MASTER OF SCIENCE BY RESEARCH

Developing Evidence-Based Practice of Limb Activation Techniques for the Remediation of Motor Dysfunction in Patients with Post-Stroke Neglect
A Systematised Review and Critical Appraisal of Intervention Reporting

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Developing Evidence-Based Practice of Limb Activation Techniques for the Remediation of Motor Dysfunction in Patients with Post-Stroke Neglect: A Systematised Review and Critical Appraisal of Intervention Reporting

By

Victoria Collie

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Certificate of Ethical Approval

Applicant:

Victoria Collie

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Developing evidence based practice of limb activation techniques for the remediation of neglect and motor dysfunction after stroke: A systematic review

This is to certify that the above named applicant has completed the Coventry University Ethical Approval process and their project has been confirmed and approved as Low Risk

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Abstract

Background: For clinicians to translate research into clinical practice, they require evidence of intervention effectiveness from high-quality studies and a full description of the intervention (Yamato et al. 2016 p121). A thorough and complete description allows the intervention to be fully evaluated in terms of effectiveness and it ensures accurate replication by clinicians and the development of research (Hoffmann et al. 2014). Accurate intervention descriptions have been found to be lacking in healthcare research and are a potentially modifiable barrier to the translation of evidence into practice (Hoffmann et al. 2015).

One particular area where confusion is currently prevalent is in the advocacy of Limb Activation Techniques (LAT) in the treatment of post stroke neglect (an impairment which prevents a person from interacting with their left side). Whilst LAT is consistently referred to in research as an effective treatment, there is little clarity about what exactly this technique is, how it should be applied in practice and what quantifies as "effective" results. Evaluating the quality and completeness of intervention reporting may be an important step in the development of LAT as an evidence-based intervention. This study will appraise the completeness of current intervention reporting of LAT, using a snap-shot of the literature focusing on motor outcomes.

Study Purpose: To determine whether LAT can be translated into clinical practice in the remediation of motor dysfunction in patients with left neglect in the first six months post stroke.

Methods: A systematic review approach was conducted to identify all primary research investigating the effect of LAT on motor outcomes in the first 6 months post stroke in patients presenting with left neglect. Both published and unpublished literature was searched for using MEDLINE, CINAHL, AMED, PEDro, OT Seeker, PsycINFO, ProQuest Dissertations, ProQuest, CENTRAL, TRIP, OpenGrey and Google Scholar. An overview of methodological quality was ascertained using a modified version McMasters Quality appraisal tool (Law et al. 1998), by two separate reviewers. The TIDiER checklist (Hoffmann et al. 2014), was used to appraise the completeness of intervention reporting and to present the intervention details. Data pertinent to study and participant characteristics and treatment results were also extracted.

Results: Seven studies met the inclusion criteria. The overall completeness of intervention reporting was lacking with the lowest score of 42% and the highest 71%. The provision of intervention details highlighted there to be no standardisation in what the technique or protocols for LAT are with four broad techniques being identified; Limb Alert Devices, Active Assisted Exercises, Functional Electrical

Stimulation, and a Mixed Programme (Constraint Induced Movement Therapy, Active Assisted Exercise, Passive Stretches and a Functional Electrical Stimulation glove). Six of the seven studies reported an intervention effect; however, no study was large enough for results to generalise and study quality ranged from the lowest at 41% to the highest of 80%.

Conclusion: The incomplete description of intervention reporting in the seven included studies and the variability of what is reported, limits the replication of LAT into clinical practice. This study does provide an insight into what the current research has reported on the LAT interventions to enable both clinicians and research to critically evaluate and build on future research.

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Abbreviations

AMED	Allied and Complementary Medicine Database
BI	Barthel Index
CBS	Catherine Bergego Scale
CENTRAL	Cochrane Central Register of Controlled Trials
CIMT	Constraint Induced Movement Therapy
CINAHL	Cumulative Index to Nursing and Allied Health Literature
CONSORT	Consolidated Standards of Reporting Trials
CRD	Centre for Reviews and Dissemination
CT	Computed Tomography
FES	Functional Electrical Stimulation
FIM	Functional Independence Measure
FMA	Fugl-Meyer Assessment
FTHUE	Functional Test for the Hemiplegic Upper Extremity
LAD	Limb Alert Devices
LAT	Limb Activation Techniques
MEDLINE	Medical Literature Analysis and Retrieval System Online
MI	Motricity Index
MMAS	Modified Motor assessment scale
MRCMS	Medical Research Council Motor Scale
MRI	Magnetic Resonance Imaging
OT	Occupational Therapist
PEDro	Physiotherapy Evidence Database
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analysis
RCT	Randomised Controlled Trial
RMA	Rivermead Motor Assessment
RMI	Rivermead Mobility Index
SCED	Single Case Experimental Design
TRIP	Turning Research into Practice database
TIDiER	Template for Intervention Description and Replication
TENS	Transcutaneous electrical stimulation
WMFT	Wolf Motor Function Test

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Chapter 1: Introduction and Background

1.0 Neglect

The neglect syndrome is a complex and heterogenous disorder of spatial perception that can occur following brain injury, whereby a person behaves as though part of the world no longer exists (Mennemeier 2011). Neglect is most commonly defined as 'the inability of a person to perceive, respond or orientate to stimuli on the side opposite a lesion, despite the absence of primary sensory or motor deficits' (Heilman et al 1985 cited by Robertson and Halligan 1999 p2). Depending on lesion size and location this can be accompanied by non-lateralised symptoms such as altered arousal and alertness, impaired attention and altered spatial working memory (Robertson and Halligan 1999). It can also be accompanied by extinction, the inability of a person to identify stimuli on the affected side when it is presented simultaneously with stimuli on the non-affected side, and anosognosia, the unawareness and denial of impairments (Robertson and Halligan 1999).

There are three neglect subtypes (Kerkhoff 2001): sensory neglect, representational neglect and motor neglect. Firstly, sensory neglect is the overarching term used to describe the loss of ability to report, respond or orientate to sensory information from the senses, such as vision, hearing and tactile sensation (Robertson and Halligan 1999). Secondly, representational neglect affects the internal representation of space. This form of neglect is less common and often co-occurs with visual neglect (Kerkhoff 2001). Both sensory and representational neglect subtypes affect how a person perceives themselves (internal representation) or the environment (external representation) and has also been termed perceptual or attentional neglect (Robertson and Marshall 1993). The third subtype of neglect is motor neglect which affects action as opposed to perception (Robertson Marshall 1993) and can present as the reduced use of the affected limbs on the side opposite the lesion or the reduced use of the non-affected limbs, into the side of space opposite the lesion (Punt and Riddoch 2006).

Neglect behaviours can also be dissociated into different representations of space or different frames of reference. Space is separately coded in the brain as personal, interpersonal and far space (Berryhill, Hoelscher and Shipley 2012). Examples of neglect in these different spaces may include patients failing to dress the affected limb (personal), eating only half a plate of food (interpersonal) or failing to recognise people or objects on the side opposite the lesion (far space) (Robertson and Halligan 1999). Frames of reference further determine where a person bases the measurement of the left and right side (Berryhill, Hoelscher and Shipley 2012). This can be viewer-

centred (egocentric) where the middle is determined by the position of body, head or eyes; allocentric which determines the relationship between two objects (Berryhill, Hoelscher and Shipley 2012); or object-centred whereby a patient will fail to recognise one side of a single object regardless of its location in space i.e. a word, drawing or a face (Kerkhoff 2001 p10).

1.0.1 Assessment

These multimodal presentations of neglect make assessment and in turn treatment a complex process (Bailey and Riddoch 1999a). The signs and symptoms are difficult to dissociate from each other and from primary impairments such as primary sensory, motor and visual loss (Kerkhoff 2001). The most common assessments of neglect are conducted with neuropsychological pen and pencil tests. For example, cancellation tests, line bisection tests, reading, drawing and copying tasks (Azouvi 1996). These tests have most often been adapted from visual assessments, although some tools can assess for representational and motor subtypes and can differentiate personal from extra personal neglect (Bailey and Riddoch 1999a) and a battery of tests is required to successfully diagnose neglect (RCP Guidelines 2016). Many terms are often used interchangeably to describe neglect including; visual spatial neglect, hemispatial neglect and hemi inattention (Kerkhoff 2001).

Neglect has been found to be commonly underreported by all members of the MDT in the clinical setting (Chen et al. 2013). Therapy staff, predominantly occupational therapists, often play a more prominent role in the rehabilitation of this impairment; however, it has been found that both physiotherapists and occupational therapists are unlikely to use standardised assessment measures in clinical practice (Menon-Nair, Korner-Bitensky and Ogourtsova 2007). A knowledge gap of both professional groups was identified, however, this may be more pronounced in physiotherapists, who were often unaware of different neglect subtypes (Plummer et al. 2006).

1.0.2 Incidence

Features of the neglect syndrome are often found in patients following a stroke, with an incidence of 20-65% following left sided hemisphere damage, and 33-82% in right hemisphere damage (Bowen, McKenna and Tallis 1999). Right sided lesions are often reported to be more prevalent but have been reported to be longer lasting and more severe (Chen et al. 2015). As a result, the right side of the brain is considered to play a more prominent role in spatial perception than the left side (Robertson and Halligan 1999). However, this difference in incidence has not always been found and the timing of assessment and assessment measures used may have an impact on findings (Bowen, McKenna and Tallis 1999).

1.0.3 Anatomical Location

Anatomical lesion studies have found many areas of the brain to have been associated with neglect including the parietal lobe, frontal lobe, temporo-parietal-occipital junction, thalamus, basal ganglia and white matter (Robertson and Halligan 1999). This suggests that spatial perception is not located in one distinct area of the brain but instead operates across a complex neural network (Robertson and Halligan 1999). A study examined eighty patients with right sided neglect and suggested the different neglect behaviours can be linked to specific anatomical locations; lesions in the inferior parietal lobe were linked to the perceptive visual-spatial components of neglect; the right dorsolateral pre-frontal cortex were linked with an exploratory-visual-motor component; deep temporal lobe regions were linked with the allocentric-object centred component of neglect; and lesions of the white matter likely have an impact on more than one functional domain and were therefore associated with more severe levels of neglect (Verdon et al. 2009).

1.0.4 Neglect Mechanisms

Many mechanisms have been proposed to further explain the neglect phenomena including attentional theories, representational theories, transformational theories, central balance theory and dorsal versus ventral contributions to neglect (Kerkhoff 2001). The two most prominent of these theories will be described and includes the spatial attention theories and spatial awareness (representation) theories.

Firstly, several theories have been developed based on the idea that neglect is a disorder of attention (Robertson and Halligan 1999). That patients are unable to orientate, respond or move their affected limb due to damage to attentional mechanisms. One theory suggests there to be an imbalance in how attention is controlled, that the left hemisphere controls attention to the right side only, whilst the right hemisphere has a bilateral role in attention. In this model, damage to the right hemisphere will result in more severe neglect with reduced attention to the left side and also increased attention to the right side (Heilman, Watson, Valenstein and Damasio 1983 cited by Kinsbourne 1987 p73). Kinsbourne (1987), instead proposed that spatial attention of both perceptual information and internal representation is controlled by opponent processors whereby each hemisphere directs attention to the contralesional side, on an attentional gradient. An impairment of an opponent processor of attention would lead to an activation imbalance across the two hemispheres further aggravating the attentional bias. Additionally, others have argued that neglect results from an inability to disengage attention from the unaffected right side (Posner and Driver (1992) cited by Kerkhoff 2001 p15).

In contrast, the spatial awareness theories consider neglect to be a disorder of the mental representation of space (Robertson and Halligan 1999). The perception of sensory events requires the mental representation of space in the brain (Bisiach and Luzzatti 1978 cited by Robertson and Marshall 1993 p 93). Furthermore, it has been suggested that different aspects of space are motorically coded in the brain and a lesion of these structures results in neglect (Rizzolatti and Colleagues 1997 cited in Kerkhoff 2001 p15). The representational theory of neglect is based on the assumption that space is also represented in several brain areas and requires joint activation of different spaces (personal, interpersonal and far space), for conscious awareness of space to be realised. This might explain why neglect behaviours can be dissociated into different spaces and frames of reference.

1.0.5 Functional Consequences

The presence of neglect is widely acknowledged to be linked with higher levels of disability and worse functional outcomes. In a systematic review over a ten-year period, 1995 to 2006, it was determined that the presence of neglect was associated with worse functional outcomes in 25 of 26 studies (Jehkonen, Laihosalo and Kettunen 2006). A more recent study reaffirmed these findings in a cohort of one hundred and eight patients (Chen et al. 2015). They determined it was the presence and not just the severity of neglect that resulted in poorer functional outcomes, longer length of stay, increased falls and requirement of more support at discharge.

Patients diagnosed with left neglect have also been found to have more severe levels of hemiparesis and motor dysfunction at both admission and discharge in comparison to patients without neglect (Chen et al. 2015, Meyer et al. 2016, Nijboer, Kollen and Kwakkel 2014). The presence of neglect has also been linked to the presence of prolonged muscle flaccidity (Formisano et al. 1993); the reduced recovery of synergism and strength in the paretic upper limb (Nijboer, Kollen and Kwakkel 2014); impaired recovery of self-care, transfer and locomotion (Nijboer et al. 2013); reduced improvements of goal directed movements (Ogourtsova, Archambault and Lamontagne 2015); dexterity of the upper limb (Kong, Chua and Lee 2011); longer recovery of postural control (Pérennou et al. 2002) and worse community mobility even after three years (Oh-Park et al. 2014).

1.0.5 Motor Dysfunction and Neglect

Although the signs and symptoms of the neglect syndrome are defined as having a separate mechanism to primary impairments of the visual, sensory and motor system, they have often been

observed to co-occur (Kerkhoff 2001, Meyer et al. 2016). Alternatively, it has been suggested that the increased incidence of motor impairment in patients with right sided lesions is not anatomically viable. Instead, the increased presence of motor impairment in these patients may result from an attentional deficit as opposed to a primary motor impairment (Robertson and Halligan 1999). In reality, motor control is not just dependent on an intact primary motor system, instead, movement requires a complex interaction of sensory, perceptual, cognitive and motor systems (Shumway-Cook 2017). Disorders or impairments of any of these systems can, therefore, affect motor performance.

Spatial perception supports motor control by providing information about body position in relation to the environment. Visuospatial attention then influences motor planning of voluntary goal directed movements (Peters et al. 2015). The relationship between visuospatial attention and motor planning in the neglect impairment has been explained using the pre-motor theory of selective attention (Peters et al. 2015). The pre-motor theory of selective attention suggests that the neural pathways for spatial attention and motor planning are the same whereby planning movement directs attention to the movement, and the ocular system is specialised to orientate attention to the planned movement goal (Peters et al. 2015 p1425). It is proposed that we need perception to move and we need to move to perceive (Berryhill, Hoelscher and Shipley 2012). Therefore, the impairment of spatial perception as seen in patients with neglect, may impair movement post stroke.

The presence of neglect may also hinder the recovery of movement after injury. The recovery of primary motor impairment and motor functional activities is dependent on plasticity and motor re-learning. Neuroplasticity is the ability of the brain to show modification following injury. Motor re-learning is the permanent change in skill and function after injury (Raine, Meadows and Lynch-Ellerington 2009). 'The goal of motor rehabilitation is to facilitate the neural reorganisation that underlies relearning of motor skills and function following stroke-induced damage to the central nervous system' (Richards et al. 2008 p397). 'Motor rehabilitation operates on the assumption that behaviour forces neuroplastic changes, which in turn leads to improved motor function and motor skills acquisition' (Richards et al. 2008 p397). The main principles of motor rehabilitation include repetition and active, goal-oriented movements.

The presence of neglect may reduce the desire for movement and develop into a learnt non-use of the affected side. This is the phenomena by which following a stroke there is a learned suppression of movement that is not necessarily related to primary motor impairment following neurological injury that may further impair motor rehabilitation (Taub et al. 2006). Following stroke,

the ability to attend has also been suggested as a prerequisite for motor re-learning (Bailey and Riddoch 1999b). Barrett and Muzzafar (2014) have speculated that spatial neglect could be responsible for suppressing motor recovery and reducing motor learning (Barrett and Muzaffar 2014). Furthermore, it has been reported that neglect impairs recovery of motor impairments most in the first 10 weeks post stroke (Nijboer, Kollen and Kwakkel 2014) which is when neuroplasticity is considered to be most potent.

1.1 Limb Activation Technique

Limb Activation Technique (LAT), otherwise referred to as spatio-motor cueing, is a technique that uses contralesional limb movements in the contralesional hemispace to remediate signs of visual neglect, function and motor dysfunction in patients with neglect post stroke (Robertson McMillan et al. 2002).

The development of limb activation as a treatment technique was initially based on work by Joannette (1986) and Halligan and Marshall (1989) (cited by Robertson and Halligan 1999). They observed that if patients with neglect had no additional hemiparesis, they performed movements or completed pen and paper neglect assessments better when using their affected upper limb. As the majority of patients with neglect will also have additional hemiparesis and therefore have a reduced ability to conduct movements with the affected limb, Robertson and colleagues conducted a series of experiments to build on and test these findings (Robertson 1991, Robertson and North 1992a, Robertson and North 1992b, Robertson, North and Geggie 1992, Robertson and North 1993, Robertson, McMillan et al. 2002). Using patients with various levels of hemiparesis, they found that even minimal movements of the affected limbs in the affected space resulted in improved performance on neglect assessments, whilst passive movements did not.

In contrast, Ladavas et al (1997) replicated Robertson's study and found passive movements were effective (Làdavas et al. 1997). The difference in findings may have been due to the use of different neglect assessment measures (Robertson and Hawkins 1999). Robertson and colleagues tested the effect of passive movement with a cancellation test which requires simultaneous movement of the non-affected limb, whilst Ladavas et al (1997) used an object naming task that does not require right sided movement. According to Kinsbourne's activation theory (Kinsbourne 1987), the activation of the non-affected hemisphere through movement of the non-affected limb, may divert attention away from the affected side. Frassinetti and colleagues (2001) also assessed for the effect of passive movements. They found that larger movements from the shoulder using a

passive movement device was also successful in remediating signs of neglect even with simultaneous right arm movements. This suggests that passive movement can play a role in remediating neglect, but movements may need to be larger to overcome the attentional gradient (Frassinetti, Rossi and Ladavas 2001).

1.1.1 Mechanisms of Limb Activation Technique

Three overlapping theories have been proposed to explain the mechanism of limb activation in the remediation of neglect. Firstly, the remediating effect of moving the affected limb in the affected side of space has been theorised to work through Kinsbourne's hemispheric activation theory (Robertson and Hawkins 1999). Movement of the affected limb would activate the damaged hemisphere thus improving or balancing the attentional gradient or spatial representation across the two hemispheres whilst movement of the non-affected limb would further imbalance the attentional gradient and contribute to the neglect impairment. Secondly, Robertson and colleagues explained the effect of LAT using Rizzolatti's pre-motor theory (Robertson and Hawkins 1999) that suggests perception and action are so closely integrated that activity of one may plausibly lead to recruitment in the other. Thirdly, Halligan, Manning and Marshall (1991), suggests movement instead acts as a somatosensory cue, drawing attention to the left side of space. That the movement creates a cue for attention as opposed to the movement activating the affected hemisphere. This theory may also explain the beneficial effect of passive movement by some studies. All three of these theories emphasise the importance of movement of the affected limb in the affected space. It has been surmised that in isolation none of these theories are sufficient to explain the mechanism of limb activation and all three may play a role.

The beneficial effect of LAT has also been associated with the remediation of hemiparesis and motor function (Robertson, McMillan et al. 2002). Robertson, Hogg and McMillan (1998) have further elaborated Rizzolatti's pre-motor theory to explain this. They speculate that the higher levels of hemiparesis seen in patients with neglect is in fact due to the spatial impairment as opposed to a primary motor impairment. They believe movement of the affected limb feeds into a positive feedback loop whereby movement activates the affected hemisphere which in turn increases the attention of the limb and left side of space. This increased attention improves the chance for spontaneous movement and thus further activation of the affected hemisphere. The use of movement to increase attention may then improve the chance of movement which then balances the attentional problem and then results in further movement (Robertson, McMillan et al. 2002, Robertson, Hogg and McMillan 1998). The use of movement to aid recovery of a damaged

hemisphere post stroke is also in keeping with neuroplasticity, motor relearning principles and learnt non-use mechanisms used to explain motor recovery.

1.1.2 Evidence

Since the development of limb activation as an intervention for patients with post-stroke neglect, a number of systematic reviews have been conducted to evaluate its effectiveness (Lin 1996), (Pierce and Buxbaum 2002), (Klinke et al. 2015). The evidence to date of LAT effectiveness is however inconsistent, with different reviews drawing different conclusions (Azouvi, Jacquin-Courtois and Luauté et al. 2016). In one of the first systematic reviews of neglect-based interventions, Lin (1996), strongly recommended LAT as an intervention for remediating the neglect impairment. Subsequent reviews, however, have been unable to consistently confirm this finding due to methodological weaknesses.

The evidence of LAT effectiveness has also been focused on remediation of the neglect at an impairment level using pen and pencil neuropsychological tests and not on the generalisation to functional outcomes. The only review to have specifically evaluated the effect of interventions on function found there were insufficient high-quality studies investigating LAT to make a clinical recommendation (Luauté et al. 2006). In this study, functional outcomes were also wide ranging and included wheelchair navigation and reading & writing. Although these measures will be relevant to some patients, they are less likely to be the focus of most patients in the acute phase post-stroke. Therefore, despite the claim by Robertson, McMillan et al. (2002) that LAT remediates motor dysfunction, no review has systematically evaluated the evidence for this.

Further criticisms of the primary intervention studies have included the lack of specific intervention allocation based on neglect subtypes and the heterogeneity of neglect assessment measures (Lisa, Jughters and Kerckhofs 2013). It has been suggested that different subtypes of neglect require more specific intervention allocation (Pierce and Buxbaum 2002). Previous studies have failed to specifically assess for the type of neglect which in turn will reduce the evidence on intervention effectiveness if one technique is more suited to one subtype of neglect. For example, the mechanisms underpinning LAT may be suited to the recovery of motor neglect (Barrett and Muzaffar 2014). However, during its development, LAT was mostly tested on patients with visual neglect and therefore there is no systematic evidence to support or refute this claim. As neglect and motor are linked some researchers have suggested that integrating specific spatial cognitive techniques could result in greater motor-based functional recovery (Barrett and Muzaffar 2014).

1.3 Intervention Reporting

Despite the growing number of studies investigating the effectiveness of LAT, none of the literature so far has evaluated intervention reporting in any depth or detail. The quality of intervention reporting in intervention studies has been of growing concern in the research community in all areas of healthcare (Hoffmann, Erueti and Glasziou 2013). This is especially the case for complex interventions used by therapists in stroke rehabilitation, whereby, clarity about what an intervention entails has been referred to as the 'black box' of interventions (DeJong et al. 2005). With the recent development of intervention reporting guidelines (Hoffmann et al. 2014), Hoffmann et al. (2015) found even basic information such as the materials or procedures for intervention application were lacking in up to 88% of systematic reviews investigating stroke interventions. Using a sample of 200 physiotherapy intervention studies, Yamato et al. (2016), found that up to 45% of the randomised controlled trials failed to account for even half of the required information in the experimental group which was even worse for the control group.

Without adequate reporting of an intervention a reader will find it difficult to determine the external validity of an intervention and the applicability of the findings to their own clinical context (Alvarez, Cerritelli and Urrutia 2016). A clear and detailed intervention description is necessary to evaluate intervention effectiveness. Even the same techniques, if administered differently, may have a major influence on treatment effectiveness (Herbert and Bo 2005). An understanding of any intervention differences is important when comparing studies in systematic reviews and in developing future research (Lohse et al. 2018).

In a previous systematic review, Luauté et al. (2006) identified there to be no consistency in the techniques being classified as LAT. They recommended that future research should focus on determining the optimal paradigm of LAT. Clinical heterogeneity in intervention delivery can be a source of statistical heterogeneity in reviews (Herbert and Bo 2005). However, there appears to have been no consideration of this in subsequent reviews. It is not clear why some techniques have been included in some reviews and not in others. Neither is it clear why other techniques involving movement of the affected limb such as mirror therapy, robotics and functional training have not been classed as LAT. No subsequent reviews have even provided an explanation as to how they conceptualised what constitutes a limb activation technique. Providing a framework of an intervention is essential for defining the intervention and allowing the reader to interpret the results (Gough 2012). The clinical heterogeneity of LAT in the previous reviews therefore casts concerns as to the relevance of the results.

Without high quality intervention reporting it is also difficult for clinicians and researchers to physically replicate interventions. Glasziou and colleagues (2008) found that even when articles are deemed to be methodologically sound and demonstrate intervention effectiveness, the incomplete reporting of interventions was still a barrier to the uptake of research into practice (Glasziou et al. 2008). A lack of intervention reporting has therefore been identified as a limitation to the translation of evidence into practice by clinicians (Glasziou et al. 2008) and is a likely contributor to research waste (Chalmers and Glasziou 2009). Evaluating the quality and completeness of intervention reporting may, therefore, be an important step in the development of LAT as an evidence-based intervention.

1.4 Research Question

Are limb activation technique interventions reported in enough detail to support their replication into practice in the remediation of motor dysfunction in patients with post stroke neglect?

1.5 Purpose

The purpose of this study was to identify whether limb activation techniques, for remediating motor dysfunction in patients with left neglect in the first six months post stroke, are reported in enough detail to support their replication into practice.

1.6 Research Objectives

1. To systematically identify the primary intervention studies that have implemented limb activation techniques for the remediation of motor dysfunction in patients with post stroke neglect.
2. To critically appraise intervention reporting using the Template for Intervention Description and Replication (TIDieR) checklist and guide (Hoffmann et al. 2014).
3. To narratively describe study results in regard to the effectiveness of these techniques on motor function
4. To make recommendations on future reporting of limb activation techniques

2. Methodology

To answer the above research question and ultimately determine whether LAT studies have been reported in sufficient detail to support their replication into practice, a literature review, based on a systematic review design, was conducted. A systematic review 'uses a systematic, explicit and reproducible method for identifying, evaluating, and synthesising the existing body of completed and recorded work produced by researchers, scholars, and practitioners (Booth, Papaioannou and Sutton 2012 p1-2). The benefit of conducting secondary research is that primary studies can be collated and re-evaluated to produce stronger results (Centre for Reviews and Dissemination 2009). However, the details of what is involved in each step is not standardised and is often adapted to fit the purpose of the research question (Grant and Booth 2009).

Systematic reviews of intervention effectiveness are the most widely utilised form of systematic review used in healthcare. Systematic reviews of effectiveness that use meta-analysis to synthesise the results of high quality randomised controlled trials (RCTs), are the top of the research hierarchy (Moule 2014). However, the availability of high quality RCTs is often lacking in therapy related research and from the background literature review carried out for this research, detailed above, it is known that there are minimal randomised controlled trials in this research area. As a result, it is not uncommon for reviews to include different study designs and conduct a narrative synthesis of the results (Booth, Papaioannou and Sutton 2012).

