

# Evaluating two implementation strategies for whiplash guidelines in physiotherapy: A cluster-randomised trial

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**Question** Are implementation strategies involving education any more effective than mere dissemination of clinical practice guidelines in changing physiotherapy practice and reducing patient disability after acute whiplash? **Design** Cluster-randomised trial. **Participants** Twenty-seven physiotherapists from different private physiotherapy clinics and the 103 patients (4 dropouts) who presented to them with acute whiplash. **Intervention** The implementation group of physiotherapists underwent education by opinion leaders about whiplash guidelines and the dissemination group had the guidelines mailed to them. **Outcome measures** The primary outcome was patient disability, measured using the Functional Rating Index, collected on admission to the trial and at 1.5, 3, 6 and 12 months. Physiotherapist knowledge about the guidelines was measured using a custom-made questionnaire. Physiotherapist practice and cost of care were measured by audit of patient notes. **Results** There were no significant differences between groups for any of the patient outcomes at any time. The implementation patients had 0.6 points (95% CI -7.8 to 6.6) less disability than the dissemination patients at 12 months; 44% more physiotherapists in the implementation group reported that they prescribed two out of the five guideline-recommended treatments; and 32% more physiotherapists actually prescribed them. The cost of care for patients in the implementation group was \$255 (95% CI -1505 to 996) less than for patients in the dissemination group. **Conclusion** Although the active implementation program increased guideline-consistent practice, patient outcomes and cost of care were not affected. [Rebeck T, Maher C and Refshauge K (2006) Evaluating two implementation strategies for whiplash guidelines in physiotherapy: A cluster-randomised trial. *Australian Journal of Physiotherapy* 52: 165-174]

Key words: Health Plan Implementation, Practice Guidelines, Whiplash Injuries

## Introduction

Health after whiplash is generally poor, with recovery in the short term reported as between 29% (Karlsborg et al 1997) and 40% (Sterling et al 2003) in Western cultures that have compensation schemes for whiplash. Whiplash is involved in 42% of Compulsory Third Party claims in New South Wales (NSW), Australia, and the cost associated with rehabilitating whiplash is the highest of any musculoskeletal injury in the scheme. Clinical practice guidelines for the management of acute whiplash were developed by the Motor Accidents Authority (MAA), the NSW Government regulator of Compulsory Third Party insurers (MAA 2001). The purpose was to maximise treatment effectiveness and minimise cost in the management of whiplash in NSW. The guidelines were targeted at all primary care practitioners, however, physiotherapists were the focus of this study as they are one of the largest provider of care for whiplash sufferers.

In order to facilitate the implementation of clinical guidelines in Australia, the National Health and Medical Research Council (NHMRC) released a guide (NHMRC 1999) suggesting a multifaceted approach to improve guideline-consistent behaviour by practitioners. Active strategies such as interactive education (Davis et al 1995, Schectman et al 2003, Thomson O'Brien et al 2004a), educational outreach (Thomson O'Brien et al 2004b) and the use of opinion leaders as educators about guidelines (Soumerai et al 1998, Thomson O'Brien et al 2004c) successfully change practice in the medical profession. Passive interventions such as dissemination of printed materials and lectures (Bero et

al 1998, Davis et al 1995) have been less effective. One physiotherapy study found an active strategy, including education, feedback and the use of reminders, to result in more guideline-consistent behaviour for low back pain than dissemination of the guidelines by mail alone (Bekkering et al 2005a).

Successful guideline implementation is dependent on acceptance of the guidelines by the target audience. For example, in primary care, guidelines are less likely to be followed if patient preference differs from the guidelines (Schectman et al 2003, Schers et al 2001, Tomlin et al 1999), if the guideline is perceived as prescriptive or ineffective (Langley et al 1998), or if the practitioner lacks the knowledge to apply it (Bekkering et al 2003). Conversely, adoption of guideline-consistent behaviour is more likely if a summary check list is provided and if the guideline is produced by a trusted local body (Langley et al 1998). Identifying barriers to guideline acceptance is therefore suggested by the NHMRC (1999) as a key factor in the success of implementation strategies.

The main purpose of implementing guidelines, however, should be to improve patient outcomes, rather than simply improving practitioner knowledge, behaviour and satisfaction or cost. Despite this, studies rarely measure these outcomes. For example, changes in practitioner behaviour are often reported without reference to the concurrent effect on health outcomes (eg, Onion and Bartzokas 1998, Schriger et al 2000). Furthermore, health outcomes rarely change after implementation of guidelines (eg, Eccles et al 2002, Morrisson et al 2001) even when practitioner

knowledge improves (eg, Thomas et al 2003, Thompson et al 2000). Whilst many reasons for the lack of change in health outcomes are proposed in these studies, barriers to guideline-based care are infrequently measured (eg, Davis et al 2004, Thomas et al 2003), leading to a limited explanation for the lack of effect. A more complete understanding of the effect of implementation of guidelines would be achieved by measuring both patient and practitioner outcomes as well as perceived barriers, within the same study.

