Published in final edited form as:

Clin J Pain. 2013 May ; 29(5): 411–416. doi:10.1097/AJP.0b013e318257099e.

A prognostic approach to defining chronic pain across a range of musculoskeletal pain sites

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Abstract

Objectives—To test whether the prognostic definition of chronic pain, which has previously been applied in specific anatomical areas, performed well in a cohort of older adults with a range of musculoskeletal pain sites.

Methods—Data are taken from the PROG-RES Study of adults aged 50 years consulting their general practitioner with any musculoskeletal pain who completed postal surveys immediately after consultation and 12 months later. Baseline risk of clinically significant pain persisting at 12-months follow-up, defined as a Chronic Pain Grade II, was calculated using the prognostic approach, which includes a range of pain and related factors. The approach was implemented using logistic regression models and performance of the approach, including cut-offs in the score to define groups with differing levels of risk, was assessed in terms of calibration and discrimination.

Results—Application of the original risk cut-offs created groups with increasing proportions of chronic pain (area under the curve=0.79). However, the probability of chronic pain in each group was higher than expected by the model. New cut-offs were defined for this group of older adults: score 5 = probability of chronic pain <20%, 11 = probability < 50%, 16 = probability < 80% which resulted in good calibration of the model.

Discussion—The prognostic approach to defining chronic pain is suitable for use in older adults consulting primary care with musculoskeletal pain at a range of sites, but new cut-offs are needed to allow for the higher risk profile in this group. An adapted version of this method may also have the potential for application directly within the clinical consultation.

Keywords

Pain; Prognosis; General practice

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Authors' contributions: SM Conducted all the analyses and drafted the manuscript. KMD and CDM conceived of the study and helped draft the manuscript. ET advised on the analyses and helped to draft the manuscript. All authors read and approved the final manuscript.

Conflicts of interest statement: The author(s) declare that they have no competing interests.

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Introduction

Chronic pain is typically defined by duration, an approach that has often been criticised as being unhelpful in terms of the attitudes of patients and clinicians towards chronic pain [1-3] and the implications this has for the development of treatment [4].

Using a latent transition regression model, Von Korff and Miglioretti [1] developed a prognostic approach to the definition of chronic low back pain (LBP). This approach uses a Risk Score constructed from a small number of pain severity and prognosis-related (depression, pain duration, diffuse nature of pain) items. These items were chosen, as they had previously been shown to have prognostic value in predicting pain outcomes [1]. The Risk Score was shown to predict the likelihood of significant pain one year later in a group of LBP primary care consultants in the US. The Risk Score moves away from defining chronic pain as a static state, which it is not [5], and towards a prognostic definition of chronicity.

Recently, the Risk Score approach has been applied, and performed well, in a group of LBP patients in the UK [4], in American patients with LBP, headache and orofacial pain [3] and in a community sample in the UK reporting knee pain [6]. This suggests the prognostic value of Von Korff and Miglioretti's Risk Score in a range of pain conditions, across a number of anatomical sites [3,4,6].

It is known that patients experiencing pain want to know their expected prognosis [2,7] and the Risk Score approach has been shown to have stronger prognostic ability than considering duration of pain alone [3]. It therefore presents a potential method by which prognostic estimates could be accurately calculated in a clinical setting.

It is reasonable to assume that this model for the prognosis of pain will perform well in the setting of generic musculoskeletal pain, i.e. the model is not specific to the site of pain, or underlying cause of pain, but performs well in evaluating the prognosis of any reported musculoskeletal pain. Further evidence of this potential was provided in a systematic review of prognostic factors for chronic musculoskeletal pain, which identified many of the same factors used in the Risk Score [8].

The aim of this paper is then to assess the performance of the Von Korff & Miglioretti [1] model in the definition of chronic pain in an older population with musculoskeletal pain across a broad range of anatomical sites over a 12-month period.

Materials and Methods

Setting and sample

The data come from the PROG-RES Study, a prospective cohort of older adults consulting with musculoskeletal pain in primary care. Full details of this study have been described previously [9]. Briefly, five general practices (GP) in central Cheshire, UK, recruited consecutive patients aged 50 years and over consulting with non-inflammatory musculoskeletal pain between September 2006 and March 2007. Patients were excluded if they demonstrated red flag pathology, inflammatory arthropathy, or were deemed to be vulnerable (severe cognitive impairment, terminal illness, severe mental illness).

