Evaluation of a cognitive behavioural programme for rehabilitating patients with chronic pain

A C DE C WILLIAMS
M K NICHOLAS
P H RICHARDSON
C E PITHER
D M JUSTINS
J H CHAMBERLAIN
V R HARDING
J A RALPHS
S C JONES
I DIEUDONNÉ
J D FEATHERSTONE
D R HODGSON
K L RIDOUT
E M SHANNON

SUMMARY. The aim of this prospective longitudinal study was to evaluate an inpatient cognitive behavioural pain management programme for patients with chronic pain. A physical and psychological assessment of patients was carried out before and after treatment, and at one and six months follow up. A total of 212 patients with disabling chronic pain of mean duration 10.5 years, for whom no further medical or psychiatric treatment was appropriate or available, were admitted; their mean age was 50 years and 65% were women. The four week programme was delivered by a multidisciplinary team of two psychologists, a physiotherapist, nurse, occupational therapist and anaesthetist. The main components of therapy included: education, teaching behavioural and cognitive skills, a stretch and exercise programme, medication reduction, goal setting and pacing, and relaxation training. Outcome measures assessed quality of life, physical performance (for example walking speed), pain intensity and distress, depression severity and confidence. Assessment immediately after treatment revealed significant improvements on all measures. Improvements were well maintained at six month follow up.

Cognitive behavioural treatment can be of value in improving the day-to-day functioning and quality of life of patients with chronic pain for whom conventional medical treatments have apparently failed.

Keywords: chronic pain; rehabilitation; cognitive therapy; behaviour therapy; management of disease.

A C de C Williams, MSc and M K Nicholas, PhD, programme directors; C E Pither, FRCA, medical director; V R Harding, MCSP, senior physiotherapist; J A Ralphs, RGN, charge nurse; S C Jones, BA and D R Hodgson, MA, assistant psychologists; I Dieudonné, associate psychologist; J D Featherstone and E M Shannon, BApSc, senior occupational therapists; and K L Ridout, MSc, principal clinical psychologist, INPUT Pain Management Unit, St Thomas' Hospital, London. P H Richardson, PhD, senior lecturer in psychology and D M Justins, FRCA, consultant in anaesthetics and pain management, St Thomas' Hospital London. J H Chamberlain, MRCP, director, Trinity Hospice, London.
Submitted: 26 October 1992; accepted: 10 March 1993.

Introduction

CHRONIC pain affects over 10% of the population worldwide,[1-3] and about 1% of the population are severely disabled.[4] While many sufferers do not complain of significant deterioration in their quality of life, some develop a disabled state characterized by persistent pain which outlasts the normal duration of healing or resolution of an injury, difficulty in coping with the pain, and associated psychological and social problems.[5-7] The causes of chronic pain are not yet fully understood.[8] Diagnostic tests frequently fail to identify clear cut pathology,[9-12] drugs provide limited relief and adverse effects are common,[7,9,12-14] invasive treatments often prove unhelpful and carry a significant risk of making matters worse[5,9,15-17] and the disappointment of both patient and physician fuels misunderstanding and despair.[18-20] Patients are discharged from specialist care to their general practitioners, who provide support, but may respond to patients' increased disability and complaint by re-referral for investigation and treatment, to the frustration of patient, general practitioner and specialist.

Cognitive behavioural approaches to pain management directly address the patient's distress and dysfunction, rather than attempting to identify and cure a putative lesion.[21] According to this perspective, patients whose adaptations to acute pain (such as resting, seeking medical help, and withdrawal from everyday duties and pursuits) persist beyond the expected healing phase become increasingly distressed by the failure of the pain to respond. Such adaptations are more likely to become established habits when they are supported by the patient's environment. Factors which may encourage maladaptive habit formation include advice to rest until recovered, loss of work or delegation of household duties, a solicitous and overprotective family which encourages dependence, and the vain pursuit of further diagnosis and treatment. Consequently, the patient with chronic pain may become increasingly unfit, fearful of activity, and pessimistic about the prospects of pain relief.[7,22-24]

The behavioural treatment of chronic pain aims to improve physical performance and coping skills, and to transfer the control of pain and management of its related problems back to the patient. The treatment was pioneered in the United States of America,[5] and outcome studies in the USA and Sweden have demonstrated the efficacy of both inpatient and outpatient programmes.[25-30]

This approach to pain management has been slow to be adopted in the United Kingdom and there has been only one outcome study from inpatient and one from outpatient treatment programmes.[31,32] There also appear to be substantial differences in the populations in the USA and UK. American patients with chronic pain entering pain management programmes are mainly men,[11,33-40] and at peak working age (mean age about 45 years).[11,33-35,37,39-50] Funding for treatment in the USA is often contingent on a return to work,[40,51] and this in turn influences selection, excluding up to 50% of otherwise suitable patients.[51] Pain clinics in the UK offer cognitive behavioural treatment to a population which is largely permanently retired from work on medical grounds, or otherwise unlikely to take up work as part of recovery of function. Patients are predominantly women, and have a longer history of chronic pain, but fewer invasive treat-

ments.[31,32] In view of these differences on variables which have in some cases predicted poorer response to treatment in American studies,[34,45,46] it remains to be established whether the approach used in the USA is applicable in the UK.

