals per age category, %pat.= percentage of patients referred per age category.
* P<0.05 , **P<0.01

Referrals to therapy and specialists

Table 4 presents an overview of referrals to another health care provider. Of all 53,121 patients who contacted a GP for back complaints between 2006 and 2009, 34,023 patients (21.7%) received a referral for their back pain. The percentage of patients who received a referral decreased slightly with increasing age; 23.9% of those aged 0-17 years, 23.2% of those aged 18-34 years, 22.8% of those aged 35-54 years, 20.0% of those aged 55-74 years, and 16.3% of patients aged ≥75 years.

The majority of referred back pain patients were referred to physical therapy (ranging from 52.2% in those aged 0-17 years to 79.5% in those aged ≥75 years). Back pain patients were less often referred to other forms of therapy: 7.2% of the referred patients were referred to Cesar therapy, 4.8% to Mensendieck therapy and 2.5% to manual therapy. Both Cesar therapy and Mensendieck therapy are forms of exercise therapy. Older patients were referred less often to exercise therapy: the percentage of patients referred to Cesar therapy ranged from 24.0 in age category 0-17 years until 1.4% in age category ≥75 years and to Mensendieck therapy the percentage ranged from 15.9-1.0%. For referrals to another medical specialist, most referrals were made to neurology (24.0%). The majority of neurology referrals (54.6%) were for back pain complaints with the diagnosis low back pain with radiation of pain (ICPC code L86). 18.3% of the referred back pain patients were referred to orthopaedic surgery, 9.3% to general surgery, 2.8% to rheumatology, and 0.9% to neurosurgery.

DISCUSSION

This study examined the medical consumption of back pain patients visiting their GP between 2006 and 2009. In this period, 402,308 people contacted a GP collaborating with the LINH. About 13% (n=53,121) of these registered patients contacted their GP for back complaints. Of these back pain patients 48% (n=24,676) received one or more prescriptions for medication and 22% (n=7,372) got at least one referral to another healthcare provider. NSAIDs (mainly diclofenac) were the most prescribed in all age categories. The percentage of prescriptions for acetaminophen and opioids was highest in patients aged ≥75 years. Back pain patients were mostly referred to physical therapy, i.e. 52-80% of all referred back pain patients in the different age categories. When referred to a medical specialist, this was mostly to neurology (i.e. 24% of the referrals).

Other studies have examined medication use among patients with back complaints [15-18] and some compared the results with the guidelines. One of these studies also compared medication use in different age categories [16]. These studies[15,17-18] also reported that (when medication was prescribed) NSAIDs were the most prescribed medication, even though acetaminophen is the medication recommended as first step in various

back pain guidelines.[5,7] In a USA study, it was reported that as much as 87% of back pain patients prescribed any medications at the initial visit received an NSAID prescription.[15] An explanation why NSAIDs are more often prescribed than acetaminophen could be that patients more often used over-the-counter acetaminophen than NSAIDs, or that good experience of the patient with NSAIDs in the past could play a role in the GP's decision.[17,19] The reason why older patients received less prescriptions for NSAID is probably because they have a higher risk of upper gastrointestinal tract complications.[10,20] In this study, the percentage of omeprazol prescriptions is lower than the percentage of NSAID prescriptions in the age category ≥75 years. The lower percentage of omeprazol prescriptions could be due to the fact that we only registered the omeprazol prescriptions which were issued for a back pain complaint (ICPC codes L02, L03, 76.06, L84, L85, L86). Therefore, our results were an underestimation of omeprazol prescriptions issued for the patients in this age category.

Regarding referrals by the GP, other studies also indicate that most back pain patients were referred by their GP to physical therapy.[17-18] This is consistent with the recommendations of various guidelines.[5-7] If referred to another medical specialist, GPs tended to refer patients to neurology or orthopaedics.[18] Another study described that older people (>70 years) were more likely to have been prescribed pain killers and were less likely to visit a physical/exercise therapist than younger people (≤40 years); this is, to a large extent, consistent with our results.

A limitation of the present study is that some information is missing, e.g. information on additional diagnostic referrals (to radiology for X-ray, MRI or CT scan) and referrals to laboratory research (for blood analysis). They were not available because the GPs did not register these referrals. Also, data on over-the-counter medication, medication prescribed by a medical specialist other than the GP, and information on the use of direct access to physical/exercise therapy, were not available. Since 2006 and 2008 patients are allowed to visit physical and exercise therapists, respectively, without referral. The percentage of back pain patients who received a referral from the GP for exercise and/or physical therapy is an underestimation of the percentage of patients with back pain who visited an exercise/physical therapist. In 2006, 28% of the people visited the physical therapist by direct access.[21]

Another limitation is that patient selection was based on the ICPC codes. Although the GPs were requested to code all complaints of the patients, some contacts did not have an ICPC code. Although the LINH performed a quality check on the GPs' data, some back pain contacts may not be included because the ICPC code was missing. A third limitation is that some information is lacking to compare these results to the guideline: the data did not include incident cases only. Therefore we were unable to describe if the medication issued is the first medication prescribed for the back pain. That is why we can only globally compare these results with the guidelines for back complaints.

The results of our study show that the medical consumption of back pain patients differs between age categories; however, it was not possible to examine whether there is a different treatment effect of these medications or referrals in the different age categories. Randomized controlled trials are needed to determine whether differences in treatment effect do exist depending on the age of the patients.

In summary, the type and frequency of medication prescriptions and referrals to other healthcare providers prescribed by the GPs for back pain patients differed between the age categories. In all age categories, NSAIDs were prescribed most often and the percentage of NSAIDs prescribed decreases with increasing age category. Patients aged ≥75 years were less often referred to exercise therapy and were more often prescribed opioids.

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Chapter 8

Frequency and characteristics of patients with back pain visiting physical therapists through direct access versus referral

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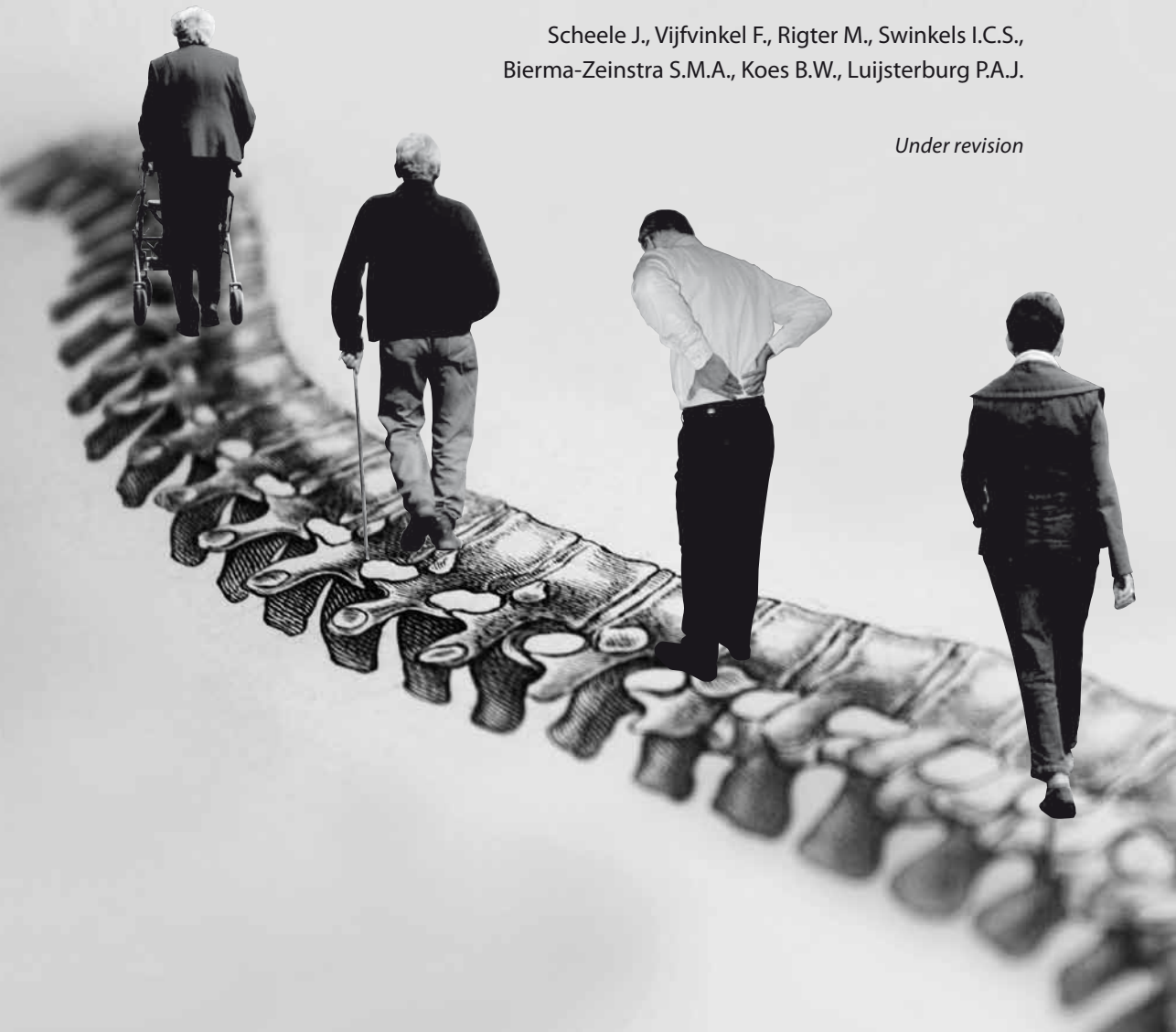
Under revision



ABSTRACT

Background: In the Netherlands, direct access to physical therapy was introduced in 2006. Although many back pain patients visited these therapists through direct access, the frequency and characteristics of these patients are unknown.