Establishing intervention effectiveness, however, was not the main focus of this review. The purpose of this review was to identify whether the interventions in LAT studies had been reported in enough detail to support their replication into practice. To answer this research question the intervention description of each included study was appraised for depth and detail using the Template for Intervention Description and Replication (TIDieR) Checklist and Guide (Hoffman et al. 2014) To further enhance the clinical usability of these results, the intervention details were also extracted and narratively described using the TIDIER checklist.

There are many types of literature review, however, the systematic review approach is most aligned with the positivist paradigm. A paradigm is 'a cluster of beliefs about what the nature of reality is, what constitutes valid knowledge and how knowledge is acquired and explained (Wahyuni 2012). In the positivist paradigm the nature of reality is considered to be objective and separate from the researcher (Wahyuni 2012). This review considered the researcher to be separate from the review process and as such used standardised measures to appraise both the methodological quality and the completeness of intervention. The use of a standardised measure ensures that all the

included studies were treated equally and enables the results to be based on observable facts as opposed to subjective opinions.

In the positivist paradigm valid knowledge is based on measurable and observable facts which is most commonly aligned with the use of quantitative data, whereby numbers are used to understand and use knowledge (Wahyuni 2012). In this review the completeness of intervention reporting was quantified into a percentage score and the effectiveness of LAT on motor outcomes was established from the primary studies that used empirical research methods and quantitative data to answer their research question. To acquire knowledge the positivist paradigm is based on scientific enquiry (Wahyuni 2012). A systematic review adheres to this by aiming to be both systematic and explicit in the identification, selection and appraisal of studies.

3. METHOD

3.0 Introduction

This section will describe the systematic methods by which the literature and the data, pertinent to answering the research question, was identified, quality appraised and extracted. The subsequent sections include the search strategy (key word development and source selection), the study selection process (including the inclusion and exclusion criteria), quality assessment and data extraction and synthesis methods.

3.1 Search Strategy

To identify the primary intervention studies required to answer the research question a pragmatic search, based on a systematic approach, was used to develop the search strategy. As searching success is a skill that requires training and experience, a librarian was consulted to ensure both specificity and sensitivity (Moule 2014). This section details both the development of key words and the sources searched.

3.1.1 Key Words and Search Terms

To identify effective key words and search terms, the Centre for Reviews and Dissemination (CRD) (2009) recommends breaking the review question down into the PICO format and using those elements that are most clearly defined, to create search terms. For this research question the key aspects of the PICO format included;

Population; Post stroke neglect
Intervention; Limb activation technique
Comparison; Any intervention
Outcome; motor function / motor impairment

As the research question does not specifically relate to a comparison treatment, this feature was not considered for use in the development of key words. Furthermore, scoping searches that incorporated motor outcomes in the search strategy failed to identify potentially relevant studies. Failing to locate and synthesise all relevant literature would have reduced the confidence in the review findings, as they would not have been representative of the current evidence (Boland, Cherry and Dickson 2014).

The final key words: stroke, neglect and 'Limb activation technique' were then developed into a search strategy using Boolean operators and adapted for the differing capabilities of each source searched (Boland, Cherry and Dickson 2014). Where applicable, index terms, alternative spellings and truncations for each key word were searched for separately to increase the chance of identifying all relevant studies (Boland, Cherry and Dickson 2014) and to improve the accuracy of the search results (Boland, Cherry and Dickson 2014). Each search strategy can be viewed in Appendix 1.

3.1.2 Sources

The aim of this search strategy was to identify as many relevant studies pertinent to answering the research question as available. Conducting a thorough search to identify relevant studies is a key factor in minimizing bias in the review process (Centre for Reviews and Dissemination (2009). The sources were also chosen to ensure the identification of both published and unpublished literature. Published literature is deemed to provide the most reliable research as it has undergone many levels of peer review. However, it has been demonstrated that articles with more positive results are more likely to be published and published in English (Boland, Cherry and Dickson 2014). The inclusion of only published studies has been found to lead to an exaggeration of intervention effect and bias in review findings (Booth, Papaioannou and Sutton 2012). It is therefore advised to search for non-published or grey literature. Grey literature includes non-published studies as well as abstracts and conference material. This literature, however, is not subjected to the same level of peer review as published literature and is, therefore, at a high risk of bias. In addition, sources with access to non-English studies were also identified to limit language bias.

A total of twelve sources were selected including; larger academic databases with a broad medical scope such as: MEDLINE, AMED, CINAHL and ProQuest and ProQuest Dissertations; smaller more profession specific databases for physiotherapists (PEDro), occupational therapists (OT Seeker) and psychologists (PsycINFO), all of which are involved in the rehabilitation of this patient group and therefore may have conducted research in this specialist field of healthcare; relevant online databases such as CENTRAL and TRIP; internet search engines such as Open Grey and Google Scholar and finally the reference lists of all included studies and systematic reviews pertinent to the topic area were additionally screened for potential studies. No further references were identified.

All searches were conducted in March 2017 and re-run in November 2017. Although all search terms were in English, no search limits were applied for language, full text, dates or types of publication for the search strategy.

3.2 Study Selection

3.2.1 Inclusion and exclusion criteria

Prior to conducting the search an inclusion and exclusion criteria was developed to aid in the retrieval of significant studies. The inclusion criteria specifies the nature and boundaries of the evidence that the review will consider (Gough 2012). To ensure alignment to the research question, the inclusion and exclusion criteria were structured using the population, intervention, outcomes and study design features of the PICOS framework that had informed the development of both the research question and search strategy (Booth, Papaioannou and Sutton 2012).

Population: This study included patients diagnosed with left neglect following right sided hemispheric stroke, treated as an inpatient within the first six months of onset.

- Diagnosis of stroke in clinical practice is generally achieved using radiographic investigations including; CT or MRI scans. However, as the gold standard intervention for stroke is thrombolysis the scans are administered within four hours of onset (RCP Guidelines 2016). In this acute time frame the location of infarcts does not always show. Instead, clinical diagnosis based on the observations of clinical signs and symptoms were accepted.
- Neglect can occur after a number of brain related injuries that include stroke, traumatic brain injury and tumours. The highest incidence of neglect occurs following right sided lesions, therefore, in keeping with other research in this area, this study included only left sided neglect patients following right hemispheric strokes. Although excluding patients with right neglect may give a false representation of neglect after stroke, the neuroanatomy is different in these patients, and limb activation techniques have been developed on patients with right sided lesions (Robertson and Marshall 1993).
- The diagnosis of neglect can be difficult to observe in the acute stages due to the complex mix of impairments commonly seen at this time. Therefore, a diagnosis of neglect was accepted if a recognised objective measure was used. This can include traditional pen and pencil tests (i.e. line bisection, cancellation tests), or the more behavioural neglect specific measures such as the Catherine Bergego Scale (CBS). It has been speculated that distinct types of neglect would benefit from individualised interventions. However, due to the lack of specific research in this area and the lack of consistency in the use of terminology to describe and diagnose neglect, no limitation was placed on the type of neglect population for this study.

Intervention: This study included studies that had investigated the use of Limb Activation Techniques or the derivative spatio-motor cueing

- There is no specific classification of what techniques constitute as 'limb activation techniques'. There is a consensus that limb activation involves either active or passive movement of the limb and previous reviews have included studies using constraint induced movement therapy (CIMT), active movements, transcutaneous electrical stimulation (TENS) and functional electrical stimulation (FES). Studies identified during the search process using active or passive movement techniques were, therefore, considered for inclusion in this review. TENS was excluded as it does not result in movement and is not therefore in keeping with the mechanisms underpinning limb activation techniques.

Outcome: This study included any study that measured for the effect of limb activation techniques on motor dysfunction. For the purpose of this study motor dysfunction was classified as motor impairment or functional tasks involving gross movement patterns. Functional activities that are concerned with cognitive skill such as wheelchair navigation, reading or writing were excluded.

- Examples of outcome measures at an impairment or activities level identified in previous systematic reviews include: Barthel Index (BI), Functional Independence Measure (FIM), Catherine Bergego Scale (CBS). Any activity used to assess before and after affects that are related to motor function including; Bed mobility, Upper limb (Frenchay Arm Test), Sitting and Posture (Postural assessment scale for Stroke (PASS), Balance, Transfers, mobility (Rivermead Mobility Index (RMI), gait. (Luauté et al. 2006) (Klinke et al. 2015)

Study Design: This study included all quantitative study designs that are experimental (Randomised Controlled Trials and Non-Randomised Controlled Trials) or observational designs (i.e case studies). Surveys, qualitative study designs, non-experimental designs and incomplete works were excluded.

- Randomised Controlled Trials (RCT's) are considered to be the gold standard for investigating intervention effectiveness (Booth, Papaioannou and Sutton 2012). This study design is often considered to be the most robust. Previous reviews in this topic area suggest that RCTs are few in number and alternative experimental designs are more frequently used (Luauté et al. 2006). Although the robustness of alternative research designs, for establishing intervention effectiveness, is questioned, RCT's are also more difficult to undertake in the healthcare environment (Centre for Reviews and Dissemination 2009) and can still be poorly designed and of low methodological quality. The inclusion of different study designs may offer new insights into intervention application that may be of more practical relevance to

clinicians and systematic reviews should not limit themselves to including only RCTS (Centre for Reviews and Dissemination 2009).

3.2.2 Study Selection Process

Following completion of the database searches, the titles and abstracts of all identified studies were exported, or imported, into the data management system RefWorks. The use of bibliographic software is encouraged by the Centre for Reviews and Dissemination (2009) as a way of efficiently managing sources and aiding the documentation of the search results. Due to the large number of studies identified by Google Scholar and the difficulty in exporting results from open grey, the studies from these sources were screened, and then only the potentially relevant studies were imported into RefWorks. In addition, only the first three-hundred references found by Google Scholar were screened (Haddaway et al. 2015). To aid in the transparency and replicability of the study selection process a PRISMA diagram was completed and can be seen in Figure 1 (page 33).

Stage 1: Duplicates were removed using the RefWorks function.

Stage 2: Titles and abstracts were screened by the main author and studies were excluded if they did not obviously meet the inclusion criteria (Booth, Papaioannou and Sutton 2012) .

Stage 3: To reduce the risk of bias during the study selection process, the full text of the remaining papers were reviewed against the inclusion and exclusion criteria by two independent reviewers. The use of two independent reviewers improves the identification of eligible studies (Centre for Reviews and Dissemination 2009) and was piloted in order to ensure familiarity and agreement. Any disparities between the two reviewers were then resolved through discussion and final decisions recorded in a summary table which can be seen in Appendix 2.

3.3 Quality assessment

The quality assessment of studies is a key feature of the systematic review methodology (Booth, Papaioannou and Sutton 2012). A modified version of the McMasters quantitative critical appraisal tool (Law et al. 1998) was used to inform the quality assessment process of the studies included within this review. The use of an established critical appraisal tool, to guide the critical appraisal process, is often advocated (Centre for Reviews and Dissemination 2009). This ensures studies are appraised in a systematic and standardised way which will improve the credibility of the review findings (Boland, Cherry and Dickson 2014). There is, however, no gold standard critical

appraisal tool for allied health professionals (Glenny 2005). The McMasters tool (Law et al. 1998) was chosen because a mixed selection of quantitative studies was expected, and this tool was designed for use with any quantitative design. Previous reviews have used the McMasters critical appraisal tool (Law et al. 1998) to inform the quality assessment process and have reported it to have good interrater reliability (Wilson and Bialocerkowski 2015).

The McMasters approach to appraising the quality of studies was piloted on one of the studies found in the search. This pilot enabled the researchers to establish the usability of the appraisal framework and to make sure that important study features were captured (Boland, Cherry and Dickson 2014). One key issue was that an overall quality score for each article was not provided, subsequently this made it difficult for synthesis and comparison of studies within the review. However, other authors that have used this approach have adapted the McMasters criteria to include an overall summary score (Jarrett, Orlando and Grimmer-Somers 2012). Others have added in additional questions (Lee et al. 2014) or further modified the tool by incorporating other quality assessment criterion (Schabrun and Hillier 2009). Taking the lead from other authors the McMasters tool was adapted to ensure its relevance and suitability for this study and is briefly discussed below.

Seventeen questions were finally identified. One question from the original form was removed, 'was intervention described in detail', as this would be assessed in more detail using the TIDieR tool (Hoffmann et al. 2014). Three questions were then added to improve clarity of randomisation and blinding, as studies without these features have been shown to exaggerate their odds ratios and overestimate treatment effects (Bandolier 2001). Each study was independently appraised by two reviewers (the author and Anna Brown) (Moule 2014). The use of two reviewers reduces the risk of systematic errors in how the studies are assessed and therefore improves the methodological rigor (Booth, Papaioannou and Sutton 2012). Each item was answered with a yes, no, not reported or not applicable response in keeping with the original McMaster format and to provide an overall quality score, each yes answer was allocated one point. Due to the different study designs, different items were occasionally classed as not applicable, therefore overall scores were converted into percentages (Lekkas et al. 2007). All disagreements were discussed, and agreement was achieved without the need of a third party. The completed McMaster forms have been presented in Appendix 3 (Page 109).

3.4 Data Extraction

This section seeks to detail the methods used to extract and synthesise the data pertinent to answering the research question. This section is separated into two sections; study & participant characteristics and intervention effectiveness & appraisal of intervention reporting using the Template for Intervention Description and Replication (TIDieR) Checklist (Hoffman et al. 2015).

3.4.1 Study and Participant Characteristics and Intervention Effectiveness

A data extraction form was developed using an excel spreadsheet prior to starting the data extraction process to ensure studies were treated consistently (Booth, Papaioannou and Sutton 2012). For efficiency, this data was extracted at the same time as the quality assessment by one reviewer (Booth, Papaioannou and Sutton 2012). Descriptive data pertinent to participant and study characteristics and study results for each motor function outcome measure was extracted and are presented in Table 1 (page 35-38). The extracted data was synthesised into tables and narratively described.

3.4.2 TIDieR Checklist

The Template for Intervention Description and Replication (TIDieR) Checklist and Guide (Hoffman et al. 2014) was used to describe the completeness of intervention reporting of LAT. The TIDieR checklist is an extension of the CONSORT Statement and was developed to facilitate better reporting of interventions in research studies (Hoffman et al. 2014). It was developed in collaboration by the CONSORT steering group, expert consensus from a range of health disciplines, and experts in the development of trial, methodology and/or reporting guidelines using a two-round modified Delphi consensus survey method and face to face panel meetings (Hoffmann et al. 2014). The tool was designed for use with any study design and guidance has been provided for interpretation of reporting quality of each item. The checklist has been used to evaluate the completeness of intervention reporting in a number of reviews and has been reported to have a good inter-rater reliability by allocating a score of 1 to those items fully described and 0 to those lacking sufficient detail for replication (Yamato et al. 2016). The twelve TIDieR items include:

Item 1. Brief name: Provide the name or a phrase that describes the intervention

Item 2. Why: Describe any rationale, theory, or goal of the elements essential to the intervention.

Item 3. What (materials): Describe any physical or informational materials used in the intervention, including those provided to participants or used in intervention delivery or in the training of intervention providers.

Item 4. What (procedures): Describe each of the procedures, activities, and/or processes used in the intervention, including any enabling or supporting activities.

Item 5. Who provided: For each category of intervention provider describe their expertise, background and any specific training given.

Item 7. Where: Describe the type of location where the intervention occurred, including any necessary infrastructure or relevant features

Item 8. When and how much: Describe the number of times the intervention was delivered and over what period of time including the number of sessions, their schedule, and their duration, intensity or dose

Item 9. Tailoring: If the intervention was planned to be personalised, titrated or adapted, then describe, what, why, when and how

Item 10. Modifications: If the intervention was modified during the course of the study, describe the changes (what, why, when and how)

Item 11. How well (planned): If intervention adherence or fidelity was assessed, describe how and by whom, and if any strategies were used to maintain or improve fidelity, describe them

Item 12. How well (actual): If intervention adherence of fidelity was assessed, describe the extent to which the intervention was delivered as planned (Hoffmann et al. 2014)

Two reviewers (the author and Anna Brown) separately extracted the intervention protocols and appraised each study for the completeness of intervention reporting to reduce the risk of bias (Moule 2014). The data extracted was then compared to ensure consistency in interpretation of the items in line with the supplied guidance. The tool was initially piloted for usability by the two separate reviewers on one of the included studies chosen at random. The initial piloting of the tool revealed subjectivity in the interpretation of completeness. Therefore, items were classed as yes, partial or not reported and all items achieving a yes were allocated 1 point in keeping with previous reviews and those with partial information were allocated a score of 0.5 in order to capture more accurately the level of detail reported. The final score was converted into a percentage. The intervention details can be seen in Appendix 5 (Page 138).

4. Results

4.0 Introduction

This results section will be separated into five sections:

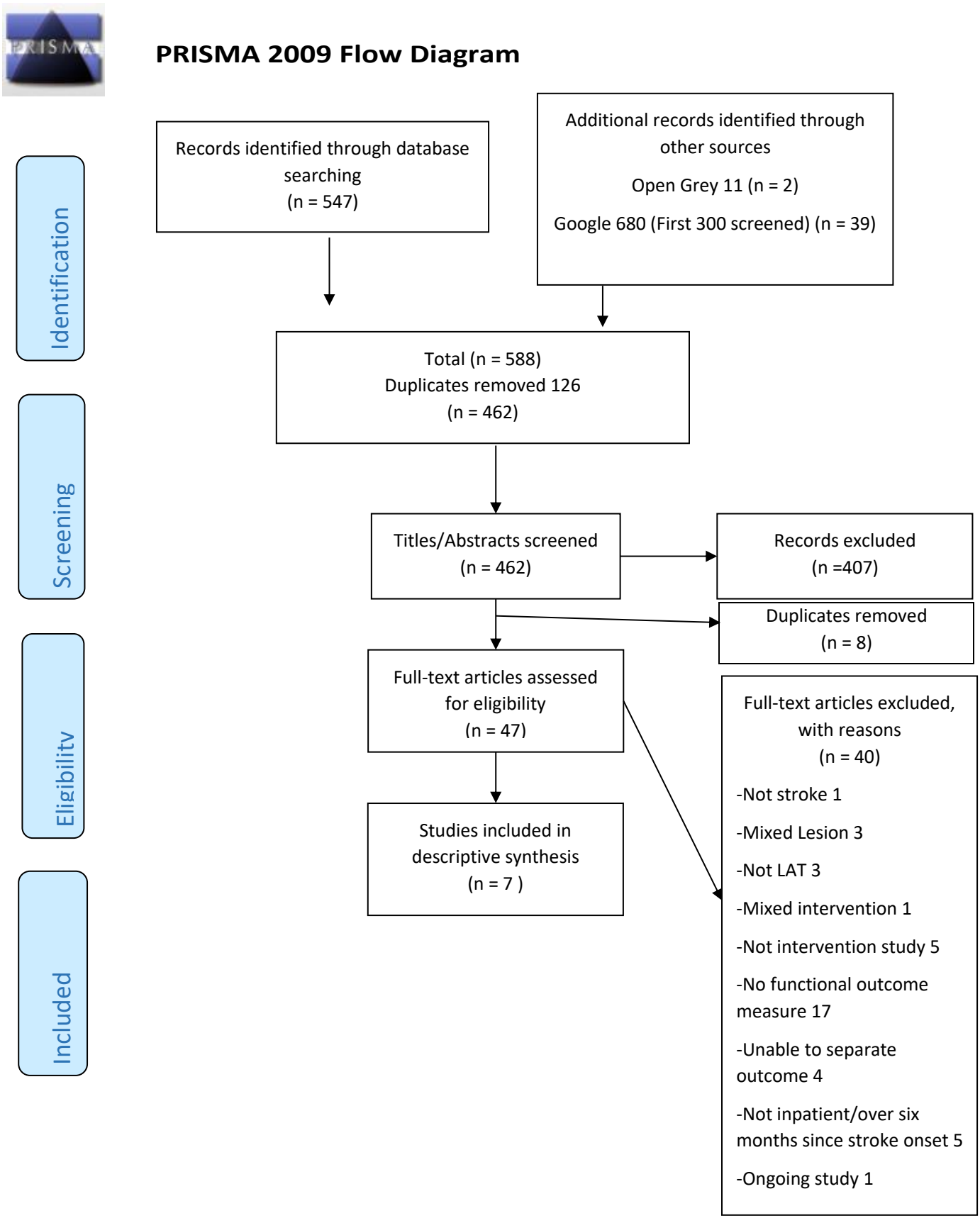
1. Results of the summary selection process
2. Study and participant characteristics
3. Methodological quality assessment
4. Intervention effectiveness
5. Critical appraisal of intervention reporting

The results of the data extraction process will be narratively described with the support of tables. In the tables, studies will be listed by the intervention technique (Limb Alert Device, Active Assisted Exercises, Functional Electrical Stimulation and Mixed Programme) and then date of publication. Each intervention category has been separated into different colours.

4.1 Results of study selection process

The study selection process has been presented using the PRISMA diagram (Fig. 1, Page 33). A total of five hundred and eighty-eight data sources were identified from the initial search strategy, and one hundred and twenty-six duplicates were removed. Initial screening of titles and abstracts excluded a further four hundred and seven studies and highlighted an additional eight duplicates. The full text, of the remaining forty-seven studies, was assessed against the inclusion and exclusion criteria. The majority of studies were excluded for not delivering an intervention programme or because no motor outcome measures were used. Seven studies were ultimately identified for inclusion within this review and are detailed in Table 1 (Page 35-38). Further details of inclusion and exclusion criteria and decisions can be found in Appendix 2 (Page 101).

Figure 1 PRISMA Diagram



4.2 Study and Participant Characteristics

To provide the reader with an overview of the seven included studies, a summary of the study and participant characteristics has been presented in Table 1 (page 35-38). A narrative description of these characteristics has been presented under the following headings; study design, population, intervention, and outcome measures.

Table 1. Study and Participant Characteristics

Authors, Primary	Study Purpose	Study Design	Time since stroke onset	Level of baseline limb movement	Neglect Type (Assessment tool)	Sample size	Location	Control	Intervention	Duration	Functional outcome measures	Results Summary	
												Post Intervention	Follow up
Fong et al. (2013)	To test whether contralesional sensory cueing and limb activation was feasible and would promote patients' awareness over their contralesional field, reduce unilateral neglect, and improve hemiplegic arm functions when compared with those receiving sham treatments	Multicentre, randomized, sham-controlled pilot investigation with blinded outcome assessment	Mean 24.3+18.5 days	Severe to moderate hemiplegia (FTHUE)	Unilateral neglect (BIT)	Intervention Arm N = 19 Control N = 16	Hong Kong	Sham device + conventional rehab	Limb Alert Device.	3 weeks	Fugl-Meyer Assessment (FMA)- Upper Limb subscore - Hand subscore (improved by x2 in comp to sham FTHUE FIM motor score	Improvement p = 0.05 Improvement p = 0.05 Improvement p = 0.01 Improvement p = 0.01	6weeks Improvement p = 0.05 Improvement p = 0.05 Improvement p = 0.01 Improvement p = 0.01
O'Neill and McMillan (2004)	To trial LAT in an acute environment (more intensive, shorter duration). Examine LAT on hemiplegia. Hypothesis: increasing attention may improve rehab outcomes generally	AB design. (A 2 weeks B 4 weeks)	A phase started 67 days post onset. B phase started 81 days post onset	Described as minimal movement of affected arm	Visual neglect (visual object and spatial perception battery, BIT)	1	University Hospital NHS Trust Glasgow	Not applicable	Limb Alert Device	4 weeks	Motricity Index Total Score Shoulder Elbow Pinch Barthel Index (BI)	Significant Improvement p = 0.05 No significant improvement Improvement	4 week Improvement No significant Improvement --------
Maddicks, Marzillier and Parker (2003)	This study replicated and extended the work of Robertson et al. (1998) to evaluate Limb Activation Therapy in all three spatial domains at a more acute stage of recovery and determine if this would lead to improvements in neglect behaviour in daily life	ABABA design. A1 5days B1 5 days A2 5 days B2 5 days A3 5 days	A1 started 56 days post onset B1 started 61days post onset	Minimal movement of upper limb good recovery was noted of lower limb	Unilateral neglect (BIT)	1	United Kingdom	N/A	Limb Alert Device	2x 2weeks	CBS Ansognsoia	No Change No Change	-------- --------

Authors, Primary	Study Purpose	Study Design	Time since stroke onset	Level of baseline limb movement	Neglect Type (Assessment tool)	Sample size	Location	Control	Intervention	Duration	Functional outcome measures	Results Summary	
												Post Intervention	Follow up
Bailey, Riddoch and Crome (2002)	The purpose of this study was to evaluate the use of 2 approaches to reduce neglect in elderly patients with stroke and severe left neglect. The aim was not to compare these two approaches, but to separately evaluate the efficacy of each approach in the clinical setting	A-B-A treatment-withdrawal single-subject experimental design. Subject 6 A1 4 weeks B1 3 weeks 10 sessions A2 3weeks Subject 7 A1 2 weeks B1 3 weeks 7 sessions. A2 undetermined time period only 2 data sets recorded	Subject 6: Started A1 20 days post onset and B1 48 days post onset Subject 7: Started A1 13 days post onset and B1 26 days post onset	Subject 6 moderate hemiplegia, moderate active control of left upper and lower limbs Subject 7 mild hemiplegia, mobile with support	Unilateral Visual Neglect (Star Cancellation Test, the Line Bisection Test, and the Baking Tray Task)	7 Single subjects in total. 2 Subjects undertook LAT Subject 6 and Subject 7	United Kingdom	Visual scanning and cueing (N=5)	Active Assisted Exercises - Voluntary left upper limb movements during board games and functional tasks	3 weeks	Barthel Index (BI) Rivermead Mobility Index (RMI)	All demonstrated improvement in scores but only Subject 6 is reported to have demonstrated coincident improvement with the BI	----- -----
Samuel et al. (2000)	To assess the efficacy of visuo-spatial-motor cueing, particularly the generalisation to daily life activities in patients with severe neglect who had failed to improve with visual scanning training	ABAB withdrawal design. A1 14 days A1 14days A2 14 days B2 14 days	Started A1 112days	Severe hemiplegia, movement limited to elementary shoulder movements	Unilateral neglect (Line cancellation, CBS)	2 cases. Only one included due to time since stroke	France	Visual scanning conducted by all three professional group sessions	Active Assisted Exercises - Limb movements were encouraged if participant failed to carry out tasks during conventional PT, OT and SALT rehabilitation sessions	2 weeks (2 intervention phases)	CBS Anosognosia Therapist cueing Spontaneous Limb Movements	Improvement (24/30 to 12/30) Improvement (19/30 to 8/30) B1 5.4 B2 5.2 B1 1.2 B1 1.3	4 weeks Worsening (14/30) Improvement (4/30) 1.1

Authors, Primary	Study Purpose	Study Design	Time since stroke onset	Level of baseline limb movement	Neglect Type (Assessment tool)	Sample size	Location	Control	Intervention	Duration	Functional outcome measures	Results Summary	
												Post Intervention	Follow up
Harding and Riddoch (2009)	The aim was to report the long term impact of FES on neglect	Multiple baseline across subject approach, with an A-B-A treatment-withdrawal single subject experimental design A1 4 weeks B1 Alternative intervention to opposite limb 3weeks. B2 4weeks LAT. A2 baseline	Started A1 3 days post onset	VL Medical Research Council Motor Assessment Scale (Ref) between 4-5/5 BB normal power and function of limbs KD 3/5 Upper and lower limbs MH 0-1/5 Dense spastic hemiplegia 0/5 - 5/5 (0-1/5, 3/5, 4-5/5, 5/5)	Unilateral visual neglect (BIT)	4 cases	Birmingham	B1 FES right upper limb	Functional Electrical Stimulation	4 weeks	Barthel Index Rivermead Motor Assessment: Gross Function Trunk and Leg Arm	3 of the 4 patients showed significant improvement ($p<0.001$). 1 participant showed no improvement 2 of the 4 participants showed significant benefits ($p = 0.05$) 2 of the 4 participants showed significant improvement ($p = 0.05$) 1 of the 4 participants showed significant improvement ($p = 0.05$) 1 participant showed no change in all measures	Ceiling effect for 3 participants No change Ceiling effect for the three participants Ceiling effect for 2 participants, No change for 2 participants

Authors, Primary	Study Purpose	Study Design	Time since stroke onset	Level of baseline limb movement	Neglect Type (Assessment tool)	Sample size	Location	Control	Intervention	Duration	Functional outcome measures	Results Summary	
												Post Intervention	Follow up
Luukkainen-Markkula et al. (2009)	To determine if arm activation alone is sufficient to produce a long lasting amelioration of neglect and improves the motor function of the affected arm comparable to the effect obtained with traditional visual or other simultaneous functional training	RCT	m sd 81.0 + 64.6. Range of 18-180 days.	Described as slight (n=1), moderate (n=2, severe (n=3)	Hemi spatial neglect (BIT, CBS)	12 patients in total. 6 patients in each treatment arm	Finland	visual scanning	Mixed Programme n = 6. 1 patient received CIMT. 5 patients received combination of passive movements, electrical stimulation glove and passive stretches	3weeks	FIM Modified motor assessment Scale (MMAS) CBS Wolf motor function test	Statistically significant improvement (p = 0.031) Improvement Statistically significant improvement (p = 0.002) in text but not table Improvement	6months ----- Improvement Improvement Improvement

4.2.1 Study Design Characteristics

The purpose of all seven studies was to investigate the effect of LAT on neglect, whilst three of the studies also aimed to investigate the effectiveness of LAT on hemiplegia (Fong et al. 2013, O'Neill and McMillan 2004, Luukkainen-Markkula et al. 2009) and two on functional ability (Maddicks, Marzillier and Parker 2003, Samuel et al. 2000). Two of the included studies were randomised controlled trials (RCTs) (Fong et al. 2013 and Luukkainen-Markkula et al. 2009), whilst five were single case experimental designs (SCED) (Bailey, Riddoch and Crome 2002, O'Neill and McMillan 2004, Maddicks, Marzillier and Parker 2003, Samuel et al. 2000). Each SCED differed by design with AB, ABA, ABAB, ABABA to ABBA alternatives. Each with different lengths of baseline (one week to four weeks), length of intervention (five days to two weeks) and the number of intervention phases (one or two). The intervention period of both the RCTs was three weeks. The sample size ranged from one to four participants in the SCED's and six to nineteen participants in the treatment arm of the RCTs. Time from stroke onset to recruitment ranged from three days to three months. All the studies were based in a hospital setting, four of which were in the UK, and one each in Finland, Hong Kong and France.

