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Prognostic factors for neck pain in general practice

Jan L. Hoving[a,b], Henrica C.W. de Vet[a,*,1], Jos W.R. Twisk[a,c], Walter L.J.M. Devillé[a,d], Daniëlle van der Windt[a,e], Bart W. Koes[a,f], Lex M. Bouter[a]

[a]*Institute for Research in Extramural Medicine, VU University Medical Center, Van der Boechorststraat 7, 1081 BT Amsterdam, The Netherlands*
[b]*Unit of Occupational and Environmental Health, Department of Epidemiology and Preventive Medicine, Monash University, Melbourne, Australia*
[c]*Department of Clinical Epidemiology and Biostatistics, VU University Medical Center, Amsterdam, The Netherlands*
[d]*Institute for NIVEL, Utrecht, The Netherlands*
[e]*Department of General Practice, VU University Medical Center, Amsterdam, The Netherlands*
[f]*Institute of General Practice, Erasmus Medical Center, Rotterdam, The Netherlands*

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Abstract

Prognostic studies on neck pain are scarce and are typically restricted to short-term follow-up only. In this prospective cohort study, indicators of short- and long-term outcomes of neck pain were identified that can easily be measured in general practice. Patients between 18 and 70 years of age, suffering for at least 2 weeks from neck pain were recruited by 42 general practitioners (GPs). Perceived recovery, pain intensity and neck dysfunction after 7 and 52 weeks were considered as outcome measures. Indicators of prognosis were identified by means of logistic regression analyses (perceived recovery) and linear regression analyses (pain intensity and neck dysfunction). In total, 183 patients were included. After 1 year, 63% had recovered. The prognostic models showed differences between short- and long-term indicators. At the short term, besides the baseline values of the respective outcome measurements, only older age (≥ 40) and concomitant low back pain and headache were associated with poor outcome. At the long term, in addition to age and concomitant low back pain, previous trauma, a long duration of neck pain, stable neck pain during the 2 weeks prior to baseline measurement, and previous neck pain predicted poor prognosis. The predictive power of the models was weak: the explained variance (R^2) varied from 24 to 36%. Patient history and physical examination give GPs little handholds to predict the prognosis for patients with sub-acute and chronic neck pain. A few indicators of a less favourable prognosis of neck pain were identified, of which older age and concomitant low back pain was the most consistent.

Keywords: Neck pain; Prognosis; Prediction model; Prognostic indicators; General practice

1. Introduction

Neck pain is a common complaint in industrialized countries, and constitutes a major medical and socio-economic problem. Neck pain is one of three most commonly reported complaints of the musculoskeletal system, and point prevalences vary between 10 and 22% depending on the population and the definition of neck pain (Andersson et al., 1993; Brattberg et al., 1989; Coté et al., 1998; Mäkelä et al., 1991; Picavet et al., 2000). The lifetime prevalence has been estimated to be between 67 and 71% indicating that approximately two-thirds of all individuals will experience an episode of neck pain at some time during life (Mäkelä et al., 1991; Picavet et al., 2000). Overall, the prevalence is reported to be somewhat higher for women than for men (Borghouts et al., 1999a; Nachemson and Johnsson, 2000), and is highest around the age of 50 (Borghouts et al., 1998; Van Tulder et al., 2000). Neck pain is often accompanied by headache or by radiating complaints in the upper extremity (Coté et al., 2000).

Recently, Borghouts et al. (1998) systematically summarized the literature concerning neck disorders, and concluded that little is known about the clinical course of acute neck pain. For patients suffering from neck pain for 6 months or more, improvement rates of 50% (median) have been reported, mainly in secondary care or occupational settings (Borghouts et al., 1998). However, these studies do not present a clear picture of the prognostic indicators in a primary care setting. Prognostic studies on neck pain are

* Corresponding author. Tel.: +31-20-444-8176; fax: +31-20-444-8181.
E-mail address: hcw.devet@vumc.nl (H.C.W. de Vet).
[1] www.emgo.nl

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scarce and show a large variety in patients' characteristics and settings. In addition, few studies include a long-term follow-up (Gross et al., 1996). Some of the prognostic indicators which have been reported are age, sex, severity of pain, localization, duration, occupation and radiological findings (Borghouts et al., 1998). In general, the methodological quality of studies on prognostic factors for neck pain is low (Borghouts et al., 1998). Common flaws include the inadequate selection of the study population, small sample-size, only a short-term follow-up, and inadequate statistical analyses.

