SYSTEMATIC REVIEW

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Evidence for the effectiveness of Alexander Technique lessons in medical and health-related conditions: a systematic review

J. P. Woodman,[1] N. R. Moore[2]

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[1]Private Practice and Visiting Research Fellow, Department of Health Sciences, University of York, York, UK
[2]Centre for Research on Socio-cultural Change, University of Manchester, Manchester, UK

Correspondence to:
Julia Woodman BSc, PhD, MSTAT, 2A, Stanley Road, Knutsford, Cheshire, UK
Tel.: +44 1565 632508
Email: julia@woodman.eclipse.co.uk

Disclosures
J. P. Woodman teaches the Alexander Technique in private practice. She is a member of the Scientific Research Committee of the Society of Teachers of the Alexander Technique, contributing in a voluntary capacity.

SUMMARY

Background: Complementary medicine and alternative approaches to chronic and intractable health conditions are increasingly being used, and require critical evaluation. **Objective:** The aim of this review was to systematically evaluate available evidence for the effectiveness and safety of instruction in the Alexander Technique in health-related conditions. **Methods:** PUBMED, EMBASE, PSYCHINFO, ISI Web-of-Knowledge, AMED, CINHAL-plus, Cochrane library and Evidence-based Medicine Reviews were searched to July 2011. Inclusion criteria were prospective studies evaluating Alexander Technique instruction (individual lessons or group delivery) as an intervention for any medical indication/health-related condition. Studies were categorised and data extracted on study population, randomisation method, nature of intervention and control, practitioner characteristics, validity and reliability of outcome measures, completeness of follow-up and statistical analyses. **Results:** Of 271 publications identified, 18 were selected: three randomised, controlled trials (RCTs), two controlled non-randomised studies, eight non-controlled studies, four qualitative analyses and one health economic analysis. One well-designed, well-conducted RCT demonstrated that, compared with usual GP care, Alexander Technique lessons led to significant long-term reductions in back pain and incapacity caused by chronic back pain. The results were broadly supported by a smaller, earlier RCT in chronic back pain. The third RCT, a small, well-designed, well-conducted study in individuals with Parkinson's disease, showed a sustained increased ability to carry out everyday activities following Alexander lessons, compared with usual care. The 15 non-RCT studies are also reviewed. **Conclusions:** Strong evidence exists for the effectiveness of Alexander Technique lessons for chronic back pain and moderate evidence in Parkinson's-associated disability. Preliminary evidence suggests that Alexander Technique lessons may lead to improvements in balance skills in the elderly, in general chronic pain, posture, respiratory function and stuttering, but there is insufficient evidence to support recommendations in these areas.

Review Criteria
Criteria for inclusion in the review were prospective studies in which instruction in the Alexander Technique was being evaluated as an intervention for a medical indication, or other health-related condition. PRISMA guidelines were followed. Eight publication databases were searched up to July 2011. Included studies were categorised by design and strength of evidence.

Message for the Clinic
Alexander Technique lessons (one-to-one with a registered teacher) represent an appropriate option to consider for patients with chronic back pain. Alexander Technique lessons may also help individuals to better manage the disability associated with Parkinson's disease. Further research is required to determine the effectiveness of Alexander Technique lessons in other health-related conditions.

Introduction

The Alexander Technique (AT) is a practical self-help method originally developed more than 100 years ago. The AT is generally taught one-to-one by teachers who have been trained by one of several professional associations based in the UK, USA and a number of other countries. AT teachers combine hands-on guidance and verbal explanation to show individuals how to diminish self-damaging postural and movement habits, and to modify habitual responses to stimuli, which can include pain and stress. The manual contact is used to guide individuals in everyday tasks, to help them experience altered movement coordination in a way that requires less effort. The instruction and manual guidance used in AT lessons differs markedly from that in disciplines such as physiotherapy or osteopathy.

The physiological basis of the AT is unclear, but it is known to affect various aspects of motor behaviour. AT instruction has been shown to lead to altered postural regulation in standing, by reducing axial stiffness and increasing the adaptability of muscle tone (1). Reduction in posture-related muscle activity and changes in posture have been well documented (2–5). AT instruction has also been shown

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to lead to changes in the coordination of voluntary movement, including marked differences in spinal coordination, prolonged and smoother weight transfer and reduced body acceleration during whole body movement (4,6). Evidence also suggests that balance and automatic balance recovery improve following AT lessons (7).

AT instruction has been employed for many years in the fields of acting and music, with objectively assessed improvements in performance (8–10). A systematic review of the effectiveness of AT instruction for different medical conditions was conducted in 2003, (11) but, given subsequent research and the increased use of non-conventional-medicine approaches to healthcare, we consider it timely to review the available evidence.

The primary objective of this review was to evaluate systematically the currently available evidence for the effectiveness and safety of the use of AT instruction (one-to-one lessons or group delivery) in different medical conditions and other health-related areas. Studies were evaluated and categorised according to the strength of the evidence to identify areas where further research is required. The review also examines the evidence for how acceptable AT lessons are as a health-related intervention to individuals and to healthcare practitioners, as well as for the cost effectiveness of AT lessons.

Methods

The PRISMA (preferred reporting items for systematic reviews and meta-analyses) guidelines were used as a basis for constructing the review methodology (12). The following electronic databases were searched to identify all relevant publications: PUBMED (1809–date), EMBASE (1974–date), PSYCHINFO (1806–date), ISI Web of Knowledge (1945–date), AMED (Allied and Complementary Medicine; 1985–date) and CINHAL-plus (Cumulative Index to Nursing and Allied health; 1947–date). The last search date was July 2011. The search criteria were ''Alexander technique [All Fields]'', with no date limits. In addition, reference sections from eligible studies and published reviews, and the Cochrane library and Evidence-based Medicine Reviews databases, were searched for studies not otherwise identified. Finally, clinicaltrials.gov and the metaRegister of Controlled Trials (http://www.controlled-trials.com), which includes the International Standard Randomised Controlled Trial Register Number (ISRCTN), were searched for details of ongoing trials.

Citations identified were assessed and information extracted separately by the two authors, with any disagreements regarding eligibility or differences in information to be extracted resolved by referral to a contributor to the paper. Criteria for inclusion were prospective studies in which instruction in the AT (one-to-one lessons or group delivery) was being evaluated as an intervention for a medical indication, or other health-related condition. Exclusion criteria were retrospective studies, non-medical/health-related indications, and secondary publications such as review articles and commentaries. Exclusion was generally made on the basis of information included in the title and abstract of the citation, with full papers retrieved where required.

