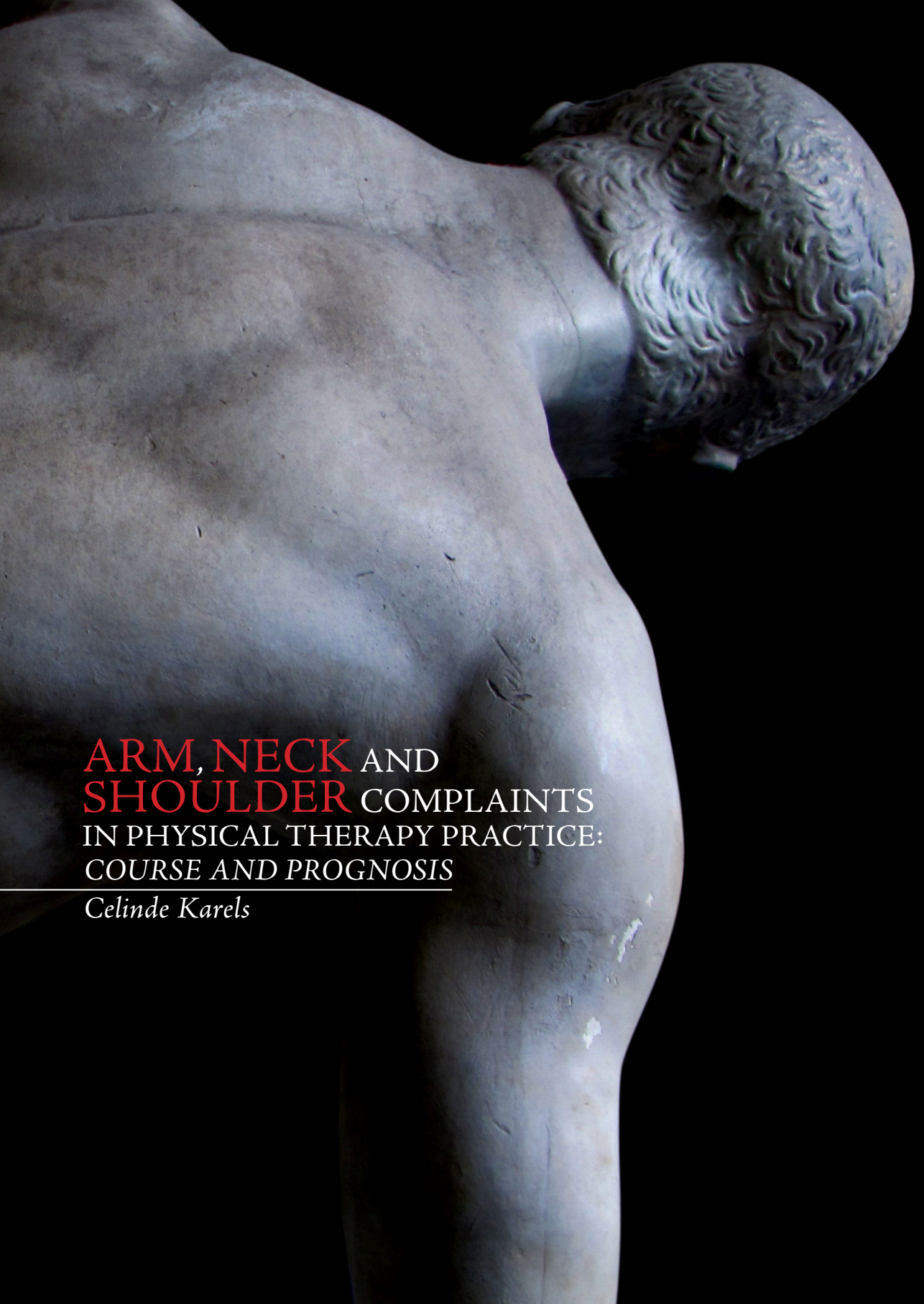

ARM, NECK AND SHOULDER COMPLAINTS IN PHYSICAL THERAPY PRACTICE: *COURSE AND PROGNOSIS*

Celinde Karels

Arm, Neck and Shoulder Complaints in Physical Therapy Practice: Course and Prognosis

Celinde Karels

The work presented in this thesis was financially supported by College voor Zorgverzekeringen, The Netherlands. Deelprogramma Paramedische Zorg, DPZ 00-04 en 519/002/2002

CVZ College voor zorgverzekeringen

The printing of this thesis was financially supported by:
The Department of General Practice of the Erasmus Medical Center, Rotterdam,The Netherlands;
Stichting Anna Fonds, Leiden, The Netherlands;

Anna Fonds

Steunt orthopedische research

Het Wetenschappelijk College Fysiotherapie (WCF), Amersfoort, The Netherlands.

de Fysiotherapeut
Koninklijk Nederlands Genootschap voor Fysiotherapie

Cover design: Optima Grafische Communicatie Rotterdam
Cover photography: Celinde en René Karels. Discuswerper van Myron. Ca. 450 v. Chr. Kopie. Gymnasium Haganum, Den Haag.
Printed by: Optima Grafische communicatie Rotterdam
ISBN: 978-90-8559-603-5

Arm, Neck and Shoulder Complaints in Physical Therapy Practice: Course and prognosis

Arm-, nek- en schouderklachten in de fysiotherapiepraktijk: beloop en prognose

Proefschrift

ter verkrijging van de graad van doctor
aan de Erasmus Universiteit Rotterdam
op gezag van de rector magnificus
Prof.dr. H.G. Schmidt
en volgens besluit van het College voor Promoties.

De openbare verdediging zal plaatsvinden op
vrijdag 18 december 2009 om 09:30 uur

door
Celinde Haggaï Karels
geboren te Gouda

ERASMUS UNIVERSITEIT ROTTERDAM

Promotiecommissie

Promotor:	Prof.dr. B.W. Koes
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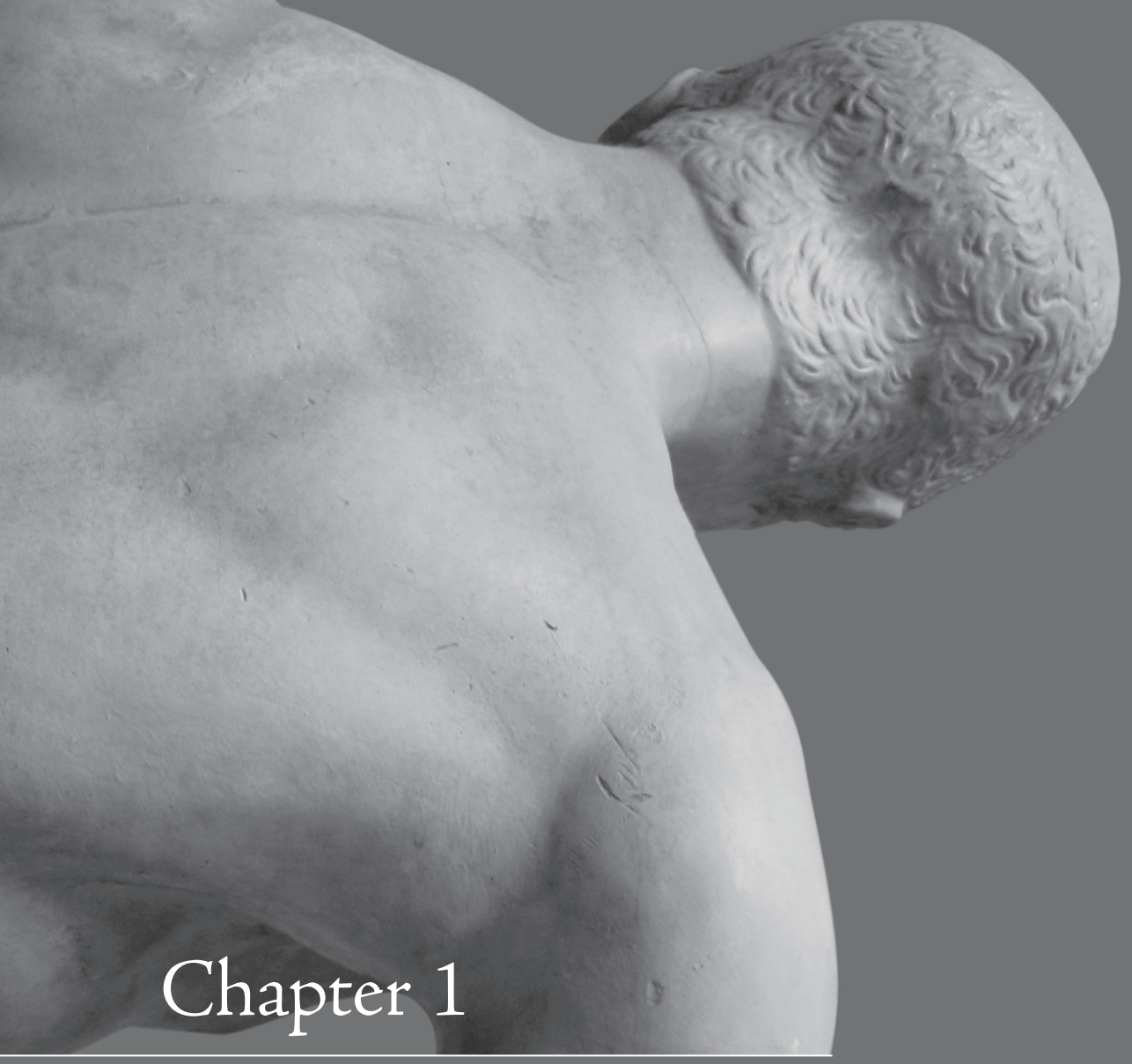

Chapter 1

General Introduction

INTRODUCTION

Musculoskeletal disorders are the most common cause of severe long-term pain and physical disability, affecting millions of people worldwide [1]. Pain and sensory disturbance in the upper limb are common symptoms with reported point prevalence rates ranging from 4-35% [2]. The Dutch population-based Musculoskeletal Complaints and Consequences Cohort Study (DMC3 study) estimated the 12-month prevalence to be 31.4% for neck, 30.3% for shoulder, 18.8% for higher back, 11.2% for elbow and 17.5% for wrist/hand pain. About 30% of persons with pain in the neck or upper extremity experienced limitations in daily life [3]. Of those with pain in the neck, shoulder or higher back 32.8% contacted a physiotherapist during the previous year, compared with 21.6% with elbow or wrist/hand pain [3]. Besides pain, reported symptoms may include clumsiness, stiffness, tingling, loss of coordination, loss of physical strength, skin discoloration and temperature differences located in the neck, shoulder, arm, elbow, wrist, hand and/or fingers [4].

In the literature various terms and classification systems are used to describe complaints of the upper extremity [5,6]. Although we prefer to use the term 'arm, neck and shoulder complaints', in the various (published) chapters in this thesis other terms have been used to conform with the policy of the selected journal.

Our large prospective cohort study (presented in this thesis) on patients with arm, neck and shoulder complaints who consulted the physical therapist started in 2001; in this cohort study the complaints were divided into specific and non-specific diagnoses based on the Saltsa report [7]. Subsequently, in 2004, a multidisciplinary team of professionals achieved consensus on the terminology and classification of upper extremity musculoskeletal disorders, and labeled them 'Complaints of Arm, Neck and Shoulder' (CANS) [8]. Compared with this latter classification, most of our earlier diagnoses were classified in a similar manner.

COURSE OF COMPLAINTS

Given the high rate of prevalence, apart from establishing risk factors, investigation of the course of arm, neck and shoulder complaints and their related prognostic factors is needed. This information can be used for patient education and management, as well as to develop and follow interventions for these complaints - especially when modifiable prognostic factors can be identified. However, data on the clinical course of arm, neck and shoulder complaints and the factors related to outcome are scarce [9]. Until now,

a few studies in *general practice* have focused on the predictive factors of complaints located in the neck [10], neck-shoulder [11], shoulder [12,13], elbow [14], and arm, neck and shoulder [15]. Nevertheless, the clinical course and prognostic factors of these complaints in *physical therapy practice* is not yet known, and information on long-term follow-up is also lacking.

SICKNESS ABSENCE

Arm, neck and shoulder complaints are a major cause of sick leave. In one study 8% of the general workforce reported sickness absence in the past year because of complaints at the arm, neck or shoulder [16]. Risk factors associated with sickness absence include heavy physical work in patients who worry too much [17], work-related neck flexion/rotation, low decision authority and medium skill discretion in patients with neck pain [18], and being female, living alone and high job strain among industrial workers with arm, neck and shoulder symptoms [19]. Overall, however, little is known about the association between factors related to an episode of and duration of sickness absence in patients with arm, neck and shoulder complaints. Increased knowledge on possible determinants of sick leave and its duration would help in the development of interventions that interrupt the process from the onset of complaints.

MANAGEMENT OF COMPLAINTS

The management of arm, neck and shoulder complaints mainly takes place in primary care. Many treatment options are available, ranging from ergonomic advice and workload restrictions, to physical therapies and prescription of medical aids [20]. Conservative interventions (such as physiotherapy and ergonomic adjustments) play a major role in the treatment [21]. Although many patients with arm, neck and shoulder complaints are referred to and treated with physical therapy, the efficacy of most interventions is not well established. Besides the question of efficacy, there is lack of insight regarding the type of physical therapy that is applied to patients with arm, neck and shoulder complaints.

OBJECTIVES OF THE THESIS

This thesis describes the course and management of arm, neck and shoulder complaints in physical therapy practice, and the related sickness absence in patients with these complaints.
The main aims are as follows:

Course of complaints

- to evaluate the clinical course of arm, neck and shoulder complaints in physical therapy practice
- to identify prognostic factors which influence the course of arm, neck and shoulder complaints in physical therapy practice

Sickness absence

- to examine sickness absence among patients with arm, neck and shoulder complaints as well as the determinants influencing this absence

Management of complaints

- to describe the current treatment and efficacy of treatment of arm, neck and shoulder complaints in physical therapy practice

OUTLINE OF THE THESIS

The following chapters are based on data from a prospective cohort study of arm, neck and shoulder complaints in physical therapy practice (with the exception of Chapter 5 which is a systematic review of the literature).

Chapters 2 and 3 present the 6-month and 24-month clinical course, respectively, and identify prognostic factors for the persistence of complaints in both the total and the working population. Chapter 3 also addresses the recurrence of complaints at 6-months follow-up.

Chapter 4 describes sickness absence in patients with arm, neck and shoulder complaints during 6-months follow-up.

Chapter 5 presents and discusses evidence for the effectiveness of interventions given to patients with work-related complaints of arm, neck and shoulder.

Chapter 6 focuses on the management of arm, neck and shoulder complaints in physical therapy practice during 6-months follow-up.

Chapter 7 explores whether baseline clinical factors in patients with non-specific neck pain are related to recovery after manual therapy versus treatment with physiotherapy without manual therapy.

Finally**, Chapter 8** discusses the main results of the studies and the study limitations. In addition, implications for daily practice and recommendations for further research are presented.

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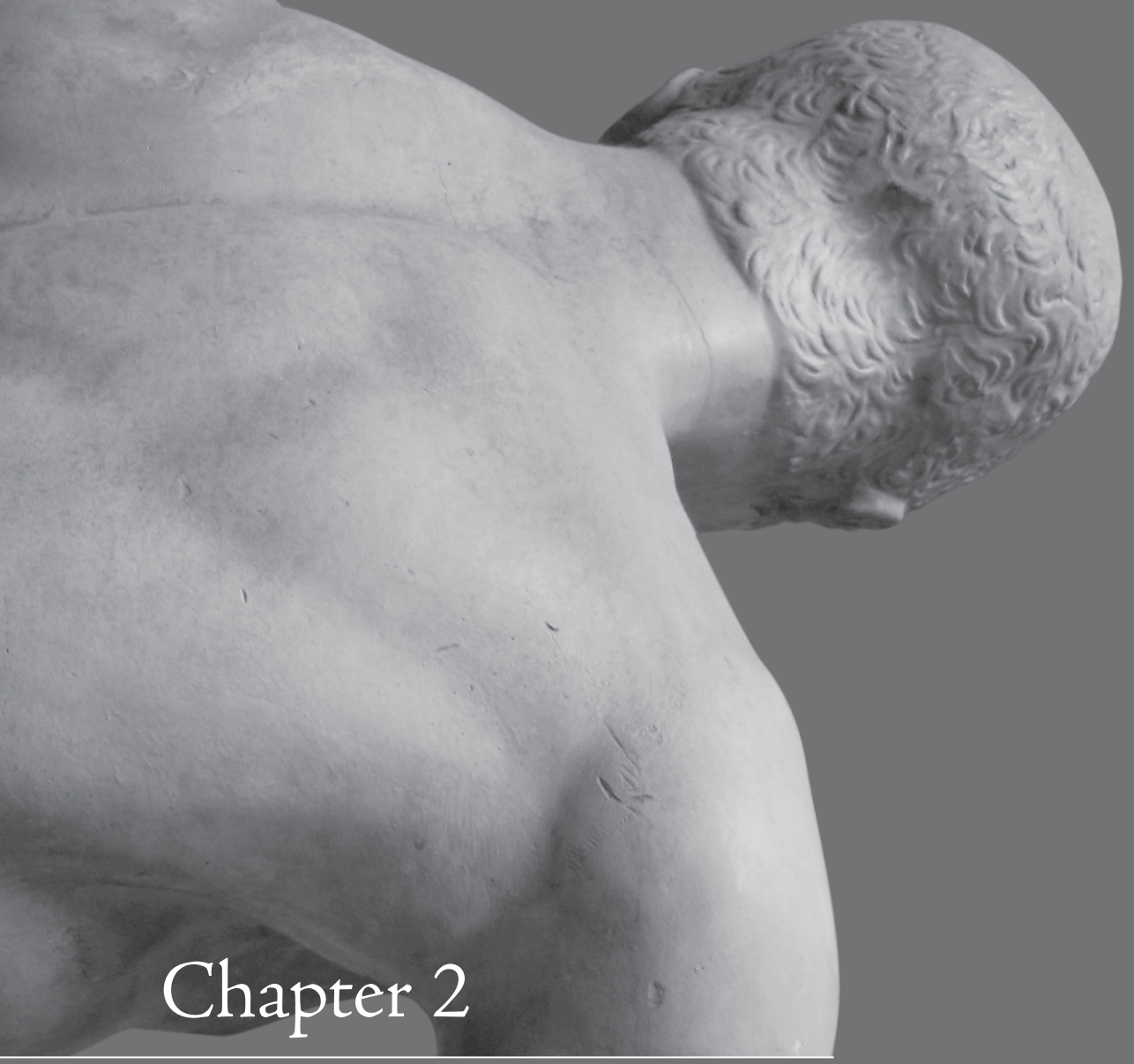

Chapter 2

Social and psychological factors influenced the course of arm, neck and shoulder complaints

C.H. Karels, S.M.A. Bierma-Zeinstra, A. Burdorf, A.P. Verhagen, A.P. Nauta, B.W. Koes

Journal of Clinical Epidemiology 2007; 60: 839-848

ABSTRACT

Objective To investigate the clinical course and prognostic factors of complaints of arm, neck and shoulder.

Study Design and Setting A prospective cohort study in physical therapy practice. Participating physiotherapists recruited new consulters with musculoskeletal complaints of the neck and/or upper extremities. Participants filled in questionnaires at baseline, at 3 months and 6 months. The main outcome measure was the persistence of complaints over 6 month follow-up. Possible predictors like social and psychological factors, physical factors and complaint specific factors were tested in univariate and multivariate logistic regression analyses for repeated measurements.

Results Of the 624 participants at baseline 543 (87%) returned at least one follow-up questionnaire. At 6 month follow-up 40% had persisting pain and discomfort. Somatization, kinesiophobia, catastrophizing, and a long duration of complaints at baseline were significantly related to the persistence of complaints over 6 months in the total population. In those with paid work (77%), catastrophizing, low decision authority at work and a long duration of complaints at baseline were significantly related to the persistence of complaints over 6 months.

Conclusion 40% of the participants had persisting pain and discomfort after 6 months and mainly social and psychological factors played a role in this course.

INTRODUCTION

Different terms are used in the literature to describe pain and discomfort in the neck and upper extremities, for example repetitive strain injury, occupational overuse syndrome, cumulative trauma disorder or work-related upper extremity disorders [1-3]. In the literature the use of this terminology is not consistent. Moreover, this terminology is confusing because it suggests a single common pathway whereas currently experts are of the opinion that this is not the case [4]. Therefore we use the less loaded term "pain and discomfort in the neck and upper extremities" to describe all musculoskeletal complaints in the neck and upper extremities not caused by acute trauma or specific systemic diseases.

The pain and discomfort can partly originate from the work environment and performance of work, but sport and other recreational activities can also contribute to the development of these complaints [1]. Activities associated with pain and discomfort in the neck and upper extremities are repetitive or forceful motions, static or awkward postures, and activities being accompanied by vibrations or activities in extreme temperatures [1,2,5]. Nowadays, besides physical factors, other characteristics are also recognized as important risk factors. Especially perceived stress at work, but also general distress and other pain (comorbidity) are consistently related to pain and discomfort in the neck and upper extremities [6]. Physical, psychosocial and personal factors probably all play a role, but the way they interact with each other is not exactly known [6].

The pain and discomfort can consist of clumsiness, stiffness, tingling, loss of coordination, loss of physical strength, skin discoloration and temperature differences located in the neck, upper back, shoulder, arm, elbow, wrist, hand and/or fingers [7].

According to the "Criteria Document for evaluation of the work-relatedness of upper extremity disorders" [3] pain and discomfort in the neck and upper extremities can be divided into specific and nonspecific: specific complaints have defined diagnostic criteria (e.g., carpal tunnel syndrome) whereas non-specific complaints do not [3].

There is literature, which demonstrates, that neck and upper extremity complaints originating from work cause increased compensation and health care costs [1,8]. The reported rates of pain and discomfort in the neck and upper extremities tripled between 1986 and 1993 in the USA; in 1990 these complaints accounted for more than 60% of occupational illnesses [1]. Large increases in incidence have also been reported in other countries [1]. In the Netherlands, the 12-month prevalence of chronic or regular pain and discomfort in neck and upper extremities partly or totally due to work increased slightly from 26% in the year 2000 to 28% in the year 2002 [9].

Given these prevalence's, it is not only of importance to study risk factors for development but also to study the course of such complaints and their prognostic factors. Such information is important for patient education and management, but can also be used

to develop and study interventions for these complaints, especially when modifiable prognostic factors can be identified. However, insight into the clinical course of these complaints and the factors related to outcome at follow-up is scarce [10]. Therefore, this study investigated the course of pain and discomfort in neck and upper extremities and evaluated prognostic factors, which can influence its course.

METHODS

Design and setting

From four provinces in the western part of the Netherlands, physiotherapists from physical therapy practices active in primary care or occupational health care were invited to participate. Consecutive patients were then recruited in this prospective cohort study with a follow-up period of 6 months.

Participants

New consulters with pain and discomfort in neck and upper extremities (neck, upper back, shoulder, upper arm, elbow, forearm, wrist and hand) aged 18-65 years were recruited by the participating physical therapists during the 12-month period from August 2001 to July 2002. Exclusion criteria were: consultation of the physical therapist in the previous 6 months for the same complaint, acute complaints caused by trauma, systemic disorders and/or generalized neurological syndromes, comorbidity causing severe disability in daily activities, and not being able to fill in Dutch questionnaires.

Physical therapists

The approached physical therapists were all qualified, registered at the Royal Dutch Society for Physical Therapy (KNGF) and working within the region of interest. We randomly selected the physical therapists by using lists of the KNGF. We used Microsoft Excel for the random number selection. A total of 100 physical therapists were first approached by letter and subsequently by telephone.

From these 100 physical therapists 93 were visited by our researcher and received more information about the study. These 93 physical therapists agreed to include patients for our study, but finally only 77 physical therapists (37 males, 40 females) really included patients. So the response rate of practitioners is 77%. Their average number of years of professional experience was 14.0 (S.D. = 7.4 years). The average number of hours worked each week was 32.3 (S.D. = 12.3 hours).

Procedures

Data were collected by means of self-administrated questionnaires at baseline, 3 and 6 months. During the first consultation the physical therapist handed out the baseline questionnaire together with informed consent forms. The follow-up questionnaires were sent to the patient's home addresses by the research institute. All questionnaires had to be completed within 8 weeks; reminders were sent 2 weeks after mailing the questionnaire. The physical therapists completed a treatment record and all participants received standard care for their complaints.

Determinants

At baseline the following possible prognostic factors were assessed:

1. Participant characteristics

Age, gender, educational level, body mass index (BMI, kg/m2), sports (Do you participate in sports long enough to sweat? Yes/No) and work participation (Do you have a paid job? Yes/No). Education level was defined as the highest level achieved (low = no education, primary school or lower vocational school, medium = lower general secondary school level or middle vocational school, high = higher general secondary school, higher vocational school, or university).

2. Complaint-specific characteristics

The duration of the complaints at baseline, comorbidity (musculoskeletal or not), earlier musculoskeletal trauma of arm, neck or shoulder, and the prognosis as assessed by the physical therapist were assessed.

Complaints were divided into specific and non-specific. Symptoms were defined as specific if the physical therapist had indicated one of the following diagnoses: rotator cuff syndrome; epicondylitis lateralis/medialis; cubital tunnel syndrome; radial tunnel syndrome; peritendonitis/tenosynovitis flexors or extensors; de Quervain's syndrome; carpal tunnel syndrome; Guyon's channel syndrome; Raynaud's phenomenon and peripheral neuropathy in combination with exposition to hand-arm vibration and osteoartrosis of elbow, wrist or hand [3]. Shoulder capsulitis/frozen shoulder, local arthritis (no rheumatoid arthritis) and cervical hernia were also defined as specific. All other complaints were classified as nonspecific, including the diagnosis radiating neck complaints [3]. If more than one diagnosis was indicated the specific diagnosis was given priority for the classification.

In addition, the complaints were classified as local (the participant indicated only one location on a manikin) or not local (more than one location indicated), and as being work-related or not. Complaints were defined as work related if the participant had a paid job and gave a positive answer to one of the following questions:

A. Do the complaints return or worsen during activities at work?
B. Have you adapted or diminished your activities at work?
C. Do the complaints diminish after several days off (e.g. during the weekend or vacation)?

3. Social and psychological factors

The Dutch version of the Tampa Scale of Kinesiophobia (TSK-DV) was used to measure pain-related fear of movement. The questionnaire has 17 items scored from 1 "strongly disagree" to 4 "strongly agree"; the total score ranges from 17 to 68, with a higher score indicating more kinesiophobia [11,12].

Social support was measured with the Social Support Scale. This Dutch scale is based on the Social Support Questionnaire. The scale has 12 items scored from 1 "no, not at all" to 5 "very clearly" and ranges from 12 to 60, with a higher score indicating more social support [13, 14].

To measure distress and somatization we used two scales of the Dutch Four Dimensional Symptom Questionnaire. Both scales have 16 items scored from 0 "no" to 4 "very often/ continuous" and after recoding 3 and 4 to 2 it ranges from 0 to 32. A higher score indicates more distress or somatization [15].

Catastrophizing was measured with six items scored from 0 to 10, based on the subscale catastrophizing from the Dutch version of the Coping Strategy Questionnaire. The scores ranges from 0 to 60 and high scores indicate more catastrophizing [16-18].

All these questionnaires were analyzed in tertiles.

The social and psychological factors at work were measured with the Dutch translation of the core Job Content Questionnaire (JCQ) [19]. The following scales were used: quantitative job demands, skill discretion, decision authority, supervisor support and coworker support. Job insecurity was measured with the item "My job security is good". In the analysis, the scores of the JCQ scales (except job insecurity) were analysed in tertiles. Higher scores indicate more job demands, skill discretion, decision authority, supervisor support and co-worker support.

4. Physical factors

Physical activities during leisure time were measured with six items (housekeeping, taking care of chronic patients and/or disabled persons, do-it-yourself work, gardening, computer use and handicrafts). These items were scored from 0 "seldom" to 3 "always". Two scores were calculated: "Heavy physical activities in leisure time" (four items) and "Static repetitive activities in leisure time" (two items). In the analysis, these scales were dichotomized in "Doing heavy physical activities in leisure time" (score ≥ 4) and "Doing static repetitive activities in leisure time" (score ≥ 2).

Physical load at work was measured with 15 items. The items derived from the index musculoskeletal workload of the Dutch Musculoskeletal Questionnaire [20]. The items concerned force exertions, static, dynamic and repetitive loads of the upper extremities (see Appendix). The items were scored from 1 "seldom" to 4 "always" estimating the frequencies of postures, movements and tasks. Two scores were calculated "Heavy physical work" (seven items) and "Static repetitive work" (eight items); in the analysis these two scales were dichotomized on the median score. Higher scores of the above mentioned questionnaires concerning physical factors indicate more physical load.

Measurements

The primary outcome measure was subjective recovery. The question was as follows: How do you experience the complaints for which you visited the physical therapist 3 months ago? This was measured by a seven-point scale from 1 "Worse than ever" to 7 "Completely recovered". The scores were dichotomized to persistence of complaints (worse than ever to slightly improved), and no persistence of complaints (strongly improved and completely recovered). The question of subjective recovery was asked in the follow-up questionnaires [21].

Besides the persistence of complaints, the clinical course was measured by two secondary outcome measures. First, the functional limitations of the arm, neck, shoulder and hand were measured using a 29-item questionnaire, each item scored separately on a five-point Likert scale. This questionnaire is based on the 30 items of the Disabilities of the Arm, Shoulder and Hand questionnaire [22]; one question on sexual activities was excluded. Higher scores indicate more functional limitations.

Secondly, the severity of complaints in the previous week was measured on a numerical rating scale from 0 (no pain/ complaints) to 10 (intolerable pain/ complaints) [23].

Statistical analyses

The descriptive statistics were performed with SPSS 11.0 for windows. To evaluate selective dropout we compared the means of the functional limitation score, the severity score, and the age of the population available for follow-up with the baseline population. The outcome in the prognostic model is subjective recovery measured by a seven-point scale from 1 "Worse than ever" to 7 "Completely recovered". The scores were dichotomized to persistence of complaints (worse than ever to slightly improved), and no persistence of complaints (strongly improved and completely recovered).

To assess the prognostic factors, which might influence the clinical course, we used both univariate and multivariate logistic regression analyses for repeated measurements (GEE; Generalized Estimating Equations). The GEE was performed with SAS 8.2.

In the univariate analysis the possible prognostic variables obtained at baseline, were checked for a significant contribution ($P \leq 0.1$) to the persistence of complaints. This

analysis was done for the total population and for the working subpopulation separately. The univariable models were adjusted for severity of complaints at baseline.

We assumed that the relationship between baseline measures and the outcomes would be the same for both 3 and 6 month outcomes. To test this assumption we added interaction terms of the baseline measures and time in the univariable models.

In the multivariate analysis we first divided the different factors into domains (participant characteristics, complaint specific characteristics, social and psychological factors and physical factors) to avoid multicollineairity and then analyzed the factors in domains.

The factors with a significant contribution ($P \leq 0.05$) in the domains were combined in the total model. The variables were eliminated in the domain analyses until those with $p <= 0.05$ were left in the model. Subsequently, the factors significantly contributing ($P \leq 0.05$) to the total model constituted the final model. In all multivariate analyses we adjusted for education, age, gender and severity of complaints at baseline.

RESULTS

Participants

The physical therapists invited consecutive patients with pain and discomfort in the neck and upper extremities for participation in our study. This resulted in 748 participants. Of these 710 met the inclusion criteria, and 624 participants gave informed consent and filled in the baseline questionnaire. Of the 624 participants in the total population 511 (81.9%) returned the questionnaire at 3 months, 474 (76%) returned the questionnaire at 6 months and 543 (87%) returned one of these two follow-up questionnaires. Of the 483 working participants in the study population 395 (81.8%) returned the first follow-up questionnaire at 3 months, 359 (74.3%) returned the second follow-up questionnaire at 6 months and 420 (87.0%) returned one of these two follow-up questionnaires.

Baseline data

The mean age of the population was 43.5 (S.D. = 11.4 years); 440 (70.5%) of the participants were women and 483 (77.4%) had a paid job. At baseline most participants had suffered their complaints for 3 months or more. Table 1 presents baseline data of the 624 participants and the distribution of the possible prognostic factors.

Loss to follow-up

The mean age of the dropouts was significantly lower compared to participants who filled in at least one follow-up questionnaire (39.3 years vs. 44.7 years; $P = 0.003$).