Patient outcomes after guideline implementation for acute whiplash have not been examined to date. Conditions that are managed by the medical profession, such as hypertension (Hetlevik et al 1999), heart disease (Moher et al 2001), infection (Onion and Bartzokas 1998) and asthma (Premaratne et al 2005) are typically studied. The closest patient group to whiplash of those studied is low back pain, where results of implementation studies are mixed. Some show an improvement in patient outcomes when prescription practices are more consistent with guidelines (Rossignol et al 2000) and others show no improvement (Bekkering et al 2005b). In acute whiplash, where patient outcomes are poor and the cost is high, there is clearly a need to determine whether improvement in guideline-consistent care results in better patient outcomes.

On completion of the clinical practice guidelines for whiplash (MAA 2001), a copy of the professional and consumer versions were sent to all registered physiotherapists in two states – New South Wales and Australian Capital Territory. The MAA then funded the present study to evaluate the effectiveness of the guidelines. This study aimed to evaluate the effect of an active implementation strategy that included education by opinion leaders compared with a passive implementation strategy that consisted of dissemination of the guidelines only. Effectiveness was evaluated by examining patient disability, physiotherapist knowledge, and clinical practice, as well as cost of care. During the conduct of the trial, all further promotion of the guidelines by the MAA was curtailed.

## Method

**Design** We conducted a cluster-randomised trial in order to minimise contamination between patients, with physiotherapists the unit of randomisation. Physiotherapists were stratified into low and high cost providers and the physiotherapists in each stratum were randomised into an implementation or a dissemination group by an insurer. Interventions were coded so that the purpose of allocation was concealed from the insurer. Stratification was concealed from the trial centre. Physiotherapists were blinded to the study hypothesis by being informed that they were randomised into one of two implementation groups. All outcome measures were collected via questionnaires or by audit of patient notes. Patient questionnaires were collected on admission to the trial and at 1.5, 3, 6 and 12 months after injury as recommended in the guidelines (MAA 2001). Once the patient was discharged from treatment, the remaining questionnaires were sent directly to the patient from the trial centre. Physiotherapist questionnaires were collected before the trial commenced and after the trial finished. All questionnaires were de-identified. Ethical approval for this study was obtained from the University of Sydney Human Research Ethics Committee. Consent was obtained from physiotherapists and patients to allow audit of patient notes to determine physiotherapy clinical practice during the trial.

## Participants

**Physiotherapists** 100 physiotherapy clinics in two states of Australia (NSW and ACT) that had seen at least five whiplash cases in the previous year were identified from an insurer database. They were ranked by median cost per whiplash claim by the insurer. Invitations to participate in the study were sent to 48 of the physiotherapy clinics – 24 clinics in the highest and 24 clinics in the lowest quartiles. Twenty-seven clinics consented to participate, each providing one physiotherapist to the study.

**Patients** Participating physiotherapists invited patients presenting to their clinic with acute whiplash to participate in the trial. The inclusion criteria were: being over 18 years of age, having been involved in a motor vehicle accident within the previous six weeks, having sustained a whiplash-associated disorder Grade I–III (Spitzer et al 1995), and being prepared to give informed consent. The trial centre contacted the participating physiotherapists regularly to remind them to recruit patients to the trial. Encouragement was offered by providing the participating physiotherapists with quarterly newsletters containing information about the effectiveness of physiotherapy intervention for whiplash that could be used as marketing targeted at local general practitioners.

**Intervention** There were two groups of physiotherapists – an implementation group and a dissemination group. Intervention for the implementation group consisted of dissemination of guidelines, initial education by opinion leaders, and follow-up education. Physiotherapists in the implementation group initially attended a one-day (8 hour) workshop. The workshop included interactive sessions outlining the content of the guidelines, practical sessions covering the treatments endorsed in the guidelines, particularly those that were relatively ‘new’ for physiotherapists (ie, ‘reassure patient’ and ‘advise to act as usual’), and the use of functional outcome measures. Local opinion leaders were used to deliver some of the program content. Physiotherapists were given a laminated copy of the algorithms outlining the process of care (MAA 2001), appointment cards, and marketing material to be used for general practitioners who usually refer to the practice. They received a follow-up educational outreach visit (2 hours) approximately six months later. At this session, problem solving regarding use of the guidelines in clinical practice was undertaken and an update of the evidence given.

Intervention for the dissemination group consisted of dissemination of guidelines by mail, ie, physiotherapists in this group were given but not directed to use the guidelines. Both groups were given the same information regarding the trial and its outcome measures.

## Outcome measures

**Patient outcomes** Disability was measured using the Functional Rating Index (Feise and Menke 2001) which measures disability due to back and neck pain and was adapted from the Oswestry Low Back Disability Questionnaire and the Neck Disability Index. The Functional Rating Index is a 10-item questionnaire with a 5-point response scale for each item. Summation of the 10 items yields a score ranging from 0 to 40, with higher scores indicating greater perceived disability. The Functional Rating Index has high test-retest reliability (ICC = 0.99) and correlates strongly with the SF12 Physical Component Score (Pearson’s  $r =$

0.76) and the Disability Rating Instrument (Pearson's  $r = 0.76$ ) (Feise and Menke 2001).