Objective: To investigate the frequency of back pain patients who directly accessed physical therapy or were referred. Also, to identify which demographic and clinical characteristics of back pain patients are associated with direct access versus referral.

Design: Cross-sectional study using data of a longitudinal study with registration data of physical therapy for the years 2006-2009.

Methods: Data were used from the National Information Service for Allied Health Care (LiPZ), a registration network of physical therapists in the Netherlands. Mode of access (direct access or referral) was registered for each back pain episode in 2006-2009. Logistic regression analysis was used to explore associations between mode of access and demographic and clinical characteristics.

Results: The percentage of back pain patients who directly accessed a physical therapist for a back pain episode increased from 28.9% in 2006 to 52.1% in 2009. Patients with an episode of back pain who directly accessed a physical therapist more often had a middle/higher education level, had previous experience with therapy, had recurrent back complaint(s) and were more often aged ≤ 55 years.

Limitations: Information on the severity of the complaint, treatment management and outcome was missing for too many cases.

Conclusions: An increasing percentage of back pain patients used direct access to visit a physical therapist. Some patient and clinical characteristics were associated with the mode of access. Further research should evaluate if treatment outcomes are also influenced by the mode of access.

INTRODUCTION

In 2006 a new health care system was introduced in the Netherlands. The aim of this reform was to control the need for cost containment, to reduce waiting lists and give patients more freedom of choice.[1-2] Since 2006, all citizens can choose their own health insurance company, although a basic medical insurance is obligatory for the entire Dutch population. Since 2006, formal referral by the general practitioner (GP) or other medical doctor is no longer required to visit a physical therapist. Advocates of direct access emphasise the freedom of choice for patients, faster access to therapy and the lower health care costs.[3] Opponents of direct access are concerned that physical therapists might miss serious pathology which could lead to higher health care costs.[3] In 2006, Leemrijse et al. investigated the number of patients using direct access and their characteristics.[4] They reported that the number of patients treated by physical therapist had not increased the year after the introduction of direct access compared to the year before introduction. In the year after introduction, 28% of all patients directly accessed the physical therapist with any complaint. Especially higher-educated patients aged <59 years more often used direct access, and patients with back/neck complaints were more likely to use direct access for physical therapy compared to patients with other complaints.[4]

Back pain patients are not only more likely to use direct access, in the Netherlands back pain is also the most common complaint of patients visiting a physical or exercise therapist.[5] Because this patient group is large, it is important for policy makers in the Netherlands, GPs and physical therapists to know which proportion of back pain patients uses direct access for physical therapy and any changes in proportion over the years and to know the characteristics of these patients. This information might help physical therapists to organise their facilities and help researchers to plan the inclusion of patients for cost-effectiveness studies for direct access. Information about the frequency of direct access use is also important for policy makers of countries which consider direct access.

Therefore, the aim of this study is: 1) to investigate the frequency of back pain patients who either directly accessed physical therapy or were referred by medical doctor in 2006-2009, and 2) to identify which demographic and clinical characteristics of back pain patients are associated with mode of access.

METHODS

Study population

Physical therapists

The data used in this study originate from the National Information Service for Allied Health Care (LiPZ). LiPZ is a Dutch registration network of randomly selected extramurally working (community-based) physical therapists (n=82) in the Netherlands. These therapists form a representative sample of all Dutch therapists.[4,6] The therapists collected data through a special module that is installed in their regular administration software. The LiPZ data were checked for incorrect values of variables and double submission.

Back pain patients

The study population consisted of all back pain patients who visited a physical therapist (member of the LiPZ network) in the period 2006-2009. This period was chosen because direct access to the physical therapist became available in 2006 and relevant data were available until 2009. The health issues of all patients were classified in LiPZ according to the International Classification of Primary Care (ICPC) codes.[7-8] The following codes were used to select the back pain patients: back symptoms and complaints (L02), low back complaints without radiation of pain (L03), fracture of the spine (L76.06), osteoarthritis of the spine (L84), acquired deformities of the spine (L85), and lumbar disk lesion or radiation of pain (L86). The ICPC codes were given by the referrer or, in case of direct access, the LiPZ researcher coded the description of the health problem as an ICPC code. A patient could visit the physical therapist for several back pain episodes in the period 2006-2009. Because the mode of access might differ between episodes for the same patient, each episode was registered separately. An episode is defined as an event of back pain, starting from the first consultation with a therapist to the end of treatment or absence of complaints.

Measurements

The following data were collected for each back pain episode in the period 2006-2009: mode of access (direct access or referral), age, sex and education level of the patient, degree of urbanization of patients' residence, diagnosis (based on the ICPC code), recurrence of back pain, duration of back pain at start of treatment, severity of back pain at the beginning of treatment, severity of back pain at the end of treatment, and previous physical therapy.

Direct access means that the back pain patient visited the therapist without a referral from another medical doctor. A referred patient implies that the patient was referred by a medical doctor, e.g. a GP, orthopaedic surgeon or neurologist. Education level was divided into lower education (primary school, lower vocational education or lower sec-

ondary education), middle education (intermediate vocational education or intermediate/higher secondary education) and higher education (higher vocational education and university). Urbanization was divided into five categories (very strongly urbanized, strong, moderate, little, and not urbanized), which is a measure of the concentration of human activities according to classification of the Dutch Central Bureau of Statistics, based on the average area density. Severity of back pain was measured at the beginning and end of treatment on an 11-point numerical rating scale (NRS) in which 0 represents 'no pain' and 10 represents 'the worst pain ever'.[9] Previous physical therapy means that the patients had received earlier physical therapy for a complaint (back pain or other complaint) in the two years preceding the present therapy.

Data analysis

Descriptive statistics was used to calculate which percentage of back pain patients directly accessed the physical therapist or were referred in 2006-2009. If a patient visited a physical therapist several times for back pain in 2006-2009, all episodes were included in the analyses because the mode of access could differ between the episodes. Multivariate logistic regression analysis (method enter) was used to identify which demographic and clinical characteristics of back pain episodes were associated with the mode of access (direct access or referral) of physical therapist. Mode of access was the dependent variable. The patient characteristics (age, sex, education level, and degree of urbanization) and clinical characteristics (duration of health problem before start of treatment, recurrence of back pain and previous therapy) were the independent variables (categorical or dichotomous). The associations were presented as odds ratios (OR) with 95% confidence intervals (CI) The variables 'severity of back pain at the beginning and end of treatment' were not included in the analyses because these variables were not registered from the beginning of data collection in 2006 and therefore information was missing for many cases (>75%). Covariations between the independent variables were measured, using a covariance matrix to check for correlation between the variables. Data were analysed with SPSS version 17.0.

RESULTS

Patient characteristics

Characteristics of the episodes (grouped by mode of access) of back pain patients are presented in Table 1. In total, 10,887 patients visited a physical therapist between 2006 and 2009 for 12,931 episodes of back pain. Of these episodes, the mode of access was known for 12,018 episodes. 42.1% of the back pain patients who were referred were male, compared to 46.9% of the patients who directly accessed the physical therapist.

Table 1: Characteristics of episodes of back pain patients undergoing physical therapy in 2006 to 2009, episodes of therapy are grouped by mode of access.