Table 1: Participant characteristics at baseline (N=624)

Variables		Score
Participant characteristics		
Age (years); mean (S.D.)		43.5 (11.4)
Women, N (%)		440 (70.5)
Educational level: N (%)		
	Low	204 (32.7)
	Medium	203 (32.5)
	High	217 (34.8)
Sports participation N (%)		299 (47.9)
Body Mass Index (kg/m2), [16.4-60.2] mean (S.D.)		25.3 (4.3)
Paid work (working population), N (%)		483 (77.4)
Complaint specific characteristics		
Work-related complaints N (%)*		372 **(**77.0**)**
Prognosis physical therapist, development chronic complaints N (%)		
	Very likely	111 (17.8)
	Likely	141 (22.6)
	Not likely	328 (52.6)
	Not likely at all	44 (7.1)
Duration of the complaint; N (%)		
	More than 6 months	217 (34.8)
	3 to 6 months	106 (17.0)
	6 weeks to 3 months	151 (24.2)
	3-6 weeks	100 (16.0)
	0-3 weeks	50 (8.0)
Local complaint N (%)		339 (57.2)
Specific complaint N (%)		223 (35.7)
Co-morbidity (musculoskeletal) N (%)		286 (46.3)
Co-morbidity (not musculoskeletal) N (%)		99 (16)
Earlier musculoskeletal trauma N (%)		128 (20.6)
Severity of complaints in the last week [0-10]; mean (S.D.)		5.7 *** (2.0)
Location of complaints N (%)		
	Neck	280 (44.9)
	Shoulder	392 (62.8)
	Upper back	77 (12.3)
	Upper arm	73 (11.7)
	Elbow	95 (15.2)
	Forearm	30 (4.8)
	Wrist	46 (7.4)
	Hand	55 (8.8)

Table 1 continued

Variables	Score
Psychosocial factors	
Distress [0-32]; mean (S.D.)	11.2 (8.5)
Somatization [0-32]; mean (S.D.)	9.4 (6.0)
Kinesiophobia [17-68]; mean (S.D.)	34.3 (6.6)
Catastrophizing [0-60]; mean (S.D.)	13.5 (12.3)
Social Support [12-60]; mean (S.D.)	53.1 (8.0)
Psychosocial factors in work *	
Job insecurity N (%)	87 (18.2)
Co-worker support [4-16]; mean (S.D.)	11.9 (1.7)
Supervisor support [4-16]; mean (S.D.)	10.9 (2.6)
Quantitative job demands [12-48]; mean (S.D.)	31.5 (6.1)
Skill discretion [12-48]; mean (S.D.)	34.2 (6.1)
Decision authority at work [12-48]; mean (S.D.)	35.9 (7.5)
Physical factors	
Physical heavy work in leisure time [0-12]; N (%); mean (S.D.)	149 (23.9); 2.6 (1.7)
Static repetitive activities in leisure time [0-6]; N (%); mean (S.D.)	301 (48.2) ; 1.6 (1.2)
Physical heavy work [0-100]; N (%); mean (S.D.)*	217 (45.0); 21.6 (23.6)
Static repetitive work [0-100]; N (%); mean (S.D.) **	223 (49.3); 45.0 (23.1)

Abbreviation: S.D.= standard deviation
[..] =score range
*=only assessed in the working population (N=483), **=only assessed in the working population (N=452)
*** correction : 6.1

The mean functional limitation score of the dropouts was lower (33.2 vs. 37.2) with borderline significance (P= 0.075) compared to those who filled in at least one follow-up questionnaire. The education of the dropouts was significantly lower compared to the participants who filled in at least one follow-up questionnaire (P=0.05). No difference was found in the mean severity score (6.0 vs. 6.1) and in the distribution of gender.

Clinical course

At 3-month follow-up the complaints were strongly improved; 47.4% of the total population (50.1% of the working subgroup) and 11.2% (12.2% of the working subgroup) had completely recovered; this means that 58.5% (62.3% of the working subgroup) was considered to have recovered in 3 months.

At 6 month follow-up the complaints were strongly improved; 43.2% of the total population (44.3% of the working subgroup) and 17.1% (18.4% of the working subgroup) had completely recovered; this means that 60.3% (62.7% of the working subgroup) had

recovered in 6 months. Data on functional limitation and the complaint severity scores are shown in Figs. 1 and 2.

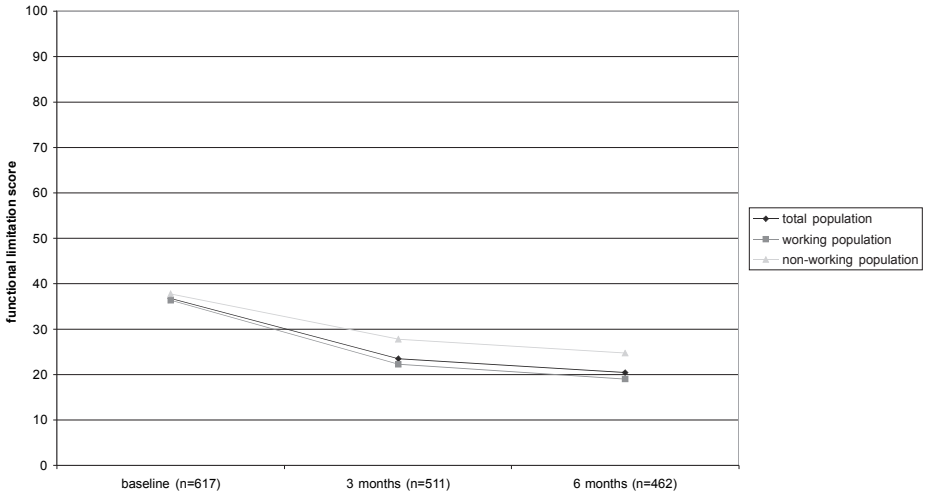

Figure 1. Mean functional limitation scores at baseline and at 3 and 6 months follow-up.

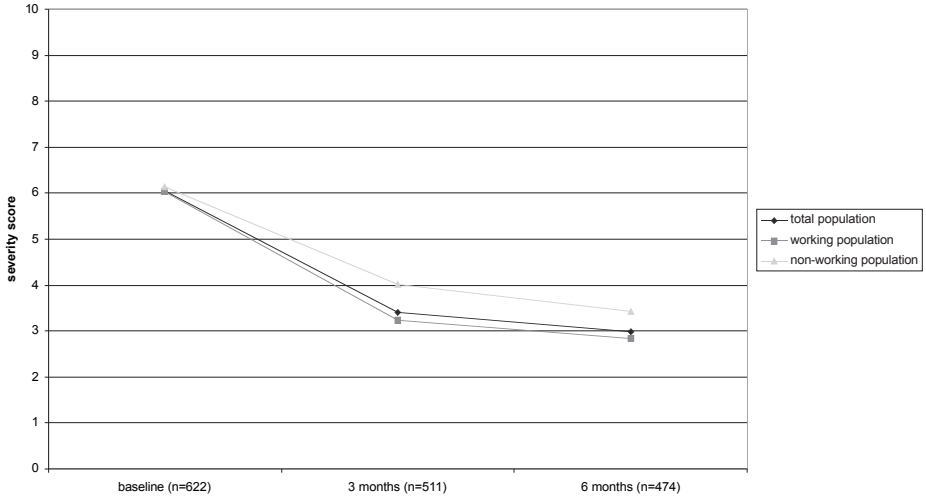

Figure 2. Mean severity scores at baseline and at 3 and 6 months follow-up.

Prognostic factors for persistence of complaints

In the analysis, we assumed that the relationship between baseline measures and the outcomes would be the same for both the 3 and 6 month outcomes, because after 3 and 6 month follow-ups almost the same percentages of the population have persistent complaints. Moreover we were a priori interested in this 6-month period as a whole.

However, we tested this assumption by adding interaction terms and it appeared that only one of the 22 variables showed a univariate significant p-value (P=0.009). According to these findings we maintained our assumption.

In the univariate analysis 19 factors were related (P<=0.10) to the persistence of complaints over 6 months (Table 2). The final multivariate model showed that higher levels of somatization (odds ratio [OR] = 2.0; CI =1.3-3.0; overall P < 0.001)], kinesiophobia [OR=1.9; CI=1.2-2.8; overall P<0.001] and catastrophizing [OR=1.6; CI=1.0-2.6; overall P< 0.0001] are significantly related to the persistence of complaints over 6 months in the total population. Also, a longer duration of complaints at baseline [OR=3.9; CI=2.1-7.2; overall P<0.001] contributes to the persistence of complaints over 6 months. (Table 2)

Table 2. Prognostic factors for persistence of complaints in the working and in the total population

Prognostic factors		**Working population (N=420)**		**Total population (N=543)**	
		Odds Ratio# Univariate [95% CI]	**Odds Ratio** Multivariate (P<=0.05) [95% CI]**	**Odds Ratio# Univariate [95% CI]**	**Odds Ratio** Multivariate (P<=0.05) [95% CI]**
Participant characteristics					
Age (years) [18-65]		1.0 [1.0-1.0]		1.0 [1.0-1.0]	
Gender (being a male)		1.0 [0.7-1.5]		0.9 [0.6-1.3]	
Education	Low	1.3 [0.8-2.0]		1.5 [1.0-2.2]*	
	Medium	1.1 [0.7-1.6]		1.1[0.8-1.6]	
	High	1.0		1.0 †	
Sports participation (yes)		0.7 [0.5-1.0]*		0.7 [0.5-0.9]*	
Body Mass Index (kg/m2), >25		0.7 [0.5-1.0]*		1.2 [0.9-1.6]	
Having paid work				0.6 [0.4-0.8]*	
Complaint specific characteristics					
Work-related complaints (yes)		1.2 [0.8-1.9]			
Prognosis physical therapist (chronic complaints)					
	Very likely	1.7 [0.7-4.2]		2.1 [1.0-4.5]*	
	Likely	1.6 [0.7-3.9]		1.7 [0.8-3.6]	
	Not likely	1.1 [0.5-2.5]		1.2 [0.6-2.5]	
	Not likely at all	1.0		1.0 †	
Duration of complaints at baseline					
	More than 6 months	4.3 [2.1-8.9]*	4.0 [2.0-8.2]	4.4 [2.3-8.4]*	3.9 [2.1-7.2]
	3-6 months	3.5 [1.6-7.8]*	3.7 [1.7-8.1]	3.3 [1.6-6.6]*	3.0 [1.5-5.9]
	6 weeks–3 months	1.5 [0.7-3.2]	1.5 [0.7-3.1]	1.7 [0.8-3.3]	1.8 [1.0-3.5]
	3-6 weeks	1.5 [0.6-3.4]	1.4 [0.6-3.1]	1.6 [0.8-3.4]	1.5 [0.7-3.1]
	0-3 weeks	1.0 †	1.0	1.0 †	1.0

Table 2 continued

Prognostic factors		**Working population (N=420)**		**Total population (N=543)**	
		Odds Ratio# Univariate [95% CI]	**Odds Ratio** Multivariate (P<=0.05) [95% CI]**	**Odds Ratio# Univariate [95% CI]**	**Odds Ratio** Multivariate (P<=0.05) [95% CI]**
Local complaints (yes)		0.7 [0.5-1.0]*		0.7 [0.5-1.0]*	
Specific complaints (yes)		1.0 [0.7-1.4]		1.0 [0.7-1.4]	
Co-morbidity (musculoskeletal) (yes)		1.9 [1.3-2.7]*		1.8 [1.3-2.4]*	
Co-morbidity (not musculoskeletal) (yes)		2.2 [1.3-3.6]*		2.0 [1.4-3.1]*	
Earlier musculoskeletal trauma (yes)		1.6 [1.0-2.6]*		1.4 [1.0-2.1]*	
Severity of complaints in the last week [0-10]		1.1 [1.0-1.2]*	1.0 [1.1-1.1]	1.1[1.0-1.2]*	1.0 [0.9-1.1]
Psychosocial factors (in tertiles)					
Distress	>14 (high)	1.4 [0.9-2.1]		1.5 [1.0-2.2]*	
	6-14	1.1 [0.7-1.6]		1.0 [0.7-1.5]	
	<=6	1.0		1.0 †	
Somatization	>11 (high)	2.4 [1.5-3.7]*		2.4 [1.6-3.6]*	2.0 [1.3-3.0]
	6-11	1.5 [1.0-2.3]*		1.4 [0.9-2.0]*	1.4 [1.0-2.1]
	<=6	1.0 †		1.0 †	1.0
Kinesiophobia	>37 (high)	2.0 [1.3-3.1]*		2.2 [1.5-3.3]*	1.9 [1.2-2.8]
	31-37	1.2 [0.8-1.8]		1.2 [0.8-1.7]	1.1 [0.7-1.6]
	<=31	1.0 †		1.0 †	1.0
Catastrophizing	>17 (high)	2.7 [1.7-4.3]*	2.1 [1.3-3.4]	2.5 [1.6-3.7]*	1.6 [1.0-2.6]
	5-17	1.2 [0.8-1.8]	1.1 [0.7-1.8]	1.1 [0.8-1.7]	1.0 [0.6-1.4]
	<=5	1.0 †	1.0	1.0 †	1.0
Social support	<=52 (low)	0.9 [0.6-1.5]		1.1 [08-1.7]	
	52-59	0.8 [0.5-1.2]		0.9 [0.6-1.3]	
	>59	1.0		1.0	
Psychosocial factors in work (in tertiles)					
Job insecurity (yes) (not in tertiles)		0.9 [0.6-1.4]			
Co-worker support	<=11 (low)	0.9 [0.5-1.5]			
	12	0.8 [0.5-1.3]			
	>=13	1.0			
Supervisor support	<=10 (low)	1.5 [0.9-2.5]			
	11-12	1.4 [0.9-2.4]			
	>=13	1.0			
Quantitative job demands	>=35 (high)	0.8 [0.5-1.3]			
	29-35	1.0 [0.7-1.5]			
	<29	1.0			

Table 2 continued

Prognostic factors		Working population (N=420)		Total population (N=543)	
		Odds Ratio# Univariate [95% CI]	Odds Ratio** Multivariate (P<=0.05) [95% CI]	Odds Ratio# Univariate [95% CI]	Odds Ratio** Multivariate (P<=0.05) [95% CI]
Skill discretion	<=16 (low)	1.5 [1.0-2.3]*			
	16-19	1.3 [0.9-2.1]			
	>=19	1.0			
Decision authority at work	<=8 (low)	2.1 [1.4-3.2]*	2.2 [1.4-3.4]		
	9	1.5 [1.0-2.3]*	1.7 [1.1-2.6]		
	>=10	1.0 †	1.0		
Physical factors					
Physical heavy work in leisure time (yes)		1.1 [0.7-1.7]		1.0 [0.7-1.4]	
Static, repetitive activities leisure time (yes)		0.9 [0.6-1.3]		0.7 [0.5-1.0]*	
Physical heavy work (yes)		1.4 [1.0-2.1]*			
Static repetitive work (yes)		1.4 [0.9-2.0]			

#	The univariate model was adjusted for the severity of complaints in the last week
**	The multivariate model was also adjusted for age, gender and education.
CI	Confidence Interval
*	P<=0.10
†	overall P<=0.10

In the working population higher levels of catastrophizing [OR=2.1; CI=1.3-3.4; overall P=0.0016], low decision authority at work [OR=2.2; CI=1.4-3.4; overall P=0.0040] and a longer duration of complaints at baseline [OR=4.0; CI=2.0-8.2; overall P<0.0001] were related to the persistence of complaints over 6 months (Table 2).

DISCUSSION

In this large study on prognostic factors in pain and discomfort in the neck and upper extremities somatization, kinesiophobia, and catastrophizing were predictive factors for the persistence of complaints in the total population over 6 months follow-up. In the working population, catastrophizing and a lack of decision authority at work were associated with the persistence of complaints over 6 months. The factor somatization was not significant enough, although borderline (P=0.06), to stay in the final multivariate model for the working population.

In this study, social and psychological factors are important in the course of pain and discomfort in the neck and upper extremities. This possibility has been proposed in the literature [24] and is supported by our empirical data. Our results are almost compa-

rable with those found in patients with musculoskeletal illness in general practice by Jørgensen et al. [25]. They found that psychological distress and somatization acted as significant predictors of four different outcome measures, including patient self-rated improvement. We think that our results subscribe the fear-avoidance model of chronic pain. In this model patients who catastrophize are more likely to be fearful and fear of movement leads to increased avoidance and in the long run to disuse, depression and increased disability [11, 26]. Participants in our study who catastrophize show significantly more persistence of complaints than participants who do not catastrophize. Moreover kinesiophobia (fear of movement) was a predictive factor for the persistence of complaints in the total population over 6 month follow-up.

Physical workload or force, awkward postures and repetitiveness are known to be risk factors for pain and discomfort in the neck and upper extremities [9, 27]. Although the results of this study show that heavy physical work was associated with persisting pain and discomfort in the neck and upper extremities in the univariate analysis, they did not contribute in the multivariate analysis. Thus at work psychosocial factors seem to be more important in the persistence of complaints than physical factors.

We found significantly more functional limitations and severity in the nonworking population compared to the working population at 3 and 6 month follow-ups. Although we found no difference at baseline, the "healthy worker effect" may play a role in these results; workers are in generally healthier than nonworkers and may recover faster than nonworkers.

Complaints were divided into specific and nonspecific. For this classification we trusted on the participating physical therapists. They indicated for us one of the noted diagnoses applicable to the complaints of the patients. Based on these diagnoses we classified the complaints as described in section 2. We are aware of the fact that clinically valid examination using predefined objective diagnostic criteria is the standard method for assessing the patients' diagnosis. However, those are hardly available [28] and therefore we choose an alternative method. We leaned on the participating physical therapists diagnoses (filled in on a form with the possible disorders and complaints) and as they further used in their management of the patient.

To compare the data of our physical therapists with the national data of physical therapists we consulted the KNGF. About 60% of the physical therapists registered at the KNGF are male and 40% female. Compared to our study 48% are male and 52% female. Information about age, professional experience and working hours was not registered at the KNGF.

In the analysis we did the variable selection by using domains. However this method, choosing the variables based on P-values, does not overcome the problem of collin-

earity or confounding. In the literature Harrell recommends testing the significance of the domain as a whole (a multiple degree of freedom test, testing the significance of the collection of variables within a domain together) and then if significant, selecting all the variables, or some summary of the variables, or one variable to represent the domain (not on the basis of p-values, but rather on measurement properties, or on cost/ease of measurement). There are many different ways to build a model, all with their advantages and disadvantages. Therefore our findings should at least be validated in an independent sample [29].

In the analyses only the outcomes from 3 and 6 months were used. The outcome in the prognostic model is subjective recovery (seven-point scale from "worse than ever" to "completely recovered", dichotomized to persistence of complaints) and could not be asked at baseline. We therefore adjusted this model for baseline severity of the complaint. The reasons for the adjustment of age and education are partly mentioned in section 3. We found significant differences in the distribution of age and education in the dropouts compared to the participants who filled in at least one follow-up questionnaire. Therefore we adjusted the multivariate models for age and education. Moreover we found in literature in another musculoskeletal cohort study in primary care indications for a selective recruitment based on age and gender, which could not be investigated in our study [30].

We decided not to consider functional limitations as a prognostic factor. The reasons for our decision are as follows: firstly the scores for functional limitations are variable over time and change in follow-up. Secondly, the follow-up population seems to be selected based on their functional limitation. Concerning this point we expect an overestimation of the association and therefore we did not include functional limitation in the analysis. We studied the functional limitations during follow-up and we saw that the group with the lowest scores on functional limitations was increasing.

Moreover there is a statistical significant association (P = 0.000) between the factors somatization, catastrophizing, kinesiophobia and the factor functional limitations. Therefore, functional limitations consist of different social and psychological factors, indicating that functional limitations may be a compound factor. We preferred to study the association of the social and psychological factors separately to show a more detailed view.

A few limitations of this study should be discussed. First, we depended on the cooperation of the physical therapists for the recruitment of participants. Our a priori idea was to recruit all new patients. We informed the physical therapists about the inclusion and exclusion criteria and left to the physical therapists to decide whom they recruited. We hoped that all physical therapists followed our study protocol. Nevertheless, as in most

clinical studies, it is possible (for whatever reasons) that not all consecutive patients with pain and discomfort in the neck and upper extremities were included. Unfortunately, recruiting incident patients in physical or general practice is often disappointing by Lasagnas law [31, 32]. Further, being dependent on the time and alertness of the recruiting therapist also implies nonoptimal recruitment.

We were unable to evaluate possible entry selection in our study population, because the physical therapists did not have a computerized patient registry.

In addition it's difficult to compare our patients with other study populations, because the recruitment of patients in physical therapy practice has not been done before. Another study population in primary care concerning patients with pain and discomfort in the neck and upper extremities is recruited from general practice [33]. This population consists of 63% females and the mean age was 49.2 (S.D. = 13.8). The intensity of pain on a scale from 0-10 was 5.1 (S.D. = 2.2). The duration of the current episode of complaints was more than 6 months in 34% of the population [34]. Our study population consists of 70% females and the mean age was 43.5 (S.D. = 11.4). The severity of complaints on a scale from 0-10 was 5.7 (S.D. = 2.0). The duration of complaints was more than 6 months in 35% of the study population. There is a slight difference in the intensity of pain between these study populations. But it can be expected that more patients with severe complaints be referred to physical therapy.

Moreover, because most data here are based on self-administered questionnaires it is impossible to exclude possible overestimation or underestimation of the participants' complaints.

Finally, because participants were referred for physical therapy, we cannot generalize our results to a nonreferred population.

Nevertheless, the results of this study do indicate the importance of the social and psychological components of pain and discomfort in the neck and upper extremities and future intervention studies should take these factors into account. This study had a prospective design with a 6-month follow-up, future studies should explore which factors contribute to the longer persistence of pain and discomfort in the neck and upper extremities and related long-term absence from work.

ACKNOWLEDGEMENTS

The authors thank all the physical therapists and participants for their cooperation in this study, and Roos Bernsen (Department of Community Medicine, United Arab Emirates University, Al Ain) for her help and support with the statistical analyses.

Funding for this research was provided by CvZ (College voor Zorgverzekeringen, The Netherlands).

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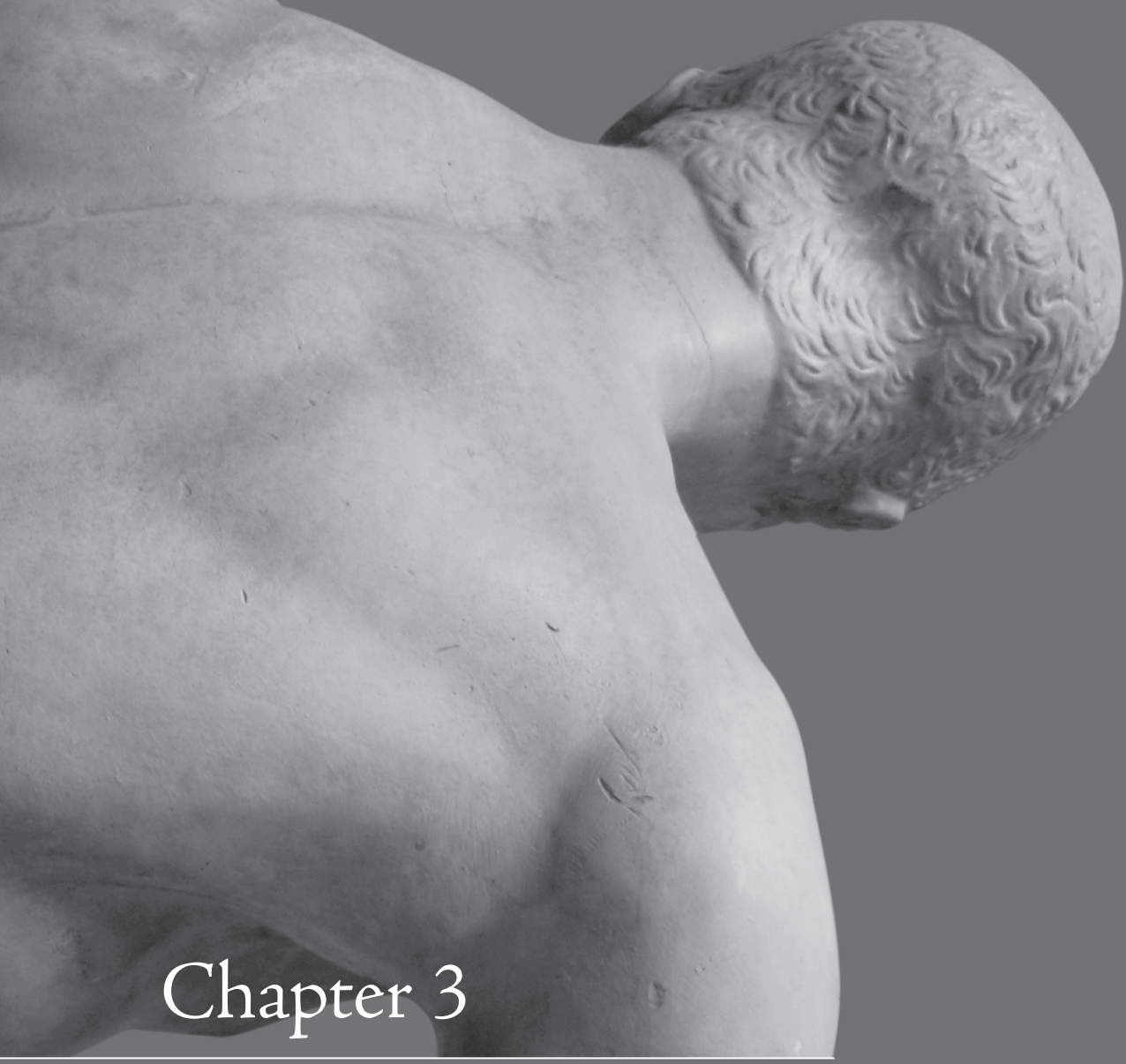
APPENDIX

Questionnaire derived from the Dutch musculoskeletal questionnaire

(Static repetitive work: question 1-8, heavy physical work: question 9-15)
Does your work involve…

1. Sitting for long periods of time?
2. VDU work for long periods of time?
3. Making the same movement for long periods of time?
4. Holding your neck in a bent or twisted position for long periods of time?
5. Bending or twisting your neck often?
6. Holding your wrist in a bent or twisted position for long periods of time?
7. Working in the same position for long periods of time?
8. Doing repetitive tasks with arms, hands or fingers many times per minute?
9. Work(ing) with your hands above shoulder level?
10. Moving loads (more than 5 kg)?
11. Moving heavy loads (more than 25 kg)?
12. Exerting force with your arms or hands?
13. Exerting maximal force?
14. Physical hard work?
15. Working in uncomfortable postures?

VDU, visual display unit.



Chapter 3

Prognostic factors for the persistence and recurrence of complaints at arm, neck and shoulder in physical therapy practice: two year follow-up

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submitted

ABSTRACT

Question The objective of the study is to investigate the long-term clinical course and recurrence of complaints of arm, neck and shoulder (CANS) and to evaluate the prognostic factors related to this clinical course in patients presenting in physical therapy practice.

Design This is a prospective cohort study with 2-year follow-up.

Participants New patients with pain and discomfort in neck and upper extremities in physical therapy practice.

Intervention All patients received physical therapy in a non-experimental manner. Long term follow-up data were collected by means of self-administrated questionnaires at 18 and 24 months.

Outcome measures The main outcome measures were persistence of complaints and the recurrence of complaints at 2-year follow-up.

Results At 2-year follow-up, 39% had persisting complaints. In the total population, higher scores on somatization and kinesiophobia, a longer duration of complaints at baseline, and a lower level of education contributed to the persistence of complaints. In the working population, similar factors contributed to the persistence of complaints. Between 6 and 24 months follow-up 58% had a recurrence of complaints. In the total population, higher scores on somatization, earlier musculoskeletal trauma and musculoskeletal co-morbidity contributed to the recurrence of complaints. Being a male and regularly doing sports reduced the probability of recurrence of complaints.

Conclusion About 40% of the study participants had persisting pain and discomfort at 2-year follow-up. Social and psychological factors contributed to the persistence of complaints in the long term and are associated with the recurrence of complaints.

INTRODUCTION

Arm, neck and shoulder complaints are frequently reported in Western countries [1]. The reported prevalence ranges from 5-10% for non-specific complaints and from 22-40% in specific working populations [2]. A study of the prevalence of muscular complaints of arm, neck and shoulders in the working population in 15 European countries showed that the overall reported percentages were higher for neck and shoulder pain (24.9%), compared to pain at the upper limbs (14.5%) [3]. The highest prevalence rates of neck and shoulder pain, as well as forearm pain, were reported in the Scandinavian countries. A Dutch survey showed that the prevalence of work-related musculoskeletal disorders of neck and upper extremity increased from 26% in 2000 to 28% in 2002 [4]. The Dutch population-based Musculoskeletal Complaints and Consequences Cohort Study (DMC3 study) estimated the 12-month prevalence to be 31.4% for neck, 30.3% for shoulder, 18.8% for higher back, 11.2% for elbow and 17.5% for wrist/hand pain [1]. About 30% of those with pain in the neck or upper extremity experienced limitations in daily life. Of those with pain in the neck, shoulder or higher back 32.8% contacted the physiotherapist during the previous year, compared with 21.6% with elbow or wrist/hand pain [1].

Data on prognosis and factors possibly related to neck and upper extremity complaints are slowly emerging. A review of prognostic cohort studies on shoulder disorders reported that there is consistent evidence that high pain intensity in people attending primary healthcare providers and being middle aged (45-54 years) in employed populations, are strong predictors for a poor prognosis [5]. A recent prognostic cohort study set in general practice showed that complaint characteristics, passive coping and less social support were related to a poorer prognosis at 12-months follow-up [6]. In addition, Feleus et al. showed that complaint characteristics, more somatization and less social support are prognostic factors for non-recovery at 6-months follow-up [7]. Our previous study in physical therapy practice (with 6-months follow-up) showed that social and psychological factors influence the course of arm, neck and shoulder complaints [8].

The present study (with 2-year follow-up) investigates which factors contribute to the persistence of complaints in the neck and upper extremities in patients who consulted the physical therapist**.** Further, we explore determinants contributing to recurrent complaints during 2 years of follow-up. The research questions were:

1. Which factors contribute to the persistence of complaints in the arm, neck and shoulder (CANS) in patients who consulted the physical therapist?
2. Which determinants contribute to the recurrence of these complaints during 2 years of follow-up?

METHOD

Design

The design is a prospective cohort study with a follow-up period of 2 years. In this report we describe the long term follow-up (18 and 24 months). The short term follow-up (clinical course and prognostic indicators of outcome at 3 and 6 months) of this cohort was previously reported in 2007 [8].

Participants

New patients with complaints in arm, neck and shoulder (CANS) were recruited by the participating physical therapists during a 12-month period [8].

Questionnaires

Data were collected by means of self-administrated questionnaires. The same prognostic factors as in the report of the short term follow-up were investigated in this study: 1) participant characteristics, 2) complaint-specific characteristics, 3) social and psychological factors (at work) and 4) physical factors. Most of the possible prognostic factors were measured by validated questionnaires [8].

Outcome measures

The primary outcome measure was subjective recovery. The question was as follows: How do you experience the complaints for which you visited the physical therapist 3 months ago? This was measured by a 7 points scale from 1 "Worse than ever" to 7 "Completely recovered". The scores were dichotomised to persistence of complaints (worse than ever to slightly improved), and no persistence of complaints (strongly improved and completely recovered). The question of subjective recovery was asked in the follow-up questionnaires [9].

Besides the persistence of complaints, the clinical course was measured by two secondary outcome measures. First, the functional limitations of the arm, neck, shoulder and hand were measured using a 29-item questionnaire, each item scored separately on a 5-point Likert scale. This questionnaire is based on the 30 items of the Disabilities of the Arm, Shoulder and Hand questionnaire (DASH) [10]; one question on sexual activities was excluded. Higher scores indicate more functional limitations. Secondly, the severity of complaints in the previous week was measured on a numerical rating scale from 0 (no pain/ complaints) to 10 (intolerable pain/ complaints) [11].

Recurrent complaints were defined as those that recurred between 6 and 24 months follow-up.

Data analysis

First, multiple imputation (MI) by chained equations was used to create a complete dataset. This imputation step was carried out 7 times, creating 7 complete but slightly different datasets. The results of the 7 analyses are integrated into a final result [12]. To assess prognostic factors which might influence the clinical course, we used both univariate and multivariate logistic regression analyses for repeated measurements (GEE; Generalized Estimating Equations). The MI and the GEE were performed with SAS 9.1 and IVEware. In the univariate analysis the possible prognostic variables for the persistence of complaints were selected (P≤ 0.1). This analysis was done separately for the total population and for the working subpopulation. The univariable models were adjusted for severity of complaints at baseline. To reduce the amount of variables in the multivariate analysis we first divided the different factors into domains (participant characteristics, complaint-specific characteristics, social and psychological factors, and physical factors). Then we analysed the variables belonging to each domain separately. The factors making a significant contribution (P≤ 0.05) to the domains were combined in the total model. Subsequently, the factors making a significant contribution to the total model (P≤ 0.05) constituted the final model. In all multivariate analyses adjustment was made for age, gender, education and severity of complaints at baseline. In addition, to assess prognostic variables which might influence the development of recurrent complaints we used the logistic regression analysis (backward selection) method in SPSS 15.0. This analysis was performed in those patients who were recovered at 6 months follow-up. In the univariate analysis the possible prognostic variables were selected (P≤ 0.1). The selected variables were combined, and in the multivariate analysis the variables with a significant contribution to the development of recurrent complaints (P≤ 0.05) formed the final model. To analyze differences between the drop-outs and the non drop-outs we used the unpaired t-test and the chi-square test.

RESULTS

Participants

The total population at baseline consisted of 624 participants. The response rate at 18 and at 24 months follow-up was 69% (n=431) and 64% (n=402), respectively. The subgroup who had paid work at baseline consisted of 483 participants. The response rate at 18 and 24 months follow-up in this group was 68% (n=328) and 63% (n=304), respectively.