Data collection

During a routine, patient-initiated consultation, electronic templates were activated when one of a pre-specified list of musculoskeletal Read codes was entered by the GP, leaving a marker in the patient's record. Read codes are a coded thesaurus of clinical terms used in

UK general practice [10]. They are the way in which GPs record symptoms, diagnoses, procedures and investigations in the electronic medical record. Patients whose GP had completed the template were identified weekly by staff from the Keele General Practice Research Partnership. All such patients were sent a postal questionnaire within one week of consultation. This questionnaire contained further questions concerning pain, including the Chronic Pain Grade (CPG) [11], depression, assessed by the Hospital Anxiety and Depression Scale (HADS) [12], and information on socio-demographic characteristics. The questionnaire asked for written informed consent to both medical record review and further contact. Those people who did not respond the initial questionnaire within two weeks received a reminder postcard. After a further two weeks, non-responders received a reminder letter and a second copy of the questionnaire. Those participants consenting to further contact received a further postal questionnaire, similar to that used at baseline, 12 months later.

Risk Score

Following the same procedures as Dunn et al [4] and Thomas et al [6], the scoring mechanism below was used to calculate the Risk Score for each individual, based on the score developed by Von Korff and Miglioretti [1].

Average pain intensity: 0-3 = 0; 4-6 = 1; 7-10 = 2.

Worst pain intensity: 0-4 = 0; 5-7 = 1; 8-10 = 2.

Current pain intensity: 0-2 = 0; 3-4 = 1; 5-10 = 2.

Interference with usual activities: 0-2 = 0; 3-4 = 1; 5-10 = 2.

Interference with work/household activities: 0-2 = 0; 3-4 = 1; 5-10 = 2.

Interference with family/social activities: 0-2 = 0; 3-4 = 1; 5-10 = 2.

Days of activity limitation in the prior 3 months: 0-3 = 0; 4-7 = 1; 8-15 = 2; 16+ = 3.

Pain duration: <3 months = 0; 3-6 months=1; 7-12 months=2; 1-2 years=3, 3 years=4.

Number of other pains (outside index site): 0 = 0; 1 = 1, 2 = 2, 3 = 3; 4-7 = 4.

Depression (HADS): 0-3 = 0; 4-7 = 1; 8-10 = 2; 11-12 = 3; 13-21 = 4.

In the baseline questionnaire, participants were asked to report the areas in which they had pain from a pre-specified list of eight discrete sites (neck, shoulder, elbow, wrist/hand, low back, hip, knee, ankle/foot). From this, the number of pain sites additional to the 'index site' was calculated as the number of areas in which pain was reported, from eight, minus one. This was then categorised, as shown above.

The possible range for the Risk Score is 0 (lowest risk) to 27 (highest risk). This is one less than the highest total Risk Score proposed by Von Korff & Miglioretti [1], because the PROG-RES Study considered activity limitation in the previous three months on four levels rather than the five considered in the original paper.

Outcome

As in all previous work on this prognostic method of defining chronic pain [1,3,4,6], the definition of clinically significant pain, i.e. a poor outcome, at follow-up was a CPG II.

Statistical Methods

People who triggered the template, baseline responders and 12-month responders were compared on the basis of age, gender and pain characteristics to assess the potential for response bias.

After calculating the Risk Score for all individuals, the same methods as Dunn et al [4] and Thomas et al [6] were used to assess the performance of the model in predicting the prognosis of patients. First, the baseline cut-offs defined by Von Korff & Miglioretti [1] (i.e. low risk=0-7, intermediate risk=8-15, possible chronic pain=16-21, probable chronic pain=22+), were applied to the current dataset to calculate a) the proportion of people falling into each Risk Score group at baseline, b) the proportion in each of the baseline Risk Score groups completing the 12-month follow-up, and c) the proportion in each of the baseline Risk Score groups with clinically significant pain, i.e. a CPG II, at 12-month follow-up. Second, the discriminative ability (using the area under the receiver operating characteristic curve, and associated 95% confidence interval (95% CI)) and the calibration (using and Hosmer-Lemeshow test [13]) of the Risk Score in predicting outcome at 12-month follow-up was assessed. Third, the method proposed by Von Korff & Miglioretti [1] was applied to identify cut-offs for possible and probable chronic pain, specific to the PROG-RES Study dataset. A binary logistic model was fitted to determine the predicted probabilities of outcome and a plot, smoothed using a five-point rolling average, was used to display these probabilities. The new cut-offs were set to represent 50% and 80% probability of a poor outcome, respectively.

Ethical approval for this study was gained from the Central Cheshire Local Research Ethics Committee (REC Reference number: 06/Q1503/60).

