Interventions for reducing sedentary behaviour in people with stroke

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[Intervention Review]

Interventions for reducing sedentary behaviour in people with stroke

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ABSTRACT

Background

Stroke survivors are often physically inactive as well as sedentary,and may sit for long periods of time each day. This increases cardiometabolic risk and has impacts on physical and other functions. Interventions to reduce or interrupt periods of sedentary time, as well as to increase physical activity after stroke, could reduce the risk of secondary cardiovascular events and mortality during life after stroke.

Objectives

To determine whether interventions designed to reduce sedentary behaviour after stroke, or interventions with the potential to do so, can reduce the risk of death or secondary vascular events, modify cardiovascular risk, and reduce sedentary behaviour.

Search methods

In December 2019, we searched the Cochrane Stroke Trials Register, CENTRAL, MEDLINE, Embase, CINAHL, PsycINFO, Conference Proceedings Citation Index, and PEDro. We also searched registers of ongoing trials, screened reference lists, and contacted experts in the field.

Selection criteria

Randomised trials comparing interventions to reduce sedentary time with usual care, no intervention, or waiting-list control, attention control, sham intervention or adjunct intervention. We also included interventions intended to fragment or interrupt periods of sedentary behaviour.

Data collection and analysis

Two review authors independently selected studies and performed 'Risk of bias' assessments. We analyzed data using random-effects meta-analyses and assessed the certainty of the evidence with the GRADE approach.

Main results

We included 10 studies with 753 people with stroke. Five studies used physical activity interventions, four studies used a multicomponent lifestyle intervention, and one study used an intervention to reduce and interrupt sedentary behaviour. In all studies, the risk of bias was high or unclear in two or more domains. Nine studies had high risk of bias in at least one domain.

The interventions did not increase or reduce deaths (risk difference (RD) 0.00, 95% confidence interval (CI) -0.02 to 0.03; 10 studies, 753 participants; low-certainty evidence), the incidence of recurrent cardiovascular or cerebrovascular events (RD -0.01, 95% CI -0.04 to 0.01; 10 studies, 753 participants; low-certainty evidence), the incidence of falls (and injuries) (RD 0.00, 95% CI -0.02 to 0.02; 10 studies, 753 participants; low-certainty evidence), or incidence of other adverse events (moderate-certainty evidence).

Interventions did not increase or reduce the amount of sedentary behaviour time (mean difference (MD) +0.13 hours/day, 95% CI -0.42 to 0.68; 7 studies, 300 participants; very low-certainty evidence). There were too few data to examine effects on patterns of sedentary behaviour.

The effect of interventions on cardiometabolic risk factors allowed very limited meta-analysis.

Authors' conclusions

Sedentary behaviour research in stroke seems important, yet the evidence is currently incomplete, and we found no evidence for beneficial effects. Current World Health Organization (WHO) guidelines recommend reducing the amount of sedentary time in people with disabilities, in general. The evidence is currently not strong enough to guide practice on how best to reduce sedentariness specifically in people with stroke.

More high-quality randomised trials are needed, particularly involving participants with mobility limitations. Trials should include longer-term interventions specifically targeted at reducing time spent sedentary, risk factor outcomes, objective measures of sedentary behaviour (and physical activity), and long-term follow-up.

PLAIN LANGUAGE SUMMARY

Interventions to reduce sedentary behaviour after stroke

Review question
We reviewed the evidence that examines the effects of treatments to reduce the amount of sedentary behaviour in people after stroke.

Background
'Sedentary behaviour' refers to sitting or lying down (e.g. sitting watching the television) during the daytime rather than being active and 'up and about'. After any kind of stroke, it is very common for people to spend a lot of time in sedentary behaviour. This is common both among stroke patients who are in hospital as well as those who have been discharged home. Sedentary behaviours are known to be damaging to health; they increase the risk of heart attacks and strokes, and increase the chance of dying. Spending less time sitting after stroke could reduce these risks for people during life after stroke. If sedentary time is reduced then, by definition, physical activity (such as walking) must increase. In combination, this could not only reduce health risks but also improve the way people with stroke move and the way they feel.

Study characteristics
In December 2019, after comprehensively searching the scientific literature, we identified 10 randomised controlled trials for inclusion in the review. The studies involved a total of 753 participants at all stages of care, including being in hospital or back to living at home. Most of the people who took part were able to walk and stand on their own. The interventions ranged in duration from six weeks up to 18 months and all involved some element of increased physical activity. Studies included exercise alone (one study) or in combination with education and coaching (one study); physical activity alone (one study) or in combination with a mobile phone 'app' (one study), multi-component lifestyle interventions including physical activity (four studies), and additional inpatient physiotherapy (one study). One study used an intervention specifically aimed at breaking up long periods of continuous sitting.

Because of problems in the ways they were conducted, and in the ways they were reported by the research teams, all studies were at high or unclear risk of bias.

Key results
Currently, the evidence shows that interventions to reduce sedentary behaviour do not increase or reduce death, cardiovascular events, falls or other adverse events, or amount of time spent sitting. However, even though the evidence is incomplete, there may still be value in people after stroke trying to sit less, providing it is safe to do so.

Certainty of the evidence
We assessed the 'certainty' of the evidence with the GRADE methodology. Our certainty about the effects of these interventions on death, cardiovascular events, and falls is low, and for their effects on other adverse events it is moderate. The certainty of the effects on sedentary behaviour itself is very low. Interest in sedentary behaviour after stroke is relatively recent; the main problem with the evidence is that very

few studies have examined this to date. The available evidence tends to be restricted to patients after stroke who are more mobile. Many studies were not conducted for long enough periods to show longer-term changes in sitting behaviour, or changes in the risk of illness or death.

