

Repeatability and validity of an upper limb and neck discomfort questionnaire: the utility of the standardized Nordic questionnaire

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The repeatability and validity of a questionnaire for upper limb and neck complaints were assessed in a population of 105 hospital outpatients with a range of upper limb and neck disorders (including cervical spondylosis, adhesive capsulitis, lateral epicondylitis, carpal tunnel syndrome and Raynaud's phenomenon). Subjects were asked to complete a modified Nordic-style upper limb and neck discomfort questionnaire on two occasions closely spaced in time. The repeatability of their responses was assessed by calculating a kappa coefficient (κ), and the sensitivity and specificity of component items in the questionnaire were determined for specific diagnostic categories of upper limb and neck disorder. Symptom reports for pain in the upper limb and neck, pain interfering with physical activities, neurological symptoms and blanching were all found to be highly repeatable ($\kappa = 0.63-0.90$). A number of regional pain reports proved to be very sensitive in relation to specific upper limb disorders, but, with the exception of reported finger blanching in patients with Raynaud's phenomenon, none proved to have a good specificity (range = 0.33-0.38). We conclude that a modified Nordic-style questionnaire is repeatable and sensitive, and is likely to have a high utility in screening and surveillance. However, a complementary examination schedule of adequate specificity and repeatability is essential to establish a clinical diagnosis.

Key words: Musculoskeletal; Nordic; questionnaire; repeatability; surveillance; validity.

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INTRODUCTION

Upper limb and neck conditions such as cervical spondylosis, adhesive capsulitis, epicondylitis, carpal tunnel syndrome and Raynaud's phenomenon, are common causes of morbidity. However, their exact frequency and burden on health in industry and the community are difficult to ascertain. Investigations have been hampered by the lack of an accepted measuring instrument for use in screening and diagnosis.

Ideally, such a tool would be cheap, repeatable and diagnostically valid. One common approach has been to seek information by means of a self-completed musculoskeletal questionnaire. The Nordic questionnaire,¹ for example, has often been used in epidemiological surveys

in industry and in the community,²⁻¹¹ and collects information on the period prevalence of symptoms and interference with work and leisure arising from symptoms. The repeatability of this questionnaire has occasionally been tested,¹⁻³ but there is scant information on its validity. Since symptom complaints do not translate into exact clinical diagnoses, it appears likely that the diagnostic specificity of its component items will be lower than their sensitivity, but there is no direct information on this matter, and the value of the questionnaire in workplace screening and in epidemiological practice, bears closer examination.

In this paper we report on the repeatability of a modified form of the Nordic questionnaire and on its ability to distinguish between the different diagnostic possibilities in a sample of hospital outpatients and general practice patients with musculoskeletal and other diagnoses. The relevance of these findings to occupational health practice is discussed.

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MATERIALS AND METHODS

The study sample was obtained from patients attending a number of outpatient clinics at a university teaching hospital and a local general practice surgery. The clinical records of patients attending the rheumatology, orthopaedic and physiotherapy departments at the hospital were scrutinized over a four month period between November 1996 and March 1997, to identify subjects with a diagnosis of cervical spondylosis, adhesive capsulitis, lateral epicondylitis, carpal tunnel syndrome or Raynaud's phenomenon as the primary reason for attendance. In every case the clinical record relating to the patient's attendance was examined afterwards to ensure that the presumptive diagnosis was confirmed by a rheumatologist. In addition, during the same 30 hospital outpatient sessions, patients were identified for whom no specific upper limb or neck diagnosis had been made following consultation with a rheumatologist and at two clinic sessions in a nearby general practice surgery, patients were selected if their reason for attendance was not a musculoskeletal one.

Subjects were approached and asked to complete a musculoskeletal screening questionnaire on each of two occasions — while awaiting their appointment in the clinic, and a week later at home (the questionnaire was mailed to them with a reply envelope). The questionnaire asked about (1) pain in the upper limbs, neck, knees and hips lasting a day or more in the past week, and in the past year and (2) pain in these regions preventing the conduct of normal everyday activities over the past year. (The questions used were those appearing in the Nordic questionnaire.¹) Supplementary questions were included on upper limb neurological symptoms (numbness and paraesthesiae), finger blanching and the need for treatment by steroid injection.

For each subject a note was made of the primary diagnosis as indicated in the patient's completed records following consultation, and whether any treatment such as an injection was given during the consultation.

