

Editorial Manager(tm) for Pain  
Manuscript Draft

Manuscript Number:

Title: A systematic review of pain drawing literature-should pain drawings be used for psychological screening?

Article Type: Full-Length Article

Section/Category:

Keywords: Pain drawings, validity, reliability, psychological evaluation.

Corresponding Author: Ms Dawn Carnes, BSc

Corresponding Author's Institution: Barts and The London, Queen Mary School of Medicine and Dentistry

First Author: Dawn Carnes, B.Sc.

Order of Authors: Dawn Carnes, B.Sc.; Deborah Ashby, PhD.; Martin R Underwood, M.D., FRCGP

Manuscript Region of Origin:

**Abstract:** Introduction: The use of pain drawings to identify the psychological 'state' of patients in terms of distress, depression, somatisation and anxiety has been advocated. They are used as a psychological screen before considering treatments, such as surgery. For pain drawings to be clinically useful as a psychological screen they need good positive and negative predictive values. We systematically reviewed the literature that directly compared pain drawing scoring systems with measures of psychological state.

**Method:** We searched 12 medical and social science databases, using key words and their derivatives.

Nineteen articles were suitable for analysis. The majority focused on low back pain (79%) and secondary and tertiary care (90%). Pain drawings were evaluated against psychological tools testing: personality (MMPI); somatisation (MSPQ, IBQ); depression (Zung); anxiety (SF36) and distress (GHQ).

**Results:** Three studies concluded that the association between pain drawings and psychological state was sufficient for clinical use; of these only one showed reasonable sensitivity and specificity data. Six reported a statistical association and 10/19 studies reported inconclusive results and weak association. More clinically

relevant, sensitivity data ranged from 24-93%, specificity 44-91%, positive predictive values 28-93% and negative predictive values 35-92%. The range and magnitude of these predictive statistics is too wide and inconsistent to accept the pain drawing as a clinical diagnostic tool to predict psychological state.

Conclusions: We conclude that the available data do not support the assumption that unusual pain drawings or extensive marking indicate disturbed psychological state. There is no high quality evidence to support pain-drawing use as a psychological assessment tool; therefore pain drawings are not recommended for this purpose.



**Institute of Community Health Sciences**

Medical Sciences Building  
Mile End Road London E1 4NS  
Telephone: + 44 (0)20 7882 7910  
Facsimile: + 44 (0) 20 7882 7924  
Website: www.qmul.ac.uk

**Centre for General Practice and  
Primary Care**

Dawn Carnes  
PhD student  
E-mail. [d.carnes@qmul.ac.uk](mailto:d.carnes@qmul.ac.uk)

To: The Editor.

**Ref: A systematic review of pain drawing literature – should pain drawings be used for psychological screening?**

Attached is the manuscript for the above article for your consideration. There are no conflicts of financial interest or other relationships that may bias the outcome of this study, with any of the authors. The principle researcher, Dawn Carnes is funded by Barts and London Joint Research Board a charitable trust which funds both research and PhD studentships at Barts and The London Queen Mary School of Medicine and Dentistry. Martin Underwood and Deborah Ashby are both Professors employed by Barts and The London Queen Mary School of Medicine and Dentistry, Queen Mary University of London.

The recommended field editor is Karen Davis, Pain Measurement and Imaging.

Four potential referees are:

Dr. H. Susan J. Picavet  
Centre for Prevention and Health Services Research  
National Institute of Public Health and the Environment  
P.O. Box 1, 3720 BA, Bilthoven,  
The Netherlands  
Tel +31302743063,  
Fax +31302744407  
Email: [Susan.Picavet@rivm.nl](mailto:Susan.Picavet@rivm.nl)

Lance McCracken, PhD  
Pain Management Unit  
Royal National Hospital for Rheumatic Diseases  
Bath BA1 1RL

Phone: 01225 473403  
Fax: 01225 473461  
Email: [lance.mccracken@rnhrd-tr.swest.nhs.uk](mailto:lance.mccracken@rnhrd-tr.swest.nhs.uk)

Prof Chris J. Main  
Dept of Behavioural Medicine  
Hope Hospital,  
Salford.  
UK  
M6 8HD  
Tel 0161 787 5596 (DL)  
or 0161 787 5436(Sec)  
Fax 0161 787 5589  
Email: [c.j.main@fs1.ho.man.ac.uk](mailto:c.j.main@fs1.ho.man.ac.uk)

Blair Smith  
Department of General Practice and Primary Care  
University of Aberdeen  
Forest Hill Health Centre  
Westburn Road  
Aberdeen  
Scotland  
AB25 2AY  
Tel: +44 (0) 1224 553 972  
Fax: +44 (0) 1224 550 683  
Email: [blairsmith@abdn.ac.uk](mailto:blairsmith@abdn.ac.uk)

This work has not been submitted or considered for publication elsewhere.

Should you have any queries or questions please do not hesitate to contact me.

Yours truly,

Dawn Carnes

## Abstract

**Introduction:** The use of pain drawings to identify the psychological ‘state’ of patients in terms of distress, depression, somatisation and anxiety has been advocated. They are used as a psychological screen before considering treatments, such as surgery. For pain drawings to be clinically useful as a psychological screen they need good positive and negative predictive values. We systematically reviewed the literature that directly compared pain drawing scoring systems with measures of psychological state.