Disability due to acute whiplash was measured more specifically using an adapted version of the 7-item Core Outcome Measure for neck pain (White et al 2004). The Core Outcome Measure (Whiplash) was reduced to a 5-item questionnaire by reducing 'symptom bothersomeness' from two items to one, and deleting another item 'provider satisfaction'. Each item was scored on a 5-point response scale. Summation of the 5 items yields a score ranging from 5 to 25; higher scores indicate greater perceived disability.

An external criterion of clinically important change was measured using Global Perceived Effect (eg, Pengel et al 2004). Patients were asked the question 'Compared to when your symptoms first started, how are your symptoms these days?' which was scored on an 11-point Likert scale ranging from -5 (vastly worse) to +5 (completely recovered).

Patient satisfaction was measured using a 5-point Likert scale ranging from 1 (extremely dissatisfied) to 5 (extremely satisfied). Patients were asked to rate satisfaction with care provided by their general practitioner, care provided by their physiotherapist, and with the consumer version of the guidelines.

**Physiotherapist outcomes** Physiotherapist knowledge of the guidelines was measured using a custom-made questionnaire developed for this study. Questions included: self-rating of knowledge of the guidelines, treatments currently used to manage whiplash, treatments understood to be evidence-based, when and why physiotherapists refer to other disciplines, treatment goals set for whiplash patients, reporting responsibilities, and understanding of yellow flags (see Appendix 1 which appears as an eAddendum on the journal website). The questionnaire yields a score ranging from 0 to 28, with higher scores indicating greater knowledge of the guidelines.

Physiotherapist clinical practice was measured as the percentage of participating physiotherapists prescribing guideline recommendations taken before and after the trial (from responses to the questionnaire) and during the trial (audited from patient notes).

Physiotherapist satisfaction was measured using a 7-point Likert scale ranging from -3 (extremely unhelpful) to +3 (extremely helpful). Physiotherapists were asked to rate satisfaction with the guidelines, the intervention package (implementation or dissemination), and the consumer version of the guidelines.

**Cost of care** Cost of care was measured as the median cost per patient for each physiotherapist. This was determined before the trial from the insurer database and during the trial by audit of patient notes.

### Data analysis

**Patient outcomes** Functional Rating Index, Core Outcome Measure (Whiplash), and Global Perceived Effect were analysed using an independent t-test and adjusted using methods for cluster-randomised trials as described by Donner and Klar (2000), calculated using ACLUSTER<sup>(a)</sup>. This program provides mean differences between groups, 95% confidence intervals and  $p$  values adjusted to account for any cluster effect (see equations Donner and Klar 2000). Medians (IQR) for individual items on the Core Outcome

Measure (Whiplash) were also calculated. Patient satisfaction was analysed using the Mann-Whitney test for ordinal data. The  $p$  values from the Mann-Whitney test were adjusted to account for any cluster effect, by dividing the original  $z$  value by the square root of the design effect (Campbell et al 2000). The design effect was calculated using the formula  $1 + (m - 1)$  where  $m$  is the adjusted mean cluster size (Wears et al 2002) and is an estimate of the intercluster correlation co-efficient  $(BMS - WMS / BMS + (n - 1)WMS)$ .

**Physiotherapist outcomes** Knowledge and clinical practice were analysed using linear regression for continuous data (ie, total questionnaire score, self-rated understanding of guidelines) adjusted for before trial score, Mann-Whitney test for ordinal data (ie, ability to identify yellow flags) and chi-square test for categorical data (ie, self-rated use of functional outcome measures, prescription of guideline recommendations). Physiotherapist satisfaction was treated as continuous data and analysed using an independent t-test.

**Cost of care** was analysed using linear regression for continuous data adjusted for before trial score.

Significance levels were set at  $p < 0.05$ .

## Results

**Flow of participants through the trial** Forty-eight physiotherapists were eligible to participate and 27 consented (Figure 1). The characteristics of participating physiotherapists did not differ from non-participating physiotherapists, other than that a greater percentage of participating physiotherapists resided in the ACT (Table 1). Similarly, there were no significant differences between physiotherapists in the implementation group ( $n = 14$ ) and dissemination group ( $n = 13$ ) in billing history or knowledge of the guidelines (Table 1). One physiotherapist from the dissemination group subsequently withdrew, leaving 12 physiotherapists enrolled in this group (Figure 1). Eight physiotherapists, the majority of whom were allocated to the dissemination group ( $n = 7$ ), did not recruit patients. Reasons for non-recruitment included not seeing acute whiplash patients (2) and being a sole practitioner with no support (2). The characteristics of physiotherapists who did not recruit patients ( $n = 8$ ) did not differ from physiotherapists who did ( $n = 18$ ) (Table 1).

Patient enrolment began in July 2001 and continued until December 2002. As many patients as possible were recruited for 12 months after release of the guidelines. As the trial progressed and the target was not met, the MAA agreed to extend the moratorium on guideline implementation for a further six months. The baseline characteristics of patients were similar for both groups (Table 2) except that the implementation patients had more dependents than the dissemination patients. Of the 103 patients who entered the study, four withdrew for the following reasons: referred elsewhere by their general practitioner ( $n = 1$ ), became pregnant ( $n = 1$ ), or unspecified ( $n = 2$ ), leaving 99 patients who completed the study (Figure 1). The poorest follow up (72%) occurred at Month 6. Follow up at Month 12 was 90% when six patients were lost to follow up due to: moving overseas ( $n = 1$ ), no longer residing at the same address ( $n = 3$ ), or were non-contactable after 5 attempts ( $n = 2$ ).