Baseline data

Table 1 presents baseline data on the 624 participants and the distribution of the possible prognostic factors. (Table 1)

Table 1: Characteristics of the study population at baseline

Variables		Total population (N=624)	Working population (N=483)
Participant characteristics			
Age (years); mean (sd)		43.5 (11.4)	41.5 (10.4)
Women, N (%)		440 (70.5)	322 (66.7)
Educational level, N (%)			
	Low	204 (32.7)	129 (26.7)
	Medium	203 (32.5)	160 (33.1)
	High	217 (34.8)	194 (40.2)
Sports participation, N (%)		299 (47.9)	249 (51.6)
Body Mass Index (kg/m^2), [16.4-60.2] mean (sd)		25.3 (4.3)	25.2 (4.3)
Paid work (working population), N (%)		483 (77.4)	483 (100)
Complaint-specific characteristics			
Work-related complaints, N (%)*			372 (77.0)
Prognosis of physical therapist, development of chronic complaints, N (%)			
	Very likely	111 (17.8)	79 (16.4)
	Likely	141 (22.6)	104 (21.5)
	Not likely	328 (52.6)	265 (54.9)
	Not likely at all	44 (7.1)	35 (7.2)
Duration of the complaint; N (%)			
	More than 6 months	217 (34.8)	160 (33.1)
	3 to 6 months	106 (17.0)	78 (16.1)
	6 weeks to 3 months	151 (24.2)	119 (24.6)
	3-6 weeks	100 (16.0)	83 (17.2)
	0-3 weeks	50 (8.0)	43 (8.9)
Local complaint, N (%)		339 (57.2)	263 (57.0)
Specific complaint, N (%)		223 (35.7)	175 (35.7)
Co-morbidity (musculoskeletal), N (%)		286 (46.3)	202 (42.3)
Co-morbidity (not musculoskeletal), N (%)		99 (16)	63 (13.1)
Earlier musculoskeletal trauma, N (%)		128 (20.6)	107 (22.2)

Table 1 continued

Variables		Total population (N=624)	Working population (N=483)
Functional limitations of arm, shoulder and hand [0-100]; mean (sd)		36.7 (18.4)	36.4 (18.2)
Severity of complaints in the last week [0-10]; mean (sd)		6.1 (2.0)	6.0 (2.0)
Location of complaints, N (%)			
	Neck	280 (44.9)	217 (44.9)
	Shoulder	392 (62.8)	304 (62.9)
	Upper back	77 (12.3)	63 (13.0)
	Upper arm	73 (11.7)	50 (10.4)
	Elbow	95 (15.2)	71 (14.7)
	Forearm	30 (4.8)	20 (4.1)
	Wrist	46 (7.4)	40 (8.3)
	Hand	55 (8.8)	44 (9.1)
Psychosocial factors			
Distress [0-32]; mean (sd)		11.2 (8.5)	10.7 (8.4)
Somatization [0-32]; mean (sd)		9.4 (6.0)	9.0 (5.7)
Kinesiophobia [17-68]; mean (sd)		34.3 (6.6)	34.2 (6.6)
Catastrophizing [0-60]; mean (sd)		13.5 (12.3)	12.8 (11.5)
Social support [12-60]; mean (sd)		53.1 (8.0)	53.7 (7.5)
Psychosocial factors in work *			
Job insecurity, N (%)			87 (18.2)
Co-worker support [4-16]; mean (sd)			11.9 (1.7)
Supervisor support [4-16]; mean (sd)			10.9 (2.6)
Quantitative job demands [12-48]; mean (sd)			31.5 (6.1)
Skill discretion [12-48]; mean (sd)			34.2 (6.1)
Decision authority at work [12-48]; mean (sd)			35.9 (7.5)
Physical factors			
Physical heavy work in leisure time [0-12]; mean (sd)		2.6 (1.7)	2.5 (1.6)
Static repetitive activities in leisure time [0-6]; mean (sd)		1.6 (1.2)	1.7 (1.2)
Physical heavy work [0-100]; mean (sd)*			21.6 (23.6)
Static repetitive work [0-100]; mean (sd) **			45.0 (23.1)

[..] =score range, sd= standard deviation
*=only assessed in the working population (N=483), **=only assessed in the working population (N=452)

Loss to follow-up

A total of 150 (24%) participants did not fill in the follow-up questionnaires after 18 and 24 months follow-up and were defined as dropouts. The education level of the dropouts was significantly lower compared with participants who filled in at least one follow-up questionnaire, at 18 or 24 months (P=0.01). The dropouts had significantly more co-morbidity (not musculoskeletal) (P=0.048), a longer duration of complaints at baseline (P=0.029) and more non-specific complaints (P=0.040). In addition, the mean age of the dropouts was significantly lower than that of the participants who filled in at least one follow-up questionnaire at 18 or 24 months (41.7 years vs. 44.7 years; P=0.038).

Imputation

The outcome measure persistence of complaints was imputed in 17.9% of the cases for one follow-up moment, and in 32.1% of the cases for more than one follow-up moment.

Clinical course

Compared with 6-months follow-up, at both 18 and 24 month follow-up the percentage of strongly improved subjects had declined and the percentage of completely recovered persons had increased. However, when comparing the total percentages (dichotomized as persistence of complaints vs. no persistence of complaints), the results on the short term (3 and 6 months) and long term (18 and 24 months) were stable and similar. The group of subjects with persistence of complaints was about 40% at both short-term and long-term follow-up; similar results were found in the working population.

Prognostic factors for the persistence of complaints at long-term follow-up

In the analysis we assumed that the relationship between baseline measures and outcomes would be the same at both 18 and 24 months, because after 18 and 24 months follow-up a similar percentage of the population had persistence of complaints. In the univariate analysis, 17 factors were selected to be possible prognostic factors ($P \leq 0.10$) for the persistence of complaints. These were: gender, education, sports participation, prognosis by physical therapist, duration of complaints, local complaints, specific complaints, co morbidity (not) musculoskeletal, severity of complaints, distress, somatization, kinesiophobia, catastrophizing, skill discretion, decision authority at work and physical heavy work. (Table 2)

In the total population, the final multivariate model showed that higher levels of somatization and kinesiophobia are significantly related to the persistence of complaints at 2-year follow-up. For example participants in the total population with a high score on somatization at baseline report significantly more often that they have persistence of complaints at 2-year follow-up than participants with low scores on somatization

Table 2. Prognostic factors for the persistence of complaints at long-term follow-up in the total and the working population (univariate)

Prognostic factors		Total Population (N=474)	Working population (N=363)
		Odds ratio [95% CI]	Odds ratio [95% CI]
Participant characteristics			
Age (years) [18-65]		1.0 [1.0-1.0]	1.0 [1.0-1.0]
Gender (being male)		0.6 [0.4-0.9]	0.7 [0.5-1.0]*
Education	Low	2.1 [1.4-3.0]*	1.9 [1.2-3.0]*
	Medium	1.9 [1.3-2.7]*	1.9 [1.2-3.0]*
	High	1.0 †	1.0 †
Sports participation (yes)		1.4 [1.0-2.0]*	1.5 [1.0-2.2]*
Body Mass Index (kg/m^2), >25		0.9 [0.7-1.3]	0.9 [0.6-1.3]
Having paid work		0.8 [0.5-1.2]	
Complaint-specific characteristics			
Work-related complaints (yes)			1.3 [0.8-2.0]
Prognosis physical therapist (chronic complaints)			
	Very likely	3.0 [1.3-6.9]*	2.6 [0.9-7.2]*
	Likely	2.1 [0.8-4.8]	1.9 [0.6-5.8]
	Not likely	1.5 [0.7-3.6]	1.4 [0.5-4.2]
	Not likely at all	1.0 †	1.0 †
Duration of complaints at baseline			
	More than 6 months	2.2 [1.1-4.3]*	2.1 [1.0-4.6]*
	3-6 months	1.1 [0.5-2.3]	1.0 [0.4-2.3]
	6 weeks–3 months	0.8 [0.4-1.5]	0.7 [0.4-1.5]
	3-6 weeks	0.9 [0.5-1.8]	0.9 [0.4-1.9]
	0-3 weeks	1.0 †	1.0 †
Local complaints (yes)		0.6 [0.4-0.8]*	0.6 [0.4-0.9]*
Specific complaints (yes)		0.7 [0.5-1.0]*	0.7 [0.5-1.0]*
Co-morbidity (musculoskeletal) (yes)		1.6 [1.2-2.1]*	1.7 [1.2-2.4]*
Co-morbidity (not musculoskeletal) (yes)		2.1 [1.4-3.1]*	2.1 [1.3-3.3]*
Earlier musculoskeletal trauma (yes)		1.4 [0.9-2.0]	1.4 [0.9-2.1]
Severity of complaints in the last week [0-10]		1.2[1.0-1.3]*	1.1 [1.0-1.3]*
Psychosocial factors (in tertiles)			
Distress	>14 (high)	1.6 [1.1-2.5]*	1.3 [0.8-2.0]
	6-14	0.9 [0.7-1.4]	0.9 [0.6-1.4]
	≤6	1.0 †	1.0
Somatization	>11 (high)	3.1 [2.1-4.6]*	2.6 [1.6-4.0]*
	6-11	1.9 [1.3-2.7]*	1.8 [1.2-2.6]*
	≤6	1.0 †	1.0 †

Table 2 continued

Prognostic factors		Total Population (N=474)	Working population (N=363)
		Odds ratio [95% CI]	Odds ratio [95% CI]
Kinesiophobia	>37 (high)	1.6 [1.1-2.4]*	1.5 [1.0-2.3]*
	31-37	0.9 [0.6-1.3]	0.9 [0.6-1.4]
	≤31	1.0 †	1.0 †
Catastrophizing	>17 (high)	2.3 [1.5-3.5]*	2.3 [1.4-3.8]*
	5-17	1.5 [1.0-2.3]*	1.5 [0.9-2.5]*
	≤5	1.0 †	1.0 †
Social support	≤52 (low)	1.4 [0.9-2.1]	1.1 [0.7-1.8]
	52-59	1.0 [0.7-1.4]	0.9 [0.6-1.4]
	>59	1.0	1.0
Psychosocial factors in work (in tertiles)			
Job insecurity (yes) (not in tertiles)			0.9 [0.5-1.4]
Co-worker support	≤11 (low)		0.7 [0.4-1.1]
	12		0.6 [0.4-1.0]*
	≤13		1.0
Supervisor support	≤10 (low)		0.9 [0.6-1.6]
	11-12		1.0 [0.6-1.6]
	≤13		1.0
Quantitative job demands	≤35 (high)		1.0 [0.7-1.6]
	29-35		1.1 [0.7-1.6]
	<29		1.0
Skill discretion	≤16 (low)		1.7 [1.1-2.7]*
	16-19		1.7 [1.1-2.6]*
	≤19		1.0 †
Decision authority at work	≤8 (low)		1.8 [1.2-2.7]*
	9		1.5 [0.9-2.4]
	≤10		1.0 †
Physical factors			
Physical heavy work in leisure time (yes)		0.9 [0.6-1.4]	1.0 [0.6-1.2]
Static, repetitive activities leisure time (yes)		0.8 [0.6-1.1]	0.9 [0.6-1.5]
Physical heavy work (yes)			1.4 [1.0-2.0]*
Static repetitive work (yes)			1.1 [0.8-1.6]

\# The univariate model was adjusted for the severity of complaints in the last week
CI Confidence Interval
* P≤0.10
† overall P≤0.10

Table 3. Prognostic factors for the persistence of complaints at long-term follow-up in the working and in the total population (multivariate)

Prognostic factors		Total population (N=474)	Working population (N=363)
		Odds Ratio# [95% CI]	Odds Ratio# [95% CI]
Participant characteristics			
Age (years) [18-65]		1.0 [1.0-1.0]	1.0 [1.0-1.0]
Gender (being male)		0.6 [0.4-1.0]*	0.7 [0.5-1.1]
Education	Low	1.8 [1.2-2.8]	1.8 [1.1-3.0]
	Medium	1.7 1.2-2.5]	1.8 [1.2-2.9]
	High	1.0†	1.0†
Complaint-specific characteristics			
Duration of complaints at baseline			
	More than 6 months	1.6 [0.8-3.2]	1.7 [0.7-3.7]
	3-6 months	0.9 [0.4-2.0]	0.8 [0.3-2.1]
	6 weeks–3 months	0.7 [0.4-1.3]	0.7 [0.3-1.4]
	3-6 weeks	0.7 [0.3-1.4]	0.7 [0.3-1.5]
	0-3 weeks	1.0†	1.0 †
Co-morbidity (not musculoskeletal) (yes)		1.8 [1.2-2.9]*	2.1 [1.2-3.6]*
Severity of complaints in the last week [0-10]		1.0 [0.9-1.2]	1.0 [0.9-1.2]
Psychosocial factors (in tertiles)			
Somatization	>11 (high)	2.3 [1.5-3.5]	2.0 [1.2-3.3]
	6-11	1.7 [1.2-2.6]	1.7 [1.1-2.6]
	≤6	1.0†	1.0†
Kinesiophobia	>37 (high)	1.5 [1.0-2.1]	
	31-37	0.8 [0.5-1.3]	
	≤31	1.0†	

\# The multivariate model was adjusted for age, gender, education and the severity of complaints in the last week.
CI Confidence Interval
* P≤0.05
† overall P≤0.05

(OR:2.3; 95%CI: 1.5-3.5). A longer duration of complaints at baseline and a lower level of education also contribute to the persistence of complaints at 2 years (Table 3).

In the working population higher levels of somatization, co-morbidity (not musculoskeletal) and a longer duration of complaints at baseline were related to the persistence of complaints at 2 years. A lower level of education also contributes to the persistence of complaints at 2 years (Table 3).

Table 4: Prognostic factors for recurrent complaints within 2-years follow-up in patients recovered at 6 months follow-up in the total population (univariate)

Prognostic factors		Odds Ratio Univariate (P≤0.10) [95% CI] (N=167)
Patient characteristics		
Gender (being male)		0.4 [0.2-0.8]
Sports participation (yes)		0.4 [0.2-0.7]
Complaint-specific characteristics		
Co-morbidity (musculoskeletal) (yes)		2.7 [1.4-5.2]
Earlier musculoskeletal trauma (yes)		2.4 [1.0-5.7]
Psychosocial factors (in tertiles)		
Distress	>14 (high)	2.9 [1.3-6.4]
	6-14	2.2 [1.1-4.6]
	≤6	1.0†
Somatization	>11 (high)	6.6 [2.4-17.9]
	6-11	2.4 [1.2-4.9]
	≤6	1.0†
Catastrophizing	>17 (high)	1.9 [0.9-4.0]
	5-17	2.5 [1.2-5.2]
	≤5	1.0†

CI Confidence interval
† overall P≤0.10

Recurrence of arm, neck and/or shoulder complaints and determinants for recurrence

At 6 months follow-up, 286 patients had recovered from CANS and were thus 'at risk' to develop a recurrence. Of these patients recovered at 6 months, 167 (58%) filled in the questionnaires at 18 and/or 24 months follow-up; in this latter group 75% had paid work. During the period 6 to 24 months follow-up, 98 (59% of the available data) patients had a recurrence of CANS. In the total population, 7 variables (measured at baseline) were selected to be possible prognostic factors for the development of recurrent complaints: gender, sports participation, co morbidity (musculoskeletal), earlier musculoskeletal trauma, distress, somatization and catastrophizing (Table 4). Additionally, in the working population with work-related complaints, low supervisory support and static repetitive work were selected to be possible prognostic factors (P ≤0.10) for the development of recurrent complaints.

Table 5: Prognostic factors for recurrent complaints within 2-years follow-up in patients recovered at 6 months follow-up in the total population. (multivariate)

Prognostic factors		Odds Ratio Multivariate (P≤0.05) [95% CI] (N=167)
Patient characteristics		
Gender (being male)		0.4 [0.2-0.9]
Sports participation (yes)		0.4 [0.2-0.8]
Complaint-specific characteristics		
Co-morbidity (musculoskeletal) (yes)		2.2 [1.0-4.7]
Earlier musculoskeletal trauma (yes)		2.6 [1.0-6.9]
Psychosocial factors (in tertiles)		
Somatization	>11 (high)	4.6 [1.5-13.6]
	6-11	2.0 [1.0-4.4]
	≤6	1.0†

CI Confidence interval
† overall P≤ 0.05

In the total population, the multivariate model showed that more somatization, earlier musculoskeletal trauma and musculoskeletal co-morbidity contribute to the recurrence of complaints at 2-year follow-up. Being a male and regularly doing sports reduce the risk of recurrence of complaints at 2 years (Table 5).

DISCUSSION

This large study on prognostic factors of complaints in the neck and upper extremities is unique because of the long-term follow-up: participants were followed for 2 years. The results show that social and psychological factors are important in the long-term course of complaints in the neck and upper extremities. Higher levels of somatization and kinesiophobia were related to the persistence of complaints at 2 years.

Our findings corroborate earlier reports. First, the present study underscores our earlier investigation which showed that mainly psychological and social factors influence the course of CANS over a period of 6 months [8]. Secondly, in a cohort study in general practice somatization was also reported to be a prognostic indicator for non-recovery of non-traumatic CANS patients [7]. Psychological distress and somatization are predictors of a negative outcome in self-rated improvement in patients with musculoskeletal

illness referred to physiotherapy from general practice [13]. Furthermore, in a study on predictors of outcome in neck and shoulder complaints "more worrying" was associated with a poor prognosis in all models at 12 months follow-up [6]. Coping with pain are reactions to pain and defined as people's behavioral and cognitive attempts to manage or tolerate pain and its effects. Passive strategies include withdrawal, avoidance and negative self-statements about pain (worrying-catastrophizing) [14]. The passive coping strategy is thought to generate a preoccupation with bodily symptoms, which in turn may exacerbate pain and functional disability [6,15,16]. Another study reported that a passive coping strategy is a strong and independent predictor of disabling neck and/or back pain [17]. In an overview, the general conclusion of Bongers et al. was that work-related psychosocial factors are modestly related to symptoms of neck and upper limb symptoms and that no single factor is implicated specifically [18]. The Lange et al. concluded that 16 of the 19 high-quality studies provided support for normal causal relationships of psychosocial factors (mostly indicators of psychological distress) on self-report measures for poor health and/or well-being [19]. In a another review 11 prognostic factors for musculoskeletal pain in primary care were identified [20]. Similar prognostic factors have been related to poor outcome irrespective of the site. The psychological factors described in the review (e.g. higher somatic perceptions/distress and pain characteristics) [20], are supported by our results.

We found that about 40% of the patients was recovered at both short-term (3 and 6 months) and long-term follow-up (18 and 24 months). Further, we found similar prognostic factors for short term follow-up as for long term-follow-up. This indicates that overall outcome and prognostic factors are also irrespective of duration of follow-up.

One strength of the present study is that (over 2 years) we could evaluate the recurrence of complaints. About 60% of patients who were recovered at 6 months had a recurrence of CANS between 6 and 24 months follow-up; this is comparable with earlier reports. A high recurrence rate of more than 60% of shoulder and neck pain was described in a study on nursing home employees during 2 years follow-up [21]. Other studies reported recurrent episodes of shoulder complaints among 41-51% of patients in primary care during an 18-month follow-up [22, 23]. In a prospective cohort study on chronic shoulder pain, more than 50% of all subjects reported shoulder pain with disabling symptoms about 3 years later [24].

We also found that regularly doing sports reduces the risk of recurrence of complaints. A prospective study investigating work-related factors, physical exercise and shoulder pain found that physical exercise had a more protective than impairing effect on the shoulders [25].

In the 'Criteria document for the evaluation of upper extremity musculoskeletal disorders', the complaints were defined as being either specific or non-specific [26]. In the Netherlands, a multidisciplinary team recently achieved consensus on the terminology and classification of upper extremity musculoskeletal disorders [27]. Compared with this latter classification, most of our diagnoses were classified the same, but with a few differences. For example, we classified osteoarthritis of elbow, wrist or hand as specific whereas this particular diagnosis was excluded from the CANS model. Huisstede et al. consider the absence of the specific disorder 'osteoarthritis' in their model as a limitation [27]. In the present study about 1.5% of all diagnoses were 'osteoarthritis'.

The diagnosis 'bursitis of the shoulder' was defined as specific in the CANS model [27] whereas we defined it as non-specific; in the present study about 1.3% of all diagnoses were 'bursitis of the shoulder'. We can conclude that, although there are a few differences, our classification is almost identical to that used in the CANS model.

In the present study, because most data are based on self-administered questionnaires, we cannot exclude possible overestimation or underestimation of the participants' complaints.

Unfortunately we have no data on physical examinations; however, functional limitation was measured with a modified version of the DASH, a validated complaint-specific instrument for arm, shoulder and hand [10]. Although this questionnaire was not developed for neck complaints, our group found similar scores among patients with neck complaints compared with patients with CANS [28].

Furthermore, because we had a considerable drop-out in our study, we choose to impute the missing data by using known variables of these persons. This method is assumed to be more valid than leaving those persons missing out from analysis. However when the outcome given covariates depends on a measurement being missing or not, the results may be biased.

Summarized, based on the present study it may be concluded that, similar to the results at short term follow-up, social and psychological factors and duration of complaints at baseline also are important prognostic factors at long term follow-up. Additionally somatization contributes to the recurrence of complaints at 2-year follow-up. Regularly doing sports protects participants from the recurrence of complaints. Based on our results, a controlled trial in which a group of patients with arm, neck shoulder complaints with high scores on somatization randomly receive regular treatment or a more psychosocial oriented intervention, would be indicated to assess whether better improvement in these patients can be accomplished.

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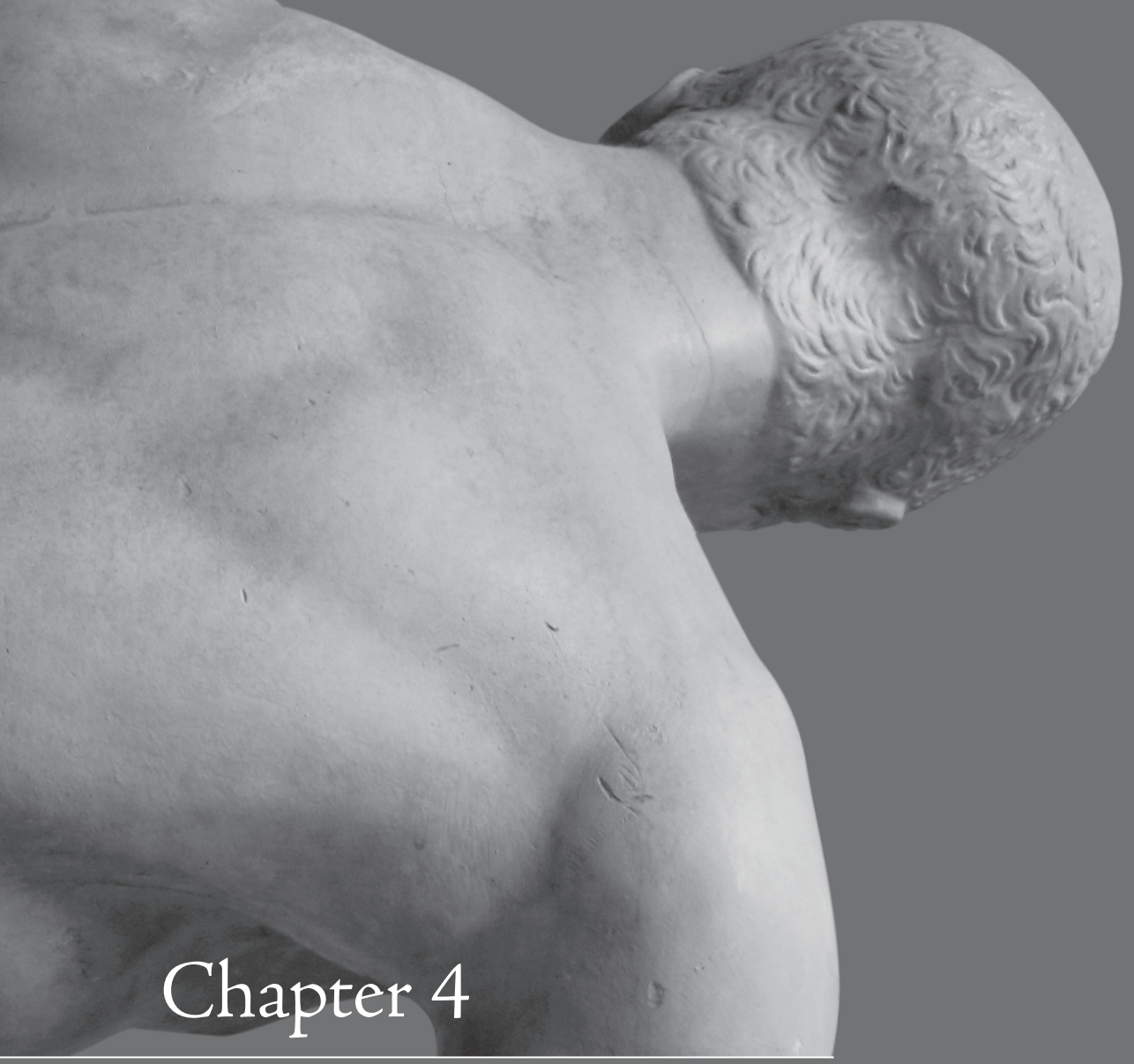

Chapter 4

Sickness absence in patients with arm, neck and shoulder complaints presenting in physical therapy practice: 6 months follow-up

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submitted

ABSTRACT

Objective To describe sickness absence in patients with arm, neck and/or shoulder complaints and to evaluate determinants of sickness absence during 6 months follow-up**.**

Methods A prospective cohort study in physical therapy practice with follow-up measurements at 3 and 6 months. The main outcome measure was the occurrence of sickness absence due to arm, neck and shoulder complaints during 6 months follow-up. Determinants were tested in univariate and multivariate GEE (Generalized Estimating Equations) analysis.

Results At baseline 161 patients (33%) reported absence from work. The multivariate analysis showed that self-reported work-relatedness of complaints, previous musculoskeletal trauma, higher severity of complaints at baseline, more somatization and low decision authority at work were associated with sickness absence during the follow-up period.

Conclusion In physical therapy practice, social and psychological factors (at work) influence the occurrence of sickness absence in patients with arm, neck and/or shoulder complaints. These factors can be taken into account when developing and evaluating interventions to reduce sickness absence among these patients.

INTRODUCTION

Many people suffer from arm, neck and shoulder complaints. It is difficult to estimate the precise extent of the problem because the reported point prevalence ranges from 2-53% and the 12-month prevalence ranges from 2-41% depending on the setting, definition, and classification used [1]. The reported 12-month prevalence in various working populations ranges from 22-40% [2]. In a study on the prevalence of arm, neck and shoulder complaints in the general population, the 12-month prevalence was 37%, the point prevalence was 26%, and 19% of the patients reported chronic complaints [3]. Of those with chronic complaints who sought medical care in the past 12 months, 81% visited their general practitioner (GP) and more than half contacted a medical specialist (59%) or physiotherapist (54%) [3]. Among patients with chronic complaints of the arm, neck and/or shoulder, healthcare users reported more sickness absence due to arm, neck and shoulder complaints (37%) than non-healthcare users (9%) [3].

Neck and upper extremity complaints are an important reason for sickness absence. The annual prevalence of sickness absence due to work-related upper-extremity complaints is reported to be 2-4% of the general workforce [4]. Among personnel of the laundry works and dry cleaning establishments, a total of 216 workers reported upper extremity complaints and 54 workers with these complaints had related sickness absence, which implies that 25% reported sick at least once for these complaints [5]. Among self-employed Dutch farmers, of all claims for sick leave up to 1 year, neck/upper extremity disorders accounted for 8% of the total number of claims; in the group of claims lasting more than 1 year, these latter diagnoses accounted for almost 9% of the total number of claims [6].

In a study among industrial workers from 9 companies in the Netherlands, 22% of those with neck/upper extremity symptoms took sick leave; in that study, sick leave for neck/upper extremity symptoms was significantly associated with being female, living alone, and high job strain [7]. Similar findings for job strain were reported in a prospective cohort study among a working population in various industrial/service branches throughout the Netherlands, where work-related neck flexion and neck rotation, low decision authority and medium skill discretion were prospectively related to an increased risk of sickness absence due to neck pain [8]. However, in the study among personnel of the laundry works and dry cleaning establishments, high levels of physical and psychosocial workload were associated with musculoskeletal complaints but did not seem to influence sickness absence due to these complaints [5]. Also, inconsistent findings were reported with regard to the influence of concurrent low-back pain on sickness absence in people with arm, neck and/or shoulder complaints [5, 9]. Sickness absence was also examined in a large observational study among patients who consulted their GP with a new complaint or new episode of a complaint at the neck or upper extremity; this latter

study showed that heavy physical work increased the risk of sick leave in patients who worry a lot [10].

It appears that most studies on sickness absence for arm, neck and/or shoulder complaints are performed in a specific work setting. Moreover, the studies assess only a limited number of risk factors for sickness absence. Most importantly, because only a few studies used a prospective design, the evidence for causal relationships is scarce. Therefore, using a prospective design, we explored the influence of psychological factors, social factors, work-related factors, complaint-specific factors, and demographic factors on the occurrence of sickness absence among people who consult in physical practice for arm, neck and/or shoulder complaints. As an important aim in physical therapy is to enable patients to perform their daily activities (including work), more knowledge on risk factors associated with the occurrence of sickness absence might contribute to dedicated interventions aimed at avoiding or preventing sick leave in these patients.

METHOD

Design and setting

This study is part of a large prospective cohort study on arm, neck and/or shoulder complaints in physical therapy practice. Details on the study design have been published earlier [11]. Physical therapy practices active in primary care or occupational healthcare (from four provinces in the western part of the Netherlands) participated in this study and recruited consecutive patients.

Participants

Included were patients with complaints of the arm, neck and/or shoulder consulting the participating physical therapists during a 12-month period (August 2001 to July 2002). Exclusion criteria were consultation of the physical therapist in the previous 6 months for the same complaint, acute complaints caused by trauma, systemic disorders and/or generalized neurological syndromes, co-morbidity causing severe disability in daily activities, and inability to fill in Dutch questionnaires. Only patients who reported to have paid work were included in the present study.

Questionnaires

Data were collected by means of self-administrated questionnaires. Most of the possible prognostic factors were measured by means of validated questionnaires.

1. Participant characteristics

Age, gender, educational level, body mass index (BMI, kg/m^2), and sports participation.

2. Complaint-specific characteristics

The duration of the complaints at baseline, co-morbidity (musculoskeletal or not), earlier musculoskeletal trauma of arm, neck or shoulder, and the prognosis as assessed by the physical therapist were measured. Complaints were divided into specific and non-specific ones [12]. In addition, the complaints were classified as local (the participant indicated only one location on a manikin) or not local (more than one location indicated), and as being work-related or not.

3. Social and psychological factors

The Dutch version of the Tampa Scale of Kinesiophobia (TSK-DV) was used to measure pain-related fear of movement [13,14].

Social support was measured with the Social Support Scale (SOS). This Dutch scale is based on the Social Support Questionnaire (SSQ) [15,16].

To measure distress and somatization we used two scales of the Dutch Four-Dimensional Symptom Questionnaire (4DSQ) [17].

Catastrophizing was measured with 6 items and based on the subscale catastrophizing from the Dutch version of the Coping Strategy Questionnaire (CSQ) [18-20].
All these questionnaires were analysed in tertiles.

The social and psychological factors at work were measured with the Dutch translation of the core Job Content Questionnaire (JCQ). The following scales were used: quantitative job demands, skill discretion, decision authority, supervisor support, co-worker support, and job insecurity [21]. In the analysis, the scores of the JCQ scales (except job insecurity) were analysed in tertiles.

4. Physical factors

Physical activities during leisure time were measured with 6 items. Two scores were calculated: "Heavy physical activities in leisure time" (4 items) and "Static repetitive activities in leisure time" (2 items).

Physical load at work was measured with 15 items. The items derived from the index musculoskeletal workload of the Dutch Musculoskeletal Questionnaire (DMQ) [22]. The items concerned force exertions, and static, dynamic and repetitive loads of the upper extremities. Two scores were calculated "Heavy physical work" (7 items) and "Static repetitive work" (8 items).

Details on these questionnaires and the possible prognostic factors have been published earlier [11].

Outcome measures

The primary outcome measure was the occurrence of sickness absence during the past 3 months. This was assessed at 3 and 6 months follow-up by the following question: "Have

you been absent from work during the past 3 months because of your arm, neck and/or shoulder complaints?" [23].

Statistical analyses

The dependent variable in the statistical analysis was the occurrence of sick leave during follow-up, measured by the questionnaires at 3 and 6 months. For each participant repeated measurements were available; therefore, generalized estimating equations (GEE) with Poisson regression was used to explore the associations between the possible determinants and the occurrence of sickness absence during follow-up. Poisson regression analysis is a robust method to use when there is a slight variation in the occurrence of (multiple) events over the follow-up period, and the event of interest is less common. The odds ratio (OR) expresses the association between the factor measured at baseline and the occurrence of sickness absence during follow-up. Within the two distinguished domains: i.e. 1) individual characteristics, complaint-specific characteristics, social and psychological factors, and 2) social, psychological and physical factors at work and in leisure time, first all variables were evaluated in univariate analyses and variables with a p-value ≤0.05 were selected for further investigation. Second, relevant variables from the first step were investigated in a multivariate analysis within each domain and retained when significant at $p < 0.05$. In case of two strongly correlated factors, both showing a significant association with the occurrence of sick leave, the choice was made to include only the factor with the highest overall goodness-of-fit in order to avoid problems with multicollinearity in the multivariate analysis. Third, relevant variables from the second step were investigated in a multivariate analysis across all domains and retained when significant at $p < 0.05$.