	Physical therapy [a] (2006-2009)	
	Referral n=7,077 n (%)	Direct access n=4,941 n (%)
Sex: male	2,976 (42)	2,319 (47)
Age in years, mean ± SD	50.3 ± 17.9	47.0 ± 16.3
Age category in years		
1-17	187 (3)	119 (2)
18-34	1,197 (17)	1000 (20)
35-54	2,873 (41)	2293 (46)
55-74	2,056 (29)	1,253 (25)
75+	764 (11)	275 (6)
Education level		
Lower	2,445 (35)	1,389 (28)
Middle	1,919 (27)	1,501 (30)
Higher	862 (12)	1,080 (22)
Urbanization		
Very strong	1,191 (17)	725 (15)
Strong	2,030 (29)	1,460 (30)
Moderate	1,143 (16)	916 (19)
Little	1,226 (17)	715 (14)
Not	1,471 (21)	1,113 (23)
Duration of health problem before start of treatment		
< 7 days	605 (9)	1,095 (22)
1 week - 3 months	4,005 (57)	2,847 (58)
3-12 months	1,134 (16)	397 (8)
>1 years	1,205 (17)	555 (11)
Recurrence of back pain		
Yes	2,951 (42)	2,598 (53)
Previous physical therapy		
Yes	2,945 (42)	2,653 (54)
Diagnosis		
L02: back symptoms and complaints	1,848 (26)	1,647 (33)
L03: low back complaints without radiation of the pain	3,125 (44)	2,706 (55)
L76.06: fracture of the spine	73 (1)	6 (0)
L84: osteoarthritis of the spine	361 (5)	88 (2)
L85: acquired deformities of the spine	88 (1)	45 (1)
L86: low back pain with radiation	1,582 (22)	449 (9)

[a] Missing data: 0.2% from data of urbanisation, 1.5% from data of duration, 3.1% from data of recurrence, 12.1% from data of earlier therapy and 23.5% for education.

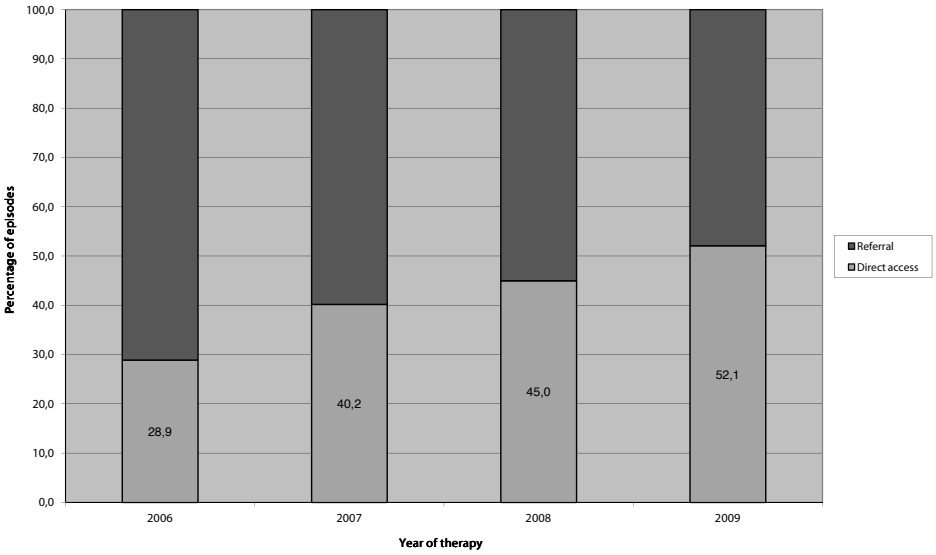


Figure 1: Percentage of back pain episodes (n=12,018) for which patients used direct access or were referred to a physical therapist (2006-2009).

The mean age of the back pain patients with a referral for physical therapy was 50.3 years, for the direct access group 47 years. Most patients who visited the physical therapist had suffered back pain for 1 week to 3 months before starting treatment (56.6% of the referred episodes and 57.6% of the direct accessed episodes). The most frequently used ICPC code was 'L03, low back complaints without radiation of the pain': this applied to 44.1% of the referred and 54.8% of the direct accessed physical therapy group.

Direct access or referral

Figure 1 shows the distribution of back pain episodes in which direct access or referral was used in 2006-2009. In total, 7,077 (59%) episodes were treated via referral from a medical doctor and 4,941 (41%) episodes via direct access. The percentage of back pain episodes for which direct access was used increased from 28.9% (973 episodes) in 2006, to 40.2% (1128 episodes) in 2007, to 45.0% (1296 episodes) in 2008 and to 52.1% (1544 episodes) in 2009.

Associations between patient or complaint characteristics and mode of access

Because no strong correlations were found between the variables (all <0.44), all independent variables (n=7) were included in the multiple logistic regression analysis (Table 2). Patients in the age category 55-74 years and 75+ years were less likely to use direct access compared to patients aged 0-17 years (OR 0.7; 95% CI:0.5-1.0 and OR 0.5; 95% CI:0.3-0.7, respectively). Back pain patients who used direct access more often had a middle/higher education level than lower education (OR 1.3; 95% CI:1.2-1.5 for middle education level

Table 2: Overview of the associations of patient and complaint characteristics with mode of access (referral versus direct assess) for physical therapy episodes.

	Physical therapy n= 12,018 episodes[a]	
	OR (95% CI)	p-value
Male sex	1.1 (1.0-1.2)	0.15
Age in years		
1-17	ref. category	
18-34	1.0 (0.7-1.4)	0.87
35-54	0.8 (0.6-1.1)	0.25
55-74	0.7 (0.5-1.0)	0.03
75+	0.5 (0.3-0.7)	<0.01
Education level		
Lower	ref. category	
Middle	1.3 (1.2-1.5)	<0.01
Higher	2.1 (1.8-2.4)	<0.01
Urbanization		
Very strong	ref. category	
Strong	1.2 (1.0-1.4)	0.06
Moderate	1.6 (1.4-2.0)	<0.01
Little	1.1 (0.9-1.3)	0.28
Not	1.3 (1.1-1.6)	0.01
Duration of health problem before start of treatment		
< 7 days	4.0 (3.4-4.9)	<0.01
1 week - 3 months	1.7 (1.5-1.9)	<0.01
3-12 months	0.8 (0.6-1.0)	0.02
>1 years	ref. category	
Recurrence of back pain		
Yes	1.4 (1.3-1.6)	<0.01
Previous physical therapy		
Yes	1.7 (1.5-1.8)	<0.01

[a] Due to missing values of the independent variables, the analysis runs over 7904 episodes.

and OR 2.1; 95% CI: 1.8-2.4 for higher education level). Back pain patients using direct access more often lived in moderate urbanized areas compared to very strongly urbanized areas (OR 1.6 95% CI: 1.4-2.0). The back complaints was more often of a short duration than >1 year (OR 4.0; 95% CI: 3.4-4.9 for a duration of < 7 days and OR 1.7; 95% CI:1.5-1.9 for a duration of 1 week to 3 months). Patients with a back pain episode who used direct access were more likely to have recurrent back complaints (OR 1.4; 95% CI: 1.3-1.6) and reported receiving previous physical therapy (OR 1.6; 95% CI:1.5-1.8).

DISCUSSION

This study examined the proportion of back pain patients who used direct access or were referred to physical therapy in 2006-2009 and investigated the characteristics of those using direct access. The percentage of back pain episodes for which patients directly accessed the physical therapist increased substantially from 28.9% in 2006 to 52.1% in 2009. Patients with an episode of back pain who used direct access more often had a middle/higher education level, more often had previous physical therapy, were relatively younger, and more often had a recurrent complaint and a shorter duration of their complaint.

Leemrijse et al. performed a similar analysis with all patients (irrespective of their complaint) who visited the physical therapist during 2006.[4] They also compared patients who used direct access for their episode with patients who were referred. Their results were well comparable with our results regarding the percentage of patients using direct access and patient characteristics. Leemrijse et al. concluded that patients with a back pain episode were more likely to use direct access than patients with other complaints, and that many patients seen by a physical therapist used direct access.[4] Our results indicate that the percentage of patients using direct access for visiting a physical therapist had increased over the years. This could be due to the increasing acquaintance with direct access, or because patients who directly accessed the physical therapist are more likely to use that mode again. Other studies comparing the characteristics of referred and direct access patients in other countries, reported similar results to ours.[10-13] In the present study, the characteristics associated with direct access were education level, previous physical therapy, recurrence, duration of back complaint, and patient's age.

The association between short duration of the complaint and direct access might be related to the amount of time involved in visiting a GP/other medical doctor and being referred for therapy, implying that the back pain may have been present for some time when these patients visit their physical therapist. Patients with a recurrent complaint and those with previous experience with physical therapy are probably more aware of the possibilities and therefore more likely to directly access physical therapy. The prevalence of back pain and other musculoskeletal disorders increases with increasing age[14] and older patients have more comorbidity for which they visit their GP[15-16] and probably find it easier to ask for a referral to physical therapy for their back complaints.

A limitation of the study was that it was not possible to investigate whether patients using direct access for their back complaints differ from referred patients regarding the treatment they received and the outcome of the therapy. Earlier studies on direct access reported that patients who used direct access received fewer treatment sessions.[4, 12-13] Unfortunately we had insufficient information on the number of treatment sessions to confirm or refute this statement. Information on the severity of the complaints was miss-

ing for too many episodes (>75%) and was therefore omitted from the analysis. When we did analyse the available information, the following data emerged: severity of the complaint at the beginning of treatment was available for 2,211 episodes with a mean of 7.0 (SD 1.5) for referred episodes and a mean of 6.6 SD 1.7 for direct accessed episodes (OR 0.9 95% CI:0.8-0.9) indicating that patients with higher pain severity at the beginning of treatment were less likely to use direct access. Severity of the complaint at the end of treatment was available for 700 episodes with a mean of 3.0 (SD 2.3) for referred episodes and a mean of 2.5 SD 2.3 for direct accessed episodes (OR 0.9 95% CI:0.8-1.0).