**Effect of intervention on patients** There was no significant difference between the implementation patients or the

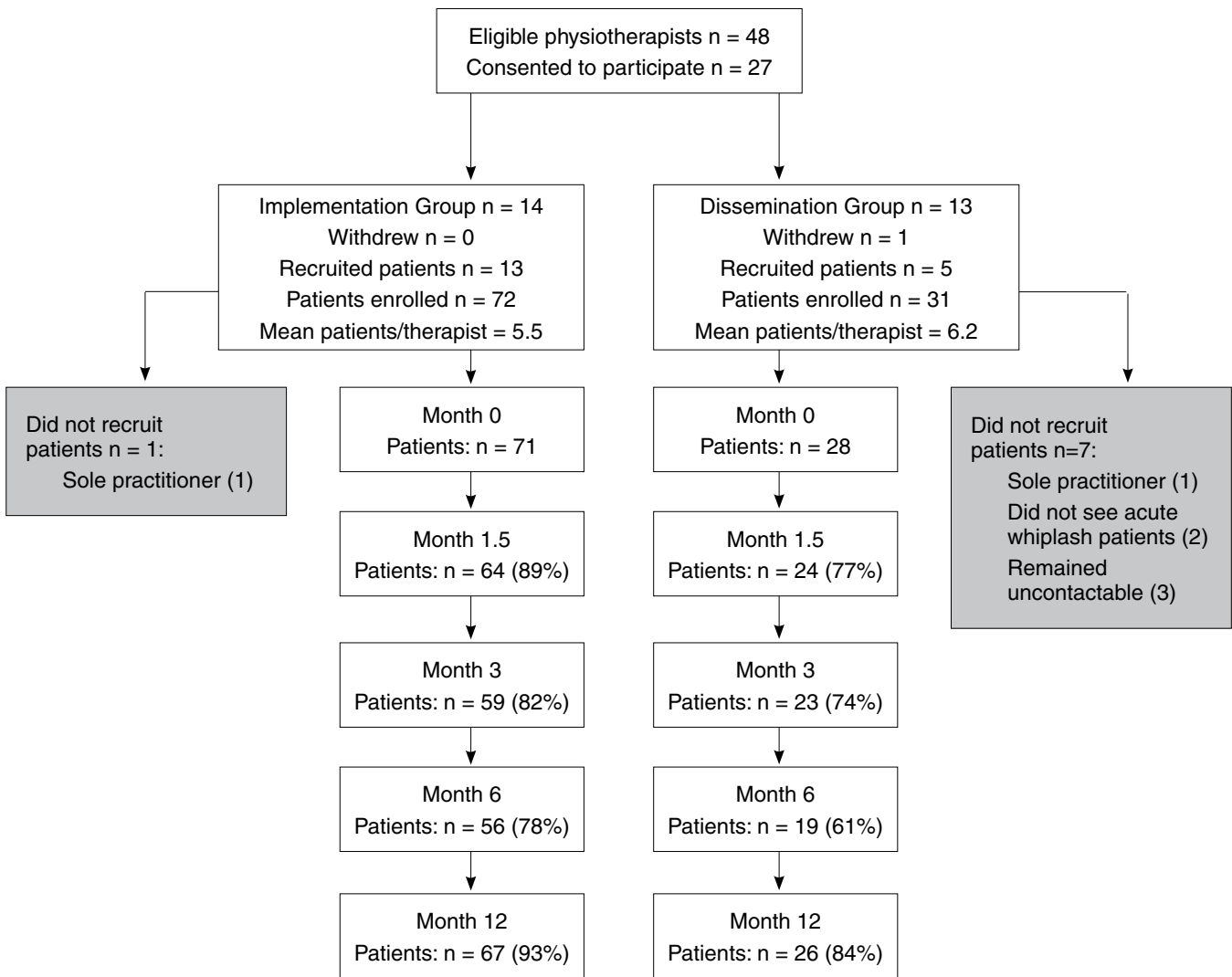


Figure 1. Flow of physiotherapists and patients through trial.

Table 1. Number (%) or mean (SD) of baseline characteristics of physiotherapists.

	Eligible			Participated			Recruited patients		
	Did participate n = 27	Did not participate n = 21	p	Impl n = 14	Diss n = 13	p	Yes n = 18	No n = 8	p
Median cost / patient / therapist (\$)	638 (465)	736 (572)	0.52	606 (452)	672 (495)	0.72	639 (474)	635 (475)	0.99
Whiplash caseload (# patient / therapist)	8.5 (4.6)	7.6 (4.2)	0.51	7.4 (2.2)	9.7 (6.2)	0.20	10.3 (6.7)	7.7 (3.4)	0.17
Knowledge of guidelines (0 to 28)				13.6 (3.2)	14.6 (2.3)	0.40	14.1 (2.1)	14.1 (0.7)	0.95
Location of therapist									
Sydney	5 (18)	13 (62)	0.01	3 (21)	2 (15)	0.62	1 (12.5)	4 (21)	0.28
Canberra	14 (52)	4 (19)		8 (57)	6 (46)		6 (75)	8 (42)	
Regional NSW	8 (30)	4 (19)		3 (21)	5 (38)		1 (12.5)	7 (37)	