Summary of findings 1. Interventions compared to control at end of intervention

Interventions compared to control at end of intervention for reducing sedentary behaviour in people with stroke

Participants: people with stroke, who participated in an intervention to reduce or fragment sedentary time
Setting: any
Intervention: any intervention designed to reduce or fragment sedentary behaviour with or without usual care
Comparison: no intervention, attention control, sham intervention or adjunct intervention with or without usual care

Outcomes		Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	No of participants (studies)	Certainty of the evidence (GRADE)	Comments
		Risk with control at end of intervention	Risk with interventions				
Death Analysis 1.1		25 per 1,000	30 per 1,000 (13 to 71)	RD 0.00 (-0.02 to 0.03)	753 (10 RCTs)	⊕⊕⊖⊖ Low[a, b]	Interventions do not increase/reduce death
Recurrent cardiovascular or cerebrovascular events Analysis 1.2		85 per 1,000	101 per 1,000 (42 to 238)	RD -0.01 (-0.04 to 0.01)	753 (10 RCTs)	⊕⊕⊖⊖ Low[a, b]	Interventions do not increase/reduce recurrent cardiovascular or cerebrovascular events
Adverse events	Falls Analysis 1.3	20 per 1,000	23 per 1,000 (10 to 56)	RD 0.00 (-0.02 to 0.02)	753 (10 RCTs)	⊕⊕⊖⊖ Low[a, b]	Interventions do not increase/reduce the risk of falls
	Other	Not including falls, there were 51 recorded adverse events in the intervention groups and 50 in the control groups		-	753 (10 RCTs)	⊕⊕⊕⊖ Moderate[a]	Interventions do not increase/reduce the number of other adverse events Although the reporting of this outcome was not always clear, there is a reasonable number of events and these are balanced across the intervention and control groups
Sedentary behaviour (time)	Time Analysis 1.4	The mean sedentary behaviour	MD 0.13 hours/day higher	-	300 (7 RCTs)	⊕⊖⊖⊖ Very low[a, c, d]	Interventions do not increase/reduce in sedentary behaviour quantified as sitting time

		(time) was 9.22 hours/day	(0.42 lower to 0.68 higher)			This outcome combines objectively (weight 74%) and subjectively (weight 26%) assessed data which can underestimate sedentary time
	Pattern	Effects on reducing prolonged (> 30min) sitting time and effects increasing interruptions to sitting (sit to stand transitions) are inconclusive	-	188 (3 RCTs)	⊕⊖⊖⊖ Very low[e, f]	The data are too few and biased for any conclusions about effects on patterns of sedentary behaviour. The direction of effect is in favour of the control groups in 2 of the 3 studies

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the __relative effect__ of the intervention (and its 95% CI).

CI: confidence interval; **MD:** mean difference; **RCT:** randomised controlled trial; **RD**: risk difference

GRADE Working Group grades of evidence
High certainty: We are very confident that the true effect lies close to that of the estimate of the effect
Moderate certainty: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
Low certainty: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect
Very low certainty: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

[a]Indirectness: higher function patients who can stand and walk independently and who can participate in physical activity and exercise may not represent those who are most likely to benefit from interventions to reduce sedentary behaviour
[b]Imprecision: the very low number of events means evidence is downgraded
[c]Only one of the two hospitals in LAST 2018 had analysable sedentary time data and there were multiple other risk of bias items which reduce confidence in this measurement.
[d]Only LAST 2018 and English 2016b used objectively measured sedentary time; all other studies report subjective data
[e]The STARFISH 2018 study is at high risk of bias and the sit to stand data of Wellwood 2004 are biassed through a high proportion of dropouts
[f]Low number of studies, low number of participants

BACKGROUND

Current World Health Organization (WHO) advice is that adults living with disability should limit the amount of time spent sedentary and that replacing sedentary behaviours with physical activity is beneficial (WHO 2020). Interventions to increase physical activity, including exercise, are routinely included in recommendations for stroke rehabilitation and secondary prevention; some also include a recommendation for reduced sedentary behaviour (Billinger 2014). However, little is known about the effectiveness of interventions to reduce sedentary behaviour after stroke. There is growing public health concern about the effects of sedentary behaviours (Chau 2013; Ekelund 2020; Young 2016).

The Sedentary Behaviour Research Network (SBRN) Terminology Consensus Project defines sedentary behaviours as any waking behaviour characterized by an energy expenditure less than or equal to 1.5 metabolic equivalents (METs), while in a sitting, reclining or lying posture (Tremblay 2017). METs are a tool used for estimating energy expenditure in many kinds of physical activities (Ainsworth 2011).

An underlying assumption in this definition is a lack of muscle activity in the large muscle groups that contribute to the weight-bearing of the body during a sitting or reclining posture (Tikkanen 2013). A lack of muscle activity leads to suppression of skeletal muscle lipoprotein lipase (LPL) (Hamilton 2004). Reduced LPL activity is linked to decreased levels of high-density lipoprotein (HDL) cholesterol, increased triglyceride levels (Pesola 2015), insulin resistance and glucose intolerance (Bergouignan 2011), and increased risk of all-cause mortality (Thomsen 2014). Therefore, the amount of muscle activity seems to be an important (albeit implicit) factor of the sedentary behaviour definition and must be taken into account when identifying sedentary behaviour. Sitting is the predominant wake-time sedentary behaviour, and therefore is often the target for measurement and intervention efforts to reduce sedentary behaviour. Indeed, many of the devices used to objectively measure sedentary behaviour do not readily distinguish between sitting and reclining postures.