All included studies were then categorised as (i) randomised, controlled trials (RCTs), (ii) controlled, non-randomised studies, (iii) uncontrolled studies and prospective case reports, (iv) other (health economic analyses and qualitative research publications on prospective studies). For each study, the data extracted were: randomisation method (if applicable), study population, nature of the intervention, practitioner characteristics, nature of the control intervention (if applicable), whether outcome measures had been previously validated, the completeness of follow-up and statistical analyses conducted. For RCTs, the methodological quality of the studies was assessed using the modified Jaded scoring system (13), as described by Ernst and Canter (11); thus the maximum score possible was 4.

Results

Of the 271 publications identified, 253 were excluded (Figure 1). A total of 18 studies met the inclusion criteria. Three studies were RCTs, two were controlled non-randomised studies, eight were non-controlled studies, four were qualitative analyses and one was a health economic analysis.

Randomised, controlled trials

Of the three RCT studies identified, two were in chronic back pain and one in Parkinson's disease (Table 1).

Chronic back pain

The two RCTs of the effectiveness of AT lessons in chronic back pain are the ATEAM trial and a study by Vickers et al. (14,15).

ATEAM trial. The ATEAM trial (Alexander Technique lessons, Exercise, And Massage; ISRCTN26416991) in patients with chronic or recurrent non-specific back pain (14) is acknowledged by the UK National Institute for Health and Clinical Excellence to be a well-conducted RCT with a low risk of bias (16).

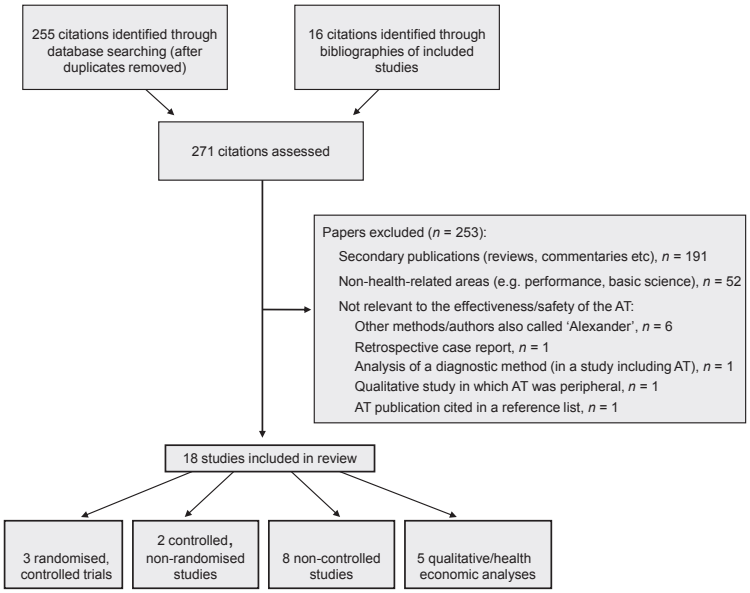

Figure 1 Study selection. Note: three of the qualitative/health economic studies were analyses of one of the RCTs; some of the excluded publications classed under non-health-related areas may also have been secondary publications

Objectives: The objective was to determine the effectiveness of AT lessons for chronic or recurrent low back pain, in comparison with usual care. Massage, which can be an effective intervention for non-specific low back pain (17), was also included as a comparator and to allow assessment of any non-specific effects of attention and touch. The effect of exercise prescription was also assessed (14).

Study population: Patients had presented with non-specific low back pain at least 3 months previously and had current back pain of ≥ 3 weeks' duration (14).

Study design: The ATEAM trial had a factorial design that allowed the additional effect of GP-prescribed exercise to be assessed, either combined with or independently of the other interventions. Using a computer programme number generator, 579 patients were randomised to one of eight groups: (i) usual standard GP care (e.g. continued monitoring, painkillers, referral for physiotherapy or surgery, as appropriate); (ii) usual care plus therapeutic massage (one session per week for 6 weeks); (iii) usual care plus six one-to-one AT lessons (Table 1); (iv) usual care plus 24 one-to-one AT lessons (Table 1); (v) to (viii) as for (i) to (iv) but with an exercise prescription for general aerobic exercise such as walking, backed up by nurse-delivered behavioural counselling (14). Six AT lessons were chosen as being an affordable number from the perspective of the UK National Health Service (NHS), and 24 AT lessons were selected to reflect private practice, where 15–30 AT lessons are typical for people with back pain. AT lessons were provided by teachers trained by, and registered with, the Society of Teachers of the Alexander Technique (STAT), with at least 3 years' experience. Massage was provided by therapists registered with the Massage Training Institute with at least 2 years' experience.

Outcome measures: Two main outcome measures were used, both previously validated in the back pain population (18–20). The Roland Morris disability score (RMS) is determined using a patient questionnaire with more than 20 statements to ascertain the number of everyday activities that are limited by back pain. It is generally considered that an improvement in the RMS of 2–3 points or more is representative of a clinically significant change (21). The second main measure was the number of days that the individual was in pain during the last 4 weeks. Secondary outcomes included measures of quality of life, pain, incapacity and enablement. All outcome measures were assessed at baseline, 3 months and 1 year, with the primary analysis at 1 year to evaluate the long-term effects of the interventions (14).

Findings: At baseline, participants had on average 27 days of back pain out of every 28 days and they had an average RMS of 11. At 3 months, all interventions had a statistically significant benefit compared with usual GP care, with the biggest difference observed in the 24 AT lesson group (mean −2.91 point change in RMS score and median 16 less days in pain per month than usual care; $p < 0.001$ for both) (14).