Impl = Implementation group, Diss = Dissemination group

**Table 2.** Number (%) or mean (SD) of baseline characteristics of patients.

	All n = 99	Impl n = 71	Diss n = 28
Age (yr)	35.6 (12.6)	35.5 (11.5)	36.1 (15.5)
Gender (F)	79 (80)	54 (76)	25 (89)
Dependents (number)	1.1 (1.5)	1.3 (1.5)	0.6 (1.3)
Grade of Whiplash			
I	16 (16)	15 (21)	1 (4)
II	78 (79)	53 (75)	25 (89)
III	5 (5)	3 (4)	2 (7)
Duration of symptoms (day)	13.6 (13.3)	13.8 (13.3)	13.3 (13.6)
Mental health SF36 MHS (0 to 100)	62.3 (22.9)	63.6 (23.6)	59.0 (21.4)

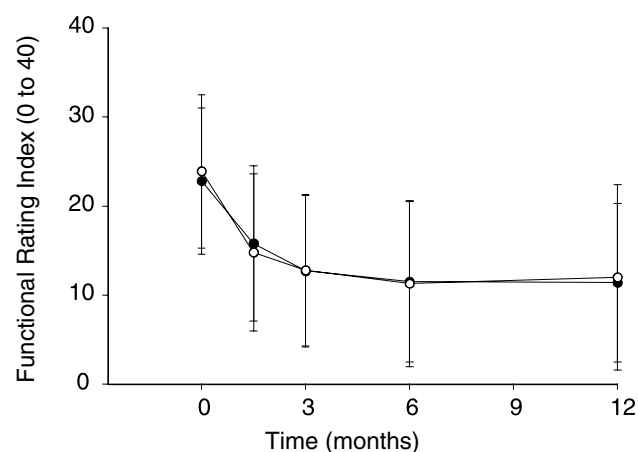
Impl = Implementation group, Diss = Dissemination group

dissemination patients at any follow up for the Functional Rating Index (Figure 2), the Core Outcome Measure (Whiplash), or Global Perceived Effect (Table 3). A breakdown of responses to the separate items of the Core Outcome Measure (Whiplash) is presented in Table 4. In addition, both groups of patients were equally satisfied with care provided by their general practitioner ( $p = 0.69$ ), their physiotherapist ( $p = 0.87$ ), and with the consumer version of the guidelines ( $p = 0.93$ ) (Table 5).

**Effect of intervention on physiotherapists** Physiotherapists in the implementation group increased their knowledge of the guidelines by 5.5 points (95% CI 2.5 to 8.4) more than physiotherapists in the dissemination group ( $p = 0.001$ ). Their self-rated understanding of the guidelines increased by 1.5 points (95% CI 0.7 to 2.3) more than the dissemination group ( $p = 0.001$ ). Their ability to identify yellow flags ( $p = 0.02$ ) and their self-reported use of functional outcome measures ( $p = 0.01$ ) also increased significantly more than the dissemination group (Table 6). Two out of five guideline recommendations were identified by more physiotherapists in the implementation group than the dissemination group at the end of the trial – ‘reassure patient’ ( $p = 0.05$ ) and ‘advise to act as usual’ ( $p = 0.02$ ) (Table 7). Furthermore, these recommendations were actually prescribed more by the implementation physiotherapists during the trial ( $p = 0.04$  and  $0.02$ ) as measured by audit of patient notes (Table 7).

Physiotherapists in the implementation group were equally satisfied with the guidelines ( $p = 0.29$ ) or the consumer version of the guidelines ( $p = 0.20$ ) as physiotherapists in the dissemination group. There was a trend for physiotherapists in the implementation group to be more satisfied with their implementation package ( $p = 0.07$ ) than physiotherapists in the dissemination group (Table 8).

**Effect of intervention on cost of care** The cost of care for patients in the implementation group increased from \$606

**Figure 2.** Mean (SD) disability measured by the Functional Rating Index for patients in the implementation (closed circles) and dissemination (open circles) groups over time.

per patient per physiotherapist (SD 452) before the trial to \$1092 (SD 1099) which was not significantly different ( $p = 0.67$ ) from the increase in cost for patients in the dissemination group from \$627 (SD 489) to \$1408 (SD 1342). The cost per one point improvement on the Functional Rating Index was \$116 for the implementation group; this was not significantly different ( $p = 0.55$ ) from \$189 for the dissemination group. Physiotherapists delivered a median of 13 treatments to patients in the implementation group which was also not significantly different ( $p = 0.75$ ) from the 19 treatments delivered to the dissemination group.

## Discussion

This trial is the first to examine the effect of an implementation program consisting of education compared with simple dissemination of guidelines for acute whiplash. Whilst the program resulted in improved knowledge and clinical practice more consistent with the guidelines, patient outcomes and cost of care were not affected. We suggest that this may be explained either by the high quality of treatment prescription at baseline by both groups, or that elements of the guidelines may not be essential. The guidelines in general were received well by patients and physiotherapists. We are confident in our conclusions because of the study strengths, which include a prospective randomised design, blinding of physiotherapists and patients to the study hypothesis and a 90% long-term follow up.