Another limitation was that we had no information on the diagnosis of the back complaints. Some information on the diagnosis could be obtained from the ICPC code; however, in this study the ICPC code of the referred patient was provided by the referrer and the ICPC codes of the direct access patients by the researcher. Because of this methodological difference we did not analyse the associations between ICPC code and mode of access. The lower percentage of specific causes of back pain (ICPC codes L76.06: fracture of the spine, L84 osteoarthritis of the spine and L85 acquired deformities of the spine) in the direct access groups could indicate a negative association with direct access, or could be due to the different method used to assign an ICPC code.

In summary, in the present study a large proportion of back pain patients used direct access to visit a physical therapist for their back pain episode. This group of patients differed from those who were referred on several patient and clinical characteristics. Further research should evaluate whether treatment management and outcomes are also influenced by the mode of access.

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Chapter 9

General discussion

The overall aim of this thesis was to gain insight into: 1) the course of back pain in older adults in general practice, 2) the characteristics of these patients and their back pain, 3) prognostic factors for poor recovery of older adults with back pain, 4) the association between perceived lumbar stiffness and lumbar disc degeneration (LDD) as assessed on X-ray, and 5) the medical consumption of back pain patients.

The previous chapters describe the findings of each study and their limitations in detail. This final chapter summarizes the main findings, discusses the results in a broader context, and presents implications for clinical practice and further research.

DIFFERENCES BETWEEN AGE CATEGORIES

The current literature on older adults with back pain is very scarce, especially in relation to primary care. The available literature mostly focuses on the working-age population. Therefore, older adults are under-represented in studies and are often excluded from participation in clinical trials.[10,26] Because it is possible that some patient-related and complaint-related characteristics differ between younger and older adults, the results of studies in younger age groups may not be generalizable to older adults. In Chapters 4 and 7 we compared different age categories and in Chapter 8 we described the influence of, among others, age on the probability of using direct access to physical therapy, as compared to physical therapy via referral from a physician. In Chapter 4 we examined the differences in baseline characteristics between patients aged >55-74 years and ≥75 years in the 'back complaints in the elders' (BACE) study. Patients aged ≥75 years reported more disability [12.1 points on the Roland Disability Questionnaire (RDQ) compared to 9.4 points for patients aged >55-74 years], more psychological health problems (e.g. lower quality of life and more depressive symptomatology), more often had lower bone quality (29% compared to 8%, respectively), and required more time to complete the timed 'Up and go' test (13 sec compared to 9.9 sec for the patients aged >55-74 years). The differences we found between the age groups concerning disability and psychological health problems were small but statistically significant: 2.7 points on the 24-point RDQ, 3.8 points on the 100-point Short Form-36 (SF-36) quality of life scale, and 2.1 points on the Center for Epidemiologic Studies Depression (CES-D) Scale (range 0-60 points). These small differences are not clinically significant,[9,20] but might increase when the age differences between the groups are greater. These findings of differences between the age categories are consistent with the available literature; i.e. others also reported that older patients experience more disability and more severe back pain that interferes with their daily activities compared with younger back pain patients.[6,27] Older adults generally experience lower quality of life than younger adults, and patients with chronic diseases (such as back pain) also experience lower quality of life compared to

those without a chronic condition.[15,32] Also, older adults generally have lower bone quality than younger adults, which leads to a higher risk of osteoporotic fracture. At around age 50 years, bone quality decreases more rapidly in women than in men.[16]

Another difference between younger and older adults which is often described in literature is the presence of co-morbidities. In Chapters 4 and 7 we assessed which other diseases were frequently present in the different age categories of back pain patients in primary care. In the BACE study, back pain patients aged ≥75 years more often reported heart diseases (29 vs. 13%), high blood pressure (50 vs. 35%), kidney diseases (9 vs. 3%), anemia or other blood diseases (6 vs. 1%) and osteoporosis (21 vs.13%) than patients aged >55-74 years. The most common other diseases for which back pain patients aged ≥ 75 years contacted their GP (based on registration data from the National Information Network of General Practitioners) were: other musculoskeletal disorders, problems in the circulatory system, and skin conditions. The number of co-existing disorders tends to increase with older age.[31] Almost 13% of the total Dutch population and 37% of people aged >55 years experience two or more chronic illnesses.[28]

In Chapters 7 and 8 we describe the variation in medication use of back pain patients in primary care for different age categories. Although diclofenac is the most prescribed medication in all age categories (27-57% of all back patients who received a medication prescription), the percentage of patients who received diclofenac or other non-steroidal anti-inflammatory drug (NSAID) prescriptions is lower for patients aged ≥ 55 years (27-42% of all back patients who received a medication prescription) compared to younger adult back pain patients (48-57% of all back patients who received a medication prescription). On the other hand, the percentage of patients who received a prescription for acetaminophen or opioids increased with older age; About 12% of all prescribed back pain patients aged ≥75 years received an acetaminophen prescription compared to only 3% of patients aged 55-74 years, this is 17% vs. 13% for tramadol prescriptions. When referred by the GP, patients in all age categories were most often referred to physical therapy, ranging from 52% of the referred patients aged 0-17 years and increasing to 80% of patients aged ≥ 75 years. However, older patients were less likely to use direct access for treatment by a physical therapist than patients of a younger age. Referral to neurology, rheumatology and neurosurgery is most common in the middle age categories (35-74 years). Other studies on back pain patients reported that older back pain patients (aged ≥ 60 years) were more likely to receive a medication prescription from their GP than younger adult patients, and less likely to receive a referral to physical therapy or another medical specialist.[17] More detailed information on differences between age categories with regard to prescriptions and referrals for patients with back pain are not currently available in the literature.

In summary, there are differences in patient and complaint characteristics and GP management between older and younger adult patients with back pain in primary care, and these differences could influence the course and prognosis of their back pain.

COURSE AND PROGNOSTIC FACTORS

The systematic literature review presented in Chapter 3 underlines that research focusing on older adults with back pain is very scarce. None of the articles included in the review described prognostic factors for poor recovery of back pain for older adults. Generally, the course of back pain was reported for the total population and was also described for different age categories, including an age group of patients aged >45 years. In order to fill this gap in knowledge, we designed and conducted a prospective cohort study of back pain in older patients (aged >55 years) in general practice, as described in Chapters 2, 4 and 5.

Some other studies reported on the course and prognostic factors of back pain in the working age population, but the design and methods used in these studies differ, making a direct comparison difficult .[12,21] Therefore, the Multinational Musculoskeletal Inception Cohort Study (MMICS) statement was designed;[23] this is a consensus statement which recommends a core set of measurements in order to improve the quality of back pain prognosis research. The design of the BACE cohort study was based on this MMICS statement and is described in detail in Chapter 2. The study in Chapter 5 shows that a relatively high percentage (61%) of the back pain patients aged >55 years included in the BACE study had not recovered at 3 months follow-up (measured with the Global Perceived Effect). This percentage is higher than the reported number of persistent back complaints at 3 months follow-up reported in our systematic review (37-40%) (Chapter 3). This percentage is also higher than the percentage described in several other studies on the total adult back pain population.[3-4,24]

Prognostic factors for poor recovery found in our study (Chapter 5) using multivariate logistic regression analysis were: longer duration of the back complaint, having a history of back pain, absence of radiating pain in the legs below the knee, more comorbidities, bad expectation of recovery of the patients, and longer duration of the timed 'Up and go' test. In back pain research, the variables duration of back pain, history of back pain and patients' expectation of recovery, are often reported as prognostic factors for poor recovery or other unfavorable outcomes such as persistent pain or disability or no return to work.[8,12] Older age is frequently reported as a prognostic factor in earlier research and also significantly associated with poor recovery in the BACE study. However, this is not a factor of importance in the multivariate regression model. This might indicate that age is less predictive for older adults.

In summary, the course of back pain seems to be less favorable for older patients than younger adult back pain patients. Some baseline characteristics are identified to be associated with a self reported poor recovery. This information can help GPs to better inform their patients about their probable prognosis.

COMPARISONS WITH OTHER MUSCULOSKELETAL DISORDERS

Patients with a musculoskeletal disorder often report pain at multiple pain sites. The most common regional pain sites reported by older adults are (besides back pain) knee, hip, shoulder and neck pain.[22] Pain and disability are the most frequently reported symptoms of all musculoskeletal disorders. Characteristics found to be prognostic factors for poor recovery for several different musculoskeletal disorders, include higher baseline pain severity, longer pain duration, previous episodes of pain, multiple pain locations, and a higher level of disability, anxiety and depression.[19] These results are consistent with our findings based on the binary regression analysis described in Chapter 5.