Too much time spent sedentary is associated with poor physical and mental health. The recent WHO guidelines show sedentary behaviour and physical activity are important in relation to all-cause and cause-specific mortality and incidence of cardiovascular disease, cancer, type 2 diabetes, and adiposity/body composition (WHO 2020). Sedentary behaviour and physical activity are also important in relation to mental health and cognitive outcomes, physical function, musculoskeletal health, sleep duration and quality, and health-related quality of life.

Therefore, interventions to reduce sedentary behaviour could benefit cardiovascular risk and mortality in a range of patient populations, including people with stroke.

Description of the condition

A stroke is caused by an interruption to the circulation of the brain, either by a clot (ischemic stroke) or a bleed (haemorrhagic stroke). The classic definition of stroke is "rapidly developing clinical signs of focal (at times global) disturbance of cerebral function, lasting more than 24 hours or leading to death with no apparent cause other than that of vascular origin" (Hatano 1976). Globally, stroke is the second leading cause of death and third leading cause of disability adjusted life years (DALYs) (WHO 2016), with around 50% of stroke survivors experiencing long-term disability (Mackay 2004).

The Global Burden of Stroke report indicated significant increases globally between 1990 and 2013 in stroke-related prevalence, total deaths, and DALYs in younger adults aged 20 to 64 years, with two-thirds of all strokes reported to occur in people under the age of 70 years (Feigin 2017). In young and middle-aged people, stroke may be increasing because of the increase in metabolic risk factors, including obesity and diabetes mellitus (Feigin 2017).

Risk factors

Global risk factors for stroke include hypertension, elevated blood lipids, diabetes, atrial fibrillation, and modifiable lifestyle factors, including physical inactivity, poor diet, obesity, smoking, and alcohol (Kuklina 2012; O'Donnell 2016). The key risk factors for first or recurrent stroke are cardiometabolic in nature and include hypertension (Sacco 1997), and impaired glucose tolerance (Fonville 2014). Pre-diabetes is present in 23% to 53% of stroke and transient ischemic attack (TIA) survivors and is responsible for a two-fold increase in the risk of recurrent stroke (Fonville 2014). Sedentary behaviours, coupled with physical inactivity, could be contributing to the increased cardiovascular risk and mortality after stroke.

Recurrent stroke

Recurrent stroke is common among those who survive the initial index stroke event. Systematic review data demonstrates the cumulative risk of stroke recurrence is 3.1% at 30 days, 11.1% at one year, 26.4% at five years, and 39.2% at 10 years after the index stroke event (Mohan 2011). While there is some evidence of declining rates of stroke recurrence, this remains a major clinical issue, with one-third of patients having secondary strokes or dying within five years (Pennlert 2014). Secondary stroke prevention, by, for example, reducing sedentary behaviour and increasing physical activity after stroke, is therefore of paramount importance.

Sedentariness and inactivity

Many stroke survivors are both sedentary (i.e. sit for long periods each day) and physically inactive (i.e. do not meet guidelines for moderate to vigorous physical activity (MVPA) (Bull 2010)), even those who have the physical capability to be more active (Tieges 2015). There are a number of studies that demonstrate the nature of these issues in people with stroke.

- Observational studies have objectively measured sedentary behaviour (sitting time) in stroke survivors living at home and show stroke survivors typically sit for more than 10 hours per day (English 2016a; Kerr 2015; Kunkel 2015; Paul 2016; Tieges 2015). This falls within the category of concern identified by Ekelund 2016.
- Sitting time is known to remain high for at least the first year after stroke. Sedentary time exceeding 10 hours per day has been observed immediately post-discharge (Kerr 2015), one year post-stroke (Kunkel 2015; Tieges 2015), and several years post-stroke (4.2 ± 4.0 years: Paul 2016; and 4.4 ± 10 years English 2016a).
- High sitting time after stroke includes a pattern of prolonged, uninterrupted bouts of sedentary time (median bout length 1.7 hours (interquartile range (IQR) 1.4 to 2.2; Tieges 2015).

- People with stroke also tend to be physically inactive. A systematic review of 26 studies (983 participants) demonstrated that community-dwelling stroke survivors' step counts were less than 50% of their age-matched controls and sedentary time occupied 63% to 87% of reported monitoring periods (English 2014).
- People with stroke spend less time daily in light physical activity and MVPA in comparison with age-matched healthy control participants (English 2016a); people with stroke spent 4.9 (standard deviation (SD) 5.8) minutes per day, whilst control participants spent 38 (SD 31.0) minutes per day in MVPA. Failure to achieve regular adequate levels of MVPA places stroke survivors at even higher risk from the effects of high sitting time (Ekelund 2016).

The reasons why stroke survivors tend to be physically less active and more sedentary than their healthy counterparts are beginning to be better understood. First, lack of physical activity may be one of the risk factors that precipitates stroke in a proportion of cases, and if habitual, might be difficult to change after stroke. Findings from qualitative studies (Morris 2015; Morris 2017; Nicholson 2014), and systematic reviews (Morris 2012; Nicholson 2013), have highlighted a range of barriers to increasing physical activity after stroke; these relate to stroke survivors themselves (e.g. fear of another stroke, fatigue, depression), carers (e.g. lack of confidence), professionals (e.g. perceived role limitations), and the environment (e.g. lack of appropriate access).

People with stroke report that they became more sedentary after stroke because of balance and co-ordination impairments, increased fatigue, and reduced confidence in mobilising (Hall 2020). Sedentary behaviour after stroke may also be influenced by pain when attempting to stand up, fear of falling, tiredness after undertaking daily activities, feelings of anxiety, depression or apathy, environmental barriers to engaging in activities, lack of social interaction, as well as habitual behaviour (Fitzsimons 2020).