Our implementation program involving education and the use of opinion leaders successfully improved physiotherapists' knowledge, and reported and actual practice became more consistent with the guidelines for whiplash. The effect of this implementation program was large; eg, an average of 44% more physiotherapists in the implementation group reported that they prescribed the two treatments (reassurance and act as usual) that were expected to change, whilst an average of 32% more physiotherapists actually prescribed these treatments. In comparison, implementation trials of low back pain guidelines found smaller differences, of 12% (Bekkering et al 2005b) and 8% (Schechtman et al 2003) in the proportion of therapists adopting guideline-consistent

**Table 3.** Mean (SD) score, and mean (95% CI) difference between groups for the implementation patients and the dissemination patients.

Outcome	Score						Difference between groups*													
	Month 0		Month 1.5		Month 3		Month 6		Month 12		Month 0		Month 1.5		Month 3		Month 6		Month 12	
Impl n = 71	22.8 (8.2)	23.9 (8.6)	15.8 (8.7)	14.8 (8.8)	12.7 (8.5)	12.8 (8.5)	11.5 (9.0)	11.3 (9.3)	11.4 (8.9)	12.0 (10.4)	Impl minus Diss	1.00 (-5.1 to 7.1)	0.1 (-6.4 to 6.7)	0.1 (-6.4 to 6.7)	0.1 (-6.4 to 6.7)	Impl minus Diss	1.00 (-5.1 to 7.1)	0.1 (-6.4 to 6.7)	0.1 (-6.4 to 6.7)	0.1 (-6.4 to 6.7)
Diss n = 28	22.8 (8.2)	23.9 (8.6)	15.8 (8.7)	14.8 (8.8)	12.7 (8.5)	12.8 (8.5)	11.5 (9.0)	11.3 (9.3)	11.4 (8.9)	12.0 (10.4)	Impl minus Diss	1.00 (-5.1 to 7.1)	0.1 (-6.4 to 6.7)	0.1 (-6.4 to 6.7)	0.1 (-6.4 to 6.7)	Impl minus Diss	1.00 (-5.1 to 7.1)	0.1 (-6.4 to 6.7)	0.1 (-6.4 to 6.7)	0.1 (-6.4 to 6.7)
Functional Rating Index (0 to 40)	22.8 (8.2)	23.9 (8.6)	15.8 (8.7)	14.8 (8.8)	12.7 (8.5)	12.8 (8.5)	11.5 (9.0)	11.3 (9.3)	11.4 (8.9)	12.0 (10.4)	Impl minus Diss	1.00 (-5.1 to 7.1)	0.1 (-6.4 to 6.7)	0.1 (-6.4 to 6.7)	0.1 (-6.4 to 6.7)	Impl minus Diss	1.00 (-5.1 to 7.1)	0.1 (-6.4 to 6.7)	0.1 (-6.4 to 6.7)	0.1 (-6.4 to 6.7)
ICC = 0.13																				
Core Outcome Measure (Whiplash) (5 to 25)	16.3 (3.7)	15.5 (3.2)	13.5 (4.9)	10.9 (3.8)	11.5 (4.4)	10.2 (3.7)	10.9 (5.2)	9.4 (4.3)	10.3 (4.4)	10.0 (4.2)	Impl minus Diss	2.8 (-0.5 to 6.2)	1.3 (-2.3 to 3.8)	1.7 (-2.3 to 5.7)	1.7 (-2.3 to 5.7)	Impl minus Diss	2.8 (-0.5 to 6.2)	1.3 (-2.3 to 3.8)	1.7 (-2.3 to 5.7)	1.7 (-2.4 to 3.0)
ICC = 0.12																				
Global Perceived Effect (-5 to +5)	-0.4 (2.3)	-0.6 (2.0)	2.1 (2.2)	2.4 (1.9)	2.6 (2.3)	2.6 (2.0)	2.6 (2.2)	3.3 (1.5)	2.8 (2.2)	2.3 (2.9)	Impl minus Diss	0.1 (-1.6 to 0.9)	0.0 (-1.1 to 1.1)	0.2 (-2.2 to 0.7)	0.2 (-2.2 to 0.7)	Impl minus Diss	0.1 (-1.6 to 0.9)	0.0 (-1.1 to 1.1)	0.2 (-2.2 to 0.7)	0.1 (-1.7 to 1.8)
ICC = 0.27																				

Impl = Implementation group, Diss = Dissemination group; ICC = Intercluster correlation coefficient; \* = mean, 95% CI, and p are from independent t-test adjusted for cluster effect

**Table 4.** Median (IQR) score for Items 1-5 of the Core Outcome Measure (Whiplash) for the implementation patients and the dissemination patients.