INPUT, an inpatient cognitive behavioural pain management programme at St Thomas' Hospital, London, has treated chronic pain patients since January 1989. This paper reports the outcome for patients completing the programme in the first two years and three months.

Method

Patients

Patients were referred to St Thomas' Hospital pain clinic from all over the UK. The patients were assessed for suitability for the programme by an anaesthetist and a psychologist. Patients were included if they fulfilled two of the following criteria: widespread disruption in activity (except work) owing to pain; habitual overactivity leading to increased pain; use of excessive medication related to pain problems (regular use of analgesics and/or sedatives for more than six months without adequate relief); high affective distress score on assessment, or clear signs or reports of emotional distress attributed by the patient to pain; use of unnecessary aids, such as crutches or a corset, assessed during medical examination by the anaesthetist; high levels of reported or observed pain behaviour; work reduced, impaired or ceased owing to pain. Patients were excluded if they fulfilled one of the following criteria: cannot use English, written or spoken; cannot climb stairs; current psychotic illness; unavailable for a four week period; suitable for further physical treatment, assessed during medical examination; pain for less than one year; less than 18 years old; currently using opiod analgesics prescribed as treatment for drug dependence, or not prescribed for patient. Patients who met the inclusion criteria and who were receiving outpatient psychiatric treatment compatible with the programme were not excluded. Patients who met the selection criteria were offered the inpatient cognitive behavioural pain management programme (they could elect to receive the programme as an outpatient); those who accepted joined a waiting list, and were admitted between two and 10 months later.

Treatment

Patients were admitted in cohorts of five every two weeks for a four week stay, returning home for weekends. They were accommodated in single rooms in a building separate from the main hospital. The programme ran from 08.30 hours to 17.00 hours, Monday to Friday. Outside this time, patients applied the programme methods to their daily routines and activities without direct staff supervision.

Behavioural and cognitive approaches to the problems of chronic pain emphasize the role of learning, perceptions and beliefs in the development and maintenance of chronic pain problems and provide a basis for interventions aimed at reversing their effects.[9,22,23] All programme staff (two psychologists, an anaesthetist, a physiotherapist, an occupational therapist and a nurse) applied behavioural principles to all relevant areas of patient activity and inactivity, with the goals of achieving manageable activity levels in pursuits of the patient's own choosing and reducing medication intake and pain behaviour (limping, grimacing, repeated description of the pain, and so on).[9] The rationale of changing habitual behaviour was shared with patients, and at first any behaviour directed towards specified goals, or demonstrating management of the pain, was enthusiastically and promptly reinforced by the staff, who gradually reduced this as patients learned to reinforce themselves. Cognitive principles were taught to enable patients to estimate their abilities and limitations realistically, and to achieve greater control over their lives and over the negative affect associated with pain. Information, with written back up, was given about the causes and treatment of pain, the rationale of the programme, the effects of activity and inactivity on the body, the effects of medication, sleep management, and techniques for establishing new habits of thought and behaviour. Patients were taught in group sessions, applying the principles to their individual situations and goals. All staff contributed to the educational aspects of the programme.

Exercise and therapeutic stretch routines were taught, setting baselines at 80% of the patient's pre-treatment performance,[9] and gradual increments planned and recorded jointly with the patient, to be attempted regardless of pain level. Patients set long term and intermediate goals, and were taught to break these down into component movements and positions to be addressed by the exercise programme. Manageable timed limits (tolerances) were established for sitting, standing, walking and so on and the patients taught the concept of pacing: gradual and steady increases in the time spent on each activity, with systematic variation of position and movement, and/or regular breaks.[56]

A simple relaxation technique[57] was taught for use in situations in which pain or anxiety increased. Distraction and other cognitive techniques[56,58] were taught in conjunction with relaxation, and patients were expected to practise regularly each day. Standard cognitive approaches to fear and to depression were taught.[22,59–61] Patients learned to monitor thoughts and feelings about pain, and to observe antecedents of increased pain and their responses to it. They were then encouraged to aim for a realistic perspective, and to challenge and change thoughts which contributed to increased anxiety, distress and maladaptive coping with pain.