Balance can be improved through various different types of exercise intervention (Saunders 2020). Therefore, physical activity including exercise could have an indirect role by addressing barriers known to encourage sedentariness after stroke as well as a direct role in providing functional and risk factor benefits. Interventions that included tailored counselling were more effective in increasing the uptake and maintenance of physical activity after stroke than supervised exercise alone (Morris 2015). The effectiveness of interventions aimed at changing sedentary behaviour after stroke is, however, yet to be established.

In summary, prolonged uninterrupted periods of sedentary behaviour (sitting) occurs alongside the low levels of physical activity common after stroke in a pattern which persists for the long term. This could contribute to the long-term high risk of secondary cardiovascular events and death observed among stroke survivors. Therefore, interventions to reduce and/or interrupt sedentary time or increase physical activity time at any time post-stroke might help reduce the global burden of stroke.

Description of the intervention

Interventions to reduce sedentary behaviour, including replacing it with physical activity behaviours, require behaviour change strategies. A review of behaviour-change strategies to reduce sedentary behaviour in adults indicated that interventions incorporating changes to environment (social and physical), self-regulatory techniques (self-monitoring and problem-solving), and provision of health information were connected to effectiveness (Gardner 2016). More than 50% of the interventions reviewed were work site-based. Secondly, there are barriers to performing physical activity after stroke (including lack of motivation, environmental factors, health concerns, and stroke impairments) and also motivating factors (including social support and desire to perform activities of daily living (ADL)) (Nicholson 2013). These factors are therefore also intervention targets.

Therefore, interventions to reduce (or interrupt) sedentary behaviours after stroke could vary greatly in nature. Possible behavioural interventions to reduce sitting time could include, but not be limited to:

- prompting mechanisms to interrupt prolonged sitting (e.g. mobile phone 'apps' or wearable fitness devices);
- provision of information about health consequences (e.g. effects of sedentary behaviour, physical activity and inactivity);
- provision of feedback on behaviour (e.g. devices to demonstrate the amount of time people have spent sitting);
- action planning (e.g. prompting a person on when they might sit less at a particular time on a certain day);
- restructuring the physical home environment to encourage standing or moving (e.g. cushions that offer vibratory feedback on time spent sitting, furniture for sitting, TV lockout mechanisms, restricting use of remote controls and labour-saving devices);
- facilitating walking in place of seated transport.

Sedentary time reduction need not explicitly be restricted to behavioural interventions. It is also plausible that pharmacological interventions with the potential to reduce fatigue (e.g. caffeine or modafinil) could be provided with the intention of reducing sedentary time.

Two systematic reviews have examined the effectiveness of interventions to reduce sedentary time in adults (Martin 2015; Prince 2014); neither included cohorts of people with stroke. One of these focused on interventions targeting physical activity or sitting time, or both, in adults (Prince 2014: 63 studies, 446 participants). Martin 2015 (51 studies, 8087 participants) included a broader range of potential interventions comprising those specifically intended to reduce sitting time (3/51), interventions aimed at increasing physical activity (16/51), interventions combining sitting time reduction with increased physical activity (9/51), dietary interventions (1/51), and multi-component lifestyle interventions (22/51). A recent umbrella review also demonstrated the effectiveness of interventions for the reduction of sitting time and screen time among younger adults and children (Nguyen 2020).

Gardner 2016 suggests that interventions targeting sedentary behaviour rather than increasing physical activity may be more effective. Conversely, there are good reasons why replacing sedentary behaviours with physical activity/exercise after stroke may provide additional advantage not just for cardiovascular disease (CVD) risk and mortality (Ferreira 2016), but also multiple cognitive, physical, and psychosocial benefits (Saunders 2014). Also, high levels of moderate intensity physical activity (i.e. about 60 to 75 minutes per day) seem to ameliorate the increased risk of death associated with high sitting time (Ekelund

2016). However, because achieving adequate MVPA is difficult for stroke survivors, reducing sedentary time might be a more achievable target for secondary prevention in many stroke survivors. Therefore, interventions to reduce sedentary behaviour could be widely applicable after stroke because they could be used by stroke survivors who find physical activity difficult, and still be implemented alongside physical activity and exercise interventions for those who are more high functioning.

In summary, interventions for reducing sedentary time may be complex in nature, comprising a number of 'active ingredients', and they may be achievable and relevant for a wide range of people with stroke - including those who are non-ambulatory.

How the intervention might work

Recent systematic review evidence demonstrates that lifestyle interventions and those specifically targeting sitting time among adults are effective in reducing total sitting time (Martin 2015). Evidence of intervention effects on changes in patterns of accumulation of sitting time remains limited. These behavioural interventions seem feasible in adults and, if the effects on sitting time can be replicated in people with stroke, this could trigger benefits which are clinically important as well as meaningful for people with stroke.

Risk reduction

In people with stroke, high sedentary time is prevalent (English 2016a; Kerr 2015; Kunkel 2015; Paul 2016; Tieges 2015), and high sedentary time is associated with increased cardiometabolic risk (Biswas 2015; Matthews 2012). Therefore, it can be hypothesised that interventions that reduce sedentary time after stroke could improve the profile of cardiometabolic risk, which, in turn, could reduce the chance of vascular events (including recurrent stroke) and reduce mortality. For example, hypertension is the most important cardiometabolic risk factor for first and recurrent strokes (Sacco 1997). Increased time spent in sedentary behaviours is associated with increased blood pressure (Lee 2015). Reducing systolic blood pressure (SBP) by 5 mmHg causes a 10% reduction in the risk of cardiovascular and cerebrovascular events (including stroke) (BLTTC 2008).