Core Outcome Measure (Whiplash)	Score									
	Month 0		Month 1.5		Month 3		Month 6		Month 12	
Item 1	Impl n = 71	Diss n = 28	Impl n = 64	Diss n = 24	Impl n = 59	Diss n = 23	Impl n = 56	Diss n = 19	Impl n = 67	Diss n = 26
Symptom bothersomeness (1 to 5)	4 (3-4)	4 (3-4)	3 (2-3)	3 (2-3)	2 (2-3)	3 (2-3)	2 (1-3)	2 (1-3)	2 (1-3)	3 (1-3)
Item 2	4 (3-5)	4 (3-5)	3 (2-4)	2 (1-3)	2 (2-3)	2 (1-3)	2 (1-3)	2 (1-4)	2 (1-3)	2 (1-4)
Work interference (1 to 5)	1 (1-1.5)	1 (1-1)	2 (1-2)	2 (1-3)	2 (1-3)	1 (1-2)	2 (1-4)	2 (1-4.5)	2 (1-4)	2 (1-4)
Quality of life (1 to 5)	7 (3-14)	7 (4-12)	7 (1-15)	4 (0-18)	2 (0-10)	2 (0-7.8)	2 (0-10)	1 (0-7)	2 (0-6)	3.5 (0-8)
Item 4 (Days off activity / past month)	4 (1-9)	4 (3-10)	0 (0-8)	0 (0-3)	0 (0-0)	0 (0-5)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-1)
Item 5 (Days off work / past month)										

Impl = Implementation group, Diss = Dissemination group

**Table 5.** Median (IQR) score of satisfaction for the implementation patients and the dissemination patients at 12 months after injury.

Patient satisfaction	Score		<i>p</i> *
	Impl n = 67	Diss n = 26	
GP care (1 to 5)	5 (4–5)	4 (3–5)	0.69
Physiotherapy care (1 to 5)	5 (5–5)	5 (4–5)	0.87
Consumer version of guidelines (1 to 5)	4 (4–4)	4 (4–4)	0.93

Impl = Implementation group, Diss = Dissemination group;  
\* = *p* from Mann-Whitney test adjusted for cluster effect

behaviour. Our findings are consistent with other studies, where educational strategies have been shown to improve knowledge of guidelines in primary care (Davis et al 1995, Thomson O'Brien et al 2004), particularly when compared with passive strategies such as dissemination of printed materials (Freemantle et al 2004, Onion and Bartzokas 1998). Support for an active implementation strategy to improve practitioner knowledge and clinical practice to be more consistent with guidelines for whiplash is now evident.

Despite the improvement in guideline-consistent clinical practice with this implementation program, patient outcomes did not differ between groups. The quality of treatment prescription at baseline may account for this. At entry to the trial, all physiotherapists were prescribing 'exercise', which is both recommended in the guidelines (MAA 2001) and supported by other evidence (eg, AAMPGG 2003, Rosenfeld et al 2003, Seferiadis et al 2004). The treatments that changed in the implementation group, were the prescription of 'reassure patient' and 'advise to act as usual'. These treatments have been shown to be more effective than passive treatment such as collar and rest (Borchgrevink et al 1998), but have not been compared with exercise. The treatments at baseline were typically not passive. Perhaps greater change in patient outcomes may have been observed if passive treatments were common before the release of the guidelines. Similar observations have been made in other trials, where a lack of change in patient outcomes after a successful change in practitioner clinical practice is explained by the high baseline level of knowledge and practice consistent with the guideline (Lee et al 2002, Bahrami et al, 2004, Moher et al 2001, Schectman et al 2003). Improvements in patient outcomes have been observed when knowledge and treatment prescription were low and varied more substantially from the guidelines at baseline (Veninga et al 1999). It appears, therefore, that the effectiveness of an implementation program depends upon the quality of current clinical practice. Where current practice is closer to that endorsed in the guideline, as occurred in our trial, implementation programs have less opportunity to produce an effect.

The similarity in patient outcomes between groups, despite change in knowledge and clinical practice, also suggests that some elements of the guidelines may not be essential. For example, the guidelines recommend advice to 'act as

usual' based on the evidence of one trial (Borchgrevink et al 1998). Whilst trials have not compared the benefit of advice with exercise, our results would suggest that educating physiotherapists to provide advice in addition to exercise may not be required in order to improve patient health outcomes. We also demonstrated that physiotherapists in the implementation group improved their knowledge of the nine yellow flags identified in the guidelines initially (MAA 2001), which included factors such as age, gender, and initial injury severity. However, recent systematic reviews found that initial injury severity or disability is the most consistent factor associated with poor outcome (Cote et al 2001, Scholten-Peters et al 2003). It is unknown whether greater knowledge regarding prognostic indicators in whiplash influences patient outcome, although it is clear that such knowledge does not necessarily influence patient outcome in low back pain (Jellema et al 2005). Despite this, our results would suggest that some elements of the guidelines may not be essential, and may require revision in line with current research.

There is a possibility that a change in patient outcomes after implementation could be detected if greater patient numbers were recruited. Whilst the difference between groups for the Functional Rating Index was less than 1 point (on a 0–40 scale) the upper estimate of the 95% confidence intervals included clinically meaningful differences. Accordingly we cannot exclude the possibility that the implementation package may have an effect on disability. However, this was not the case for Global Perceived Effect or the Core Outcome Measure (4 points on a 25 point scale). Recruiting large numbers of whiplash patients in primary care proved to be difficult in this trial. We recruited those physiotherapists who had treated the greatest number of whiplash patients in the recent past. However, they had treated only an average of 6 whiplash patients in the year prior to the trial. It is worth noting that cluster-randomised trials with greater sample sizes have not yet shown a difference in patient outcomes (eg Bekkering et al 2005b, Eccles et al 2002, Moher et al 2001). We conclude, therefore, that whilst a greater sample size would improve the power of the study, our best estimate is that the differences between groups for patient outcomes are unlikely to be significant.

