

2017-04-01

# Effectiveness of non-pharmacological interventions in treating orthostatic hypotension in the elderly and people with a neurological condition

Logan, A

<http://hdl.handle.net/10026.1/9380>

---

10.11124/JBISRIR-2016-003027

JBI Database of Systematic Reviews and Implementation Reports

Ovid Technologies (Wolters Kluwer Health)

---

*All content in PEARL is protected by copyright law. Author manuscripts are made available in accordance with publisher policies. Please cite only the published version using the details provided on the item record or document. In the absence of an open licence (e.g. Creative Commons), permissions for further reuse of content should be sought from the publisher or author.*

# Effectiveness of non-pharmacological interventions in treating orthostatic hypotension in the elderly and people with a neurological condition: a systematic review protocol

Angela Logan • Jonathan Marsden • Jennifer Freeman • Bridie Kent

*The University of Plymouth Centre for Innovations in Health and Social Care: a Joanna Briggs Institute Centre of Excellence*

**Review question/objective:** The objectives of the review are to determine:

- The effectiveness of non-pharmacological interventions for OH in elderly people and people with a neurological condition.
- Whether, in the elderly or people with a neurological condition who have OH, non-pharmacological interventions:
  - are effective in improving OH, resting blood pressure and cerebral blood flow
  - allow more or earlier mobilization (especially standing) to undertake activities of daily living and/or participate in rehabilitation programs

Specifically, the review question is:

What is the evidence base for non-pharmacological interventions in treating orthostatic hypotension (OH) in elderly people and people with a neurological condition?

**Keywords** Cerebral vascular accident; neurological condition; non-pharmacological; orthostatic hypotension; stroke

*JBI Database System Rev Implement Rep 2017; 15(4):948–960.*

## Background

Orthostatic (postural) hypotension (OH) is defined by consensus as a sustained drop in systolic blood pressure of at least 20 mmHg and/or diastolic blood pressure of at least 10 mmHg within three minutes of moving from supine to standing or following head-up tilt to at least 60 degrees.<sup>1,2</sup>

In healthy individuals, a change in position from supine to upright results in approximately 500–1000 ml of blood moving from the upper body to the lower body, primarily the lower abdomen, buttocks and legs. This fluid shift produces a decrease in venous return, ventricular filling, cardiac output and blood pressure.<sup>3</sup> In healthy individuals, a compensatory reflex initiated by baroreceptors in the aortic arch and carotid sinus triggers tachycardia (increased heart rate) and vasoconstriction

(narrowing of the blood vessels) that restores normal blood pressure in the upright position.<sup>4</sup> This compensatory mechanism is termed a baroreflex and is mediated by afferent and efferent autonomic peripheral nerves and is integrated within autonomic centers in the brainstem. Orthostatic hypotension is the result of baroreflex failure (autonomic failure), end-organ dysfunction or volume depletion.<sup>5</sup>

Orthostatic hypotension has both non-neurogenic and neurogenic causes and can be acute or chronic.<sup>6</sup> Non-neurogenic causes of OH fall into three categories: hypovolemia (reduced blood volume), cardiac pump failure and venous pooling. Hypovolemia can be caused by acute dehydration due to nausea and vomiting or to chronic blood loss from gastric ulcers. Cardiac pump failure can be caused by bradycardia, tachyarrhythmia, aortic stenosis or myocardial infarction. Venous pooling can be caused by prolonged standing motionless; however, it can also be caused by heat exposure, fever, severe varicose veins and postprandial dilation of splanchnic blood vessels. In addition, medications such as

*Correspondence:* Angela Logan, [angie.logan@plymouth.ac.uk](mailto:angie.logan@plymouth.ac.uk)