Table 1 Randomised controlled trials of effectiveness of Alexander Technique (AT) lessons in different medical conditions

Area	Study	Design	Jaded score*	No. of participants	Experimental intervention†	Control intervention	Outcome measures	Main results
Chronic low back pain	Little et al. (14)	RCT with factorial design	4	579	(i) 6 AT lessons over 4 weeks‡; (ii) 24 AT lessons over 9 months.§ AT lessons delivered by 58 teachers	(i) Usual GP care (ii) 6 weekly therapeutic massage sessions Massage delivered by 94 massage therapists	Primary: (i) Roland Morris disability score (RMS) (ii) days in pain in last 4 weeks Secondary: 8 other validated measures (total of 11 measures including sub-scales)	RMS at 1 year: AT groups had significantly less incapacity than the usual care group (difference in RMS score vs. usual care was −3.4 for the 24 AT lesson group, $p < 0.001$, and −1.4 for the 6 AT lessons arm, $p = 0.045$). No significant difference for massage group (−0.58 difference vs. usual care, $p = 0.4$) Days in pain at 1 year: AT groups had significantly less pain than usual care group (3 days vs. 21 days per month, $p < 0.001$ for the 24 AT lessons arm and 11 vs. 21 days for the 6 AT lessons arm, $p < 0.001$). Massage group also significant difference with 14 vs. 21 days ($p = 0.004$) Secondary measures at 1 year: 24 AT group had significantly better scores than usual care on 10/11 sub-scales ($p < 0.01$); 6 AT group was significantly better on 5/11 ($p < 0.05$) and massage on 4/11 subscales ($p < 0.05$)
	Vickers et al. (15)	RCT with three parallel arms	3	91	20 AT lessons (2/week for 10 weeks) delivered by one teacher	(i) 10 weekly self-help group meetings (total time equivalent to experimental intervention arm) (ii) Usual care	Visual analogue pain scale (VAS), raw pain score (RPS), disability score (DS), inappropriate-pain behaviour (IPB)	Post-intervention: Significantly lower disability and pain in AT arm compared with other arms (DS: $p < 0.001$, VAS: $p = 0.05$, IPD $p < 0.001$). At 6 months, DS was significantly lower for the AT arm ($p = 0.005$), VAS and RPS were numerically but not significantly lower. 12 months' follow-up was only for VAS and RPS; both were numerically but not significantly lower in the AT arm.
Parkinson's disease	Stallibrass et al. (22)	RCT with three parallel arms	3	93	24 AT lessons (2/week for 12 weeks) delivered by two teachers	(i) 24 massage treatments (2/week for 12 weeks) (ii) No additional intervention (usual care)	Primary: Self-assessment Parkinson's disease disability scale (SPDDS) Secondary: Beck Depression Inventory (BDI), Attitude-to-self scale (ASS)	SPDSS (both at best and at worst¶) was significantly better in the AT group than usual care post-intervention ($p \leq 0.04$), with improvement maintained at 6 month follow-up ($p \leq 0.04$). Secondary outcomes were also positive compared with usual care, but only significant for BDI post-intervention ($p = 0.03$) and for ASS at 6-month follow-up ($p = 0.04$).

*Modified Jaded scoring system with a maximum possible score of 4 (11); †All AT lessons delivered one-to-one; ‡Lesson frequency was two/week for 2 weeks, then one/week for 2 weeks; §Lesson frequency was two/week for 6 weeks, then one/week for 6 weeks, one/fortnight for 8 weeks and one revision lesson at 7 and 9 months. RCT: randomised, controlled trial; ¶SPDDS was measured at best and worst time during a 1-week period.

The outcome at 1 year is, however, of more interest as it indicates longer-term effects of interventions which had since ended (assessment 10–11 months after completion of 6 AT lessons or massage, and 7 months after the majority of the 24 AT lessons). First, with respect to the RMS scores, the difference between the massage and usual care groups was no longer significant at 1 year (Figure 2A, Table 1). In contrast, in the 6 AT group, the difference in RMS from usual care was statistically significant, but it would not generally be considered clinically significant (Figure 2A, Table 1). In the 24 AT lesson group, the difference in RMS from usual care was both clinically and statistically significant (Figure 2A, Table 1).

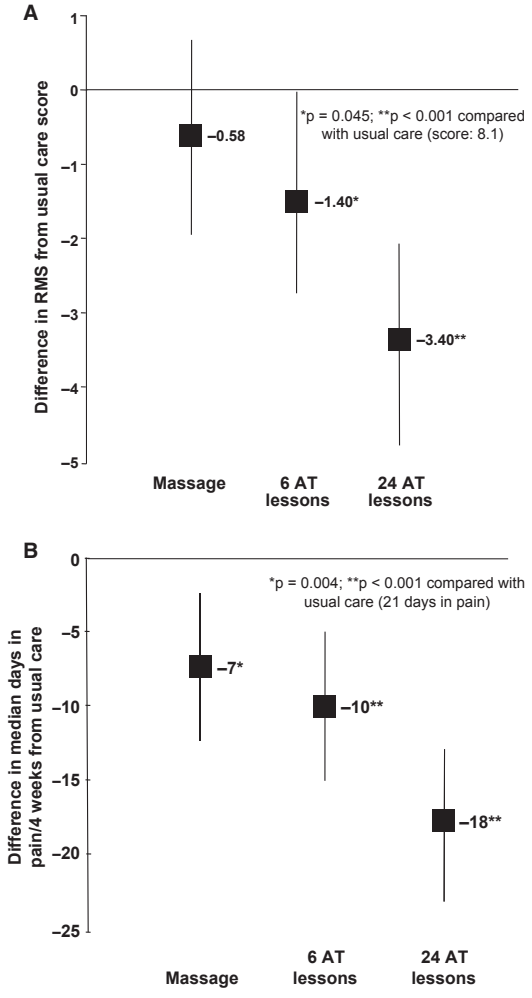

Figure 2 ATEAM trial primary outcomes at 1 year: (A) Difference in mean Roland Morris score (RMS) between intervention and control (usual GP care). (B) Difference between intervention and control (usual GP care) in median number of days in pain in the last 4 weeks. Figure shows mean/median and 95% confidence intervals and is based on data from Little et al. (14)

On the second main outcome measure, at 1 year, both the massage and 6 AT groups had significant reductions in days in pain compared with the usual care group (Figure 2B, Table 1). The most striking results, however, were observed with the 24 AT lesson group, which had a median 3 days of pain in every 4 weeks compared with 21 days for the usual care group (Figure 2B, Table 1).

Of note, in the group which received 24 AT lessons, both the RMS and the number of days in pain actually improved between 3 months and 1 year, and in the 6 AT group, the outcome measures were fairly stable over this time. In contrast, there was a waning of benefit in the massage group on both measures from 3 months to 1 year (14). The improvement (24 AT group) or maintenance (6 AT group) of benefits over the longer term suggests that patients had continued to apply what they had learnt in their AT lessons to their daily life.