These findings show similarities between different non-specific regional musculoskeletal pain syndromes. Back pain could also be a result of a specific pathology, such as spondylolisthesis, a fracture, malignity, or other specific pathologies. Although these pathologies are not often presented in primary care, it is important to identify these pathologies if present. 'Red flags' are needed to distinguish these disorders from non-specific musculoskeletal disorders. At older age, osteoarthritis (OA) might be a more frequent and benign specific cause of low back pain. To identify these patients, we need symptoms which are associated with this disorder. For knee and hip OA there are radiographic classification criteria, of which the Kellgren and Lawrence classification criteria[14] are frequently used to identify OA on the basis of X-rays. Also, there are clinical classification criteria of which the American College of Rheumatology (ACR) criteria are frequently used. [1-2] The ACR criteria describe morning stiffness of the joint as one of the symptoms for both knee and hip OA.[1-2] Because these symptoms are related to hip and knee OA, in Chapter 6 we analysed whether these factors were also associated with lumbar disc degeneration (LDD), being part of the degenerative disease of the spine in elders and identifiable on X-ray. We found that radiographic LDD was associated with spinal morning stiffness alone (odds ratio (OR) 1.3-1.8) and the combination of spinal morning stiffness with back pain (OR1.5-2.5). The magnitude of the associations of spinal morning stiffness and back pain with radiographic LDD are comparable with the associations between radiographic hip/knee OA and morning stiffness in the legs combined with hip or knee pain.

Therefore, the combination of back pain and morning stiffness in the spine are symptoms which could be helpful to identify patients with LDD. Additional studies are required to examine whether treatment response or the course of back pain differs between patients with pain and morning stiffness compared to other patients with non-specific low back pain.

STUDY LIMITATIONS AND METHODOLOGICAL ISSUES

Many researchers distinguish between acute, (subacute) and chronic back complaints and use this distinction when establishing their inclusion criteria for the studies. For the BACE cohort study, we used the inclusion criteria 'a new episode of back complaint', i.e. a back complaint for which the patient has not visited a GP during the preceding 6 months and thus concerns acute, subacute and chronic back complaints. This inclusion criterion was selected because it represents the population of patients presenting to the GP, because back pain patients do not always visit the GP directly when they experience back pain. Factors which are associated with care seeking are severe back pain or disability.[5,30]

Another methodological issue is the inclusion method used for the BACE study. Our initial target was to include 1,000 older back pain patients within 1.5 years. The plan was to invite the patients to participate in the BACE study during their back pain consultation with their GP. However, due to initial disappointing inclusion results, the inclusion period was prolonged by one year. GPs reported that they had difficulties with referral to the BACE study due to their high workload and/or because they sometimes forgot to invite eligible patients. Therefore, we initiated a second inclusion method in which back pain patients were invited to join the BACE cohort study in writing within two weeks after the GP consultation. For this, the GPs screened their databases for eligible patients at regular intervals. The inclusion criteria remained unchanged, but patients not invited directly during consultation were now invited in writing maximally two weeks after the consultation. Overall, this resulted in 105 patients who entered BACE directly during consultation and 570 patients who were included after a written invitation. The participation rate of patients invited directly during consultation was 74% compared with 45% for patients who received a written invitation. We have no information about the patients who were invited but chose not to participate. When comparing patients recruited via the two inclusion methods, patients invited directly during consultation had slightly more severe back pain (mean score of 6.5 on an 11-point Numeric Rating Scale versus 4.9 point for patients invited after a written invitation) and reported a somewhat higher disability (mean score of 11.3 on the Roland Disability Questionnaire versus 9.5 points). This difference might be explained by the difference between the groups in the number of days between the GP consultation and the completion date of the baseline measurement; i.e. for patients who received a written invitation this was a mean of 24 days compared with only 5 days for patients who were directly invited during consultation. Apart from pain severity, disability and the time between the GP consultation and baseline measurement, the two groups did not differ in any other patient or complaint characteristics.

Selection bias due to inclusion selection and patients lost to follow-up is a methodological issue in all data collection. In the studies in which we used data from a registration network (described in Chapters 7 and 8) inclusion is not an issue, but selection bias

could have occurred because patients were selected based on the ICPC codes; in this the quality of the data depends on the correctness and completeness of the registration by the participating GPs and/or researchers. In the study sample of the Rotterdam study, which was used to assess the association between LDD and spinal morning stiffness (Chapter 6), selection bias may have occurred because, for other study reasons, we only scored the spinal radiographs of participants who have made a spinal radiograph at baseline and 6.6-years follow-up measurement. The participants who participated in the follow-up measurements were healthier than those who were lost to follow-up. Therefore this study sample would be healthier than the total baseline study population.

Although these studies have some methodological limitations, the limitations and their possible influence on the results are well described in each article. This thesis is a first initiative with the aim to collect data on back pain in older adults and to describe the short-term course of back pain and prognostic factors for poor recovery, differences between younger and older back pain patients, associations between LDD and morning stiffness in the spine, and the medical consumption of back pain patients of several age categories.

IMPLICATIONS FOR DAILY PRACTICE

The results from the studies described in this thesis have some implications for daily practice. A high percentage of patients aged >55 years reported a poor recovery at 3 months follow-up (Chapter 5) and some prognostic factors for poor recovery were indicated. Information on the course and prognostic factors may help the GP to better inform their older adult patients about their back pain.

Validation of these results is of course advised before full implementation in daily practice and the (national) guidelines takes place. Because patients find it important to be accurately informed about their prognosis[18] it is therefore helpful for a GP to know that the average course of back pain is less favorable for older adults than for younger adult patients.

It is also important for GPs to realise that they already adjust their treatment to the age of their patient (Chapter 7): The percentage of prescriptions of acetaminophen and other opioids rises with increasing age, as do the number of referrals to physical therapy and neurology. The prescription of non-steroidal anti-inflammatory drugs (NSAIDs) and referral to exercise therapy decreases with each increasing age category. The remarkable finding is that NSAIDs are still the most frequently prescribed type of medication in the age category ≥ 75 years, even though GPs are advised to minimise NSAID prescriptions for older adults because of the high risk of upper gastrointestinal tract complications.[13] In this age category the percentage of prescribed proton-pump inhibitors is lower than the percentage of prescribed NSAIDs, whereas the guidelines state that all patients with

a high risk of upper gastrointestinal tract complications (age >70 years) should also receive a proton pump inhibitor when they receive a NSAID prescription.[29]

IMPLICATIONS FOR FURTHER RESEARCH

Although this thesis collected information on the back complaints of older adults, several questions remain unanswered. We indicated that some differences exist between age groups regarding patient and complaint characteristics. Therefore, it is important to acquire information on the different aspects of back pain in older adults and compare these with the results from the younger adult back pain population. The short-term course during 3 months of follow-up, and the prognosis of back pain in older adults, is described in this thesis, however information on the long-term course and prognostic factors for poor recovery are still missing. Once prognostic factors for a poor recovery are identified and validated, additional studies are needed to examine whether changes in these prognostic factors (if modifiable) influence the recovery rate of older back pain patients.

In Chapter 6 we identified an association between LDD scored on a lumbar radiograph and morning stiffness of the spine. However, the prevalence of other spinal deviations and their association with symptoms such as severity of back pain and level of disability remain unknown. Future research should also examine whether patients with these spinal deviations differ in treatment response or course of back pain compared with other groups of patients with back pain. Also, future research should also investigate the additional value of magnetic resonance imaging (MRI). MRI is an imaging technology which is more detailed than radiographs, but the disadvantages of MRI are higher costs and the high prevalence of 'abnormal' findings which are not always associated with back pain.[11,25]

Furthermore, there are other aspects of back complaints in the elders, which are not described in this thesis but nevertheless warrant investigation. For example, in the current clinical guidelines on back pain, the importance of 'red flags' used to identify serious pathology is described. However, the clinical relevance of red flags is often discussed because the information is mostly based on clinical experience rather than on scientific evidence. Little information is available on the prevalence of red flags and/or their diagnostic value in relation to serious pathology and more information, in older adult back pain patients, is required.

THE BACE CONSORTIUM

The BACE study, for which the first results are described in Chapters 4 and 5, is part of the BACE consortium, a collaboration between research groups of the Netherlands,

Australia and Brazil, and other research groups are still being invited to join the BACE consortium. These research groups will conduct cohort studies using the same methods and design as the Dutch BACE cohort study (described in Chapter 2). Validation of the prognostic factors for poor recovery at follow-up measurement (described in Chapter 5) is also possible in other cohort studies of this consortium. Many advantages of consortia have been described in the literature; e.g. the meta-analysis using individual patient data will increase the statistical power and might lead to more precise results.[7] Another advantage is that the studies are conducted in different countries which also allows to investigate the influence of different cultural, economic and healthcare systems on the clinical course of back pain and treatment management of the GPs. Sharing knowledge and expertise between the research groups should lead to increased quality of research, and data emerging from worldwide consortia are more likely to influence the guidelines and health policies of various governments.[7]

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Summary

With the aging of the Dutch population, the number of older aged back pain patients is also expected to increase. However, information on the course and prognosis of older patients with back pain in general practice is very scarce.