If neck pain is not prevented from becoming chronic, it may lead to a substantial economical burden for the patient, as well as for society in general. Borghouts et al. (1999b) reported the share of the total costs of US $686 million for chronic (>6 months) neck pain to be approximately 1% of the total health care expenditures in the Netherlands. It is tempting to be able to predict the prognosis of patients, in spite of the lack of evidence for effective early interventions which might influence the clinical course. Careful monitoring of patients with poor prognosis and focussing research on this group is indicated. The objective of this prospective study was to investigate whether the findings of history-taking and physical examination can predict the course of neck disorders in both the short- and the long-term, with emphasis on prognostic indicators that can easily be measured in general practice.

2. Methods

Our study was conducted within the framework of a randomised clinical trial on the effectiveness of three common treatment options for neck pain in general practice (Koes and Hoving, 1998). Treatment in the first 7 weeks consisted of either manual therapy (specific mobilization techniques) once a week, physical therapy (mainly exercise therapy) twice a week, or continued care by the general practitioner (GP) (analgesics, counselling and education). These interventions were not considered as prognostic indicators in this study, but were adjusted for in all analyses.

2.1. Subjects

The sample represented a cohort of consecutive patients who consulted their GP for neck pain between February 1997 and November 1998. In total, 42 GPs participated in this study, representing most of the practices in the cities of Zoetermeer and Gouda. In the Netherlands, access to the health care system is nearly always through a GP ('the gatekeeper'). Potential participants were referred to a local research center by their GP. All patients underwent a physical examination and completed a baseline questionnaire within 2 weeks. The following selection criteria were applied: age between 18 and 70 years, pain and/or stiffness in the neck for at least 2 weeks, neck complaints reproducible during physical examination, willingness to adhere to the study protocol, and written informed consent. Patients were excluded if they had received physical therapy or manual therapy for their neck pain during the previous 6 months, had undergone surgery of the neck, or had evidence of specific pathology, such as malignancy, neurological diseases, fracture, herniated disc or systemic rheumatic diseases.

2.2. Measurements

At baseline, the patients completed a questionnaire containing questions on potential prognostic indicators. Based on the history-taking, the following prognostic indicators were taken into consideration (Table 1): gender, age, duration of neck pain at the initial visit, previous episodes of neck pain, concurrent headache or low back pain, pain radiating below the elbow, the course of neck pain during the previous 2 weeks, a traumatic cause of the neck pain (according to the patient) and disturbed sleep due to neck pain. Based on the physical examination, the research assistant rated the severity of physical dysfunctioning on a numerical 11-point scale (range 0–10, higher scores indicating more severe dysfunctioning) (Koes et al., 1992).

Outcomes were assessed during two follow-up visits, at 7 and 52 weeks. The three outcomes used were those which were frequently reported in the literature on neck pain: pain intensity, neck dysfunction and perceived recovery (Borghouts et al., 1998; Gross et al., 1996; Van Tulder et al., 2000). Patients rated their general improvement on a 6-point ordinal transition scale, ranging from 'much worse' to 'completely recovered' (Guyatt et al., 1992). A priori, recovery was defined as 'completely recovered' or 'much improved' as reported by the patient. Pain intensity in the previous week was measured on a numerical 11-point scale

Table 1
Patient characteristics at baseline ($n = 183$)

Prognostic indicators	*N*	%
Age ≥40 years	122	66.7
Female	111	60.7
Duration neck pain ≤6 weeks	88	48.1
Duration neck pain 7–12 weeks	48	26.2
Duration neck pain ≥13 weeks	47	25.7
History of neck pain	119	65.0
Traumatic cause according to patient	30	16.4
Concomitant complaints		
Radiating pain below elbow	29	15.8
Headache of cervical origin	127	69.4
Low back pain	44	24.0
No change in neck pain previous 2 weeks	86	47.0
Disturbed sleep due to neck pain	93	50.8
High severity of physical dysfunctioning[a]	116	63.4

[a] High severity, severity of physical dysfunctioning assessed by the research assistant in a physical examination: ≥7 points on a 0–10 point scale.

by the patient (score 0–10; higher scores indicate more severe pain), which is a valid method according to Von Korff et al. (2000). Neck dysfunction was measured using the Neck Disability Index (NDI), which consists of 10 items concerning activities of daily living with a score from 0 to 5 (maximal score 50; higher scores indicate more disability) (Vernon and Mior, 1991). The reliability and validity of the NDI have been shown to be acceptable (Hains et al., 1998). Using these three different outcome measures made it possible to compare its prognostic indicators.