Two principal analyses were conducted. The repeatability of each item in the questionnaire was assessed by calculating a Cohen's kappa coefficient (or Cohen's weighted kappa coefficient as appropriate), for replicate reports.¹² Also, the sensitivity and specificity of the component items were determined by comparison with the reference standard of diagnosis as established in the

rheumatology clinic. The baseline for this comparison was subjects with all other conditions in the sample. Finally, to explore whether reporting of particular symptoms was more consistent in patients with 'an appropriate pathology' (for example, reporting of neck pain in patients with cervical spondylosis), kappa coefficients were calculated item-by-item for replicate observations in patients belonging to a few of the specific diagnostic groups. (This analysis was confined to groups that contained sufficient numbers.)

RESULTS

Table 1 describes the demographic characteristics of the study participants. A total of 105 subjects took part, comprising 64 cases with one or more of the specified diagnoses, 26 hospital outpatients with no clear rheumatological diagnosis and 15 patients from the general practice surgery. Seven subjects had two upper limb diagnoses, and one had three.

Every patient who was approached completed a first stage questionnaire. Sixty-nine subjects (66%) completed and returned a repeat questionnaire, the response rate being higher among hospital subjects than among patients drawn from general practice clinics.

Repeatability

The repeatability of pain reports for the neck, shoulder, arm and hand are detailed in Table 2, and those for neurological complaints and blanching in Table 3. Most of the items in the questionnaire showed a good level of agreement while some — notably pain in the upper limbs and neck over the past year (kappa coefficients (κ) = 0.73–0.82), elbow and neck complaints over the past year interfering with work or leisure activity (κ = 0.75–0.78) and numbness/tingling of the upper limb disturbing sleep over the past year (κ = 0.75) — showed excellent agreement.

The reporting of symptoms occurring in the past year was somewhat more consistent than for symptoms occurring in the past week, or pain giving rise to disability (defined as preventing normal activities such as work, daily activities and hobbies for a day or longer) in the past year.

In the case of patients reporting blanching attacks there was a high level of agreement for attacks of pallor

Table 1. Demographic characteristics of the study participants

	Subjects with:							Total
	Cervical spondylosis	Adhesive capsulitis	Lateral epicondylitis	Carpal tunnel syndrome	Raynaud's phenomenon	No diagnosis (outpatients)	No musculoskeletal complaint (general practice)	
Number	30	6	10	9	18	26	15	105
Age (IQ range)	64 (51–72)	61 (50–67)	49 (40–56)	56 (51–76)	53 (39–63)	56 (43–72)	36 (30–76)	56 (43–71)
Gender (M:F)	0.89	1.00	0.67	0.12	0.20	0.37	0.89	0.56
Handedness (% right)	80	83	60	78	89	96	80	85

Table 2. The repeatability of neck, shoulder, arm and hand symptom reports in the questionnaire

Item	No. of pairs ^a (answering both questionnaires)	Observed agreement (%)	kappa ^b coefficient	Prevalence	
				1st Qre	2nd Qre
Pain ^d in the past week					
Shoulder(s)	66	86.4	0.71	63.6	62.1
Elbow(s)	68	85.3	0.69	35.3	41.2
Wrist/hands(s)	68	85.3	0.68	64.7	61.8
Neck	65	83.1	0.64	66.2	58.5
Pain ^d in the past year					
Shoulder(s)	64	89.1	0.74	71.9	67.2
Elbow(s)	66	90.9	0.82	45.5	48.5
Wrist/hand(s)	64	89.1	0.73	71.9	70.3
Neck	63	90.5	0.75	76.2	73.0
Pain in the past year interfering with work or leisure ^e					
Shoulder(s)	65	84.6	0.69	46.2	49.2
Elbow(s)	66	89.4	0.75	25.8	33.3
Wrist/hand(s)	65	80.0	0.59	53.9	58.5
Neck	66	89.4	0.78	43.9	42.4
Pain in elbow, past year leading to injection	63	84.1	0.56 ^b	15.9 ^c	17.5 ^c

^a 69 subjects maximum.

^b Or weighted kappa for more than two ordered categories.

^c Prevalence amongst those who had elbow pain.

^d Pain lasting a day or more.

^e Preventing jobs, normal activities, hobbies.