**Method:** We searched 12 medical and social science databases, using key words and their derivatives. Nineteen articles were suitable for analysis. The majority focused on low back pain (79%) and secondary and tertiary care (90%). Pain drawings were evaluated against psychological tools testing: personality (MMPI); somatisation (MSPQ, IBQ); depression (Zung); anxiety (SF36) and distress (GHQ).

**Results:** Three studies concluded that the association between pain drawings and psychological state was sufficient for clinical use; of these only one showed reasonable sensitivity and specificity data. Six reported a statistical association and 10/19 studies reported inconclusive results and weak association. More clinically relevant, sensitivity data ranged from 24-93%, specificity 44-91%, positive predictive values 28-93% and negative predictive values 35-92%. The range and magnitude of these predictive statistics is too wide and inconsistent to accept the pain drawing as a clinical diagnostic tool to predict psychological state.

**Conclusions:** We conclude that the available data do not support the assumption that unusual pain drawings or extensive marking indicate disturbed psychological state. There is no high quality evidence to support pain-drawing use as a psychological assessment tool; therefore pain drawings are not recommended for this purpose.

## Title Page

### Title:

A Systematic Review of Pain Drawing Literature - Should Pain Drawings be used for Psychological Screening?

### Authors:

Carnes Dawn \*, Ashby Deborah\*\*, Underwood Martin\*.

### Affiliations:

\*Institute of Community Health Sciences, Barts and The London, Queen Mary's School of Medicine and Dentistry, London, UK.

\*\* The Wolfson Institute of Preventive Medicine, Barts and The London, Queen Mary's School of Medicine and Dentistry, London, UK.

**Number of Pages in manuscript:** 14

**Numbers of Figures:** 1 (1 page)

**Number of Tables:** 6 (6 pages)

### Corresponding Author:

Dawn Carnes  
Institute of Community Health Sciences,  
Centre for General Practice and Primary Care  
Barts and The London, Queen Mary's School of Medicine and Dentistry, London,  
Mile End Road  
London.  
E1 4NS  
UK.

Telephone +44 (0)20 7882 7910

Fax: +44 (0)20 7882 6396

Email: [d.carnes@qmul.ac.uk](mailto:d.carnes@qmul.ac.uk)

## **Introduction**

Pain drawings are simple line drawings of the human figure on which patients can indicate their pain for both clinical information and epidemiological research.

In the 1970s Ransford et al reported that a 'penalty points' system for scoring pain drawings could be used to identify patients with elevated hysteria and hypochondriasis scores on the Minnesota Multiphasic Personality Inventory (MMPI) (Ransford, Mooney and Cairns 1976). Clinicians have used pain drawings to evaluate patients' psychological states, to predict outcome and to avoid unnecessary invasive procedures on patients whose problems are not entirely physiological (Dzioba and Doxey 1984, Ransford et al, 1976, McNeill 1986, Bessette 1997, Hagg et al, 2003).

Pain drawings that convey 'abnormal', unexpected or unexplainable pain distributions are thought to identify patients with a greater psychological component to their problem. Sivik 1992, Chan 1993, and Ransford 1976 have all advocated the use and advantages of using pain drawings as a psychological pre-screening tool.

It is well documented that psychological distress is associated with chronic pain (McWilliams et al 2004, Currie and Wang 2004). Psychological factors such as distress, depression and somatisation are implicated in the transition to chronic pain (Pincus et al, 2002). If these psychological factors are important and pain drawings can identify them, then they may be a useful clinical tool that will help identify those at a higher risk of developing chronic pain and inform the management of those with chronic pain. Pain drawings could be an effective screening tool for chronic pain conditions; when compared with some other psychometric tests they are cheap, and easy to use and analyse. Furthermore they may be more acceptable to patients than the sometimes distressing questions used in many psychometric tests.

We report here a systematic review of studies assessing the utility of pain drawings and their scoring systems as a screening tool for psychological distress when used in clinical situations. Assessment of the scoring systems includes validity when compared with psychological measures and positive & negative predictive values of 'abnormal' drawings.

## Method

Two researchers independently searched 12 computerised data bases which covered a range of both medical and social science literature (Table 1).

The key search words were: Pain drawing\*, pain diagram\*, pain AND drawing\* and diagram\* pain AND body map\*, body map\*, mannequin\*, manikin\* mannikin\*, homuncul\*, pain visuali\*, pain AND visuali\*, pain constructs. The exact wording of the search varied according to the search engine used and the researcher.

We identified additional studies by citation tracking from key papers, searching for full reports of studies published as abstracts only, and from personal & peer reference collections. Table 2 shows the inclusion and exclusion criteria for the initial paper selection. The search was conducted during the first three months in 2003.

Two researchers (DC & MU) independently reviewed titles and then abstracts to identify full text papers for review. These were reviewed in detail to identify eligible studies. We developed a data extraction pro forma based on the Critical Appraisal Skills Programme (CASP) guidelines ( NHS Public Resource Unit 2003) for reviewing papers about diagnostic tests. We focused on the most relevant aspects of the study and the usual minimum acceptable standard for study design, sampling, data analysis and presentation of results (Greenhalgh 1997).