In other populations, including overweight and obese, and diabetic and pre-diabetic populations, laboratory-based studies have shown positive, short-term effects of breaking prolonged sitting time on cardiovascular disease risk factors, such as postprandial hyperglycaemia (Bailey 2015; Dempsey 2016; Dunstan 2012, Henson 2015; Holmstrup 2014; Peddie 2013), plasma clotting factors (Howard 2013), blood pressure (Larsen 2014), and possibly endothelial shear forces (Thosar 2015). However, the long-term effectiveness of reducing sedentary time remains largely unknown.

High sedentary time in the most inactive people increases the risk of premature death in adults (Ekelund 2020); the risk is lowered when sedentary time is less and/or if the amount of MVPA is higher. Therefore, risk of premature death could be reduced by different combinations of interventions targeting sedentariness and/or physical activity.

Other benefits

Reducing sedentary time necessarily (by definition) involves replacing it with some form of physical activity. Therefore, numerous plausible, meaningful benefits could be achieved though reducing sedentary time; these may be similar in nature to other interventions that aim to increase energy expenditure, including physical activity and exercise. Even the demands of simply rising from sitting in a chair should not be underestimated. Sit-to-stand transitions themselves increase metabolic energy expenditure by approximately 35% above resting levels (Júdice 2016), and recruit 78% to 97% of maximal muscle strength in older people (Hughes 1996): this represents substantive high-intensity muscle contraction and effort. Therefore, the most basic element of interventions to reduce or fragment sitting time could, in itself, result in benefits resembling those expected from physical activity and even exercise. This means a broad range of benefits might occur for people with stroke including those relating to physical function, complications of immobility (Govan 2007), and cognition (Cumming 2012). Importantly, interventions to interrupt sedentary behaviour (e.g. assisted sit-to-stand transitions) may be feasible for stroke survivors who are unable to do so independently. There are good reasons why a range of multiple, meaningful benefits could arise from interventions to reduce sedentary behaviour after stroke in the same way that they do for physical activity and exercise interventions (Saunders 2014).

Why it is important to do this review

As described earlier, recurrent stroke (and death) are very common after stroke (Mohan 2011; Pennlert 2014). Interventions to avoid recurrent stroke are ranked highly by stroke patients (Rudberg 2020). Sedentary behaviour is a common and persistent feature of life after stroke (English 2016a; Tieges 2015), and this is likely to have a negative impact on cardiovascular risk factors which increase the chance of recurrent strokes and death (Ekelund 2016; Ekelund 2020).

Therefore, interventions designed to reduce/interrupt sedentary behaviours (see Description of the intervention) may reduce cardiovascular risk factors and reduce the chance of recurrent strokes and death for a large proportion of stroke survivors. It is also plausible that interventions that reduce sedentary behaviour may also ameliorate some common complications of immobility (Govan 2007), and could benefit cognitive function, which is ranked highest among the 'top 10 research priorities for life after stroke' as identified by stroke patients, their carers, and healthcare professionals (Pollock 2014).

Two existing systematic reviews investigate sedentary behaviours interventions in relation to stroke (Kringle 2020; Mackie 2019). However, the first includes non-randomised studies and those lacking sedentary behaviour outcomes (Kringle 2020), and the second is a scoping review which included studies with non-stroke population (Mackie 2019).

Reducing sedentary behaviour is currently recommended for all people, including those with chronic disease (WHO 2020). It is also recommended within guidelines for physical activity and exercise after stroke (Billinger 2014). However, the benefits (and risks) of reducing sedentary behaviour after stroke have not been established or explored using rigorous systematic review methodology.

Currently, we do not know if sedentary behaviour can be reduced effectively after stroke and whether doing so has an impact on adverse events. If sedentary behaviour can be reduced after stroke, we do not know whether cardiometabolic risk is reduced and whether benefits to secondary prevention and mortality occur.

The findings of this review will:

- inform development of new trials and interventions;
- add to future iterations of the physical activity and exercise guidelines for people after stroke;
- inform clinical practice;
- inform education and training of health, social care, and exercise professionals working with people with stroke.

OBJECTIVES

To determine whether interventions designed to reduce sedentary behaviour after stroke, or that have the potential to do so, can reduce the risk of death or secondary vascular events, modify cardiovascular risk and reduce sedentary behaviour.

We will include interventions that reduce the time spent sedentary and/or those that reduce the length of prolonged uninterrupted periods of sedentary time (i.e. interventions to fragment or interrupt sedentary behaviour).

Primary objectives

To determine whether interventions to reduce or interrupt sedentary time, or that have the potential to do so, influence:

- mortality;
- recurrent cerebrovascular or cardiovascular events.

Secondary objectives

To determine whether interventions to reduce or interrupt sedentary time, or that have the potential to do so, influence:

- amount of sedentary time;
- cardiometabolic risk profile (e.g. glucose tolerance, arterial function, blood cholesterol and blood pressure);
- adverse events (in addition to recurrent events, e.g. falls).

Other objectives

In addition, as a scoping exercise, we will describe the range of all outcome measures reported in all trials. By definition, any included study interventions will fall within the umbrella of physical activity. Therefore, it may be that multiple plausible benefits could emerge that are common to other energy-expending interventions.

METHODS

Criteria for considering studies for this review

Types of studies

We included randomised controlled trials (RCTs) including cluster-RCTs. We included randomised cross-over studies if data from the first iteration were available and were analyzed as an RCT.