The factorial trial design permitted combining data for participants in all groups who did and did not receive exercise prescription. An overall modest but beneficial effect of exercise on the RMS at 1 year was seen (difference of −1.29, 95% CI: −2.25, −0.34; $p = 0.008$, i.e. statistically but not clinically significant); the reduction in pain for exercise vs. no exercise was not statistically significant. Results for the individual groups, i.e. intervention plus or minus exercise, showed significant improvement in RMS for massage plus exercise (−2.37, $p = 0.015$), 6 AT plus exercise (−2.98, $p = 0.002$) and 24 AT irrespective of exercise or no exercise (−4.22 and −4.14, $p = 0.002$ and $p < 0.001$, respectively), compared with the usual care no exercise group, which acted as control for this analysis (14). Significant reductions in number of days in pain compared with control were observed for all four AT groups: −13 days for both 6 AT alone and 6 AT plus exercise ($p < 0.05$) and −20 days for both 24 AT alone and 24 AT plus exercise ($p = 0.001$). The difference in days in pain between the control and massage plus or minus exercise was not significant, which is incongruent with the overall results for massage and may, perhaps, be explained by the smaller group sizes in the individual group analysis.

Of the secondary measures, the 24 AT lesson group had significantly better results than the usual care group on all but one (SF-36 mental) of the 11 measures/sub-scales ($p < 0.01$; Table 1). Overall, the results for the 6 AT and massage groups were quite similar (Table 1).

No adverse events were reported in any of the 288 participants in the AT groups, nor in any of those who received exercise prescription. One person (< 1%) in the massage group reported a worsening of back pain that was attributed to the intervention (14).

Study limitations: Limitations of the trial include the fact that it was largely predicated on 6 AT lessons as the principal test intervention, with implications for data interpretation and possibly study design. In terms of design, a group receiving 24 massage sessions would have provided the most appropriate control for non-specific effects for the 24 AT lesson group (perhaps this was not selected because this number of massage sessions may not reflect usual practice). One can, nonetheless, conclude that, overall, the trial adequately controlled for non-specific effects of individual care and attention, as 6 AT lessons consistently led to a higher magnitude of improvement than massage, with statistically significant differences from control in nearly all main outcome measures (overall results or by individual groups). Furthermore, the fact that the improvement at 3 months continued to increase up to 1 year in the group receiving 24 AT lessons, and that benefit was maintained in the 6 AT lesson group, suggests that individuals had integrated the AT into their daily lives and were able to self-manage to further progress their recovery. In contrast, massage has little explicit educational content, and benefits began to disappear once the sessions had ceased.

While the factorial nature of the trial design allowed for analysis by individual groups, it is nonetheless surprising that there was a focus on these results, given the smaller group size and hence less statistical power of these analyses compared with the overall results. Hence, the effectiveness of the 6 AT lessons plus exercise group was highlighted, despite the fact that 24 AT lessons led to the greatest and most consistent improvement across all outcome measures and that this benefit occurred regardless of exercise prescription. The study's conclusion that '6 lessons followed by exercise prescription were nearly as effective as 24 lessons' (14) is debatable, given that 6 lessons plus exercise were only 65% as effective on days in pain and 72% as effective on the RMS.

Conclusions: The ATEAM scored the maximum possible for methodological quality on the modified Jaded score (Table 1). Outcome measures were comprehensive and appropriate and previously validated for this patient population. Patient disposition was documented and adherence was high with 91% attending ≥ 5/6 massage sessions, 94% attending ≥ 5/6 AT lessons and 81% attending ≥ 20/24 AT lessons. In addition, 81% of participants completed the questionnaires at 3 months and 80% at 1 year. Another strength of the study was that more than 150 AT teachers and massage therapists delivered the interventions, ensuring a representative spread and negating any individual practitioner effects. A clear, long-term benefit of AT lessons for both the pain and disability associated with chronic back pain has been demonstrated. It would appear that the optimum number of AT lessons, suitable for the majority of people with chronic back pain, has not been established but may lie somewhere between 6 and 24 lessons.

Vickers et al. study. A second, smaller and earlier RCT of AT lessons for chronic back pain was conducted by Vickers et al. (15).

Objective: To assess the effect of AT lessons on pain intensity, disability caused by pain and pain behaviour associated with chronic non-specific back pain, with follow-up to 1 year (15).

Study population: As in the ATEAM, patients ($N = 91$) had non-specific low back pain but, unlike the ATEAM, were recruited from hospital outpatient pain clinics. Inclusion criteria were a ≥ 2-year history of low back pain, or current episode of > 3-months' duration (15).

Study design: Patients were randomised to one of three groups (randomisation method not reported): (i) 20 one-to-one AT lessons given over 10 weeks by a STAT-trained and registered teacher; (ii) usual care with no additional intervention; (iii) attention control: weekly group support sessions given over 10 weeks (by the AT teacher) to control for any non-specific benefits of AT lessons. All patients continued to receive usual care as appropriate, although physiotherapy was excluded (15).

Outcome measures: Outcome measures were: pain rated on a visual analogue scale (VAS), a raw pain score, a disability score based on number of daily tasks limited by back pain and an inappropriate-pain behaviour score. Results were analysed by determining change from baseline in each outcome measure for each arm at each time point and comparing these changes across arms (15).

Findings: At the end of the 10-week intervention period, the AT group had lower pain and disability than the other two arms: disability ($p < 0.001$), pain behaviour ($p < 0.001$), VAS ($p = 0.05$), raw pain score ($p = 0.07$) (Table 1). At 6 months, the disability score remained significantly lower for the AT arm compared with usual care ($p = 0.005$), but this score was not assessed at 12 months. VAS and raw pain scores were both numerically lower in the AT arm than in the other arms at both the 6- and 12-month follow-ups, but the differences were not statistically

significant. Safety was not a specified study outcome, but no safety issues were reported (15).

Study limitations: All the AT instruction was delivered by only one teacher, making it more difficult to generalise the findings to the private practice setting than if a larger number of teachers had been involved. A further limitation is that it would appear that not all the outcome measures were validated and two of the measures (raw pain score and inappropriate-pain behaviour) were indirect, being rated by a clinician based on patient reports. It is also unclear how the relatively high drop-out rate in the study affected the results (39% at 3 months and 49% at 1 year).