*There is no conflict of interest in this project.*

*DOI:* 10.11124/JBISRIR-2016-003027

diuretics and anti-hypertensives can cause OH by interfering with autonomic reflex mechanisms and reducing intravascular volume.<sup>5</sup> Neurogenic OH is associated with neurological diseases and can be caused by abnormalities in either the central nervous system (e.g. stroke, spinal cord injury or Parkinson's disease) or peripheral nervous system (e.g. Guillain-Barré syndrome or diabetic neuropathy).<sup>7</sup>

Orthostatic hypotension can cause a variety of symptoms and is a frequent cause of syncope (transient loss of consciousness, rapid onset and short duration) that may contribute to morbidity, disability and even death, because of the potential risk of substantial injury.<sup>1</sup> Other characteristic symptoms of OH include: (a) dizziness/light headedness and pre-syncope; (b) weakness, fatigue and lethargy; (c) palpitations and sweating; (d) visual disturbances (including blurring, enhanced brightness and tunnel vision); (e) hearing disturbances (including impaired hearing, crackles and tinnitus); and (f) pain in the neck (occipital/para-cervical and shoulder region), low back pain or precordial pain.<sup>8,9</sup> These symptoms relate to the degree of the fall in blood pressure and hypoperfusion of the brain and other organs.

The prevalence of OH in elderly people (aged 50 years and over) is high, both in the United Kingdom (UK) and internationally, but variable depending on the characteristics of the population studied. Orthostatic hypotension is more common in elderly people who are hospitalized and institutionalized (up to 68%)<sup>10</sup> than in those living in the community (30%).<sup>11</sup> The high prevalence among hospitalized and institutionalized patients likely reflects multiple disease processes, including neurological and cardiac conditions, as well as the type and number of prescribed medications. In addition, orthostatic changes to blood pressure become more exaggerated after prolonged immobilization.<sup>12</sup> The prevalence of OH in people with neurological conditions is also high. Systematic reviews have concluded that OH occurs in approximately 40%<sup>13</sup> of people with Parkinson's disease and 50–82% of people with spinal cord injury, depending on the level of lesion.<sup>14</sup> Orthostatic hypotension is also very common in people with stroke and in a cohort of 71 people undergoing rehabilitation, 37 people (52.1%) had OH.<sup>15</sup> Given that stroke is predominately seen in elderly people, it is possible that the prevalence of OH post-stroke is much higher. This aligns with current European guidelines that highlight that OH is underdiagnosed.<sup>1</sup>

The presence of OH can interfere with and limit rehabilitation, especially in stroke where early mobilization (out-of-bed activities such as sitting, standing and walking) is undertaken at the earliest opportunity post-stroke.<sup>16</sup> Early mobilization is recommended by UK and European guidelines<sup>17,18</sup> and has demonstrated positive results in functional outcomes.<sup>19</sup> However, studies of early mobilization for people with acute stroke excluded people from the intervention arm if they had OH on three consecutive occasions.<sup>18</sup> Given the high incidence of OH in people with stroke, following this criterion in trials that involve standing as an early mobilization treatment intervention could limit the sample size and number of people potentially benefitting from this intervention. Furthermore, stroke is more common, although not exclusive, to people over 50 years of age,<sup>20</sup> and initial searching of the literature using MEDLINE, Embase, CINAHL, Cochrane Database and PROSPERO identified a paucity of evidence of interventions to treat OH in people with stroke. Therefore, a systematic review of people with neurological conditions and older people is required to provide healthcare professionals with evidence of the efficacy non-pharmacological interventions to treat OH. This may contribute positively toward the full participation of people with stroke in essential rehabilitation programs.

The goal of managing OH is to raise the patient's standing blood pressure without also raising their resting blood pressure, and specifically to reduce OH symptoms, increase the time they can stand and improve their ability to perform activities of daily living.<sup>5</sup> Currently, there is no specific intervention that achieves all of these goals, despite the multitude of pharmacological and non-pharmacological interventions available. A recent systematic review of pharmacological interventions highlighted that although there were multiple pharmacological interventions available in the UK, Europe and United States of America (USA), there were little high-quality data as to which was the best.<sup>21</sup> Furthermore, the review concluded that there are limited data on the benefits of long-term pharmacological interventions of OH in terms of the effects on postural blood pressure changes as well as symptom relief, suggesting that benefits should be weighed against potential side effects and adverse effects including cardiac failure, systolic hypertension and stroke.