3. Statistical analyses

First, the relationship between the outcome at issue and each of the potential prognostic indicators was individually evaluated, using logistic regression analyses (perceived recovery) and linear regression analyses (pain intensity and neck dysfunction), always adjusting for the intervention. Separate models were built for short-term (7 weeks) and long-term outcomes (52 weeks). For perceived recovery, adjusted odds ratios (ORs) were calculated to reflect the strength of the association, together with the 95% confidence intervals. For pain intensity and neck dysfunction adjusted regression coefficients and 95% confidence intervals were calculated and, in addition, standardized regression coefficients reported to facilitate comparisons of the strength of influences of prognostic factors which are measured on different scales. In multiple regression analysis all variables were entered in the model followed by backward elimination retaining only the strongest predictors ($P < 0.1$).

In addition, the proportion of explained variance (adjusted R^2) on the outcome measure of pain intensity and neck dysfunction was presented to give an indication of the predictive power of the model. Occasional missing values (<5%) were substituted by their group mean.

4. Results

During a period of 22 months a total of 183 patients were included of whom 183 patients completed the 7-week follow-up and 178 patients completed the 1-year follow-up. Reasons for loss to follow-up were lack of time (1), inability to contact a patient (3) or loss of motivation (1). The pain scores of one patient were missing. Table 1 shows the characteristics of the participants at baseline.

Table 2 presents the outcomes at 7 and 52 weeks. At 7 weeks, 51.4% of the patients had recovered, and this percentage increased to 63.5% after 1 year. The pain intensity decreased from 6 (SD 1.9) on a 0–11 scale at baseline, to 3.4 (SD 2.5) at 7 weeks and 2.2 (SD 2.5) at 52 weeks. The scores for neck dysfunction (NDI scale 0–50) started at 14.5 (SD 7.0) at baseline and decreased to 9.1 (SD 7.5) at 7 weeks and to 7.0 (SD 6.9) at 52 weeks.

Table 2
Perceived recovery, pain intensity and neck dysfunction at baseline, and after 7 and 52 weeks

Outcomes	*N*	Success rate (%)	Mean	SD
Perceived recovery				
7 weeks	94	51.4		
52 weeks	116	63.4		
Pain intensity at presentation (0–10)			6.0	1.9
7 weeks			3.4	2.5
52 weeks			2.2	2.5
Neck dysfunction (NDI: 0–50)			14.5	7.0
7 weeks			9.1	7.5
52 weeks			7.0	6.9

SD, standard deviation.

4.1. Perceived recovery

In the analyses of the individual indicators, age (≥40 years), concomitant headache or low back pain and the absence of progression or deterioration 2 weeks before the baseline assessment was significantly associated with perceived recovery at 7 or 52 weeks (Table 3). In the multiple regression analyses age (≥40 years) was significantly associated with recovery both at 7 and at 52 weeks (OR 0.43; 95% CI 0.22–0.84 and 0.26; 95% CI 0.11–0.61, respectively). In the model for perceived recovery at 7 weeks, the only other prognostic indicator was concomitant headache (OR 0.40; 95% CI 0.20–0.81). Perceived recovery at 52 weeks was independently associated with previous trauma (OR 0.40; 95% CI 0.15–1.05), concomitant low back pain (OR 0.37; 95% CI 0.17–0.80), no change in neck pain in the 2 weeks before baseline assessment (OR 0.33; 95% CI 0.17–0.66), and a high baseline severity of physical dysfunctioning (OR 0.54; 95% CI 0.27–1.11).