Conclusions: The study scored 3/4 for methodological quality on the modified Jaded score (Table 1). The significant reductions in pain and disability caused by pain that followed AT lessons appeared to be unrelated to non-specific effects of attention. However, the gradual reduction in benefits over the longer term stands in contrast to the results of the ATEAM trial where benefit was maintained to at least 1 year.

Parkinson's disease

The effectiveness of AT lessons in helping people overcome some of the disabilities associated with Parkinson's disease has been evaluated in one RCT (Table 1) (22).

Objectives. The primary objective was to determine whether AT lessons would reduce motor and postural disability in individuals who were continuing to receive conventional pharmacotherapy for Parkinson's disease. Secondary objectives included impact on depression, and whether any observed benefits were because of non-specific effects of receiving individual attention and hand contact (22).

Study population. Participants had diagnosed idiopathic Parkinson's disease (22).

Study design. The study design was informed by a previous pilot study (23). Ninety-three participants were randomised to one of three intervention arms: (i) 24 bi-weekly one-to-one AT lessons given by STAT-trained and registered teachers; (ii) 24 bi-weekly massage sessions given by trained therapeutic massage practitioners; (iii) no additional intervention (usual care). A computerised method was used to balance the arms for age, gender, and disease duration and severity. This was not a direct comparative study of AT lessons with massage, rather the massage arm (in addition to any massage-specific benefits), provided an equivalent amount of touch and individual attention to control for non-specific effects of AT lessons (22).

Outcome measures. The primary outcome was the self-assessment Parkinson's disease disability scale (SPDDS), which evaluates ability to perform a range of daily activities independently and was recorded at the best and worst times during a 1-week period. Secondary outcome measures included the Beck depression inventory (BDI) and the attitude-to-self scale (ASS). Postal questionnaires were used and data collection and analysis were performed by independent research staff blinded to intervention allocation (22).

Findings. Compared with usual care, significant improvement was observed in the AT group from baseline to post-intervention in the primary outcome measure of SPDDS, regardless of whether measured at best ($p = 0.04$) or worst time ($p = 0.01$; Table 1). The difference between groups was maintained at the 6-month follow-up ($p \leq 0.04$). In contrast, no significant differences in SPDDS were observed between massage and usual care at any time point. Significant improvements were also observed in the AT arm compared with usual care on the secondary outcomes for some time points (BDI post-intervention, $p = 0.03$ and ASS at the 6-month follow-up, $p = 0.04$; Table 1). Comparisons between the massage arm and usual care for the secondary outcomes showed no significant differences, although there was a positive trend for the BDI. Qualitative self-report measures revealed an overall greater degree of change for the AT arm, with improvements in balance, posture and walking cited frequently, as well as increased coping ability and reduced stress. For massage, the most commonly cited benefits were relaxation and a sense of well-being. A further finding was a significantly lower rate of change of Parkinson's disease medication during the study in the AT group than for either usual care or massage ($p = 0.001$). Again, safety was not a specified study outcome, but no safety issues were reported (22).

Study limitations. Limitations include the fact that the sample size was relatively small with approximately 30 participants per intervention arm. In addition, the AT lessons were delivered by only two teachers, hence the extent to which the findings can be generalised to the AT private practice setting as a whole is unclear.

Conclusions. This was a well-designed and well-conducted study with a low risk of bias (Jaded score

3/4). Balancing of groups for various baseline variables was performed, but a randomised, computerised method was used for this. The study included design features to control for potential confounding factors between arms, e.g. having uniform surroundings and a similar professional appearance of the practitioner. Outcome measures were appropriate and previously validated for this patient population or, in the case of attitude-to-self scale, in a similar population. Data documentation and follow-up were comprehensive. The significant improvements in the primary and secondary outcome measures compared with usual care that occurred in the AT arm were not observed in the massage arm, suggesting that non-specific effects of individual care and attention were not responsible for the changes. Overall, the study demonstrated that lessons in the AT for people with Parkinson's disease led to an increased ability to carry out everyday activities which was sustained at 6-month follow-up. One of the most interesting findings is the lower rate of change in Parkinson's medication in the AT group; any potential means of slowing the rate of dose increase in this progressive disease deserves further study.

Controlled, non-randomised studies

Two small, controlled studies were identified (Table 2).

Balance in the elderly

Study population and design. Dennis (24) assessed the effect of AT intervention on balance in elderly volunteers using the functional reach test, a standard clinical measure of postural stability (balance). Volunteers were more than 65 years old and mostly female. AT instruction was provided, as eight sessions over 4 weeks in a group setting, by an AmSAT-trained and registered teacher (AmSAT is the US professional association affiliated to STAT). Following a pilot with six volunteers, a further seven volunteers were recruited in the active intervention group and six in a no-intervention control group.

Findings. Functional reach was significantly greater post-AT intervention than at baseline, with a 32% improvement in the experimental AT group ($p < 0.025$) and 41% improvement in the pilot AT group ($p < 0.05$). The change in functional reach was also significantly greater for the AT group compared with the control group ($p < 0.005$). A follow-up test in the experimental AT group 1 month later showed a slight reduction in the degree of improvement, suggesting that eight group AT sessions may have been insufficient to fully maintain the change (24).

Study limitations and conclusions. Participant numbers were small and allocation to intervention arms did not use randomisation. However, the control group will have mitigated any bias produced as a result of test practice. Validation studies have shown functional reach to correlate well with common reaching tasks in daily life (25), but it should be noted that it is now optimally employed as part of a battery of balance tests (26). Finally, it may have been more appropriate if the study had only included elderly people with confirmed balance problems, or a history of falls.

Respiratory function

Study population and design. One study, together with its earlier pilot, has assessed the effect of AT lessons on respiration (27,28). Twenty healthy volunteers were enrolled: 10 received at least 20 one-to-one AT lessons at approximately weekly intervals from AmSAT-trained teachers, while 10 matched controls received no intervention. Spirometric tests were administered by a trained technician, blinded to the study group, at baseline and after a mean of 6.8 months (27).

Findings. No significant changes were observed in the control group in any of the seven measures (Table 2). In the AT group, significant changes from baseline were observed in four of the seven measures, suggesting some improvement in respiratory muscular strength and endurance, although differences between the two groups did not reach statistical significance (27).

Study limitations and conclusions. Limitations include the small sample size and the lack of randomisation. The control consisted of no intervention, so potential non-specific effects of the individual attention received were not controlled for, but any effects of test practice were. Finally, while spirometric tests are widely used in clinical practice, the physiological relevance of the observed changes in these healthy adults to a compromised population such as asthma patients is questionable, although such transferability was not a claim made by the authors.