The analysis was carried out with Proc Genmod in the statistical package of SAS (version 8.2)

RESULTS

Participants

At baseline there were 483 participants with a paid job. Of these, about 79% (381 participants) returned the follow-up questionnaire at 3 months, and 72% (348 participants) returned the questionnaire at 6 months follow-up.

Baseline data

The mean age of the working population was 41.5 (sd 10.4) years, and 322 of the participants (67%) were women. At baseline, most participants had suffered from their complaints for 3 months or more, and 161 (33%) were currently absent from work (Table 1).

Table 1: Baseline characteristics of the study population (N=483)

Variables		Score
Individual characteristics		
Age (years); mean (sd)		41.5 (10.4)
Women, N (%)		322 (66.7)
Educational level: N (%)	Low	289 (59.8)
	High	194 (40.2)
Sports participation N (%)		249 (51.6)
Body Mass Index (kg/m2), [16.4-60.2] mean (sd)		25.2 (4.3)
Complaint specific characteristics		
Work-related complaints N (%)		372 (77.2)
Prognosis physical therapist, development chronic complaints N (%)	Yes	183 (37.9)
	No	300 (62.1)
Duration of the complaint; N (%)	More than 3 months	238 (49.3)
	0 weeks to 3 months	245 (50.7)
Local complaint N (%)		263 (57.0)
Non-specific complaint N (%)		308 (64.3)
Co-morbidity (musculoskeletal) N (%)		202 (42.3)
Co-morbidity (not musculoskeletal) N (%)		63 (13.1)
Earlier musculoskeletal trauma N (%)		107 (22.2)
Baseline severity of complaints in the last week [0-10]; mean (sd) (tertiles)		6.0 (2.0)
	8-10 (high)	N=117
	6-7	N=191
	0-5	N=173
Baseline functional limitations of arm, shoulder and hand [0-100]; mean (sd) (tertiles)		36.4 (18.2)
	44.1-100 (high)	N=158
	26.1-44	N=157
	0-26	N=162
Sickness absence in the past 3months (at baseline)		N=161
Social and psychological factors (tertiles)		
Distress [0-32]; mean (sd)	7.7	(8.4)
Somatization [0-32]; mean (sd)	9.0	(5.7)
Kinesiophobia [17-68]; mean (sd)	2.2	(6.6)
Catastrophizing [0-60]; mean (sd)	8.8	(11.5)
Social Support [12-60]; mean (sd)	7.7	(7.5)
Social and psychological factors in work (tertiles)		
Job insecurity N (%) (not in tertiles)		86 (18.1)
Co-worker support [4-16]; mean (sd)		11.9 (1.7)

Table 1 continued

Variables	Score
Supervisor support [4-16]; mean (sd)	10.9 (2.6)
Quantitative job demands [12-48]; mean (sd)	31.5 (6.1)
Skill discretion [12-48]; mean (sd)	34.2 (6.1)
Decision authority at work [12-48]; mean (sd)	35.9 (7.5)
Physical factors (tertiles)	
Physical heavy work in leisure time [0-12]; mean (sd)	2.5 (1.6)
Static repetitive activities in leisure time [0-6]; mean (sd)	1.7 (1.2)
Physical heavy work [0-100]; mean (sd)	21.6 (23.6)
Static repetitive work [0-100]; mean (sd)	45.0 (23.1)

[..] = score range , sd=standard deviation

Follow-up data

In the first 3 months (n=483 participants) 88 persons (17.4%) reported sick, and between 3 and 6 months (n=347 participants) 46 persons (13.3%) reported sick. For 57% of the patients on sick leave, the sickness absence lasted less than 10 working days.

Determinants of sickness absence

Table 2 shows the factors selected for further analysis regarding the occurrence of sickness absence. In the univariate analysis 13 factors were selected ($p \leq 0.05$) for further investigation (Tables 2 and 3).

The final multivariate model (Table 4) shows that self-reported work-relatedness of complaints, previous musculoskeletal trauma, higher severity of baseline complaints, more somatization, and low decision authority at work are significantly related to sickness absence during follow-up.

Table 2: Determinants of sickness absence during follow-up: participant characteristics, complaint-specific characteristics, and social and psychological factors (univariate analysis)

Determinants	Outcome measure
	Sickness absence during the first 3 months follow-up
	Odds ratio [95% CI]
Participant characteristics	
Age (18-65 years)	1.0 [1.0-1.0]
Gender (being a woman)	1.7 [1.1-2.5]*
Education (low)	1.1 [0.8-1.6]
Sports participation (no)	1.2 [0.8-1.6]
Body Mass Index (kg/m^2), >25	1.1 [0.8-1.6]

Table 2 continued

Determinants		Outcome measure Sickness absence during the first 3 months follow-up Odds ratio [95% CI]
Complaint-specific characteristics		
Work-related complaints (yes)		4.7 [2.4-9.4]*
Prognosis physical therapist (chronic complaints)		1.4 [1.0-2.0]
Duration of complaints at baseline (more than 3 months)		0.9 [0.6-1.3]
Local complaints (yes)		0.6 [0.4-0.8]*
Specific complaints (yes)		0.8 [0.5-1.1]
Co-morbidity (musculoskeletal) (yes)		1.9 [1.3-2.8]*
Co-morbidity (not musculoskeletal) (yes)		1.3 [0.8-2.0]
Earlier musculoskeletal trauma (yes)		1.5 [1.0-2.2]*
Severity of complaints in the last week	8-10 (high)	3.7 [2.2-6.0]*
	6-7	1.8 [1.1-3.1]*
	0-5	ref
Functional limitations of arm, shoulder, hand	44.1-100 (high)	3.1 [1.9-5.2]*
	26-44	1.2 [0.7-2.2]
	0-26	ref
Social and psychological factors (in tertiles)		
Distress	>14 (high)	2.8 [1.8-4.4]*
	6-14	1.8 [1.1-2.9]*
	<=6	ref
Somatization	>11 (high)	3.3 [1.9-5.7]*
	6-11	2.7 [1.6-4.7]*
	<=6	ref
Kinesiophobia	>37 (high)	2.1 [1.3-3.4]*
	31-37	1.5 [0.9-2.5]
	<=31	ref
Catastrophizing	>17 (high)	2.8 [1.8-4.5]*
	5-17	1.4 [0.8-2.4]
	<=5	ref
Social support		
	<=52 (low)	1.5 [1.0-2.3]
	52-59	0.7 [0.4-1.2]
	>59	ref

CI =Confidence interval, * = p ≤0.05

Table 3: Determinants of sickness absence during follow-up; work and leisure time characteristics (univariate analysis)

Determinants		Outcome measure Sickness absence during the first 3 months follow-up Odds ratio [95% CI]
Social and psychological factors at work		
Job insecurity (yes)		0.8 [0.5-1.4]
Co-worker support	<=11 (low)	1.2 [0.7-2.1]
	12	1.1 [0.6-1.8]
	>=13	ref
Supervisor support	<=10 (low)	1.1 [0.7-1.8]
	11-12	0.7 [0.4-1.1]
	>=13	ref
Quantitative job demands	>=35 (high)	1.1 [0.7-1.7]
	29-35	0.8 [0.5-1.3]
	<29	ref
Skill discretion	<=16 (low)	1.3 [0.9-2.1]
	16-19	1.2 [0.7-1.9]
	>=19	ref
Decision authority at work	<=8 (low)	1.9 [1.2-2.9]*
	9	1.7 [1.1-2.8]*
	>=10	ref
Physical factors		
Physically heavy work in leisure time	4-12 (high)	1.0 [0.6-1.6]
	2-3	0.8 [0.5-1.2]
	0-1	ref
Static, repetitive activities leisure time	3-6 (high)	0.9 [0.6-1.3]
	2	0.7 [0.4-1.1]
	0-1	ref
Physically heavy work	25-100 (high)	2.0 [1.3-3.3]*
	1-24	1.5 [0.9-2.4]
	0	ref
Static repetitive work	55-100 (high)	1.3 [0.8-2.1]
	34-54	1.8 [1.1-2.9]*
	0-33	ref

CI = Confidence interval, * = $p \leq 0.05$

Table 4: Determinants of sickness absence during follow-up (multivariate final model).

Determinants		Outcome measure Sickness absence during the first 3 months follow-up Odds ratio [95% CI]
Complaint-specific characteristics		
Work-related complaints (yes)		3.2 [1.6-6.4]
Earlier musculoskeletal trauma (yes)		1.5 [1.1-2.2]
Severity of complaints in the last week		
	8-10 (high)	2.2 [1.3-3.6]
	6-7	1.3 [0.8-2.2]
	0-5	ref
Social and psychological factors (in tertiles)		
Somatization		
	>11 (high)	2.3 [1.3-4.0]
	6-11	2.3 [1.3-4.0]
	<=6	ref
Social and psychological factors at work (in tertiles)		
Decision authority at work		
	<=8 (low)	1.6 [1.1-2.5]
	9	1.6 [1.0-2.5]
	>=10	ref

CI = Confidence interval

DISCUSSION

In the present study, at baseline 33% of the participants were absent from work due to arm, neck and/or shoulder complaints. Factors associated with sickness absence during follow-up were self-reported work-relatedness of complaints, early musculoskeletal trauma, more somatization, higher severity of baseline complaints, and low decision authority at work.

Almost all social and psychological factors (somatization, distress, catastrophizing and kinesiophobia) were univariately associated with the occurrence of sickness absence. However, due to the correlations among these factors it is to some extent arbitrary which factor will survive the multivariate analysis. In this analysis we focused on the factor with the highest change in the overall goodness-of-fit of the statistical model and, thus, the factor with the best explanatory power. Somatization and distress, and distress and

catastrophizing were moderately correlated (0.42). Catastrophizing and kinesiophobia, and catastrophizing and somatization were weakly correlated (0.27). In our total model somatization was the strongest factor; the other variables had no significant additional influence in the multivariate model.

The present results show that psychological and social factors are related to sickness absence due to arm, neck and/or shoulder complaints. This is in accordance with other studies examining different populations. For example, Jørgensen et al. found that psychological distress and somatization are significant predictors of sick leave in patients with musculoskeletal illness in general practice [24], and Virtanen et al. (studying sickness absence in general) showed that persons with psychological distress had 1.3 to 1.4 times higher incidence of long-term sickness absence than persons with no psychological distress [25].

The same seems to hold for the factor 'decision authority' at work. In the present study, a low decision authority at work was associated with the occurrence of sickness absence during follow-up. This result in patients with arm, neck and/or shoulder complaints is in line with other studies demonstrating this factor to be associated with sickness absence in general. In the Whitehall II study, North et al. showed that low levels of work demands, control and support are associated with higher rates of short and long spells of absence; they conclude that increased levels of control and support at work could have beneficial effects in terms of improving the health/wellbeing of employees, and increasing productivity [26]. Niedhammer et al. showed that psychosocial factors at work (especially low levels of decision latitude) are predictive of sickness absence [27]. Lidwall et al. reported that jobs with significant psychological demands (which entail both high strain and an active job situation) are associated with long-term sickness absence [28]. Alavinia et al. showed that lack of job control remained an important risk factor for moderate and long durations of sick leave, after adjusting for the strong effects of work ability on sickness absence [29].

In addition, among persons with psychological distress, Virtanen et al. reported that high job strain (low job control and high job demands) predicted sickness absence; the significant effect of job strain on sickness absence was found among workers with high socioeconomic positions, but not among employees in low socioeconomic positions [25]. Besides the reported association between social/psychological factors and sickness absence (which is in line with our results), Virtanen et al. also showed that this association can be strengthened by psychosocial factors at work. This is an interesting point for further research.

In the present study sickness absence was measured by self-administrated questionnaires, whereas data from company records could be considered a more accurate method [30]. However, in large epidemiological studies the use of questionnaires might be considered a valuable source of information on overall sickness absence [23]. Burdorf

et al. assessed the reliability of data on sickness absence using company records as reference; their results suggest that for overall sickness absence, and sickness absence due to back pain, the questionnaire data on prevalence, frequency and duration compared relatively well with the company absence records [23]. For the frequency and duration of sickness absence due to low back pain in the past 6 months, kappa values against registered sickness absence were 0.61 and 0.65, respectively [23]. Since our recall period was limited to 3 months, we assume that the self-reported occurrence of sick leave will show good agreement with the registered sickness absence. Therefore, we consider our data to be reliable.

In conclusion, according to the present study, social and psychological factors (at work) are associated with sickness absence in patients with arm, neck and/or shoulder complaints in physical therapy practice**.**

Social and psychological factors (at work) should be taken into account when considering sickness absence due to arm, neck and/or shoulder complaints. These variables may also be relevant when designing and evaluating interventions for the reduction of sickness absence.

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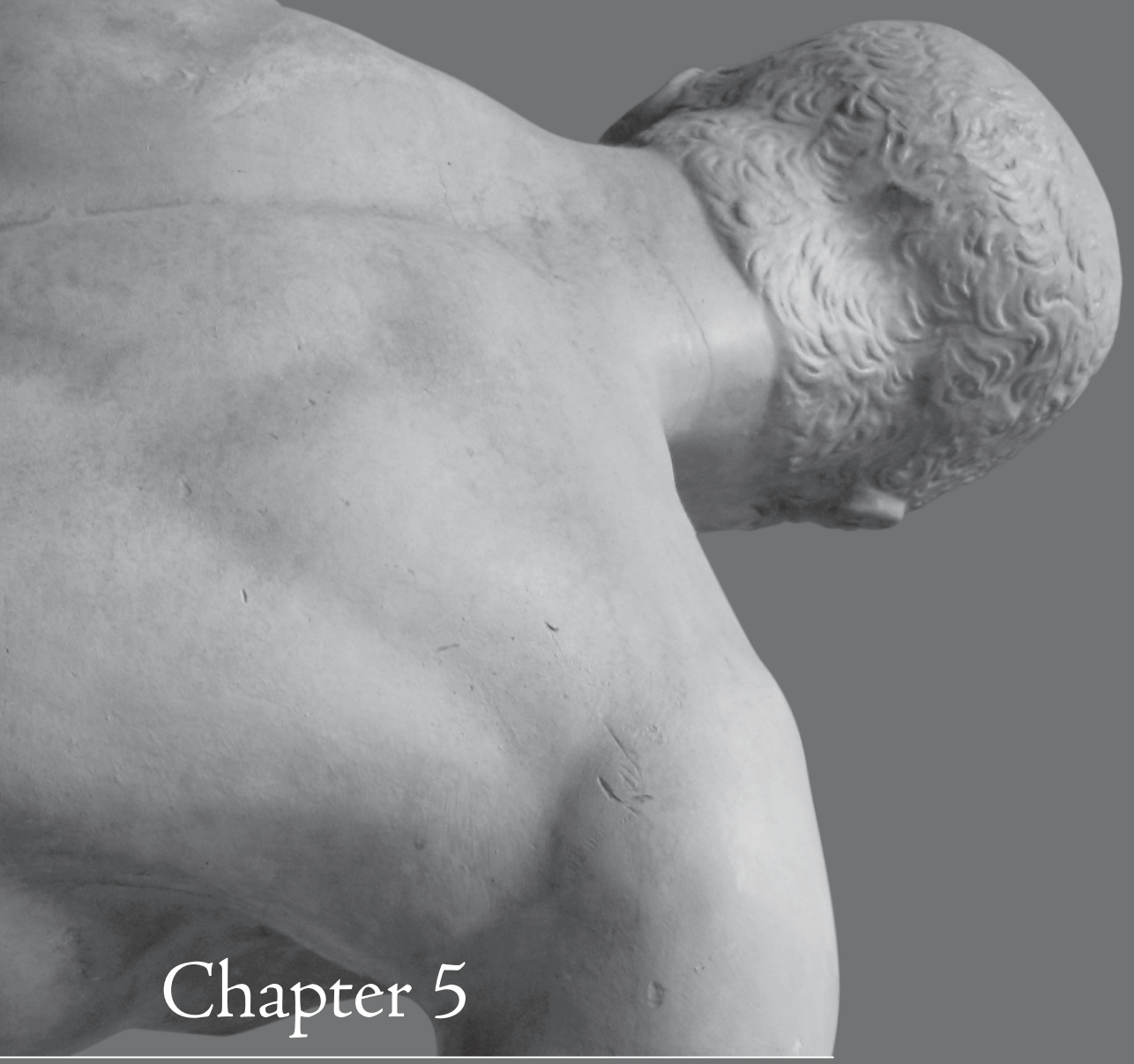

Chapter 5

Exercise proves effective in a systematic review of work-related complaints of the arm, neck, or shoulder

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Journal of Clinical Epidemiology 2007;(60): 110-117

ABSTRACT

Objective Interventions such as physiotherapy and ergonomic adjustments play a major role in the treatment of most work-related complaints of the arm, neck, and/or shoulder (CANS). We evaluated whether conservative interventions have a significant impact on outcomes for work-related CANS.

Study Design and Setting A systematic review was conducted. Only (randomized) trials studying interventions for patients suffering from work-related CANS were included. Interventions may include exercises, relaxation, physical applications, and workplace adjustments. Two authors independently selected the trials, assessed methodological quality, and extracted data.

Results We included 26 studies (in total 2,376 patients); 23 studies included patients with chronic nonspecific complaints. Over 30 interventions were evaluated and 7 main subgroups of interventions could be determined, of which the subgroup "exercises" was the largest one. Overall, the quality of the studies appeared to be poor.

Conclusion There is limited evidence for the effectiveness of exercises when compared to massage, adding breaks during computer work, massage as add-on treatment to manual therapy, manual therapy as add-on treatment to exercises, and some keyboards in people with carpal tunnel syndrome when compared to other keyboards or placebo. For other interventions no clear effectiveness could be demonstrated.

BACKGROUND

The term repetitive strain injury (RSI) is not a diagnosis, but an umbrella term for disorders that may develop in the course of repetitive movements, awkward postures, and forceful usage at work [1]. Work-related upper extremity musculoskeletal disorders have been labeled differently in various countries: RSI in Canada and Europe, both RSI and occupational overuse syndrome in Australia, and cumulative trauma disorder in the United States [2]. Recently, in the Netherlands, we have achieved consensus about the term "Complaints of the Arm, Neck, and/or Shoulder" (CANS), which can be either work related or not work related. Workrelated CANS can be divided into specific conditions such as carpal tunnel syndrome, which has relatively clear diagnostic criteria and pathology, or nonspecific conditions such as tension neck syndrome, which is primarily defined by the location of complaints and whose pathophysiology is less clearly defined or relatively unknown. In the United States, work-related CANS accounts for between 56% and 65% of all disabling occupational injuries [3,4]. Overall, the estimated prevalence of CANS is approximately 30% [1,3]. The costs associated with these disorders are high; over two billion dollars of direct and indirect costs are estimated annually in the United States [4]. Much attention is paid to the treatment of CANS [1,5]. Conservative interventions such as physiotherapy and ergonomic adjustments play a major role in the treatment [4]. Therefore, there is a need to determine whether conservative interventions have a significant impact on short-term and long-term outcomes. The objective of this systematic review is to determine the effects of conservative interventions for work-related CANS in adults.

METHOD

Search strategy

We searched the Cochrane Controlled Trials Register (current issue), PubMed, EMBASE, CINAHL, PsycLIT, Physiotherapy Index, The Cochrane Field "Rehabilitation and Related Therapies," and reference lists of retrieved articles. There were no language restrictions. The search strategy proposed by Robinson and Dickersin [6] was combined with keywords indicating the patient population such as work-related disorder*, upper extremit*, and repetitive strain injur*. Two authors (A.P.V., S.M.A.B.-Z.) independently selected the trials initially based on title and abstract. From the title, keywords, and abstract they assessed whether the study met the inclusion criteria regarding design, subjects, and intervention. Full articles of any possible relevance were retrieved for final assessment. Both authors then independently performed a final selection of the trials using a standardized form.

Study selection

We included randomized controlled trials (RCTs) and concurrent controlled trials (CCTs). Only trials specifically stating that the conditions under investigation are work related and involving adults suffering from CANS were included. Studies reporting on acute trauma, neoplasm, and inflammatory or neurological diseases were excluded. All trials studying conservative interventions, which may include exercises, relaxation, work-place adjustments, and physical applications such as ultrasound or biofeedback, were included. We were interested in the following outcome measures: pain, functional status (or quality of life), ability to work, health care consumption, and costs.

Methodological quality assessment

Two authors (A.F., C.K.) independently assessed the methodological quality using the Delphi list [7] (see Table 1). All criteria have a "yes," "no," "don't know" answer format. Equal weights were applied to all nine Delphi criteria. Items scoring a "yes" contribute to the quality scores (QSs), ranging from 0 to 9. Disagreements were solved by consensus and if necessary, by third party (A.P.V.) adjudication.

Table 1: The Delphi list

Delphi items
1. Was a method of randomization performed?
2. Was the treatment allocation concealed?
3. Were the groups similar at baseline regarding the most important prognostic indicators?
4. Were the eligibility criteria specified?
5. Was the outcome assessor blinded?
6. Was the care provider blinded?
7. Was the patient blinded?
8. Were point estimates and measures of variability presented for the primary outcome measures?
9. Did the analysis include an intention-to-treat analysis?

Data extraction

Two authors (S.D., A.P.V.) independently extracted data regarding interventions, type of outcome measures, followup, loss to follow-up, and outcomes, using a standardized form. The results of each trial were, when possible, expressed as relative risks (RRs) with corresponding 95% confidence intervals for dichotomous data, and as standardized mean differences (SMDs) (effect sizes) with 95% confidence intervals for continuous data [8].

Analysis

The inter-observer reliability of the overall quality assessment was derived by kappa statistics. Kappa values >0.7 are considered as good agreement, between 0.5 and 0.7 as moderate, and <0.5 as poor agreement. The results on the separate outcomes

were pooled only if the studies were considered clinically homogeneous for the study population and intervention. In case of clinical heterogeneity or if relevant data were lacking, we analyzed the results using a rating system with levels of evidence [9]. The rating system consists of five levels of scientific evidence, based on the quality and the outcome of the studies: (1) Strong evidence: provided by generally consistent findings (similar findings in >75% of the studies) in multiple (two or more) high-quality RCTs, (2) Moderate evidence: provided by generally consistent findings in one high-quality RCT and one or more low-quality RCTs, (3) Limited evidence: one RCT or generally consistent findings in multiple CCTs, (4) Conflicting evidence: inconsistent findings in multiple RCTs or CCTs, and (5) No evidence: no RCTs available. High quality is defined as "presenting a concealed randomization procedure and adequate blinding," or "a positive score on five or more Delphi items."

RESULTS

Search strategy

We performed the search up to March 2005. The final selection based on consensus resulted in 29 publications, of which three were double publications, resulting in 26 included studies (see Fig. 1). The assessment of the methodological quality as well as the data extraction was performed on all 29 publications. The definition of "work-relatedness" was evaluated in all studies. In most studies, the study population was selected from, for example, industrial workers who "reported a gradual onset of symptoms that were apparently workrelated" [10], or fully employed staff "who regard their complaint as work-related [11,12] or their work as contributing to the disorder" [13], or hospital staff who "reported pain or complaints during work tasks" [13] or "performed data processing tasks for 8 h a day" [14]. In the studies of Spence and colleagues [15-17] the work-relatedness of the complaints was assessed "according to a medical practitioner." Twice the work-relatedness was only described in the title or introduction [18,19].

Quality assessment

The results of the methodological assessment are presented in the Appendix.

Initially, there was disagreement between both authors in 12% of the items (kappa=0.67), meaning a moderate level of agreement. Overall, the quality of the studies is poor with a mean QS of 3.9 (median 4.0; range 1-8 points). Fig. 2 shows that the overall QS is significantly (P=0.003) associated with year of publication. Main methodological flaws were a nonconcealed randomization procedure, lack of blinding, and lack of an "intention- to-treat" analysis. Based on our criterion of high quality "presenting a concealed randomization procedure and adequate blinding" only one study was found to

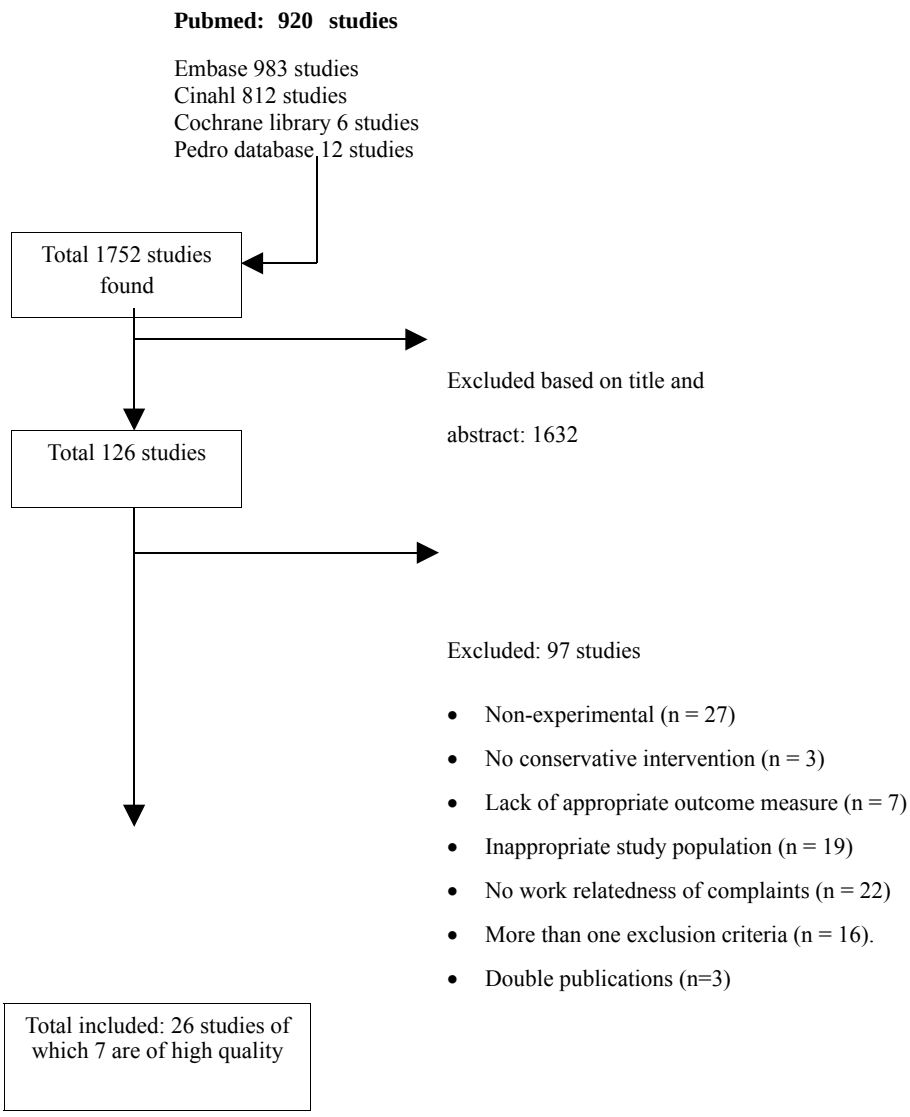

Figure 1: Trial flow diagram

be of high quality [20]. A concealed randomization procedure was described in three studies [10,20,21], and in one of them [20] the outcome assessor was blinded. Based on our criterion of high quality "an overall quality score higher than 50% of the maximum score" nine studies were found to be of high quality [20-28]. We consider these studies to be of high quality in our level-of-evidence analysis.

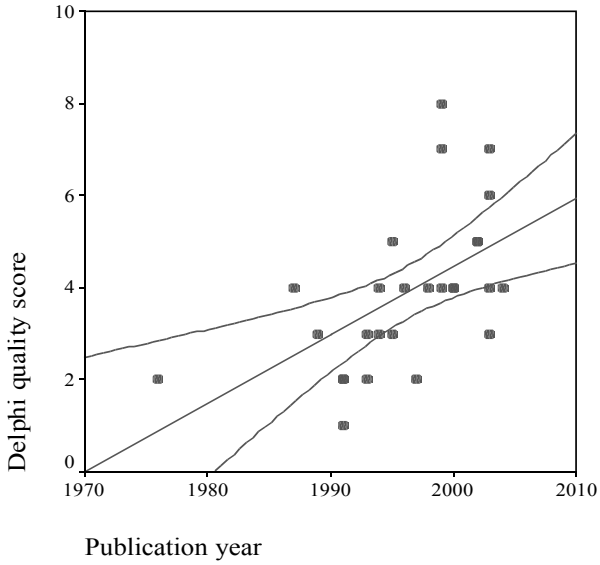

Figure 2: Plot of overall quality score and year of publication.

Study characteristics

For the study characteristics see Appendix. Twenty-three studies included people with nonspecific neck and shoulder complaints or nonspecific upper extremity disorders, and in one study only nonspecific hand and wrist complaints were included [14]. Three studies included people with a work-related carpal tunnel syndrome [23,24] and "shoulder impingement syndrome" [18]. Most studies included people with chronic complaints, varying between 3 and 12 months. When people with "prevalent complaints" were included, the mean duration of the complaints at baseline appeared to vary between months and years. In three studies, people with a recent onset of complaints were included [11,24,29]. Eleven studies included only women and one included only men [30]. Twenty-three studies used pain as the main outcome measure, although its measurement differed greatly among studies. Sometimes an index was used to measure "complaints" and in eight studies "return to work" or "sick-leave" was used as outcome measure. Other frequently used outcome measures were disability (by questionnaire), strength (by dynamometer), or "range of motion." In total, 2,376 patients are included in this review. The number of patients in each study group varied from 11 to 135; in 15 studies the smallest study group had less than 25 patients. Over 30 interventions were evaluated and we divided the studies into subgroups according to the interventions as follows:

1. Exercises: In 14 studies, a kind of exercise therapy (physical therapy) is studied including specific forms of exercises such as proprioceptive neuromuscular facilitation

(PNF) [30] and Feldenkreis therapy [31]. Exercises were compared to a control group receiving no treatment [20,21,26-28,31-34], other exercises [10,21,26-28,30], massage [30,35], behavioral therapy [20], as add-on treatment to ergonomic instructions [12,19], or as add-on treatment to breaks during computer work [11]. Vasseljen et al. [25] compared "physical therapy" individually to group "physical therapy" both including exercises given at the workplace.

2. Behavioral therapy: In six studies, a form of behavioral therapy is studied. The intervention varied between cognitive training, relaxation, and a combination of both. In five studies, it is compared to a waiting list control group [13,15-17,29,36]. In one study, relaxation is compared to a no-treatment control group and to exercises [20]; in three studies, different forms of behavioral therapy were evaluated [13,15-17].
3. Ergonomics: Various ergonomic strategies are evaluated in eight studies [11,22-24, 31, 32, 36, 37]. In four studies, ergonomic programs are compared to a no-treatment or waiting list control group [11,22, 31,36], and in one study an alternative keyboard is compared to placebo [24]. In one study, ergonomic changes at the workplace were an add-on treatment to exercises [32]. In another study, a comparison was made between intensive ergonomic guidance and education in ergonomics [22], or an ergonomic program was compared to an exercise group [38] or to "usual care," which was not defined [37]. In two high-quality studies, including patients with specific CANS (carpal tunnel syndrome), the efficacy of various keyboards (in total, six different keyboards) is compared based on reduction of complaints [12,24].
4. Massage: In three studies, massage was evaluated, twice compared to exercises [30,35], once as surplus treatment to manual therapy [38].
5. Group therapy vs. individual therapy: In two studies, an individual approach is compared to a group approach [15,16,25].
6. Manual therapy: In one study, a form of manual therapy is evaluated as surplus treatment to exercise treatment [18].
7. Energized splint: There is one study comparing an "energized splint" to placebo [14].

Data extraction

Nineteen studies presented point estimates and measures of variability of their primary outcomes; in one study a recovery percentage could be calculated [38]. We were able to calculate RRs in eight studies and effect sizes (SMD) in 16 studies (see Appendix). None of the original authors presented an RR, SMD, or odds ratio itself.

Analysis

Because of the clinical heterogeneity of the studies, we refrained from pooling and performed a "best evidence synthesis" within the several subgroups according to the

intervention. For main results from only the studies with nonspecific neck and shoulder complaints, see Table 2.

Table 2: Main results in patients with nonspecific neck and/or arm pain.