4.2.2 Participant Characteristics

A total of thirty-four subjects were included within this review. All participants were adults, diagnosed as having right sided stroke with a left sided neglect. The extent of participants' hemiplegia at recruitment, in all seven studies, was described as mild, moderate or severe. The methods for establishing the severity of hemiplegia was standardised by only two studies. Fong et al. (2013) utilised the Functional Test for the Hemiplegic Upper Extremity (FTHUE) and Harding and Riddoch (2009) used the Medical Research Council Motor Scale (MRCMS). The majority of subjects were described as having severe or moderate hemiparesis.

4.2.3 Intervention

Of the seven articles included within this review all were labelled as Limb Activation Technique studies however, four different treatment programmes were identified. Three studies investigated the use of a limb alert device, in which a removable device is worn on the ankle or wrist to cue a participant to move the respective limb (Fong et al. 2013, O'Neill and McMillan 2004, Maddicks, Marzillier and Parker 2003). Two studies used therapist mediated active assisted limb movements as the treatment session (Bailey, Riddoch and Crome 2002) or to support the treatment session (Samuel et al. 2000). One study investigated the use of Functional Electrical Stimulation (FES)

on the affected sides wrist extensors, (Harding and Riddoch 2009) and the final study used a mixture of interventions that consisted of constraint induced movement therapy (CIMT), an FES glove and a range of active assisted or passive exercises (Luukkainen-Markkula et al 2009).

4.2.4 Outcome Measures

A total of ten different outcome measures were used to assess motor dysfunction across the seven included studies. There were four upper limb outcome measures: two at an impairment level Fugl-Meyer Assessment and the Motricity Index and one at a functional level: The Functional Test for the Hemiplegic Upper Extremity (FTHUE) and a combined measure: The Wolf Motor Function Test. There were three measures of general physical ability: The Modified Motor Assessment Scale, the Functional Independence Measure and the Rivermead Motor Assessment. One measure of activities of daily living: the Barthel Index. One measure of neglect in activities of daily living: the Catherine Bergego Scale and one measure of balance and gait; the Rivermead Mobilty Index. The BI, FIM and CBS were the only measures used in more than one study.

4.3 Methodological Quality Assessment

An overview of study quality was established using the McMasters critical appraisal tool (Law et al. 1998) and is presented in Table 2 (page 41-42). The table includes the key questions used to appraise the studies in terms of study purpose, literature review, study design, study sample, outcomes, intervention, results and conclusion. The justification and methods for the application of the McMasters tool (Law et al. 1998) were documented in the methods section.

Table 2. McMasters Quality assessment Summary Table

Authors, Primary	Purpose	Literature	Design		Sample			Outcomes		Intervention			Results				Conclusions	% no.
	Was the purpose stated clearly?	Was relevant background literature reviewed?	Was the study design appropriate?	Was randomisation used?	Sample described in detail?	Was the sample justified?	Were ethics and consent obtained?	Were the outcome measures valid and reliable?	Blinding during outcome assessment?	Blinding to intervention?	Was contamination avoided?	Was cointervention avoided?	Were results reported in terms of statistical significance?	Were the analysis methods appropriate?	Was clinical importance reported?	Were drop outs reported	Were the conclusions appropriate?	
Fong et al. (2013)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	NR	No	Yes	Yes	NR	Yes	Yes	76%
O'Neill and McMillan (2004)	Yes	Yes	Yes	Yes	No	NR	yes	NR	yes	No	N/A	No	Yes	Yes	Yes	N/A	Yes	66%
Maddicks, Marzillier and Parker (2003)	Yes	Yes	Yes	No	Yes	NR	NR	Yes	NR	NR	N/A	No	N/A	Yes	NR	N/A	Yes	50%
Bailey, Riddoch and Crome (2002)	yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	N/A	No	N/A	Yes	Yes	Yes	Yes	80%
Samuel et al. (2000)	Yes	Yes	Yes	No	Yes	N/A	No	NR	No	No	N/A	No	N/A	Yes	Yes	N/A	Yes	54%
Authors, Primary	Purpose	Literature	Design		Sample			Outcomes		Intervention			Results				Conclusions	% no.

	Was the purpose stated clearly?	Was relevant background literature reviewed?	Was the study design appropriate?	Was randomisation used?	Sample described in detail?	Was the sample justified?	Were ethics and consent obtained?	Were the outcome measures valid and reliable?	Blinding during outcome assessment?	Blinding to intervention?	Was contamination avoided?	Was cointervention avoided?	Were results reported in terms of statistical significance?	Were the analysis methods appropriate?	Was clinical importance reported?	Were drop outs reported	Were the conclusions appropriate?	
Harding and Riddoch (2009)	Yes	Yes	Yes	No	Yes	No	No	NR	No	No	N/A	No	Yes	No	Yes	N/A	No	50%
Luukkainen-Markkula et al. (2009)	Yes	Yes	Yes	Yes	Yes	No	Yes	NR	NR	NR	NR	No	Yes	No	NR	NR	No	41%

The quality assessment revealed a range in quality scores from the lowest at 41% (Luukkainen-Markkula et al. 2009) to the highest of 80% (Bailey, Riddoch and Crome 2002). All seven of the included studies reported the study purpose, provided background literature and used an appropriate study design to investigate intervention effectiveness (Law et al. 1998). Two of the studies used an RCT and both studies report using simple methods of sequence generation, which is deemed to be acceptable for studies with a small sample sizes (Higgins and Green 2011). The remaining five studies used a SCED, in which the individual acts as their own control. There is no randomisation of participants to intervention group, however the randomisation of a patient to the length of baseline period has been recommended as a way of reducing threats to internal validity (Kratochwill et al. 2013) but only Bailey, Riddoch and Crome (2002) incorporated this in their study design.

The study sample was adequately described in six of the seven studies, but the sample size was only justified in two studies (Fong et al. 2013, Bailey, Riddoch and Crome 2002). Of the two RCTs, only Fong et al. (2013) provided a power calculation, however, due to drop outs this number was not achieved. Luukkainen-Markkula et al. (2009) did not justify the sample size and included only six participants per treatment arm which is too few to reliably be used in an RCT (Bandolier 2001). The lack of power achieved by either RCT means that selection bias cannot be ruled out.

The blinding of the intervention to the outcome assessor is required to reduce the chance of detection bias. This was reported in only three of the studies (Fong et al 2013, O'Neill and McMillan 2004 and Bailey, Riddoch and Crome 2002). Five of the studies reported it is not possible to blind the therapist to the treatment, whilst two of the studies made no reference to this. None of the studies were able to prevent intervention cointervention as all provided additional conventional therapy. Samuel et al. (2000) and Luukkainen-Markkula et al. (2009) also implemented other neglect-based interventions which could further influence the results and suggests the potential of performance bias.

Statistical tests were used in four of the studies (Fong et al 2013, O'Neill and McMillan 2004, Harding and Riddoch 2009 and Luukkainen-Markkula et al. 2009). Two of these studies Luukkainen-Markkula et al. (2009) and Harding and Riddoch (2009) were deemed to have used inappropriate data analysis. SCEDs require a minimum of 3-5 measurements to justify the use of statistical analysis (Smith 2012). Harding and Riddoch (2009) used only one measure to perform statistical analysis for the motor outcome measures. Luukkainen-Markkula et al. (2009) had only six participants in the

intervention arm. This is a small number for an RCT and may have been more suited to an alternative study design. The use of the statistical tests were not justified and diminishes the appropriateness of the number of statistical tests used to analyse the study results and therefore limits the degree of confidence in the study conclusions.

4.3 Intervention Effectiveness

The second objective of this study was to narratively describe study results in regard to the effectiveness of these techniques on motor function. Table 1 (page 35-38) demonstrates that six of the seven studies identified an improvement post intervention using a motor outcome measure and only one study failed to demonstrate any intervention effect (Maddicks, Marzillier and Parker 2003). The heterogeneity of outcome measures and intervention technique limits the amalgamation of results and they have therefore been presented as individual studies.

Fong et al. (2013) conducted an RCT (n=19) over three weeks and used the Fugl-Meyer upper limb and hand subscores, the FIM and the FTHUE to determine the intervention effect of a LAD. In order to assess the outcome, within group differences were measured for immediately post intervention and at six weeks follow up. The intervention group demonstrated a statistically significant improvement in the Fugel Meyer hand and upper limb scores ($p < 0.05$) and the FIM and FTHUE ($p < 0.01$) post intervention but these improvements were not found to be statistically significant when compared to changes in the control group

O'Neill and McMillan (2004) used an AB SCED of one participant over a four-week intervention phase. They measured for the effect of a LAD using the Barthel Index (BI) and the Motricity Index (MI). A thirty-point improvement was reported in the BI and an improvement of twenty-eight points in the MI post intervention which was found to be statistically significant in the MI ($p < 0.05$) at the four weeks follow up.

Baily, Riddoch and Crome (2002) used an ABA SECD with a three-week intervention phase for two subjects. The outcome measures used to measure intervention effect included the BI and the Rivermead Mobility Index (RMI). Small improvements in the scores were presented for both participants using the BI and RMI. However, the study stated one participant, with an increased score of fifteen points in the BI, could be considered as demonstrating a coincidental improvement. No statistical analysis was conducted, and no follow up measures were taken.

Samuel et al. (2000) used an ABAB SCED with the intervention phases lasting two weeks. This study measured for intervention effectiveness of a limb movement intervention using the CBS. The participant demonstrated an improvement of eleven points in the CBS post intervention which maintained at the 4 weeks follow up.

Harding and Riddoch (2009) used an ABA SCED design to investigate the effect of functional electrical stimulation on four cases. The outcome measures used in this study included the BI and Rivermead Assessment (RI). One participant demonstrated no change in any of the outcome measures. Three of the participants demonstrated an improvement in the BI ranging between thirty to sixty-five points post intervention ($p < 0.05$) but no change at follow up due to ceiling effect. The same three participants also demonstrated an improvement using the Rivermead Assessment of gross function (change in score ranged from three to seven points) and the arm function (two to seven). Due to a ceiling effect at the baseline measurement, only two of these participants demonstrated an improvement in the trunk and leg scores. No change in scores was seen by any participant at follow up. Again, statistical significance was reported for some of these measures.

Luukkainen-Markkula et al. (2009) conducted an RCT to investigate the use of limb activation (n=6) compared to visual scanning (n=6) over three weeks. The outcome measures used in this study were the MMAS, CBS and WMFT and FIM. Using a combination of techniques (CIMT, ES and exercises), they found improvements post intervention and at six-month follow up for MMAS, CBS and WMFT. FIM also improved post intervention but was not reassessed at follow up. The improvement in the CBS and FIM were also assessed to be statistically significant ($p < 0.002$ and $p < 0.031$).

Maddicks, Marzillier and Parker (2003) conducted an ABABA SCED for 1 participant, in which they received two treatment phases of five days each. This study used the Catherine Bergego Scale to measure changes in patient's ability to perform activities of daily living. They found no intervention affect with the CBS which measures the level of neglect during functional tasks but does not measure for improvements in motor ability to conduct each task.

4.5 Completeness of Intervention Reporting (TIDieR Checklist)

The primary aim of this review was to appraise the completeness of intervention reporting. The intervention of each study was assessed for completeness using the TIDiER checklist, results can be seen in Table 3 (Page 47). The purpose and justification of the tool is given in the methods. No

study provided 100% of the required intervention details with a percentage of completeness ranging from 71% (Fong et al. 2013) to 42% (Maddicks, Marzillier and Parker 2003). The studies with the most completely described interventions were; Fong et al (2013) at 71%, Bailey, Riddoch and Crome (2002) and Samuel et al. (2000) at 67% and Harding and Riddoch (2009) with a score of 58%. The studies with the worst reported interventions were; O'Neill and McMillan (2004) and Luukkainen-Markkula et al. (2009) with 50% and Maddicks, Marzillier and Crome (2003) with 42%. The completeness and details of intervention reporting will be presented by each TIDieR item below.

Table 3. Intervention Completeness Table

Authors, Primary	ITEM 1 Name	ITEM 2 Theory	ITEM 3 Materials	ITEM 4 Procedures	ITEM 5 Who	ITEM 6 How	ITEM 7 Where	ITEM 8 When and how much	ITEM 9 Tailoring	ITEM 10 Modification	ITEM 11 Fidelity Planned	ITEM 12 Fidelity Actual	% Total
Fong et al. (2013)	Yes	Yes	Yes	Yes	Partial	Partial	Partial	Yes	Yes	NR	Partial	Partial	71%
O'Neill and McMillan (2004)	Yes	Yes	Partial	Partial	Partial	Yes	NR	Yes	Partial	NR	NR	NR	50%
Maddicks, Marzillier and Parker (2003)	Yes	Yes	Yes	Partial	NR	NR	NR	Yes	Partial	NR	NR	NR	42%
Bailey, Riddoch and Crome (2002)	Yes	Yes	Yes	Yes	Partial	Yes	Partial	Yes	Yes	NR	NR	NR	67%
Samuel et al. (2000)	Yes	Yes	Partial	Yes	Partial	Yes	Partial	Yes	Partial	NR	Partial	Partial	67%
Harding and Riddoch (2009)	Yes	Yes	Yes	Yes	Partial	Yes	NR	Yes	Partial	NR	NR	NR	58%
Luukkainen-Markkula et al. (2009)	Yes	Partial	Partial	Partial	Partial	Yes	Partial	Partial	Partial	Partial	NR	NR	50%

Item 1. Brief name: Provide the name or a phrase that describes the intervention.

The provision of the intervention name or phrase allows the reader to easily identify appropriate literature and link reports of the same intervention. All seven of the studies included in this review provided a name or phrase to describe the intervention in the title and abstract. All but one study (Harding and Riddoch 2009) named the intervention to be 'limb activation technique' or a derivative of this term. Harding and Riddoch (2009) name their technique as Functional Electrical Stimulation (FES) and do not refer to the technique as 'limb activation' until the introduction located in the main body of the text. In three of the other studies additional techniques were also named including derivatives of a Limb Alert Device (O'Neill and McMillan 2004, Maddicks, Marzillier and Parker 2003), Constraint Induced Movement Therapy, FES glove and active assisted and passive exercises (Luukkainen-Markkula et al. 2009).

Item 2. Why: Describe any rationale, theory, or goal of the elements essential to the intervention.

This item was considered to be addressed if there was a summary of previous limb activation research and a theoretical explanation as to how intervention works. Details of how an intervention works helps the reader to identify which components of the intervention are essential to intervention success. All but one of the seven included studies (Luukkainen-Markkula et al. 2009) makes reference to well-known theoretical neglect mechanisms, however they did differ which highlights subtle differences in the theoretical justification by some studies. There was also limited rationale as to the effect of LAT on hemiplegia or function.

Item 3. What (materials): Describe any physical or informational materials used in the intervention, including those provided to participants or used in intervention delivery or in the training of intervention providers.

To be assessed as fully reported, the study must have provided a name of the materials used with a description or a reference where applicable. If the reader is unable to identify the materials used in an intervention then they will be unable to replicate the procedure (Hoffmann et al. 2014). All the studies provided at least partial information about the materials, but the detail of the description varied across studies and only four provided a full description. Fong et al. (2013) and Harding and Riddoch (2009) provided the most comprehensive descriptions with the aid of supplementary materials and pictures respectively. In contrast, O'Neill and McMillan (2004), Samuel et al. (2000) and Luukkainen-Markkula et al. (2009), provided the least amount of detail, naming but not describing the materials and leaving the reader to make assumptions based on intervention procedure. The most difficult studies to assess for a list of materials were Bailey, Riddoch and Crome

(2002) and Samuel et al. (2000) as both incorporated limb movement into a variety of broadly defined functional tasks and activities. The materials required could be assumed but they were not specifically stated.

Item 4. What (procedures): Describe each of the procedures, activities, and/or processes used in the intervention, including any enabling or supporting activities.

To be assessed as fully reported, the study had to describe the procedure of how the intervention was carried out. The procedures were vastly different across all seven studies and can be viewed in Appendix 7. All of the studies provided at least partial information about the intervention procedures but only four studies fully reported on this item (Fong et al 2013, (Maddicks, Marzillier and Parker 2003), (Bailey, Riddoch and Crome 2002), Harding and Riddoch 2009). These four studies were all delivered as a standalone treatment administered in addition to any conventional therapy. The studies in which the intervention was delivered as part of a conventional therapy session were less clear (O'Neill and McMillan 2004, Samuel et al. 2000). Only Luukkainen-Markkula et al. (2009) did not report whether the intervention was part of or additional to standard therapy procedures. Although not used to score on this item, the description of conventional therapy was lacking in all seven studies.

Item 5. Who provided: For each category of intervention provider describe their expertise, background and any specific training given.

This item was deemed to be fully reported if the intervention providers' speciality was named and their level of experience, background or training was provided. Who delivers the intervention can have a major bearing on the success of intervention delivery and therefore possibly intervention effectiveness. In the seven included studies, only four reported the profession of the individual that delivered the intervention: Occupational Therapist (OT), Physiotherapist, Speech and Language Therapist and a Physiotherapy assistant. No details were provided regarding their expertise, background and any specific training needs. Fong et al. (2013) does stipulate that a specially trained research OT delivered the intervention, but no further information is provided, and it is not clear if this is a prerequisite for delivering the intervention.

Item 6. How: Describe the modes of delivery of the intervention and whether it was provided individually or in a group

Interventions can be delivered face to face or across different communication platforms on a one to one basis or in a group setting. In the seven included studies, the mode of intervention delivery was

not always explicitly stated but often implied due to the nature of the intervention. For example, in Samuel et al. (2000)'s study, the intervention was delivered within the normal OT sessions and they report that the patients would require prompting, thus implying one to one application. In contrast, the description given by Fong et al. (2013) leads to uncertainty as although an OT was stated to have administered the intervention the description also implies the participant may not have been supervised for the full duration of the treatment period.

Item 7. Where: Describe the type of location where the intervention occurred, including any necessary infrastructure or relevant features

This item was assessed as fully reported if the study explicitly stated in what facility the intervention was administered. Health services and their infrastructure vary region to region and country to country and studies may carry out interventions in different locations to where participants were recruited. This was one of the worst reported items as only two studies providing partial information; Fong et al. (2013) stipulates the intervention was delivered in one of two rehabilitation centres in either a hospital ward or a therapy department. Bailey, Riddoch and Crome (2002) state only that interventions were delivered in a quiet area on the ward.

Item 8. When and how much: Describe the number of times the intervention was delivered and over what period of time including the number of sessions, their schedule, and their duration, intensity or dose

This item was assessed as fully reported if the duration, number of sessions per week and length of a session were provided. When and how long an intervention is delivered for is important in replicating an intervention. All but Luukkainen-Markkula et al. (2009) provided information for length of intervention phase, numbers of sessions, their schedule, duration and intensity. The length of each study ranged from ten days to four weeks. Interventions were administered anywhere between twice a week to twelve times a week. Each individual session ranged from twenty minutes to three hours. Total hours across a study period ranged from six hours to forty-five hours. Only Fong et al. (2013) further provides enough information for dose per session to be worked out.

Item 9. Tailoring: If the intervention was planned to be personalised, titrated or adapted, then describe, what, why, when and how

This item was assessed to be fully reported if the study described how the intervention was adapted to individual participants. The importance of tailoring an intervention is that in the real-world patients require individualised intervention delivery and this should be explained if a reader is

to consider the applicability of an intervention in their own population. Individualised tailoring was at least partially reported in six of the seven studies and was required due to the level of hemiparesis.

Item 10. Modifications: If the intervention was modified during the course of the study, describe the changes (what, why, when and how)

The modification of an intervention refers to the change to an intervention at a study level. No study mentioned the term intervention modification, although it appears modifications may have occurred in one study (Luukkainen-Markkula et al. 2009) where participants received different hours of therapy according to the time of recruitment from stroke onset. The participants with less than three months received eighteen hours of physiotherapy and twenty-one hours arm activation. Those with three to six months from stroke onset received ten hours of physiotherapy and thirty hours of arm activation. The authors do not highlight this as a modification that may alter the interpretation of intervention effect and reduces the reader's confidence in the studies robustness.

Item 11. How well (planned): If intervention adherence or fidelity was assessed, describe how and by whom, and if any strategies were used to maintain or improve fidelity, describe them

Planned fidelity is the identification of strategies to measure for the adherence of a participant to an intervention. No study explicitly stated plans to assess for treatment fidelity although Fong et al. (2013)'s limb alert device had the capability to record the number of limb movements and Samuel et al. (2000) recorded the number of prompts required to ensure the participant continued to adhere to the intervention.

Item 12. How well (actual): If intervention adherence of fidelity was assessed, describe the extent to which the intervention was delivered as planned

Actual fidelity is the measurement of the extent to which the intervention was delivered as planned. Without this information a clinician has little evidence on which to judge the intervention or understand how fidelity correlates with effectiveness. No study explicitly reports any strategy to measure intervention fidelity and although Fong et al. (2013) used a limb alert device with the capability to record number of limb movements and Samuel et al. (2000) recorded the number of prompts, neither state that this data is a measure of fidelity. This makes it difficult for the reader to judge whether intervention fidelity has been addressed. For the purpose of this review they were assessed as partially reported.

5. Discussion

Introduction

The purpose of this study was to identify whether Limb Activation Techniques, for remediating motor dysfunction in patients with left neglect in the first six months post stroke, are reported in enough detail to support their replication into practice. In order for clinicians to translate evidence into practice they require both high quality evidence of effectiveness and a complete description of how the intervention was applied (Yamato et al. 2016). This is the first review to investigate both the details of intervention effectiveness and the completeness of intervention reporting for limb activation techniques. This section will detail the key findings of the results section and discuss the results of the search strategy, the quality assessment, intervention effectiveness and completeness of intervention reporting. Strengths and weaknesses of this review process will be presented along with clinical recommendations and conclusions.

Summary of Key Findings

LAT have been advocated for the remediation of hemiplegia and function (Robertson, McMillan et al. 2002), however none have sought to systematically evaluate this claim. As patients with post stroke neglect have also been found to have worse functional outcomes, the development of treatment techniques that can remediate motor dysfunction would be of great benefit to clinicians and patients alike. To systematically identify primary intervention studies and answer this research question: 'Are limb activation technique interventions reported in enough detail to support their replication into practice in the remediation of motor dysfunction in patients with post stroke neglect?' a systematic review was carried out. A total of only seven studies were found to have measured for the effectiveness of LAT on motor outcomes in the first six months post stroke. Instead, the focus of the majority of the LAT studies has been on the remediation of neglect at the impairment level. Previous reviews have also identified and criticised primary research studies for this (Bowen et al. 2013). Without a measurement of the impact of neglect-based interventions at a functional level, clinicians are unable to determine whether the intervention can generalise to real life changes. As the neglect impairment is one of the biggest predictors of poorer outcomes, future studies should continue to investigate whether LAT can reduce this burden.

The overall quality of the seven studies was assessed using the McMasters critical appraisal tool (Law et al. 1998), whereby the lower the percentage score, the higher the potential of bias was found in the design or conduct of the study. Overall methodological quality ranged from the lowest at 41% (Luukkainen-Markkula et al. 2009) to the highest of 80% (Bailey, Riddoch and Crome 2002). Two of the studies were randomised controlled trials and five used single case experimental designs. RCTs are often deemed to be more rigorous and able to reduce the risk of bias due to the randomisation process. From an evidence-based practice perspective in which study designs are ranked according to their freedom from bias, this would indicate the majority of the studies in this review are of lower methodological quality (Masic, Miokovic and Muhamedagic 2008). Notably, it was a SCED (Bailey, Riddoch and Crome 2002), rather than an RCT that had the highest quality assessment score.