Types of participants

We sought studies recruiting stroke survivors, 18 years of age or over, with any degree of stroke severity, at any stage of care, and at any time since the stroke. We included participants regardless of their ability to walk independently or stand independently.

In studies where both stroke and non-stroke participants were included, we determined whether the subset of data for the stroke participants was accessible from the trial report or through contact with the trial authors. If not, we excluded the study.

Types of interventions

Interventions

We included RCTs of interventions where a reduction or interruption, or both, of prolonged periods of sedentary behaviour, was specifically intended, with or without a co-intervention or usual care. We also included interventions with the potential to reduce sedentary behaviour.

Examples of interventions could include, but not be limited to: prompting mechanisms to interrupt prolonged sitting, provision of information about health consequences, provision of feedback on behaviour, action planning, restructuring the physical home environment, facilitating walking in place of seated transport, and pharmacological interventions (see Description of the intervention).

Comparisons

The control intervention could include: 1) usual care; 2) no intervention or waiting-list control; or 3) attention control, sham intervention, or adjunct intervention. The types of comparison are as follows.

- [Interventions to reduce sedentary behaviour] versus [no intervention or waiting-list control]
- [Interventions to reduce sedentary behaviour] versus [attention control, sham intervention or adjunct intervention]
- [Interventions to reduce sedentary behaviour] plus [usual care] versus [no intervention or waiting-list control] plus [usual care]
- [Interventions to reduce sedentary behaviour] plus [usual care] versus [attention control, sham intervention or adjunct intervention] plus [usual care]

Types of outcome measures

A classification of the types of outcome measure in this review is summarised in Table 1.

Primary outcomes

Death

We recorded any rate or time to event data.

Recurrent cardiovascular or cerebrovascular events

We recorded any rate or time to event data.

Secondary outcomes

Adverse events

In addition to mortality, recurrent cardiovascular, and cerebrovascular events, the incidence of falls (and injuries) was the

key adverse event to consider. This is because whilst interventions to reduce sitting time could reduce the incidence of falls and fractures, they could also increase their risk (Growdon 2017).

Sedentary behaviour

Sedentary behaviours, operationalised in terms of amount of sedentary time, obtained with any objective (e.g. accelerometers or inclinometers), self-reported (e.g. questionnaires, diaries) and/or proxy (e.g. screen time, transport time) measures. In addition, some studies may report the degree to which prolonged periods of sedentary behaviour are interrupted or fragmented; there is currently no gold standard for this measurement concept.

This outcome was also an eligibility criterion. We only included studies if the amount or pattern of time spent in sedentary behaviour were included.

Risk factors

Cardiometabolic risk markers, including but not limited to: 1) glucose tolerance, 2) arterial function, 3) blood cholesterol, and 4) blood pressure.

Other outcomes

Any included study will aim to reduce sedentary behaviour and therefore, by definition, must also be increasing physical activity. Therefore, multiple benefits could arise from this class of intervention that align to common post-stroke problems and include patient-important outcomes (Pollock 2014; Rudberg 2020). As a scoping exercise, we recorded (but did not analyze quantitatively) all other outcomes reported by the included studies. A categorisation of types of other outcomes is included in Table 1.

In studies where more than one measurement tool was used to assess the same outcome (e.g. objective and self-reported measures of sitting time) we planned to include data in separate meta-analyses or use a sensitivity analysis to determine the effect of the different measurement instruments.

The time points at which outcome data were collected were: 1) at the end of intervention, and 2) the end of follow-up, if available.

Search methods for identification of studies

See the Search Methods of the Cochrane Stroke Group's Specialised Register. We searched for trials in all languages and arranged for the translation of relevant articles where necessary.

Electronic searches

We searched the Cochrane Stroke Group's Specialised Register and the following electronic databases on 2 December 2019.

- Cochrane Central Register of Controlled Trials (CENTRAL; 2019, Issue 12) in the Cochrane Library (Appendix 1)
- MEDLINE Ovid (from 1946 to 2 December 2019; Appendix 2)
- Embase Ovid (from 1974 to 2 December 2019; Appendix 3)
- CINAHL EBSCO (Cumulative Index to Nursing and Allied Health Literature; from 1937 to 2 December 2019; Appendix 4)
- PsycINFO Ovid (from 1806 to 2 December 2019; Appendix 5)
- Conference Proceedings Citation Index (Web of Science; from 1990 to 2 December 2019; Appendix 6)
- PEDro (Physiotherapy Evidence database (www.pedro.fhs.usyd.edu.au/index.html; Appendix 7)

We developed the MEDLINE search strategy (Appendix 2) with the help of the Cochrane Stroke Group Information Specialist and adapted it for the other databases. The search strategy included Cochrane Highly Sensitive Search Strategies for identification of RCTs (as described in the *Cochrane Handbook for Systematic Reviews of Interventions;* Lefebvre 2011) and Cochrane Stroke Group's search strategies for the identification of 'stroke' studies in respective databases and other resources. These were supplemented with strategies to identify interventions to reduce sedentary time; this is challenging because almost any class of intervention that improves health could plausibly cause a reduction in sedentary time. Therefore, we searched for studies that included search terms relating to 'sedentary behaviours' because these formed part of the description of any study intervention deliberately intended to reduce sedentary behaviour and those with the potential to reduce sedentary behaviour.

In order to identify other published, unpublished and ongoing studies we searched for ongoing trials, using the following registries.