Intervention	Control	Results on pain	Conclusion
Exercise	No treatment [20,21,26-28,31-34]	HQ: SMD varies between 0.1 (-0.2;0.3) and 2.1 (1.7;2.5) LQ: SMD varies between 0.1 (-0.5;0.7) and 0.8 (0.2;0.8)	Conflicting evidence
	Other exercises [10,21,26-28,30]	Strength vs. endurance exercises [21,26-28]: HQ: SMD varies between –0.1 (-0.6;0.3) and 0.4 (-0.01;0.7 LQ: SMD: 0.5 (-0.0;1.0)	No difference
	Massage [30,35]	LQ: Symptom free [35]: RR=1.3 (1.0;1.6)	Limited evidence in favor of exercise
	Behavioural therapy [20]	HQ: SMD: 0.0 (-0.2;0.2)	No difference
	Add-on treatment on ergonomic instructions [12,19]	LQ: SMD varies between 2.1 (1.4;2.7) [23] and 0.2 (-0.4-0.8) [19]	Conflicting evidence
	Add-on treatment on breaks during computer work [11]	Perceived recovery: RR=1.05 (0.8;1.5)	No difference
Behavioural therapy	No treatment [20]	HQ: SMD: 0.1 (-0.2;0.3)	No difference
	Waiting list control [13,15-17,29,36]	LQ: SMD varies between 0.2 (-0.6;1.0) [17] and 0.8 (0.1-1.5) [15,16]	Conflicting evidence
	Other forms of behavioural therapy [13,15-17]	LQ: SMD varies between -0.3 (-1.1;0.6) [17] and 0.5 (-0.2-1.3) [15,16]	No difference
Ergonomics	No treatment [11,22,31]	HQ: effect estimates vary between SMD: 0.6 (0.03;1.1) [22] and perceived recovery RR=1.6 (1.04;2.3) [11]. LQ: SMD: 0.1 (-0.5;0.8) [31]	Conflicting evidence
	Other ergonomics [22]	HQ: SMD: 0 (-0.5;0.5)	No differences
	Exercises [31]	LQ: SMD: -0.6 (-1.3;0.1)	No differences
Massage	Exercises [30,35]	LQ: symptom free RR=1.3 (1;1.6) [35]	Limited evidence in favor of exercise
	Add on treatment on manual therapy [38]	LQ: RR=0.5 (0.3;0.9)	Limited evidence in favor of additional massage
Group therapy	Individual therapy [15,16,25]	HQ: Benefit: RR=4.5 (1.2-16.6) [25] LQ: SMD: 0.5 (-0.2;1.3) [15,16]	Conflicting evidence
Manual therapy	Add on treatment on exercises [18]	LQ: SMD: 0.8 (0.2;1.4)	Limited evidence in favor of additional manual therapy

HQ: high quality; LQ: low quality

Exercises

In seven studies, exercises are compared to a control group receiving no treatment of which three studies are of high quality and one does not provide data [32]. In one high-quality study, no differences were found in pain, function, and sick leave between exercise and no-treatment subgroups [20]. In two other high-quality studies, strength and endurance training seem to be beneficial when compared to no-treatment controls [21,26-28]. In two low-quality studies, mostly no differences were found between exercise and no-treatment subgroups [33,34]. Feldenkreis therapy was shown to be beneficial only for pain reduction compared to the control group [31]. In two studies, when exercise was evaluated as an add-on treatment to computer breaks or ergonomic instructions no additional benefit was found [11,19], but Omer et al. showed beneficial effects on pain [12]. When strength exercises are compared to endurance exercises in three studies (of which two are of high quality), no differences can be found between the two [21,26-28], and one other study did not provide data about effect sizes [10]. One study compared PNF exercises with standard exercises but did not provide data on effect estimates [30]. Exercises seem to be beneficial when compared to massage in one low-quality study [35], and seem equally effective when compared to behavioral therapy (relaxation) in one high-quality study [20]. We conclude that there is limited evidence that exercises are more effective compared to massage. There is conflicting evidence concerning the efficacy of exercises over no treatment or as add-on treatment, and no differences between various kinds of exercises can be found yet.

Behavioral therapy

In five studies (all of low quality), behavioral therapy was compared to a waiting list control group, and in one high-quality study it was compared to a no-treatment control group. Three studies did not provide data [13,29,36]. In two studies (one of high quality), no differences between groups were found [17,20] and in one study, individual behavioral therapy was found to be more effective than waiting list controls [15,16]. On comparing different forms of behavioral treatment, no differences in effect were found [13,15-17]. We conclude that at the moment there is conflicting evidence about the effectiveness of behavioral therapy when compared to no-treatment or waiting list controls.

Ergonomics

One high-quality study found significant differences between two ergonomic programs (intensive ergonomic guidance or educational) and a no-treatment group [22], while one low-quality study evaluating physical therapy ergonomic intervention found no difference [31]. When breaks during computer work using signals are compared to no breaks, significant differences in favor of breaks were found [11]. No difference was found

between an ergonomic program and Feldenkreis exercises [31], between intensive and educational ergonomic guidance [11], or between a multidisciplinary work "re-entry" program and usual care [37]. One high-quality trial found that an alternative geometry of the keyboards, compared to a placebo (unchanged keyboard), is effective in people with carpal tunnel syndrome, but no differences were found between keyboards [24]. Rempel et al. [23] found that an alternative forcee displacement of the keys is effective in reducing complaints compared to a conventional keyboard. The results of these two studies cannot be combined because of differences in keyboard characteristics. Therefore, we conclude that there is conflicting evidence concerning the effectiveness of ergonomic programs over no treatment, although there is limited evidence that breaks during computer work are effective. There is also limited evidence of the effectiveness of some keyboards in people with carpal tunnel syndrome compared to placebo but conflicting compared to other keyboards.

Massage

In one low-quality study, massage was evaluated as addon treatment to manual therapy and significant results in favor of additional massage were found [38], but exercises seem to be beneficial over massage for short term only [35]. We conclude that there is limited evidence for the effectiveness of massage as add-on treatment to manual therapy.

Group therapy vs. individual therapy

In one high-quality study, individual "physical therapy" was found to be more effective when compared to group "physical therapy" [25]. Individual behavioral therapy does not seem to be more effective when compared to group therapy [15,16]. Therefore, we conclude that there is conflicting evidence concerning the effectiveness of individual vs. group therapy.

Manual therapy

Manual therapy as add-on treatment to exercises showed beneficial results for pain, function, and strength in patients with shoulder impingements syndrome in one low-quality study [18]. We conclude that there is limited evidence of the effectiveness of manual therapy as add-on treatment to exercises.

Energized splint

There is one low-quality study comparing an "energized splint" with placebo, but no data are available [14].

DISCUSSION

This review shows that there is limited evidence about the positive effect of exercises when compared to massage, adding breaks during computer work, massage as add-on treatment to manual therapy, manual therapy as add-on treatment to exercises, and some keyboards in people with carpal tunnel syndrome when compared to other keyboards or placebo. There is conflicting evidence concerning the efficacy of exercises over no treatment or as add-on treatment, and no differences between various kinds of exercises can be found yet. At the moment there is also conflicting evidence about the effectiveness of behavioral therapy when compared to no treatment or waiting list controls, of ergonomic programs over no treatment, and of individual vs. group therapy. The aim of this review was to summarize the existing knowledge and evidence concerning the efficacy of frequently preformed interventions in work-related upper extremity musculoskeletal disorders (CANS). A systematic review is a form of observational research and therefore susceptible to bias. One of the major possible biases this review might suffer from is selection bias. We used a broad search strategy aimed at finding all studies that included people suffering from work-related CANS. No specific search strategy can be made to detect these studies, mostly because defining which disorders are work related appeared to be rather difficult. There is no clear definition of the work-relatedness of complaints. In the included studies, we noticed that defining the study population in this regard appeared to be difficult and subjective. Therefore, it is possible that we have missed studies that could be included in this review. Heterogeneity is another problem. Seven main subgroups of interventions could be determined, of which the subgroup "exercises" was the largest one. Within each subgroup, a large variety of interventions (and outcome measures) was provided, which made it impossible to combine study results in a pooled analysis. Although we were able to find 27 studies, it is disappointing that so little evidence of interventions in CANS can be provided. This is partly caused by the many different interventions and partly by the overall low methodological quality of the studies. Seven studies were considered to be of high quality based on an overall QS of over 50% of the maximum attainable score, but only one could be considered when high quality was defined as "having a concealed randomization procedure and a form of blinding" [20]. Assessing quality and incorporating quality in the analysis is under debate. Broadly, there are two ways of assessing quality: the quality component approach and assigning a quality summary score. A summary score can be incorporated into the analysis in various different ways [39].We used both approaches, but chose to use a threshold to incorporate the quality results into the analysis. Whether "high" quality was based on quality components or a summary score has no influence on the conclusions in this review. Because of the heterogeneity, the more frequently used sensitivity analysis was not possible here [40]. And because of this heterogeneity

and the overall low quality, drawing firm conclusions about the efficacy of treatments becomes difficult. Hardly any clinical heterogeneity was found in the study population selected in the original studies. In most studies, patients with chronic nonspecific neck/shoulder complaints were included. CANS are mostly divided into specific and nonspecific disorders, and the latter appeared to be the largest group. This review contributed especially to the body of knowledge of nonspecific work-related disorders. Although we included far more studies than the previous review by Konijnenberg et al. [41] [27 and 15, respectively], the main conclusion in both reviews that no strong evidence was found for the effectiveness of any treatment still remains. The results of our review are slightly different compared to the review of Konijnenberg et al. [41]. Most recent trials evaluated exercises, and therefore, contrary to Konijnenberg et al., we concluded that there was conflicting instead of limited evidence of exercises over no treatment. Although our conclusion in the subgroup "behavioral therapy" is based on six studies and the conclusion in the review of Karjalainen et al. is based on two studies, our results are comparable with this Cochrane review [42]. The relevance of this systematic review in contributing to the body of knowledge concerning the efficacy of interventions in nonspecific work-related CANS lies mainly in the fact that it points out a clear lack of evidence regarding the effectiveness of most often prescribed interventions. Most important difficulties found here are lack of a definition of "work-relatedness," the wide variety of interventions used to treat people with possible CANS, and the overall poor methodological quality.

In conclusion, this review shows limited evidence for the efficacy of specific keyboards with an alternative force displacement or geometry only for patients with carpal tunnel syndrome. There is limited evidence for the efficacy of exercises when compared to massage, adding breaks during computer work, massage as add-on treatment to manual therapy, and manual therapy as add-on treatment to exercises in patients with nonspecific work-related complaints. The main advantage of this review is that it is one of the first systematic summaries of the current knowledge about CANS. This review clearly shows a need for defining what can be considered a "work-related disorder" on the one hand, and the need for better targeted, higher quality research on the other.

ACKNOWLEDGMENT

This project is funded by the Dutch Health Insurance Executive Board (CvZ). This review is an update of a review published as a Cochrane Review in the Cochrane Library 2004, Issue 1 (update expected in 2006, Issue 3). Cochrane reviews are regularly updated as new evidence emerges and in response to comments and criticisms, and the Cochrane Library should be consulted for the most recent version of the review.

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APPENDIX

Study characteristics.

Study	Design	Population	Intervention	Outcome (instrument)	Results	Notes
Bang and Deyle 2000 [18]	RCT; observer blinded.	Prevalent 'shoulder impingement syndrome' (specific); n=52 (22 women). Work overload is theorized as primary cause of impingement.	**I: Manual physical therapy + exercise**: standardized exercise program + 'manual physical therapy', n= 28. **C: Exercise**: standardized exercise program, n=24; 6 sessions, in 3-4 wks	Pain (composite score); Function (Q); Isometric strength (dynamometer).	**Function**: 37% improvement I vs 17% in C; RR=2.1 (0.8; 6); SMD=0.8 (0.2; 1.3). **Pain**: 70% reduction in I vs 35% in C; RR=2.1 (1.2; 3.9); SMD=0.8 (0.2; 1.4) **Strength**: I vs C: SMD=0.8 (0.3; 1.4).	two dropouts QS: 4 (items 1,4,5,8)
Bru et al. 1994 [13]	RCT	Prevalent neck/ shoulder complaints (nonspecific); female working hospital staff; n=119.	**I1: Relaxation training**: relaxation exercise + autogenic training, n=15. **I2: Cognitive training**: education relationship personality, work and complaints, n=19. **I3: Combination I1+I2**: n=24. **C: Waiting list controls**: n=53 10 sessions, in ? wk. Follow-up: 4 mo.	Pain intensity, duration (Likert).	Neck pain intensity reduced in I2 and I3; reduction shoulder pain in all groups except C.	Eight dropouts, unclear from which group. Pre-post analysis. QS: 3 (items 1,3,4)
Ferguson and Duncan, 1976 [30]	RCT; crossover trial; randomization of interventions; partly observer blinded.	Prevalent neck/ shoulder complaints (non-specific); only men; n=40. Full-time operating telegraphists.	**I1: Group A**: active exercise + US **I2: Group B**: PNF-training + ice **C: Group C**: massage; 4 wk intervention, cross over after 2, 4 mo.	Interview; observation; self-assessment; fear.	Self-assessment: moderate and marked improvement: n=13 in I1, n=10 in I2 and C.	11 dropouts. No separate data before the crossover. QS: 2 (items 1,5)

Study characteristics continued

Study	Design	Population	Intervention	Outcome (instrument)	Results	Notes
Feuerstein et al., 1993 [37]	CCT	Chronic (> 3 mo) complaints upper extremity (non-specific); n=34 (21 women). Work related diablement.	**I: multidisciplinary 'work re-entry rehabilitation program'**, n=19 **C: usual care**, n=15 4-6 wk. Follow-up 17 mo (3 – 35 mo)	Return to work.	**Return to work**: 73,7% in I vs 40% in C; RR=1.8 (0.9; 3.6).	Selection bias: "control group is not eligible for intervention . . . ". QS: 2 (items 8,9)
Hagberg et al., 2000 [10]	RCT; concealed randomization	Chronic (3 mo) neck/shoulder complaints (nonspecific); only women; n=77. Industrial workers with gradual onset of symptoms during work.	**I: Endurance training**: n=43; **C: Strength training**: n=34; 12 wk. Follow-up 24 wk.	Pain (VAS); ROM; sick-leave; strength (dynamometer); endurance (RPE)	Both groups tended to improve in pain and sick leave tended to decrease.	Eight dropouts (5 in I, 3 in C). Descriptive statistics, pre-post analysis. QS: 4 (items 1,2,3,4)
Van den Heuvel et al., 2003 [11]	RCT; group randomization	Neck, shoulder or arm pain (> 2 wks) (nonspecific); n=286. Workers from an office organization who considered complaints work related.	**I1: Breaks**: breaks of 5 minutes every 35 minutes, n=97; **I2: Breaks + exercises**: breaks + exercises (45 sec) at the start of each break; n=81; **C: Control**: no intervention, n=90	Perceived recovery (7-point Likert), pain (11point NRS), Sick leave (days)	**Perceived recovery**: n= 42 in I1, n=37 in I2, and n=25 in C; I1 vs C: RR=1.6 (1.04; 2.3); I2 vs C: RR=1.6 (1.1; 2.5); I2 vs I1: RR=1.05 (0.8; 1.5) **Sick leave**: no statistical significant differences.	49 dropouts (18 in I1, 15 in I2, 16 in C). QS: 4 (items 1,3,4,8)
Kamwendo and Linton, 1991 [32]	RCT	Chronic (> 12 mo) neck/shoulder complaints (nonspecific); medical secretaries currently working (women); n=79.	**I1**: **Traditional neck school**: advice + exercises, n=25 **I2: traditional neck school + ergonomic changes**, n=28 **C: controls**: n=26 2 sessions/ wk, 4 wk. Follow-up: 6 mo.	Pain (VAS); Workload (VAS); Fatigue (VAS); ROM (goniometer); sick-leave; expectation	I1 decreased in fatigue compared with C. At follow-up no between group differences.	Three dropouts. Attendance rate between 98-100%. QS: 2 (items 1,4)

Study characteristics continued

Study	Design	Population	Intervention	Outcome (instrument)	Results	Notes
Ketola et al., 2002 [22]	RCT	Neck/shoulder complaint (> 1 mo) (nonspecific); n=124. Employees who use the mouse currently.	**I1: Intensive ergonomics**, physiotherapists changed worksite according to checklist, n=39 **I2: Education ergonomics**, 1 hour training session in ergonomics, n=35 **C: Control group**, one-page leaflet, n=35	Discomfort (6 point Likert), strain (6 point Likert), pain (yes/no)	**Neck pain**: I1 vs C: SMD=0.6 (0.03; 1.1) I2 vs C: SMD=0.7 (0.2; 1.3) I1 vs I2: SMD=0 (-0.5; 0.5)	Seven dropouts (2 in I1 and I2, 3 in C) QS: 5 (items 1,3,4,8,9)
Klemetti et al., 1997 [33]	CCT, matched	Chronic tension neck (nonspecific); n=170. Bank office workers.	**I: Exercise**, physical training course, n=80 **C: Control**, no treatment, n=90	Pain, disability, sick leave	**Pain:** I vs C: SMD=0.1 (-0.2; 0.4) **Sick leave:** no significant differences	QS: 2 (items 3,8)
Leboeuf et al., 1987 [38]	RCT	Chronic (> 3 mo) complaints upper extremity (nonspecific); n=38 (35 women). Symptoms considered due to repetitive strain.	**I: Spinal manipulative therapy + massage**: n=21 **C: Spinal manipulative therapy (SMT)**: n=17 5 wk, 2 sessions/ wk. Follow-up 3 en 12 mo.	Degree of symptoms; frequency of symptoms (Likert).	**Improvement**: 41% in C vs 80% in I; RR=0.5 (0.3; 0.9)	No dropouts. Descriptive statistics. QS: 4 (items 1,3,4,9)
Levoska et al., 1993 [35]	RCT	Prevalent neck/ shoulder complaints (nonspecific); female office workers on a local bank; n=47.	**I: Active PT**: dynamic exercise; n=23 **C: Passive PT**: massage, heat etc.; n=24 5 wk, 3 sessions/ wk. Follow-up 3 mo	Pain, tender points; symptoms (Q); strength (dynamometer); endurance	**Symptom free**: 5 wks: n=22 in I vs n=18 in C; RR=1.3 (1; 1.6); 3 mo: n=8 in I vs n=4 in C; RR=2.1 (0.7; 6). **Strength** (5 wks): I vs C: SMD=0.9 (0.3; 1.5)	Three dropouts (1 in I; 2 in C). Compliance 60% - 80%. QS: 3 (items 1,4,8)

Study characteristics continued

Study	Design	Population	Intervention	Outcome (instrument)	Results	Notes
Lundblad et al., 1999 [31]	RCT	Prevalent neck/ shoulder complaints (nonspecific); female employees currently working; n=97.	**I1: Physical therapy**: ergonomic program; n=32; 2 sessions/ wk **I2: Feldenkreis**: n=33; 1 sessie/ wk. **C: Control group**: n=32 16 wk. Follow-up 1 yr.	Pain (VAS); function (Q); complaints (Q); ROM; sick-leave	**Pain 1 yr:** I1 vs C: SMD=0.1 (-0,5; 0.8); I2 vs C: SMD=0.7 (0.1; 1.3); I1 vs I2: SMD=-0.6 (-1.3; 0.1) **Function 1 yr**: I1 vs C: SMD=-0,1 (-0.7; 0.6); I2 vs C: SMD=0,2 (-0.4; 0.8); I1 vs I2: SMD=-0.3 (-1.0; 0.4) Sick leave 1 yr: PT vs C: SMD=0.2 (-0.4; 0.9); I2 vs C: SMD=0.2 (-0.4; 0.8); I1 vs I2: SMD=0.1 (-0.7; 0.7).	39 dropouts (17 in I1, 13 in I2, 9 in C). QS: 4 (items 1,3,4,8)
Moore and Weisner, 1996 [29]	RCT	Recent complaints upper extremity (nonspecific); n=32 (28 women). Diagnosed as having upper extremity RSI.	**I: HVT:** relaxation training, biofeedback, hypnosis, n=15. 45 min/wk, 6 wk. **C: Waiting list controls**; n=17	Temperature (hand); comfort (VAS).	Concerning temperature only before-after comparisons in I.	Two dropouts in C. VAS scores cannot be right. QS: 4 (items 1,3,4,8)
Omer et al., 2003/2004 [12]	RCT	Neck and upper extremity complaints (nonspecific); n=50 (41 women). Computer operators > 6 hours a day.	**I: Education +Exercises:** education (1 hr) + mobilisation, stretching, strengthening and relaxation exercises **C: Education:** education 1 hr 3 sessions a wk, 8 wks training	Pain (NRS, PDI) Tiredness, Depression (BDI)	**Pain:** 8 wks: I vs C: SMD=2.1 (1.4; 2.7) **Depression:** 8 wks: I vs C: SMD=0.5 (-0.1; 1.1)	QS: 3 (items 1,4,8)
Rempel et al., 1999 [23]	RCT, matched pairs; patient and observer blinded.	Prevalent carpal tunnel syndrome (CTS) (specific)., n=24 (16 women). Full-time laboratory personnel used a computer for > 2 hours a day.	**I: Keyboard A** (Protouch): n=12 **C: Keyboard B** (MacProPlus): n=12 12 wk, 1 hr training.	Pain (Likert); nerve conduction (electromyography); function and keyboard characteristics (Q).	**Pain** 6 wks: I vs C, SMD=0.1 (-0.7; 1). 12 wks: I vs C, SMD=1 (0.1; 1.9).	Four dropouts, 2 in each group. QS: 7 (items 1,3,4,5,6,7,8)

Study characteristics continued

Study	Design	Population	Intervention	Outcome (instrument)	Results	Notes
Rundkrantz et al., 1991 [19]	CCT	Chronic (> 12 mo) neck/shoulder complaints (nonspecific); n=45 (18 women). Official dentists with occupational cervico-brachial disorders.	**I: adjusted PT + ergonomic instructions**; n=22; 1-8 sessions **C: ergonomic instructions**; n=23; 1-2 sessions. Follow-up: 5 wks after intervention	Pain (VAS); Well-being (VAS).	**Pain neck** I vs C: SMD=0.2 (-0.4; 0.8). **Pain shoulder** I vs C: SMD=0 (-0.6; 0,6). **Well-being** I vs C: SMD=-0.1 (-0.7; 0.5)	One dropout in C. QS: 2 (items 3,8)
Spence, 1989, 1991 [15,16]	RCT	Chronic (> 10 mo) complaints upper extremity (nonspecific); n=45 (44 women). Upper extremity CTD and repetitive tasks on workplace.	**I1: Individual cognitive behavioural therapy**: n=15 **I2: Group cognitive behavioural therapy**: n=14 **C: Waiting list controls**: n=16; 9 wk, 9 sessions. Follow-up: 6 mo, 2 yrs in intervention groups.	Pain (McGill); function (SIP); return to work; satisfaction; fear (STAI), depression (BDI), coping (CSQ).	**Pain:** I1 vs C: SMD=0.8 (0.1; 1.5), I2 vs C: SMD=0.2 (-0.6; 0.8); I1 vs I2: SMD=0.5 (-0.2; 1.3). **Function:** I1 vs C: SMD=1 (0.3; 1.8), I2 vs C: SMD=0.4 (-0.4; 1.1); I1 vs I2: SMD=0.6 (-0.1; 1.4) At 2 yrs no significant difference in pain and SIP and relapse in coping strategies.	Three dropouts (1 in each group); 2 loss to follow-up at 6 mo; 6 extra loss to follow-up at 2 yr. Pre-post analysis QS: 3 (items 1,4,8)
Spence et al., 1995 [17]	RCT	Chronic (> 10 mo) complaints upper extremity (nonspecific); n=48 (40 women). Occupational pain of upper limb.	**I1: EMG biofeedback**: n=12 **I2: EMG + relaxation**: n=12 **I3: Relaxation**: n=12 **C: Waiting list controls**: n=12 8 wk. Follow-up 6 mo.	Pain (Whimpy, Likert, PBQ); depression (BDI); ADL.	**Pain:** I1 vs C: SMD=0.7 (-0.2; 1.5); I2 vs C: SMD=0.2 (-0.6; 1); I3 vs C: SMD=0.3 (-0.5; 1.2); I2 vs I3: SMD=-0.1 (-0.9; 0.8); I2 vs I1: SMD=-0.3 (-1.1; 0.6); I3 vs I1: SMD=-0.3 (-1.1; 0.6) **Function**: I1 vs C: SMD=0.4 (-0.4; 1.2); I2 vs C: SMD=0.4 (-0.5; 1.2); I3 vs C: SMD=0.7 (-0.2; 1.5); I2 vs I3: SMD=0.4 (-0.4; 1.2); I2 vs I1: SMD=-0.3 (-1.2; 0.5); I3 vs I1: SMD=0.0 (-0.8; 0.8). At 6 mo signs of relapse.	Three dropouts (1 in I2, 1 in I3, 1 in C); 7 loss to follow-up (1 in I1, 2 in I2, 4 in I3). Pre-post analysis QS: 3 (items 1,4,8)

Study characteristics continued

Study	Design	Population	Intervention	Outcome (instrument)	Results	Notes
Stralka et al., 1998 [14]	RCT, even/odd numbers. Care provider and patient blinded	Prevalent hand and wrist complaints (nonspecific); factory employees (data-processing); n=141 (84 women). CTD.	**I: Energized splint**: n=60 **C: Non-energized splint (placebo)**: n=60 7 wk; 30 min stimulation/ 20 sessions.	Pain (VAS); ROM; strength (dynamometer); swelling (volume measurement)	Improvement in energized splint group.	21 dropouts. Pre-post analysis. QS: 4 (items 1,5,6,7)
Swerissen et al., 1991 [36]	CCT, matched pairs	Chronic (> 12 mo) complaints upper extremity (nonspecific); n=22 (% women?). Occupational related injury.	**I: Occupational overuse program**; n=11 **C**: **Waiting list controls**; n=11 11 wk, 8 sessions. Follow-up: 3 mo.	Pain; function; fear (POMS); depression (POMS)	Possibly short-term results in pain en depression in A.	10 dropouts (6 in I, 4 in C). QS: 1 (item 7)
Takala et al., 1994 [34]	RCT, matched, crossover, observer blinded	Neck/shoulder complaints (> 1 mo) (nonspecific); female employees of printing company; n=44. Repetitive movements.	**I**: **Exercise**; n=22 **C**: **Controls**; n=22 10 wk, 10 sessions. After 4 mo cross-over	Pain (VAS); pressure pain (algometer).	**Pain** 10 wks: I vs C, SMD= 0.1 (-0.5; 0.7).	14 dropouts (9 in I, 5 in C). Analysis only in first period. Compliance 80% QS: 4 (items 1,3,5,8)
Tittiranonda et al., 1999 [24]	RCT, placebo controlled, random permuted block method, observer blinded	Carpal tunnel syndrome (CTS) or tendinitis wrist (complaints > 1 wk) (specific); n=80 (46 women). Computer users	**I1: Applied adjusted keyboard**; n=20 **I2: Comfort keyboard system**; n=20 **I3: Microsoft natural keyboard**; n=20 **C: Placebo group**; n=20	Pain (VAS), hand function (Q/VAS); physical examination; keyboard comfort (VAS).	**Improvement** n=9 in I1; RR=1.8 (0.7; 4.4) or n=11 in I2, I3; RR=2.2 (0.9; 5.2) compared to n=5 in C. **Pain** I1 vs C: SMD=0.4 (-0.2; 1); I2 vs C: SMD=0.6 (0; 1.3); I3 vs C: SMD=0.8 (0.1; 1.4); I1 vs I2: SMD=-0.2 (-0.8; 0.4); I1 vs I3: SMD=-0.5 (-1.1; 0.2); I2 vs I3: SMD=0.1 (-0.2; 0.3). **Function** I1 vs C: SMD=0.6 (0; 1.3); I2 vs C: SMD=0.8 (0.2; 1.5); I3 vs C: SMD=0.7 (0.1; 1.3); I1 vs I2: SMD=-0.3 (-1.0; 0.3); I1 vs I3: SMD=-0.3 (-1.0; 0.3); I2 vs I3: SMD=-0.1 (-0.7; 0.5)..	11 dropouts (1 in I1, 9 in I2, 1 in I3). QS: 8 (items 1,3,4,5,6,7,8,9)

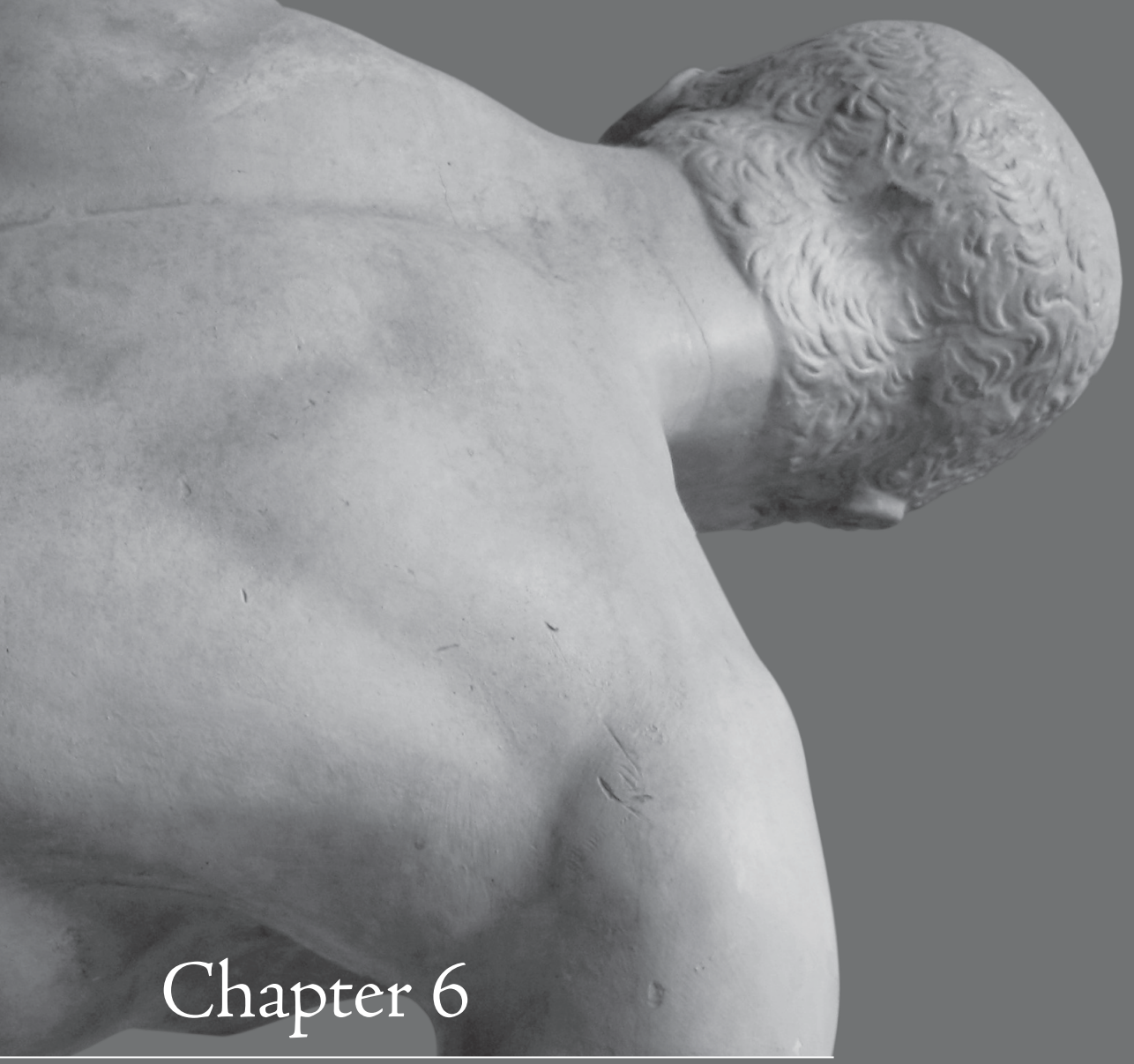
Study characteristics continued

Study	Design	Population	Intervention	Outcome (instrument)	Results	Notes
Vasseljen et al., 1995 [25]	RCT	Chronic (> 6 mo) neck/shoulder complaints (nonspecific); female office workers; n=24. Work related complaints.	**I: Individual PT**: massage, exercise, mobilisation, ergonomic adjustments; n=12; 10 wk, 2 sessions/ wk. **C: Group PT**: exercise at workplace; n=12; 6 wk, 3 sessions/ wk Follow-up: 6 mo	Pain (VAS), trigger points (algometer), strength; muscle activity (EMG).	**Benefit** at end of treatment: I (n=9) vs C (n=2): RR=4.5 (1.2; 16.6); at 6 mo: I (n=6) vs C (n=3): RR=2 (0.6; 6.2).	No dropouts. QS: 5 (items 1,3,4,8,9)
Viljanen et al., 2003 [20]	RCT, concealed randomization, outcome assessor blinded.	Chronic (> 3 mo) neck/shoulder complaints (nonspecific), female employees; n=393. Occupational complaints	**I1: Dynamic muscle training**: n=135 **I2: Relaxation training**: various relaxation techniques, n=128 **C: Control**: ordinary activity, n=130 Training for 12 wk. Follow-up 3, 6, 12mo	Neck pain (VAS); Neck disability (Q); Work ability (Likert); Sick leave	**Pain** I1 vs C: SMD=0.1 (-0.2; 0.3); I2 vs C: SMD=0.1 (-0.2; 0.3); I1 vs I2: SMD=0.0 (-0.2; 0.2). **Disability:** I1 vs C: SMD=0.1 (-0.2; 0.3); I2 vs C: SMD=0.0 (-0.2; 0.2); I1 vs I2: SMD=0.1 (-0.2; 0.3). **Sick leave** I1 vs C: SMD=0.1 (-0.1; 0.4); I2 vs C: SMD=0.0 (-0.2; 0.3); I1 vs I2: SMD=0.1 (-0.1; 0.4).	52 dropouts, no difference between groups. QS: 7 (items 1,2,3,4,5,8,9)
Waling et al., 2000, 2001, 2002 [26e28]	RCT, group randomization.	Chronic (>12 mo) neck/shoulder complaints (non-specific); female employees; n=126. Work 'contributed' to the disorder.	**I1: Coordination training**: body awareness therapy, n=31 **I2: Strength exercises**: n=34 **I3: Endurance training**: n=34 **C: Controls**: discussion + stress management, n=27 10 wk, 3 sessions/ wk	Pain (VAS), trigger points (algometer), function (Q), satisfaction (Q).	**Improvement**: 8 mo: I1 (n=23) vs I3 (n=21): RR=1.2 (0.9; 1.7); I2 (n=29) vs I3 (n=21): RR=1.4 (1.0; 1.9). **Pain**: I1 vs C: SMD=-0.8 (-1.4; -0.2); I2 vs C: SMD= -0.3 (-0.9; 0.2); I3 vs C: SMD=-0.4 (-1.0; 0.2); I1 vs I2: SMD=0.5 (-0.0; 1.0); I1 vs I3: SMD=0.5 (-0.1; 1.0); I2 vs I3: SMD=0.1 (-0.5; 0.6) **Pain 3 yr**: I1 vs C: SMD=0.5 (-0.1; 1.0); I2 vs C: SMD=0.6 (0.1; 1.1); I3 vs C: SMD=0.5 (0.0; 1.0); I1 vs I2: SMD= -0.1 (-0.6; 0.4); I1 vs I3: SMD=0.0 (-0.5; 0.5); I2 vs I3: SMD=-0.1 (-0.6; 0.3).	24 subjects did not complete training and are excluded from analysis short-term. 23 dropouts after 3 yrs (6 in I1, 5 in I2, 6 in I3, 6 in C). No data concerning of improvement at 3 yr follow-up. QS: 5 (items 1,3,4,8,9)

Study characteristics continued

Study	Design	Population	Intervention	Outcome (instrument)	Results	Notes
Ylinen et al., 2003 [21]	RCT, concealed randomization	Chronic neck pain (> 6 mo); female office workers; n=180. Work related complaints.	**I1: Strength exercises**: n=60 **I2: Endurance training**: n=60 **C: Controls**: home stretching exercises, n=60 5 sessions/wk, 9 sessions in total, 1 mo intervals during 12 mo	Neck pain (VAS), disability (Q), depression , neck muscle strength, ROM.	**Neck pain:** I1 vs C: SMD=2.1 (1.7; 2.5) I2 vs C: SMD=1.4 (1.0; 1.8) I1 vs I2: SMD=0.4 (-0.01; 0.7)	QS: 6 (items 1,2,3,4,8,9)

PT, physical therapy; EMG, electromyography; US, ultrasound; ADL, activities of daily living; VAS, visual analogue scale; NRS, numerical rating scale; ROM, range of motion; RPE, rating perceived
exertion; CTD, cumulative trauma disorder; SIP, sickness impact profile; PDI, pain disability index; Q, questionnaire; STAI, Spielberger stateetrait anxiety inventory; BDI, Beck depression inventory; CSQ,
coping strategies questionnaire; PBQ, pain beliefs questionnaire; POMS, profile of mood states; ?, unknown



Chapter 6

Treatment of arm, neck and/or shoulder complaints in physical therapy practice

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Spine 2006;31:E584-E589

ABSTRACT

Study design This is a prospective cohort study with a follow-up period of 6 months.
Objective To describe the interventions applied by physical therapists in treating patients with complaints of arm, neck and/or shoulder (CANS).
Summary of the background data Complaints of arm, neck and/or shoulder occur frequently and are usually managed within primary care. Many patients with these complaints are treated with physical therapy.
Methods During a 1-year period, the participating physiotherapists included new consulters with musculoskeletal complaints of the upper extremity. The patients filled in a questionnaire at baseline and the physical therapists completed a treatment record for up to 6 months.
Results Of the 624 patients included in the cohort, physical therapists provided treatment data of 619 patients. The main treatment consisted of exercise therapy (93%) and massage (87%) or a combination of both. More patients with specific complaints received physical modalities and more patients with non-specific complaints were treated with manipulation techniques.
Conclusions The primary treatment of complaints of the arm, neck and/or shoulder in physiotherapy practice consists of exercise therapy and massage therapy, mostly being a combination of both. Future studies should focus on the effectiveness of exercise therapies, combined or not combined with massage, for patients with complaints of the arm, neck and/or shoulder.