Results

Response and follow-up

Electronic templates were triggered for 650 patients, of whom 502 (77%) responded to the baseline questionnaire. Responders were more likely to be female and slightly younger than non-responders (Table 1). The majority of baseline responders reported pain that had been present for six months or more and 86% had a CPG II. There was some attrition from the sample over the 12 months of follow-up. Those who remained in the sample (n=329) were similar to the baseline cohort in terms of gender, baseline CPG, chronicity of pain and anxiety and depression scores. They were however, slightly older. The mostly commonly affected pain sites were the low back (29%), shoulder (27%) and knee (26%). This was similar in those who were and were not followed-up to 12-months (data not shown).

Baseline Risk Scores

Of the 502 responders at baseline, 406 provided information on all Risk Score components and 262 remained in the study, providing Chronic Pain Grade data at 12 months. In this group, the mean Risk Score at baseline was 12.2 (SD 4.7). Using the cut-offs for the groupings of the Risk Score from the original US study [1], more than half of the sample were in the intermediate Risk Score group (Table 2).

Distribution of Chronic Pain Grade over time

There was a downward shift in the distribution of Chronic Pain Grades from baseline to 12-month follow-up, with Grade 0 rising from 0.2% to 11.5% and Grade IV falling from 39.4% to 24.0%.

Association between baseline Risk Score group (Von Korff & Miglioretti [1] method) and Chronic Pain Grade over time

Of the six patients identified as probable cases of chronic pain at baseline and providing Chronic Pain Grade data at 12-month follow-up, all had a CPG II (Table 2). In accordance with the definition of “possible chronic pain cases” at baseline, up to 80% would be expected to have a CPG II at follow-up: this was exceeded in the PROG-RES Study dataset (86%). Similarly, between 20% and 50% of the patients with an intermediate risk of chronic pain at baseline would be expected to have a CPG II at 12 months: this was 50% in the PROG-RES Study sample. In those patients classified as low risk at baseline, up to 20% would be expected to have significant pain at each follow-up. This was the case, with 17% of this group reporting CPG II.

Model performance

Calibration of the Risk Score in predicting significant pain at 12-month follow-up was good (Hosmer-Lemeshow chi-square=15.68, p-value=0.8314). The area under the curve was high at 0.79 (95% CI 0.74, 0.85).

Baseline Risk Score groups (defined in current dataset) and chronic pain over time

The increasing proportion of people with significant pain in each risk group, as defined by Von Korff & Miglioretti [1], and the examination of the model performance suggest that the Risk Score is indeed predicting risk of persistent pain in the PROG-RES Study sample. However, there are higher levels of significant pain at follow-up in this older sample than would be predicted by the original groupings of the Risk Score thus suggesting that the cut-offs to define differing probabilities of outcome are different in the current study to those derived in the original US LBP sample. Figure 1 shows the probability of clinically significant pain at 12-month follow-up according to baseline Risk Score. At a score of five or below, there is less than 20% probability of significant pain at 12-month follow-up. At scores below 12, the risk at follow-up is less than 50%, whilst at scores less than 16, there is less than 80% probability of significant pain after 12 months. Applying these cut-points (i.e. low risk=0-5, intermediate risk=6-11, possible chronic pain=12-15, probable chronic pain=16+) to form risk groups specific to the PROG-RES Study dataset provides groups with increasing levels of baseline pain intensity and depression and with expected proportions of people in each group with clinically significant pain at 12-month follow-up (Table 3).

Discussion

This study has shown that the prognostic approach to defining chronic pain, developed in a back pain sample by Von Korff and Miglioretti [1], can be applied to predict the persistence of musculoskeletal pain in older adults consulting with musculoskeletal pain in a range of anatomical sites over a 12-month period. At baseline, a higher proportion of people was assigned to the intermediate risk group and as a consequence, a lower proportion was seen in the probable chronic pain group than in previous studies using this methodology [1,4,6]. The prevalence of disabling pain was higher in the current sample than in the original population, but similar to the proportions found in previous British studies employing this method [4,6].

The ability of this Risk Score to distinguish between groups of patients with varying probabilities of continued significant pain over a number of time points suggests that the combination of factors that have previously been shown to predict the prognosis of pain at specific sites is also prognostic of pain in general, irrespective of the site of that pain. This provides evidence towards the suggestion of Von Korff and Dunn [3] that the Risk score could provide a common metric for quantifying the severity and risk of pain. However, the

analysis here did not aim to, and is unlikely to, provide optimal prediction of the presence of pain at follow-up as it was restricted to small set of easily collected prognostic variables.