For those studies meeting minimum quality standards we assessed the quality of validity and reliability testing; and the statistical principles used to analyse the association between the pain drawing and the reference measure. We assessed each quality parameter relevant to the study design but did not attempt to produce an overall quality score (Table 3).

We did not assess the quality of the psychological reference measures used. These all have their limitations and assessing and describing these is beyond the scope of this work. We did however note whether the authors took into account the limitations of the tests they chose as their gold standard for assessing psychological state and whether they acknowledged this in the main body of the text.

Where possible we extracted data to show:

- a) strength of any statistical associations between the pain drawing data and the reference standard,
- b) sensitivity and specificity of the pain drawings as a diagnostic tool; that is, the potential of a diagnostic tool correctly to predict positive and negative results in those with abnormal and normal conditions respectively,
- c) positive and negative predictive values of pain drawings when used as diagnostic tools; that is, the potential of the diagnostic tool correctly to predict negative and positive results in populations studied.

Predictive statistics give a better indication of pain drawing's clinical utility than correlation data and/or levels of significant statistical association. Correlation and association can show data trends only. Statistics for diagnostic tools have to illustrate



more than this: they have to show a high probability of the tool predicting the condition (Hennekens and Buring 1987).

We extracted and assessed data about: the characteristics of the sample; the sample size, to show the power of the statistics presented; the methodological approach and its appropriateness to achieving the stated aim; the rationale for the chosen statistical analysis; and whether the conclusions made were supported by the data.

All data extraction was done by two researchers working independently, who then conferred to achieve consensus. Where appropriate and possible, we did fresh analyses on data derived from the published papers.

## Results

Our searches generated 4,636 titles, of which 725 titles and abstracts were selected for review. From these, 179 full texts were sourced for further study; 57 of these articles directly assessed pain drawing validity and reliability as an independent screening tool; 19 of these assessed, in part or completely, the relationship between pain drawings and psychological state (Figure 1).

Two of the 19 articles were by Sivik (1991, 1992). The data set used for these was the same, but the analysis and research question were different; therefore they are included as two separate studies.

### *Study characteristics*

Sample size and study design varied considerably; three studies used controls and only two (Hagg 2003 and Dahl 2001) calculated sample size appropriate for their research design. The power of the statistics in the majority of studies is low, making some of the results statistically weak. Seventeen out of the 19 (89%) studies were conducted in secondary or tertiary care (Table 4). Fourteen out of the 19 (74%) studies focus on the lower back.

### *Pain drawing scoring*

We identified three types of scoring systems used by researchers:

- a) *Penalty point scoring*  
Drawings are allocated points for 'unreasonableness' of markings; that is, markings that are thought to be atypical of 'normal' expected pain patterns score higher than those that conform to recognised text book patterns of pain.
- b) *Regional scoring*  
Pain at different regions are registered or scored, for example, lower back, knees etc.
- c) *Extent scoring*  
This usually involves counting the number of pixels or grid squares that are covered on a transparent template placed over the drawing.

Depending on the results of these scoring systems pain drawings are then classified using a variety of terms such as organic vs non organic, disturbed vs not disturbed, normal vs abnormal etc. Almay (1987), Ohlund (1996) and Parker (1995) compared whole body and lower body extent measuring systems with modified penalty point systems and found that they correlated well. However extent measures were easier to use and more reliable. Bryner (1993), and Schwartz (1984) suggest that the different scoring systems measure roughly the same thing.

### *Psychological reference measures*

The 19 studies used 20 different psychological tests to explore the relationship between psychological state and the pain drawing. These can be grouped into three areas (Table 5).

Only eight authors discussed and highlighted the limitations of the psychometric tests used or took into account whether the tests had been validated on the populations they were investigating (Table 3).

#### *Ransford et al's penalty points system*

Ransford et al's research (1976) is nearly 30 years old and it is still widely seen as the gold standard in this field; therefore we have considered it in more detail. Ransford developed a pain drawing 'penalty points' scoring system based on standard 'text book' patterns of pain. Points are scored for unusual or unexpected markings and extra annotations. It is uncertain from the article what the maximum possible score is, but Ransford's cut-off value for determining an 'abnormal' pain drawing is greater than two. Unfortunately the scoring system was validated on the same sample as was used to develop it. The sample was a very specific population of low back pain patients with an average of 8.9 years of pain and 1.5 spinal operations; they would have been highly likely to have high scores on both the MMPI and the pain drawing. No controls were used and reliability of the scoring method was not tested.

Von Baeyer (1983) was unable to replicate Ransford's findings. He found weak pain drawing association with the Hysteria scale on the MMPI, that could not be clinically substantiated. Sivik (1991) concluded, as Ransford did, that there is an association between pain drawings and psychological state (somatisation). However, no positive or negative predictive values were given to justify using the pain drawing as a diagnostic screening tool. She used small control groups and more robust statistical approaches than Ransford, but unfortunately she did not cross validate her findings with Ransford's methods, or with her initial 'gold standard', or take into account pain as a confounding variable.

#### *Associations with psychological state*

Ransford (1976), Sivik (1991), and Dahl (2001) concluded that there was a definite association between pain drawings and psychological state, suggesting their use as a psychological screening tool; but only Ransford (1976) supported this by giving strong predictive data (Table 6). Six of the 19 articles (Table 4) found a positive association between pain drawing scores and psychological data, with the authors suggesting possible clinical utility, whilst the remaining 10 studies concluded that the statistical association between the pain drawing and the psychological test was too weak to use pain drawing as a diagnostic psychological screening tool.