On admission, patients were encouraged to consider withdrawal from as many as possible of their pain-related drugs. Multiple prescriptions of similar drugs were simplified, regular intake was recommended rather than when required, and patients chose between withdrawal using a morphine-based cocktail in which the active ingredients were gradually reduced, or cutting down their own tablets according to a written plan.

Patients were also given guidance in applying practical behavioural and cognitive strategies to improve their sleep patterns.[62]

Assessment

A standard assessment was carried out by INPUT staff at pre-treatment interview (one to two weeks before admission to the programme) and on two occasions after treatment (one month and six months after discharge). A briefer version was completed on the penultimate day of the four week inpatient treatment programme (end of treatment assessment). Not all measures taken are reported here. All assessment was executed using a standard format, and assessors making post-treatment assessments were blind to the patient's previous performance. All the assessments were carried out in the INPUT unit.

The impact of pain on the patients' day-to-day functioning was measured using the sickness impact profile given by interview.[52] Average pain intensity and pain distress over the last week were rated by the patient on a scale from 0 (no pain) to 100 (pain as intense/distressing as it could be). Depression severity was measured using the Beck depression inventory,[53] and confidence in performing a range of activities despite the pain was measured using a pain self-efficacy questionnaire.[54] Walking speed and distance walked in 10 minutes were measured over a 20 metre indoor course, with the patient permitted to rest as necessary. The number of stairs climbed, up or down, in two minutes was counted, and the number of sit-ups to tolerance (until pain or

exhaustion unmanageable) was recorded. Pain-related medication was classified as non-steroidal anti-inflammatory drugs, including aspirin and paracetamol; opioid analgesics; antidepressants; benzodiazepines; and other drugs (mainly carbamazepine and phenytoin). The morphine equivalent 24-hour dose was calculated for opioid analgesics, and the diazepam equivalent 24-hour dose for benzodiazepines.[55] The collection of drug-related data began after the treatment programme had been running for six months; the results are therefore presented for fewer patients. Patients were asked at the one month follow up to rate their overall satisfaction with the treatment received on the programme on a scale from 0 (not at all satisfied) to six (very satisfied). Patients were asked at the one month and six month follow ups how frequently they used the exercise, stretch, relaxation and coping strategies they had been taught.

Statistical analysis

All data were subjected to repeated measures analysis of variance, using the *BMDP* statistical software.[63] Where necessary, the scores of outliers were corrected to within 3.5 standard deviations of the mean, and square root or log transformations used to achieve adequate normality of skewed data.[64] Raw means are reported here for clarity. Where the analyses of variance were concerned, and a sphericity test indicated inequality of variance across repeated measures, the degrees of freedom and significance values were modified using the Greenhouse–Geisser adjustment.[63]

To examine possible population differences between those patients who attended and those who defaulted from follow up, *t*-tests were performed comparing their pre-treatment mean scores on each measure.

Results

Of the 593 patients referred and assessed over the two years and three months period, 134 failed to meet the criteria for acceptance to the programme (further physical treatment was recommended in 53 cases), and 77 declined the treatment, leaving 382 (64.4%) accepted for treatment. Of these, 86 opted to be treated as outpatients and 53 were still awaiting treatment at the time of this study. Of the 243 patients who entered inpatient treatment, 23 dropped out and three were discharged before four weeks, and five patients gave insufficient data for analysis (owing to language or literacy problems). Pre-treatment and end of treatment data were thus obtained for 212 patients. At one month follow up, complete data were obtained for 182 of the 212 patients who had been discharged over one month before (85.8%), and psychological data were obtained by post from another 12 (5.7%), with no data for 15 (7.1%). At six month follow up, data were obtained for 118 of the 166 possible patients (71.1%).

Of the 212 patients receiving treatment, the mean age was 50.0 years (standard deviation (SD) 13.3 years, range 20–84 years), and 74 were men (34.9%). The mean duration of the current episode of chronic pain was 10.5 years (SD 9.9 years, range 1–47 years). One hundred and forty five patients had spinal pain (68.4%), 34 had torso pain (16.0%), 17 had pain mainly in upper or lower limbs (8.0%), six had head pain (2.8%), four had central/thalamic pain (1.9%) and six had pain all over (2.8%). Of the 212 patients, 47.8% had undergone at least one operation for the pain, 31 patients (14.6%) were employed full or part time, 34.6% were unemployed owing to the pain, 19.4% were on long term leave owing to the pain, 19.9% were retired, 9.5% were homemakers and 1.9% were unemployed for reasons unrelated to the pain. Seventeen patients (12.5%) had unresolved compensation claims. Of the 212 patients 18.9% lived alone, 72.1% with spouse and/or children, and 8.9% with other relatives or friends.