INTRODUCTION

The reported incidence and prevalence of upper extremity complaints have increased steadily during the last decades. The rates of upper extremity disorders in the United States tripled between 1986 and 1993; in 1990 these disorders accounted for more than 60% of the occupational illnesses. Other countries (such as the United Kingdom, Australia, Norway, Sweden and Japan) also report an increasing incidence of these disorders [1]. In the Netherlands, the 12-month prevalence of work-related complaints of arm, neck and/or shoulder is only available from self-reported questionnaires; this prevalence (not adjusted for severity and duration) is reported to be 20-40% in one year [2]. The costs associated with these disorders are high, e.g. in the United States estimated to be over two billion dollars direct and indirect costs annually [3]. In recent years, various terms are used to describe work-related upper extremity complaints (e.g., occupational overuse syndrome, cumulative trauma disorder, repetitive strain injury). In the Netherlands arm, neck and/or shoulder complaints are indicated with the term "CANS". This term was achieved by consensus of different professions. [4]

Treatment of complaints of arm, neck and/or shoulder mainly takes place in primary care. Many treatment options are available, ranging from ergonomic advice and work-load restrictions, to physical therapies and the prescription of medical aids [1]. Although many patients with musculoskeletal complaints are referred to and treated with physical therapy, the efficacy and effectiveness of most interventions is not yet clear. In their review Verhagen et al. [5] found limited evidence in favour of the effectiveness of exercise therapy compared to no treatment. However, due to the lack of valid studies in this area the efficacy of commonly applied interventions are usually unknown [5]. Besides this issue about the efficacy of treatments, to our knowledge, there is no insight in type of physical therapy treatments given to patients with complaints of arm, neck and/or shoulder. Therefore the presented study aimed to improve our insight into how patients with complaints of arm, neck and/or shoulder are managed by physical therapists.

MATERIAL AND METHODS

Design and Setting

From 4 provinces in the western part of the Netherlands, physical therapy practices active in primary care or occupational healthcare were invited to participate. Consecutive patients visiting their practices were asked to participate in this prospective cohort study, which includes a follow-up period of 6 months. The Ethics Board of the Erasmus University Medical Centre Rotterdam approved this study.

Patients

New consulters with complaints of arm, neck and/or shoulder (neck, upper back, shoulder, upper arm, elbow, forearm, wrist and hand complaints) aged 18-65 years were recruited by the participating physical therapists between August 2001 and July 2002. Exclusion criteria were: consultation for physical therapy in the previous 6 months for the same complaint, acute complaints caused by trauma, systemic disorders and/or generalised neurological syndromes, co-morbidity causing severe disability in daily activities, and not being able to fill in Dutch questionnaires.

Procedures

Self-administered questionnaires were used to collect data. During the first consultation the physical therapist handed out the baseline questionnaire together with informed consent forms, which were returned to the research centre. The questionnaires had to be completed within 8 weeks; if the questionnaire was not returned within 2 weeks the patients received a reminder. The physical therapists completed a treatment record after finalising their treatment program, and all patients received standard care for their complaints at the discretion of the physical therapist.

Patient questionnaire

The baseline questionnaire included questions on patient characteristics such as age, gender, education, work and sport participation. Data on the duration of the complaints before consultation and co-morbidity (musculoskeletal or not) were also collected. Complaints were defined as work- related if the participant had a paid job and gave a positive answer to one of the following questions:

A. Do the complaints return or worsen during activities at work?
B. Have you adapted or diminished your activities at work?
C. Do the complaints diminish after several days off (e.g. during the weekend or vacation)?

In addition, the complaints were classified as local (the participant indicated only one location on a manikin), or non-local (more than one location was indicated).

Treatment record

The physical therapist recorded in a booklet the diagnosis from a list of possible diagnoses (rotator cuff syndrome; epicondylitis lateralis/medialis; cubital tunnel syndrome; radial tunnel syndrome; peritendinitis/tenosynovitis flexors/extensors forearm; Quarvain's Syndrome; carpal tunnel syndrome; Guyon's tunnel syndrome; Raynaud's phenomenon and peripheral neuropathy in combination with exposition to hand-arm vibration; osteoarthrosis (elbow, wrist, hand) or radiating neck complaints) [6]. A blank option was also avaiable, which could be filled in by the therapist. We defined

complaints as specific if the physical therapist had made one of the aforementioned diagnoses; shoulder capsulitis/frozen shoulder, local arthritis (no rheumatoid arthritis) and cervical hernia were also classified as specific. All other complaints (including radiating neck complaints) were defined as non-specific. If more than one diagnosis was noted the specific diagnosis was given priority for the classification. The following consultation characteristics were assessed: the duration of the therapy; the total number of visits and the reason for ending the therapy. Furthermore, after every visit the physical therapist noted the date of the consultation and indicated the applied intervention: massage, exercise therapy, the application of physical modalities (i.e. ultrasound) and/or braces/orthoses. Besides these 4 categories a blank option was also available. The caregiver also had the opportunity to report any particular advice given to the patient.

Statistical analyses

The descriptive statistics were performed with SPSS 11.0 for windows software (SPSS, Inc. Chicago, IL.). Distribution of the possible diagnoses was calculated and separate inventories were made of the treatments applied by the physical therapists in the total and in the working population. This inventory shows how often each therapy was applied, and how many patients were treated with the individual interventions during the follow-up period. A scaled rectangle diagram was used to present the distribution of interventions [7]. The number of physical therapy consultations was summed from the first evaluation to the last visit. The duration of physical therapy care was the total number of weeks between the initial evaluation and case closure. The application of treatments was also investigated in the following subgroups; patients with specific complaints *versus* non-specific complaints, patients with local and non-local complaints, and patients with work-related and not work-related complaints.

RESULTS

Physical therapists

A total of 93 physical therapists agreed to participate, but finally 77 physical therapists (37 males, 40 females) recruited patients for the study. Their average number of years of professional experience was 14.0 (Standard Deviation [SD] 7.4). The average number of hours worked each week was 32.3 (SD 12.3). Almost one third (31%) of the participating physical therapists were specialized in manipulation techniques.

Patients

The physical therapists recruited 748 patients. Of these 710 met the inclusion criteria and finally 624 (83.4%) patients gave informed consent and filled in the baseline ques-

tionnaire. Of the 624 patients constituting our cohort, the physical therapists returned 619 treatment records. The mean age of the population was 43.5 (SD 11.4) years; 440 (70.5%) of the patients were women (70.5%) and 483 (77.4%) had a paid job (Table 1). Table 1 presents baseline data of the 624 patients; about half the patients (51.8%) had their complaints for >=3 months. (Table 1)

Table 1: Patient characteristics at baseline (N=624)

Variables		Score
Participant characteristics		
Age (years); mean (sd)		43.5 (11.4)
Women N (%)		440 (70.5%)
Education N (%)		
	Low	204 (32.7 %)
	Medium	203 (32.5 %)
	High	217 (34.8 %)
Sports participation, N (%)		299 (47.9%)
Body Mass Index (kg/m^2), [16.4-60.2] mean (sd)		25.3 (4.3)
Paid work (working population), N (%)		483 (77.4%)
Complaint specific characteristics		
Work-related complaints N (%)*		372 (59.6%)
Prognosis physical therapist, development chronic complaints N (%)		
	Very likely	111 (17.8 %)
	Likely	141 (22.6 %)
	Not likely	328 (52.6 %)
	Not likely at all	44 (7.1 %)
Duration of complaint; N (%)		
	More than 6 months	217 (34.8 %)
	3 to 6 months	106 (17.0 %)
	6 weeks to 3 months	151 (24.2 %)
	3-6 weeks	100 (16.0 %)
	0-3 weeks	50 (8.0 %)
Local complaint N (%)		339 (54.3%)
Specific complaint N (%)		223 (35.7%)
Co-morbidity (musculoskeletal) N (%)		286 (46.3%)
Co-morbidity (not musculoskeletal) N (%)		99 (16%)
Earlier musculoskeletal trauma N (%)		128 (20.6%)
Severity of complaints in the last week [0-10]; mean (sd)		5.7 *** (2.0)

Table 1 continued

Variables	Score
Location of complaints, N	
Neck	280
Shoulder	392
Upper back	77
Upper arm	73
Elbow	95
Forearm	30
Wrist	46
Hand	55

[..] =score range, sd= standard deviation
* = only assessed in the working population (n=483)
*** correction: 6.1

Diagnoses

The diagnoses were divided into specific and non-specific complaints. Table 2 gives the distribution of the diagnoses made by the physical therapists (more than one diagnosis per patient was possible). The majority of the patients had non-specific complaints

Table 2: Diagnoses made by physical therapists in the study population (N=619)

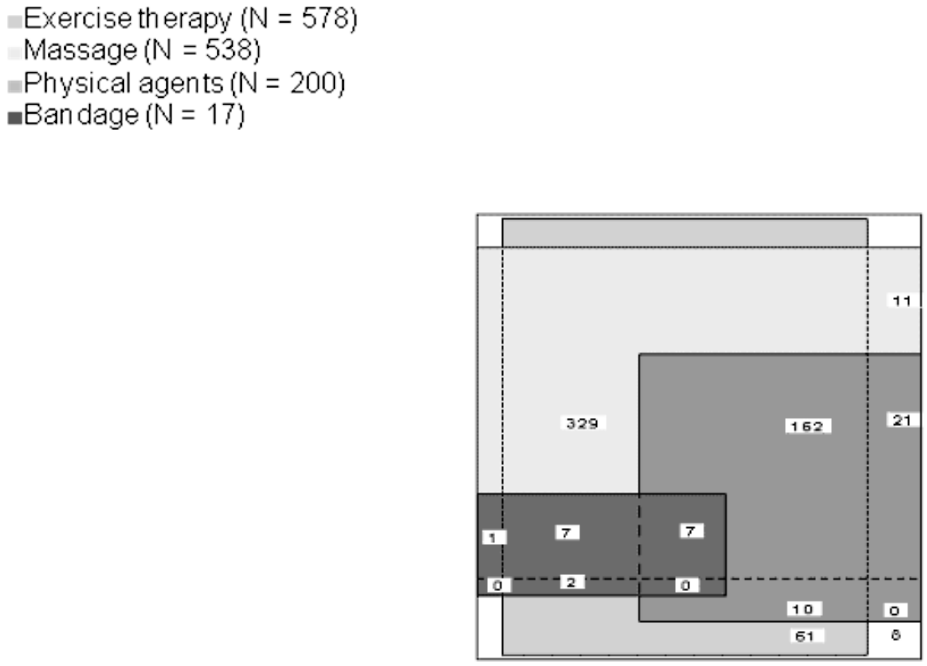
Diagnosis	Number of patients (%)*
Specific	
Rotator Cuff Syndrome	119 (19.1)
Epicondylitis;	
Lateralis	67 (10.7)
Medialis	21 (3.4)
Peritendonitis/tenosynovitis;	
Extensors	11 (1.8)
Flexors	4 (0.6)
Carpal Tunnel Syndrome	8 (1.3)
Quarvain's Syndrome	4 (0.6)
Radial Tunnel Syndrome	3 (0.5)
Cubital Tunnel Syndrome	2 (0.3)
Guyon Tunnel Syndrome	2 (0.3)
Raynaud's Phenomenon and Peripheral Neuropathy	1 (0.2)
Osteoarthrosis (elbow, wrist, hand)	9 (1.4)
Capsulitis/ frozen shoulder	17 (2.7)
Local arthritis (no Rheumatoid Arthritis)	11 (1.8)
Cervical hernia (radicular syndrome)	5 (0.8)
Non-specific	
Radiating neck complaints	452 (72.4)
Others	71 (11.4)

* More than one diagnosis per patient is possible.
For the classification mentioned in table 1 the specific diagnosis was given priority

(64%) and the most common problems were radiating neck complaints and rotator cuff syndrome. (Table 2)

Consultations

The participating physical therapists recorded 6957 visits by the study population, with an average of 11 visits (range1-49) per patient during the 6-month follow-up period; most patients visited the physical therapist 9 times (median and modus). Almost all physical therapists applied two interventions at 1 visit. Figure 1 shows that most interventions were a combination of massages and exercise therapy. The average treatment duration (i.e. the entire period a patient received physical therapy care during this study) was 10 weeks. After the 6-month follow-up period, 32 patients (5.2%) continued therapy. (Figure 1)



Figuur 1: Distribution of interventions in a scaled rectangle diagram.
The number in each area represents the number of patients. In case of intervention overlap, the number represents how many patients received that combination of interventions.

Interventions

Table 3 presents data on the number of patients receiving each type of intervention and the number of times the interventions were used by the physical therapists. The majority was treated with exercise therapy (93.4%) and massage (86.9%). Similar percentages

Table 3: Interventions applied during follow-up in the total population and per subgroup

Intervention	Total number of treatment sessions	Patients		Patients with (non) specific complaints		Patients with (non) local complaints		Patients by diagnostic category (the 3 main categories)**			Patients with (not) work–related complaints	
		Total population	Working population	Specific	Non-specific	Local	Non local	Radiating neck complaints	Rotator cuff syndrome	Epicondylitis (lateralis and medialis)	Work-related	Not work-related
	N=6957	N=619	N=479	N=223	N=396	N=337	N=282	N=452	N=119	N=73	N=369	N=110
Massage	71.4	86.9	87.3	87.0	86.9	86.9	86.9	88.3	91.6	94.5	87.5	86.4
Exercise Therapy	77.5	93.4	92.9	92.4	93.9	93.8	92.9	94.9	96.6	87.7	93.5	90.9
Physical modalities	21.7	32.3	31.3	43.5	26.0	32.3	32.3	29.4	47.9	46.6	31.4	30.9
Braces/orthoses	1.8	2.7	2.7	6.3	0.8	3.6	1.8	1.5	2.5	13.7	2.2	4.5
Manipulation techniques	8.8	19.9	20.7	11.7	24.5	19.3	20.6	23.2	10.9	15.1	21.4	18.2
Other	4.8	29.1	29.4	34.5	26.0	25.8	33.0	29.0	33.6	37.0	30.1	27.3

N=number of patients

Data are percentages

* Assessed in the working population (n=479)

** More than one diagnosis per patient is possible

emerged for the subgroup working population. Moreover, only minor differences were found between patients with (non) specific, (non) local and (not) work-related complaints. These percentages are almost the same as the data shown by diagnostic category. (Table 3) No difference is seen in the application of physical methods and braces/orthoses between the total and the working population, but more patients with specific complaints were treated with physical methods, which is shown by the data of epicondylitis and rotator cuff syndrome in Table 3. More patients with specific complaints, such as epicondylitis, those with local complaints and patients with not work-related complaints received braces/orthoses. In our study population 19.9% were treated with manipulation techniques; a similar percentage was found in the working population. More manipulation techniques were applied to patients with non-specific complaints, which is shown by the data of patients with radiating neck complaints in Table 3.

The remaining interventions that were less often applied consisted of acupuncture, behavioural treatment, breathing and relaxation therapy, background information/education and referral to another medical practitioner. Referral to another medical practitioner did not necessarily mean that physical therapy was discontinued. The percentages for the aforementioned interventions are similar in the working population and in the group of (non) specific, (non) local and (not) work-related complaints. More patients with specific complaints and those with non-local complaints received these interventions. These percentages are almost the same as the data shown by diagnostic category.

Table 4 gives data on the interventions per patient during the 6-month follow-up period. Patients with specific complaints on average received more interventions than the other patients. (Table 4)

Table 4: Interventions per patient during follow-up

Intervention	Patients with (non) specific complaints		Patients with (non) local complaints		Patients with (not) work-related complaints*	
	Specific	Non-specific	Local	Non-local	Work-related	Not work-related
	N=223	N=401	N=339	N=285	N=372	N=111
Massage	9.5 (7.6)	7.2 (5.8)	7.8 (6.4)	8.3 (6.8)	7.8 (6.6)	7.9 (6.3)
Exercise Therapy	10.6 (8.9)	7.7 (6.1)	8.9 (7.5)	8.6 (7.2)	8.6 (7.6)	8.1 (7.2)
Physical modalities	3.7 (6.4)	1.7 (4.1)	2.5 (5.4)	2.4 (4.9)	2.4 (5.1)	2.2 (4.2)
Braces/orthoses	0.5 (3.1)	0.0 (0.1)	0.3 (2.3)	0.1 (1.1)	0.1 (1.3)	0.5 (3.1)
Manipulation techniques	0.7 (2.2)	1.2 (2.6)	1.0 (2.3)	1.0 (2.6)	1.0 (2.4)	1.0 (2.6)
Other	0.6 (1.1)	0.5 (1.3)	0.4 (1.0)	0.7 (1.5)	0.6 (1.3)	0.4 (0.8)

N= number of patients
Data are mean (sd)
* Assessed in the working population (n=479)

DISCUSSION

Physical therapy plays a major part in the treatment of patients with complaints of arm, neck and/or shoulder [2]. To our knowledge this is the first large inventory of the treatment of these complaints in physical therapy practice. The results of this study show that exercise therapy (93%) and massage (87%) are the primary treatments in patients with complaints of arm, neck and/or shoulder. Most patients were treated with a combination of these intervention techniques.

Unfortunately little is known about the effectiveness of conservative treatment for complaints of arm, neck and/or shoulder. A Cochrane review showed limited evidence for the effectiveness in the favour of exercises in patients with chronic nonspecific neck and shoulder complaints when compared to no treatment [5]. Concerning massage it reported conflicting evidence concerning the efficacy in the treatment of upper extremity work-related musculoskeletal disorders; but most of the reviewed studies were of poor quality making it difficult to draw firm conclusions about the efficacy of treatments [5]. Karjalainen et al. [8] found little scientific evidence for the effectiveness of bio psychosocial rehabilitation (multidisciplinary treatment program) for upper limb repetitive strain injuries in working age adults [8].

Swenson [9] surveyed the therapeutic modalities in the management of non-specific neck pain and showed that the evidence from clinical trials suggests that exercise is beneficial in the management of neck pain. In addition, manipulation is at least as effective as intensive physical therapy or exercise programs; thermal treatments (including therapeutic ultrasound) and electromagnetic therapies, including Transcutaneous Electrical nerve Stimulation, have no demonstrated benefit on neck pain and remain unproven and cervical traction and soft-collars seem to be ineffective for non-specific neck pain [9].

Concerning the effectiveness of physiotherapy (laser, ultrasound, electrotherapy, exercise and mobilisation techniques) for lateral epicondylitis there is still insufficient evidence due to the contradicting results, low statistical power and the small number of studies per intervention. Only weak evidence was found for ultrasound compared to placebo [10]. Orthotic devices are often used as treatment strategy for tennis elbow; despite this common use, there is no clear evidence base for this specific application [11].

Regarding shoulder pain there is evidence to support the use of some interventions in specific and circumscribed cases. For example, exercise for rotator cuff disease with additional benefit from exercise plus mobilization and ultrasound is of no additional benefit over and above exercise alone [12].

Despite the small numbers of high quality Randomized Clinical Trials there is more support in literature for exercises or being active for different musculoskeletal complaints. Many patients in our cohort were still treated with a passive therapy such as

massage. For the analysis of exercise therapy we tried to divide this category into active, passive, and guided exercise therapy; however there was insufficient information to make a correct classification.

More patients with specific complaints were treated with physical methods; these patients may have clear localized symptoms for the physical therapist to use physical modalities like ultrasound.

There were more patients with specific complaints and those with local complaints were treated with braces/orthoses; patients with, for example, epicondylitis are mostly treated with braces.

More manipulation techniques were given in case of non-specific complaints; patients with (non-specific) radiating neck complaints were the largest group in the present study. Physical therapists usually treat these patients with mobilization techniques to decrease restrictions in movement. Hoving et al. found that for patients with non-specific neck pain, manual therapy seems to be a favourable treatment option compared to physical therapy or continued care by the general practioner [13]. Bergman et al. found that manipulative therapy for the shoulder girdle, in addition to usual medical care, accelerates recovery of shoulder symptoms [14]. About 31% of the participating physical therapists were specialized in spinal manipulation techniques which is somewhat more than the 24% of the physical therapists with this specialization registered at the Royal Dutch Society for Physical Therapy (KNGF).

A few limitations of this study should be discussed. First, we depended on the cooperation of the physical therapists for the recruitment of participants. Consequently, as in most clinical studies, it is possible that not all consecutive patients with complaints of arm, neck and/or shoulder were included. However, because the physical therapists did not have a computerized patient registry we were unable to evaluate possible entry selection in our study population.

Moreover, because no standardized physical tests were available to classify the patients, we had to rely on the reported diagnosis of the physical therapists.

The study is a pure observational one. At this time, to our knowledge, there are no guidelines for the treatment of CANS available for the physical therapists. Therefore we expected no desirable care provision or reporting.

The frequently used treatment massage may be country specific, but there is, to the authors' knowledge, no information about this issue. It is possible that other treatments are given in other countries. International evidence based literature is needed to compare the most common treatments in different countries.

The study population included in our cohort might differ from people with similar complaints but not referred to physical therapy, or even not having been in contact with medical care. For example in countries where the therapeutic community is less aware of the potential consequences of a whiplash injury, no difference in severity of

subsequent chronicity of neck pain in people after whiplash, and age and sex-matched people not exposed to any neck injury was shown [15,16].

From studies in countries where medical care is frequently involved in musculoskeltal complaints, for neck and shoulder complaints about 53% [17], we know that medical care consulters with musculoskeletal complaints have more severe complaints compared with people with the same complaints not consulting medical care. Studies on musculoskeletal pain in general, and of shoulder and neck pain showed that high pain intensity, sickness absence, long duration of the complaint and widespread pain were positively associated with consulting for medical care. [18,19] Another study on shoulder-neck pain [20] reported that people who seek care have worse prognosis compared to those who manage it themselves. However there are no factors known to be associated with referral to physical therapy, and therefore we do not know how many patients in our cohort differ from those with the same complaints but not referred. The only indication for this can be postulated from a recent published observational prospective cohort study concerning new consulters for neck and shoulder complaints in general practice [21]. This study describes a mean intensity of pain of 5.1 (SD 2.2) on a scale from 0 to 10 and 63% of the population consists of women. In our study population the mean severity of complaints was 5.7 (SD 2.0) on a scale from 0 to 10 and 70.5% of our study population consists of women. We think these results indicate that our study population does not differ much in severity of complaints from the whole group with neck and shoulder complaints in general practice.

CONCLUSIONS

The present study has produced a large inventory of the treatment of complaints of arm, neck and/or shoulder. Little is known about the effectiveness of frequently applied intervention techniques to (sub)groups of patients with complaints of arm, neck and/or shoulder. Future studies could focus on such evaluation of exercise therapies (combined or not combined with massage) for patients with complaints of arm, neck and/or shoulder.

ACKNOWLEDGEMENTS

The authors thank all the physical therapists and participants for their cooperation in this study.

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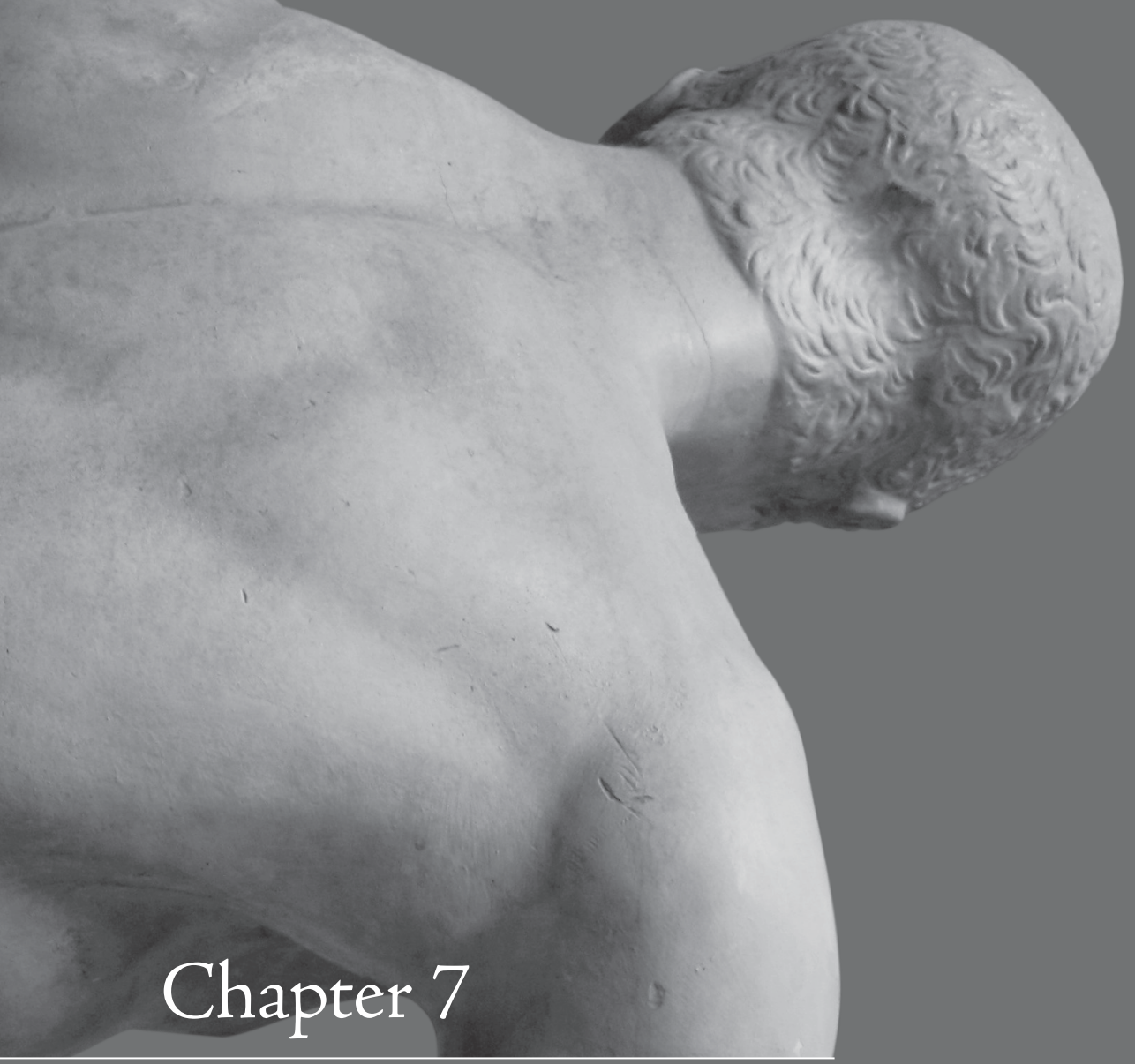

Chapter 7

Pain severity and catastrophising modify treatment success in neck pain patients in primary care

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ABSTRACT

Background Most patients with non-specific neck pain are treated in primary care by general practitioners, with as most frequently used interventions: a "wait and see" policy or referral for physiotherapy or manual therapy. It is unclear whether there are subgroups of patients who are more likely to benefit from either therapy.

Objective To evaluate whether clinical factors at baseline in patients with non-specific neck pain are related to recovery after treatment with manual therapy versus physiotherapy.

Method Participating physiotherapists recruited new consulters with complaints of the neck and/or upper extremity. For this study we selected patients from this cohort with non-specific neck complaints. Participants filled in questionnaires at baseline, 3 and 6 months. The main outcome measure was recovery at 6 months follow-up. Possible predictors like complaint specific factors, physical factors, social and psychological factors were evaluated for interaction with treatment.

Results Of the 396 participants in this study, 97 (24.5%) received manual therapy, all others received physiotherapy, consisting of exercises, massage or physical applications. In the multivariable model four variables were significantly related to recovery: duration of complaint, catastrophising, distress and somatisation. Severity of main complaint and catastrophising appeared to show interaction with treatment. It appeared that every point increase in severity or catastrophising resulted in a lower chance to recover from physiotherapy compared to manual therapy.

Conclusion Severity of main complaint and catastrophising seem to modify treatment success. Increased pain severity or catastrophising at baseline increased the chance of treatment success after manual therapy compared to physiotherapy.

Key words: treatment, interaction, manual therapy, physiotherapy, prospective cohort study

What this paper adds

What is already known:

- In primary care most neck pain patients are treated with a "wait and see" policy or referral for physiotherapy or manual therapy.
- Physiotherapy or manual therapy are effective treatment strategies, but the effect sizes are rather small.
- Increasing attention is being paid to factors that predict recovery with a specific treatment.

What this study adds:

- Treatment effect can be modified by targeting treatments to specific patients
- In patients with non-specific neck pain severity of main complaint and the catastrophising score seem to modify treatment success.

INTRODUCTION

Neck pain is a common musculoskeletal complaint with an estimated point prevalence in adults in the general population of 5.9% - 22.2%, a 1-year cumulative incidence of 14.6% - 42% and a lifetime prevalence ranging from 14.2% - 71% [1,2].

Most patients with non-specific neck pain are treated in primary care by general practitioners, with as most frequently used interventions: a "wait and see" policy or referral for physiotherapy or manual therapy [3]. In patients with non-specific neck pain the positive effects of physiotherapy and manual therapy in comparison to placebo or a "wait and see" policy are relatively small [4,5]. In the literature several factors are reported to be related to recovery in patients with non-specific neck pain, such as: age, gender, pain intensity, and duration of neck pain [1,6-9].