Uncontrolled studies and prospective case reports

The eight uncontrolled studies identified were conducted in diverse areas (Table 2). As none had a

Table 2 Non-randomised studies of AT intervention in health-related areas

Area	Study	Design	No. of participants	Experimental intervention*	Control intervention	Outcome measures	Main results
Controlled studies							
Balance in the elderly	Dennis (24)	Two parallel arms	13 elderly volunteers (plus 6 in a pilot study)	Group bi-weekly delivery of 8 AT lessons by one teacher	No intervention	Functional reach (FR)	FR increased by 3.8 cm compared with control group ($p < 0.005$), and by 32% compared with baseline ($p < 0.025$)
Respiratory function	Austin and Ausubel (27)	Two parallel arms with matched controls	20 healthy volunteers	20 AT lessons at approximately weekly intervals delivered by eight teachers	No intervention	(i) Highest forced expiratory flow measured with peak flow meter (PEF) (ii) Maximum voluntary ventilation (MVV) (iii) Maximal inspiratory pressure (MIP) (iv) Maximal expiratory mouth pressure (MEP), plus 3 other measures	Significant improvement in experimental group on 4 measures: PEF: 9%, $p < 0.05$; MVV 6%, $p < 0.05$; MIP 12%, $p < 0.02$; MEP 9%, $p < 0.005$ compared with baseline; but no changes in the other 3 measures. No significant changes in control group for any measure
Non-controlled studies							
Balance in the elderly	Batson and Barker (29)	Single group, pre-test, post-test	19 elderly people with a history of falls	Group delivery of AT in intensive 2-week course by two teachers	No control group	Fullerton Advanced Balance Scale (FAB); Timed 'up and go' (TUG); Modified Falls Efficacy Scale (MFES)	Significant improvement across the group post- vs. pre-intervention in FAB ($p = 0.05$) and TUG ($p = 0.006$). No significant change in overall MFES
Posture and surgical ergonomics	Reddy et al. (30)	Single group, pre-test, post-test	7 surgeons	2 group and 6 individual AT lessons delivered by two teachers	No control group	Pre- and post-test basic surgical skill test and assessment of postural endurance	Significantly higher score post-test for postural endurance ($p < 0.05$). Significantly greater score post-test in 4 of 10 measures of surgical ability ($p < 0.05$)
Stuttering	Schulte and Walach (31)	Prospective case reports	2 adults with chronic stuttering	30 AT lessons (2–4/week) delivered by one teacher	No control group	Frequency of stuttering during speech and 17 different variables related to stuttering or application of AT during speaking.	Reduced frequency of stuttering in both participants. Significant improvement in 8 of the 17 measures compared with baseline.
Various	Maitland et al. (32)	Prospective case series	8 adults with learning disabilities	1–27 AT lessons (dependent on individual) delivered by one teacher	No control group	Clinical assessment	Subjective improvements in breathing, mobility and anxiety levels were observed in this exploratory study

Table 2 Continued

Area	Study	Design	No. of participants	Experimental intervention*	Control intervention	Outcome measures	Main results
Parkinson's disease	Stallibrass (23)	Single group, pre-test, post-test	7 adults with Parkinson's disease	Median 12 AT lessons delivered by several teachers (number not specified)	No control group	(i) Beck Depression Inventory (BDI); (ii) Activities in daily living (ADL) scale; (iii) Body concept scale (BACS); (iv) Functioning Disability questionnaire (FDQ)	Significantly better scores post- compared with pre-intervention for BDI ($p < 0.01$), ADL and BACS ($p < 0.05$). Change in FDQ was positive, but not significant
Chronic back pain	Cacciatore et al. (7)	Prospective case report	1 adult with chronic back pain	20 AT lessons (∼weekly over 6 months) delivered by one teacher	No control group	(i) Pain [visual analogue scale (VAS)]; (ii) Postural coordination (automatic response to surface translations & one-legged balance)	Pain changed from 8.3 on VAS to 1.9 post-intervention. Pain changed from daily to 1–2 days per month. Quantitative improvement in postural coordination observed
	Elkayam et al. (33)	Single group, pre-test, post-test	67 adults with chronic back pain who had not improved with previous physiotherapy	4-week multi-disciplinary programme including 8 AT lessons	No control group	Pain rating, pain frequency and amount of analgesic use	Significant improvement vs. baseline in pain rating and duration maintained at 6 months ($p < 0.01$). Analgesic use reduced from 76% of patients at baseline to 33% at 6 months. However, impossible to evaluate the specific contribution of AT lessons to this outcome
Chronic pain	Fisher (34)	Single group, pre-test, post-test	34 adults with chronic pain (mostly low back)	4-week multi-disciplinary programme including AT lessons	No control group	Pain VAS, General Health questionnaire, Oswestry disability scale, Health Locus of Control	Modest improvement in some measures at 3 months and 1 year compared with baseline (significance not reported) but impossible to evaluate the specific contribution of AT lessons to this outcome

*All AT lessons delivered one-to-one unless otherwise specified (marked as 'group delivery').

control group, the findings are associated with an inherent high risk of bias.

Balance in the elderly

In addition to the controlled study on balance in the elderly already described, Batson and Barker (29) carried out a similar-sized, uncontrolled study that evaluated a wider range of validated outcome measures (Table 2).

Study population and design. An interesting feature of this study is that it was a feasibility study for group-learning of the AT, whereas AT instruction is generally delivered one-to-one. Nineteen volunteers (mean 78 years) were recruited from residential homes and community centres. All but two had a history of falls and most had varying degrees of fear of falling. Two validated outcome measures of balance were included, the timed 'up-and-go' (standing from a seated position, walking 3 m and returning to sitting) and the Fullerton advanced balance scale (a 10-item test of different activities requiring balance). A third validated test, the modified falls efficacy scale assessed fear of falling during 10 different daily activities. All tests were carried out independently by two physiotherapists. Instruction in the AT was given in a total of 10, 1.5-h group sessions over two consecutive weeks by AmSAT-trained and registered teachers (29).