Seven studies provided enough data for us to calculate sensitivity, specificity and positive and negative predictive values; this data is shown in table 6. The only study with reasonable sensitivity and specificity data is Ransford's, but even his figures indicate that there is a 1 in 5 chance of pain drawings predicting a false positive result. The range of data shown between studies is large and indicates poor discriminatory power, inadequate psychological validation and/or poor study sampling and size; table 6 shows the variety. There is little consistency between studies and areas tested. No pattern emerges from the data overall, and the values given in table 6 are too wide to draw any positive conclusions.

*Pain drawings, personality type and emotional disposition*

Ransford (1976), Von Baeyer (1983), Sivik (1991), Sivik (1992), Sikorski (1996), Ginzburg (1998), Lindal (1988), Greenough (1991) and Hagg (2003) compared pain drawings with personality traits, as opposed to emotional state. The latter six concluded that the relationship between pain drawings and personality traits they tested were too weak to be clinically useful. We have methodological and statistical concerns with Sivik's and Ransford's papers, which leaves little evidence to support pain drawings as predictors of personality type.

For emotional state, Sikorski (1996), Parker (1995), Ohlund (1996), Greenough (1991) and Chan (1993) all found that chronic low back pain patients, regardless of aetiology, had increased prevalence of distress, abnormal illness behaviour and somatic perception. Mc Neill (1986), Schwartz (1984), Ohlund (1996), Hildebrandt (1988), Chan (1993) and Bessette (1997) all suggest that the way pain drawings are completed may indicate a coping style rather than a form of psychological distress. The data in these studies showed a tendency for pain drawings to reflect pain perception based on ideas of somatisation, rather than psychological distress. The data however are not strong enough to confirm that pain drawings reliably reflect somatisation tendency. The pain drawing does not appear to be a good discriminator of depression, anxiety, personality or psychological distress.

## **Discussion**

Pain drawings have been compared with psychological tests that measure different psychological states and/or personality states. There are statistical associations between pain drawings and psychological state, but sensitivity, specificity and positive and negative predictive values indicate that pain drawings do not predict psychological state at a level that is acceptable for clinical use. The error risk of getting an incorrect result is too high and inconsistent accurately to diagnose psychological disposition.

One of the strengths of this review is that we analysed the data to assess the clinical diagnostic utility of pain drawings. Unfortunately only six out of 19 studies gave enough data to produce predictive statistics. Conversely one of the weaknesses or practical problems of conducting this systematic review was the exclusion of foreign language text searches. There is a possibility that we introduced publication bias by examining only English language papers. Such bias usually results in negative studies being published in less accessible journals. Thus, any bias introduced would lead us to overestimate pain drawings' predictive value. We are partly reassured that important studies have not been overlooked as none of our included studies conducted in non-Anglophone countries (8) included any relevant non-English citations.

### *Quality of research*

The generalisability of the results published and the quality of the research assessed varied. Firstly, the majority of studies in this review were conducted in pain specific populations, mostly low back pain patients in secondary and tertiary care. These are often patients with chronic pain and we know through other research that these patients have particular psychological issues compared with the rest of the population (Pincus et al 2002, Harris et al 2003, McCracken and Eccleston 2003). The pain drawing findings may not be transferable or generalisable to other populations. Secondly, the quality of the research varied in terms of methodology, statistical interpretation and justification of the statistical analyses used. The statistics used in the articles varied: both continuous and ordinal data were generated from the penalty point scoring systems, and they were analysed using both parametric and non parametric methods. Rarely were confidence intervals given and most studies were based on null hypothesis testing. The power of the data in the reviewed studies was rarely considered and sampling tended to be based on convenience and location. Statistical association and clinical utility are different concepts; this was not accounted for in the majority of studies. Nine studies recommended, or suggested, the possible utility of using pain drawings as pre-screening diagnostic tools based on correlation and/or statistical significance; this alone is insufficient to predict altered psychological state at an individual patient level. Correlation and statistical significance need to be supported by data showing high levels of sensitivity, specificity and negative and positive predictive values. The one study with reasonable predictive statistics (Ransford et al 1976) has major flaws in its design and interpretation. No other study showed reasonable and consistent data indicating that pain drawings predicted psychological state.

As illustrated, it is tempting to make inferences from self completed pain drawings as they are taken to be a direct representation of an individual's perception of their pain. Using pain drawings is attractive because of their high level of face validity for patients and clinicians alike. However, using them without establishing their content, criterion and predictive validity is misleading.

### *Content Validity*

Content validity in this instance is whether the pain drawing measures what it is supposed to measure, that is psychological state. We found that pain drawing markings that fit 'medical models' of expected pain are regarded as 'organic' or 'normal', and patients who describe pain as clinicians expect are regarded as 'experiencing pain appropriately' (Sivik, 1992). Parker (1995), Sikorski (1996) and Ohlund (1996) drew attention to the futility of classifying pain drawings into organic and non organic pain. Little is known about the causes of 'non-specific' or 'non-organic' pain, so it is not possible to say without doubt that it has no organic origin. We also found that highly emotive labels used in some studies, such as disturbed, abnormal and somatised are inappropriate and inefficient at predicting specific psychological states as measured by different psychological tests. Pain site and extent data may be more closely associated with psychological variables. For example, pain in lots of locations may have more psychological impact than pain in one, and low back pain may be more psychologically distressing than knee pain.