4.2. Change in pain intensity

With respect to predictors for pain intensity Table 4 shows a statistically significant association with pain intensity at baseline, age and concomitant low back pain (7 and 52 weeks), concomitant headache (7 weeks), duration of neck pain ≥13 weeks, a history of neck pain, and the absence of progression or deterioration in the 2 weeks before baseline assessment (52 weeks). The multiple regression analyses showed different indicators for the short- and long-term prognosis. Older age (≥40 years), which was associated with pain intensity ($B = 1.09$; 95% CI 0.40–1.78 and $B = 1.11$; 95% CI 0.38–1.84 for the short- and long-term, respectively) as was pain intensity at baseline ($B = 0.39$; 95% CI 0.21–0.57 and $B = 0.26$; 95% CI 0.07–0.45, respectively) and the presence of concomitant low back pain ($B = 0.72$; 95% CI 0.06–1.50 and $B = 0.80$; 95% CI −0.02 to 1.61, respectively). In addition, only concomitant headache ($B = 0.82$; 95% CI 0.10–1.54)

Table 3
Prognostic indicators of perceived recovery: adjusted odds ratios and 95% confidence interval for each indicator at 7 and 52 weeks

Variable[a]	Regression analyses individual indicators[b]				Multiple regression model[b]			
	7 weeks		52 weeks		7 weeks		52 weeks	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Age ≥40 years	0.50	0.26–0.96	0.34	0.17–0.69	0.43	0.22–0.84	0.26	0.11–0.61
Female	1.35	0.72–2.50	1.45	0.78–2.71				
Duration neck pain 7–12 weeks	0.74	0.35–1.53	0.88	0.41–1.87				
Duration neck pain ≥13 weeks	0.53	0.25–1.10	0.49	0.23–1.03				
Previous episodes of neck pain	0.64	0.34–1.20	0.57	0.29–1.11				
Traumatic cause	0.87	0.38–1.95	0.68	0.30–1.53			0.40	0.15–1.05
Concomitant complaints								
Radiating pain below elbow	1.25	0.55–2.89	0.67	0.30–1.51				
Headache of cervical origin	0.47	0.25–0.92	0.73	0.37–1.44	0.40	0.20–0.81		
Low back pain	0.62	0.30–1.26	0.46	0.23–0.94			0.37	0.17–0.80
No change in neck pain previous 2 weeks	0.58	0.32–1.07	0.38	0.21–0.72			0.33	0.17–0.66
Disturbed sleep due to neck pain	1.30	0.71–2.39	1.14	0.62–2.09				
High severity of physical dysfunctioning	1.18	0.63–2.21	0.63	0.33–1.19			0.54	0.27–1.11

[a] The reference category for each indicator is the contrast (female versus male). The reference category for the duration of neck pain is 2–6 weeks.
[b] Adjusted for intervention. OR, odds ratio; CI, confidence interval.

was associated with pain intensity at 7 weeks. At 52 weeks, a duration of neck pain (more than 13 weeks) ($B = 1.35$; 95% CI 0.34–1.93), and a history of neck pain ($B = 1.35$; 95% CI 0.13–1.58) were associated with a higher pain intensity. More combinations of variables were possible but these models were not as strongly associated with the outcome. The standardized β-coefficient was between 0.30 and 0.15, which showed more or less equal strength of all factors. The multiple regression models explained 24% (7 weeks) and 30% (52 weeks) of the variance of pain intensity.

4.3. Neck dysfunction

With respect to the predictors for neck dysfunction Table 5 shows that a statistically significant association with neck

Table 4
Prognostic indicators of *pain intensity*: adjusted regression coefficients and 95% confidence intervals for each indicator at 7 and 52 weeks

Variable	Regression analyses individual indicators[a]				Multiple regression model[a]					
	7 weeks		52 weeks		7 weeks			52 weeks		
	B	95% CI	*B*	95% CI	β	*B*	95% CI	β	*B*	95% CI
Pain intensity at baseline (0–10)	0.43	0.25; 0.61	0.26	0.07; 0.45	0.30	0.39	0.21; 0.57	0.20	0.26	0.07; 0.45
Age ≥40 years	0.77	0.03; 1.51	1.04	0.27; 1.80	0.21	1.09	0.40; 1.78	0.21	1.11	0.38; 1.84
Female	0.16	−0.57; 0.87	−0.15	−0.91; 0.60						
Duration neck pain 7–12 weeks[b]	0.07	−0.74; 0.87	0.07	−0.76; 0.91						
Duration neck pain ≥13 weeks[b]	0.49	−0.33; 1.30	1.03	0.19; 1.86				0.20	1.35	0.34; 1.93
Previous episodes of neck pain	0.43	−0.31; 1.17	0.83	0.06; 1.59				0.16	1.35	0.13; 1.58
Traumatic cause	0.54	−0.40; −1.47	0.72	−0.71; 1.25						
Concomitant complaints										
Radiating pain below elbow	0.61	−0.35; 1.57	0.77	−0.23; 1.71						
Headache of cervical origin	0.99	0.23; 1.75	0.52	−0.29; 1.32	0.16	0.82	0.10; 1.54			
Low back pain	1.14	0.33; 1.95	1.13	0.29; 1.97	0.13	0.72	0.06; 1.50	0.14	0.80	−0.02; 1.61
No change in neck pain previous 2 weeks	0.13	−0.58; 0.84	0.66	−0.08; 1.39						
Disturbed sleep due to neck pain	0.25	−0.46; 0.95	0.33	−0.41; 1.06						
High severity of physical dysfunctioning	0.64	−0.09; 1.37	0.66	−0.10; 1.42						
Adjusted R^{2c} (%)							24			30