Findings and conclusions. A total of 18 of the 19 participants completed the 2-week study. The average group timed up-and-go test improved by almost 2 s from baseline ($p = 0.006$) and this was considered to be due to improved overall motor performance, rather than increased risk taking. In addition, the average Fullerton Advanced Balance score was improved from baseline ($p = 0.052$), but no clear change was seen in the modified falls efficacy scale (29). This was a robustly designed and well-conducted pilot. A follow-up study would be highly justified, with outcomes assessed longer term and a control arm such as a conventional fall prevention programme.

Posture and surgical ergonomic skills

Reddy et al. (30) reported a pilot study of posture and surgical ergonomic skills in trainee surgeons pre- and post-AT lessons (Table 2). Seven underwent a routine basic skill test in laparoscopic (minimally invasive) surgery, as well as an assessment of posture. The tests were repeated after eight AT sessions (two group and six one-to-one) with AmSAT-trained and registered teachers. Each subject served as his/her own control. Compared with baseline, significant improvement was observed in post-intervention postural endurance, as assessed by the time-load test ($p < 0.05$). Tests of surgical skills also showed significant improvements, and tremor in the non-dominant hand was reduced compared with baseline ($p < 0.05$) (30).

Stuttering

Two individuals with persistent stuttering were enrolled in a study which provided 30 one-to-one AT lessons (Table 2) (31). The training of the AT teacher involved was not specified. Eight of the 17 physical and psychological measures related to stuttering showed significant improvements compared with baseline in one or both participants, for example, successful influencing of stuttering ($p = 0.04$ and $p = 0.03$ for the two subjects) (31). However, the 17 measures were not validated and not all were objective assessments.

Learning disabilities

Maitland et al. (32) conducted an exploratory study to assess any changes in physical functioning and anxiety levels following one-to-one AT lessons with a qualified AT teacher (training details not specified) in eight adults with varying degrees of learning disability and associated physical problems (Table 2). Assessments were mostly subjective and were made jointly by the AT teacher and a physiotherapist. In seven of eight participants, small but noticeable changes were observed following lessons: improved mobility/reduction in muscular tension and in anxiety measured with a recognised behavioural relaxation rating scale (32).

Other studies

Four further studies will not be discussed in detail (Table 2). A pilot study in seven individuals with Parkinson's disease showed significant improvements following AT lessons in three of four validated self-report outcome measures, including one of depression (23). Secondly, a case report described a marked reduction in back pain following AT lessons (7). Finally, instruction in the AT has been reported in two studies as part of multidisciplinary pain management programmes for patients with chronic pain (33,34), but it was not possible to determine the specific contribution of the AT to the observed improvement (Table 2).

Cost effectiveness

AT lessons are generally paid for privately, but several healthcare insurance companies will reimburse costs in certain circumstances, and some UK pain clinics provide AT lessons for chronic pain patients. One economic analysis of the AT has been identified (35).

Findings

This analysis of the ATEAM trial was conducted from the perspectives of the UK National Health Service, the participants' personal costs and society. The analysis demonstrated cost-effectiveness of AT lessons for chronic back pain, concluding that 6 AT lessons followed by exercise prescription was the most cost-effective option of those examined (35). While exercise prescription alone and 6 AT lessons alone both had a greater than 85% probability of being below the conventionally accepted threshold of £20,000 per quality-of-life-adjusted year (QALY) gained, AT lessons performed better than exercise prescription across the range of cost-effectiveness outcomes measured (QALYs, cost per point reduction in disability score and per reduction in pain-free days). Six AT lessons followed by exercise prescription cost £43 per additional pain-free day, £64 per additional point reduction on the disability score and £5332 per QALY gained (35).

Limitations and conclusions

No cost-effectiveness analysis of 24 AT lessons compared with usual care control was reported, despite the greater clinical effectiveness of 24 AT lessons vs. 6 lessons (14). In this analysis, only the 6 AT lesson arm was compared with the usual care control, and the cost-effectiveness of 24 lessons was instead compared with that of 6 AT lessons. The analysis also experienced a high degree of missing data, with questionnaire data available for only 53% of participants, which may explain the high degree of variability within the data on resource use and resource costs (35). Nonetheless, the analysis provides the first evidence of cost-effectiveness of AT lessons.

Healthcare professionals' and participants' expectations and experiences of the AT

The study of the extent of acceptability of different healthcare interventions to patients, often using mixed qualitative and quantitative research methodology, constitutes an expanding field, which allows evaluation of the patient's expectations and experience.

Participants' perceptions

As an integral part of the ATEAM trial, Yardley et al. (36) studied patients' attitudes to, and experiences of, AT lessons (n = 183) compared with exercise prescription (n = 176) using a structured questionnaire. Note that there was some overlap between the two groups because of the trial's factorial design. In-depth interviews were also conducted with a selected sample of participants in the two groups (24 participants at baseline and 15 of these at 3-month follow-up) to elucidate the beliefs and motivations relating to responses to key elements of the questionnaire. At study entry, participants in both AT and exercise groups had a positive attitude to their intervention, based on an expectation for some improvement. At the 3-month follow-up, the participants' attitude to exercise had not changed. In contrast, participants' attitude to AT had become more positive, with a significant change in the questionnaire results ($p < 0.001$). This change resulted from a perceived increased ability to cope with and prevent back pain. Unlike for exercise, few barriers to learning the AT were reported, particularly as it 'made sense' and could be practised while carrying out everyday activities (36). The high rate of attendance at AT lessons in the ATEAM (88%) also provides an indication of good acceptability to individuals with chronic back pain (14).

Fisher (34) described a multidisciplinary pain management programme (N = 34) in which AT instruction was consistently rated by the study participants as the component of highest value (mean subjective rating on 10-point scale during the study and 3-month and 1-year follow-up). The programme consisted of educational lectures / group discussions with nurses, physiotherapists and psychologists, auto-hypnosis and relaxation, personal exercise training and AT sessions. Finally, in the occupational setting, a study of group AT instruction for medical sonographers (N = 96) delivered with the aim of reducing work-related musculoskeletal disorders revealed that 86% found that AT was relevant to the practice of ultrasound and 83% thought that they would be able to apply what they had learnt to their work (37,38).

Healthcare professionals' perceptions

Beattie et al. (39) conducted in-depth semi-structured interviews towards the end of the ATEAM trial with a sample of 20 GPs, nurses, massage therapists and AT teachers (five in each group). They found that GPs and nurses perceived AT lessons, with or without exercise, as more beneficial and acceptable than massage, and concluded that this may be related to the educational and self-care nature of the AT (39).