When applying the cut-points of Von Korff and Miglioretti [1] to the sample, the proportion of people continuing to have pain was higher than would be expected based on the risk levels used to derive the original cut-points. This may be due to the older age of the PROG-RES Study sample, as a similar phenomenon was seen in the knee pain sample of Thomas et al [6], where the age of participants was similar to that in the PROG-RES Study. By applying the methods for the development of the cut-points in the original paper [1], new cut-points were developed for the PROG-RES Study, which were found to be similar to new cut-offs derived by Thomas et al [6]. These new cut-points were higher than those suggested by Von Korff & Miglioretti [1]: the cut-point for probable chronic pain in the current study was at approximately the same level of the cut-point for possible chronic pain in the original study [1].

As suggested previously [1,4], a major limitation of the risk score is the timing of the collection of the prognostic indicators. It has previously been shown [14] that symptoms of pain decrease in the period immediately following consultation, and so the use of a questionnaire to collect prognostic information two to six weeks after consultation, as has been the case in studies so far utilising this Risk Score, presents the question of whether the score is relevant to clinical practice. Further to this is the consideration of whether the individual variables required to calculate the Risk Score are collected in the same way in a GP consultation and in a research setting. For example, depression may be ascertained by the GP using a simple screening item, whilst in a research study, a multi-item, self-complete questionnaire might be used, as was the case in the current study with the use of the HADS. Furthermore, it is unclear whether different methods of data collection, such as face-to-face and anonymous questionnaires, result in different responses.

There was loss to follow-up in the PROG-RES Study cohort over the 12 months of follow-up. However, this is likely to have a minimal effect on the generalisability of the analyses performed in this paper, as the characteristics of the two groups, including baseline Risk Scores, were similar in those who were and were not followed-up (data not shown).

The current study used a different method of assessing the number of additional pain areas than has been used in previous studies, because the 'index' site of pain differed between patients in this study. Although this may be perceived as a weakness of the study, it should not be a cause for concern. Dunn et al [4] and Thomas et al [6] both used a different assessment of depression (HADS) to that used by Von Korff & Miglioretti [1] (SCL-90-R) without apparent ill-effect. Furthermore, the potential to interchange measures of each construct within the Risk Score widens the potential for its application in both research and practice, where different studies and clinical settings routinely use different assessments of the same constructs.

The performance of this Risk Score, developed in a younger LBP sample, among a group of older adults with a range of musculoskeletal pain conditions is encouraging, but the difference in cut-points for the score derived, empirically in this study, compared to those in the original study needs to be investigated further in larger samples. The higher levels of pain in this sample are likely responsible for this downward shift in cut-points and other similar samples from groups of older adults are needed to externally assess the usefulness of the new cut-points derived from the PROG-RES Study data. In addition, the role of this Risk Score across anatomical sites in a younger sample should be investigated.

The Risk Score used in this paper included only the prognostic factors suggested by Von Korff and Miglioretti [1]. This is not an exhaustive group of prognostic factors for the chronicity

of pain. For example, there is no measure of comorbidity (musculoskeletal or otherwise) and it may well be that the addition of anatomical site-specific pain indicators would improve the prognostic precision of the Risk Score in certain patients.

Further into the future, research might concentrate on the adaptation of this Risk Score, which is currently research-oriented, into a practical tool for use in clinical practice, as it has been established that patients desire accurate information about their likely outcome [2,8]. Many consultations, especially those with the GP, where a whole-person view of the patient is assumed, already collect information on the prognostic indicators contained within the Risk Score. However, work may be required to convert the long-form prognostic indicators collected in research studies after the initial consultation, into indicators that can be more easily administered in the consultation. The prognostic approach using this Risk Score needs to be shown to perform well in this context.

Furthermore, a recent randomised controlled trial of low back pain presenting to primary care has shown that a stratified approach, through the use of prognostic screening with matched pathways, compared to usual care, can lead to improvements in clinical outcomes and reductions in costs [15]. The findings presented in the current paper suggest that taking a similar approach across anatomical pain sites might also lead to improved clinical and economic outcomes given appropriate matched treatment pathways could be found.

Conclusions

The prognostic approach to defining chronic pain, originally suggested by von Korff and Miglioretti [1] in a sample of back pain patients, is suitable for use in older adults consulting primary care with musculoskeletal pain at a range of sites. However, new cut-offs in the Risk score are needed to allow for the higher risk profile in this older group. This holistic view of prognosis would sit well within a primary care setting, and as such, an adapted version of this method may have the potential for application directly within the clinical consultation in this setting.

Acknowledgments

We would like to thank the administration team at the Arthritis Research UK Primary Care Centre and the Keele General Practice Research Partnership. We would also like to thank Professor Peter Croft, Professor George Peat, Ms Charlotte Clements, and all the Central Cheshire general practices and patients who participated in this study.