Change during treatment

The results of outcome measures at the pre-treatment and end of treatment assessments are given in Table 1. Patients made significant improvements on all measures of psychological and physical function. Mean depression scores fell to within the normal range (0–13) from the mild/moderate range. The mean pain intensity score fell by 6.2 points in the range 0–100 while the mean pain distress score fell by 13.2 points in the same range. Physical performance in terms of time to complete 20 metre walk improved twofold, while the number of sit-ups to tolerance nearly quadrupled.

Maintenance of change

The improvements in mean scores for dysfunction, depression, self-efficacy, and for all physical measures, were maintained at one month and six month follow up, without significant increment or decrement (in all cases $F>7.1$; 3, 163+ degrees of freedom (df); $P<0.01$). Pain intensity ratings by patients who attended the one month and six month follow ups showed no significant change (mean scores 69.7, 68.2, 65.4 and 68.9 for pre-treatment, end of treatment, one month and six month follow-up assessments, respectively), although pain intensity ratings from the total sample at the pre-treatment and end of treatment assessments suggested a small reduction. By contrast, pain distress fell by around 10 points from pre-treatment values and was maintained at follow up (66.1, 55.1 51.4 and 56.5, respectively; overall $F = 8.06$; 3,273 df; $P<0.001$).

Patients who defaulted from follow up had a higher mean pre-treatment pain intensity score than those who attended ($t = 2.86$; 158 df; $P<0.05$), a higher mean pain distress score ($t = 3.13$; 160 df; $P<0.05$), a lower mean self-efficacy score ($t = 2.02$; 162 df;

Table 1. Results of outcome measures pre-treatment and at the end of treatment in patients with chronic pain.

	Mean (standard deviation)					
	Pre-treatment		End of treatment		*F*	Degrees of freedom
Dysfunction score (SIP) (%)	*28.4*	*(11.4)*	*16.8*	*(11.5)*	191.28***	1,189
Pain intensity score[a]	72.2	(19.1)	66.0	(22.0)	12.60***	1,187
Pain distress score[a]	68.4	(23.1)	55.2	(26.5)	40.39***	1,185
Depression score (BDI)[b]	18.5	(8.7)	9.7	(7.9)	239.67***	1,198
Self-efficacy score (PSEQ)[c]	24.1	(11.4)	40.7	(12.7)	334.61***	1,205
Length of 10 minute walk (metres)	421.8	(215.0)	640.3	(228.5)	285.05***	1,195
Time of 20 metre walk (seconds)	27.7	(21.5)	13.6	(6.1)	320.71***	1,192
No. of stairs in two minutes	109	(57)	173	(74)	248.01***	1,190
No. of sit-ups to tolerance	4.9	(7.0)	19.5	(14.0)	387.29***	1,193

SIP = Sickness impact profile. BDI = Beck depression inventory. PSEQ = pain self-efficacy questionnaire. [a]Range 0–100. [b]Range 0–63. [c]Range 0–60. ***$P<0.001$.

$P<0.05$), and walked a shorter mean distance in 10 minutes ($t = 2.49$; 163 df; $P<0.05$), but there was no significant difference in pre-treatment dysfunction or depression scores, walking speed or number of stairs or sit-ups to tolerance.

Medication

The percentage of patients taking non-steroidal anti-inflammatory drugs and taking antidepressants fell following the programme, and the reduction was maintained at follow up (Table 2). Although the percentage of patients taking opioid analgesics, and the mean daily dose, were reduced following treatment, there was a marked increase in their use between discharge and one month follow up, with little further change at six months. However, the mean daily dose at six month follow up remained less than half that at admission. Fewer patients began taking benzodiazepines again over the same period. The reduction in the mean daily dose achieved following treatment was smaller than for the opioid analgesics, to minimize withdrawal effects as far as possible, and at one month and six month follow up there was no further reduction in the mean daily dose.

Before treatment, 81.6% of patients were taking at least one class of drug, and 24.2% were taking three or more (Table 2). At the end of treatment 68.8% of patients were drug free, and this was maintained at follow up, with only 5.4% taking three or more classes of drugs six months after discharge.

Satisfaction and adherence to treatment

Satisfaction ratings at the one month follow up indicated that the large majority of the 182 patients were satisfied with the treatment received. Twelve patients (6.4%) rated their satisfaction in the lower half of the scale (three or less), 8.6% rated it at four, 16.6% at five and 68.4% at six (very satisfied).