Reviews<sup>22</sup> and guidelines<sup>1,23</sup> from the USA and Europe for the management of OH recommend non-pharmacological interventions as first line before progressing to pharmacological interventions if the former are ineffective or insufficient. A recent systematic review of non-pharmacological interventions to treat OH identified two general categories: physical modalities (exercise, functional electrical stimulation, compression [abdomen or lower limbs], physical counter-maneuvers, compression and sleeping with the head up) and dietary measures (food and fluid intake).<sup>24</sup> This review identified strong levels of evidence for several non-pharmacological interventions: compression of the legs and/or abdomen, physical maneuvers, functional electrical stimulation (for people with spinal cord injury) and size and timing of meals. This is aligned with a body of evidence identified in an initial review of the literature using MEDLINE, Embase, CINAHL, Cochrane Database and PROSPERO. However, people with neurological conditions often have complex needs and severe disability, which means that some non-pharmacological interventions may not be appropriate. For example, undertaking physical maneuvers requires a specific level of mobility and balance, and functional electrical stimulation may be contraindicated due to other medical conditions or skin frailty. Therefore, the results of this review cannot be adequately transferred to people with neurological conditions, and this therefore underpins the rationale for the proposed review. There are a number of non-pharmacological interventions for OH that are used in the elderly and in people with other neurological disorders such as spinal cord injury and Parkinson's disease.<sup>25,26</sup> Interventions include the use of graduated compression garments with observational studies suggesting that abdominal supports are better at preventing OH compared to leg garments.<sup>25</sup> Compression garments allow repeated safe standing and/or sitting out, and with such training people can develop orthostatic tolerance. Orthostatic hypotension prevents mobilization at the time of occurrence, and this is problematic for people who are undergoing rehabilitation, for example, people with acute stroke. Non-pharmacological interventions such as compression garments are not commonly used early post-stroke, and a clear guidance on their use is lacking. Previous reviews of standing in people with neurological conditions<sup>27</sup> have highlighted the need

to undertake a review of the effects of standing on OH and understanding the effectiveness of non-pharmacological interventions are a research priority for people with OH for older people and people with a neurological disease.<sup>28</sup>

An initial search of the literature – MEDLINE, Embase, CINAHL, Cochrane Database and PROSPERO – identified one systematic review from Canada examining studies that evaluated non-pharmacological interventions to treat OH.<sup>24</sup> However, this review was broad, covering various patient populations and not restricted to elderly people or people with a neurological condition. Furthermore, the review did not focus on any specific outcomes such as impact on mobilization or functional ability. Therefore, a systematic review of non-pharmacological interventions to treat OH in the elderly and people with a neurological condition is essential. This, coupled with a recent systematic review of pharmacological interventions,<sup>21</sup> will allow the development of a protocol to enable healthcare professionals to assess and treat OH in the early stages of people with acute stroke.

In conclusion, it is suggested that this proposed systematic review will provide novel information. It is specific to elderly people and people with a neurological condition and will include experimental and epidemiological studies.

## **Inclusion criteria**

### *Types of participants*

The current review will consider studies that include people diagnosed with OH by a doctor or other medical professional using criteria such as the International Classification of Diseases and Related Health Problems (ICD-10).<sup>29</sup> People aged 50 years and over will be included. Currently, there is no agreed definition of “older” or “old people” with ages differing widely as to what is considered “old”. However, 50 years was accepted as the definition of older people for the purpose of the World Health Organization Older Adult Health and Ageing in Africa project<sup>30</sup> and will be used for the purposes of this review. In addition, people aged 18 years and over with a neurological condition of the central nervous system, both progressive, such as multiple sclerosis, Parkinson's disease, dementia, or sudden non-progressive, such as spinal cord injury and stroke. Peripheral nervous system conditions will be excluded.