Funding: This work was supported by Arthritis Research UK via a Primary Care Fellowship to CDM and the North Staffordshire NHS Primary Care Research Consortium. SM is currently supported by a National School for Primary Care Research Fellowship. CDM is currently supported by an Arthritis Research UK Clinician Scientist Award. KMD is supported by a Wellcome Trust Fellowship.

List of abbreviations

CI	Confidence Interval
CPG	Chronic Pain Grade
GP	General practice/practitioner
HADS	Hospital Anxiety and Depression Scale
LBP	Low Back Pain
PROG-RES Study	PROGnostic RESearch Study

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Figure 1.
Probability of clinically significant pain (CPG II) at 12-month follow-up predicted from
baseline Risk Score
Footnote: CPG – Chronic Pain Grade

Table 1

Response and attrition in the PROGnostic-RESearch (PROG-RES) Study: comparison of baseline characteristics in those who were and were not followed-up

	Triggered electronic template	Responded to baseline questionnaire	Responded to 12-month questionnaire
Overall ^a	650	502(77.1) ^a	329 (50.2) ^a
Gender			
Male	264 (40.6)	194 (38.8)	126 (38.5)
Female	386 (59.4)	306 (61.2)	201 (61.5)
Age at baseline (Mean (SD))	64.8 (10.3)	62.2 (10.2)	65.2 (9.5)
Baseline pain duration ^b			
Less than 3 months	-	155 (32.9)	101 (32.5)
3 to 6 months		74 (15.7)	50 (16.1)
7 to 12 months		52 (11.0)	36 (11.6)
1 to 2 years		59 (12.5)	40 (12.9)
3 years or more		131 (27.8)	84 (27.0)
Chronic Pain Grade			
0 - Pain free	-	1(0.2)	1 (0.3)
I - Low disability, low intensity		64 (13.7)	43 (13.9)
II - Low disability, high intensity		105 (22.5)	65 (21.0)
III - High disability, moderately limiting		133 (24.2)	76 (24.5)
IV - High disability, severely limiting		184 (39.4)	125 (40.3)
Number of pain sites	-		
0		33 (6.6)	22 (6.7)
1		318 (63.5)	215 (65.4)
2		76 (15.2)	46 (14.0)
3+		74 (14.8)	46 (14.0)
Hospital Anxiety and Depression scale ^b (Mean (SD))			
Anxiety	-	7.2 (4.1)	7.5 (4.0)
Depression		5.7 (3.6)	5.6 (3.4)

SD – standard deviation; Numbers are n (%) unless otherwise stated;

^aPercentage of those people triggering electronic template (sampling frame for PROG-RES Study cohort);

^bAvailable only for those individuals responding at baseline;

^cMaximum of eight sites (neck, shoulder, elbow, wrist/hand, low back, hip, knee, ankle/foot)

Table 2

Distribution of risk groups at baseline.

Baseline Risk Score group	n (%) responded		CPG II at 12-month follow-up	
	Baseline	12-month follow-up ^a	n	% (95%CI)
Low risk (0-7)	79 (20)	48 (61)	8	17 (7, 30)
Intermediate risk (8-15)	222 (55)	151 (68)	75	50 (41, 58)
Possible chronic pain (16-21)	93 (23)	57 (61)	49	86 (74, 94)
Probable chronic pain (22+)	12 (3)	6 (50)	6	100 (54, 100) ^b

CPG – Chronic Pain Grade;

^a% of those responding at baseline;^bOne-sided 97.5% confidence interval. Risk groups determined according to cut-points from Von Korff and Miglioretti [1]

Table 3
Probability of clinically significant pain (CPG II) at 12-month follow-up by risk level at baseline

Baseline Risk Score group	n (%) responded	CPG II at 12-month follow-up	Baseline average pain intensity (mean, SD)	Baseline HADS depression score (mean, SD)	
	Baseline	12-month follow-up ^a	n	% (95%CI)	
Low risk (0-5)	35	19	2	11 (1, 33)	3.57 (2.02) 2.37 (1.93)
Intermediate risk (6-11)	137	93	30	32 (23, 43)	5.55 (2.03) 3.59 (2.28)
Possible chronic pain (12-15)	129	87	51	59 (48, 69)	7.07 (1.58) 6.19 (2.63)
Probable chronic pain (16+)	105	63	55	87 (77, 94)	8.16 (1.32) 9.05 (3.61)

CPG – Chronic Pain Grade; HADS – Hospital Anxiety and Depression Scale; CI – confidence interval; SD – standard deviation. Risk groups defined empirical in the PROGnostic-RESearch Study dataset