Patients' self-report of adherence to treatment components after discharge indicated that at one month follow up, only 8.9% of the 182 patients had stopped completely or were performing prescribed activities less than once per week. Exercises were carried out at least five times per week by 66.9% of patients, stretch routines by 75.6%, relaxation by 66.5% and coping strategies by 79.5%. At six months, 12–20% of the 118 patients were exercising, stretching or relaxing less than once per week; exercises were carried out five or more times per week by 56.6%, stretch routines by 54.3%, relaxation by 36.1% and coping strategies by 74.8%.

Discussion

The results of this pain management programme are largely consistent with those reported by similar American studies,[23,26-30] with improvements in physical performance, psychological state, and medication intake in a population chronically disabled by pain. The improvements were maintained at one month and six month follow up. Although pain intensity ratings showed a small statistically significant drop at the end of treatment assessment, by the time of the one month follow up they had returned to baseline levels.

It could be argued that these predominantly positive results reflect either the passage of time alone, or the non-specific effects of four weeks of intensive attention and associated pressure upon patients to report positive treatment outcomes. Since there was no control group such arguments are impossible to refute. However, the patients had suffered chronic pain for many years, during which they had received numerous treatments, accompanied by attention and expectations of success, with no lasting improvement. Pressure to report positive outcome also accounts poorly for the persistence of improvement at six month follow up, and for the failure of pain intensity to change in parallel with all other measures. The marked improvements in physical performance, which were recorded by observers, further undermine any explanation of the results in terms of biased reporting.

The strengths of this study include a large sample, wide ranging and systematic assessment of patients, broad admission criteria, and a low dropout rate. Follow-up assessments in the INPUT unit allowed direct measurement of patient performance, in contrast to American studies, in which almost all follow-up data were collected by telephone or postal questionnaire.[16,27]

In a recent discussion of the extent to which the results of treatment outcome studies can be generalized beyond the treated population, Turk and Rudy emphasized the problems of selectivity of programmes and of high dropout rates.[51] In this study, the admission criteria were broad and clearly specified, and the dropout rate relatively low. The results reported here suggest that the programme was able to bring about large changes in all areas of functioning in a wide range of patients with chronic pain including those with unresolved compensation claims and with numerous failed previous treatments.

The main problem in generalizing results arises from attrition at follow up. Although the defaulting patients were not consis-

Table 2. Medication taken, mean dosage levels and number of different classes of drugs being taken for patients with chronic pain pre-treatment, at end of treatment, and at one month and six month follow ups.

Medication	Pre-treatment ($n = 141$)	End of treatment ($n = 141$)	One month follow up ($n = 126$)	Six month follow up ($n = 92$)
% of patients taking:				
NSAIDS	*29.1*	*10.6*	*10.2*	*13.8*
Opioid analgesics	*55.3*	*11.3*	*22.2*	*25.0*
Antidepressants	*32.6*	*8.5*	*9.5*	*6.5*
Benzodiazepines	*42.6*	*12.1*	*18.3*	*20.7*
Mean 24-hour dose (mg) (SD)				
Opioid analgesics	36.4 (31.1)	11.9 (4.5)	14.6 (8.5)	17.4 (14.0)
Benzodiazepines	10.8 (7.2)	6.6 (3.5)	7.3 (5.5)	6.3 (3.2)
% of patients taking:				
No drugs	*18.4*	*68.8*	*59.5*	*57.6*
1 class of drug	*23.4*	*20.6*	*23.8*	*27.2*
2 classes	*34.0*	*9.2*	*14.3*	*9.8*
3 classes	*19.9*	*1.4*	*2.4*	*4.3*
4+ classes	*4.3*	*0*	*0*	*1.1*

n = number of patients for whom data available. NSAIDS = non-steroidal anti-inflammatory drugs. SD = standard deviation.

tently functioning more poorly at pre-treatment assessment than those who attended, there were some differences in this direction. The lack of continued improvement after treatment is also somewhat disappointing from the standpoint of generalization. This underlines one of the major problems for inpatient programmes, that of the transfer of new ways of managing the pain into the patient's own environment, which may previously have reinforced his or her disability. Even patients who are well equipped, physically and cognitively, to manage pain better, and who have the support of family, friends and general practitioner, may find themselves struggling almost alone against unrealistic expectations on the part of employers and others. In addition, families may be over anxious and protective, undermining the progress made in treatment, or may load the more active patient with unrewarding tasks and duties. General practitioners may find it hard to recognize improvement in quality of life and day-to-day functioning, when pain has been the focus of therapeutic efforts in recent years, and may respond to a patient's crisis or setback by prescribing rest or analgesic or psychotropic medication.