We have also included one other study assessing healthcare professionals' attitudes to the AT, although strictly it was not a prospective study of AT *per se*. In this study, 875 Canadian primary care physicians completed a questionnaire on their beliefs about the therapeutic effectiveness of 15 different complementary / alternative healthcare interventions (40). The majority (79%) of the physicians had not heard of the AT which may explain the relatively low rating given (ranked joint 12th of 15).

Future and ongoing research

The search of clinical trials registries revealed one planned participant trial which is a randomised study comparing 10 weekly AT lessons with physiotherapy exercises in 120 people with back pain (ISRCTN 51496752). In addition, a large RCT of AT lessons compared with usual care for chronic neck pain is due to begin in late 2011. Research is also continuing into other areas, including the physiological and psychological basis of the AT.

Discussion

Evaluation of current evidence for the effectiveness and safety of AT instruction

The extent to which AT instruction becomes accepted as a valid intervention for medical and health-related conditions will depend on the weight of the supporting evidence, its acceptability to potential users and to healthcare providers alike, as well as its cost-effectiveness.

Although few studies have been conducted on the efficacy and safety of instruction in the AT, the current analysis has identified strong evidence for the effectiveness of AT lessons in chronic back pain. This conclusion is based on the existence of two RCTs of a high quality design that produced credible outcomes, criteria that are generally accepted as denoting a strong level of evidence (41). The ATEAM trial in particular, provides convincing evidence of the long-term effectiveness of AT lessons in chronic back pain, with the low risk of bias suggesting that the observed efficacy reflects specific effects of the AT intervention. Of interest, chronic back pain is currently the most common single reason that people first seek AT lessons (42).

The ATEAM results for AT lessons compare favourably with conventional primary care treatments for chronic back pain. In the trial itself, AT lessons consistently provided greater long-term benefit than therapeutic massage. While caution must be exercised in comparing results across trials, the ATEAM shared a similar design, methodology and study population to the BEAM trial of spinal manipulation, plus or minus exercise, compared with usual GP care for low back pain (43). In BEAM, the maximum net benefit (difference from usual care) in RMS at 1 year was 1.30, which was achieved with manipulation plus exercise; this difference was statistically significant, but would not generally be considered clinically significant. Corresponding values in the ATEAM were threefold higher than this for 24 AT lessons (with or without exercise) and twofold higher for 6 AT lessons *plus* exercise, both of which were statistically and clinically significant (14). Given also that a meta-analysis of 26 RCTs has concluded that spinal manipulative/mobilisation therapy gave no added benefit to usual GP care for chronic low back pain (44), a course of 6–24 AT lessons should perhaps be given more consideration as an appropriate option to offer patients with this condition.

Moderate evidence for the effectiveness of AT lessons in reducing disability associated with Parkinson's disease was also identified. There was a low risk of bias with the one small, well-conducted RCT in Parkinson's, suggesting that the outcomes reported are likely to reflect true effects of the AT intervention. On the basis of this trial, the UK National Institute for Health and Clinical Excellence recommends that AT lessons may be offered to benefit people with Parkinson's by 'helping them to make lifestyle adjustments that affect both the physical nature of the condition and the person's attitudes to having Parkinson's disease' (45).

The long-term benefit of AT lessons observed in both the ATEAM and Parkinson's trials is consistent with the inherently educational nature of the Technique. Indeed, the skills acquired in a series of AT lessons have been shown to be retained in the long term, being widely and consciously employed in daily life (46).

Exploratory studies have observed an apparently beneficial effect of AT instruction in a diverse range of medical conditions and various measures of human function. These studies were generally small in size and were either uncontrolled, or poorly controlled. The preliminary nature of the evidence points to the need for further research to be conducted. As AT training appears to affect fundamental aspects of motor control, such as spinal stiffness, spinal coordination, weight transfer and balance (1,4,6,7), it could plausibly benefit a broad range of clinical conditions.

Few of the studies reviewed discussed safety or acceptability of the intervention. However, in the ATEAM trial, which is the largest AT study to date, no adverse events were observed in the 288 participants who received AT lessons. Indeed, AT intervention is widely perceived as very low risk.

Limitations of the review

The analysis is limited by the relatively small evidence base for the AT; hence no meta-analysis or other statistical evaluation of the evidence is feasible. This is not surprising given the general lack of research funding to support large studies into alternative and complementary approaches to healthcare.

It should be noted that all of the controlled studies identified involved AT teachers trained by and registered with the Society of Teachers of the Alexander Technique (STAT), or by its international affiliated organisations. This finding is not surprising given that STAT is the largest and longest-established professional association.

We are also cognisant that the review processes and tools used were designed to systematically assess the evidence base for conventional pharmaceutical-based interventions rather than alternative or complementary interventions. For example, the scoring systems used to assess the methodological quality of a trial often rely heavily on the use of blinding and placebo controls. While the RCTs described here aimed to control for the non-specific effects of individual care and attention (14,15,22), a clear confounder is that blinded trials of the AT are not possible because of the nature of the lessons, and controlling for placebo effects can be problematic. Review and modification of such tools to make them more suitable for evaluating smaller studies that may not closely follow traditional design criteria may therefore be desirable. In this respect, it is interesting to note that observational studies do not necessarily yield less reliable results than RCTs (47,48).

A further point receiving increasing attention in RCT methodology is the benefit of developing mixed-methods approaches, drawing on both quantitative and qualitative research. Such methodologies may elucidate the patient's perspective and experience of the intervention and the trial (49,50), leading to a better understanding of the processes and outcome of an RCT, as well as providing means for improving the intervention.

Conclusions

AT lessons represent an appropriate intervention to offer patients with chronic, non-specific back pain and may help patients with Parkinson's make appropriate lifestyle adjustments. Instruction in the AT is increasingly being sought by individuals looking for help in a wide range of conditions and as a means to improve overall health and well being. Further well-designed, controlled studies are therefore needed to robustly evaluate the effectiveness and safety of AT lessons, including in areas where there is currently only preliminary evidence, namely balance in the elderly, respiratory function, stuttering, posture, chronic pain, muscular tension and anxiety.

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Author contributions

JW was responsible for the concept and design of the review, performed data collection and data interpretation/analysis, was the principal author and approved the final manuscript. NM performed data collection and data interpretation/analysis, wrote the initial draft of sections on qualitative data, critically revised the paper and approved the final manuscript.

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