Regardless of study design there were a number of weaknesses common to all seven of the included studies. Firstly, a lack of blinding of participants or therapists to the intervention. Secondly, the intervention was administered alongside an unspecified regime of standard care, which diminishes the ability to attribute study outcomes to the specific intervention being investigated and the studies lacked sufficient sample sizes to generalise the results. Thirdly, the sample size of each study ranged from one to four participants in the SCED and six to nineteen participants in the treatment arm of the RCTs. A small sample size is accepted of a SCED, an RCT, however, is expected to have calculated the exact number of subjects required to detect a statistically significant and clinically important difference (Simera et al. 2008). The lower the sample size the less representative of the population the study is. This reduces the ability of the studies to generalise to the wider population (Sibbald and Roland 1998).

On the basis of this review's findings at first it appears that LAT is effective in the remediation of motor dysfunction as six of the seven studies reported an intervention effect and only one found no change (Maddicks, Marzillier and Parker 2003). However, a more in-depth look at the evidence demonstrates that these six studies are limited in their ability to inform practice due to the methodological weaknesses demonstrated above and the heterogenous use of intervention techniques and outcome measures. Even the two studies with the highest quality score fail to provide evidence of a strong intervention effect; Bailey, Riddoch and Crome (2002) identified improvements in the BI and the Rivermead Mobility index but highlighted that only the score of one of the two participants using the BI could be considered to be a large enough difference to inform practice. Whilst, Fong et al. (2013) did report a statistical improvement in the FMA upper limb and

hand score, FTHU and FIM motor scores, these were not statistically significant in comparison to the control group and therefore lacks the ability to change practice.

The main purpose of this study was to determine whether LAT have been reported in sufficient detail to support their replication into clinical practice. This review used the TIDieR checklist (Hoffmann et al. 2014), to determine both the completeness of intervention reporting and extract the intervention details pertinent to replication. This was the first systematic review to investigate the completeness of intervention reporting for limb activation techniques, as without an adequate description of how the technique was administered readers will be unable to interpret research results, systematic reviews are unable to adequately synthesise research to inform clinical decision making, clinicians are unable to physically replicate the technique into their own clinical practice and researchers are unable to build on previous research.

This review found that none of the seven included studies had provided all the details necessary for intervention replication with the overall intervention completeness ranging from 42% (Maddicks, Marzillier and Parker 2003) to 71% (Fong et al. 2013). Overall, the best reported items across the seven studies included: the intervention name, the theoretical underpinning and the intervention dose whilst the worst reported items included: who, where, tailoring, modifications, and intervention fidelity. Not only was there a wide variation in the completeness of intervention description but also in the consistency of reporting for each item. Even if an item was fully reported in all seven studies there was little standardisation of intervention protocols. This further impairs the ability to synthesise results and inform clinicians on how to replicate the intervention.

Further Discussion

The name or phrase given to describe an intervention in the title or abstract is also used to index literature in databases and therefore, agreement as to what an intervention is called is vital in allowing clinicians and researchers to identify appropriate studies and link studies of similar context (Hoffmann et al. 2014). Clear reporting of the name of a technique also ensures that only studies with similar techniques are included within a systematic review. If a name is not reported accurately, appropriate studies may be missed, which could contribute to publication bias and therefore limit confidence in review findings. In this review all seven of the studies named the intervention as a derivative of LAT in the title and abstract except one study. Harding and Riddoch (2009) did not

name the intervention to be a limb activation technique until the introduction in the main body of the text. This could have resulted in the study being missed from the review.

If the name of an intervention is not reported accurately the intervention details could be misconstrued, and interventions may be inaccurately amalgamated in systematic reviews (Page, Hoogenboom and Voight 2017). Although all seven of the studies included in this review named the intervention be to LAT, they also gave alternative names to the technique: Limb Alert Device (Fong et al. 2013, O'Neil and McMillan 2004, Maddicks, Marzillier and Parker 2003), therapist mediated active assisted limb movements (Bailey, Riddoch and Crome 2002, Samuel et al. 2000), Functional Electrical Stimulation (FES) (Harding and Riddoch 2009) and a mixture of interventions; constraint induced movement therapy (CIMT), an FES glove and a range of active assisted or passive exercises (Luukkainen-Markkula et al. 2009). This discord in what constitutes as a LAT can be seen in the previous literature reviews (Luauté et al. 2006) and there has been no attempt to explore this in more detail until now.

This highlights that there is no one technique or intervention procedure that has been definitively defined to be limb activation technique. As there is no agreed standard for the use of limb activation technique, the same term has been applied to quite different treatment protocols. The lack of standardisation of treatment protocols under the same name creates confusion. In stroke rehabilitation this has led to the phrase 'black box' in which there is no clarity on what interventions look like (DeJong et al. 2005). The limitation of naming techniques by a mechanism of action or technique developer rather than reporting the detail of what was done, is that this will be interpreted differently by different people and the intervention may therefore be replicated in a way that was not intended and can no longer be considered evidence-based practice (Page, Hoogenboom and Voight 2017). Future LAT studies would benefit from agreeing on a term or phrase used to describe the technique and classifying what techniques can be classed as LAT.

Redfern, McKevitt and Wolfe (2006) in a review of stroke interventions against the Medical Research Council Framework for development and evaluation of RCTs for complex interventions to improve health (Medical Research Council 2000), identified that most stroke based interventions failed to provide a justification of the intervention development in line with previous research and an adequate theoretical basis. (Redfern, McKevitt and Wolfe 2006). The provision of a theoretical rationale allows the reader to understand how the intervention has been developed within the

context of previous research. The development of interventions should be based on existing evidence to limit 'research waste' (Chalmers and Glasziou 2009) and should be systematically developed based on a coherent theoretical basis (Craig et al. 2008). All seven of the included studies did provide at least partial information about the theoretical development of their intervention. However, they all draw on slightly different theories which may explain why LAT has often been classified differently by different authors as both a bottom up, a top down and a mixed technique (Luauté et al. 2006, Bowen et al. 2013 and Azouvi, Jacquin-Courtois and Luauté 2016). If a clinician lacks the detail needed to understand the key components of an intervention, they will be limited in their ability to make informed decisions when applying this technique in their own clinical contexts.

Intervention materials have been consistently identified as one of the worst reported items of intervention description in healthcare research (Hoffmann et al. 2014, Yamato et al. 2016). The materials and procedures aspects of an intervention have also been described as the ingredients and methods sections of a recipe. In order to replicate an intervention, clinicians require the specific details of these features. The seven studies in this review were all found to have reported at least partial information on this item. An example of a well reported intervention in terms of materials and procedures was Harding and Riddoch (2009) as they provided pictures, references and detailed description. The differences in completeness scores for this item in comparison to other studies, may in part be due to a different scoring system. Previous reviews have allocated 1 point for fully reported and 0 points if not fully reported, whilst this study identified when studies had partially described an intervention and administered a score of 0.5. This review found only four studies had fully reported materials and three had only partially reported.

On average stroke patients will present with at least six impairments that will interact differently with each individual patient and produce a unique and complex presentation (Lawrence et al. 2001). Intervention tailoring to meet an individual's need is therefore a common reality of clinical practice post stroke (DeJong et al. 2004). It is therefore important that research account for this in the development of intervention procedures in healthcare (Hoffmann et al. 2014). Individualised tailoring was mentioned in all seven of the included studies and was usually due to the level of hemiparesis. There has been confusion in the previous literature about whether LAT can be used in a patient with severe hemiparesis and whether passive or active techniques are effective. Even within these seven studies there were different views and Bailey, Riddoch and Crome (2000) specifically excluded patients from the LAT intervention if they had no residual movement available.

In contrast, Luukkainen-Markula et al. (2009) changed the intervention technique to adapt to different levels of limb weakness.

The environment in which an intervention is delivered can often be an important component of intervention delivery (Hoffmann et al. 2014). The delivery of an intervention for patients post stroke can differ greatly both locally and internationally. The context and the environment of intervention delivery may impact greatly on the success of an intervention and therefore it is important to know the differences and similarities in how an environment may have been modified as what works in one place may not work in another (Walker et al. 2017).

Stroke units and specialist rehabilitation centres have been shown to result in improved patient outcomes in comparison to general medical wards (Trialists'Collaboration 2013). However, the evidence demonstrates that even between specialist units there is great variation in the environment and context of what is provided. Differences in both the ward environment and the wider organisational setting can impact upon intervention delivery (Walker et al. 2017). Although the national location was known for all seven of the included studies, only four studies provided any additional information. None of these seven studies provided information relevant to organisational resources, policies or culture that could influence intervention delivery. Future studies would benefit from reporting on details about the context of intervention delivery in order for clinicians to better replicate the intervention within their own clinical context.

For complex interventions and complex patient groups there may be a learning curve and need for training for any given intervention (Hoffmann et al. 2014). The neglect impairment is a complex syndrome that requires specialist skills to assess and potentially then allocate appropriate interventions (Pierce and Buxbaum 2002). However, even in specialist stroke units, this condition is often under reported (Chen et al. 2013) and the lack of knowledge and skills has been found to be a barrier to uptake of evidence based practice in this area (Petzold et al. 2014). None of the seven studies included in this review reported details about the level of skill, experience or training of the individuals administering the intervention.

The poor reporting of intervention fidelity found in this study has been reported to be a common issue in healthcare research. Intervention fidelity is how well an intervention is adhered to;

planned fidelity is the identification of strategies to measure for the adherence of a participant to an intervention and actual fidelity is the measurement of the extent to which the intervention was delivered as planned (Hoffmann et al. 2014). As the delivery of an intervention is subject to alteration by individual patients, clinical staff, research staff and organisational context (Wells et al. 2012), the reporting of factors impacting on intervention delivery and therefore success are important to clinicians considering using the intervention in clinical practice.

Only two of the seven studies mention strategies that could be considered as addressing intervention fidelity, although neither of them explicitly states this as their intent. Fong et al. (2013)'s limb alert device had the capability to record number of limb movements. Samuel et al. (2000) planned to assess whether patients effectively learned to use limb activation techniques. Patients with neglect often present with a reduced awareness of their impairment and have variable levels of hemiplegia which may impair the success of adherence to an intervention protocol. Reporting of the adherence of patients, staff and organisations to intervention procedures will therefore be very valuable to clinicians in this patient group. The replication of an intervention that cannot be sustained may require additional support and will be of especial importance in the planning stages of replication. Considering the complexity of this patient group, it is surprising that authors did not provide more information detailing the participants compliance with the treatment provided.

The explicit reporting of intervention fidelity will likely be of importance to clinicians as one barrier to the translation of evidence into practice is a lack of skill and confidence in critically appraising the evidence. The concept of intervention fidelity is a growing area in the academic world, however there is very little about this in tools used to support critical appraisal. If interventions and evaluation of intervention fidelity were reported in detail this would aid clinicians in decision making regards replicating interventions into their own area of practice. Future research studies should consider assessing and reporting intervention fidelity to enable clinicians to consider the reality of implementing this technique.

It is not only the description of the experimental intervention but the description of any co-occurring interventions and the control interventions that is an important consideration to a clinician considering replicating interventions into clinical practice. The term standard therapy or usual care is

often used to describe the therapy interventions delivered alongside any experimental interventions. Due to the nature of healthcare research often standard therapy input cannot be stopped and instead the intervention under investigation may be an additional aspect to standard care. However, the reporting of conventional therapy and control interventions has been found to be worse reported than the intervention under investigation by many previous review authors (Yamato et al. 2016, Walker et al. 2017).

'Standard care' used by one clinician in one organisation or environment may be very different to that in another. Lohse et al (2018) warns that the poor reporting seen in conventional and control interventions is a further threat to internal validity and the generalisation of results (Lohse et al. 2018). As without the adequate reporting of an intervention clinicians can neither judge the overall applicably of the experimental intervention for use in their own clinical context and nor can they consider physically replicate it. Although this study did not specifically assess for intervention completeness of the conventional interventions it was clear that the details were lacking. At best the seven included studies acknowledge whether the subjects received standard PT or OT and the time period that this was undertaken. None reported on what the intervention practically entailed. To replicate the intervention in the context of the research study it is unclear whether clinicians will need to also consider the control intervention delivered alongside it. Hoffman et al. (2014) do advise that the control, and conventional interventions are appraised using a separate TIDieR checklist. This is a limitation of this systematic review and future studies would benefit from appraising this in more detail.

Herbert and Bo (2005) have suggested that interventions with poor planning may be less effective, as the way in which interventions are administered may affect the outcomes (Herbert and Bo 2005). This review did not find a consistent link between study quality, intervention completeness and study outcomes, however, of the three studies with the highest quality score, two also had the highest intervention completeness scores (Fong et al. 2013, Bailey, Riddoch and Crome 2002) but only tentative improvements with their intervention. Samuel et al. (2000) and Harding and Riddoch (2009) both had low quality scores and moderate to high intervention completeness scores and reported an intervention effect. However, Maddicks, Marzillier and Parker (2003) the only study to find no intervention effect had a low-quality score and the lowest intervention completeness score. Future studies would benefit from considering the impact that quality of intervention reporting may have on the interpretation of results.

Strengths and Limitations

A strength of this review is that the search strategy followed a systematic process and was checked by a specialist librarian. Both published and unpublished sources were searched to minimise the potential of publication bias and a data management software was used to support transparency and replicability. Scoping searches enabled the identification of many potential derivatives of the limb activation technique, however as demonstrated in the discussion, many techniques that have previously been identified as limb activation techniques were not additionally added to the strategy. As only one reviewer conducted the search there is a chance that relevant studies may have been missed. However, as the whole search was repeated this may have reduced this risk.

The search strategy, initial screening and data extraction was conducted by only one reviewer. This increases the risk of subjectivity (Boland, Cherry and Dickson 2014). To reduce this a second reviewer was used to assess the study quality and intervention completeness for all the included studies. The second reviewer is a CEBIS librarian with specialist skills in systematic reviews. The use of standardised tools further aids with the objectivity, transparency and replicability of the methods. There were however limitations in using the McMaster Critical Appraisal Tool (Law et al. 1998) and the TIDieR checklist (Hoffmann et al. 2014). Although both tools provide supporting guidance and have been previously used in research studies, there is a lack of instruction on how to use them in a systematic review. Despite piloting the tool prior to use, there were still discrepancies in scoring of each item. It was clear that the level of experience of the reviewer in regard to the research topic or research methods influenced interpretation of the items. Future researchers may need to consider developing guidance on how to determine if an item is completely reported to enable more standardised approaches so that result can be more easily compared and contrasted.

The application of a scoring system to a quality assessment is also not advised due to the difficulty in weighting different items. It was recognised that the McMaster Critical Appraisal Tool (Law et al. 1998) assessed both reporting quality and risk of bias. Lack of reporting does not necessarily correlate with risk of bias. The tool, however, was deemed acceptable in order to aid consistency of assessment across different study designs and for level of experience of the researcher. However, it is recognised that the use of different tools designed for specific study designs would have improved overall confidence in the results.

A strength of this review is the detailed reporting of intervention details. Previous systematic reviews have been criticised for failing to provide intervention details because reviews are one of the key mechanisms for disseminating evidence-based practice to clinicians. The limitation of this study is that the conventional and control interventions were not also appraised using a separate TIDieR checklist as advised in the guidance (Hoffmann et al. 2014). Also, authors were not approached to acquire additional information. A number of studies have demonstrated the benefits of this (Yamato et al. 2016).

Future Research

The lack of complete intervention description in the seven included studies limits the synthesis of the evidence and the replicability of interventions. This reduces the ability of research to inform clinical decision making. Future researchers would benefit from using the TIDieR checklist as a way of standardising the reporting of interventions. Specifically, improved reporting may focus on the detail as to who delivers the intervention, where it is delivered, modifications and intervention fidelity. This may require further development to enable both clinicians and researchers to be able to use this consistently.

Future research would also benefit from establishing an agreed upon classification for what constitutes as a limb activation technique and a more standardised approach to the intervention protocol. This review identified that even when an item is fully reported, there is little consistency in how this was implemented between studies. To support the development of a standardised protocol a larger review of all LAT studies would be warranted.

There were too few studies identified to have investigated the effect of LAT on motor outcomes in the first 6 months post stroke. As neglect is one of the largest predicters of poor functional outcomes, that is often worse in the acute phase post stroke, future research would benefit from measuring for the impact of LAT on an agreed selection of motor outcomes.

Clinical Implications

This systematic review was the first to evaluate the completeness of intervention reporting for LAT in patients with post stroke neglect. In keeping with previous reviews of intervention description for post-stroke interventions, this study found the reporting of LAT lacked the detail

required to physically replicate the technique into clinical practice. Importantly, there is a lack of standardisation as to what constitutes as LAT. Interventions need to be reported explicitly if clinicians are to physically replicate them into clinical practice and if researchers are to develop them. Clinicians should consider the detail of the intervention in each individual study when seeking to use the evidence-based literature to support clinical decision making. The synthesis of intervention details from the previous LAT studies provided in this review may assist clinicians when reviewing subsequent research on this topic.

Too few studies have investigated the effect on LAT on motor outcomes in patients with post stroke neglect, especially in the first 6 months post stroke. Although six of the studies demonstrated a treatment effect, the overall quality, heterogeneity of intervention techniques and objective measures limits the confidence in the results and the ability to generalise. Clinicians would benefit from considering intervention techniques that have been proven to have a remediating effect on motor function in this patient group.

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Appendix

Appendix 1 Search Strategies

1.1 Overview of Sources searched

Database / Source Searched	Platform / URL	Date of each search	Years Covered in the search	Full Strategy Used	Total No. hits from most recent search
MEDLINE	Coventry University via EBSCO host	24.02.17 06/11/17	No date restriction From inception to November 2017	See appendix 1.5 for full search strategy	28
CINAHL	Coventry University via EBSCO host	23.02.17 06/11/17	No date restriction	See appendix 1.4 for full search strategy	14
AMED	Coventry University via EBSCO host	24.02.17 06/11/17	No date restriction	See appendix 1.3 for full search strategy	10
PEDro	Via Coventry University	27.02.17 06/11/17	No date restriction	Stroke AND neglect	56
OT Seeker	First search Via Coventry University. 2nd search was directly conducted on the onsite search engine: http://www.otseeker.com/Search/SearchBuilder.aspx	27.02.17 06/11/17	No date restriction	Stroke AND neglect	47

PsycINFO	Coventry University via EBSCO host	27.02.17 06/11/17	No date restriction	See appendix 1.9 for full search strategy	23
ProQuest Dissertations	Via Coventry University	27.02.17 06/11/17	No date restriction	See appendix 1.7 for full search strategy	62
ProQuest	Via Coventry University	27.02.17 06/11/17	No date restriction	See appendix 1.8 for full search strategy	79
CENTRAL	Via Coventry University	28/02/17 02/11/17	No date restriction	See appendix 1.2 for full search strategy	33
TRIP	Via UHCW	01/02/17	No date restriction	(Stroke AND Neglect) AND Limb Activation	195
OpenGrey	Internet	01/02/17 06/11/17	No date restriction	Stroke AND neglect	11
Google Scholar	Internet	01/02/17	No date restriction	Neglect AND 'limb activation	680

1.2 CENTRAL Search Strategy

Search Name: Cochrane 02.11.17
Date Run: 02/11/17 11:21:25.751
Description:

ID	Search	Hits
#1	MeSH descriptor: [Stroke] explode all trees	7179
#2	stroke	50128
#3	cerebrovascular accident	7824
#4	cerebral haemorrhage	3030
#5	cerebral haemorrhage	1306
#6	cerebral infarct*	4245
#7	cerebral infarct	831
#8	cerebral infarction	3871
#9	cerebral event	2279
#10	cva	481
#11	#1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9 or #10	54530
#12	MeSH descriptor: [Perceptual Disorders] explode all trees	713
#13	neglect	979
#14	inattention	499
#15	#12 or #13 or #14	2045
#16	#11 and #15	467
#17	limb activation	508
#18	spatio-motor cueing	3
#19	spatio-motor cueing	1
#20	#17 or #18 or #19	510
#21	#16 and #20	33

1.3 AMED Search Strategy

Last RU: Monday, November 06, 2017 4:48:36 AM

#	Query	Limiters/Expanders	Last Run Via	Results
S19	S17 AND S18	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - AMED - The Allied and Complementary Medicine Database	10
S18	S7 AND S13	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - AMED - The Allied and Complementary Medicine Database	232
S17	S14 OR S15 OR S16	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - AMED - The Allied and Complementary Medicine Database	300
S16	left limb activation OR left limb activation therapy OR left limb activation treatment OR left limb activation training	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - AMED - The Allied and Complementary Medicine Database	25
S15	spatio motor cueing	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - AMED - The Allied and Complementary Medicine Database	2
S14	limb activation training OR limb activation therapy OR limb	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search	299

	activation treatment OR limb activation		Database - AMED - The Allied and Complementary Medicine Database	
S13	S8 OR S9 OR S10 OR S11 OR S12	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - AMED - The Allied and Complementary Medicine Database	503
S12	hemi-inattention OR sensory inattention OR motor inattention OR spatial neglect OR visual inattention	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - AMED - The Allied and Complementary Medicine Database	145
S11	sensory neglect OR motor neglect	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - AMED - The Allied and Complementary Medicine Database	79
S10	unilateral neglect OR hemineglect OR hemispatial neglect OR hemisensory neglect	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - AMED - The Allied and Complementary Medicine Database	171
S9	neglect OR visual neglect OR visuospatial neglect OR spatial neglect	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - AMED - The Allied and Complementary Medicine Database	459
S8	(DE "SPATIAL NEGLECT")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - AMED - The	32

			Allied and Complementary Medicine Database	
S7	S1 OR S2 OR S3 OR S4 OR S5 OR S6	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - AMED - The Allied and Complementary Medicine Database	8,101
S6	cerebral infarction OR cerebral infarct*	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - AMED - The Allied and Complementary Medicine Database	255
S5	cerebral hemorrhag* AND cerebral haemorrhag*	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - AMED - The Allied and Complementary Medicine Database	22
S4	cerebral hemorrhage OR cerebral haemorrhage	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - AMED - The Allied and Complementary Medicine Database	125
S3	stroke OR cerebrovascular accident OR cva OR cerebrovascular event	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - AMED - The Allied and Complementary Medicine Database	7,903
S2	(DE "CEREBROVASCULAR ACCIDENT")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - AMED - The	1,452

			Allied and Complementary Medicine Database	
S1	(DE "STROKE")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - AMED - The Allied and Complementary Medicine Database	2,249

1.4 CINAHL Search Strategy

Last Run: 06/11/17

Search ID#	Search Terms	Search Options	Last Run Via	Results
S24	S18 AND S23	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	14
S23	S6 AND S22	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	700
S22	S13 OR S21	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	6,250
S21	left neglect	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	425
S20	S18 AND S19	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search	14

			Database - CINAHL Complete	
S19	S6 AND S13	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	700
S18	S14 OR S15 OR S16 OR S17	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	944
S17	limb activation therapy	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	198
S16	left limb activation OR left limb activation training OR left limb activation treatment OR left limb activation therapy	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	88
S15	spatio motor cueing OR spatio-motor cueing	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	2

S14	limb activation training OR limb activation treatment OR limb activation	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	942
S13	S7 OR S8 OR S9 OR S10 OR S11 OR S12	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	6,250
S12	hemi-inattention OR sensory inattention OR motor inattention OR spatial inattention OR visual inattention	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	231
S11	sensory neglect OR motor neglect	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	302
S10	hemineglect OR hemispatial neglect OR hemisensory neglect	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	163
S9	visual neglect OR visuospatial neglect OR spatial neglect	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases	699

			Search Screen - Advanced Search Database - CINAHL Complete	
S8	unilateral neglect OR neglect	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	6,057
S7	(MM "Unilateral Neglect")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	185
S6	S1 OR S2 OR S3 OR S4 OR S5	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	97,015
S5	cerebral infarction OR cerebral infarct*	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	8,080
S4	cerebral hemorrhag* OR cerebral haemorrhag*	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	10,590

S3	cerebral hemorrhage OR cerebral haemorrhage	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	10,039
S2	stroke OR cerebrovascular accident OR cva OR cerebrovascular event	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	88,269
S1	(MM "Stroke+")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	39,683

1.5 MEDLINE Search Strategy

Last Run 06/11/17

Search ID#	Search Terms	Search Options	Last Run Via	Results
S30	S24 AND S29	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	28
S29	S6 AND S28	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	2,921
S28	S22 OR S27	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	42,328
S27	left neglect	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	2,198
S26	S24 AND S25	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search	28

			Database - MEDLINE	
S25	S6 AND S22	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	2,921
S24	S16 OR S17 OR S18 OR S23	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	5,429
S23	limb activation therapy OR left limb activation training	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	985
S22	S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S21	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	42,328
S21	visual inattention	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	520

S20	S15 AND S19	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	28
S19	S16 OR S17 OR S18	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	5,429
S18	left limb activation OR left limb activation therapy OR left limb activation treatment	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	407
S17	spatio-motor cueing OR spatio motor cueing	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	7
S16	limb activation training OR limb activation treatment OR limb activation	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	5,422
S15	S6 AND S14	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases	2,908

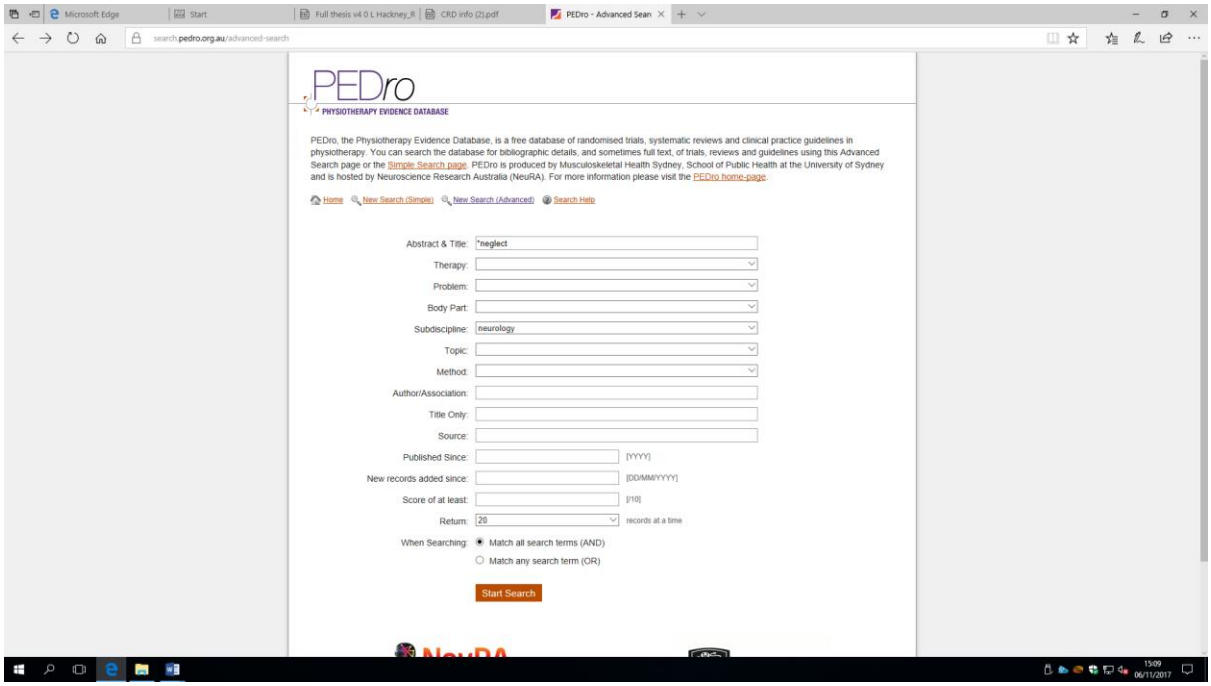
			Search Screen - Advanced Search Database - MEDLINE	
S14	S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	42,097
S13	hemi-inattention OR sensory inattention OR motor inattention OR spatial inattention	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	724
S12	sensory neglect OR motor neglect	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	1,386
S11	unilateral neglect OR hemineglect OR hemispatial neglect OR hemisensory neglect	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	2,089
S10	visual neglect OR visuospatial neglect OR spatial neglect	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	3,232