Back pain is a common musculoskeletal disorder, also in older adults, information about back pain in older adults is therefore important. In addition, because there are several important reasons why back pain in older adults might differ from back pain in the younger adult population, information about younger back pain patients may not be generalizable to older adults. The overall objective of the studies presented in this thesis are therefore to acquire information about back pain in older adults and more specific to gain insight into: 1) the course of back pain in older adults in general practice, 2) the characteristics of these patients and their back pain, 3) prognostic factors for poor recovery of older adults with back pain, 4) the association between perceived lumbar stiffness and lumbar disc degeneration (LDD) as assessed on X-ray, and 5) the medical consumption of back pain patients.

In **Chapter 2**, we systematically reviewed the literature available in Medline and other medical databases in order to gain insight into the available information on the course of acute and subacute back complaints in older people (aged ≥ 45 years) and to identify prognostic factors for poor recovery. After applying the inclusion/exclusion criteria five studies were included in this review, most of which examined the total population and described the results for different age categories. Comparison between the studies was hampered because the studies used different outcomes. However, in order to make some comparison of the results, we calculated the percentage of patients who had 'persistent back complaints' at 3 and 12-months follow-up, using the outcome(s) described in the individual studies. The percentage of older patients who still experienced back pain or disability due to their back disorder ranged from 37% to 40% at 3-months follow-up. At 12-months follow-up, the percentage of patients with persistent back complaints ranged from 26% to 45%. Four of the five studies reported on prognostic factors for a poor recovery at follow-up. Although none of them differentiated between different age categories, older age was frequently reported as a prognostic factor for poor recovery in the total population. This indicates that very little information is available on the course of back pain in these older patients, and no information is available on the prognostic factors for poor recovery of older back pain patients. Prospective cohort studies, including only elderly back pain patients, are needed to better describe the course of back pain and to identify prognostic factors for poor recovery in this patient group.

The methods used by BACE, a prospective cohort study investigating back complaints in the elders (aged >55 years) in general practice, are described in **Chapter 3**. All patients aged >55 years who visited their general practitioner (GP) with a new episode of back

pain were included in this cohort study. Baseline measurement included a questionnaire, physical examination and X-ray of the back, follow-up questionnaires were sent after 6 weeks, and at 3, 6, 9 and 12 months. The primary objectives of this study are to determine the clinical course of back pain in older people who visit the GP with a new episode of back pain, and to identify possible prognostic factors for a poor recovery. This cohort study was the start of the BACE consortium, a collaboration between research groups in the Netherlands, Australia and Brazil. The design of the cohorts will be the same across the countries which allows to perform meta-analyses of individual patient data, to validate prognostic models, and to investigate cross-cultural differences in the course and treatment of older patients with back pain.

The first results of the BACE study are described in Chapters 4 and 5. In **Chapter 4** we assessed the baseline characteristics of the BACE population and examined whether these characteristics differ between the age categories >55-74 years and ≥75 years. A total of 675 back pain patients were included in BACE, and the median age of the study population was 65 years (interquartile range 11 years). Patients were invited to participate directly during the GP consultation (105 of the included patients) or in writing within maximally two weeks after the consultation (570 of the included patients). Back pain severity and disability at baseline was somewhat higher for patients who were invited to participate direct during the consultation compared to those who received a written invitation. This might be explained by the fact that the number of days between consultation and baseline measurement is considerably less for the patients who were invited direct during the consultation. Comparison of the two age categories showed that more disabilities were reported by patients in the oldest age category (≥75 years), and that these older patients reported more psychological health problems (such as lower quality of life and more depressive symptomatology), more often had low bone quality, required more time to complete the timed 'Up and Go' test, and more frequently reported heart diseases, high blood pressure, kidney diseases, anemia or other blood diseases, and osteoporosis. In summary, older patients reported more disabilities, more physical health problems and more co-morbidities. However, the differences between the groups regarding disabilities and physical health problems were relatively small. Although the clinical relevance of these differences might be small, the influence of these differences for the course of the back pain in these older patients remains a topic for further research.

The course of back pain in older patients and prognostic factors for poor recovery at 3-months follow-up were determined in **Chapter 5**. At 6-weeks follow-up, 64% of the patients indicated that they had a poor recovery from their back pain which decreased to 61% after 3 months. Of these patients, 26% had revisited their GP within 3 months after the baseline measurement. Baseline variables showing a binary association with

a poor recovery at 3 months follow-up were: higher age, male gender, low education, patients' expectation of poor recovery, low quality of life physical and mental summary score, more depressive symptoms, kinesiophobia, pain catastrophizing, higher number of co-morbidities, more musculoskeletal co-morbidities, longer duration of the complaint, higher back pain severity, more disabilities, history of back pain, difference in quadriceps strength, a positive test of Lasègue, and longer time to complete the timed 'Up and Go' test. In the multivariate logistic regression model, the following baseline variables were associated with poor recovery at 3-months follow-up: longer duration of the complaint, history of back pain, absence of radiating pain in the legs below the knee, higher number of co-morbidities, patients' expectation of poor recovery, and longer time to complete the timed 'Up and Go' test (AUC 0.79). This information on the course of back pain in older adults, and information about prognostic factors for poor recovery, can help GPs to better inform older back pain patients during consultation. However, additional studies are needed to validate our results before full implementation in GP practice is possible.

Chapter 6 explores the association between spinal morning stiffness and lumbar disc degeneration (LDD) assessed from X-ray. Cross-sectional data from the Rotterdam study, a prospective open population-based study of people aged ≥ 55 years, were used. Two different definitions for LDD were used: one based on the narrowing of the intervertebral disc spaces ('narrowing') and one based on the presence of osteophytes ('osteophytes'), both scored on a lumbar lateral radiographs. Both definitions of LDD turned out to be associated with spinal morning stiffness (when adjusted for age, sex and BMI) adjusted odds ratio (aOR)1.3; 95% confidence interval (CI):1.1-1.6 for 'osteophytes' and aOR 1.8; 95% CI:1.4-2.2 for 'narrowing'. When spinal morning stiffness was combined with the presence of low back pain, both the aORs increased: aOR 1.5; 95% CI:1.1-2.0 for 'osteophytes' and aOR 2.5; 95% CI:1.9-3.4 for 'narrowing'. These associations were compared with the associations between morning stiffness in the legs and radiographic knee or hip osteoarthritis (OA). The associations between morning stiffness in the legs combined with knee or hip pain and radiographic knee or hip OA were: aOR3.0; 95% CI:2.1-4.1 for knee OA and aOR3.1; 95% CI:1.9-5.0 for hip OA. The magnitude of the association for the definition 'narrowing' is similar to the association between morning stiffness in the legs and knee or hip OA.

In **Chapter 7** registration data from the Dutch National Information Network of General Practitioners (LINH) was used to explore the medical consumption of back pain patients visiting their GP, and to determine the variation between the different age categories. Between 2006 and 2009, 53,121 patients (13.2% of all patients registered in LINH) contacted their GP for back pain. Medication for back pain was prescribed for 22% of all patients who contacted their GP for back pain. In all age categories, diclofenac was prescribed most often: 51.3% of all back pain patients who received a prescription. The

percentage of patient which received a diclofenac prescription ranged from 27.3% to 57.4% in the different age categories. Acetaminophen was prescribed less often (2.9% of all prescribed patients). Tramadol, and other opioids had the highest prescription rate for patients in the age category ≥75 years (16.5% for tramadol). Of the patients who contacted their GP for back pain, 21.7% received a referral to another healthcare specialist. Most patients were referred to physical therapy. Patients in the older adult age categories (>55 years) were less often referred to exercise therapy. Patients aged 35-74 years were most often referred to neurology. The majority of neurology referrals were for back pain patients given the International Classification of Primary Care (ICPC) diagnosis L86: low back pain with radiation of pain. Thus the prescribed medication and referrals for patients with back complaints differed between the age categories, and the prescribed medication and referrals from the GP were largely consistent with the Dutch guidelines for GPs on the management of back pain.

In **Chapter 8** we investigated the frequency of back pain patients who were either referred or who directly accessed physical therapy, and we identified which demographic and clinical characteristics of these patients are associated with direct access versus referral. Data were used from the National Information Service for Allied Health Care (LiPZ), a registration network of physical therapists in the Netherlands. The percentage of back pain episodes for which direct access was used increased from 28.9% in 2006 to 52.1% in 2009. Patients with an episode of back pain who directly accessed a physical therapist more often had a middle/higher education level, had previous experience with physical therapy, had recurrent back complaint(s), and were more likely to be aged ≤ 55 years. An increasing percentage of back pain patients used direct access to visit a physical therapist. Some patient and clinical characteristics (for example, the age of the patient) were associated with the mode of access.