More recently increasing attention is being paid to factors that predict recovery with a specific treatment [10,11]. In a randomised clinical trial (RCT) was found that thoracic spine thrust manipulation might be useful in the management of patients with neck pain [12]. Next the authors evaluated in a cohort study of 78 patients with neck pain who were referred for physiotherapy the ability of variables from the initial examination to identify patients that are most likely to benefit from thoracic spine thrust manipulation [10]. The authors found six variables to be related to recovery. When subjects were found positive on 4 out of the 6 variables the probability of recovery increased from 54% to 93% [10]. This conclusion is based on a prognostic model from a cohort study where all patients received the same treatment.

In another study data of three RCTs on treatment of non-specific neck pain were combined to evaluate whether variables from the initial examination can identify patients that are more likely to benefit from physiotherapy, manual therapy or general practitioners care [11]. In this study nine variables were found predictive for recovery, of which pain intensity was found to interact with treatment on short-term outcome, and age and accompanying low back pain on long-term outcome (52 weeks). At the short-term the recovery rate was 32.4% for patients receiving a treatment not advised by the model, and 57.6% for patients receiving a treatment suggested by the model. This difference is statistically significant: 25.2% (95% confidence interval (CI): 12.9% - 37.6%). For the long-term recovery rate was 50% for patients receiving a non-advised treatment, and 62.4% for patients receiving an advised treatment (difference: 12.4%; 95% CI: -12.7 - 37.4%) [11].

Both studies resulted in a clinical prediction rule for physiotherapy or manual therapy [10,11], but because of the different designs and origin of the datasets the two clinical prediction rules are quite different. The aim of the present study was to further evaluate whether it is possible to identify subgroups of patients with non-specific neck pain who are more likely to benefit from either manual therapy or physiotherapy. Therefore we

analysed in a large cohort study baseline characteristics for their interaction with treatment (physiotherapy or manual therapy).

METHODS

Design

We used the data from a prospective cohort study carried out in physiotherapy practices in four provinces in the western part of the Netherlands [13]. The population consisted of consecutive patients with arm, neck and/or shoulder complaints presenting in the participating physiotherapy practices [13].

Patient population

Included in the cohort study were new consulters between 18 - 65 years with pain and discomfort in neck and upper extremities (neck, upper back, shoulder, upper arm, elbow, forearm, wrist and hand) consulting the participating physiotherapists between August 2001 and July 2002. Exclusion criteria were: consultation of the physiotherapist in the previous 6 months for the same complaint, acute complaints caused by a trauma, systemic disorders and/or generalised neurological syndromes, co-morbidity causing severe disability in daily activities, and not being able to fill in Dutch questionnaires. From this cohort we selected the patients with a non-specific neck complaint. We defined complaints as specific if the physiotherapist had made a choice of a specific diagnosis from a predefined list [13]. All other complaints, including radiating neck complaints, were defined as non-specific. If more than one diagnosis was noted, the specific diagnosis was given priority for the classification [13,14].

Physiotherapists

The participating physiotherapists were all qualified, registered at the Royal Dutch Society for Physical Therapy (KNGF) and working within the region of interest. In total 93 physiotherapists agreed to include patients for the cohort study, but finally 77 (83%) (37 males, 40 females) actually included patients. Almost one third (31%) of the participating physiotherapists were also registered as manual therapists [13].

Measurements

Data were collected by means of self-administrated questionnaires at baseline, and at 3 and 6 months follow-up. During the first consultation the physiotherapist handed out the baseline questionnaire together with informed consent forms. The follow-up questionnaires were sent to the patient's home addresses by the research institute. All questionnaires had to be completed within 8 weeks; reminders were sent two weeks

after mailing the questionnaire. The physiotherapists completed a treatment record and all participants received standard care for their complaints.

At baseline the following possible prognostic factors were assessed: 1) participant characteristics: age, gender, educational level, body mass index, sports, and work participation; 2) complaint-specific characteristics: severity and duration of the complaints, co-morbidity, earlier musculoskeletal trauma of arm, neck or shoulder, and the prognosis as assessed by the physiotherapist; 3) social and psychological factors: fear of movement (Tampa Scale of Kinesiophobia (TSK-DV)), social support (Social Support Questionnaire (SSQ)), somatisation and distress (two scales of the Four Dimensional Symptom Questionnaire (4DSQ)), catastrophising (subscale catastrophising from the Coping Strategy Questionnaire (CSQ)), social and psychological factors at work (Dutch translation of the core Job Content Questionnaire (JCQ)); 4) physical factors: physical activities during leisure time, physical load at work (Dutch Musculoskeletal Questionnaire (DMQ)) [13].

Outcome

The primary outcome measure was perceived recovery (7-point Likert scale, ranging from completely recovered (=0) to worse than ever (=6)). The scores were dichotomised into recovered (completely recovered and much improved) and persistent complaints.

Treatment

The physiotherapist recorded in a booklet the diagnosis (specific or non-specific) and assessed consultation characteristics (duration of the therapy, and the total number of visits and the reason for ending the therapy). At every visit, the physiotherapist noted the applied intervention: manual therapy (specific mobilisations and manipulations), massage; exercise therapy; the application of physical modalities (*i.e.*, ultrasound); and/or braces/orthoses. Treatment options were dichotomised into physiotherapy alone consisting of exercise therapy; massage; the application of physical modalities and braces/orthoses or manual therapy (physiotherapy + mobilisations and manipulations).

Analysis

Imputation of missing values in the data was carried out by multiple imputation using all observed information including the outcome [15,16]. A total of 5 imputed databases were created. To be able to calculate the regression coefficients and standard errors of the predictors and interaction-terms we combined the 5 imputed datasets, according to Rubins' rules [17].

First we calculated frequencies of baseline characteristics and compared the study sample with the original cohort. Next, based on the literature, we selected possible predictors related to recovery: gender, age, severity of complaint (11-pt numerical rating scale (NRS)), duration of complaint (5 categories). Furthermore we selected possible

predictors measured in this cohort: education (3 categories), co-morbidity (yes/no), catastrophising, distress, somatisation, social support, and kinesiophobia.

Predictors for recovery were identified using univariabele and multivariable logistic regression analysis (backward Wald selection). In this selection procedure, the variables with the highest p-value were removed from the model one at a time, until all remaining variables had a p-value <0.05. Next, all variables were tested for interaction with treatment ($p<0.05$). Every interaction-test was corrected for the predictors for recovery found in the multivariable logistic regression analysis. This was done to evaluate which factors have an effect on the relative success of manual therapy or physiotherapy, while adjusting for other predictors.

RESULTS

Patient population

Between August 2001 and July 2002, 624 patients were recruited for the original cohort. In total 397 patients with non-specific neck pain were eligible for the present study [13]. Patient characteristics and initial baseline variables from the total cohort and the eligible patients for this study are presented in table 1.

No important differences were found between the original cohort and our study sample on all baseline characteristics. The mean age of the population was 42 years old and 74% were women. The majority of the population (51.1%) had chronic complaints (over 3 months), and the mean severity score at baseline in the cohort was 6.1 (range was 0-10).

Of all 397 participants, 97 (24.5%) received manual therapy; all other patients received only physiotherapy. The vast majority of the patients received exercise therapy (93.9%) and massage (86.9%). Also physical modalities (26.0%) were given when indicated [14].

Follow-up

At 6 months, 230 subjects (57.9%) were categorized as being recovered, 56 (57.5%) of which were in the manual therapy group. Results from the regression analysis are presented in table 2.

Using univariable logistic regression analysis, seven predictor variables appeared to be significantly related to recovery (significance level of less than 0.05): severity of the complaint, co-morbidity (musculoskeletal), duration of complaint, catastrophising, distress, kinesiophobia and somatisation. In the multivariable model four variables contributed significantly to the model: duration of complaint, catastrophising, distress and somatisation (see table 2). Next all variables were tested for interaction with treatment. The interaction-test was corrected for the predictors of recovery found in the multivari-

Table 1: Participant characteristics at baseline

Variables	Total sample (n=624)	Eligible sample (n=397)
Participant characteristics		
Age (years); mean (sd)	44.0 (15.5)	42.7 (17.7)
Women, N (%)	440 (70.5)	294 (74.2)
Educational level: N (%)		
Low	204 (32.7)	128 (32.3)
Medium	203 (32.5)	129 (32.5)
High	217 (34.8)	139 (35.2)
Sports participation N (%)	299 (47.9)	186 (46.9)
Body Mass Index (kg/m2), [16.4-60.2] mean (sd)	25.3 (4.3)	25.2 (3.8)
Paid work (working population), N (%)	483 (77.4)	300 (75.9)
Complaint specific characteristics		
Work-related complaints N (%)*	372 (77.0)	300 (75.9)
Prognosis physiotherapist, development chronic complaints N (%)		
Very likely	111 (17.8)	73 (18.4)
Likely	141 (22.6)	70 (17.7)
Not likely	328 (52.6)	225 (56.9)
Not likely at all	44 (7.1)	28 (7.0)
Duration of the complaint; N (%)		
0-3 weeks	50 (8.0)	37 (9.5)
3-6 weeks	100 (16.0)	61 (15.5)
6 weeks to 3 months	151 (24.2)	95 (23.9)
3 to 6 months	106 (17.0)	55 (13.8)
More than 6 months	217 (34.8)	148 (37.3)
Severity of complaints in the last week [0-10]; mean (sd)	6.1 (2.0)	6.1 (2.0)
Local complaint N (%)	339 (57.2)	213 (53.7)
Specific complaint N (%)	223 (35.7)	0
Co-morbidity (musculoskeletal) N (%)	286 (46.3)	176 (44.4)
Psychosocial factors		
Distress [0-32]; mean (sd)	11.2 (8.5)	12.1 (8.6)
Somatization [0-32]; mean (sd)	9.4 (6.0)	10.3 (5.7)
Kinesiophobia [17-68]; mean (sd)	34.3 (6.6)	33.2 (6.3)
Catastrophising [0-60]; mean (sd)	13.5 (12.3)	13.2 (11.5)
Social Support [12-60]; mean (sd)	53.1 (8.0)	53.3 (7.8)
Psychosocial factors in work *		
Job insecurity N (%)	87 (18.2)	43 (14.2)
Co-worker support [4-16]; mean (sd)	11.9 (1.7)	11.8 (1.8)
Supervisor support [4-16]; mean (sd)	10.9 (2.6)	10.8 (2.7)
Quantitative job demands [12-48]; mean (sd)	31.5 (6.1)	31.5 (6.1)
Skill discretion [12-48]; mean (sd)	34.2 (6.1)	34.3 (5.9)

Table 1 continued

Variables	Total sample (n=624)	Eligible sample (n=397)
Decision authority at work [12-48]; mean (sd)	35.9 (7.5)	36.7 (7.2)
Physical factors		
Physical heavy work in leisure time [0-12]; mean (sd)	2.6 (1.7)	2.7 (1.7)
Static repetitive activities in leisure time [0-6]; mean (sd)	1.6 (1.2)	1.6 (1.3)
Physical heavy work [0-100]; mean (sd)*	21.6 (23.6)	23.7 (23.8)
Static repetitive work [0-100; mean (sd) **	45.0 (23.1)	43.3 (22.6)

[..] =score range, sd= standard deviation
*=only assessed in the working population (N=483), **=only assessed in the working population (N=452)

Table 2: Logistic regression model

Variable	Univariable			Multivariable		
	OR	95% CI	p-value	OR	95% CI	p-value
Age	0.99	0.98-1.02	0.92			
Gender (female=1)	1.51	0.81-2.86	0.18			
Education level			0.22			
Low	Ref					
Medium	0.89	0.51-1.54				
High	0.6	0.34-1.05				
Severity complaint past week (0-10)	1.25	1.09-1.4	**0.0005**	1.08	0.92-1.28	0.31
Co-morbidity	1.8	1.14-2.86	**0.012**	0.94	0.53-1.67	0.83
Treatment			0.74			
Physiotherapy	Ref					
Manual therapy	0.91	0.52-1.58				
Duration of complaint			**0.0002**			**0.0125**
0-3 weeks	Ref					
3-6 weeks	0.85	0.44-1.61		0.97	0.47-1.99	
6 weeks – 3 months	0.36	0.21-0.63		0.53	0.29-0.97	
> 3 months	0.32	0.17-0.61		0.38	0.19-0.75	
Catastrophising	1.04	1.02-1.06	**<0.0001**	1.03	1.01-1.06	**0.015**
Distress	1.03	1.01-1.06	**0.0069**	0.97	0.93-1.0	**0.03**
Kinesiophobia	1.08	1.03-1.14	**0.0015**	1.05	0.99-1.11	0.09
Social support	0.98	0.95-1.01	0.19			
Somatisation	1.14	1.09-1.2	**<0.0001**	1.14	1.08-1.2	**<0.0001**
Interaction term severity main complaint * treatment				0.68	0.48-0.98	**0.037**
Interaction term catastrophising * treatment				0.94	0.88-0.99	**0.046**

OR = Odds Ratio; ref. = reference category, 95%-CI = 95% confidence interval
OR < 1 reflects a higher probability of recovery and OR > 1 a higher probability of persistent complaints, compared to the reference category

able logistic regression analysis. Two variables appeared to show interaction: severity of main complaint (OR of interaction term=0.7; 95%CI: 0.50-0.98) and catastrophising (OR of interaction term = 0.9; 95%CI: 0.88-0.99).

Interaction

Concerning the interaction between treatment and severity of complaint or catastrophising the relationship is presented in a figure (see figure 1 and 2).

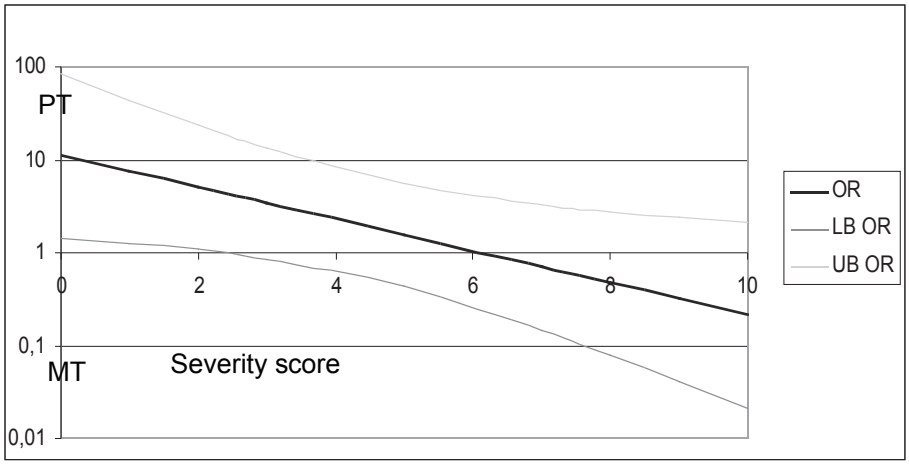
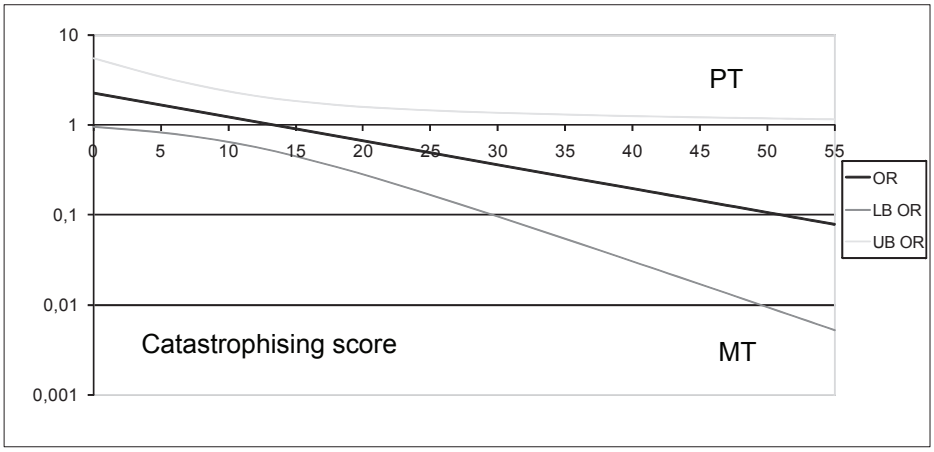


Figure 1: Relation between severity sores and treatment (when catastrophising = 0)
PT = physiotherapy; MT = manual therapy
OR = Odds ratio; LB OR and UB OR are the lower and upper bounds of the 95% confidence interval



Figuur 2: Relation between catastrophising and treatment (when severity = 0)
PT = physiotherapy; MT = manual therapy
OR = Odds ratio; LB OR and UB OR are the lower and upper bounds of the 95% confidence interval

Concerning severity of the complaint figure 1 shows that when people have a severity score of 0, there is a higher chance of recovery with physiotherapy compared to manual therapy. For every point increase in pain, the OR will decrease (see figure 1). In other words: every point increase in severity (on an 11-point NRS) results in a lower chance to recover from physiotherapy than from manual therapy. When people score a 6 on the NRS chances of recovery with physiotherapy and manual therapy are equal and with a severity score > 6 there is a higher chance to recover from manual therapy than from physiotherapy. The mean severity score in this cohort was 6.1 (SD 2.0), and almost 50% of participants scored >6 on the severity score. In people with severity scores less than 2 (3% of participants), physiotherapy is significantly more beneficial than manual therapy. Catastrophising was measured with 6 items scored from 0 to 10, based on the subscale catastrophising from the Dutch version of the Coping Strategy Questionnaire (CSQ) [18]. The scores ranges from 0-60 and high scores indicate more catastrophising. Overall the study population scored low on the catastrophising scale; mean 13 (see table 1). Figure 2 shows that for every point increase on the catastrophising scale, the OR will decrease; meaning that the more patients are catastrophising the higher the chance they will recover with manual therapy. When people score a 12 on the catastrophising scale chances of recovery with physiotherapy and manual therapy are equal. The advantage of physiotherapy over manual therapy or vice versa is never statistically significant.

DISCUSSION

Severity of the complaint and catastrophising were the only variables that showed interaction with treatment, which means that all other variables are more generic. With a severity score of less than 2, which is the case in 3% of the participants, physiotherapy is significantly more beneficial than manual therapy in our study.

Our findings are slightly different from the clinical decision rule of Schellingerhout et al [11], but differ greatly from the one developed by Cleland et al [12]. Severity of main complaint is frequently found to be related to recovery, and in this study and the study of Schellingerhout et al severity of the complaint interact significantly with the treatment given. As far as we know, this interaction has never been evaluated before

In a cohort study daily practice is observed. This means that the diagnosis of non-specific complaints and the treatments given are not standardised. Participating physiotherapists decided based on their own experience whether the complaint was specific or not. We know that diagnostic labelling is often arbitrary with low reproducibility [19]. Physiotherapy provided in this cohort study varies between physical applications, massage and exercise therapy [14]. Almost all patients received amongst others a combina-

tion of massage and exercise therapy. Whether the lack of standardisation influenced the results is unknown.

When building a predictive model, the disadvantage of using a prospective cohort study, instead of a RCT, is that there is a risk of biased results due to confounding by indication. Nevertheless confounding by indication is common daily practice, and in a cohort study like this confounding by indication is comparable to daily practice. In the study of Schellingerhout et al [11] as well as in the present study severity of main complaints interacts with treatment, showing that confounding by indication did not play an important role. Contrary to the study of Schellingerhout et al [11] we did not find evidence for interaction of age.

One common problem in the development of prediction models is that one can only evaluate variables on interaction that have been measured. The research question(s) for the original cohort focussed on the clinical course of patients with complaints of the neck and upper extremities, and whether there was a difference in clinical course (and recovery) between patients with work related complaints or not. Therefore in this cohort study several psychological variables have been measured, while these were not measured in the RCTs used in the study of Schellingerhout et al [11]. On the other hand in this cohort study the factor 'concomitant low back pain' was not measured, which appeared to interact with treatment on the long term in the study of Schellingerhout et al. Apparently in this cohort some psychological factors were related to recovery in general, and one appeared to interact with treatment. This factor (catastrophising) is rarely evaluated in other studies and never in clinical prediction models.

Another common problem in the development of prediction models is that researchers often use variables from physical examination, which are not investigated on their reliability, or appear to have a poor reliability [10,20,21]. In that case one cannot determine whether these predictor variables provide adequate reproducibility to be included in the prediction model [22]. We included only variables from history taking and questionnaires because their validity and reliability are better known [23]. Furthermore none of the studies on predictors found in the literature considered the predictive value of variables coming from physical examination as significantly related to recovery [1,6-8,24].

In order to find a clinical prediction rule that is able to define subgroups of patients, which are more likely to benefit from a specific treatment, we first evaluated one in a data set of RCTs [11]. This clinical prediction rule was internally validated, but external validation appears to be difficult because of a lack of suitable databases. Therefore we performed more or less the same analysis in this prospective cohort study with the same goal: to evaluate whether subgroups of patients can be defined which are more likely to benefit from a specific treatment. In both studies severity of the complaint modifies treatment success. This study strengthens the previous finding that severity of main complaint in patients with non-specific neck pain interacts with the treatment given

and that the chance of recovery increases when the appropriate treatment is provided; physiotherapy in patients with low pain severity and manual therapy in patients with high pain severity. Nevertheless this hypothesis should now be tested in a randomised clinical trial, where the effectiveness use of the clinical prediction rule is evaluated, compared to not using the clinical prediction rule (standard care).

In conclusion, in patients with non-specific neck pain severity of main complaint and the catastrophising score seem to modify treatment success. Higher severity or catastrophising scores increase the chance of treatment success with manual therapy in comparison with physiotherapy.

CONTRIBUTIONS

APV, SMAB-Z designed the study; SW performed the analysis; CK was responsible for data collection; APV was responsible for writing the manuscript; SMAB-Z, APV, CK, JMS and BWK critically read and approved the manuscript; APV and SMAB-Z guaranteed the study.

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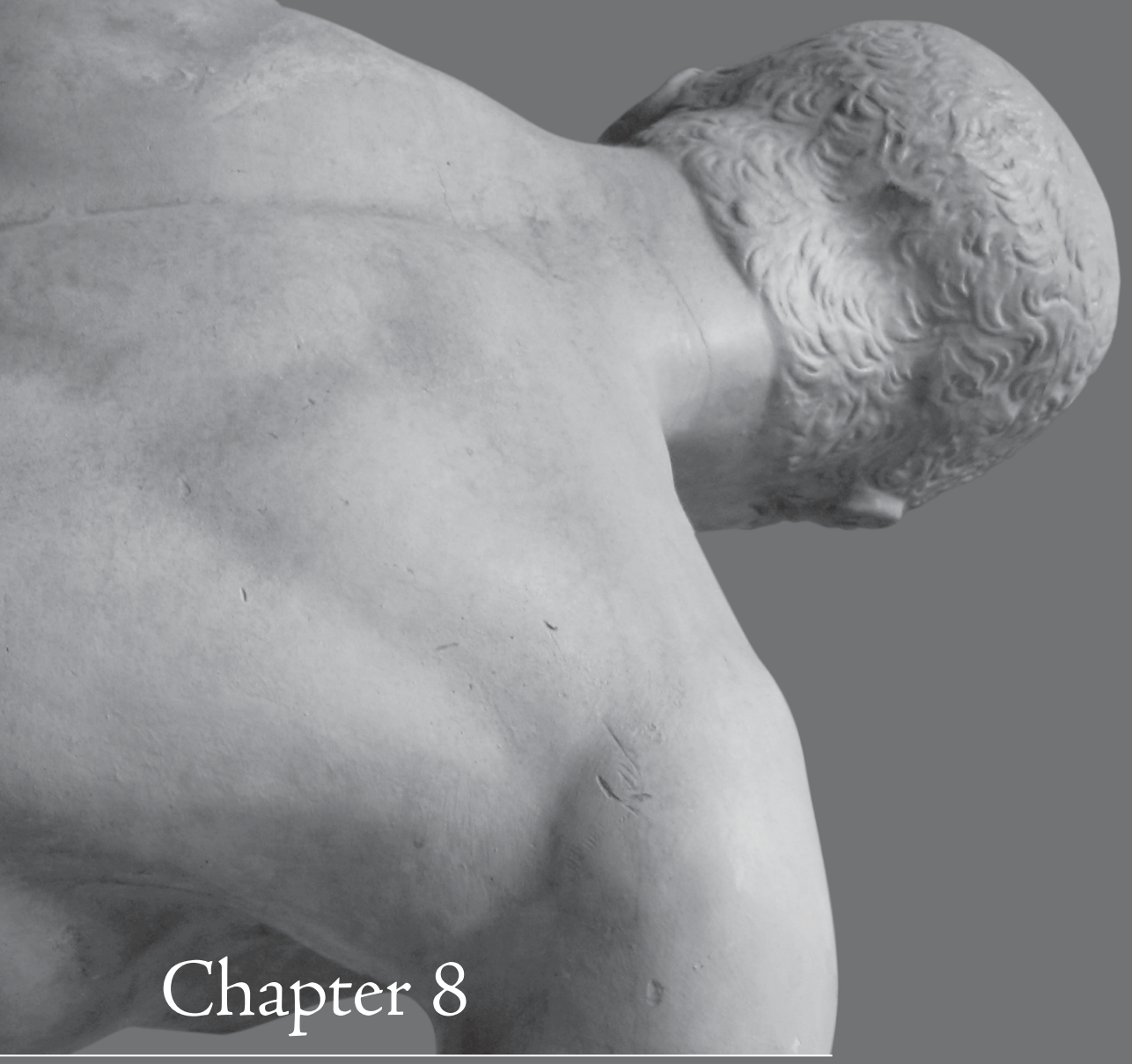

Chapter 8

General Discussion

This thesis describes the course, prognosis and management of arm, neck and shoulder complaints in physical therapy practice.

This chapter addresses the main results and limitations of the studies, and discusses the implications for daily practice and recommendations for further research.

COURSE OF COMPLAINTS

At short-term (3 months), mid-term (6 months) and long-term follow-up (18 and 24 months) about 40% of the patients in our cohort study reported not to have recovered from arm, neck and shoulder complaints. These results are in line with earlier studies in general practice reporting on the short-term and mid-term course in patients consulting for these complaints [1-4].

Our study also showed that at long-term follow-up (up to 24 months) the percentage of patients reporting not to be recovered was about the same as that at short-term and mid-term follow-up. The total percentages (dichotomized as recovered versus non-recovered) on the short, mid and long term were similar and stable. Further examination of the dichotomized results shows that the percentage of strongly improved subjects had declined and the percentage of completely recovered persons had increased. Thus, at 24 months more patients had reported to be completely recovered, but the overall differences compared to 6-months follow-up were small.

A similar pattern was seen when examining mean functional limitations and mean severity of the complaints.

Regarding the prognostic factors for the persistence of complaints, we found that mainly social and psychological factors influence the course of arm, neck and shoulder complaints at both short-term and long-term follow-up. At 6-months follow-up the variables predictive for the persistence of complaints were: a long duration of complaints at baseline, high somatization, high kinesiophobia, more catastrophizing, and (among workers) lack of decision authority at work. At 24 months the variables were: a long duration of complaints at baseline, co-morbidity (not musculoskeletal), high somatization, and high kinesiophobia.

The results of our study confirm those of earlier studies. The role of the factor 'somatization' is in line with another study investigating arm, neck and shoulder complaints in general practice [2], and similar to other findings in musculoskeletal complaints [5], back pain [6], and acute whiplash patients [7].

However, other social and psychological factors are also reported to be predictors for the persistence of complaints in patients with arm, neck and shoulder complaints. These include variables such as more worrying [3], using retreating as a coping style [3], experiencing less social support [2,3], and (among workers) lack of supervisory support [2].

The factor 'longer duration of complaints' was the most consistent predictor of the persistence of complaints [1-4, 8-10] and may be explained (in part) by the use of prospective cohorts of patients who consulted; patients who did not consult and had meanwhile recovered are not included in such cohorts.

In our cohort study, a considerable effort was made to study the long-term course of arm, neck and shoulder complaints. However, little additional information about the course and prognostic factors was obtained. The question therefore arises whether it is worthwhile to conduct prospective cohort studies which have a maximum of 6-months follow-up, when investigating patients with arm, neck and shoulder complaints. Nevertheless, in our study population we now have better insight into the more-or-less stable course at the group level between 6 and 24 months of follow-up.

We also studied the recurrence of complaints during long-term follow-up. It was found that about 60% of the patients who were recovered at 6-months follow-up had a recurrence of arm, neck and shoulder complaints between 6 and 24 months of follow-up. This result is comparable with another study showing recurrence rates of more than 60% for both neck and shoulder complaints in a working population during 24 months of follow-up [11]. Others have reported recurrent episodes of shoulder complaints among 41-51% of patients in primary care during 18-months follow-up [10,12], and more than 50% of all subjects with chronic shoulder pain reported disabling symptoms about 3 years later [13].

Secondly, in the multivariate model we found that higher scores on somatization, earlier musculoskeletal trauma and musculoskeletal co-morbidity, contribute to the recurrence of complaints at 24-months follow-up. Being male and regularly doing sports reduce the risk of recurrence of complaints at 24-months follow-up.

This means that somatization seems to influence both the chronicity and the recurrence of complaints. Whether doing regular sports represents a certain lifestyle or a personality, or whether such activity really does prevent recurrence, needs further elucidation.

Chapter 4 presents a study on sickness absence in patients with arm, neck shoulder complaints. Determinants associated with sickness absence during 6 months follow-up were work-related complaints, early musculoskeletal trauma, higher severity of complaints at baseline, higher somatization and low decision authority at work.

As also found for the outcome 'persistence of complaints' (see chapters 2 and 3), a social and psychological factor, like somatization, again proved to be an important determinant.

Almost all social and psychological factors (somatization, distress, catastrophizing and kinesiophobia) were univariately associated with the occurrence of sickness absence, but because of the correlations between these factors it is a coincidence which factor

will survive the multivariate analysis. Somatization was the strongest factor and is therefore in our total model.

An earlier study on patients with musculoskeletal illness in general practice also reported that psychological distress and somatization are significant predictors of sick leave [5].

Another important social and psychological factor associated with the occurrence of sickness absence during 6 months follow-up was a low decision authority at work. This result in arm neck and shoulder patients is in line with different studies, which describe that this factor is associated with sickness absence in general. [14-17]

MANAGEMENT OF COMPLAINTS

Our results show that the majority of the patients were treated with exercise therapy (93%) and massage (87%), and most patients were treated with a combination of these intervention techniques. Relatively more patients with specific complaints were treated with physical modalities (such as ultrasound) while patients with non-specific complaints were relatively more often treated with manipulation techniques.

Our review on work-related complaints of arm, neck or shoulder showed limited evidence in subjects with carpal tunnel syndrome for the effectiveness of exercises when compared to massage, adding breaks to computer work, massage as add-on treatment to manual therapy, manual therapy as add-on treatment to exercises, and some types of keyboards (compared with other keyboards or placebo). For other interventions no clear effectiveness could be demonstrated. Overall, the quality of the reviewed studies was poor. There is a small number of high-quality randomized controlled trials which indicate that exercises or being active may be effective for different musculoskeletal complaints.

A Cochrane review on mechanical neck disorders (about 70% of the patients in our study population were diagnosed with radiating neck complaints) showed strong evidence of benefit in favour of a multimodal care approach of exercise combined with mobilisation or manipulations for sub- acute and chronic mechanical neck disorders (with or without headache) in the short and long term. The common elements in this care strategy are mobilisation and/or manipulation plus exercise. It is unclear what the relative benefit of exercise therapy is when compared to other treatments [18,19].

The effectiveness of massage as monotherapy for neck pain remains uncertain, therefore no recommendations can be made regarding this particular intervention [20].

Our study showed that different type of interventions are used for patients with specific and non-specific complaints. Relatively more patients with specific complaints were treated with physical modalities and relatively more patients with non-specific

complaints were treated with manipulation techniques. Patients with specific complaints may have clearly localised symptoms thus enabling the physical therapist to use modalities such as ultrasound.

Manipulation techniques were often applied in case of non-specific complaints; in our study patients with (non-specific) radiating neck complaints were the largest group. Physical therapists usually treat these patients with mobilization techniques to decrease restrictions in movement; this is in line with the evidence presented in a Cochrane review [18]. Another study reported that manipulative therapy for the shoulder girdle, in addition to usual medical care, accelerates recovery of shoulder symptoms [21].

Additionally (as shown in chapter 7), the severity of the main complaint and catastrophizing seem to modify treatment success. Primary care patients with neck pain and with increased pain severity or catastrophizing at baseline, have an increased chance of treatment success after manual therapy compared to physiotherapy. This factor (catastrophizing) is rarely evaluated in studies and never in clinical prediction rules. This interaction might be explained by the patient's experience when treated with manual therapy, i.e**.** because the treatment proposed working mechanism maybe easily accepted by the patient they might perceive more benefit in such treatment.

CLINICAL GUIDELINES

In 2008 the Dutch College of General Practitioners updated the Dutch guideline on shoulder complaints, and in 2009 they updated the Dutch guideline on epicondylitis [22,23].