β, standardized regression coefficient; *B*, regression coefficient; CI, confidence interval.
[a] Adjusted for treatment.
[b] The reference category for the duration of neck pain is 2–6 weeks.
[c] The proportion of total variance explained by the final model.

Table 5
Prognostic indicators *for neck dysfunction* adjusted regression coefficients (*B*) and 95% confidence intervals for each indicator at 7 and 52 weeks

Variable	Regression analysis individual indicators[a]				Multiple regression model[a]					
	7 weeks		52 weeks		7 weeks			52 weeks		
	B	95% CI	*B*	95% CI	β	*B*	95% CI	β	*B*	95% CI
Neck function at baseline (0–50)	0.59	0.46; 0.72	0.36	0.22; 0.49	0.57	0.60	0.48; 0.73	0.42	0.41	0.28; 0.54
Age ≥40 years	2.43	0.54; 4.31	2.42	0.42; 4.42	0.15	2.42	0.54; 4.31	0.15	2.13	0.22; 4.05
Female	−0.47	−2.34; 1.40	−0.03	−2.01; 1.96						
Duration neck pain 7–12 weeks[b]	0.68	−1.36; 2.71	0.82	−1.34; 2.97						
Duration neck pain ≥13 weeks[b]	1.12	−0.93; 3.18	2.03	−0.04; 4.19				0.12	1.89	−0.22; 4.00
Previous episodes of neck pain	0.07	−1.81; 1.95	2.20	0.24; 4.17						
Traumatic cause	1.14	−1.26; 3.54	2.04	−0.49; 4.57				0.15	2.75	0.27; 5.32
Concomitant complaints										
Radiating pain below elbow	−1.27	−3.72; 1.17	−0.35	−2.24; 2.95						
Headache of cervical origin	1.08	−0.98; 3.13	1.13	−1.05; 3.31						
Low back pain	1.88	−0.20; 3.96	3.11	0.94; 5.82	0.11	1.87	−0.18; 3.91	0.18	2.97	0.87; 5.07
No change neck pain previous 2 weeks	0.44	−1.38; 2.25	2.49	0.60; 4.38				0.15	2.07	0.22; 4.91
Disturbed sleep due to neck pain	−0.55	−2.41; 1.31	0.26	−1.71; 2.23						
High severity of physical dysfunctioning	0.45	−1.54; 2.43	0.17	−1.93; 2.28						
Adjusted R[c] (%)							36%			26%

β, standardized regression coefficient; *B*, regression coefficient; CI, confidence interval.
[a] Adjusted for treatment.
[b] The reference category for the duration of neck pain is 2–6 weeks.
[c] The proportion of total variance explained by the model.

function at baseline, age and concomitant presence of low back pain at both 7 and 52 weeks and at 52 weeks additionally with duration of neck pain, previous episodes of neck pain, and stable neck pain in the 2 weeks before baseline assessment. In the multiple regression model for the short-term prognosis, these variables were the only variables that remained. The regression coefficients were 0.60 (95% CI 0.48–0.73) for neck function at baseline, $B = 2.42$ (95% CI 0.54–4.31) for age over 40 years, $B = 1.87$ (95% CI 0.18–3.91) for concomitant low back pain, indicating worse prognosis if these variables were present. For neck function at 52 weeks, in addition, duration of neck pain ($B = 1.89$; 95% CI −0.22 to 4.00), traumatic cause ($B = 2.75$; 95% CI 0.27–5.32) and stable neck pain in the 2 weeks before baseline assessment ($B = 2.07$; 95% CI 0.22–4.91) were associated with more neck dysfunction at 52 weeks. The standardized β-coefficient showed most influence of neck dysfunction at baseline. The multiple regression models explained 36% (7 weeks) and 26% (52 weeks) of the variance of neck dysfunction at 7 and 52 weeks, respectively.