Table 3. The repeatability of questions on other upper limb symptoms

Item	No. of pairs ^a	Observed agreement (%)	kappa ^b coefficient	Prevalence	
				1st Qre	2nd Qre
Numbness and/or tingling ^c in past week					
Any, upper limb(s) ^d	62	82.3	0.64	59.7	54.8
Finger(s)	65	81.5	0.63	49.2	49.2
Hand/arm(s)	62	87.1	0.73	43.6	33.9
Hand/arm and disturbing sleep	45	84.4	0.67	40.0	37.8
Numbness and/or tingling ^c in past year					
Any, upper limb(s)	61	86.9	0.70	63.9	70.5
Finger(s)	58	86.2	0.70	60.3	67.2
Hand/arm(s)	60	86.7	0.73	51.7	48.3
Hand/arm and sleep disturbance	48	87.5	0.75	39.6	47.9
Blanching attacks ^e					
Any	61	95.1	0.90	37.7	39.3
Any induced by cold	24	91.7	0.70	79.2	87.5
Any with clear edge	22	81.8	0.58	31.8	31.8
No. of digits affected	23	85.7	0.49 ^b		
No. of attacks in past year	22	88.6	0.60 ^b		

^a 69 subjects maximum.

^b Or weighted kappa for more than two ordered categories.

^c Lasting three minutes or longer.

^d Finger, hand or arm.

^e sudden attacks where digit becomes cold, numb and at the same time pale or white.

($\kappa = 0.90$) and cold-induced attacks ($\kappa = 0.70$), and even reasonable consistency in accounts of the numbers of digits involved, and the number of attacks suffered in the past year (weighted κ of 0.49 and 0.60 respectively).

An additional analysis of repeatability was conducted by diagnostic category for the two disorders of largest sample size, cervical spondylosis and Raynaud's phenomenon. Among the 20 subjects with cervical spondylosis who answered questions on neck pain in the past year, a perfect level of agreement ($\kappa = 1$) was discovered in the two rounds of testing; while 12 of the 14 patients with

Raynaud's phenomenon who answered the question on cold-induced finger blanching responded positively in each round of inquiry, and the nine who answered the question on blanching attacks with a clearly demarcated edge, again answered with perfect consistency ($\kappa = 1$).

Sensitivity and specificity

A number of items in the questionnaire had a high sensitivity in relation to particular diagnoses. Table 4 records some of these for regional pain reports in the past year for each specific pathology. The question on neck pain

Table 4. The sensitivity of pain reports in the past year by specific pathology

	Cervical spondylosis (n = 30) ^a	Adhesive capsulitis (n = 6) ^a	Lateral epicondylitis (n = 10) ^a	Carpal tunnel syndrome (n = 9) ^a	Raynaud's phenomenon (n = 18) ^a
Pain ^b in past year					
Neck	0.90	1.00	0.60	0.67	0.50
Shoulder(s)	0.83	1.00	0.40	0.67	0.47
Elbow(s)	0.43	0.67	0.90	0.33	0.22
Wrist/hand(s)	0.73	0.50	0.70	1.00	0.78

^a Maximum number of subjects — some items missing.

^b Pain lasting a day or more.

had a sensitivity of 0.90 for a diagnosis of cervical spondylosis in 30 patients with the condition. In other groups the case numbers were smaller, but high sensitivities were observed for shoulder and neck pain in the past year in adhesive capsulitis (1.0 in six cases for both symptoms); elbow pain in the past year in lateral epicondylitis (0.90 in 10 cases) and wrist and hand pain in the past year in carpal tunnel syndrome (1.0 in nine cases).

As Table 4 demonstrates, the sensitivity of a pain report was generally highest when the anatomical region of complaint corresponded to that expected from a knowledge of the disease: the neck for cervical spondylosis, shoulder for adhesive capsulitis, elbow for lateral epicondylitis and wrist for carpal tunnel syndrome. However, for other site-disease pairings there was a spectrum of differential sensitivity, such that neck pain proved a very sensitive indicator for adhesive capsulitis, but elbow pain was a poor predictor of carpal tunnel syndrome. For cervical spondylosis, shoulder pain in the past year proved to be almost as sensitive a predictor as neck pain (0.83 in 30 cases), illustrating the tendency of neck and shoulder conditions to cause similar regional patterns of pain.

A number of non-pain items from the questionnaire also had a high sensitivity for specific pathologies (data not shown). In particular, the items on blanching and cold-induced finger blanching proved highly sensitive for Raynaud's phenomenon (0.94 and 1.0 in 18 and 17 cases respectively). Other items included upper limb numbness/tingling in the past year in lateral epicondylitis (1.0 in nine cases), in carpal tunnel syndrome (0.89 in nine cases) and in cervical spondylosis (0.86 in 29 cases). Upper limb numbness/tingling disturbing sleep in the past year had a sensitivity of 0.75 in eight cases of carpal tunnel syndrome.

The highest specificities (data not shown) were found for the questions on blanching in patients with Raynaud's phenomenon (0.78 for any blanching attacks in 18 cases and 0.75 blanching attacks with a clearly demarcated edge in 14 cases). The specificities of other individual items of the questionnaire all proved to be poor, ranging from 0.33–0.38.