Participants receiving treatment for acute or chronic OH will be included, which may encompass treatment being carried out in acute and community hospitals, outpatient clinics, in-patient rehabilitation units and the community (either in their own homes or in a residential or nursing home setting).

#### *Types of intervention(s)*

The current review will consider studies that evaluate non-pharmacological interventions to treat OH, which may include compression garments (e.g. lower limb compression stockings or abdominal corset); neuromuscular stimulation; physical maneuvers (e.g. squatting and bending at the waist) and isometric exercises for arms, lower limbs and abdominal muscles during standing; raising head of bed at nighttime; elimination of any offending agents (a-blockers and diuretics) or increasing fluid and salt intake. However, a full systematic search may identify additional interventions that will be considered. Interventions of any duration, frequency or intensity will be considered.

#### *Comparator*

The current review will consider studies that compare the non-pharmacological interventions listed above with no intervention, pharmacological interventions and/or other non-pharmacological interventions not listed above.

#### *Outcomes*

Outcomes will include systolic blood pressure, diastolic blood pressure (both lying and standing using manual or automated device) including time to symptoms and time to recovery; resting heart rate using manual or automatic device; cerebral blood flow using transcranial Doppler or correlation spectroscopy and others; observed and/or perceived symptoms; tolerance of therapy (e.g. ability to participate in therapy measured in length and frequency of sessions); duration of standing or sitting in minutes; and adverse events/effects where this information is provided.

#### *Types of studies*

Experimental and epidemiological study designs including randomized controlled trials, non-randomized controlled trials, quasi-experimental, before and after studies, prospective and retrospective cohort

studies, case-control studies and analytical cross-sectional studies will be considered. Descriptive epidemiological study designs including case series, individual case reports and descriptive cross-sectional studies will also be considered.

#### **Search strategy**

The search strategy aims to find both published and unpublished studies. A three-step search strategy will be utilized in this review. An initial limited search of MEDLINE, AMED, CINAHL and Embase will be undertaken followed by analysis of the text words contained in the title and abstract, and of the index terms used to describe the articles. A second search using all identified keywords and index terms will then be undertaken across all included databases. Third, the reference list of all identified reports and articles will be searched for additional studies. Studies published in English will be considered for inclusion in this review. The initial scoping search identified literature dated 1983; however, to ensure that the review has comprehensively captured all possible data with regard to the review question, there will be no lower date limit. The upper date limit will be present day of searching.

The databases to be searched include:

MEDLINE (Ovid)  
Embase (Ovid)  
The Cochrane Central Register of Controlled Trials  
CINAHL  
AMED (EBSCO)  
PEDro

The search for unpublished studies will include scanning of references of identified studies, unpublished studies and gray literature. It will be undertaken using Google Scholar, Conference Papers Index and a search of clinical trials registers via [www.controlled-trials.com](http://www.controlled-trials.com) and <http://clinicaltrials.gov>.

Initial keywords to be used will be “stroke” (MeSH) or “post-stroke” or “poststroke” or “post stroke” or “CVA” or “cerebral vascular accident” or “cerebrovascular accident” or “cerebrovascular disease” or “cerebral vascular disease” or “upper motor neurone disorder” or “neurological” or “neuro” or “neurology” or “brain injury” or “hemorrhage” or “Parkinson’s disease” or “multiple sclerosis” or “spinal cord injury” “nonpharmacological” or “non pharmacological” or “non-pharmacological” or “non-invasive”

“pressure (active or passive)” or “bandages” or “splint” or “compression” and “abdominal” and/or “legs” or “lower limbs”

“orthostatic hypotension” (MeSH) or “postural hypotension” or “orthostasis” or “low blood pressure” or “vascular response” or “autonomic dysfunction”

“cerebral blood flow”

“function” or “functional outcome” or “activities of daily living”

“quality of life”

An example of the search strategy for MEDLINE (OVID) is included in Appendix I.