Chapter 9 summarizes and discusses the main findings of the studies described in this thesis. In addition, the limitations of these studies and main implications for clinical practice are described and recommendations are made for further research.

Samenvatting

De Nederlandse populatie wordt steeds ouder en hierdoor zal het aantal oudere patiënten met rugpijn ook stijgen. Er is echter weinig informatie over het beloop en de prognose van ouderen met rugklachten.

Rugpijn is een veel voorkomende aandoening van het bewegingsapparaat bij ouderen en daarom is informatie over het beloop van rugklachten bij ouderen belangrijk. Er zijn verschillende redenen waarom rugpijn bij ouderen kan verschillen van rugpijn in de jongere volwassen populatie en daarom is de informatie over jongere volwassen rugpijn patiënten niet generaliseerbaar voor ouderen. De algemene doelstelling van de studies beschreven in dit proefschrift is om inzicht te verkrijgen over rugpijn bij oudere patiënten in de huisartspraktijk en meer specifiek in: 1) het beloop van rugklachten bij ouderen in de huisartspraktijk, 2) de karakteristieken van deze patiënten en hun rugklachten, 3) prognostische factoren voor onvoldoende herstel van ouderen met rugklachten, 4) de associatie tussen gerapporteerde spinale ochtendstijfheid en lumbale discus degeneratie zoals beoordeeld op röntgenfoto's en 5) de medische consumptie van rugpijn patiënten in de huisartspraktijk.

In **hoofdstuk 2** hebben we systematisch in de literatuur gezocht, die beschikbaar was in Medline en andere medische databases, om de beschikbare informatie over het beloop van acute of subacute rugklachten bij ouderen (leeftijd ≥ 45 jaar) te verkrijgen en om prognostische factoren voor onvoldoende herstel te identificeren. Na toepassing van de in- en exclusie criteria hebben we 5 studies geïncludeerd in deze review. De meeste studies onderzochten de totale populatie en beschreven de resultaten voor verschillende leeftijdscategorieën. Het vergelijken van de studies was moeilijk omdat de studies verschillende uitkomstmaten gebruikten. Om de resultaten van de studies toch te kunnen vergelijken, hebben we het percentage patiënten met 'persisterende rugklachten' op 3 en 12 maanden follow-up berekend waarbij we gebruik maakten van de uitkomsten die beschreven waren in de individuele studies. Het percentage oudere patiënten dat nog steeds rugpijn of beperkingen aangaf vanwege de rugklachten, varieerde van 37% tot 40% op 3 maanden follow-up. Op 12 maanden follow-up varieerde het percentage patiënten met persisterende rugpijn van 26% tot 45%. Vier van de vijf studies rapporteerden over prognostische factoren voor onvoldoende herstel na follow-up. Geen van de studies beschreef de prognostische factoren voor de verschillende leeftijdscategorieën. Een hogere leeftijd werd echter vaak gerapporteerd als een prognostische factor voor onvoldoende herstel in de totale populatie. De resultaten van de review geven aan dat er erg weinig informatie beschikbaar is over het beloop van rugklachten voor deze oudere patiënten en dat er geen informatie beschikbaar is over prognostische factoren voor onvoldoende herstel van oudere rugpijn patiënten. Prospectieve cohort studies, die alleen ouderen patiënten met rugklachten includeren zijn nodig om het beloop van ouderen met rugklachten beter te beschrijven en prognostische factoren voor onvoldoende herstel te identificeren.

De onderzoeksmethode van BACE, een prospectieve cohort studie over rugklachten bij ouderen (leeftijd >55 jaar) in de huisartsenpraktijk, is beschreven in **hoofdstuk 3**. Alle patiënten ouder dan 55 jaar, die de huisarts bezochten voor een nieuwe episode van rugklachten werden uitgenodigd deel te nemen aan deze cohort studie. De baseline meting bestond uit een vragenlijst, een lichamelijk onderzoek en een röntgenfoto van de rug. Follow-up vragenlijsten werden verstuurd na 6 weken en 3, 6, 9 en 12 maanden. De hoofddoelstellingen van deze studie waren het vaststellen van het beloop van rugklachten bij ouderen die de huisarts bezochten met een nieuwe rugpijn episode en het identificeren van prognostische factoren voor onvoldoende herstel. Deze cohort studie was het begin van het BACE consortium, een samenwerking tussen verschillende onderzoeksgroepen in Nederland, Australië en Brazilië. De onderzoeksmethode van deze cohort studies zal hetzelfde zijn in de verschillende landen, wat ervoor zorgt dat we in de toekomst meta-analyses kunnen uitvoeren met individuele patiënt data, prognostische modellen kunnen valideren en om cross culturele verschillen in het beloop en de behandeling van ouderen met rugklachten kunnen onderzoeken.

De eerste resultaten van de BACE studie zijn beschreven in hoofdstuk 4 en 5. In **hoofdstuk 4** hebben we de baseline karakteristieken beschreven van de BACE populatie en onderzocht of deze karakteristieken verschilden tussen de leeftijdscategorieën > 55-74 jaar en ≥75 jaar. In totaal zijn er 675 patiënten met rugpijn geïncludeerd in BACE, de mediaan leeftijd van de studie populatie was 65 jaar (interkwartielafstand 11 jaar). Patiënten werden uitgenodigd om deel te nemen aan de studie tijdens het huisartsenconsult (105 van de geïncludeerde patiënten) of schriftelijk binnen maximaal twee weken na het consult (570 van de geïncludeerde patiënten). De ernst van de rugpijn en beperkingen bij baseline waren iets hoger voor patiënten die uitgenodigd waren om deel te nemen direct tijdens het consult vergeleken met degene die uitgenodigd waren via een schriftelijke uitnodiging. Dit kan verklaard worden door het feit dat het aantal dagen tussen het consult en de baseline meting aanzienlijk lager was voor patiënten die waren uitgenodigd direct tijdens het consult. Het vergelijken van de twee leeftijdscategorieën liet zien dat er meer beperkingen werden gerapporteerd door de hoogste leeftijdscategorie (≥75 jaar) en dat deze oudere patiënten meer psychologische gezondheidsproblemen (zoals lagere kwaliteit van leven en meer depressieve symptomen) rapporteerden, vaker lage botkwaliteit hadden, meer tijd nodig hadden om de timed 'Up and Go' test te voltooien. Ook rapporteerden ze vaker comorbiditeiten zoals hartproblemen, hoge bloeddruk, nierproblemen, anemie of andere bloedziekten en osteoporose. Samengevat, oudere patiënten rapporteerden meer beperkingen, meer psychische gezondheidsproblemen en meer comorbiditeiten. Maar het verschil tussen de leeftijdsgroepen wat betreft beperkingen en psychische gezondheidsproblemen was relatief klein. De klinische relevantie van deze verschillen is klein. De invloed van

deze verschillen op het beloop van de rugklachten bij deze oudere patiënten is een onderwerp voor toekomstig onderzoek.

Het beloop van rugklachten bij oudere patiënten en de prognostische factoren voor onvoldoende herstel op 3 maanden follow-up worden beschreven in **hoofdstuk 5**. Op 6 weken follow-up gaf 64% van de patiënten aan dat ze onvoldoende hersteld waren van hun rugklachten, op 3 maanden follow-up was dit gedaald naar 61%. Van deze patiënten heeft 26% hun huisarts opnieuw bezocht binnen 3 maanden na de baseline meting. De volgende baseline variabelen vertoonden een bivariate associatie met onvoldoende herstel op 3 maanden follow-up: hogere leeftijd, mannelijk geslacht, laag opleidingsniveau, negatieve verwachtingen van herstel van de patiënt, lage score op de kwaliteit van leven vragenlijst, meer depressieve symptomen, kinesiofobie, catastroferen, meer comorbiditeiten, meer bewegingsapparaat gerelateerde comorbiditeiten, langere duur van de rugklachten, ernstigere pijn, meer beperkingen, eerder rugklachten, verschil in kracht van de quadriceps, een positieve Lasègue test en meer tijd om de timed 'Up and Go' test te voltooien. In het multivariate logistische regressiemodel waren de volgende baseline variabelen geassocieerd met onvoldoende herstel op 3 maanden follow-up: langere duur van de rugklachten, eerder rugklachten, afwezigheid van uitstralende pijn in de benen onder de knie, meer comorbiteiten, negatieve verwachtingen van herstel van de patiënt, meer tijd om de timed 'Up and Go' test te voltooien (Area Under Curve 0.79). Deze informatie over het beloop van rugklachten bij ouderen en informatie over prognostische factoren voor onvoldoende herstel kan huisartsen helpen om oudere rugpijn patiënten beter te informeren tijdens het consult. Maar er zijn aanvullende studies nodig om deze resultaten te valideren voordat volledige implementatie in de huisartsenpraktijk mogelijk is.