Some authors suggest that pain drawings may indicate coping style rather than psychological distress (Hildebrandt 1988, Sivik 1992, Schwartz 1984). However, the behavioural coping mechanisms referred to differ between the authors, and the definitions are unclear. This in itself needs to be explored. It should be noted that we did not identify any studies exploring the meaning of pain drawings to those who complete them. It is still unclear what pain the drawings are measuring.

### *Criterion validity*

This assesses how well a test compares with any 'gold standards' that exist in the same area. In this review pain drawing scores have been evaluated against psychological tests measuring certain psychological traits. The reliability and validity of psychological tests are regularly debated and the fallibility of many of the 'gold standards' used in the studies we reviewed has been extensively discussed in the psychological journals. However, in the absence of perfect measures, the limitations of the tests concerned should be accounted for. Unfortunately no studies in this systematic review did so. Few control group comparisons were made; normative test data were used where available in some studies, but generally the sample population characteristics were not considered against these norms.

### *Predictive validity*

The accuracy of a diagnostic test, in this case the pain drawing to predict correctly a psychological state, is essential if the pain drawing is to be used in a clinical situation. Few studies in this review assessed sensitivity, specificity or negative and positive predictive power of the pain drawing, which are by far the most important data to be presented if authors wish to suggest that the pain drawing be used as a diagnostic tool.

The sensitivity and specificity data we extracted showed ranges that are too wide and inconsistent to indicate any patterns or trend for predicting psychological state.

#### *Pain drawing utility*

Pain drawings may have a utility, for example describing pain distribution in community studies and providing and obtaining useful information for epidemiological research. Other uses may include predicting treatment outcome. Outcome may not be determined by psychological state but by the extent of the pain as shown by pain drawing markings reflecting the complexity of the condition to be treated. Complex pain drawings may reflect complex pain conditions and co-morbidities, which may or may not affect individual states of mind, rather than predict psychological disturbance. Pain drawings may have a role to illustrate pain patterns, both complex and 'simple'; and they may also be useful for clinical note taking and as a self completed record of pain for historical documentation and for monitoring the progression of certain conditions.

#### **Conclusion**

Overall there is no good quality evidence to support the use of pain drawings as a psychological assessment tool in clinical practice. Statistical associations may be apparent between pain drawing scoring methods and certain psychological states but the strength of the association is too weak to justify the use of pain drawings as a clinical diagnostic tool for evaluating psychological state.

#### **Acknowledgements**

Acknowledgements are extended to Barts and The London Joint Research Board for funding the researcher and this study and for the advice and guidance from the Musculoskeletal Process of Care and Collaboration ([www.musculoskeletal.org](http://www.musculoskeletal.org))

## References:

- Almay BG. Clinical characteristics of patients with idiopathic pain syndromes. Depressive symptomatology and patient pain drawings. *Pain* 1987; 29(3):335-346.
- Beattie PF, Meyers SP, Stratford P, Millard RW, Hollenberg GM. Associations between patient report of symptoms and anatomic impairment visible on lumbar magnetic resonance imaging. *Spine* 2000; 25(7):819-828.
- Beck A., Ward C, Mendelson M., Mock J, & Erbaugh, J. (1961). An inventory for measuring depression. *Archives of General Psychiatry*, 4, 561–571.
- Bessette L, Keller RB, Lew RA, Simmons BP, Fossel AH, Mooney N et al. Prognostic value of a hand symptom diagram in surgery for carpal tunnel syndrome. *J Rheumatol* 1997; 24(4):726-734.
- Boaz A, Ashby D, Young K. Systematic Reviews: what have they got to offer evidence based policy and practice? ESRC UK Centre for Evidence Based Policy and Practice: Working Paper 2. 2002.
- Bryner P. Pain Drawing Analysis: A review. *Chiropractic. J. Australia*. 1993; 23:86-91.
- Chan CW, Goldman S, Ilstrup D, Kunselman AR, O'Neill PI. The Pain Drawing and Waddell's Nonorganic Physical Signs in Chronic Low Back Pain. *Spine*. 1993; 18(13), 1717-1722.
- Chibnall JT, Tait RC. The short form of the Beck Depression Inventory: validity issues with chronic pain patients. *Clinical Journal of Pain* 1994; 10(4):261-266.
- Critical Reviews Advisory Group. Introduction to Systematic Reviews. School for Health and Related Research (SchARR) . 1996.
- Currie SR, Wang J. Chronic pain and major depression in the Canadian population. *Pain* 2004; 107:54-60.
- Dahl B, Gehrchen PM, Kiaer T, Blyme P, Tondevoid E, Bendix T. Nonorganic pain drawings are associated with low psychological scores on the preoperative SF-36 questionnaire in patients with chronic low back pain. *European Spine Journal* 2001; 10(3):211-214.
- Dzioba RB, Doxey NC. A prospective investigation into orthopaedic and psychological predictors of outcome of first lumbar surgery following industrial injury. *Spine*. 1984; 9:614-23.



Ginzburg BM. The relationship between pain drawings and the psychological state. *Pain Kingdom*; 1988; 35(2):Nov-146.