### Assessment of methodological quality

Papers selected for retrieval will be assessed by two independent reviewers for methodological validity prior to inclusion in the review using standardized critical appraisal instruments from the Joanna Briggs Institute Meta Analysis of Statistics Assessment and Review Instrument (JBI-MASARI) (Appendix II). Any disagreements that arise between the reviewers will be resolved through discussion or with a third reviewer.

### Data extraction

Data will be extracted from papers included in the review using the standardized data extraction tool from JBI-MASARI (Appendix III). These data extracted will include specific details about the interventions, populations, study methods and outcomes of significance to the review question and specific objectives.

Authors of primary studies will be contacted for missing information or to clarify unclear data.

### Data synthesis

Quantitative data will, where possible, be pooled in statistical meta-analysis using JBI-MASARI. All results will be subject to double data entry. Effect sizes expressed as odds ratio (for categorical data) and weighted mean differences (for continuous data) and their 95% confidence intervals will be calculated for analysis. Heterogeneity will be assessed statistically using the standard Chi-square,  $I^2$  of 60% for moderate heterogeneity<sup>31</sup> and also explored using subgroup analyses based on the different study designs included in this review. Where statistical pooling is not possible, the findings will be presented

in narrative form including tables and figures to aid in data presentation where appropriate.

### Acknowledgements

We thank Rod Gregg, librarian at Royal Cornwall Hospitals NHS Trust, for guidance on search terms and setting up search Excel database.

The author AL is funded by Health Education England National Institute for Health Research (NIHR) Integrated Clinical Academic Programme as part of a Clinical Doctoral Research Fellowship. The views expressed are those of the authors’ and not necessarily those of the NHS, NIHR or the Department of Health.

### References

1. Lahrman H, Cortelli P, Hilz M, Mathias CJ, Struhal W, Tassinari M. Chapter 33, orthostatic hypotension. *European Handbook of Neurological Management*. Blackwell Publishing Ltd; 2011. ISBN: 978-1-405-18533-2.
2. Freeman R, Wieling W, Axelrod FB, Benditt DG, Benarroch E, Biaggioni, et al. Consensus statement on the definition of orthostatic hypotension, neurally mediated syncope and the postural tachycardia syndrome. *Clin Auton Res* 2011;21(2):69–72.
3. Sjostrand T. The regulation of the blood distribution in man. *Acta Physiol Scand* 1952;26(4):312–27.
4. Ziegler MG, Lake CR, Kopin IJ. The sympathetic nervous system defect in primary orthostatic hypotension. *N Eng J Med* 1977;296(6):293–7.
5. Figueroa JJ, Basford JR, Low PA. Preventing and treating orthostatic hypotension: as easy as A, B, C. *Cleve Clin J Med* 2010;77(5):298–306.
6. Engstrom JW, Aminoff MJ. Evaluation and treatment of orthostatic hypotension. *Am Fam Physician* 1997;56(5):1378–84.
7. Berger MJ, Kimpinski KA. Practical guide to the treatment of neurogenic orthostatic hypotension. *Can J Neuro Sci* 2014; 41(2):156–63.
8. Mathias CJ, Mallipeddi R, Bleasdale-Barr K. Symptoms associated with orthostatic hypotension in pure autonomic failure and multiple system atrophy. *J Neurol* 1999;246(10):893–8.
9. Naschitz J, Rosner I. Orthostatic hypotension: framework of the syndrome. *Postgrad Med J* 2007;83(983):568–74.
10. Weiss A, Grossman E, Beloosesky Y, Grinblat J. Orthostatic hypotension in acute geriatric ward: is it a consistent finding? *Arch Intern Med* 2002;162(20):2369–74.
11. Tilvis RS, Hakala SM, Valvanne J, Erkinjuntti T. Postural hypotension and dizziness in a general aged population: a four year follow-up of the Helsinki Aging Study. *J Am Geriatr Soc* 1996;44(7):809–14.