The reduction in medication use alongside the improvements in activity, mood, and pain-related distress, deserves particular mention. The programme offered a viable alternative to long term reliance on analgesic, antidepressant and anxiolytic medication. While this study was not a controlled comparison between cognitive behavioural pain management and medication, it certainly raises questions about the value of continued prescription of these medications for patients with chronic pain. It is interesting to note that no increase of pain was reported over the period of drug reduction, which is consistent with the findings of many other studies.[32,36,41,44–46,50,65]

Questions remain about whether the results described here could be obtained more economically, and a randomized comparison of inpatient and outpatient pain management, with a waiting list control group, is nearing completion at the INPUT unit. The only published randomized trial comparing inpatient and outpatient treatment found improvement in both groups over untreated controls, but various methodological problems made direct comparison of the two groups of patients impossible.[66] It seems likely, however, that for some patients there will be no alternative to inpatient treatment. These may include very disabled patients, those who have to travel long distances to their pain clinic, and those who are heavily reliant on medication. Despite recent advances in understanding the development of chronic pain, and the possibilities of prevention,[17,67,68] it is likely that there will continue to be many such patients requiring rehabilitation.

References

1. Crook J, Tunks E. Defining the 'chronic pain syndrome': an epidemiological method. *Clin J Pain* 1985; **1:** 159-163.
2. Sternbach RA. Survey of pain in the United States: the Nuprin pain report. *Clin J Pain* 1986; **2:** 49-53.
3. Magni G, Caldieron C, Rigatti-Luchini S, Merskey H. Chronic musculoskeletal pain and depressive symptoms in the general population. An analysis of the 1st national health and nutrition examination survey data. *Pain* 1990; **43:** 299-307.
4. von Korff M, Dworkin SF, Le Resche L. Graded chronic pain status: an epidemiologic evaluation. *Pain* 1990; **40:** 279-291.
5. Fordyce WE. *Behavioural methods for chronic pain and illness.* St Louis, MO: CV Mosby, 1976.
6. Sternbach RA. Psychological factors in pain. In: Bonica JJ, Albe-Fessard D (eds). *Advances in pain research and therapy.* Volume 1. New York, NY: Raven Press, 1976.
7. Bonica JJ. Neurophysiologic and pathologic aspects of acute and chronic pain. *Arch Surg* 1977; **112:** 750-761.
8. Bonica JJ. Definitions and taxonomy of pain. In: Bonica JJ (ed). *The management of pain.* Volume 1. 2nd edition. Philadelphia, PA: Lea and Febiger, 1990.
9. Flor H, Turk DC. Etiological theories and treatments for chronic back pain. I. Somatic models and interventions. *Pain* 1984; **19:** 105-121.
10. Parry CBW. The failed back. In: Wall PD, Melzack R (eds). *Textbook of pain.* 2nd edition. Edinburgh: Churchill Livingstone, 1989.
11. Rosomoff HL, Fishbain DA, Goldberg M, *et al.* Physical findings in patients with chronic intractable benign pain of the neck and/or back. *Pain* 1989; **37:** 279-287.
12. Turner JA, Calsyn DA, Fordyce WE, Ready LB. Drug utilization patterns in chronic pain patients. *Pain* 1982; **12:** 357-363.
13. McNairy SL, Maruta T, Ivnik RJ, *et al.* Prescription medication dependence and neuropsychologic function. *Pain* 1984; **18:** 169-177.
14. King SA, Strain JJ. Benzodiazepine use by chronic pain patients. *Clin J Pain* 1990; **6:** 143-147.
15. Waddell F, Kummel EG, Lotto WN, *et al.* Failed lumbar disc surgery and repeat surgery following industrial injuries. *J Bone Joint Surg [Am]* 1979; **61:** 201-207.