Greenhalgh T. How to read a paper: papers that summarise other papers (systematic reviews and meta-analyses). *BMJ*. 1997; 315: 672-675 (13 Sept).

Greenough CG, Fraser RD. Comparison of eight psychometric instruments in unselected patients with back pain. *Spine* 1991; 16(9):1068-1074.

Hagg O, Fritzell P, Hedland R, Moller H, Ekselius L, Nordwall A. Pain Drawing does not predict the outcome of fusion surgery for chronic low back pain: a report from the swedish lumbar spine study. *European Spine Journal* 2003; 12:2-11.

Harris S, Morley S, Borton S. Role loss and emotional adjustment in chronic pain. *Pain*; 2003;363-370.

Hathaway S.R, McKinley J.C. Minnesota Multiphasic Personality Inventory Manual. Psychological Corporation, NewYork, 1951.

Hennekens C, Buring J. *Epidemiology in Medicine*. Ed by Mayrent S, Little Brown and Co, Boston/Toronto 1987.

Herron LD, Pheasant HC. Changes in MMPI profiles after low-back surgery. *Spine* 1982; 7(6):591-597.

Hildebrandt J, Franz CE, Choroba-Mehnen B, Temme M. The use of pain drawings in screening for psychological involvement in complaints of low-back pain. *Spine* 1988; 13(6):681-685.

McWilliams LA, Goodwin RD, Cox BJ. Depression and anxiety associated with three pain conditions: results from a nationally representative sample. *Pain* 111: 2004; 77-83.

Lindal E, Uden A. Cognitive differentiation, back pain, and psychogenic pain drawings. *Percept Mot Skills* 1988; 67(3):835-845.

Main CJ, Waddell G. Behavioural Responses to Examination: A Reappraisal of the Interpretation of 'Nonorganic Signs'. *Spine* 23(21), 2367-2371. 1-11-1998.

Main C. The Modified Somatic Perception Questionnaire (MSPQ) 1983. *J of Psychosomatic Research*. 27:503-514.

McCracken L.M, Eccleston C. Coping or Acceptance: what to do about chronic pain? *Pain* 105, 197-204. 2003.

Mc Neill T, Sinkora G, Leavitt F. Psychological classification of low back pain patients: a prognostic tool. *Spine* 1986;11(9):955-959.

Mulrow C.D. Systematic Reviews: Rationale for systematic reviews. *BMJ* 309, 1994:597-599. 3-9.

NHS. Public Health Resource Unit, learning and development. Critical Appraisal Skills Programme (CASP) and Evidence Based Practice. 2003. [www.phru.nhs.uk/casp](http://www.phru.nhs.uk/casp)

Ohlund C, Eek C, Palmblad S, Areskoug B, Nachemson A. Quantified pain drawing in subacute low back pain. Validation in a nonselected outpatient industrial sample. *Spine* 1996; 21(9):1021-1030.

Papageorgiou A.C, Croft P.R, Ferry S, Jayson M, Silman A. Estimating the prevalence of low back pain in the general population: Evidence from the South Manchester back pain survey. *Spine*, 1995; 20 (17):1889-1894.

Parker H, Wood PL, Main CJ. The use of the pain drawing as a screening measure to predict psychological distress in chronic low back pain. *Spine* 1995; 20(2):236-243.

Pilowski I, Spence ND. Manual for the Illness behaviour Questionnaire (IBQ), 2<sup>nd</sup> ed, Adelaide: University of Adelaide, Dept of Psychiatry, 1983.

Pincus T, Vogel S, Field A.P. A Systematic review of psychological factors as predictors of chronicity/disability in prospective cohorts of low back pain. *Spine* 2002; 27: E109-E120.

RankineJJ, Fortune DG, Hutchinson CE, Hughes DG, Main CJ. Pain Drawings in the Assessment of Nerve Root Compression: A Comparative study with Lumbar Spine Magnetic Resonance Imaging. *Spine*. 1998; Aug 1:1668-1676.

Ransford AO, Cairns D, Mooney V. The Pain Drawing as an Aid to the Psychological Evaluation of Patients with Low Back Pain. *Spine*, 1976; 1:1-127.

Schwartz DP, DeGood DE. Global Appropriateness of Pain Drawings. Blind Ratings Predict Patterns of Psychological Distress and Litigation Status. *Pain*, 1984; 19:383-388.

Sikorski JM, Stampfer HG, Cole RM, Wheatley AE. Psychological Aspects of Chronic Low Back Pain. *Aust. N.Z. J.Surg.* 1996; 66:294-297.

Sivik TM. Personality traits in patients with acute low-back pain. A comparison with chronic low-back pain patients. *Psychother Psychosom* 1991; 56(3):135-140.

Sivik TM. Relationship between back pain and personality: Psychologic vulnerability as risk factor for the development of chronic back pain. *Nordic Journal of Psychiatry Norway*; 1992; 46(3):192-193.

Tait RC. Comments on the article by B. M. Ginzburg, H. Merskey and C. L. Lau, entitled "The relationship between pain drawings and psychological distress in chronic pain patients," *Pain*. 35.1988: 141-246. *Pain Kingdom*; 39(1):Oct-124.

Takata K, Hirotsu H. Pain drawing in the evaluation of low back pain. *International Orthopaedics* 1995; 19(6):361-366.