12. Kauffman TL, Barr J, Moran ML. *Geriatric Rehabilitation Manual*. Churchill Livingstone; 2007.
13. Velseboer DC, de Haan RJ, Wieling W, Goldstein DS, de Bie RMA. Prevalance of orthostatic hypotension in Parkinson's disease: a systematic review and meta analysis. *Parkinsonism Relat Disord* 2011;17(10):724–9.
14. Krassioukov A, Eng JJ, Warburton DER, Teasell R. A systematic review of the management of orthostatic hypotension following spinal cord injury. *Arch Phys Med Rehabil* 2009;90(5):876–85.
15. Kong K-H, Chuo AM. Incidence and outcome of orthostatic hypotension in stroke patients undergoing rehabilitation. *Arch Phys Med Rehabil* 2003;84(4):559–62.
16. Intercollegiate Stroke Working Party. National clinical guideline for stroke (5e). London: Intercollegiate Stroke Working Party; 2016; Available from: <https://www.rcplondon.ac.uk/guidelines-policy/stroke-guidelines>. [Cited 15 December 2016].
17. European Stroke Organisation (ESO) Executive Committee; ESO Writing Committee. Guidelines for management of ischaemic stroke and transient ischaemic attack 2008. *Cerebrovasc Dis* 2008;25(5):457–507.
18. Bernhardt J, Dewey H, Thrift AA. Very Early Rehabilitation Trial for Stroke (AVERT): Phase II safety and feasibility. *Stroke* 2008;39(2):390–6.
19. Disrens K, Moreira T, Hirt L, Faouzi M, Grujic J, Bieler G, et al. Early mobilization out of bed after ischaemic stroke reduces severe complications but not cerebral blood flow: a randomized controlled pilot trial. *Clin Rehabil* 2012;25(5):451–9.
20. Townsend N, Wickramasinghe K, Bhatnagar P, Smolina K, Nichols M, Leal J, et al. *Coronary heart disease statistics, 2012 edition*. London: British Heart Foundation; 2012.
21. Ong AC, Myint PK, Shepstone L, Potter JF. A systematic review of the pharmacological management of orthostatic hypotension. *Int J Clin Pract* 2013;67(7):633–46.
22. Perlmutter LC, Sarda G, Casavant V, Mosnaim AD. A review of the etiology associated with cormorbidities and treatment of orthostatic hypotension. *Am J Ther* 2012;29(3):279–91.
23. The Task Force for the Diagnosis, Management of Syncope of the European Society of Cardiology (ESC). Guidelines for the diagnosis and management of syncope. *Eur Heart J* 2009;30(21):2631–71.
24. Mills PB, Fung CK, Travlos A, Krassioukov A. Nonpharmacologic management of orthostatic hypotension: a systematic review. *Arch Phys Med Rehabil* 2015;96(2):366–75.
25. Gillis DJ, Wouda M, Hjeltnes N. Non-pharmacological management of orthostatic hypotension after spinal cord injury: a critical review of the literature. *Spinal Cord* 2008; 46(10): 652–65.
26. Thompson P, Wright J, Rajkumar C. Non-pharmacological treatments for orthostatic hypotension. *Age Ageing* 2011; 40(3):292–3.
27. Newman M, Barker K. The effect of supported standing in adults with upper motor neurone disorders: a systematic review. *Clin Rehabil* 2012;26(12):1059–77.
28. Frith J, Bashir AS, Elliott CS, Newton JL. Public and patient research priorities for orthostatic hypotension. *Age Ageing* 2014;43(6):865–8.
29. World Health Organization. *International Classification of Diseases and Related Health Problems (ICD-10)*. Geneva, Switzerland: WHO; 2016 ; Available from: <http://www.who.int/classifications/icd/icdonlineversions/en/> [Cited 5 December 2016].
30. World Health Organization. *Definition of an older or elderly person*. Geneva, Switzerland: WHO; 2010; Available from: <http://www.who.int/healthinfo/survey/ageingdefnolder/en/index.html>. [Cited 12 September 2016].
31. Higgins JPT, Green S (editors). *Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0* [updated March 2011]. The Cochrane Collaboration, 2011. Available from [www.handbook.cochrane.org](http://www.handbook.cochrane.org).