16. Linton SJ, Bradley LA, Jensen I, *et al.* The secondary prevention of low back pain: a controlled study with follow-up. *Pain* 1989; **36:** 197-207.
17. Pither CE, Nicholas MK. The identification of iatrogenic factors in the development of chronic pain syndromes; abnormal treatment behaviour. In: Bond MR, Charlton JE, Woolf CJ (eds). *Proceedings of the VIth world congress on pain.* Amsterdam, Netherlands: Elsevier, 1991.
18. Singh R, Nunn K, Martin J, Yates J. Abnormal treatment behaviour. *Br J Med Psychol* 1981; **54:** 67-73.
19. Posner RB. Physician–patient communication. *Am J Med* 1984; **77** Suppl: 59-64.
20. Priel B, Rabinowitz B, Pels RJ. A semiotic perspective on chronic pain: implications for the interaction between patient and physician. *Br J Med Psychol* 1991; **64:** 65-71.
21. Turk DC, Meichenbaum D, Genest M. *Pain and behavioural medicine: a cognitive-behavioural perspective.* New York, NY: Guilford Press, 1983.
22. Keefe FJ. Behavioural assessment and treatment of chronic pain: current status and future directions. *J Consult Clin Psychol* 1982; **50:** 896-911.
23. Brena SF, Chapman SL. Acute verus chronic pain states: the 'learned pain syndrome'. *Clin Anaesthesiology* 1985; **3:** 41-55
24. Philips HC. Avoidance behaviour and its role in sustaining chronic pain. *Behav Res Ther* 1987; **25:** 273-279.
25. Turner JA, Chapman CR. Psychological interventions for chronic pain: a critical review. II. Operant conditioning, hypnosis, and cognitive-behavioural therapy. *Pain* 1982; **12:** 23-46.
26. Tan S-Y. Cognitive and cognitive-behavioural methods for pain control: a selective review. *Pain* 1982; **12:** 201-228.
27. Aronoff GM, Evans WO, Enders PL. A review of follow-up studies of multidisciplinary pain units. *Pain* 1983; **16:** 1-11.
28. Linton SJ. Behavioural remediation of chronic pain: a status report. *Pain* 1986; **24:** 125-141.
29. Philips HC. The effects of behavioural treatment on chronic pain. *Behav Res Ther* 1987; **25:** 365-377.
30. Malone MD, Strube MJ. Meta-analysis of non-medical treatments for chronic pain. *Pain* 1988; **34:** 231-244.
31. Fisher K. Early experiences of a multidisciplinary pain management programme. *Holistic Med* 1988; **3:** 47-56.
32. Skinner JB, Erskine A, Pearce S, *et al.* The evaluation of a cognitive behavioural treatment programme in outpatients with chronic pain. *J Psychosom Res* 1990; **34:** 13-19.
33. Newman RI, Seres JL, Yospe LP, Garlington B. Multidisciplinary treatment of chronic pain: long-term follow-up of low-back pain patients. *Pain* 1978; **4:** 283-292.
34. Painter JR, Seres JL, Newman RI. Assessing benefits of the pain center: why some patients regress. *Pain* 1980; **8:** 101-113.
35. Gottlieb HJ, Alperson BL, Koller R. Low back pain comprehensive rehabilitation program: a follow-up study. *Arch Phys Med Rehabil* 1982; **63:** 458-461.
36. Heinrich RL, Cohen MJ, Naliboff BD, *et al.* Comparing physical and behaviour therapy for chronic low back pain on physical abilities, psychological distress, and patients' perception. *J Behav Med* 1985; **8:** 61-78.
37. Mayer TG, Gatchel RJ, Kishino N, *et al.* Objective assessment of spine function following industrial injury. A prospective study with comparison group and one-year follow-up. *Spine* 1985; **10:** 482-493.
38. Kerns RD, Turk DC, Holzman AD, Rudy TE. Comparison of cognitive-behavioural and behavioural approaches to the outpatient treatment of chronic pain. *Clin J Pain* 1986; **1:** 195-203.
39. Turner JA, Clancy S, McQuade KJ, Cardenas DD. Effectiveness of behavioural therapy for chronic low back pain: a component analysis. *J Consult Clin Psychol* 1990; **58:** 573-579.