S9	perceptual disorders	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	13,564
S8	neglect	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	17,096
S7	(MM "Perceptual Disorders+")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	18,114
S6	S1 OR S2 OR S3 OR S4 OR S5	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	326,599
S5	cerebral infarction OR cerebral infarct	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	48,960
S4	cerebral hemorrhag* OR cerebral haemorrhag*	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases	60,229

			Search Screen - Advanced Search Database - MEDLINE	
S3	cerebral haemorrhage OR cerebral hemorrhage	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	55,531
S2	stroke OR cerebrovascular accident OR CVA OR cerebrovascular event	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	255,329
S1	(MM "Stroke+")	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	79,895

1.6 PEDro Search Strategy

Last Run: 06/11/17 https://search.pedro.org.au/advanced-search



1.7 ProQuest Dissertations & Theses: UK & Ireland Search Strategy

Last search 06/11/17

(((stroke OR (cerebrovasular accident OR cva) OR (cerebrovascular event)) OR ((cerebral hemorrhage) OR (cerebral heamorrhage) OR (cerebral infarction) OR (cerebral hemorrhag*) OR (cerebral heamorrhag*) OR (cerebral infarct*))) AND ((neglect OR (unilateral neglect) OR (left neglect) OR (hemi neglect) OR (visual neglect) OR (sensory neglect) OR (spatial neglect) OR (motor neglect)) OR ((visuospatial neglect) OR (hemispatial neglect) OR (hemisensory neglect)) OR (inattention OR (sensory inattention) OR (visual inattention) OR (spatial inattention) OR (motor inattention)))) AND ((limb activation) OR (limb activation technique) OR (limb activation treatment) OR (limb activation therapy) OR (left limb activation) OR (left limb activation treatment) OR (left limb activation technique) OR (left limb activation therapy) OR (spatio motor cueing))

1.8 ProQuest Nursing & Allied Health Database Search Strategy

Last search: 06/11/17

((stroke OR (cerebrovascular accident OR cva) OR (cerebrovascular event) OR (cerebral hemorrhage) OR (cerebral heamorrhage) OR (cerebral infarction)) AND (su.Exact("stroke") AND mesh.Exact("Stroke"))) AND ((neglect OR (unilateral neglect) OR (left neglect) OR (hemi neglect) OR (hemispatial neglect) OR (hemisensory neglect) OR (visuospatial neglect) OR (visuosensory neglect)) AND ((motor neglect) OR (sensory neglect) OR (spatial AND neglect) OR (visual neglect) OR inattention OR (sensory inattention) OR (visual inattention) OR (motor inattention) OR (spatial inattention))) AND ((limb activation) OR (limb activation technique) OR (limb activation therapy) OR (limb activation treatment) OR (left limb activation) OR (left limb activation technique) OR (left limb activation treatment) OR (left limb activation therapy) AND (spatio motor cueing OR spatio-motor cueing))

1.9 PsycINFO Search Strategy

Last search 06/11/17

Search ID#	Search Terms	Search Options	Last Run Via	Results
S17	S12 AND S16	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - PsycINFO	23
S16	S13 OR S14 OR S15	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - PsycINFO	1,036
S15	spatio motor cueing OR spatio-motor cueing	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - PsycINFO	7
S14	left limb activation OR left limb activation technique OR left limb activation therapy OR left limb activation treatment	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - PsycINFO	137
S13	limb activation OR limb activation technique OR limb activation treatment OR limb activation therapy	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search	1,030

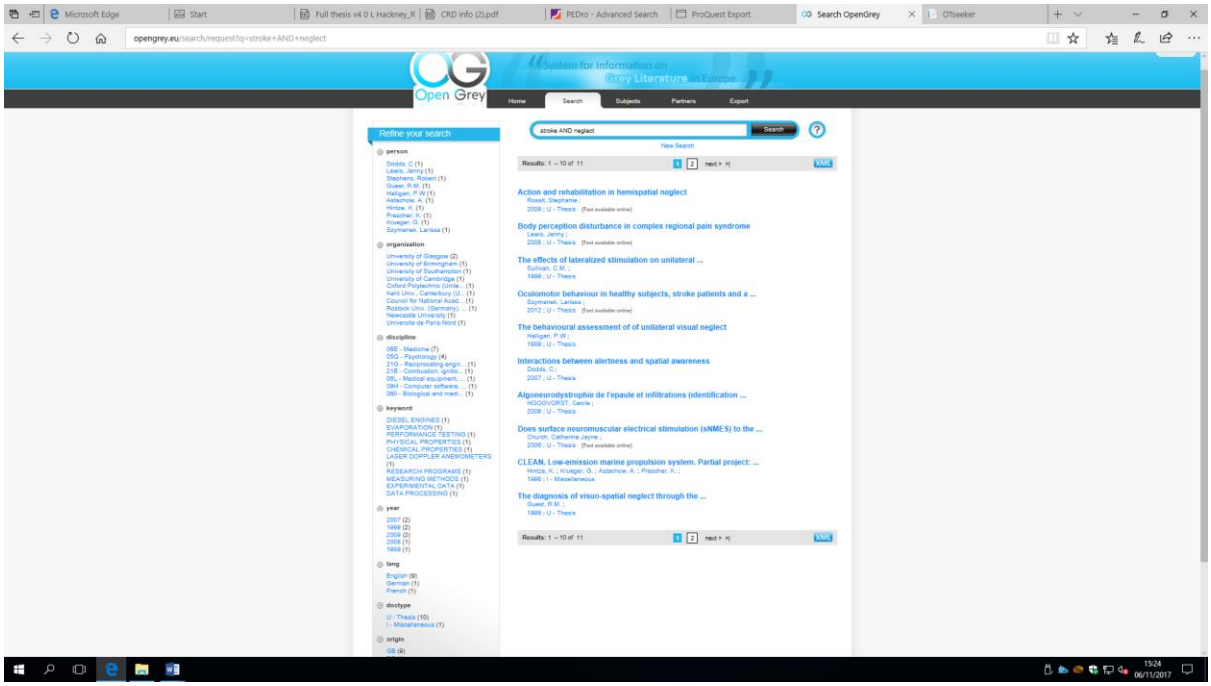
			Database - PsycINFO	
S12	S6 AND S11	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - PsycINFO	1,498
S11	S7 OR S8 OR S9 OR S10	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - PsycINFO	29,801
S10	inattention OR sensory inattention OR motor inattention OR visual inattention OR spatial inattention	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - PsycINFO	5,279
S9	hemispatial neglect OR hemisensory neglect OR motor neglect	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - PsycINFO	1,409
S8	visual neglect OR visuospatial neglect OR visuosensory neglect OR spatial neglect OR sensory neglect	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - PsycINFO	3,734

S7	neglect OR unilateral neglect OR hemi-neglect OR left neglect	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - PsycINFO	24,967
S6	S1 OR S2 OR S3 OR S4 OR S5	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - PsycINFO	42,140
S5	cerebral infarction OR cerebral infarct*	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - PsycINFO	6,765
S4	cerebral hemorrhag* OR cerebral heamorrhag*	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - PsycINFO	4,365
S3	cerebral hemorrhage OR cerebral haemorrhage	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - PsycINFO	4,336
S2	cerebrovascular accident OR cva OR cerebrovascular event	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases	19,724

			Search Screen - Advanced Search Database - PsycINFO	
S1	stroke	Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - PsycINFO	34,944

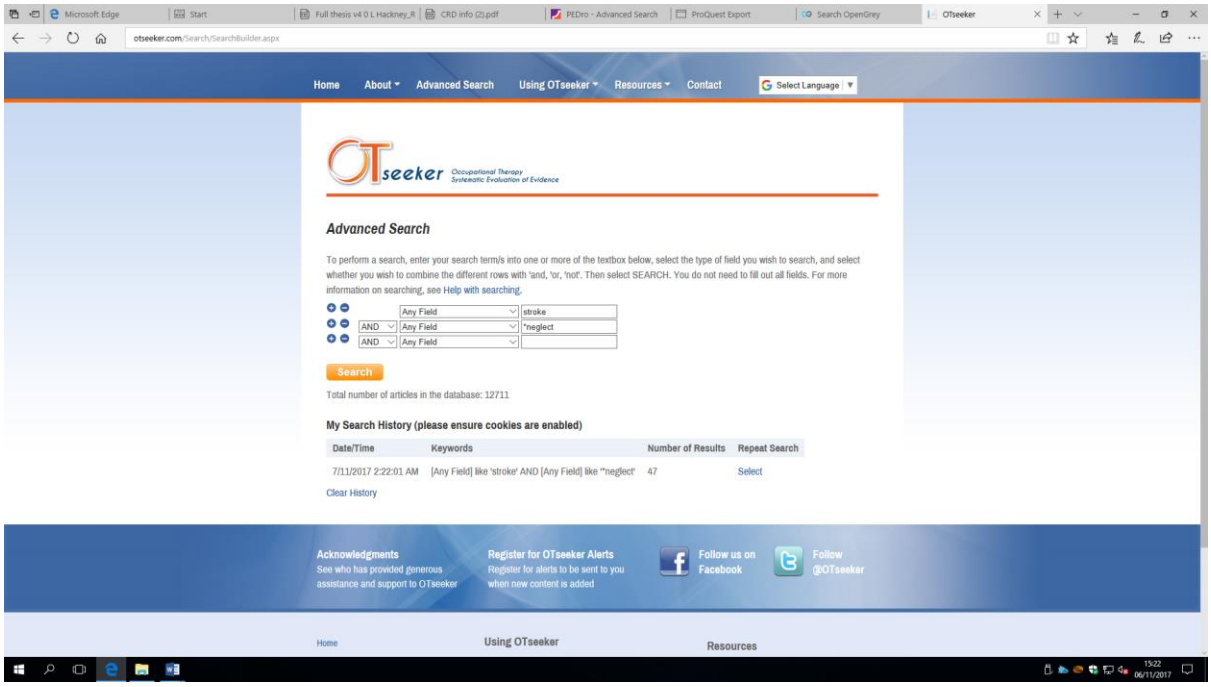
1.10 OPENGREY Search Strategy

Last searched 06/11/17 http://www.opengrey.eu/search/request?q=stroke+AND+neglect



1.11 OT Seeker Search Strategy

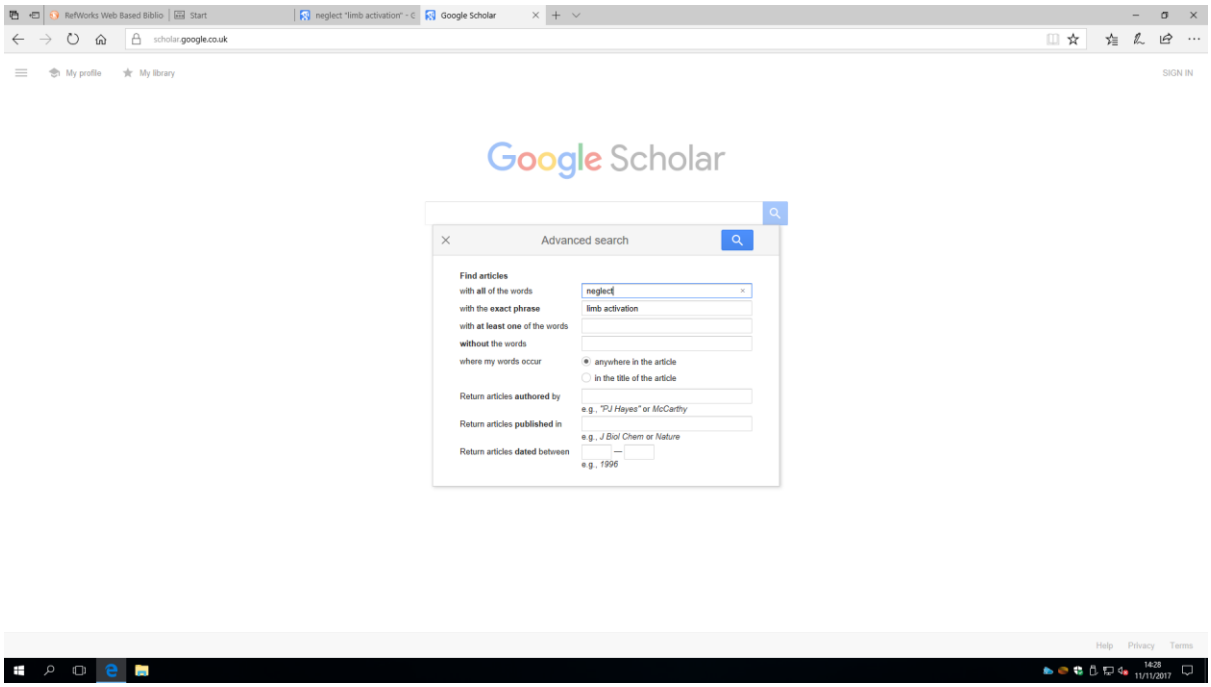
Last search 06/1/17 http://www.otseeker.com/Search/SearchBuilder.aspx

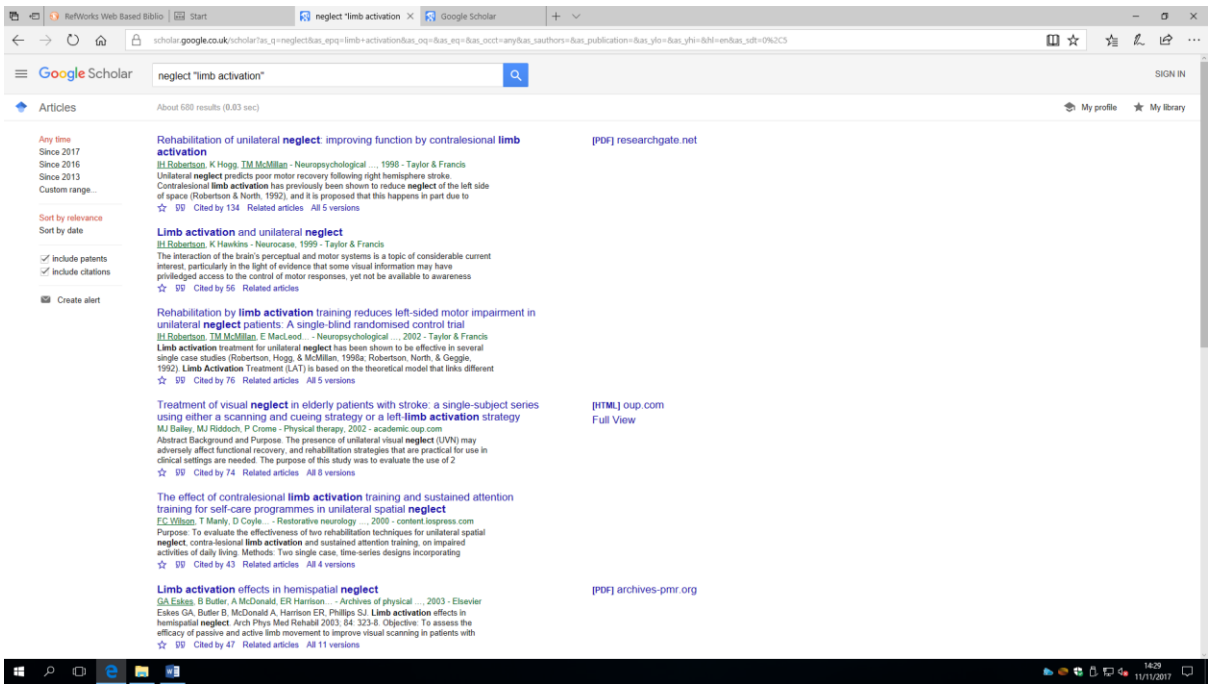


1.12 Google Scholar Search Strategy

Last search 11/11/17

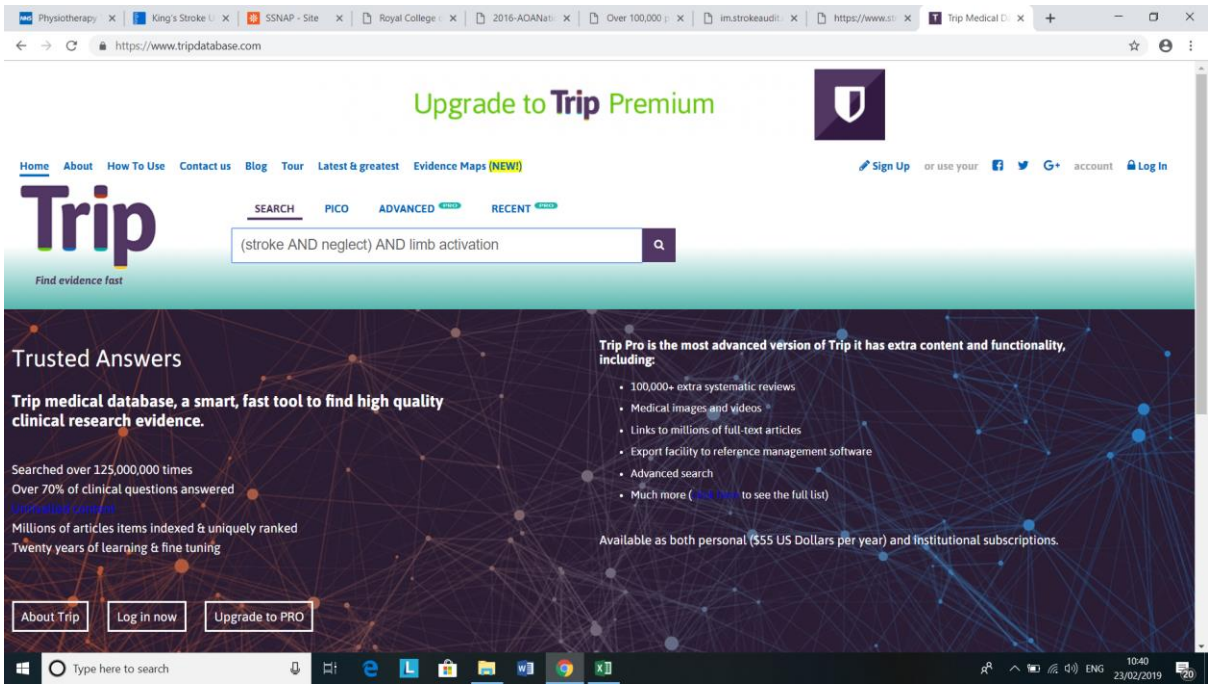
https://scholar.google.co.uk/scholar?as_q=neglect&as_epq=limb+activation&as_oq=&as_eq=&as_occt=any&as_sauthors=&as_publication=&as_ylo=&as_yhi=&hl=en&as_sdt=0%2C5





1.13 TRIP Database Search

Last searched 01/02/17 at University Hospital Coventry and Warwickshire NHS Trust Site.



Appendix 2 Inclusion and Exclusion Table

Authors, Primary	Title Primary	Pub Year	Right Stoke	left Neglect	LAT	Motor Function outcome	Inpatient setting	design	Incl/excl	Comments
Anon	mCIMT and Eye Patching for Neglect Rehabilitation Post Stroke: A Longitudinal Study of Separate and Combined Effects	2005	--	--	--	--	--	--	exclude	Ongoing study no information available
Bailey, Maggie J.; Riddoch, M. J.; Crome, Peter	Treatment of visual neglect in elderly patients with stroke: a single-subject series using either a scanning and cueing strategy or a left-limb activation strategy	2002	yes	yes	yes	yes	yes	yes	Include	Aim was not to compare these 2 approaches, but to separately evaluate due to efficacy of each approach in the clinical setting.
Brown, Valerie; Walker, Robin; Gray, Chris; Findlay, John M.	Limb activation and the rehabilitation of unilateral neglect: evidence of task-specific effects	1999	yes	yes	yes	no	--	yes	exclude	No motor outcome measure
Brunila, Teea; Lincoln, Nadina; Lindell, Arja; Tenovuo, Olli; Hämäläinen, Heikki	Experiences of combined visual training and arm activation in the rehabilitation of unilateral visual neglect: A clinical study	2002	yes	yes	LAT + Visual scanning	no	--	yes	exclude	No motor outcome measure
Butler, Beverly C.; Eskes, Gail A.	Effect of limb movements on orienting of attention in right-hemisphere stroke	2014	yes	yes	yes	no	--	no	exclude	No motor outcome measure
Cubelli, Roberto; Paganelli, Nadia; Achilli, Donatella; Pedriui, Silva	Is one hand always better than two? A replication study	1999	yes	yes	LAT + Reading, LAT + cancellation test	no	--	yes	exclude	It was more about improving performance of writing/reading. No functional outcome measures
Eskes, Gail A.; Butler, Beverly	Using limb movements to improve spatial neglect: the role of functional electrical stimulation	2006	yes	yes	yes	no	--	yes	exclude	No motor outcome measure

Eskes, Gail A.; Butler, Beverly; McDonald, Alison; Harrison, Edmund R.; Phillips, Stephen J.	Limb activation effects in hemispatial neglect	2003	yes	yes	yes	No	--	yes	exclude	No motor outcome measure
Fong, Kenneth N. K.; Yang, Nicole Y. H.; Chan, Marko K. L.; Chan, Dora Y. L.; Lau, Andy F. C.; Chan, Dick Y. W.; Cheung, Joyce T. Y.; Cheung, Hobby K. Y.; Chung, Raymond C. K.; Chan, Chetwyn C. H.	Combined effects of sensory cueing and limb activation on unilateral neglect in subacute left hemiplegic stroke patients: a randomized controlled pilot study	2013	yes	yes	wrist watch	yes	yes	yes	Include	
Frassinetti, F.; Rossi, M.; Ladavas, E.	Passive limb movements improve visual neglect	2001	yes	yes	yes	no	--	yes	exclude	No motor outcome measure
Fujii, T.; Yamadori, A.; Fukatsu, R.; Suzuki, K.	Effects of hand-used on unilateral spatial neglect: a case study	1996	yes	yes	no	no	--	yes	exclude	Not about treatment but about effect of which hand on line bisection. No motor outcome measure
Gainotti, Guido; Perri, Roberta; Cappa, Antonella	Left hand movements and right hemisphere activation in unilateral spatial neglect: a test of the interhemispheric imbalance hypothesis	2002	yes	yes	yes	no	--	yes	exclude	No motor outcome measure
Grattan, Emily S.; Lang, Catherine E.; Birkenmeier, Rebecca; Holm, Margo; Rubinstein, Elaine; Van Swearingen, Jessie; Skidmore, Elizabeth R.	Examining the Feasibility, Tolerability, and Preliminary Efficacy of Repetitive Task-Specific Practice for People with Unilateral Spatial Neglect	2016	11 of 20	11 of 20	task specific functional activities	yes	no	yes	exclude	Mixed lesion group and outpatient setting
Halligan, P. W.; Manning ,L.; Marshall, J. C.	Hemispheric activation vs spatio-motor cueing in visual neglect: a case study	1991	yes	yes	no	no	not clear	yes	exclude	Not really about intervention effect, no functional outcome measure

Harding, Peter; Riddoch, M. Jane	Functional electrical stimulation (FES) of the upper limb alleviates unilateral neglect: a case series analysis	2009	yes	yes	yes	yes	yes	yes	Include	Not clear but have intensive input and way recovery is described appears to be acute.
Kalra, L.; Perez, I.; Gupta, S.; Wittink, M.	The influence of visual neglect on stroke rehabilitation	1997	mixed	yes	yes	yes	no	yes	exclude	Stipulates that 16 out of 25 had right hemi stroke
Keller, I.; Lefin-Rank, G.; Losch, J.; Kerkhoff, G.	Combination of pursuit eye movement training with prism adaptation and arm movements in neglect therapy: a pilot study	2009	yes	yes	no	no	--	yes	exclude	It wasn't really about the limb movement
LaGarde, Geneviave; Higgins, Johanne; Tremblay, Lucie	Implementation of an evidence-based combined therapy for post-stroke unilateral spatial neglect: a feasibility study	2016/17	yes	YES	yes but not in isolation to the implement-ation of other separate treatment	yes	yes	yes	exclude	LAT was one treatment implemented alongside other neglect treatments that couldn't be separated from each other in terms of outcomes
Lin, Keh-Chung; Cermak, Sharon A.; Kinsbourne, Marcel; Trombly, Catherine A.	Effects of left-sided movements on line bisection in unilateral neglect	1996	yes	yes	no	no	no	no	exclude	No motor l outcome. it was more about improving line bisection
Luukkainen-Markkula, R.; Tarkka, I. M.; Pitkanen, K.; Sivenius, J.; Hamalainen, H.	Rehabilitation of hemispatial neglect: a randomized study using either arm activation or visual scanning training	2009	yes	yes	yes	yes	not clear but all under 6months so included	yes	include	Not clear but all under 6months, with one only 18 days, so included

Maddicks, Richard; Marzillier, Sarah L.; Parker, Gabrielle	Rehabilitation of unilateral neglect in the acute recovery stage: The efficacy of limb activation therapy	2003	yes	yes	yes	yes	?	yes	include	
O'Neill, B.; McMillan, T. M.	The efficacy of contralesional limb activation in rehabilitation of unilateral hemiplegia and visual neglect: A baseline-intervention study	2004	yes	yes	yes	yes	yes	yes	include	Identified at 67 days. Not that clear.
Paolucci, S.; Antonucci, G.; Guariglia, C.; Magnotti, L.; Pizzamiglio, L.; Zoccolotti, P.	Facilitatory effect of neglect rehabilitation on the recovery of left hemiplegic stroke patients: a cross-over study	1996	yes	yes	yes	yes	--	yes	exclude	neglect and non-neglect group.
Park, Jin-hyuck; Park, Ji-hyuk	The effects of vibration stimulation applied to the left forearm on unilateral neglect in patients with stroke: A pilot randomized controlled trial	2015	yes	yes	TENS	no	yes	yes	exclude	TENS not FES No motor or functional outcome measures
Pitteri, Marco; Arcara, Giorgio; Passarini, Laura; Meneghello, Francesca; Priftis, Konstantinos	Is two better than one? Limb activation treatment combined with contralesional arm vibration to ameliorate signs of left neglect	2013	yes	yes	yes	no	--	yes	exclude	No motor outcome measure
Priftis, Konstantinos; Passarini, Laura; Pilosio, Cristina; Meneghello, Francesca; Pitteri, Marco	Visual Scanning Training, Limb Activation Treatment, and Prism Adaptation for Rehabilitating Left Neglect: Who is the Winner?	2013	yes	yes	yes	yes	not clear	yes	exclude	Results for CBS in the LAT group were not presented separately. Mixed acute and chronic patients, not clear if inpatient or outpatient
Punt, T. D.; Kitadono, Keiko; Hulleman, Johan; Humphreys, Glyn W.; Riddoch, M. J.	Modulating wheelchair navigation in patients with spatial neglect	2011	yes		yes	?	no	--	exclude	outcome is wheelchair navigation skills