## Appendix I: Search strategy example

1.	orthostatic adj2 hypotension [.ti; .tw; .mp]
2.	exp hypotension, orthostatic/ [MeSH] [.ti; .tw; .mp]
3.	postural adj2 hypotension [.ti; .tw; .mp]
4.	Orthostasis [.ti; .tw; .mp]
5.	dizziness/ [MeSH] [.ti; .tw; .mp]
6.	“low blood pressure” [.ti; .tw; .mp]
7.	hypotension/ [MeSH] [.ti; .tw; .mp]
8.	vascular adj2 response [.ti; .tw; .mp]
9.	“autonomic dysfunction” [.ti; .tw; .mp]
10.	“cerebral bloodflow” or “cerebral blood flow” [.ti; .tw; .mp]
11.	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10
12.	elderly or “older people” or “older person*” or aged/ or aging or ageing or senior* or geriatric [.ti; .tw; .mp]
13.	11 and 12
14.	“non-pharmacological treatment*” or “nonpharmacological treatment*” or “non pharmacological treatment*” [.ti; .tw; .mp]
15.	“non-pharmacological management” or “nonpharmacological management” or “non pharmacological management” [.ti; .tw; .mp]
16.	“non-pharmacological intervention*” or “nonpharmacological intervention*” or “non pharmacological intervention*” [.ti; .tw; .mp]
17.	14 or 15 or 16
19.	13 and16
20.	11 and 17
20.	Compression adj2 garment* [.ti; .tw; .mp]
21.	Compression adj2 stocking* [.ti; .tw; .mp]
22.	Compression adj2 bandag* or compression therapy [.ti; .tw; .mp]
23.	Compression adj2 wrap [.ti; .tw; .mp]
24.	Stockings, compression/ [MeSH] [.ti; .tw; .mp]
25.	Abdominal adj2 binder [.ti; .tw; .mp]
26.	20 or 21 or 22 or 23 or 24 or 25
27.	11 and 26

28.	Rehabilitation [.ti; .tw; .mp]
29.	11 and 28
30.	“Functional electrical stimulation” [.ti; .tw; .mp]
31.	11 and 30
32.	Exercise [.ti; .tw; .mp]
33.	11 and 32
34.	Physical manoeuvres [.ti; .tw; .mp]
35.	11 and 34
36.	Diet [.ti; .tw; .mp]
37.	Fluid [.ti; .tw; .mp]
38.	Meal* [.ti; .tw; .mp]
39.	Water [.ti; .tw; .mp]
40.	Food [.ti; .tw; .mp]
41.	36 or 37 or 38 or 39 or 40
42.	11 and 41
43.	parkinson* or alzheimer* or dementia or “multiple sclerosis” or “motor neuron*” or stroke [.ti; .tw; .mp]
44.	exp Stroke [MeSH] [.ti; .tw; .mp]
45.	exp “Neurodegenerative diseases” [MeSH] [.ti; .tw; .mp]
46.	exp Dementia [MeSH] [.ti; .tw; .mp]
47.	exp “Multiple sclerosis” [MeSH] [.ti; .tw; .mp]
48.	exp Cerebrovascular adj2 disease [MeSH] [.ti; .tw; .mp]
49.	exp “Brain ischemia” [MeSH] [.ti; .tw; .mp]
50.	exp “Spinal cord injur*” [MeSH] [.ti; .tw; .mp]
51.	exp Brain adj2 injur* [MeSH] [.ti; .tw; .mp]
52.	exp Craniocerebral adj2 trauma [MeSH] [.ti; .tw; .mp]
53.	exp “Central nervous system diseases” [MeSH] [.ti; .tw; .mp]
54.	exp Brain damage, chronic/ [MeSH] [.ti; .tw; .mp]
55.	43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 or 53 or 54
56.	11 and 55
56.	13 and 55
57.	11 and 17 and 55