Taylor WP, Stern WR, Kubiszyn TW. Predicting Patients Perceptions of Response to Treatment for Low Back Pain. *Spine*. 1984;9[3],313-316.

von Baeyer CL. Invalid use of pain drawings in psychological screening of back pain patients. *Pain Kingdom*. 1983; 16:103-107.

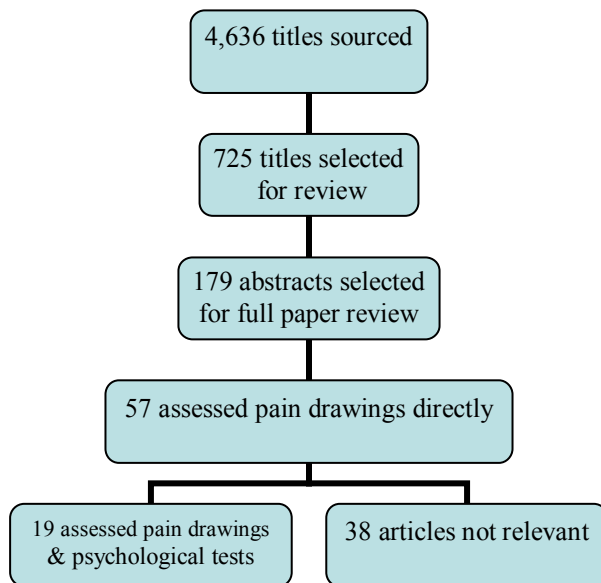
Ware J, Sherbourne C. The MOS 36 item short form health survey (SF36) 1. Conceptual Framework and Item Selection. 1992. *Med Care* 30: 473-483.

Wolfe F. Practical issues in psychosocial measures. *J Rheumatology* 1997; 24(5):990-993.

Wong AL, Wong WK, Harker J, Sterz M, Bulpitt K, Park G et al. Patient self-report tender and swollen joint counts in early rheumatoid arthritis. *J Rheumatology*. 1999; 26(12):2551-2561.

Zung W. A self rating depression scale. 1965. *Arch. Gen. Psychiatry* 12: 63-70.

**Figure 1. Flow chart illustrating search.**



**Table 1. Databases searched for the review**

<b>Database</b>	<b>Description</b>	<b>Dates</b>
Medline and Pre-Medline	National Library of Medicine Medical Journals	1966- present
AMED	Allied Medicine Electronic Database	1985 – present
ISI Web of Science	Scientific Journals	1981-2003
Pub Med and CAM	Medical and Complementary and Alternative Medicine	1993 – present
CINAHL	Cumulative Index to Nursing and Allied Health Literature	1982 - present
EBM	Evidence Based Medicine including Cochrane Databases	1993 - present
EMBASE	Evidence Based Medicine Articles and Reviews	1974 - present
A&HCI	Arts and Humanities Citation Index	1981 - present
SSci	Social Science Citation Index	1981 - present
Psychinfo	Psychological Texts and Journals	Historical texts 1800s, for Journals 1967 - present
ASSIA	Applied Social Science Index and Abstracts	1987 - present

**Table 2. Inclusion and Exclusion Criteria**

<b>Inclusion Criteria</b>	<b>Exclusion Criteria</b>
Manikin pain drawings representing musculoskeletal pain as opposed to free expression art therapy drawings Validity of the pain drawing tested against a recognised or robust psychological test The pain drawings had to be evaluated as an independent tool  The drawings had to be self completed by adults (aged 18 or over)	Musculoskeletal pain that is predominantly systemic in origin, such as rheumatoid arthritis Non-English language papers  Conference and dissertation abstracts (searches were conducted to find papers subsequently) Pilot studies with little or no data

**Table 3. Outcome of Article Reviews**

<b>Quality Assessment</b>	<b>Ransford 1976</b>	<b>Bayeur 1983</b>	<b>Schwartz 1984</b>	<b>McNeill 1986</b>	<b>Almay 1987</b>	<b>Hildebran dt 1988</b>	<b>Lindal 1988</b>	<b>Greenoug h 1991</b>	<b>Sivik 1991</b>	<b>Sivik 1992</b>	<b>Chan 1993</b>	<b>Parker 1995</b>	<b>Ohlund 1996</b>	<b>Sikorski 1996</b>	<b>Bessette 1997</b>	<b>Ginzburg 1998</b>	<b>Rankine 1998</b>	<b>Dahl 2001</b>	<b>Hagg 2003</b>
<b>Was the aim clear and did the study address the aim?</b>	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
<b>Was sample size appropriate and power considered?</b>	no	no	no	no	no	no	no	no	no	no	yes	no	yes*	no	no	no	no	yes	no
<b>Was the reference standard described?</b>	yes	yes	yes	yes	yes	yes	yes	yes	no	no	yes	no	yes	yes	yes	yes	yes	yes	yes
<b>Were the reference standard limitations considered?</b>	no	no	no	no	no	no	no	yes	yes	yes	no	no	yes	yes	yes	yes	yes	no	no
<b>Was there control and/or blinding processes to avoid bias?</b>	no	no	yes	yes	yes	yes	yes	yes	yes	yes	no	no	no	yes	no	no	yes	no	yes
<b>Was reliability tested?</b>	no	yes	yes	no	no	yes	yes	no	no	yes	yes	yes	no	no	no	no	no*	no	yes
<b>Were the pain drawing procedures described and scoring method explained?</b>	yes	yes	yes	yes	yes	yes	yes	yes	no*	no*	yes	yes	yes	yes	yes	yes	yes*	yes	yes
<b>Were predictive data presented?</b>	yes	yes	no	yes	no	no	no	yes	no	no	no	yes	no	no	no	no	no	no	no
*referred to another paper																			