The Dutch guideline for general practitioners does not recommend treatment of epicondylitis by means of physical therapy. When our study started in 2001, about 12% of the patients in our study population were diagnosed with epicondylitis by the physical therapist and treated with various physical therapy interventions [23]. The Dutch guideline for shoulder complaints recommends exercises or manual therapy when complaints persist after 1-2 weeks despite advice and the use of analgesics [22]. Most of the patients in our study population experienced shoulder complaints; 93% of our study population received exercise therapy, which is in line with the Dutch guideline for shoulder complaints. Unfortunately, until now, no guidelines are available for the Dutch physical therapists for the treatment of arm, neck and/or shoulder complaints, but are expected to be published late 2009 or in 2010.

The Bone and Joint Decade 2000-2010 Task Force on Neck Pain and its Associated Disorders examines the economic consequences, risk and prevention measures, diagnosis, prognosis, treatment and rehabilitation of neck pain and its associated disorders. The

Task Force has developed clinical practice guidelines for the management of neck pain and its associated disorders [24,25]. In addition to their general guidelines, it may be helpful if they developed guidelines specifically for the physical therapist. The work of the Task Force laid a welcome starting point for the development of specific guidelines for physical therapists.

STUDY LIMITATIONS

Some limitations of our work should be addressed. First, we depended on the cooperation of physical therapists for the recruitment of study participants. In our cohort study the aim was to recruit all new consecutive patients. We informed the physical therapists about the inclusion and exclusion criteria, and they actually made the decision as to who was recruited or not. Although we assume that most physical therapists followed the study protocol, it is possible that (for whatever reason) not all consecutive patients were included. Moreover, having to depend on the availability of time and the alertness of the recruiting therapists could imply that recruitment was not always optimal. It was not possible to evaluate possible entry selection because the physical therapists did not have computerized patient registers.

In addition, it is difficult to compare our patients with other study populations because recruitment of patients in physical therapy practice has not been done before. Comparison of our study population with two other populations of patients with arm, neck and/or shoulder complaints in general practice, showed slight differences in pain intensity and duration of complaints at baseline [2,3]. However, in general it can be assumed that patients with more severe complaints are referred to physical therapy.

Moreover, because most of our data are based on self-administered questionnaires we cannot exclude possible overestimation/underestimation of the participants' complaints. This is not a drawback for pain measures since we wanted to measure the pain experience. However, for measurement of function, it is generally preferable to use more objective measures of daily functioning (e.g. function tests, ADL monitoring devices). Because our participants were referred for physical therapy we cannot generalize our results to a non-referred population. In the Netherlands patients currently have open access to the physical therapist, which was not the case at the time of their inclusion in this study cohort (i.e. 2001). To investigate the generalizability of our study results we need to further explore differences between our referred population and the population who currently directly consult the physical therapist.

Although we lack data on the patients' physical examination, this does not make the information about the characteristics of our patients, their work and disease less valid. We used variables from the self-reported questionnaires, because their validity and

reliability are well established. In non-emergency neck pain without radiculopathy the validity of the most commonly used objective tests is reported to be lacking, and there is support for subjective self-report assessment in monitoring patients' course, response to treatment, and for clinical research [26].

The diagnoses as indicated by the physical therapists were not standardized. The physical therapist recorded the diagnosis from a list of possible diagnoses according to the Saltsa report [27]. Although physical therapists are accustomed to applying such a diagnosis in clinical practice, it is unknown whether all physical therapists in our study interpreted these diagnoses in exactly the same way. Therefore, some degree of misclassification might have occurred.

We have no specific information about the type of exercise treatment given to the patients. Although we initially planned to collect detailed information on the different exercise treatments, this was not feasible in practice. Therefore, we asked the physical therapists to fill in one of four common treatment options (or a 'blank' treatment option) to indicate the given treatment.

IMPLICATIONS OF THE RESULTS

Implications for clinical practice

The results of our study may help physical therapist to inform patients about their prognosis. In our patient group, 60% of the patients with persistent complaints had persistent/recurrent sickness absence from work.

Screening patients at the first consultation may help physical therapists to better assess which patients with acute complaints are at risk for persistent complaints and/or sickness absence from work.

The questionnaires we used to assess the most prognostic factors contain many items and are not practical for routine clinical use; shorter questionnaires would be more acceptable. A study on one-item and two-item measures of pain beliefs and coping strategies supports the validity of these brief subscales [28]. Another study provided additional support for the use of these two-item scale versions, as well as preliminary support for their use in a veteran population [29]. Also, a single-item visual analogue scale assessing global quality of life has demonstrated good validity and reliability [30].

Future research

In primary care, more studies are needed to explore the possibility of modifying social and psychological variables associated with an intervention in order to positively influence its course. Until now only a few randomized clinical trials have studied the effect of behavioural treatment in primary care. A study on chronic shoulder complaints

compared the short and long-term clinical effectiveness of graded exercise therapy with usual care [31,32]; a small effect of the graded exercise therapy on restoring the performance of daily activities was found [31]. The effectiveness persists for at least 52 weeks, although the clinical benefits were rather modest [32]. In another trial among patients with acute and sub-acute shoulder complaints, an education and activation program had no significant effect on the functional limitations and patient-perceived recovery [33]. Also, no differences in effectiveness between a behavioural graded activity program and conventional exercise were found in the management of patients with chronic neck pain [34].

More studies are needed to provide additional information about the effectiveness of psychosocial interventions in primary care; for example, trials which examine the effectiveness of these interventions in patients with high scores on somatization versus patients with low scores on somatization.

As mentioned above, many patients in our cohort were treated with exercises or with massage (mostly a combination of both); these results reflect the treatment in daily practice. Unfortunately no data are available on the effectiveness of the combination of these interventions. Our systematic review (chapter 4) revealed that only the effectiveness of separate interventions have been evaluated. Moreover, the Cochrane review on mechanical neck disorders showed strong evidence for the benefit of favouring a multimodal care approach of exercise combined with mobilisation or manipulations for subacute and chronic mechanical neck disorders [18]. Therefore, studies are also required on the effectiveness of the interventions applied by physical therapists in daily practice.

Others also concluded that high-quality trials reflecting the current clinical practice of combined interventions using standardized methods of delivery need to be conducted before drawing conclusions about the benefits and optimal use of physiotherapy interventions in the treatment of shoulder disorders [35].

We studied arm, neck and shoulder complaints in a referred population. It is reported that 49% of the patients consulting the general practitioner with these complaints are referred to the physical therapist [2]. Nowadays, patients have open access to the physical therapist and the type of patient consulting the physical therapist may have changed. Therefore, we also need to explore which patients with arm, neck and shoulder complaints currently consult the physical therapist.

In the Netherlands, a multidisciplinary team achieved consensus on the classification of arm, neck and shoulder complaints and developed the CANS model with 23 specific complaints [36]. As mentioned above, because we found differences between the treatment of specific and non-specific complaints we recommend that the evidence regarding the most commonly used interventions for arm, neck and shoulder complaints be

investigated for specific and non-specific complaints. A recent evidence-based overview of the effectiveness of (conservative and surgical) interventions for the four specific pain disorders of the hand [37] is the first review on the effectiveness of specific complaints of arm, neck or shoulder. This ongoing project will also explore the effectiveness of other specific arm, neck and shoulder complaints. This information will be valuable for both clinicians and researchers, and will help clinicians to select the most appropriate intervention available. Another topic for investigation is why treatment success varies between different subgroups of patients. This type of study may also lead to specific investigation of the effectiveness of the various types of interventions that are currently used.

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Summary

Chapter 1 is the introduction. Arm, neck and shoulder complaints are frequently reported in Western countries. The reported prevalence ranges from 5-10% for non-specific complaints and from 22-40% in specific working populations. In the Netherlands about 32.8% of the patients with pain in the neck, shoulder or higher back contacted the physiotherapist during the previous year, compared with 21.6% with elbow or wrist/hand pain.

Given the high prevalence and the few studies in general practice, the clinical course of arm, neck and shoulder complaints and the prognostic factors of these complaints in *physical therapy practice* is not yet known, and information on long-term follow-up is also lacking. Moreover arm, neck and shoulder complaints are an important reason for sickness absence. The annual prevalence of sickness absence due to work-related arm, neck and shoulder complaints is reported to be 2-4% of the general workforce.

The aim of this thesis was to provide more knowledge about the course and management of arm, neck and shoulder complaints in physical therapy practice, and the related sickness absence in patients with these complaints.

Chapter 2 describes a prospective cohort study in which the 6-month clinical course and the prognostic factors of arm, neck and shoulder complaints are investigated. Participating physiotherapists recruited new consulters with musculoskeletal complaints of the neck and/or upper extremities. All patients received physical therapy in a non-experimental manner. Participants filled in questionnaires at baseline, at 3 months and 6 months. The main outcome measure was the persistence of complaints over 6-month follow-up and we tested possible predictors like social and psychological factors, physical factors and complaint specific factors. Of the 624 participants at baseline 543 (87%) returned at least one follow-up questionnaire. At 6-month follow-up 40% had persisting pain and discomfort. Somatization, kinesiophobia, catastrophizing, and a long duration of complaints at baseline were significantly related to the persistence of complaints over 6 months in the total population. In those with paid work (77%), catastrophizing, low decision authority at work and a long duration of complaints at baseline were significantly related to the persistence of complaints over 6 months. 40% of the participants had persisting pain and discomfort after 6 months and mainly social and psychological factors played a role in this course.

In **Chapter 3** we describe the long-term clinical course and recurrence of complaints of arm, neck and shoulder and evaluate the prognostic factors related to this clinical course in the same population of patients presenting in physical therapy practice mentioned in chapter 2. Long-term follow-up data were collected by means of self-administrated questionnaires at 18 and 24 months. The main outcome measures were persistence of complaints and the recurrence of complaints at 2-year follow-up. At 2-year follow-up, 39% had persisting complaints. In the total population, higher scores on somatization and kinesiophobia, a longer duration of complaints at baseline, and a lower level of education

contributed to the persistence of complaints. In the working population, similar factors contributed to the persistence of complaints. Between 6 and 24 months follow-up 58% had a recurrence of complaints. In the total population, higher scores on somatization, earlier musculoskeletal trauma and musculoskeletal co-morbidity contributed to the recurrence of complaints. Being a male and regularly doing sports reduced the probability of recurrence of complaints. About 40% of the study participants had persisting pain and discomfort at 2-year follow-up. Social and psychological factors contributed to the persistence of complaints in the long term and are associated with the recurrence of complaints.

In **chapter 4** we describe the occurrence of sickness absence in only the working population of the above mentioned cohort of patients with arm, neck and/or shoulder complaints and evaluate determinants of sickness absence during 6 months follow-up. At baseline 161 patients (33%) reported absence from work. Self-reported work-relatedness of complaints; previous musculoskeletal trauma, higher severity of complaints at baseline, more somatization and low decision authority at work were associated with sickness absence during the follow-up period. In physical therapy practice, social and psychological factors (at work) influence the occurrence of sickness absence in patients with arm, neck and/or shoulder complaints. These factors can be taken into account when developing and evaluating interventions to reduce sickness absence among these patients.

Interventions such as physiotherapy and ergonomic adjustments play a major role in the treatment of most work-related complaints of the arm, neck, and/or shoulder. In **chapter 5** we evaluated whether conservative interventions have a significant impact on outcomes for work-related complaints at arm, neck and shoulder. A systematic review was conducted. Only (randomized) trials studying interventions for patients suffering from work-related complaints of the arm, neck, and/or shoulder were included. Interventions may include exercises, relaxation, physical applications, and workplace adjustments. Two authors independently selected the trials, assessed methodological quality, and extracted data. We included 26 studies (in total 2,376 patients); 23 studies included patients with chronic nonspecific complaints. Over 30 interventions were evaluated and 7 main subgroups of interventions could be determined, of which the subgroup "exercises" was the largest one. Overall, the quality of the studies appeared to be poor. There is limited evidence for the effectiveness of exercises when compared to massage, adding breaks during computer work, massage as add-on treatment to manual therapy, manual therapy as add-on treatment to exercises, and some keyboards in people with carpal tunnel syndrome when compared to other keyboards or placebo. For other interventions no clear effectiveness could be demonstrated.

In **chapter 6** we describe the interventions applied by physical therapists in treating patients with complaints of arm, neck and/or shoulder. We used the study population mentioned in chapter 2 with a follow-up period of 6 months. Complaints of arm, neck and/or shoulder occur frequently and are usually managed within primary care. Many

patients with these complaints are treated with physical therapy. During a one –year period, the participating physiotherapists included new consulters with musculoskeletal complaints of the upper extremity. The patients filled in a questionnaire at baseline and the physical therapists completed a treatment record for up to 6 months. Of the 624 patients included in the cohort, physical therapists provided treatment data of 619 patients. The main treatment consisted of exercise therapy (93%) and massage (87%) or a combination of both. More patients with specific complaints received physical modalities and more patients with non-specific complaints were treated with manipulation techniques. The primary treatment of complaints of the arm, neck, and/or shoulder in physiotherapy practice consists of exercise therapy and massage therapy, mostly being a combination of both. Future studies should focus on the effectiveness of exercise therapies, combined or not combined with massage, for patients with complaints of the arm, neck, and/or shoulder.

Most patients with non-specific neck pain are treated in primary care by general practitioners, with as most frequently used interventions: a "wait and see" policy or referral for physiotherapy or manual therapy. It is unclear whether there are subgroups of patients who are more likely to benefit from either therapy. In **chapter 7** we evaluate whether clinical factors at baseline in patients with non-specific neck pain are related to recovery after treatment with manual therapy versus physiotherapy. We used the prospective cohort mentioned in chapter 2. For this study we selected patients from this cohort with non-specific neck complaints. Participants filled in questionnaires at baseline, 3 and 6 months. The main outcome measure was recovery at 6 months follow-up. Possible predictors like complaint specific factors, physical factors, social and psychological factors were evaluated for interaction with treatment. Of the 396 participants in this study, 97 (24.5%) received manual therapy; all others received physiotherapy, consisting of exercises, massage or physical applications. Four variables were significantly related to recovery: duration of complaint, catastrophising, distress and somatization. Severity of main complaint and catastrophising appeared to show interaction with treatment. It appeared that every point increase in severity or catastrophising resulted in a lower chance to recover from physiotherapy compared to manual therapy. Severity of main complaint and catastrophising seem to modify treatment success. Increased pain severity or catastrophising at baseline increased the chance of treatment success after manual therapy compared to physiotherapy.

Chapter 8 addresses the main results and limitations of the studies, and discusses the implications for daily practice and recommendations for further research.

Samenvatting

Hoofdstuk 1 is de inleiding. Arm-, nek- en schouderklachten komen veel voor in de westerse samenleving. De prevalentie voor aspecifieke klachten varieert van 5 tot 10 %. In specifieke arbeidspopulaties is dat 22 tot 40% . In Nederland consulteerde 32,8% van de patiënten met pijn in de nek, schouder of bovenrug de fysiotherapeut, ten opzichte van 21,6% van de patiënten met pijn in de elleboog, pols of hand.

Gegeven de hoge prevalentie en het kleine aantal onderzoeken in de *huisartsenpraktijk* zijn het beloop en de prognostische factoren van arm-, nek- en schouderklachten in de *fysiotherapiepraktijk* onbekend. Bovendien ontbreekt er informatie over het beloop op de lange termijn.

Arm-, nek- en schouderklachten zijn een belangrijke reden voor ziekteverzuim. De jaarprevalentie van het ziekteverzuim door werkgerelateerde arm-,nek- en schouderklachten is 2-4 % in de algemene arbeidspopulatie.

Het doel van dit proefschrift is meer informatie te verschaffen over het beloop en de behandeling van arm-, nek- en schouderklachten in de fysiotherapiepraktijk en het hieraan gerelateerde ziekteverzuim van patiënten met deze klachten.

In **hoofdstuk 2** wordt de prospectieve cohortstudie beschreven met 6 maanden follow-up. De prognostische factoren van arm-, nek- en schouderklachten werden onderzocht. Deelnemende fysiotherapeuten rekruteerden nieuwe patiënten met aandoeningen aan het bewegingsapparaat in de arm-, nek- en schouderregio. Alle patiënten kregen fysiotherapie (usual care). Patiënten vulden vragenlijsten in aan het begin van het onderzoek en na 3 en 6 maanden follow-up. De primaire uitkomstmaat was persisterende klachten na 6 maanden follow-up. Verder werden mogelijke prognostische factoren zoals sociale en psychologische factoren, fysieke factoren en klachtspecifieke factoren getest. Van de 624 patiënten op baseline, retourneerden 543 (87%) ten minste 1 follow-up-vragenlijst. Na 6 maanden follow-up bleek 40% van de patiënten nog klachten te ervaren. In de totale populatie waren somatisatie, bewegingsangst, catastroferen en een lange duur van de klachten aan het begin van het onderzoek significant gerelateerd aan persisterende klachten gedurende 6 maanden. In de werkende populatie (77%) waren catastroferen, minder autonomie op het werk en een lange duur van de klachten aan het begin van het onderzoek significant gerelateerd aan persisterende klachten gedurende 6 maanden. Na 6 maanden had 40 % van de patiënten persisterende klachten. Vooral sociale en psychologische factoren spelen een rol bij het beloop.

In **hoofdstuk 3** wordt het beloop op de lange termijn beschreven, het recidiveren van arm-, nek- en schouderklachten en de evaluatie van de prognostische factoren die

gerelateerd zijn aan het beloop. Het betrof dezelfde patiëntenpopulatie zoals genoemd in hoofdstuk 2. De gegevens van het lange termijn beloop werden verzameld met behulp van vragenlijsten na 18 en 24 maanden. De primaire uitkomstmaten waren persisterende klachten en het terugkomen van de klachten na 2 jaar. Na 2 jaar had 39% persisterende klachten. In de totale populatie waren hoge scores op somatisatie en bewegingsangst, een lange duur van de klachten aan het begin van het onderzoek en een laag opleidingsniveau, gerelateerd aan persisterende klachten. In de werkende populatie speelden vergelijkbare factoren een rol. Tussen 6 en 24 maanden follow-up kwamen de klachten terug bij 58% van de patiënten. In de totale populatie waren hoge scores op somatisatie, een eerder trauma aan het bewegingsapparaat en co-morbiditeit van het bewegingsapparaat, van invloed op het terugkomen van de klachten. Ongeveer 40% van de patiënten had persisterende klachten na 2 jaar follow-up. Sociale en psychologische factoren bleken geassocieerd te zijn met persisterende klachten op lange termijn en bij het terugkomen van de klachten.

Hoofdstuk 4 bevat een beschrijving van het ziekteverzuim in de werkende populatie van het bovengenoemde cohort van patiënten met arm-, nek- en schouderklachten en verder een evaluatie van de determinanten gedurende 6 maanden follow-up. Aan het begin van het onderzoek rapporteerden 161 patiënten (33%) ziekteverzuim. Zelfgerapporteerde werkgerelateerdheid van de klachten, een eerder trauma aan het bewegingsapparaat, ernstiger klachten aan het begin van het onderzoek, meer somatisatie en minder autonomie op het werk waren geassocieerd met ziekteverzuim tijdens de follow-up. Sociale en psychologische factoren (op het werk) beïnvloeden het voorkomen van ziekteverzuim bij patiënten met arm-, nek- en schouderklachten. Met deze factoren zou rekening gehouden kunnen worden bij het ontwikkelen en evalueren van interventies om het ziekteverzuim te verminderen in deze patiëntengroep.

Fysiotherapeutische interventies en ergonomische aanpassingen spelen een belangrijke rol bij de behandeling van de meeste werkgerelateerde arm-, nek- en schouderklachten. Door middel van literatuuronderzoek (een systematische review) wordt i**n hoofdstuk 5** nagegaan of conservatieve interventies een significante invloed hebben op de uitkomsten van werkgerelateerde klachten aan arm, nek en schouder. Alleen (gerandomiseerde) trials die de interventies voor patiënten met werkgerelateerde arm-, nek- en schouderklachten evalueren, werden meegenomen in het literatuuronderzoek. Interventies kunnen bestaan uit oefeningen, ontspanning, fysische applicaties en werkplekaanpassingen. Twee auteurs selecteerden onafhankelijk van elkaar de trials, maten de methodologische kwaliteit en extraheerden de data. In totaal werden 26 trials (totaal 2376 patiënten) met betrekking tot chronische aspecifieke klachten geïncludeerd. Meer dan 30 interventies werden geëvalueerd. Er werden zeven belangrijke interventie-subgroepen vastgesteld, waarvan “oefeningen” de grootste was. Over het

algemeen bleek de kwaliteit van de onderzochte studies slecht te zijn. Er is beperkt bewijs gevonden voor de effectiviteit van oefeningen vergeleken met massage, het toevoegen van pauzes gedurende computerwerk, massage als extra behandeling naast manuele therapie, manuele therapie als extra behandeling naast oefeningen en sommige toetsenborden bij patiënten met carpaal tunnelsyndroom vergeleken met andere toetsenborden of placebo. Voor andere interventies is geen duidelijk bewijs gevonden.

Hoofdstuk 6 laat de interventies zien die door de fysiotherapeuten werden toegepast om patiënten met arm-, nek- en schouderklachten te behandelen. Het ging om dezelfde studiepopulatie die in hoofdstuk 2 wordt beschreven met een follow-up-periode van 6 maanden. Arm-, nek- en schouderklachten komen veel voor en worden meestal in de eerste lijns gezondheidszorg behandeld. Veel patiënten komen bij de fysiotherapeut terecht. Gedurende 1 jaar hebben de fysiotherapeuten nieuwe patiënten met arm-, nek- en schouderklachten aangemeld voor het onderzoek. Aan het begin van het onderzoek vulden de patiënten een vragenlijst in en de fysiotherapeut vulde een behandelboekje in gedurende maximaal 6 maanden. Van de 624 patiënten die meededen aan het onderzoek, heeft de fysiotherapeut van 619 patiënten het behandelboekje ingevuld. De meest voorkomende behandeling van arm-, nek- en schouderklachten bleek te bestaan uit oefentherapie (93%) en massage (87%) of een combinatie van beide. Patiënten met specifieke klachten werden vaker behandeld met fysische toepassingen en patiënten met aspecifieke klachten werden vaker behandeld met manuele therapie. De belangrijkste behandeling van arm-, nek- en schouderklachten in de fysiotherapiepraktijk bestaat uit oefen- en massagetherapie, meestal een combinatie hiervan. Toekomstig onderzoek voor patiënten met arm-, nek- en schouderklachten zou zich kunnen richten op de effectiviteit van oefentherapie, al dan niet gecombineerd met massage.

De meeste patiënten met aspecifieke nekpijn worden in de eerstelijns gezondheidszorg behandeld door de huisarts, meestal met afwachtend beleid of met een verwijzing naar de fysiotherapeut of manueel therapeut. Het is onduidelijk of bepaalde subgroepen van patiënten meer profijt hebben bij een specifieke behandeling. **Hoofdstuk 7** beschrijft welke klinische factoren bij patiënten met aspecifieke nekpijn gerelateerd zijn aan het herstel door behandeling met fysiotherapie of door manuele therapie. Hiervoor werd het prospectieve cohort gebruikt dat in hoofdstuk 2 werd genoemd. Voor deze studie werden patiënten geselecteerd met aspecifieke nekpijn. Deelnemers vulden vragenlijsten in aan het begin van het onderzoek, na 3 en na 6 maanden. De primaire uitkomstmaat was herstel na 6 maanden follow-up. Mogelijke voorspellers zoals klachtspecifieke factoren, fysieke factoren, sociale en psychologische factoren werden onderzocht op interactie met behandeling. Van de 396 patiënten in de studie kregen 97 (24,5%) manuele therapie, alle anderen kregen fysiotherapie, bestaande uit oefeningen, massage

en fysische applicaties. Vier variabelen bleken significant gerelateerd te zijn aan herstel: duur van de klacht, catastroferen, distress en somatisatie. De ernst van de klacht en catastroferen vertoonden interactie met de behandeling.

Het bleek dat per punt stijging op de schaal van ernst of catastroferen dit resulteerde in een kleinere kans op herstel door fysiotherapie vergeleken met manuele therapie. De ernst van de klacht en catastroferen veranderden het behandelingssucces. Een verhoogde ernst score of catastroferen score aan het begin van het onderzoek verhoogde het behandelingssucces na manuele therapie vergeleken met fysiotherapie.

In **hoofdstuk 8** worden de belangrijkste resultaten en beperkingen van de studies beschreven en worden de implicaties voor de dagelijkse praktijk alsmede aanbevelingen voor verder onderzoek, bediscussieerd.

Dankwoord

In 2001 ben ik begonnen met de KANS-F studie (Klachten aan Arm, Nek en Schouder in de Fysiotherapiepraktijk) op de afdeling Huisartsgeneeskunde van het Erasmus MC. Ik ben blij dat ik de kans kreeg om dit grote cohortonderzoek op te zetten en ik heb veel geleerd tijdens het hele promotietraject. En nu is het eindelijk af! Het eindresultaat van jarenlang werken is het boekje dat nu voor me ligt. De totstandkoming van dit proefschrift heeft niet kunnen plaatsvinden zonder de medewerking, inzet en betrokkenheid van veel mensen. Bij deze wil ik iedereen bedanken die hieraan een bijdrage heeft geleverd. Een aantal mensen noem ik in het bijzonder.

Ten eerste alle patiënten en fysiotherapeuten die hebben deelgenomen aan dit project. Zonder jullie had ik geen data gehad om onderzoek te kunnen doen. Bedankt voor jullie tijd en inzet!

Sita Bierma-Zeinstra, met jou als co-promotor heb ik het goed getroffen. Bedankt voor je directe begeleiding. Je deur stond altijd voor me open als ik kwam met vragen. Mede dankzij jouw enthousiasme en optimisme ben ik gestimuleerd om door te gaan. Bovendien was je ook altijd geïnteresseerd in mijn persoonlijke situatie. Ik vind het fijn om met je samen te werken. Bedankt!

Bart Koes, bedankt voor je positieve bijdrage aan mijn proefschrift. Als promotor had je altijd de grote lijn voor ogen en een heldere kijk op zaken. Je positieve opmerkingen naast je commentaar op een artikel waren altijd motiverend om mee aan de slag te gaan. Ook bedankt voor je toegankelijkheid en je adviezen.

Arianne Verhagen, bedankt voor je medewerking aan mijn proefschrift, met name je bijdrage aan hoofdstuk 5 en 7. Ik vond het prettig en leerzaam om met je samen te werken.

Lex Burdorf, bedankt voor je betrokkenheid bij mijn project en in het bijzonder je bijdrage aan hoofdstuk 4. Ik heb je vaak lastig gevallen met mijn "deadlines". Ik waardeer je directheid en je kennis op het gebied van arbeid en gezondheid. Bedankt voor de samenwerking.

Sten Willemsen, ik heb je veel gemaild, gebeld en lastig gevallen met mijn vragen op het gebied van statistiek. Bedankt voor je tijd en inzet bij de analyses van mijn gegevens.

Roos Bernsen, toen ik de eerste resultaten van mijn onderzoek aan het verwerken was, heb ik je vaak geraadpleegd voor statistische adviezen. Je hebt me geholpen met de analyses en ik bewonder je gave om statistische problemen op een heldere manier uit te leggen. Onze overleggen waren altijd gezellig en leerzaam voor mij. Bedankt!

Noks Nauta, bedankt voor je bijdrage aan mijn project, met name bij de vragenlijstontwikkeling in de eerste fase van het onderzoek.

Anita Feleus, we hebben veel samengewerkt tijdens de ontwikkeling van onze vragenlijsten en de opzet en uitvoering van onze projecten die veel gemeen hadden met elkaar. Bedankt voor de gezelligheid en de leuke samenwerking. Ik wil je ook bedanken voor alle tips voor mijn promotie. Ik ben blij dat je mijn paranimf bent en naast me staat op deze bijzondere dag.

Wendy Polling, bedankt voor je bijdrage aan hoofdstuk 6 en de werkzaamheden die je van me hebt overgenomen tijdens mijn verlofperiode.

Ariënne Stehouwer, Peter Overzier, Anushka Oemraw en Marlies Luiten, bedankt voor jullie inzet en bijdrage met betrekking tot de data-invoer en het belwerk.

Laraine Visser-Isles, bedankt voor het corrigeren van mijn Engels en de snelle reacties op mijn mails.

René Suurland en Marlies Luiten, bedankt voor jullie hulp bij het regelen van allerlei praktische zaken rond mijn project.

Alle collega's en oud-collega's van de afdeling Huisartsgeneeskunde, bedankt voor jullie interesse, praktische tips en alle gezellige gesprekken.

Pim Luijsterburg en Edith Heintjes, jullie waren altijd bereid om mijn problemen op te lossen en mijn vragen te beantwoorden. Bedankt voor jullie praktische hulp.

Jasper Schellingerhout, bedankt voor je hulp en uitleg bij mijn vragen over hoofdstuk 7.

Janneke Belo en Rianne Rozendaal bedankt voor alle praktische tips m.b.t. mijn promotie.

Mijn kamergenootjes Esther Röder en Anita Feleus bedankt voor de gezelligheid en de goede gesprekken. Esther veel succes met de afronding van je proefschrift!

Familie en vrienden, bedankt voor de steun, de afleiding en de fijne gesprekken gedurende de afgelopen jaren.

Jitske Gulmans, we leerden elkaar kennen tijdens onze studie in Maastricht en nu woon jij in Groningen. Dat is een hele afstand, maar zo voelt het niet! Bedankt voor je vriendschap en de fijne relativerende gesprekken. Voor jou zal de eindstreep ook in zicht komen!

Wendy Stieltjes-van der Eijk, mijn vriendin en ook paranimf. We kennen elkaar al heel veel jaren sinds de middelbare school. We hebben het altijd gezellig samen en kunnen uren kletsen. Bedankt voor je vriendschap en ik vind het fijn dat je ook naast me staat op deze bijzondere dag.

Lieve Stiena, ik heb het goed getroffen met zo'n lieve schoonmoeder. Bedankt voor je praktische hulp in de afgelopen jaren.

Lieve Rachna, ik ben blij dat je mijn zus bent! Bedankt voor alles.

Lieve pap en mam, ik ben jullie erg dankbaar voor de kansen die ik door jullie heb gekregen. Bedankt voor jullie liefde en steun in al die jaren! Jullie staan altijd voor me klaar. Ik kan me geen betere ouders wensen.

Lieve Trigo en Sando, mijn twee lieve katten, bedankt voor de ontspannende momenten in de afgelopen jaren. Als ik achter mijn computer zat, sprongen jullie gewoon bovenop het toetsenbord en alle papieren!

Lieve Gertjan, mijn lieve man, bedankt voor alle steun in de afgelopen jaren. Het heeft lang geduurd maar nu is het dan eindelijk af. Bedankt voor je geduld en de ruimte die ik gekregen heb.

Lieve Julian en Merijn, mijn twee lieve donderstenen! Jullie zijn altijd vrolijk en door jullie heb ik veel afleiding gehad in de afgelopen jaren. Promoveren is mooi, maar jullie zijn het allermooist.

Over de Auteur

Curriculum Vitae

PhD Portfolio

CURRICULUM VITAE

Celinde Karels is geboren op 15 september 1975 in Gouda. Na het behalen van haar Atheneum-diploma aan de Goudse Scholengemeenschap te Gouda ging ze in 1995 Gezondheidswetenschappen studeren aan de Universiteit van Maastricht. In 1999 studeerde ze af in de Biologische Gezondheidkunde met een pilot-studie naar de voedingstoestand van patiënten met hartfalen. Daarnaast behaalde ze de Master of Science in de Epidemiologie.

Vervolgens heeft ze een jaar gewerkt aan de Vrije Universiteit in Amsterdam aan een onderzoek naar de late effecten na de behandeling van kanker op de kinderleeftijd.

Daarna was ze vanaf 2001 werkzaam op de afdeling Huisartsgeneeskunde van het Erasmus MC en startte ze met de opzet en uitvoering van het onderzoek naar arm-, nek- en schouderklachten in de fysiotherapiepraktijk. Deze studie heeft geleid tot dit proefschrift.

Ze heeft ook nog anderhalf jaar gewerkt bij het Integraal Kankercentrum West in Leiden.

Celinde is in 2003 getrouwd met Gertjan Scharloo en samen hebben ze twee zonen, Julian (09-04-2004) en Merijn (28-12-2006). Zij wonen in Gouda.

PhD PORTFOLIO

PhD Portfolio

Name PhD student:	Celinde H. Karels
ErasmusMC Department:	General Practice
PhD period:	2001-2009
Promotor:	Prof. dr. B.W. Koes
Co-promotor:	Dr. S.M.A. Bierma-Zeinstra

Courses

Course "oral presentation", 2002
NIHES course "Analysis of repeated measurements", 2003

Conferences /presentations

- Annual Conference of the Royal Dutch Society for Physical Therapy (KNGF):
  2001, The Hague (oral presentation)
  2003, The Hague (oral presentation)
  2005, The Hague (oral presentation)
- Annual Dutch Symposium of Epidemiology (WEON):
  2003, Rotterdam (oral presentation)
  2005, Wageningen (poster presentation)
- Annual Science Conference of the Dutch College of General Practitioners (NHG):
  2005, Rotterdam (oral presentation)
- National conference "Neck complaints in primary care"
  2008, Rotterdam (oral presentation)

International conference

- World Confederation for Physical Therapy, International Congress
  2003, Barcelona, Spain (oral presentation)