Appendix II: Appraisal instruments

MAStARI appraisal instrument

**JBI Critical Appraisal Checklist for Randomised Control / Pseudo-randomised Trial**

Reviewer ..... Date .....

Author ..... Year ..... Record Number .....

	Yes	No	Unclear	Not Applicable
1. Was the assignment to treatment groups truly random?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Were participants blinded to treatment allocation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Was allocation to treatment groups concealed from the allocator?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Were the outcomes of people who withdrew described and included in the analysis?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Were those assessing outcomes blind to the treatment allocation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Were the control and treatment groups comparable at entry?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Were groups treated identically other than for the named interventions?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Were outcomes measured in the same way for all groups?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Were outcomes measured in a reliable way?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Was appropriate statistical analysis used?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Overall appraisal:    Include                     Exclude                     Seek further info.

Comments (Including reason for exclusion)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**JBI Critical Appraisal Checklist for Descriptive / Case Series**

Reviewer ..... Date .....

Author ..... Year ..... Record Number .....

	Yes	No	Unclear	Not Applicable
1. Was study based on a random or pseudo-random sample?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Were the criteria for inclusion in the sample clearly defined?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Were confounding factors identified and strategies to deal with them stated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Were outcomes assessed using objective criteria?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. If comparisons are being made, was there sufficient descriptions of the groups?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Was follow up carried out over a sufficient time period?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Were the outcomes of people who withdrew described and included in the analysis?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Were outcomes measured in a reliable way?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Was appropriate statistical analysis used?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Overall appraisal:    Include                   Exclude                   Seek further info

Comments (Including reason for exclusion)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**JBI Critical Appraisal Checklist for Comparable Cohort/ Case Control**

Reviewer ..... Date .....

Author ..... Year ..... Record Number .....

	Yes	No	Unclear	Not Applicable
1. Is sample representative of patients in the population as a whole?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Are the patients at a similar point in the course of their condition/illness?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Has bias been minimised in relation to selection of cases and of controls?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Are confounding factors identified and strategies to deal with them stated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Are outcomes assessed using objective criteria?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Was follow up carried out over a sufficient time period?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Were the outcomes of people who withdrew described and included in the analysis?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Were outcomes measured in a reliable way?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Was appropriate statistical analysis used?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Overall appraisal:    Include                   Exclude                   Seek further info.

Comments (Including reason for exclusion)

---



---



---

Appendix III: Data extraction instruments  
MAStARI data extraction instrument

**JBI Data Extraction Form for  
Experimental / Observational Studies**

Reviewer ..... Date .....

Author ..... Year .....

Journal ..... Record Number .....

**Study Method**

RCT                       Quasi-RCT                       Longitudinal

Retrospective                       Observational                       Other

**Participants**

Setting \_\_\_\_\_

Population \_\_\_\_\_

**Sample size**

Group A \_\_\_\_\_ Group B \_\_\_\_\_

**Interventions**

Intervention A \_\_\_\_\_

Intervention B \_\_\_\_\_

Authors Conclusions:  
\_\_\_\_\_  
\_\_\_\_\_

Reviewers Conclusions:  
\_\_\_\_\_  
\_\_\_\_\_

**Study results**

**Dichotomous data**

Outcome	Intervention ( ) number / total number	Intervention ( ) number / total number

**Continuous data**

Outcome	Intervention ( ) number / total number	Intervention ( ) number / total number