5. Discussion

Our study included three outcome measures and two follow-up measurements. This made it possible not only to compare the prognostic indicators of perceived recovery, pain intensity and neck function, but also to examine the differences between short- and long-term outcomes.

As could be expected the value of the outcome measures at baseline are highly predictive for the respective outcome measures at 7 and 52 weeks. They appeared in all multiple regression models for pain intensity and neck function, and for the same reason, the severity of physical dysfunctioning as assessed by the research assistant appeared in the model for perceived recovery.

Irrespective of the outcome measure used and the moment of follow-up, a less favourable prognosis was found for patients who were over 40 years of age and who had concomitant low back pain. For the short-term prognosis only the presence of concomitant headache was included in the models for two of the three outcome measures, indicating a less favourable prognosis at 7 weeks, but not on the long term. For the prognosis at 52 weeks a number of other variables appeared to be associated with a poor outcome: traumatic cause, duration of neck pain more than 13 weeks, and stable neck pain during the 2 weeks before baseline were identified as indicators in two of the three models and previous episodes of neck pain in one model. These variables all represent characteristics of neck pain and indicate that patients with chronic and/or recurrent neck pain at baseline have a poor long-term prognosis.

The predictive power of both models in the short- and long-term is rather weak. The combination of prognostic variables, including the intervention, explained only 24% (7 weeks) and 30% (52 weeks) of the variance of change in pain intensity. For neck function the explained variance was 36% at 7 weeks and 26% at 52 weeks. Apparently, the clinical course to recovery of neck pain is not strongly influenced by

these clinical characteristics. Other prognostic indicators, such as psychosocial or work-related factors may play an important role (Leclerc et al., 1999; Nachemson and Johnsson, 2000; Viikari-Juntura et al., 2000). However, these were not evaluated in this study. Including standardized questionnaires to evaluate psychosocial factors (e.g. depression) or work-related factors (ergonomics or autonomy) may be more difficult to implement during regular GP consultations. We focused on a short history-taking and a systematic physical evaluation.

Not surprisingly, the level of pain intensity at baseline was associated with the change in pain intensity during follow-up. Pain intensity at baseline acted as a confounder in the association between headache or low back pain and change in pain intensity. Patients with higher pain intensity at baseline had more complaints of concomitant headache or low back pain. Cross-sectional studies have already confirmed that chronic neck pain is associated with the presence of concomitant low back pain and headache (Coté et al., 2000; Mäkelä et al., 1991). To our knowledge, no other prospective studies have identified these factors to be associated with both improvement in pain and function and perceived recovery.

This study has some strengths and weaknesses. Our sample of patients was studied prospectively, and can be considered a cohort study in which the interventions are regarded as prognostic indicators. The patients were recruited as a consecutive sample, with an almost complete follow-up rate. Unfortunately the GPs certainly did not refer all patients with neck pain to the trial, but there are no indications that the sample was selected on prognosis. The pragmatic design of our study made it possible to evaluate a broad spectrum of patients in a general practice. At some point in the course of their episode of neck pain these patients had consulted their GP. So it is not an inception cohort with all new neck pain patients. However, our sample represents the mix of patients that present themselves to a GP. Our study may therefore reflect current clinical practice. Although the design of an RCT results in less treatment heterogeneity, the interventions investigated in this study are commonly applied in the Netherlands (Borghouts et al., 1999a; Kroese et al., 1999). In daily practice, referrals for additional treatment are a frequent component of usual GP care. The design of the study made it possible to adjust for the interventions, which is often more difficult in non-randomised studies (Laupacis et al., 1994).

The patient sample was moderate, and therefore the number in some subgroups became small (Table 1). For that reason the number of prognostic variables was restricted, and loss to follow-up and missing data were kept to a minimum. It is recommendable to perform a larger study to examine whether the predictive factors found in this study can be reproduced when applied to similar populations.

Our study has some implications for daily practice. Using a standard method of patient evaluation, the GP can identify patients with a higher risk of a poor prognosis on the basis of a few indicators. More high quality studies in general practice are needed to confirm our results, based on a broad spectrum of both treatment and patient characteristics, including an adequate follow-up period. In addition, it would be useful to develop a prognostic classification that could be used in clinical practice and also serve as an instrument for the selection of patients to be included in randomised clinical trials.

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