Reinhart, S.; Schmidt, L.; Kuhn, C.; Rosenthal, A.; Schenk, T.; Keller, I.; Kerkhoff, G.	Limb activation ameliorates body-related deficits in spatial neglect	2012	yes	yes	yes	no	--	yes	exclude	No motor outcome measure
Riddoch, M. Jane; Humphreys, Glyn W.; Burroughs, Erica; Luckhurst, Linda; Bateman, Andrew; Hill, Simon	Cueing in a case of neglect: modality and automaticity effects	1995	yes	yes	?	no	--	yes	exclude	No motor outcome measure and Not really about treatment
Robertson ,Ian H.; Hawkins, Kari	Limb activation and unilateral neglect	1999	N/A	--	--	--	--	no	exclude	review
Robertson, Ian H.; Hogg, Karen; McMillan, Tom M.	Rehabilitation of unilateral neglect: improving function by contralesional limb activation	1998	no	yes	yes	yes	--	yes	exclude	TBI
Robertson, Ian H.; Nico, Daniele; Hood, Bruce M.	Believing what you feel: using proprioceptive feedback to reduce unilateral neglect.	1997	yes	yes	Rods	No	yes	?	exclude	No motor outcome measure. Used rods but not about treatment
Robertson, Ian H.; Tegner, Richard; Goodrich, Susan J.; Wilson, Claire	Walking trajectory and hand movements in unilateral left neglect: a vestibular hypothesis	1994	yes	yes	hand clenching whilst walking through doorway	walking through doorway	not clear	yes	exclude	Not intervention study. Not really a treatment technique, more a strategy
Robertson, I. H.; North, N.	Spatio-motor cueing in unilateral left neglect: the role of hemispace, hand and motor activation	1992	yes	yes	not interventio n study	no	not clear	yes	exclude	not intervention study

Robertson, I. H.; North, N. T.; Geggie, C.	Spatio-motor cueing in unilateral left neglect: three case studies of its therapeutic effects	1992	yes	yes	no	no	yes	yes	exclude	Anchor
Robertson, Ian	Use of left vs right hand in responding to lateralized stimuli in unilateral neglect	1991	yes	yes	no	no	not clear	yes	exclude	Not an intervention study, no motor outcomes
Robertson, Ian H.; McMillan, Tom M.; MacLeod, Eleanor; Edgeworth, Jennifer; Brock, Daryl	Rehabilitation by limb activation training reduces left-side motor impairment in unilateral neglect patients: A single-blind randomised control trial	2002	yes	yes	yes	yes	no	yes	exclude	chronic
Robertson, Ian H.; North, Nigel	Active and passive activation of left limbs: Influence on visual and sensory neglect	1993	yes	yes	different conditions including PROM. But not implement-ed as a treatment programme	no	not clear	yes	exclude	no motor outcome measure. Not a treatment programme
Rossit, S	Action and rehabilitation in hemispatial neglect	2009	yes	yes	yes	yes	no	yes	exclude	Rods, but purpose is left upper limb movement for motor. But they call it visuomotor cueing. Treatment occurred at home, not inpatient
Sampanis, Dimitrios S.	The rehabilitation of motor and cognitive disorders after stroke	2014	mixed	yes	yes	yes	not clear	yes	exclude	mixed but can separate out left neglect patients for most. However not clear if inpatient or outpatient. Definitely

Samuel, C.; Louis-Dreyfus, A.; Kaschel, R.; Makiela, E.; Troubat, M.; Anselmi, N.; Cannizzo, V.; Azouvi, P.	Rehabilitation of very severe unilateral neglect by visuo-spatio-motor cueing: Two single case studies	2000	yes	yes	yes	yes	1/2 case within first 6 months	yes	include	Include the case study at 4 months. Number of times needed cueing
Seniow, K. Polanowska, J.; Czlonkowska, E. Paprot, M. Lesniak and A.	Left-hand somatosensory stimulation combined with visual scanning training in rehabilitation for post-stroke hemineglect: a randomised, double-blind study	2009	yes	yes	no	yes	not clear	yes	exclude	TENS no movement elicited. Recruitment started within acute phase of 2 weeks and patients received daily therapy which likely only correlates with inpatient rehab.
Song, Bo Kyung; Chung, Sang Mi; Hwang, Byong Yong	The effects of somatosensory training focused on the hand on hand function, postural control and ADL of stroke patients with unilateral spatial neglect and sensorimotor deficits	2013	? mixed	yes	different type of treatment but it is on the upper limb for neglect	yes	yes inpatient but on average over 6 months since onset	yes	exclude	neglect and non-neglect group. Think neglect group were all left neglect. Somatosensory treatment. Were admitted into inpatient setting but were chronic and on average 10 months post stroke
Tunnard, Catherine; Wilson, Barbara A.	Comparison of neuropsychological rehabilitation techniques for unilateral neglect: An ABACADAEAF single-case experimental design	2014	yes	yes	yes	yes	--	yes	exclude	Unable to separate results of CBS from other treatments therefore had to exclude
Wilson, F. C.; Manly, Tom; Coyle, Donna; Robertson, Ian H.	The effect of contralesional limb activation training and sustained attention training for self-care programmes in unilateral spatial neglect	2000	yes	yes	yes	no	--	yes	exclude	No functional outcomes. No prompts during self-care tasks. 2 case studies one with LAT and one with attend

Ching-Yi Wu, Tien-Ni Wang, Yu-Ting Chen, Keh-Chung Lin, Yi-An Chen, Hsiang-Ting Li, Pei-Luen Tsai	Effects of Constraint-Induced Therapy combined with Eye Patching on Functional Outcomes and Movement Kinematics in Poststroke Neglect	2013	yes	yes	yes	yes	?	yes	exclude	Chronic participants

Appendix 3 McMasters Critical Appraisal Forms

Critical Review Form – Quantitative Studies
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McMaster University
- Adapted Word Version Used with Permission –

The EB Group would like to thank Dr. Craig Scanlan, University of Medicine and Dentistry of NJ, for providing this Word version of the quantitative review form.

Instructions: Use tab or arrow keys to move between fields, mouse or spacebar to check/uncheck boxes.

CITATION	**Provide the full citation for this article in APA format:** Fong, Kenneth N. K.; Yang, Nicole Y. H.; Chan, Marko K. L.; Chan, Dora Y. L.; Lau, Andy F. C.; Chan, Dick Y. W.; Cheung, Joyce T. Y.; Cheung, Hobby K. Y.; Chung, Raymond C. K.; Chan, Chetwyn C. H. Combined effects of sensory cueing and limb activation on unilateral neglect in subacute left hemiplegic stroke patients: a randomized controlled pilot study. (2013)
STUDY PURPOSE **Was the purpose stated clearly?** ☒ Yes ☐ No	**Outline the purpose of the study. How does the study apply to your research question?** Abstract: 'To compare the effects of contralesional sensory cueing and limb activation with that of sham control in the treatment of unilateral neglect after stroke.' Introduction: 'The purpose of this study was to test the effects of a novel training – the combined contralesional sensory cueing and limb activation v sham control. We hypothesized that sensory cueing (vibration and auditory signals emitted from a new ambulatory wristwatch device tied to the wrist of the hemiplegic arm), followed by consecutive arm movements subsequent to the cues, when compared with those receiving sham treatments, was feasible and would promote patients' awareness over their contralesional field, reduce unilateral neglect, and improve hemiplegic arm functions. Because sensory inputs are received from both sides of the body simultaneously, the interhemispheric rivalry between sensations resulting from unilateral neglect means the body only recognizes stimuli on the contralesional side; the proposed sensory cues emitted from the experimental device would thus promote the sensory afferent inputs from the contralesional side' p 629
LITERATURE Was relevant background literature reviewed? ☒ Yes ☐ No	**Describe the justification of the need for this study:** Page 629 - Succinct review of the literature: neglect quite common and has serious effects on rehab/recovery. Treatments available often have transient effects / not generalizable to daily life. Sensory cueing with alert device and subsequent limb movement has had some promising results in recent studies, but effect on neglect / function remains to be seen. Pilot study showed combination of cueing from wristwatch device with limb movement to be useful and feasible in treatment improving hemiplegic arm function in chronic stroke and CP (without neglect). Riddock and Humphreys 1994 found improvements in motor but not neglect impairments. Theoretical References;'Interhemispheric rivalry model of spatial attention Robertson (2002)'

DESIGN ☒ Randomized (RCT) ☐ cohort ☐ single case design ☐ before and after ☐ case-control ☐ cross-sectional ☐ case study	**Describe the study design. Was the design appropriate for the study question? (e.g., for knowledge level about this issue, outcomes, ethical issues, etc.):** Multicenter, randomized, sham-controlled pilot investigation, with blinded outcome assessment. Yes, appropriate because efficacy of this treatment not demonstrated yet (ethical to have control group); testing new treatment against no treatment. **Specify any biases that may have been operating and the direction of their influence on the results:** Most biases should have been avoided by rigorous design: use of sham control and blinding of outcome assessors to minimize attention bias, measurement/detection bias. 630 All tests were administered by a research assistant who was blinded to the group assignment. Assessments were carried out without any device present. All patients were tested one day before the treatment started and one day after the treatment ended. Each center had its own independently trained occupational therapists to carry out the treatments according to the study protocol, but they were not blinded to the treatment conditions. Therapists were told to have their patients continue wearing the wristwatch devices during the treatment period. Randomization procedures (pg. 630) should have avoided favoring either group. Patients were randomly assigned to either the experimental group or the sham control in the two occupational therapy departments using computerized random number generators according to random permuted blocks of four. Allocation-to-treatment sequences were concealed from all investigators responsible for carrying out the training or patients involved. Drop outs did occur which reduced power.
SAMPLE N = Was the sample described in detail? ☒ Yes ☐ No Was sample size justified? ☒ Yes ☐ No ☐ N/A	**Sampling (who; characteristics; how many; how was sampling done?) If more than one group, was there similarity between the groups?:** Table 1 shows demographic characteristics (pg. 633); no significant differences between groups except more females and better neglect cancellation scores in group 2 – though neither statistically significant (pg. 632). Neglect scores may be a possible confounding factor. (pg. 636) Inclusion / exclusion criteria described on pg. 630 629 Subacute inpatient stroke patients were recruited by convenience sampling from two rehab hospitals in Hong Kong. Could have provided more explanation of what they meant by this and therefore may be a potential source of selection bias. 630 The sample size of this study was estimated with reference to a pooled analysis of four studies 8,12,27,28 using line bisection in a recent Cochrane's review of spatial neglect following stroke.18 By assuming 80% power at 5% Type I error for one-tailed test, 19 subjects were needed per group to detect significant between group differences with a large effect size of 0.84 after immediate treatment (G*power, Version 3.1.3, University of Kiel, Germany, 2010). Power calculation on page 630 – 19 subjects per group needed. **Describe ethics procedures. Was informed consent obtained?** "Participants gave informed written consent prior to data collection. The study was approved by the Human Ethics Committee of The Hong Kong

<table>
<tr><td></td><td colspan="2">Polytechnic University and two affiliated ethics committees of the Hong Kong Hospital Authority.” Pg 630
No conflicts of interest (pg 636)</td></tr>
<tr><td rowspan="2">OUTCOMES

Were the outcome measures reliable?
☒ Yes
☐ No
☐ Not addressed

Were the outcome measures valid?
☒ Yes
☐ No
☐ Not addressed</td><td colspan="2">Specify the frequency of outcome measurement (i.e., pre, post, follow-up):
One day before treatment started and one day after treatment completed. Week 0 (pretraining – 1 day before), after Week 3 (post training – 1 day after), and Week 6 (follow-up). (pg 630, 631)

Uses a good number of measures and talks about relevance to the Hong Kong population but doesn’t back this up with references. Provides a brief description for some and all have references. But these are well known measures. It was a blind assessor that measured. Measured at 0, 3 and 6 weeks post intervention so not so much long term.</td></tr>
<tr><td>Outcome areas:
Arm impairments
Arm functions
Basic functional performance</td><td>List measures used.
FIM, Functional Independence Measure;
FTHUE, Functional Test for Hemiplegic Upper Extremity; (Referenced and has been validated in Hong Kong by adding culturally relevancy items.)
FMA, Fugl-Meyer Assessment.
Number of times moved

A global declaration that the tools have demonstrated good reliability and validity in Hong Kong samples, but no reference given to this claim. “All of these scales have demonstrated good reliability and validity in Hong Kong samples.” (pg. 631)

Scales are well-described on pg. 631, references provided.</td></tr>
<tr><td>INTERVENTION

Intervention was described in detail?
☐ Yes
☐ No
☐ Not addressed

Contamination was avoided?
☐ Yes
☐ No
☒ Not addressed
☐ N/A</td><td colspan="2">Provide a short description of the intervention (focus, who delivered it, how often, setting). Could the intervention be replicated in practice?
See TIDieR

Patients had own devices therefore unlikely, but not reported.</td></tr>
</table>

Cointervention was avoided? ☐ Yes ☒ No ☐ Not addressed ☐ N/A	Co-intervention was not avoided but it was the same in both groups. Own independent therapist to carry out intervention, but not blinded to treatment conditions. No way of blinding conventional group either.
RESULTS Results were reported in terms of statistical significance? ☒ Yes ☐ No ☐ N/A ☐ Not addressed Were the analysis method(s) appropriate? ☒ Yes ☐ No ☐ Not addressed	**What were the results? Were they statistically significant (i.e., p < 0.05)? If not statistically significant, was study big enough to show an important difference if it should occur? If there were multiple outcomes, was that taken into account for the statistical analysis?** P 631Chi-square tests were used to test for demographic differences between Groups 1 and 2, and t-tests were used to analyse the differences in baseline functionality measures between the two groups. Between-(experimental vs. sham) and within-group differences over time in three repeated-measurement intervals (Week 0, 3, and 6) were evaluated using analysis of variance (ANOVA) for repeated measurements, with the baseline of each outcome measure entered as a covariate. Significance was set to 0.05 (two tailed). P632 Neither the group nor the group-by-occasion interaction effect was statistically significant in the neglect cancellation tasks, the Functional Independence Measure, the FTHUE, and the total score of Fugl-Meyer Assessment. Nevertheless, it should be noted that there were significant within group differences in the FMA hand sub score in the experimental group, but not in the sham group while the between-group differences were not statistically significant. Regarding the mean total movements recorded by the wristband, the upper extremity movements in the experimental group were greater than that of the sham group after wearing the cueing device, but the difference did not reach statistical significance (p = 0.104). The mean gains from baseline in the BIT, the Functional Independence Measure, the FTHUE, and the FMA after intervention (Week 3) and at the Week 6 follow up were greater for the experimental group than the sham control, except for the Functional Independence Measure, which was similar between the two groups. The experimental group improved almost two times more than the sham group in the BIT and the FMA hand score. This difference persisted at Week 6 follow-up. In the FTHUE, for example, the experimental group improved 53%–93%, while the sham group gained 40%–60% (Table 2). **No statistically significant difference between the intervention & control groups for any functional outcome measure (although the experimental group did improve more than the control group on mean FMA hand sub score and FTHUE, this was not statistically significant). Patients in both groups showed a statistically significant improvement from baseline on mean FIM, FTHUE, and FMA upper limb scores. Greater numbers of participants might show a statistically significant outcome, however, power calculation was done and estimated 19 needed in each group to demonstrate a significant difference – though I think this power calculation was based on neglect outcomes not functional (note after dropouts there were 19 in intervention, but only 16 in control group – underpowered & uneven group sizes - see pg. 635-6).** **ANOVA for repeated measurements is used for outcome analysis, with baseline used as a covariate. I think this is appropriate – "mixed**

	between-within ANOVA" is appropriate for 2 or more groups, each measured on 2 or more occasions (ref: SPSS handbook)
Clinical importance was reported? ☐ Yes ☐ No ☒ Not addressed	**What was the clinical importance of the results? Were differences between groups clinically meaningful? (if applicable)** Clinical importance not really directly addressed, though the functional measures themselves give some idea of impact in daily life. Differences between groups not statistically significant, and therefore presumably not clinically significant Improvements may be due to spontaneous recovery (pg. 634)
Drop-outs were reported? ☒ Yes ☐ No	**Did any participants drop out from the study? Why? (Were reasons given and were drop-outs handled appropriately?)** Pg. 631 Intention to treat analysis was conducted The 'last observation carried forward' method was used; that is, if a subject dropped out, missing values were replaced by the last assessment score of that variable. Pg. 632 figure 1 5 drop outs12.5 %. **See Fig 1: 5 dropouts at intervention phase (reasons were given and seem reasonable); An additional 7 lost to follow-up (reasons given, 4 out of 7 "moved away", does this mean discharged from hospital? – moving home seems unlikely?!?)** **Pg. 631: "After removing dropout cases, all available data were analysed in an intention-to-treat analysis. The 'last observation carried forward' method was used; that is, if a subject dropped out, missing values were replaced by the last assessment score of that variable." – although intention-to-treat and last observation method are appropriate, these should be used *on* dropout cases, not *after removing* dropouts. Fig 1 suggests dropouts were not included in the analysis, however Table 2 suggests that only those 5 that dropped out at intervention phase (not follow-up) were excluded from the analysis. Confusing!**
CONCLUSIONS AND IMPLICATIONS Conclusions were appropriate given study methods and results ☒ Yes ☐ No	**What did the study conclude? What are the implications of these results for practice? What were the main limitations or biases in the study?** The experimental group did not show significant improvements in all impairment and functional measures after training or follow up. Not clear if positive effect on ULN was to be attributed to an increase in active motor output, proprioceptive input or both as limb movement itself can act as a cue to activate multiple spatial representations of the contralesional side. Limitations pg. 635 small sample size and drop out, statement the study did not reach the statistical power. Uneven group sizes. Could have done with a pure control. Long term follow-up was not tested for **Mostly appropriate.** **Perhaps make a bit too much of the greater improvement in mean FMA hand subscore and FTHUE in the experimental group, given that there was not a statistically significant difference between the groups.** **Page 635:** **"it was unclear whether sensory cueing and limb activation could help**

	patients with neglect improve their hemiplegic arm function" **"this study did not support the use of sensory cueing and limb activation to improve overall functional performance as measured by the Functional Independence Measure"** **More research needed.** **Limitations are outlined on pg. 635-6:** **Small sample + dropouts, uneven group size** **Baseline differences between groups (gender & neglect cancellation scores)** **Sham device may have improved neglect; addition of 3rd "true" control group would help measure this.** **Short follow up (3 weeks); what are longer term outcomes?**

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Instructions: Use tab or arrow keys to move between fields, mouse or spacebar to check/uncheck boxes.

CITATION	Provide the full citation for this article in APA format: O'Neill and McMillan (2004)
STUDY PURPOSE Was the purpose stated clearly? ☒ Yes ☐ No	**Outline the purpose of the study. How does the study apply to your research question?** To trial the use of LAT in a model more similar to early inpatient rehabilitation (more intensive over shorter duration) and to examine the effect of LAT on hemiplegia p439 By using single N methodology, the temporal order of the effects of LAT on two related symptoms (visual neglect and hemiplegia) could be closely examined in the sub-acute phase after CVA. P439 **Not actually well defined. Assumption that the purpose is to see whether the treatment is effective in acute and more intense way and the effect on hemiplegia;**
LITERATURE Was relevant background literature reviewed? ☒ Yes ☐ No	**Describe the justification of the need for this study:** Motor problems after stroke are compounded by visual inattention and LAT may contribute to rehab of co-occurring hemiplegia (Abstract) Link of unilateral hemineglect and motor problems. Hypothesis that increasing attention may improve rehab outcomes generally pg. 438 Evidence of increasing attention to contralesional side using movement and in particular LAD pg. 438. Previous study that demonstrated no improvement in neglect but significant improvement in hemiplegic limb, suggesting a permanent change could underpin rehab of disability. Pg. 438. Learned nonuse may be counter conditioned in acute and subacute stages pg. 439
DESIGN ☐ Randomized (RCT) ☐ cohort ☒ single case design ☐ before and after ☐ case-control ☐ cross-sectional ☐ case study	**Describe the study design. Was the design appropriate for the study question? (e.g., for knowledge level about this issue, outcomes, ethical issues, etc.):** By using single N methodology, the temporal order of the effects of LAT on two related symptoms (visual neglect and hemiplegia) could be closely examined in the sub-acute phase after CVA. P439 Baseline intervention (AB) design rather than a bassline-intervention-baseline (ABA) design (ref given) was used because the effects of limb activation treatment were not expected to return to baseline. **Specify any biases that may have been operating and the direction of their influence on the results:** Attempts were made to assign patient to baseline period of 1,2 or 3 weeks are random by the OT using brown envelope concealment. The assessor was blind to the onset of LAT. No control was used as is the case with single subject design and instead it is recognized they act as their own control during baseline. Sample bias Measurement bias

<table>
<tr><td></td><td colspan="2">Intervention bias</td></tr>
<tr><td>SAMPLE

N =
Was the sample described in detail?
☐ Yes
☒ No

Was sample size justified?
☐ Yes
☐ No
☒ N/A</td><td colspan="2">Sampling (who; characteristics; how many; how was sampling done?) If more than one group, was there similarity between the groups?:
Only very brief summary of patient characteristics were given i.e. no objective accounts of impairments. Not really clear what the 67-post lesion assessment is referring to and what had been his rehab journey prior to 67 days. P439
There is no information pertaining to the population from which patient was sampled or how the patient was recruited. P 439

Describe ethics procedures. Was informed consent obtained?:
Ethics approval was obtained from the research ethics committee of the south Glasgow University Hospitals NHS Trust. P 439
The participants gave written informed consent p439</td></tr>
<tr><td rowspan="2">OUTCOMES

Were the outcome measures reliable?
☒ Yes
☐ No
☐ Not addressed

Were the outcome measures valid?
☒ Yes
☐ No
☐ Not addressed</td><td colspan="2">Specify the frequency of outcome measurement (i.e., pre, post, follow-up):
3times per week (Motricity index)
Pre-post treatment (BI)</td></tr>
<tr><td>Outcome areas:
Contralesional limb impairment
General disability</td><td>List measures used.:
Motricity Index (reference and description given)
Barthel index (reference given)</td></tr>
<tr><td>INTERVENTION

Intervention was described in detail?
☐ Yes
☒ No
☐ Not addressed

Contamination was avoided?
☐ Yes
☐ No
☐ Not addressed
☒ N/A

Cointervention was avoided?
☐ Yes
☒ No
☐ Not addressed
☐ N/A</td><td colspan="2">Provide a short description of the intervention (focus, who delivered it, how often, setting). Could the intervention be replicated in practice?
See TIDieR.

LAT was used as part of OT rehab sessions, although what this consisted of is unclear and no mention of other therapy such as PT.
In discussion highlights that patient had an art class pg. 444
Examined LAT as an adjunct to ‘rehab as usual’ for participant with left sided weakness and visual neglect following stroke.</td></tr>
</table>

RESULTS Results were reported in terms of statistical significance? ☒ Yes ☐ No ☐ N/A ☐ Not addressed Were the analysis method(s) appropriate? ☒ Yes ☐ No ☐ Not addressed	**What were the results? Were they statistically significant (i.e., p < 0.05)? If not statistically significant, was study big enough to show an important difference if it should occur? If there were multiple outcomes, was that taken into account for the statistical analysis?** Motricity index – arm – no sig overall change baseline to post intervention. But significant change in slope indicates a change in rate of recovery between phases. No sig change for shoulder, forearm or grip. Not very clear and can't read the graph easily. BI – Improvement from 55/100 pre-treatment and 85/100 post treatment. No statistical measure used The analysis methods are explained and justified. Pg. 441
Clinical importance was reported? ☒ Yes ☐ No ☐ Not addressed	**What was the clinical importance of the results? Were differences between groups clinically meaningful? (if applicable)** Only that improvements in transfer, bathing, dressing and walking were seen in the BI. But this doesn't really add any information. P445 see
Drop-outs were reported? ☐ Yes ☐ No	**Did any participants drop out from the study? Why? (Were reasons given and were drop-outs handled appropriately?)** Only one patient treated, and he did not drop out N/A
CONCLUSIONS AND IMPLICATIONS Conclusions were appropriate given study methods and results ☒ Yes ☐ No	**What did the study conclude? What are the implications of these results for practice? What were the main limitations or biases in the study?** There may have been a delayed or time lagged improvement pg. 444. These findings could suggest a modest treatment effect of limb activation, although this is difficult to determine given the difficulty ascribing cause to the sizeable improvements in activities of daily living. Discussion of theory pg. 444 Improvements in function may have been due to improved left sided awareness and or use, although there is no direct evidence for this interpretation The effect of LAT on the trajectory of motor recovery is clinically important in preventing learned non use. LAT may serve as an interim step before people can benefit from CIMT. This is suggested as a direction for future research Limitations pg. 445 spontaneous recovery is difficult to control for in general rehab studies. Attempts were made by starting at day 67. would have benefited from control Blinding mishap Did not investigate relationships between fractionation of neglect and LAT, measures of outcome focusing on personal (motor movement\) and peri-personal (neglect measures) space

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Instructions: Use tab or arrow keys to move between fields, mouse or spacebar to check/uncheck boxes.