- US National Institutes of Health register of ongoing trials (ClinicalTrials.gov; Appendix 8)
- WHO International Clinical Trials Registry Platform (ICTRP) (apps.who.int/trialsearch; Appendix 9)

We searched for dissertations and theses using:

- ProQuest Dissertations and Theses Global (www.proquest.com/products-services/pqdtglobal.html; Appendix 10);
- British Library EThOS (e-theses online service) (www.ethos.bl.uk);
- DART-Europe E-theses PortAL (www.dart-europe.eu/basic-search.php).

We searched grey literature using:

- Google Scholar (scholar.google.co.uk/).

Searching other resources

We checked the bibliographies of included studies and performed forward citation-tracking of all included trials (and other relevant studies) using Google Scholar (scholar.google.co.uk/) for further references to relevant trials. We contacted researchers in the field (e.g. SBRN) to obtain additional information on relevant trials and contacted original authors for clarification and further data if trial reports were unclear.

Data collection and analysis

Selection of studies

Two review authors (DS or CF or CE or PK or OV) independently screened titles and abstracts of the unique references obtained as a result of our searching activities. We excluded trials that two review authors classified as 'exclude'; we retained all other trials for full-text screening.

We retrieved the full-text articles for the remaining references and two review authors (DS or CF or CE or PK or OV or KB) independently screened the full-text articles and identified studies for inclusion,

and identified and recorded reasons for exclusion of the ineligible studies. We resolved any disagreements through discussion or, if required, we consulted a third review author (DS or CF or CE or PK or OV or KB or GM or FVW). We collated multiple reports of the same study so that each study, not each reference, was the unit of interest in the review.

We used the Covidence tool (www.covidence.org) to carry out the selection process and recorded this process in sufficient detail to complete: 1) a PRISMA flow chart, and 2) a 'Characteristics of excluded studies' table.

We included studies irrespective of publication status, providing available reports had sufficient detail to apply eligibility criteria and perform 'Risk of bias' assessment.

We retained potentially relevant studies with insufficient information to either include or exclude in the 'Characteristics of studies awaiting classification' table.

Data extraction and management

One review author (DS or CF or CE or PK or KB) extracted data from each included study. The study and outcome data were entered directly into Review Manager 5 (RevMan 2014). A second review author (DS or CF or KB or FVW) then cross-checked all entered data. We contacted study authors to obtain any missing data if required.

The domains for data extraction included but were not limited to:

- participant details: including age, gender, country of study, type of stroke, time since stroke, stroke severity, ability to stand independently at baseline and ability to walk independently at baseline;
- intervention description: since there is potential for diverse types of intervention we ensured that we recorded a clear description of the intervention type (sedentary behaviour, physical activity, or part of a multi-component lifestyle intervention), the dose (e.g. time, intensity, frequency and overall programme duration), the intervention setting, the conditions under which the intervention took place (e.g. supervised), and a description of any usual care co-intervention exposure. We documented the intervention parameters using the TIDieR format (Hoffmann 2014);
- comparison intervention: including any usual care exposure;
- outcome measures and data: including frequencies (dichotomous variables) and means and standard deviations (continuous variables) at the end of intervention and at end of follow-up time points. Where required, change from baseline data and other variables which allow imputation of standard deviations were recorded (e.g. standard error or 95% confidence intervals). We recorded the type of outcome tool used to measure sedentary behaviour (i.e. objective measurement tool, sitting time self-report, proxy measurement tool);
- risk of bias items.

Assessment of risk of bias in included studies

Two review authors (DS and KB) independently assessed each study using Cochrane's tool for assessing risk of bias (Higgins 2011b). We resolved any disagreements by discussion or by involving another review author (CF or CE or PK or OV or GM or FVW). We assessed the risk of bias for each of the standard domains in the Cochrane 'Risk of bias' tool, with the following exceptions and amendments.

Blinding of participants (performance bias and detection bias)

Participant blinding is often impossible to achieve in behavioural interventions. However, we considered studies to be at low risk of bias if some attempt was described by the trial authors to disguise the true purpose of the comparisons being made (e.g. describing a trial as a comparison of two different interventions or some kind of 'sham' intervention). We considered studies to be at high risk of bias if there was an imbalanced exposure, such as would occur with no control intervention or a waiting-list control.

Incomplete outcome data (attrition bias)

This domain was assessed twice, once at the end of intervention and once at the end of follow-up (if this took place). We considered studies to be at high risk of bias where imbalanced losses were judged to have occurred coupled with a per-protocol analysis. If overall participant attrition was 20% or greater of those randomised, we considered a trial at high risk of bias (Schulz 2002), irrespective of distribution of losses, reasons given or analytical approach (e.g. imputations, intention-to-treat).

Other bias

We considered 'Risk of bias' items relevant to cluster-RCTs in this domain.

Imbalanced exposures

We included this additional 'Risk of bias' item because an imbalanced exposure could exaggerate benefits (or harms) in a way where it is impossible to separate the effects of the intervention content from the effects of attention. Therefore, strictly speaking, this is a confounding effect rather than a bias effect, but it is appropriate to record it and analyze it in the same way as other risk of bias items. We considered studies to be at low risk of bias if a 'dose' of exposure or attention was provided in the control group which matched that in the intervention groups (e.g. attention control or sham intervention). We considered studies to be at high risk of bias if the control group received no control intervention including being allocated to a waiting-list control.

In all categories when there was insufficient information to assign either a 'low risk' or 'high risk' of bias, we contacted the trial authors and asked them for clarification. Where missing supplementary information could not be obtained we recorded an 'unclear' risk of bias. We recorded 'high', 'low' or 'unclear' risk of bias along with a descriptive justification for our judgment in the 'Risk of bias' tables. The data were presented in a 'Risk of bias summary' figure and 'Risk of bias graph' figure.