40. Deardoff WW, Rubin HS, Scott DW. Comprehensive multidisciplinary treatment of chronic pain: a follow-up study of treated and non-treated groups. *Pain* 1991; **45:** 35-43.
41. Fordyce WE, Fowler R, Lehmann J, *et al.* Operant conditioning in the treatment of chronic pain. *Arch Phys Med Rehabil* 1973; **54:** 399-408.
42. Seres JL, Newman RI. Results of treatment of chronic low-back pain at the Portland Pain Center. *J Neurosurg* 1976; **45:** 32-36.
43. Swanson DW, Maruta T, Swenson WM. Results of behaviour modification in the treatment of chronic pain. *Psychosom Med* 1979; **41:** 55-61.
44. Roberts AH, Reinhardt L. The behavioural management of chronic pain: long-term follow-up with comparison groups. *Pain* 1980; **8:** 151-162.
45. Keefe FJ, Block AR, Williams RB, Surwit RS. Behavioural treatment of chronic low back pain: clinical outcome and individual differences in pain relief. *Pain* 1981; **11:** 221-231.
46. Aronoff GM, Evans WO. The prediction of treatment outcome at a multidisciplinary pain center. *Pain* 1982; **14:** 67-73.
47. Cairns D, Mooney V, Crane P. Spinal pain rehabilitation: inpatient and outpatient treatment results and development of predictors for outcome. *Spine* 1982; **9:** 91-95.
48. Cinciripini PM, Floreen A. An evaluation of a behavioural program for chronic pain. *J Behav Med* 1982; **5:** 375-389.
49. Sturgis ET, Schaefer CA, Sikora TL. Pain center follow-up study of treated and untreated patients. *Arch Phys Med Rehabil* 1984; **65:** 301-307.
50. Meilman PW, Skultety FM, Guck TP, Sullivan K. Benign chronic pain: 18-month to ten-year follow-up of a multidisciplinary pain unit treatment program. *Clin J Pain* 1985; **1:** 131-137.
51. Turk DC, Rudy TE. Neglected factors in chronic pain treatment outcome studies — referral pattern, failure to enter treatment, and attrition. *Pain* 1990; **43:** 7-25.
52. Bergner M, Bobbitt RA, Carter WB, Gilson BS. The sickness impact profile: development and final revision of a health status measure. *Med Care* 1981; **19:** 787-805.
53. Beck AT, Ward CH. Mendelson M, *et al.* An inventory for measuring depression. *Arch Gen Psychiatry* 1961; **4:** 561-571.
54. Nicholas MKN. *An evaluation of treatments for chronic low back pain (dissertation).* Sydney, Australia: University of Sydney, 1988.
55. Halpern LM. Psychotropic drugs in the management of chronic pain. In: Bonica JJ (ed). *Advances in neurology.* Volume 4. New York, NY: Raven Press, 1974.
56. Philips HC. *The psychological management of chronic pain: a treatment manual.* New York, NY: Springer, 1988.
57. Benson H, Greenwood MM, Klemchuk H. The relaxation response: psychophysiologic aspects and clinical applications. In: Lipowski ZJ, Lipsitt DR, Whybrow PC (eds). *Psychosomatic medicine: current trends and clinical applications.* Oxford University Press, 1977.
58. Rybstein-Blinchik E. Effects of different cognitive strategies on chronic pain experience. *J Behav Med* 1979; **2:** 93-101.
59. Beck AT, Rush AJ, Shaw BF, Emery G. *Cognitive therapy of depression.* New York, NY: Guilford Press, 1979.
60. Clark DM. A cognitive approach to panic. *Behav Res Ther* 1986; **24:** 461-470.
61. Blackburn I-M, Davidson K. *Cognitive therapy for depression and anxiety.* Oxford: Blackwell, 1990.
62. Lacks P. *Behavioural treatment for persistent insomnia.* New York, NY: Pergamon Press, 1987.
63. Dixon WJ, Brown MB, Engelman L, Jennrich RI. *BMDP statistical software manual.* Volumes I and II. Berkeley, CA: University of California Press, 1990.
64. Tabachnik BG, Fidell LS. *Using multivariate statistics.* 2nd edition. New York, NY: Harper and Row, 1989.
65. Maruta T, Swanson DW, McHardy MJ. Three year follow-up of patients with chronic pain who were treated in a multi-disciplinary pain management center. *Pain* 1990; **41:** 47-53.
66. Peters JL, Large RG. A randomized control trial evaluating in- and out-patient pain management programs. *Pain* 1990; **41:** 283-293.
67. Waddell G. A new clinical model for the treatment of low-back pain. *Spine* 1987; **12:** 632-644.
68. Fordyce WE, Brickway JA, Bergman JA, Spengler D. Acute back pain: a control-group comparison of behavioural vs traditional management methods. *J Behav Med* 1986; **9:** 127-140.

Useful addresses

St Christopher's Hospice Drug Information Service, St Christopher's Hospice, Sydenham Hill, London SE26.
St Thomas' Hospital Drug Information Service, St Thomas' Hospital, Lambeth Palace Road, London SE1 7EH.

Acknowledgements

The authors thank Rosalinde Garvin for collection of much of the data on physical performance, the assessors and volunteers who have contributed to data collection, and the patients for their part in generating data for the study. The work described in this paper was carried out while the INPUT unit was funded by the Kind Edward's Hospital Fund for London, the special trustees of St Thomas' Hospital, and the South East Thames Regional Health Authority.

Address for correspondence

A C de C Williams, INPUT, St Thomas' Hospital, Lambeth Palace Road, London SE1 7EH.