There were no barriers to implementing whiplash guidelines in this study as determined by patient and physiotherapist satisfaction with the guidelines and cost. Patients reported a high satisfaction with their care in both groups indicating that patient preference was not a barrier to implementation. In contrast, studies in primary care often cite patient preference as the reason that guidelines are not followed (Langley et al 1998, Schectman et al 2003, Schers et al 2001). Physiotherapists in both groups also reported a high level of satisfaction with the guidelines and the implementation package. This indicates that dissatisfaction with the guidelines or group allocation was not a barrier to implementation nor, presumably, to patient recruitment. Therefore the reason that physiotherapists in the dissemination group recruited 30% of the patients is likely to reflect the lack of patients presenting with acute whiplash and lack of administrative support. Finally, given the similarity in the cost of care between groups, there is no financial barrier for either method of implementation.

In conclusion, an implementation strategy involving education successfully changed physiotherapists' knowledge and clinical practice to be more consistent with guidelines

**Table 6.** Mean (SD) score, and mean (95% CI) difference between groups of physiotherapist knowledge for the implementation physiotherapists and the dissemination physiotherapists.

Outcome	Score				Difference between groups After trial minus before trial Impl minus Diss
	Before trial		After trial		
	Impl n = 14	Diss n = 13	Impl n = 14	Diss n = 12	
Total Questionnaire (0 to 28)	13.6 (3.2)	14.6 (2.3)	17.9 (3.5)	12.8 (3.3)	5.5 (2.5 to 8.4) $p = 0.001^{\#}$
Self-rated understanding of guidelines (0–10)	5.8 (2.2)	7.4 (2.5)	9.0 (0.4)	7.7 (1.2)	1.5 (0.7 to 2.3) $p = 0.001^{\#}$
Ability to identify yellow flags (0–9)	3.6 (1.6)	4.2 (0.9)	6.4 (2.3)	3.9 (2.2)	$p = 0.02^{\&}$
Self-rated use of functional outcome measures (%)	64	67	77	20	$p = 0.01^{\circ}$

Impl = Implementation group, Diss = Dissemination group;  $\#$  = mean, 95% CI,  $p$  from linear regression adjusted for before trial score;  $\&$  =  $p$  from Mann-Whitney test;  $\circ$  =  $p$  from chi-square test

**Table 7.** Percentage of physiotherapists prescribing guideline recommendations taken before and after trial (from responses to the questionnaire) and during the trial (audited from patient notes) for the implementation physiotherapists and the dissemination physiotherapists.

Guideline recommendation	Before trial		After trial			During trial		
	Impl n = 14	Diss n = 13	Impl n = 14	Diss n = 12	$p^*$	Impl n = 14	Diss n = 12	$p^*$
Reassure patient	14	41	57	18	0.05	46	14	0.04
Advise to act as usual	7	8	67	18	0.04	31	0	0.02
Prescribe function	7	8	25	0	0.22	23	0	0.14
Prescribe exercise	100	92	100	100	1.00	83	100	0.09
Prescribe medication	7	17	8	9	0.10	23	0	0.09

Impl = Implementation group, Diss = Dissemination group;  $*$  =  $p$  from chi-square test

**Table 8.** Mean (SD) score, and mean (95% CI) difference between groups for physiotherapist satisfaction for the implementation physiotherapists and the dissemination therapists.

Physiotherapist satisfaction	Score		Difference between groups* Impl minus Diss
	Impl n = 14	Diss n = 12	
Guidelines (–3 to +3)	2.2 (0.6)	1.7 (1.3)	0.5 (–0.3 to 1.3) $p = 0.29$
Implementation package (–3 to +3)	2.2 (0.6)	1.5 (1.1)	0.7 (0 to 1.4) $p = 0.07$
Consumer version of guidelines (–3 to +3)	2.4 (0.7)	1.9 (1.1)	0.5 (–0.2 to 1.2) $p = 0.20$

Impl = Implementation group, Diss = Dissemination group;  $*$  =  $p$  from independent t-test



for management of acute whiplash. Despite this, there was no change in patient outcomes. We suggest this may be because of the quality of treatment prescription at baseline. Implementation programs may have less opportunity to produce an effect when baseline treatment prescription does not vary greatly from the guidelines. Alternatively, we suggest that some elements of the guidelines may not be essential to improve patient outcomes. The guidelines and implementation package were well received by physiotherapists and patients in both groups and the cost of care was similar in both groups indicating there were no barriers to implementation.

**eAddenda** Appendix 1: Whiplash Initiative Questionnaire, available on the journal website: [www.physiotherapy.asn.au/AJP](http://www.physiotherapy.asn.au/AJP)

**Footnotes** <sup>(a)</sup>Update Software, Oxford, UK.

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