<b>Table 4. Description of articles by author</b>		<b>Ransford 1976</b>	<b>Von Bayeur 1983</b>	<b>Schwartz 1984</b>	<b>McNeil 1986</b>	<b>Almay 1987</b>	<b>Hildebrandt 1988</b>	<b>Lindal 1988</b>	<b>Greenough 1991</b>	<b>Sivik 1991</b>	<b>Sivik 1992</b>	<b>Chan 1993</b>	<b>Parker 1995</b>	<b>Ohlund 1996</b>	<b>Sikorski 1996</b>	<b>Bessette 1997</b>	<b>Ginzburg 1998</b>	<b>Rankine 1998</b>	<b>Dahl 2001</b>	<b>Hagg 2003</b>	
Sample size	<100					X	X	X			X								X		
	<200	X		X						X				X	X			X			
	>201		X		X				X			X	X			X	X			X	
<b>Sector</b>	<b>Primary</b>							X													
	<b>Secondary</b>				X				X	X	X	X			X	X			X		
	<b>Tertiary</b>	X	X	X		X	X						X				X	X		X	
	<b>Occupational</b>													X							
Area of the body studied	Whole body			X		X											X				
	Hand/arm															X					
	Upper body																				
	Low back low body	X	X		X		X	X	X	X	X	X	X	X	X			X	X	X	
<b>Psychological domain</b>	<b>Personality</b>	X	X					X	X	X	X				X		X			X	
	<b>Somatisation</b>			X			X	X	X			X		X	X			X			
	<b>Depression/anxiety</b>				X	X	X	X	X					X		X	X	X	X		
Scoring method	Points/classification	X	X	X	X		X	X	X	X	X	X	X	X	X					X	X
	Region					X							X			X	X			X	
	Extent					X								X		X	X	X		X	
<b>Definite association between pain drawings and psychological state</b>		X								X									X		
Association present and pain drawing possibly useful for psychological screening					X	X					X	X		X		X					
<b>Weak association and pain drawing not useful for determining psychological state.</b>			X	X			X	X	X				X		X		X	X		X	



**Table 5. Categories and the Most Common Psychological Tests Used**

<b>Category</b>	<b>Abbreviation</b>	<b>Name</b>
Personality	MMPI	Minnesota Multiphasic Personality Inventory. (Hathaway and McKinley 1951)
Somatisation	MSPQ	Modified Somatic Perception Questionnaire. (Main C 1983)
	IBQ	Illness Behaviour Questionnaire. (Pilowski and Spence 1983)
Psychological and/or emotional state	BDI	Beck Depression Inventory. (Beck A 1961)
	Zung	Zung Depression Scale. (Zung W 1965)
	SF36 (anxiety)	Short Form 36. (Ware J, Sherbourne C 1992)
	GHQ (distress)	General Health Questionnaire. (Goldberg D 1978)

**Table 6. Predictive value of Pain Drawings**

Author	Sample size	Sector	Psych. Test	Sensitivity (CI 95%)	Specificity (CI 95%)	Positive predictive value (CI 95%)	Negative predictive value (CI 95%)
<b>Ransford 1976</b>	109	tertiary	MMPI	<b>93%</b> <b>(85-97%)</b>	<b>79%</b> <b>(59-97%)</b>	<b>93%</b> <b>(85-97%)</b>	<b>79%</b> <b>(59-92%)</b>
<b>Von Bayeur 1983</b>	212	secondary	MMPI	<b>44%</b> <b>(34-53%)</b>	<b>80%</b> <b>(71-88%)</b>	<b>70%</b> <b>(58-81%)</b>	<b>56%</b> <b>(48-65%)</b>
<b>Mc Neill 1986</b>	158	secondary	BPCS	<b>24%</b> <b>(10-44%)</b>	<b>88%</b> <b>(88-93%)</b>	<b>30%</b> <b>(13-53%)</b>	<b>84%</b> <b>(76-90%)</b>
<b>Almay 1987</b>	70	secondary	CPRS	<b>68%</b>	<b>52%</b>	<b>82%</b>	<b>35%</b>
<b>Greenough 1991</b>	274	secondary	MMPI,MSQ, Zung	<b>42%</b>	<b>91%</b>		
<b>Chan 1993</b>	651	secondary	Waddell signs	<b>82%</b> <b>(74-95%)</b>	<b>48%</b> <b>(44-53%)</b>	<b>28%</b> <b>(23-33%)</b>	<b>92%</b> <b>(88-95%)</b>
<b>Parker 1995</b>	100 100	secondary tertiary	DRAM DRAM			<b>94%</b> <b>71%</b>	<b>81%</b> <b>90%</b>
<b>Range %</b>				<b>24-93%</b>	<b>44-91%</b>	<b>28-94%</b>	<b>35-92%</b>