CITATION	Provide the full citation for this article in APA format: Maddicks, Marzillier and Parker (2003)
STUDY PURPOSE Was the purpose stated clearly? ☒Yes ☐ No	**Outline the purpose of the study. How does the study apply to your research question?** Unilateral neglect has been shown to dissociate into three areas of space: personal, peri-personal, and locomotor. Robertson, Hogg, and McMillan (1998) showed that movement of the contralesional limb (limb activation therapy) reducedneglectinapatient18monthsafterbraininjury.However, the beneficial effects of treatment were only maintained in peri-personal space. This study replicated and extended the work of Robertson et al. (1998) to evaluate limb activation therapy at a more acute stage of recovery (Abstract) The present study is an extension and replication of the study reported by Robertson et al. (1998). Using a single-case design, the effect of limb activation p 393 Therapy on unilateral neglect in the three spatial domains will be investigated. Our first hypothesis is that limb activation therapy will be effective at an earlier stage of recovery. It is well documented that there is an acute phase of recovery after brain damage, where the majority of spontaneous recovery will occur. Robertson et al (1998) report the effect of limb activation therapy on a patient 18months post-injury, where a great deal of the functional recovery will have already occurred. The present study investigates the effect of limb activation therapy on a patient at a far earlier stage in his rehabilitation (8 weeks post stroke). An ABABA design was adopted to differentiate the effects of limb activation from those due to other therapies or spontaneous recovery. Our second hypothesis is that improvements in neglect were not maintained in personal and locomotor space in the Robertson et al. (1998) study due to inherent task difficulty rather than the nature of the spatial domains. This study will follow a similar method to Robertson et al (1998), but used different tasks to measure neglect in the three spatial domains. The likelihood of different tasks having the same inherent level of difficulty is fairly small. Therefore, we would not expect improvements only to be maintained in peri-personal space. Our third hypothesis is that limb activation therapy will lead to improvements in neglect behavior in daily life. A function measure of neglect, the Catherine Bergego Scale (CBS; Azouvietal., 1996; Bergegoetal., 1995) was completed at the beginning and the end of the study to assess whether improvements had been made.
LITERATURE Was relevant background literature reviewed? ☒ Yes ☐ No	**Describe the justification of the need for this study:** Disorder of attention in three areas of space. Visual scanning can be unsuccessful and fail to generalize. Explanation of development of LAT. Robertson has drawn on work by Rizzolattii. Posits multiple frames of reference that can be electively impaired. The spatial system is vitally important in making purposeful movements in space. Left hand movement activates attention to the space the movement occurs in and the activation of both personal and peri-personal system may be necessary to reach the activation necessary to

	reduce neglect. It works because it actives the motor circuits in the damaged hemsphere and counteracts the inhibitory competition from the undamaged hemisphere demonstrated indicates. Discuss previous evidence for LAD.	
DESIGN ☐ Randomized (RCT) ☐ cohort ☒ single case design ☐ before and after ☐ case-control ☐ cross-sectional ☐ case study	Describe the study design. Was the design appropriate for the study question? (e.g., for knowledge level about this issue, outcomes, ethical issues, etc.): ABABA design on order to try and differentiate between effects of the treatment and improvement due to normal therapy and spont recovery. **Specify any biases that may have been operating and the direction of their influence on the results:** The patients OT completed this assessment at beginning and end of study. Not clear if they were blind, No mention of blinding to intervention.	
SAMPLE N = Was the sample described in detail? ☒ Yes ☐ No Was sample size justified? ☐ Yes ☒ No ☐ N/A	**Sampling (who; characteristics; how many; how was sampling done?) If more than one group, was there similarity between the groups?:** P395 Not clear how he was chosen **Describe ethics procedures. Was informed consent obtained?:** No ethics and no consent reported	
OUTCOMES Were the outcome measures reliable? ☒ Yes ☐ No ☐ Not addressed Were the outcome measures valid? ☒ Yes ☐ No ☐ Not addressed	**Specify the frequency of outcome measurement (i.e., pre, post, follow-up):** Beginning and end	
	Outcome areas:	**List measures used.:** CBS Reference provided and mentions reliability and validity. And describes it. And anosognosia
INTERVENTION Intervention was described in detail? ☒ Yes ☐ No ☐ Not addressed Contamination was avoided? ☐ Yes ☐ No	**Provide a short description of the intervention (focus, who delivered it, how often, setting). Could the intervention be replicated in practice?** See TIDieR	

☐ Not addressed ☒ N/A Cointervention was avoided? ☐ Yes ☒ No ☐ Not addressed ☐ N/A	
RESULTS Results were reported in terms of statistical significance? ☐ Yes ☐ No ☒ N/A ☐ Not addressed Were the analysis method(s) appropriate? ☒ Yes ☐ No ☐ Not addressed	**What were the results? Were they statistically significant (i.e., $p < 0.05$)? If not statistically significant, was study big enough to show an important difference if it should occur? If there were multiple outcomes, was that taken into account for the statistical analysis?** No change Stats not really applicable
Clinical importance was reported? ☐ Yes ☐ No ☒ Not addressed	**What was the clinical importance of the results? Were differences between groups clinically meaningful? (if applicable)**
Drop-outs were reported? ☐ Yes ☐ No	**Did any participants drop out from the study? Why? (Were reasons given and were drop-outs handled appropriately?)** NA
CONCLUSIONS AND IMPLICATIONS Conclusions were appropriate given study methods and results ☒ Yes ☐ No	**What did the study conclude? What are the implications of these results for practice? What were the main limitations or biases in the study?** Limited evidence that LAT would have an effect in the acute phase of rehab Improvements persisted in peri-personal space due to nature of tasks rather than the spatial domain The improvements in neglect shown in the locomotor and briefly in the peri-personal spatial domains did not lead to an improvement I neglect in daily life tasks. Difficulty due to it being in the acute phase Limitations Pg. 404 influence of confounding variables intrinsic in the acute period spontaneous recovery. Patient had left sided hemianopia Intensive rehab therefore shorter sessions than seen on other studies. Lower limb rather than upper limb Not at same time as other therapies as in previous studies. Did not use a combo

	of movement and limb anchoring which has been successful in others. Coin task was not sufficient to measure what was needed Provides tentative support Look for Duhamel and Brouchon 1990 sensorimotor aspects of unilateral neglect: a single case analysis cognitive neuropsychology

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CITATION	**Provide the full citation for this article in APA format:** Bailey, Riddoch and Crome (2002)
STUDY PURPOSE Was the purpose stated clearly? ☒ Yes ☐ No	**Outline the purpose of the study. How does the study apply to your research question?** The presence of unilateral visual neglect (UVN) may adversely affect functional recovery and rehabilitation strategies that are practical for use in clinical settings are needed. The purpose of this study was to evaluate the use of 2 approaches to reduce UVN in people who have had strokes. (Abstract)
LITERATURE Was relevant background literature reviewed? ☒ Yes ☐ No	**Describe the justification of the need for this study:** Treatments involving artificial manipulation of proprioception or vision has only demonstrated immediate effects and not long-term carryover. They also often require specified equipment and therefore do not easily lend themselves to the application in real life clinical situations Sustained attention training appears to be effective, but these devices require a degree of insight, memory and cooperation. More practical techniques may be visual scanning and cueing (LAT). Scanning encourages attention and cueing, either from trainer or self-generated, facilitates direction of attention. Pg. 783 Further detail provided pg. 784 It could have been clearer.
DESIGN ☐ Randomized (RCT) ☐ cohort ☒ single case design ☐ before and after ☐ case-control ☐ cross-sectional ☐ case study	**Describe the study design. Was the design appropriate for the study question? (e.g., for knowledge level about this issue, outcomes, ethical issues, etc.):** Considered a SCED to be an appropriate design for subjects in a rehab setting due to the heterogeneity of the visual neglect syndrome and other features of stroke such as movement ability and level of sensation which can be confounding variables in group studies. A nonconcurrent, multiple baseline across subject's design was chosen because it was not possible to obtain more than one subject for study at any one-time pg. 786 **Specify any biases that may have been operating and the direction of their influence on the results:** Patients were randomly assigned to a 2,3 or 4 week baseline phase as they became available for evaluation. Varying the length of the first baseline phase controls of some threats to internal validity because factors such as history, maturation and the possibility of spontaneous recovery and is also appropriate when withdrawal of the interventions might not result in the outcome behavior returning to baseline levels p 786 The therapists were aware of the presence of visual neglect in all subjects, and although treatment focused on this problem was not given to the patient, all subjects were encouraged to look toward their neglected side during activities such as dressing, self-care and physical rehab exercises.

<table>
<tr><td></td><td>Testing procedures were not directly used for intervention, nor were intervention procedures implemented during testing.
Pg. 786 for logistical reasons, the same person undertaking the training, which normally occurred on alternate weekdays, assessed the first 2 subjects (subjects 1 and 2). To reduce the possibility of observer bias, all testing sessions for UVN for these 2 subjects were videotaped and later independency analyzed in an effort to ensure that test admonition was standardized. For all other subjects, testing and training were carried out by 2 different individuals, and the assessor was masked to which phase of the single-subject design was in effect in each test session.</td></tr>
<tr><td>SAMPLE

N =
Was the sample described in detail?
☒ Yes
☐ No

Was sample size justified?
☐ Yes
☒ No
☐ N/A</td><td>Sampling (who; characteristics; how many; how was sampling done?) If more than one group, was there similarity between the groups?:
Characteristics table 1 p786. 2 patients underwent the LLA. 1 male 72 years, 20 days post stroke. Large MCA. 1female, 60years, right parietal infarct, 13 days post stroke.
Although patients separated into groups the groups were not being compared to each other, but to separately evaluate the efficacy of each approach in the clinical setting. Treatment group was chosen due to available limb movement. P 786
Case study characteristics provided in results section p 792
P793 although slightly act as own control there was no control and therefore treatment can’t be definitely not due to spontaneous recovery
They haven’t justified. However, over 12months. But justification of wider population.

Describe ethics procedures. Was informed consent obtained?:
All subjects were given written and verbal explanations about the study, and all subjects gave written informed consent before taking part in the study. P 789</td></tr>
<tr><td>OUTCOMES

Were the outcome measures reliable?
☒ Yes
☐ No
☐ Not addressed

Were the outcome measures valid?
☒ Yes
☐ No
☐ Not addressed</td><td>Specify the frequency of outcome measurement (i.e., pre, post, follow-up):
Functional test were undertaken weekly

Outcome areas:
Mobility
Activities of daily living

Stroke severity

List measures used.:
Rivermead Mobility Index
Barthel index
These two tests were chosen to reflect different aspects of everyday function
Canadian Neurological Scale

All these tests have been validated for use in elderly patients with stroke and have demonstrated good to excellent reliability (kappa>.6) in patients. References provided.</td></tr>
<tr><td>INTERVENTION

Intervention was described in detail?
☐ Yes
☐ No</td><td>Provide a short description of the intervention (focus, who delivered it, how often, setting). Could the intervention be replicated in practice?
See TIDieR</td></tr>
</table>

☐ Not addressed Contamination was avoided? ☐ Yes ☐ No ☐ Not addressed ☒ N/A Cointervention was avoided? ☐ Yes ☒ No ☐ Not addressed ☐ N/A	N/A All received usual OT and PT on ward throughout all phases. 30mins 5days week. Pg. 786.
RESULTS Results were reported in terms of statistical significance? ☐ Yes ☐ No ☒ N/A ☐ Not addressed Were the analysis method(s) appropriate? ☒ Yes ☐ No ☐ Not addressed	**What were the results? Were they statistically significant (i.e., p < 0.05)? If not statistically significant, was study big enough to show an important difference if it should occur? If there were multiple outcomes, was that taken into account for the statistical analysis?** Because there were only 3 data points for each of these tests per phase, insufficient for subsequent inferential analysis, the data will be presented descriptively. Tests of sensation, function, mobility, or stroke severity were examined to determine whether any score change coincided with phase change (ie, between the Al and B phases and the B and A2 phases). Subject 6; ere changes in scores in severity, function, mobility, and sensation, only changes in the BI and the light touch scores were coincide with the change from the Al phase to the B phase. The increase in BI scores from 30 lo 45 was due to improvements in continence, dressing ability, and balance (ability to transfer with help). Improvements continued during the A2 phase. Light touch appreciation improved from 14 to 17 in the forearm and hand during the B phase, and improvement was maintained during the A2 phase. He reported that he was now able to find medications and refreshments placed on the table in front of him or to his left, which previously he had missed. P792 Subject 7 Table 6 indicates that, although there were some changes in function and mobility scores (BI and RMI), these were not coincident with change from the Al phase to the B phase. She reported that she was how able to find medications and refreshments placed on the table in front of her or to her left, which previously she had missed. P793
Clinical importance was reported? ☒ Yes ☐ No ☐ Not addressed	**What was the clinical importance of the results? Were differences between groups clinically meaningful? (if applicable)** They used functional outcomes in order to test for this.
Drop-outs were reported? ☐ Yes ☐ No	**Did any participants drop out from the study? Why? (Were reasons given and were drop-outs handled appropriately?)** Subject 7 received only 7 of the 10 planned intervention sessions. This is not justified. Although the patient was discharged early during A2 which may have had some bearing. Because the results are presented as individual cases this does not interfere with the reporting of the results although may need to be considered in intervention reporting

CONCLUSIONS AND IMPLICATIONS Conclusions were appropriate given study methods and results ☒ Yes ☐ No	**What did the study conclude? What are the implications of these results for practice? What were the main limitations or biases in the study?** Both the patients receiving LAT demonstrated reduced VSN P 795. LAT may work due to motor stim, or activation of left personal space system. We believe that the limb activation approach used in this study was more functionally based than the approaches used in many previous studies, including the use of finger tapping"* or turning off a buzzer activated at random intervals/'^ p 795 This study demonstrated a lack of generalization to functional tests. Although subject 6 demonstrated improvements in BI and both demonstrated improved ability to find objects and ? use left upper limb.

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CITATION	**Provide the full citation for this article in APA format:** Samuel et al (2000)
STUDY PURPOSE Was the purpose stated clearly? ☒ Yes ☐ No	**Outline the purpose of the study. How does the study apply to your research question?** To investigate the effect of spatio-motor cueing on neglect and generalizability to daily life activities in severe neglect Assessing the efficacy of visuo-spatial-moto-cueing, particularly the generalization to daily life activities in patients who had failed to improve with visual scanning training
LITERATURE Was relevant background literature reviewed? ☒ Yes ☐ No	**Describe the justification of the need for this study:** History of development of LAT. Pages 385-8: evidence is still inconclusive as to effectiveness of various neglect treatments, especially in generalizability of effects to daily living. There is some evidence of effectiveness of spatio-motor cueing / visuo-motor cueing / limb activation but not in very severe intractable neglect nor in outcomes related to activities of daily living.
DESIGN ☐ Randomized (RCT) ☐ cohort ☒ single case design ☐ before and after ☐ case-control ☐ cross-sectional ☐ case study	**Describe the study design. Was the design appropriate for the study question? (e.g., for knowledge level about this issue, outcomes, ethical issues, etc.):** Single-case ABAB design (A=baseline/no treatment, B=intervention). Appropriate, pragmatic design for 'real-life' clinical setting and an intervention that has not been well researched in severe neglect. Single-case experimental designs give fine-graded information about the process of change, instead of focusing on the presence or absence of effects in larger group studies. Such designs differ from anecdotal case reports in that they attempt to control for non-specific effects related to spontaneous improvement and believed-in efficacy. In neuropsychological rehabilitation most single-case designs use withdrawal or multiple-baseline strategies (Wilson, 1987). Whereas multiple baseline designs focus on differential effects on different dependent variables such as various target behaviors or different subjects (Wilson, 1987), withdrawal designs address the question of whether presence or absence of treatment is critical to evoke and to diminish therapeutic effects (on–off rationale). A withdrawal ABAB design was used in the present study, to which a late follow-up was added. **Specify any biases that may have been operating and the direction of their influence on the results:** Difficult to tell whether any effects are due to the intervention itself or other factors (no control group); however, the ABAB design and stable/intractable nature of the neglect minimize this. Selection bias? not sure how participants were selected over other patients

	OT doing Bergego assessment was aware of intervention (possible source of bias), but not of neglect results. Patients had received a period of rehab prior to commencing on this study. This included physio, OT and SALT five times a week where neglect and anosognosia were specifically addressed during all therapeutic sessions. ? if this can be classed as cointervention None of the tasks used as assessment measures was used in rehabilitation. During the baseline period patients continued to receive visual scanning training by all therapists with the same duration as period B but without left arm activation. Outcome measure was scored by the OT who was blind to the results of paper and pencil tests but not to intervention. Not clear if it is the same therapist that conducted the intervention.
SAMPLE N = Was the sample described in detail? ☒ Yes ☐ No Was sample size justified? ☐ Yes ☐ No ☒ N/A	**Sampling (who; characteristics; how many; how was sampling done?) If more than one group, was there similarity between the groups?:** Detailed description of individual participant(s) (page 389) Selection bias: not sure how participants were selected over other patients (?may be the only 2 patients at that institution with severe intractable neglect?) N/A patients were chosen based on their difficulties in previous rehab. **Describe ethics procedures. Was informed consent obtained?:** **"**patients and their families were informed of the experimental nature of the trial and gave their consent to participate." (page 388) No further ethics procedures / approval reported. Reason / justification for sample size not really discussed (presumably pragmatic), though see discussion of choice of single-case study design on page 388
OUTCOMES Were the outcome measures reliable? ☐ Yes ☐ No ☒ Not addressed Were the outcome measures valid? ☐ Yes ☐ No ☒ Not addressed	**Specify the frequency of outcome measurement (i.e., pre, post, follow-up):** Admission to rehab (4 months pre-intervention); start of trial (baseline); 1 month (i.e. immediately after 1st intervention); 2 months (immediately after 2nd intervention); 3 months (i.e. 1 month after end of trial). Page 391 / 394 That the CBS scores were stable for 3 months before intervention, then improved, across both patients, and in parallel with neglect assessments, may suggest an element of reliability and validity (? Or bias?!).

Outcome areas:	**List measures used.:**
activities of daily living	Catherine Bergego Scale (page 387)

		An established outcome measure for neglect-related behaviours, has presumably been tested for reliability & validity, though the authors of this study do not report/discuss this. References are provided.(see page 387-8)
INTERVENTION Intervention was described in detail? ☐ Yes ☐ No ☐ Not addressed Contamination was avoided? ☐ Yes ☐ No ☐ Not addressed ☒ N/A Cointervention was avoided? ☐ Yes ☒ No ☐ Not addressed ☐ N/A	**Provide a short description of the intervention (focus, who delivered it, how often, setting). Could the intervention be replicated in practice?** See TIDieR Contamination N/A as no control group Patient continued visual scanning training (without limb activation) during baseline periods (page 390). Had received 3 months "conventional rehab" (also including visual scanning I think) before trial started; not clear whether this also continued during trial period (seems likely; in which case, any improvement during trial period likely due to new/additional experimental intervention) (pg. 389)	
RESULTS Results were reported in terms of statistical significance? ☐ Yes ☐ No ☒ N/A ☐ Not addressed Were the analysis method(s) appropriate? ☒ Yes ☐ No ☐ Not addressed	**What were the results? Were they statistically significant (i.e., $p < 0.05$)? If not statistically significant, was study big enough to show an important difference if it should occur? If there were multiple outcomes, was that taken into account for the statistical analysis?** CBS results not reported in terms of statistical significance, however this is because "For practical reasons, the Catherine Bergego Scale was only performed at the end of each AB treatment pair, and it was not possible to make statistical analysis on these data to differentiate between effects of treatment and baseline" (pg. 396, pg. 392) – I have therefore judged narrative/descriptive analysis to be appropriate.	
Clinical importance was reported? ☒ Yes ☐ No ☐ Not addressed	**What was the clinical importance of the results? Were differences between groups clinically meaningful? (if applicable)** CBS outcome measure included specifically to address impact on daily life. (pg. 387, 395), however clinical importance of CBS results is not discussed further	

Drop-outs were reported? ☐ Yes ☐ No	**Did any participants drop out from the study? Why? (Were reasons given and were drop-outs handled appropriately?)** N/A – no drop-outs, only 1 (2) participant(s)
CONCLUSIONS AND IMPLICATIONS Conclusions were appropriate given study methods and results ☒ Yes ☐ No	**What did the study conclude? What are the implications of these results for practice? What were the main limitations or biases in the study?** Improvement in neglect behavior (CBS) parallel to neglect scores improvement, partly maintained at 1-month follow-up. However, neglect did not disappear and was still quite severe. (pg. 397) Visuo-spatio-motor cueing found to be quite an easy method, though patient 2 required therapist prompting (pg. 397) "may help to reduce, at least in part, the clinical consequences of unilateral neglect." – Appropriately cautious conclusion given limitations of study and limited improvement. Would like to see a bit more discussion of clinical / practical (and research) implications. Single case methodology has some limitations, e.g. may not demonstrate effect that takes several sessions to become apparent. (pg. 396). No further discussion of limitations or bias.

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CITATION	**Provide the full citation for this article in APA format:** Harding and Riddoch (2009)
STUDY PURPOSE Was the purpose stated clearly? ☒ Yes ☐ No	**Outline the purpose of the study. How does the study apply to your research question?** To report the long-term impact of FES on neglect.
LITERATURE Was relevant background literature reviewed? ☒ Yes ☐ No	**Describe the justification of the need for this study:** There is controversy whether passive movements are effective, suggests FES may be a cost-effective adjunct.
DESIGN ☐ Randomized (RCT) ☐ cohort ☒ single case design ☐ before and after ☐ case-control ☐ cross-sectional ☐ case study	**Describe the study design. Was the design appropriate for the study question? (e.g., for knowledge level about this issue, outcomes, ethical issues, etc.):** A multiple baseline across subject approach, with an ABA treatment with drawl single subject experimental design **Specify any biases that may have been operating and the direction of their influence on the results:** The Rehab therapists were not involved in the research Blind assessments were not feasible in this study. In an attempt to reduce bias, the therapy team did not discuss any findings until all the participants had completed the trial. No blinding to intervention
SAMPLE N = Was the sample described in detail? ☒ Yes ☐ No Was sample size justified? ☐ Yes	**Sampling (who; characteristics; how many; how was sampling done?) If more than one group, was there similarity between the groups?:** 4 patients. No details about wider population that they were recruited from. Each subject was described. Not really reported on **Describe ethics procedures. Was informed consent obtained?:** All gave informed consent No mention of ethics

<table>
<tr><td>☒ No
☐ N/A</td><td colspan="2"></td></tr>
<tr><td>OUTCOMES

Were the outcome measures reliable?
☒ Yes
☐ No
☐ Not addressed

Were the outcome measures valid?
☒ Yes
☐ No
☐ Not addressed</td><td colspan="2">Specify the frequency of outcome measurement (i.e., pre, post, follow-up):
Bassline of global and weekly assessments (A1). During intervention (B1 ipsilitional and B2 contra lesional) all weekly assessments were undertaken weekly. At end of treatment phases (A2) global assessments were repeated</td></tr>
<tr><td></td><td>Outcome areas:

All had references but none had justification for choice</td><td>List measures used.:
Global Assessments
BIT, Picture naming test, line bisection test, baking tray test, Rivermead Motor Assessment, sensory assessment, barthel index

Weekly assessments;
Star cancellation test, picture naming test, line bisection test, baking tray test</td></tr>
<tr><td>INTERVENTION

Intervention was described in detail?
☒ Yes
☐ No
☐ Not addressed

Contamination was avoided?
☐ Yes
☐ No
☐ Not addressed
☒ N/A

Cointervention was avoided?
☐ Yes
☒ No
☐ Not addressed
☐ N/A</td><td colspan="2">Provide a short description of the intervention (focus, who delivered it, how often, setting). Could the intervention be replicated in practice?
See TIDieR

N/A

PT and OT</td></tr>
</table>

RESULTS Results were reported in terms of statistical significance? ☒ Yes ☐ No ☐ N/A ☐ Not addressed Were the analysis method(s) appropriate? ☐ Yes ☐ No ☒ Not addressed	**What were the results? Were they statistically significant (i.e., p < 0.05)? If not statistically significant, was study big enough to show an important difference if it should occur? If there were multiple outcomes, was that taken into account for the statistical analysis?** BI – 3 demonstrated statistical improvement Rivermead gross function – 2 demonstrated statistical improvement Rivermead Leg and trunk – 2 improved statistically Rivermead arm – 1 improved significantly Those that improved tended to hit a ceiling – and the two that did well already had good arm and leg function McNemar Chi-Square No justification given Not enough data sets used to perform
Clinical importance was reported? ☒ Yes ☐ No ☐ Not addressed	**What was the clinical importance of the results? Were differences between groups clinically meaningful? (if applicable)** One patient was described to have improved with leg and walking and post treatment was completely self-caring and able to compensate for reduced hand function.
Drop-outs were reported? ☐ Yes ☐ No	**Did any participants drop out from the study? Why? (Were reasons given and were drop-outs handled appropriately?)** N/A
CONCLUSIONS AND IMPLICATIONS Conclusions were appropriate given study methods and results ☐ Yes ☒ No	**What did the study conclude? What are the implications of these results for practice? What were the main limitations or biases in the study?** They conclude that ¾ patients responded to FES with improved neglect or physical scores. The patient who demonstrated very severe neglect showed no improvements. They state that it is unlikely that improvements were due to spontaneous recovery or other rehab. They do contradict in that patients were recruited due to poor baseline scores, however they all had preserved motor and sensory functions. Speculate that the right hemisphere may have a dominant role in body schema and therefore FES may have worked on visual and body schema. May have similar mechanism to prisms. Therefore, both of which demonstrate linger term effects No discussion of clinical implications No limitations provided. Not sure there justified

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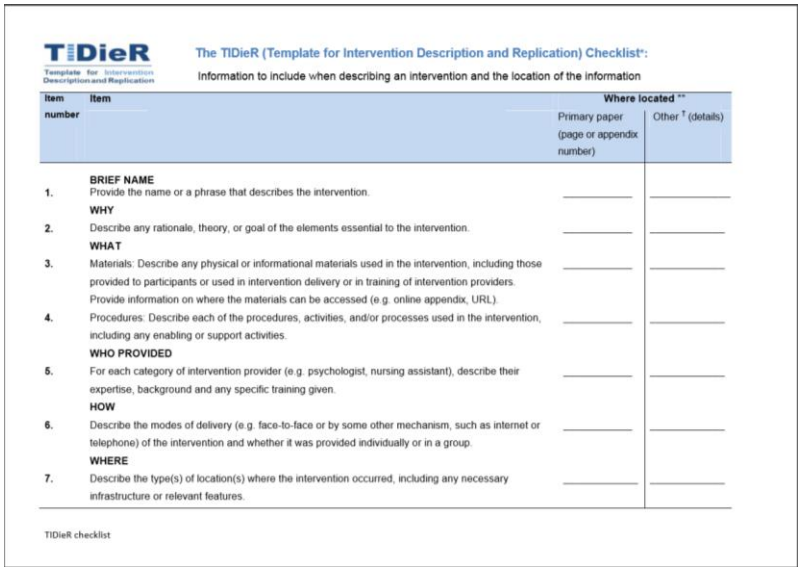
CITATION	**Provide the full citation for this article in APA format**: Luukkainen-Markkula et al. (2009)
STUDY PURPOSE Was the purpose stated clearly? ☒ Yes ☐ No	**Outline the purpose of the study. How does the study apply to your research question?** Is arm activation alone sufficient to produce a long-lasting amelioration of neglect comparable to the effect obtained with traditional visual or other simultaneous functional training, could be sufficient to produce a long lasting amelioration of neglect comparable to the effect obtained with traditional visual training. (Abstract and literature review pg. 664) We also studied, if the arm activation improves the motor function of the affected arm as has previously been shown in studies of the CIMT training of chronic stroke patients
LITERATURE Was relevant background literature reviewed? ☒ Yes ☐ No	**Describe the justification of the need for this study**: Identifies previous studies and the development of limb activation technique. There are studies already that have demonstrated that limb activation can impact on both neglect and motor function. Does not link to any theories to explain the intervention effect.
DESIGN ☒ Randomized (RCT) ☐ cohort ☐ single case design ☐ before and after ☐ case-control ☐ cross-sectional ☐ case study	**Describe the study design. Was the design appropriate for the study question? (e.g., for knowledge level about this issue, outcomes, ethical issues, etc.):** Design not stated but implied: Randomization using brown envelope concealment. **Specify any biases that may have been operating and the direction of their influence on the results:** No mention of blinding during randomization. Do state that people who scored and, in some cases, conducted the assessments were not the same as the treatment therapists Small study size, not stat sig but rob not appropriate. One of the AA group could only participate in bedside activities during the fort week of rehab. Blinding to outcome was not reported for all measures
SAMPLE N = Was the sample described in detail?	**Sampling (who; characteristics; how many; how was sampling done?) If more than one group, was there similarity between the groups?** States that over 3 years 28 patients referred to a local rehab centre for rehab with first right hemispheric stroke were screened for neglect within their first 6months. It is not clear what the population form which they were

☒ Yes ☐ No Was sample size justified? ☐ Yes ☒ No ☐ N/A	recruited from. Different diagnosis procedures depending if under or over 3months. No justification of this. 12 patients ultimately included; 12 did not meet criteria, 2 declined, 1 was too tired and 1 was excluded due to left handiness. Table of demographics of two groups was provided. The limb activation group had a wider range of times since onset but a lower average by 14days. Visual scanning group had milder sensory and visual impairments. Whilst LLA group had more severe and lower motor functional scores. **Describe ethics procedures. Was informed consent obtained?:** Provided informed consent p 665 The local ethical committee had approved the study So, the sample was unclear and there were quite potentially significant differences between the groups. The activation group had less ability to move and the visual scanning group, less ability to scan. Some outcome measures were blind, but others are not reported
OUTCOMES Were the outcome measures reliable? ☒ Yes ☐ No ☐ Not addressed Were the outcome measures valid? ☒ Yes ☐ No ☐ Not addressed	**Specify the frequency of outcome measurement (i.e., pre, post, follow-up):** Pre-rehab, after the three-week intervention, 6month follow up. They are named, and reference provided, but no mention of validity and reliability one or two is a little described and mention that it is well known. Many different people performed the different measures but not clear about whether they were blinded.
	Outcome areas: Motor disability Depression General functional status Visual neglect Behavioral neglect Motor recovery Motor performance
	List measures used.: Modified Rankin Scale (neurologist at start only) Beck depression Inventory (by patients at start and FU) Functional Independence measure ? who) Behavioral Inattention test Catherine Bergego Scale (OT? IF BLIND) Modified Motor Assessment Scale (by a PT. one person conducted the test and the scoring was performed simultaneously by another trained person not involved in other parts of the study following published criteria). Hand grip force Wolf Motor Function Test
INTERVENTION Intervention was described in detail? ☒ Yes ☐ No ☐ Not addressed	**Provide a short description of the intervention (focus, who delivered it, how often, setting). Could the intervention be replicated in practice?** See TIDieR Three participants with less than 3months from stroke onset received 18 hours of physio and 21 hours AA. Three patients who had 3-6months from stroke received 10 hours physio and 30 hours of AA. VS group received 10 hours of visual scanning.