DISCUSSION

We have tested the repeatability and validity of a modified Nordic-style questionnaire of upper limb and neck

complaint in 105 patients from hospital and general practice outpatient clinics, many of whom were known to be suffering specific disorders of these sites. Our data indicate that items such as pain experienced in the past week and past year, and complaints of neurological disturbance and finger blanching have a high repeatability, as judged by Fleiss's criteria (a κ greater than 0.75 is said to denote excellent agreement and that of 0.4–0.75 a good agreement).¹³

Investigations of upper limb and neck symptoms and their potential relation to working activities have commonly employed the Nordic questionnaire or one of its variants.^{4–11} These measuring instruments have also been advocated for use in the medical screening of exposed populations.¹⁴ However, the reliability and validity of their component items have not often been subjected to rigorous evaluation.

In one study involving 29 safety engineers, 17 medical secretaries and 22 railway maintenance workers, the proportion of non-identical items in the general questionnaire ranged from 0–23%, and that for neck-shoulder symptoms in 27 clerical workers ranged from 0–30%.¹ A second survey of 44 supermarket cashiers reported findings in a similar range (0%–26%).² These studies did not allow for the possibility of a chance agreement between the rounds of testing by calculating kappa coefficients, but more recently, Franzblau *et al*³ reported the test-retest agreement (κ) among 148 industrial workers for an upper extremity discomfort questionnaire based on several of the original Nordic items. These workers found good-to-excellent repeatability for symptoms in the upper limb and neck over the previous week, with κ values ranging from 0.68 (elbow/forearm) to 0.79 (wrist/hand). A direct item-by-item comparison with our own data is not possible as pain symptoms and neurological symptoms were presented in their analysis in aggregated form, but the impression is one of broad consistency between the studies: the data indicate that many of the items drawn from the Nordic questionnaire are repeatable over a short time interval. The small number of additional items we included for testing, such as blanching and numbness/tingling disturbing sleep, and elbow pain leading to injection, also fared well, with good or excellent κ values.

Our study involved a group of patients with a high prevalence of complaint who were expected to have chronic and persistent health problems. Hence, a high degree of repeatability might reasonably have been anticipated. The fact that this was observed provides

reassurance that the test items are robust in clear-cut cases of disease.

Although the number of observations was small, the additional analyses of repeatability by diagnostic category for cervical spondylosis and Raynaud's phenomenon further suggest, for subjects with specific upper limb pathology, that important elements of the history tend to be reported even more consistently. This provides further reassurance that the measuring instrument is likely to be repeatable in circumstances of clinical importance.

Reports of recent symptoms (those in the past week), and of symptoms leading to interference with work or leisure activity proved somewhat less reliable than reporting of symptoms in the past year. The former observation may be an artefact, arising from a genuine change in health status (the week being reported on was not the same week in each questionnaire). Our data may even understate the size of such an effect if there was a response bias which favoured those with unresolved symptoms completing a second questionnaire. The differences were quite small, but it may be more dependable (and arguably more relevant) in epidemiological and occupational investigations to focus inquiries on symptoms that are protracted in their time course.

The test items refer to pain lasting 'a day or longer' in the past week or year, without further qualification, but it may also help to concentrate on symptoms that lie at the more severe end of the spectrum. Subjects' consistency in reporting work and leisure interference was reasonable, but it should be noted that we have selected a sample of patients referred for secondary care, in whom disability might be expected to exist and to be remembered. Further improvement might be expected from the development of a more specific panel of disability questions, of the kind recently reported for disorders of the shoulder.¹⁵

Finally, our data indicate that a number of the questionnaire items had a high sensitivity for detecting upper limb and neck disease states, but that their specificity, and hence their ability to discriminate in a group of patients with rheumatic complaints was low. (Finger blanching in Raynaud's phenomenon proved to be an exception.) This assessment was based on a study group with a high prevalence of pathology, and an even lower specificity might be expected if the questionnaire were applied in the general population or in occupational health screening. The lack of specificity is not surprising, as the distinction between possibilities such as adhesive capsulitis, bicipital tendinitis and supraspinatus tendinitis can only be made following a carefully conducted clinical examination.

The high sensitivity displayed by component items of the questionnaire is a finding of practical importance. It implies that a modified Nordic-style questionnaire will have a high utility when used in screening and surveillance. The expected finding of a low specificity confirms that simple questioning is not an adequate basis for diagnosis in individuals: the questionnaire needs to be supported by a complementary examination schedule of

adequate specificity and repeatability, and reports that are based solely on the use of a Nordic-style questionnaire need to be interpreted with this in mind.

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