Hoofdstuk 6 exploreert de associaties tussen spinale ochtendstijfheid en lumbale discus degeneratie (LDD) die zijn beoordeeld op een röntgenfoto. De data van de Rotterdam studie is hiervoor gebruikt en dit betreft een cross-sectionele open populatie studie van mensen in de leeftijd ≥ 55 jaar. Twee verschillende definities voor LDD zijn gebruikt: één gebaseerd op het aanwezig zijn van versmalling van de intervertebrale tussenwervelruimte ('versmalling') en één is gebaseerd op de aanwezigheid van osteofyten ('osteofyten'). Beide zijn gescoord met behulp van een lumbale laterale röntgenfoto. Allebei de definities van LDD bleken geassocieerd te zijn met spinale ochtendstijfheid: (geadjusteerd voor leeftijd, geslacht en BMI) geadjusteerde odds ratio (aOR) 1,3; 95% betrouwbaarheids interval (CI):1,1-1,6 voor 'osteofyten' en aOR 1,8; 95% CI:1,4-2,2 voor 'versmalling'. Wanneer spinale ochtendstijfheid werd gecombineerd met het aanwezig zijn van lage rugpijn werden beide aOR's hoger: aOR 1,5; 95% CI:1,1-2,0 voor 'osteofyten' en aOR 2,5; 95% CI:1,9-3,4 voor 'versmalling'. Deze associaties werden vergeleken met de

associaties tussen ochtendstijfheid in de benen en radiologische knie- of heupartrose. De associaties tussen ochtendstijfheid in de benen gecombineerd met pijn in de knie of heup en radiologische knie- of heupartrose waren: aOR 3,0; 95% CI:2,1-4,1 voor knieartrose OA en aOR 3,1; 95% CI:1,9-5,0 voor heupartrose. De grootte van de associaties van de definitie 'versmalling' is dus ongeveer gelijk aan de associatie tussen ochtendstijfheid in de benen en knie- of heupartrose.

In **hoofdstuk 7** was registratie data van het Landelijk Informatienetwerk Huisartsenzorg (LINH) gebruikt om de medische consumptie van rugpijn patiënten die hun huisarts bezochten te onderzoeken en om de variatie tussen leeftijdscategorieën te bepalen. Tussen 2006 en 2009, hebben 53.121 patiënten (13,2% van alle patiënten die geregistreerd zijn bij het LINH) contact opgenomen met hun huisarts vanwege rugpijn. Medicatie voor de rugpijn was voorgeschreven bij 22% van de patiënten. In alle leeftijdscategorieën werd diclofenac het meeste voorgeschreven: 51,3% van alle rugpijn patiënten die een recept ontvingen. Het percentage patiënten dat een diclofenac recept ontving, varieerde van 27,3% tot 57,4% in de verschillende leeftijdscategorieën. Paracetamol was minder vaak voorgeschreven (2,9% van alle patiënten die een recept ontvingen). Tramodol en andere opioïden waren het meeste voorgeschreven in de leeftijdscategorie ≥75 jaar (16,5% voor tramadol). Van alle patiënten die contact opnamen met hun huisarts voor rugklachten, ontving 21,7% een verwijzing van de huisarts. De meeste patiënten werden verwezen naar fysiotherapie. Patiënten in de oudere leeftijdscategorieën (>55 jaar) werden minder vaak verwezen naar oefentherapie. Patiënten van 35-74 jaar werden het meeste verwezen naar neurologie. De meerderheid van de neurologie verwijzingen betrof patiënten met rugpijn die de International Classification of Primary Care (ICPC) diagnosis L86: rugpijn met uitstraling gekregen hadden. De voorgeschreven medicatie en verwijzingen voor patiënten met rugpijn verschilde tussen de leeftijdscategorieën en de voorgeschreven medicatie en verwijzingen van de huisarts kwamen grotendeels overeen met de Nederlandse richtlijnen voor huisartsen wat betreft het behandelen van rugpijn.

In **hoofdstuk 8** hebben we onderzocht wat de frequentie is van rugpijn patiënten die een fysiotherapeut bezochten met een verwijzing of via directe toegankelijkheid en we identificeerden welke demografische en klinische kenmerken van deze patiënten geassocieerd waren met directe toegankelijkheid versus verwijzing. Data van de Landelijke Informatievoorziening Paramedische Zorg (LiPZ) werd gebruikt. Dit is een registratie netwerk van fysiotherapeuten in Nederland. Het percentage van rugpijn episodes waarbij patiënten via directe toegankelijkheid in behandeling kwamen nam toe van 28,9% in 2006 naar 52,1% in 2009. Patiënten met een episode van rugpijn die via directe toegankelijkheid bij de fysiotherapeut kwamen hadden vaker een gemiddeld of hoger onderwijs niveau, hadden eerdere ervaringen met fysiotherapie, hadden terugker-

ende rugklachten en waren vaker jonger dan 55 jaar. Een stijgend percentage rugpijn patiënten gingen via directe toegankelijkheid naar de fysiotherapeut. Sommige patiënt en klinische kenmerken (bijvoorbeeld leeftijd van de patiënt) waren geassocieerd met de manier waarop patiënten bij de fysiotherapeut kwamen.

Hoofdstuk 9 geeft de belangrijkste bevindingen van de studies in dit proefschrift weer en bediscussieerd deze. Daarnaast worden de beperkingen van deze studies en de belangrijkste implicaties voor de klinische praktijk beschreven en bevat dit hoofdstuk aanbevelingen voor toekomstig wetenschappelijk onderzoek.

DANKWOORD

Eerst wil ik mijn begeleiders bedanken, want zonder goede begeleiding is promoveren volgens mij een 'never ending story'.

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CURRICULUM VITAE

Jantine Scheele is op 5 december 1981 geboren in Amsterdam. Samen met haar ouders en oudere broer, verhuisde ze in 1985 vanuit Uithoorn naar Hendrik Ido Ambacht. Na het behalen van haar VWO diploma aan het Develstein college te Zwijndrecht begon ze in 2000 aan de studie Bewegingswetenschappen aan de Vrije Universiteit in Amsterdam. Haar onderzoeksstage ging over de betrouwbaarheid en validiteit van de Performance Oriented Mobility Assessment (POMA), een schaal waarmee bij ouderen het risico om te vallen beoordeeld kan worden. In 2005 studeerde ze af in de studierichting gezondheidszorg, met als specialisatie psychomotorische therapie. Na haar studie ging ze werken als projectleider van Club Extra in Zwijndrecht. Club Extra is een beweegprogramma voor kinderen met een motorische achterstand. Dit was een deeltijdbaan, hiernaast werkte ze eerst als administratief medewerker bij een verpleeghuis en later als onderzoeksmedewerker bij de afdeling Neurologie van het Leids Universitair Medisch Centrum. In december 2008 begon ze als wetenschappelijk onderzoeker bij de afdeling Huisartsgeneeskunde van het Erasmus MC te Rotterdam. Ze werkte aan een cohortstudie over rugklachten bij ouderen, waaruit de artikelen voortkwamen die in dit proefschrift beschreven zijn. Tijdens deze periode is de cohortstudie uitgebreid tot een consortium, waarbij onderzoeksafdelingen uit Australië en Brazilië meewerken door dezelfde cohortstudie op te zetten. Jantine is op 27 april 2012 getrouwd met Bram van Rijckevorsel.

PHD PORTFOLIO

Summary of PhD training and teaching

Name PhD student:	Jantine Scheele
Erasmus MC Department:	Department of General Practice
PhD period:	December 2008-August 2012
Promotor(s):	Prof. Dr. B.W. Koes
	Prof. Dr. S.M.A. Bierma-Zeinstra
Supervisor:	Dr. P.A.J. Luijsterburg

Courses

Biomedical English Writing and Communication, 2011	4 ECTS
Introduction to Data-analysis, NIHES research school, 2011	1 ECTS
Regression Analysis, NIHES research school, 2011	1.9 ECTS
Research Integrity (BROK cursus), 2009	25 hours

Conferences

International Forum on Low-Back Pain Research in Primary Care

- Poster and short oral presentation, Melbourne, 2011 — 30 hours
- Poster presentation, Odense, 2012 — 16 hours

Annual epidemiology conference (WEON)

- Poster presentation, Rotterdam, 2012 — 16 hours

Osteoarthritis Research Society International (OARSI) congress

- Oral presentation, San Diego, 2011 — 20 hours

Annual conference of the Dutch College of General Practitioners (NHG wetenschapsdag)

- Poster presentation, Amsterdam, 2010 — 16 hours
- Poster presentation, Maastricht, 2012 — 16 hours

International Primary Care Musculoskeletal Research congress (PRIMUS)

- Poster presentation, Rotterdam, 2010 — 16 hours

Teaching activities

Supervising 2 medical students, 201 — 120 hours

Annual research symposia for GP trainees
Oral presentation, Rotterdam, 2010, 2011, 2012 — 60 hours