Contamination was avoided? ☒ Yes ☐ No ☐ Not addressed ☐ N/A Cointervention was avoided? ☐ Yes ☒ No ☐ Not addressed ☐ N/A	Both groups received similar amount of physio hours but this contradicts above. VS recived more OT p 0.01. Aa GROUP RECOVED 0.2 = 0.4 (0-1) hours VS. cointervention p = 0.00 But VS group was also planned to have 1-hour PT and 1 hour OT. Yes of visual scanning. Not justified in text but in table. Patients received PT and OT alongside intervention.
RESULTS Results were reported in terms of statistical significance? ☒ Yes ☐ No ☐ N/A ☐ Not addressed Were the analysis method(s) appropriate? ☒ Yes ☐ No ☐ Not addressed	**What were the results? Were they statistically significant (i.e., p < 0.05)? If not statistically significant, was study big enough to show an important difference if it should occur? If there were multiple outcomes, was that taken into account for the statistical analysis?** Due to lack of normality, non-parametric tests were used Fishers exact test (exact significance, 2 sided) Other group comparisons by the non-parametric Mann Whitney test using exact significance Freidman rank analysis of variance *(exact test) Wilcoxen signed ranks test (exact test, 2tailed) Spearman's correlations Level of significance was set at 0.05 CBS sig improvement. FIM sig improvement, MMAS almost sig Potentially fishing post hoc analysis. Small group of 6 and one of these couldn't participate. To small a number to state them as significantly different. Do not explain that calculations were altered to account for the 1 patient in AA group that couldn't participate in first week. Thus, further diminishing the number of participants. There were discrepancies in the data in tables to text.
Clinical importance was reported? ☐ Yes ☐ No ☒ Not addressed	**What was the clinical importance of the results? Were differences between groups clinically meaningful? (if applicable)** Results were discussed in terms of statistical significances but not if this was clinically meaningful
Drop-outs were reported? ☒ Yes ☐ No	**Did any participants drop out from the study? Why? (Were reasons given and were drop-outs handled appropriately?)** No drop outs. However, 1 patient was unable to participate in all elements. The way in which the authors dealt with this in terms of results is only provided towards end of discussion
CONCLUSIONS AND IMPLICATIONS Conclusions were appropriate given study methods and results	**What did the study conclude? What are the implications of these results for practice? What were the main limitations or biases in the study?** They wanted to determine if AA alone is as effective as VS. 'All patient received total of 48 hours of therapy including at least 10 hours PT during the 3-week rehab.' This isn't the number in the table 45 was the

☐ Yes ☒ No	lowest total. And in looking at the totals there was some contamination. The AA was 21-30 hours to 9-10 hours visual scanning. When you consider this in light of the range of different interventions across individuals in the AA group it leaves confusion. Both groups had sig improvements for FIM and only VS from MMAS post and 6months. They conclude that 20-30 hours of active or passive arm activation generalized almost significantly, so they shouldn't just make these claims, there a wasn't enough numbers, and they didn't train for this many hours in the AA intervention and the intervention itself was not just AA. And compares this to Samuels study, saying they found improvement when this study proves they didn't. They think they found improvement in motor recovery similar to Robertson and goes on to say that those which had more physio over AA improved better than these with less PT and more AA which contradicts all their previous conclusions. And they feel it is appropriate to say that time since stroke onset played no role in outcome. All had sufficient movement but 3 scored 0 on WMFT and these didn't improve, contradicting constantly AA may be a suitable treatment for these whose co-operation is limited. Beneficial to offer both, especially when AA is available irrespective of hemiplegia. Not all AA patents recovered same amount of training Arm activation appears to be as effective in the first 6months. It may be a suitable treatment for these neglect patients whose coop is limited in bed side activities in the very acute phase or have some voluntary hand movement at baseline. Offer both. Determine if there is a difference in effectiveness depending on time since lesion and treatment onset. And compare amount of therapy Do acknowledge that different intervention duration was a limitation. Conclusions are confusing as statements don't tend to be backed up with correct data, i.e. all 6 patients had enough movement to perform push pull equipment, but these patients scored 0/80 on wolf test.

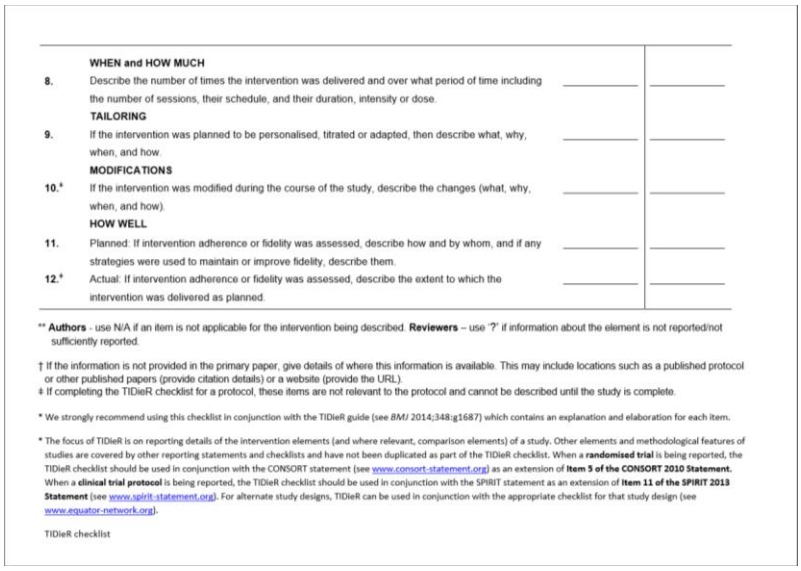
Appendix 4 TIDieR Checklist



The TIDieR (Template for Intervention Description and Replication) Checklist*:

Information to include when describing an intervention and the location of the information

Item number	Item	Where located **	
		Primary paper (page or appendix number)	Other † (details)
	BRIEF NAME		
1.	Provide the name or a phrase that describes the intervention.		
	WHY		
2.	Describe any rationale, theory, or goal of the elements essential to the intervention.		
	WHAT		
3.	Materials: Describe any physical or informational materials used in the intervention, including those provided to participants or used in intervention delivery or in training of intervention providers. Provide information on where the materials can be accessed (e.g. online appendix, URL).		
4.	Procedures: Describe each of the procedures, activities, and/or processes used in the intervention, including any enabling or support activities.		
	WHO PROVIDED		
5.	For each category of intervention provider (e.g. psychologist, nursing assistant), describe their expertise, background and any specific training given.		
	HOW		
6.	Describe the modes of delivery (e.g. face-to-face or by some other mechanism, such as internet or telephone) of the intervention and whether it was provided individually or in a group.		
	WHERE		
7.	Describe the type(s) of location(s) where the intervention occurred, including any necessary infrastructure or relevant features.		



	WHEN and HOW MUCH		
8.	Describe the number of times the intervention was delivered and over what period of time including the number of sessions, their schedule, and their duration, intensity or dose.		
	TAILORING		
9.	If the intervention was planned to be personalised, titrated or adapted, then describe what, why, when, and how.		
	MODIFICATIONS		
10.‡	If the intervention was modified during the course of the study, describe the changes (what, why, when, and how).		
	HOW WELL		
11.	Planned: If intervention adherence or fidelity was assessed, describe how and by whom, and if any strategies were used to maintain or improve fidelity, describe them.		
12.‡	Actual: If intervention adherence or fidelity was assessed, describe the extent to which the intervention was delivered as planned.		

** **Authors** - use N/A if an item is not applicable for the intervention being described. **Reviewers** – use '?' if information about the element is not reported/not sufficiently reported.

† If the information is not provided in the primary paper, give details of where this information is available. This may include locations such as a published protocol or other published papers (provide citation details) or a website (provide the URL).
‡ If completing the TIDieR checklist for a protocol, these items are not relevant to the protocol and cannot be described until the study is complete.

* We strongly recommend using this checklist in conjunction with the TIDieR guide (see *BMJ* 2014;348:g1687) which contains an explanation and elaboration for each item.

* The focus of TIDieR is on reporting details of the intervention elements (and where relevant, comparison elements) of a study. Other elements and methodological features of studies are covered by other reporting statements and checklists and have not been duplicated as part of the TIDieR checklist. When a **randomised trial** is being reported, the TIDieR checklist should be used in conjunction with the CONSORT statement (see www.consort-statement.org) as an extension of **Item 5 of the CONSORT 2010 Statement**. When a **clinical trial protocol** is being reported, the TIDieR checklist should be used in conjunction with the SPIRIT statement as an extension of **Item 11 of the SPIRIT 2013 Statement** (see www.spirit-statement.org). For alternate study designs, TIDieR can be used in conjunction with the appropriate checklist for that study design (see www.equator-network.org).

Appendix 5 TIDieR Data Extraction

Fong et al. (2013)											
Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11	Item 12
Yes	Yes	Yes	Yes	Partial	Partial	Partial	Yes	Yes	No	No	No
Identified in the title as sensory cueing and limb activation.	Identifies the interhemispheric rivalry model as a mechanism of neglect. Highlights aims of treatments based on this mechanism. Summarises the techniques identified in literature to date. Focuses in on one technique, sensory cueing therapy, to induce active limb movement. Summarises the literature on this so far. Aim was to determine if this technique would promote patient's awareness over their contralesonal field, reduce unilateral neglect, and improve	The device was described in detail and supplementary material provided. Small ambulatory wristwatch with neoprene straps. 30mm (h) x 75mm(1) x 50mm(w), 91g. Vibration cue (196Hz similar to a cell phone) and a simultaneous auditory signal (a buzzing noise at 67dBA) for 3 mins at a predetermined interval. Could be terminated with a deactivation button. Rechargeable batteries. Recorded horizontal and vertical arm	Participants to wear device on hemiplegic wrist for 3 consecutive waking hours (except bathing) during the day time (e.g. 9am to noon). Device would vibrate and buzz every 5mins. Patient were instructed to press the button with right hand as soon as possible after each cue and follow up with customary consecutive movements of hemiplegic arm. See item 9. Patients were told to move their arms as much as possible during the wearing period. All received additional conventional OT,	Independently trained OT to carry out treatment according to study protocol, no indication as to grade or training	Not clear if device worn during conventional rehab. Not clear if research OT present for full three-hour wearing period.	Recruitment from 2 rehabilitation centres in Hong Kong. In hospital ward or therapy departments.	3 weeks 5 days a week 3 hours a day Total 45hrs intervention time	Patients in levels 3–5 of the FTHUE who had partial use of their shoulders or arms were instructed to flex or extend their elbows, while those in levels 2–3 of the FTHUE who had some voluntary motion of the shoulder were told to flex or abduct their shoulders.	Not reported	It was reported if patients forgot to perform the tasks after cueing while a therapist was present, they were reminded by the therapist to continue. However, it appears that patients were not supervised for the three hours daily session and therefore unclear on how often patients required prompting.	The drop outs did not appear to be due to intervention delivery.

	hemiplegic arm functions.	movements on digit display	PT, SALT but did not specifically target neglect								

O'Neill and McMillan (2004)											
Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11	Item 12
Yes	Yes	Partial	Partial	Partial	Yes	NR	Yes	NR	NR	NR	NR
The intervention was identified in the title and slight variation given in abstract: contralesional limb activation, limb activation training (LAT)	Identify neglect as an impairment in the ability to direct attention to the contralesional side. Identifies the association between neglect and motor dysfunction. Identifies limb activation as a successful strategy for manipulating attention to neglected space. General overview of how limb movement has been used to remediate neglect and influence motor outcomes. Aim was to reproduce earlier study in more acute phase, with more intensity, shorter duration and examine the effects of LAT on hemiplegia.	The device was only minimally described. It was reported to emit a buzzing tone (frequency 4KHz) at pre-set intervals that could be terminated by movement	LAD was worn throughout OT session on hemiplegic forearm. Patient was asked to move hemiplegic arm after the tone sounded every 60 seconds to cancel the tone. This could be terminated by minimal movement and participants only had minimal movement. Although the procedure of the LAD is described, it is not clear if any other activity was occurring during this session as it was in combination with the OT session and not an additional. No mention of other therapy input	OT delivered the intervention, no further details provided	One to one with OT can be assumed	In introduction they state that present case study was in a model more similar to early inpatient rehab. South Glasgow University Hospitals NHS trust.	4 weeks 4 sessions per week of 45mins Total 12 hours	Not reported	Not reported	N/A (single case report)? Could have assessed adherence to reacting to buzzer?	In the first session the OT prompted the participant if he did not cancel the tone. But fidelity not reported or measured

Maddicks, Marzillier and Parker (2003)											
Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11	Item 12
Yes	Yes	Yes	Yes	NR	NR	NR	Yes	Yes	NR	NR	NR
Identified in the title \\ limb activation Therapy	Identifies neglect as a disorder of attention. Explains the development of limb activation. Focuses on neglect in different spatial references, personal, near and far. Summarises that contralesional limb movement activates the motor circuits in the damaged hemisphere and postulate this will also inhibit competition from the undamaged hemisphere. Its an extension of previous study with aim to determine the effects of LAT in a less chronic patients and will lead to improvements in neglect behaviour in daily life.	Although the details were not specifically described, a reference for which the device was given. Small plastic box with an LED mounted on it. At pre-set intervals the device would beep until it was switched off with an air pressure switch.	At pre-set time intervals the light went on and the device produced a beep that continued until the switch was pressed. The buzzer went off at intervals of 8 seconds, participant was instructed to switch it off using left foot as movement in his left arm was not precise enough. This treatment was not conducted during normal occupational therapy. Patient continued with his normal OT and PT throughout the study	Not reported	Not reported	In introduction suggests that this is conducted in early stages of rehab, otherwise it was not reported	2 separate bouts of 5days in, 40mins. ABAB design therefore same treatment repeated for a further 2 weeks following week off in-between 9 Total 6.6hrs	Left foot used as left arm not precise enough	None reported. Could the fact that they had planned to reproduce Robertson's study with different tasks. Other modifications included; The intervention was predicted to be too overwhelming due to the already demanding nature of the therapy and was not therefore conducted during normal occupational therapy and it was of shorter duration and intensity. And then made changes as they felt the previous design would be too overwhelming therefore the treatment was not conducted during normal OT.	None reported; N/A (single case report)? Talks about having to give them a rest and not wanting to over tax, but this is not backed up by evidence >? Where whether this is opinion. Despite highlighting They identify that in the acute phase the intervention would be too overwhelming to coincide with normal occupational therapy nor do they make plans to assess for it. The ABABA design was chosen to limit the impact of spontaneous recovery. despite highlighting concerns	Not reported

Bailey, Riddoch and Crome (2002)											
Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11	Item 12
Yes	Yes	Yes	Yes	NR	Yes	Partial	Yes	Yes	NR	NR	NR
Identified in the title. Other variations were used within the main body of text: left limb activation strategy, contralesional limb activation approach.	Identifies the attention and interhemispheric activation theories. Identifies the literature so far, providing evidence for and against. Summarises that different techniques have been used to induce contralesional limb movements. Aim of this study was to reduce methodological shortcomings from previous studies, to see whether the technique would reduce UVN in selected elderly patents. justification of technique to be simple, low cost and easily available. No mention of the impact on the limb.	Enough examples of the types of activates and games were given to reproduce in clinical practice. Treatment based on board games and functional tasks. Therefore, basic equipment needs described within procedures.	Subjects were told that research showed that moving the left limb on the left side of their body space had been shown to reduce visual neglect and to possibly improve function. Each session consisted of; 15 minutes of tapping hand or foot prior to and during bored games that direct attention to neglected side. 30 mins of functional and goal-oriented activities/tasks i.e. hair combing. 15 mins using a cloth, held in the left hand, to rub off words, letters, drawings, and so on made on the left side of the white board by the therapist. All additionally received their	Not reported	Not stated, but one to one session can be presumed	Rehab setting. Quiet area on the ward.	3 weeks, alternative weekdays, 1 hour. Minimum of 10 sessions (min 10 hrs). Specifically, subject 7 only received 7 intervention and testing sessions as was discharged home. Could have been clearer	Patients were only allocated to limb activation if they had some spared upper limb voluntary activity. This is not specified in any more detail. Therapist would assist if patients unable to actively achieve a particular functional goal	Not reported. They had planned 10 data sets but in subject 7 only 7 were taken.	Not reported	Subject 6 received 10 treatment sessions; subject 7 received 7 treatment sessions - reason for this not reported though may be due to improvement / impending discharge (page 792)

			usual OT/PT on the ward throughout all phases, which consisted of approximately 30 minutes each weekday for each type of therapy, although treatment focused on this problem was not given to the subjects, all subjects were encouraged to look toward their neglected side during activities such as dressing, self-care, and physical rehabilitation exercises.								

Samuel et al 2000											
Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11	Item 12
Yes	Yes	Partial	Partial	Partial	Yes	NR	Yes	Partial	NR	NR	NR
Found in title. In the abstract this term was defined as voluntary activation of the left upper limb in the left hemispace\\ Visuo-spatio- motor cueing	Highlighted limitations with visual scanning. Introduces LAT, and links to the theoretical framework provided by Rizzolatti and Camarda (1987), suggesting that attentional and motor circuits are intrinsically liked. Study aimed to determine if this technique could be used in very severe neglect and its impact on daily lives	No details of materials are given but examples of the tasks used may be enough for clinicians to reproduce	Intervention delivered during a PT, OT or SALT session i.e. motor tasks with PT, Functional tasks with OT and paper and pencil tasks with SALT. Patients were trained to look at and move the left arm as soon as they did not find a target in an exercise. At the beginning therapist regularly repeated the instruction, then self-instructional training was used to encourage the patients to spontaneously use left arm. In baseline period they were giving visual scanning. Not clear if each	Treatment was provided by an OT, PT and SALT. No further details provided.	One to one assumed due to nature of intervention and level of support required	Not reported	2 weeks, 4days per week, 45 mins each session. (6hrs)	Both subjects only had limited movement therefore could only produce shoulder movements. At the beginning therapist regularly repeated the instruction, then self-instructional training was used to encourage the patients to spontaneously use left arm. Would have benefited from more specific details as to what movement was planned and examples of how that was tailored given the wide array of	Not reported	Not reported. There appeared to be an aim that patients would learn to self-cue. This was measured for during salt sessions. Patient's awareness of difficulty was limited. They were given constant feedback by confronting them with their performance, before and after motor cueing. would have benefited from more specific details as to what movement was planned and examples of how that was tailored given the wide array of different specific tasks	Not reported. Visuospatial motor cueing was found by the patients and the therapist to be an easy method that could be used in daily life. This case study found

			discipline provided additional therapy.					different specific tasks			

Harding and Riddoch (2009)											
Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11	Item 12
Yes	Yes	Yes	Yes	Partial	Partial	NR	Yes	Partial	NR	NR	NR
The title did not initially imply limb activation technique; however, the introduction demonstrates that this is a technique that may induce passive movement for limb activation: functional electrical stimulation of the upper limb	Spatial bias in attention and exploratory motor behaviour. Two interacting frontoparietal networks resulting from a localised lesion. Damage to either can result in disorders of attention, but with different symptoms. Identify LAT as a potential technique to facilitate multisensory integration. Explores the evidence in respects to active and passive movements. They suggest FES is a cost-effective way to induce passive movement. Identifies one previous study of FES. Aim was to report on the long-term impact of FES on neglect and sought to conduct a control element to differentiate benefits of	Detailed description given including use of images. Microstim box, electrode leads and two standard electrodes. Copy. The FES equipment is illustrated in Figure 1 and includes the Microstim box, electrode leads and two standard electrodes. The intensity of the stimulation outputs from the two channels change relative to each other in a number of different possible formats (continuous, alternate, simultaneous,	Intervention was additional. 20mins of alternating current every 10seconds, the intensity was sufficient to produce an adequate tetanic contraction of the forearm extensors resulting in at least 20 degrees from neutral extension at the wrist and some extension of the fingers. General rehab throughout all stages. 5 one-hour sessions per week of PT. 3 one-hour sessions per week of OT. Rehab evolved as the patent improved, did not include specific intervention for neglect.	PT assistant administered the FES. No details of training. rehab therapists were not involved in the research.	Can assume 1-to-1 with PT assistant	Not reported, recruited from city hospital Birmingham	Yes 4weeks, 2 sessions 5 days a week for 20 mins each. (13.3HRS)	Yes Intensity was sufficient to produce adequate tetanic contraction of the forearm extensor muscles resulting in at least 20 degrees from neutral wrist extension. Intensity was never enough to cause pain.	Not reported	Not reported	Not reported

	movement > generalised arousal effects.	and overlapping). Here an alternating current of 40 Hertz was used, which is optimal at producing a tetanic contraction within the muscle (see Figure 2). The alternating format gives a short duration of electrical stimulation followed by an inter-stimulus interval (ISI) of approx. 10 seconds,									

Luukkainen-Markkula et al. (2009)											
Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11	Item 12
Yes	Yes	Partial	Partial	NR	NR	NR	Partial	Yes	Partial	NR	NR
Identified in the title and the abstract: arm activation, left arm activation training	Introduces LAT literature. And effect was thought to derived from the movement itself or the spatial location of the arm in the hemispace. Aim to determine if limb activation alone was enough to remediate neglect. They also studied if limb activation improves the motor function of the affected am as demonstrated in previous CIMT studies.	Although techniques were named, no detail of this was given. i.e. sling, video screen/iReach programme (pg. 667). Push pull equipment. Multichannel functional electrical stimulation FES stimulating glove.	Table 2, page 667 Arm activation: pg. 666. Control: pg. 667. One patient with sufficient arm movement received arm activation comparable to CIMT. CIMT was defined as a set of rehab techniques where the emphasis is placed on intensive exercise of the affected arm while movement of the healthy arm is simultaneously restrained with a sling. 5 patients without sufficient arm movement received modified arm activation therapy which included voluntary shoulder motor	Not reported	Not reported; assume individual face to face due to nature of interventions. Video/computer(?) programme used in control group	Not reported - Presumably in hospital where recruited	Table 2, pg. 666-7, 9g. 669. can't differentiate. Three patients with less than three months from stroke received 18hours of physio and 21 hours of arm activation training. The three patients who had 3-6 months from stroke received 10 hours of physio and 30 hours of limb activation. No mention of the drop out.	Pg. 666, based on WMFT pg. 667, individual starting level, individualised rehab programmes. Depended on level / presence of spasticity would determine if received FES stim glove or passive stretches from therapist. All patients had sufficient voluntary movement n the shoulder to perform the activation with push pull equipment. Those with some movement were the only ones to improve in their arm function.	Inclusion criteria was altered for patients with different time periods since stroke onset. Pts received diff hours of therapy according to the time from stroke onset. The patens with less than three months 18 hours physio and 21 hours AA. Those with three months from onset 10 hours physio and 30 hours AA	Not Reported	Not Reported

			training of the left arm in a simple push pull equipment 50% of the training time and passive movement 50%. Passive movement was either with FES stimulating glove or stretches aided by the therapist if the patient had spasticity. in those with spasticity, stretching exercises were aided by the therapist. Not clear if patients received general rehab. The other group did. Not clear if and what other therapy occurred for the LAT group as did appear to occur with visual scanning group.					only one patent in bed first week			

Appendix 6 Ethics Documentation

Amendment request form for HLS undergraduate and postgraduate students online

Project reference	**P50566**
Applicant name	Vicki Collie
Submission date of module	26/05/2017
Please outline what you would like to amend to your application. Be specific.	Previous title and question: Impact of interventions for neglect post stroke on motor function: can interventions be incorporated into physiotherapy practice based on reporting quality? The overall aim of this study is to identify the studies that have investigated the impact of neglect interventions on motor function post stroke and determine if the reporting quality of these interventions would enable the direct application into practice. Instead of conducing a systematic review for 'interventions' I have decided to narrow the focus to one particular intervention type or theme. 'Limb activation techniques. I have therefore made a more specific research title, question aims and objectives to demonstrate this. TITLE: Developing evidence-based practice of limb activation techniques for the remediation of neglect and motor dysfunction after stroke: A systematic review RESEARCH QUESTION: Do limb activation technique studies, offer enough descriptive detail to support their replication into clinical practice, in the remediation of neglect and motor dysfunction after stroke. PURPOSE: To determine if limb activation techniques can be replicated into clinical practice for the remediation of neglect and motor dysfunction after stroke, using the template for intervention description and replication (TIDieR) checklist and guide. OBJECTIVES: To draw together and synthesise intervention protocols To determine if enough reporting information has been presented to draw adequate conclusions from the findings of each study To determine if enough reporting information has been presented to allow for transfer of interventions into clinical practice

What stage of your project are you currently at?	Choose an item. I have conducted scoping searches and am ready to apply searches in full
Will the participants be affected in any way by this amendment?	Choose an item. It is a literature-based search so no
Will any of your documents be changed due to this amendment?	Choose an item. I will be using the same tools outlined in my original application
Do you require a date extension?	Choose an item. No

Please complete the below form and send as an attachment, with any other relevant documents or e-mails, to ethics.hls@coventry.ac.uk

Please expect a turnaround time of 5-7 working days for ethics admin to process this request, during this time please suspend data collection. Any queries should be directed to ethics.hls@coventry.ac.uk