Measures of treatment effect

Dichotomous data

For dichotomous outcome data, we calculated the risk difference (RD), with 95% confidence intervals (CIs).

Continuous data

Where possible, we presented the effects of interventions on all continuous outcome data in terms of the mean difference (MD) with 95% CIs. In instances where different scales were used to measure

the same clinical outcome, we planned to present the data as the standardized mean difference (SMD) with 95% CIs.

Unit of analysis issues

Cluster-RCTs: where clustering was a unit of allocation not controlled by the trial authors, we planned to implement this, where appropriate, during meta-analysis, using the methods described in the *Cochrane Handbook* (Higgins 2021).

Crossover studies: if the data could be truncated after the first iteration of a crossover study, the study was treated as an RCT. We planned to ignore subsequent iterations because of the risk of carry-over effects.

Lag-control or waiting-list trials: we planned to deal with these in the same way as crossover studies. We planned to ignore the delayed or waiting-list iteration of these studies because of the risk of carry-over effects.

In studies with more than one relevant control group, we planned to use only one control group within a meta-analysis. We planned to perform sensitivity analysis to examine the relative influence of selecting each group on meta-analysis results. Where data from multiple control groups were similar considered combining the control group data using the methods described in the *Cochrane Handbook* (Higgins 2021).

In studies with more than one relevant intervention group, we included all intervention groups as separate comparisons within a meta-analysis, with the control group data replicated across all comparisons, but with the control group sample size divided evenly (where possible) across among the comparisons to prevent inflation of overall sample size.

Dealing with missing data

Missing participants: we accounted for the nature and extent of missing participant data (e.g. losses to follow-up) and how this was dealt with by the trial authors (e.g. intention-to-treat analysis) via one of the 'Risk of bias' assessments (Assessment of risk of bias in included studies; Incomplete outcome data).

Incomplete reporting: if RCTs had missing information, we contacted the trial authors to request this. If there was insufficient information to include or exclude a potentially-relevant trial and this could not be retrieved, we retained the trial in the 'Studies awaiting classification' section in case the information emerges at a later date.

Assessment of heterogeneity

We assessed heterogeneity using the I^2 statistic presented as part of the forest plots in Review Manager 5 (RevMan 2014). We interpreted values of I^2 exceeding 50% as indicating substantial heterogeneity.

Assessment of reporting biases

The comprehensive search strategy for this review will help to reduce the risk of reporting bias.

When meta-analyses included a minimum of 10 studies, we used a funnel plot (treatment effect versus trial size) to assess the potential for reporting bias.

Data synthesis

Where we considered studies to be sufficiently similar, we conducted a meta-analysis by pooling the appropriate data using Review Manager 5 (RevMan 2014).

We used random-effects meta-analytic models to calculate measures of effect and 95% CIs at the end of intervention and the end of follow-up, for each outcome measure with sufficient suitable data to pool.

Subgroup analysis and investigation of heterogeneity

We obtained all the data to allow subgroup categorisation at the point of data extraction. We planned to perform subgroup analyses for any outcome when there were five or more RCTs within one meta-analysis comparison, which could be partitioned into subgroups, based on the following criteria.

- Time since stroke (acute; chronic; based on definition of Bernhardt 2017; acute and subacute phases 0 to 6 months and chronic > 6 months)
- Ability to stand at baseline (independent; requires assistance)
- Ability to walk at baseline (independent, requires assistance)
- Intervention duration (less than three months; three months or longer)
- Intervention type (reduce sedentary time; interrupt sedentary time; reduce and interrupt sedentary time)

The subgroups may indicate informally whether study level characteristics (of participant and intervention) were connected to study effects sizes and were potentially introducing a source of heterogeneity into pooled effect sizes.

Sensitivity analysis

We planned to use sensitivity analyses for any outcome to examine the effect of decisions made during the review process including:

- effect of including cluster-RCT data;
- effect of more than one relevant control group;
- effect of more than one measurement tool for the same outcome;
- effect of including study data imputed by the review authors.

Summary of findings and assessment of the certainty of the evidence

We used GRADE (Schünemann 2013) to assess the certainty of evidence for the primary outcomes of death and recurrent events, plus the secondary outcomes of adverse events and sedentary behaviour. We downgraded evidence for each outcome if there were considered to be serious or very serious concerns or limitations as follows.

- Indirectness: Evidence was downgraded for higher functioning participants who could stand and walk independently and who could participate in physical activity and exercise. This is because they may not represent those who are most likely to benefit from interventions to reduce sedentary behaviour.
- Imprecision: Evidence was downgraded where there were very low numbers of events in dichotomous outcomes (deaths, secondary events and falls) and in analyses where there were considered to be low number of studies/participants.

- Risk of bias: Evidence was downgraded where there were concerning and/or multiple high risk of bias items.
- Inconsistency: Evidence for sedentary behaviour outcomes was downgraded where subjective and objectively measured sedentary time data were pooled.

We presented these analyses in a 'Summary of findings' table generated using GRADEpro GDT software (GRADEpro GDT 2020). The 'Summary of findings' table included the primary outcomes (death and recurrent events), plus the secondary outcomes of adverse events and sedentary behaviour.

RESULTS

Description of studies

Results of the search

Eight relevant systematic reviews were identified and screened for RCTs (Gebruers 2010; Heron 2016; Kringle 2020 ; Lawrence 2015 ; Lynch 2018; Mackay-Lyons 2013; Mackie 2019; Moore 2018). Of these, only Kringle 2020 and Mackie 2019 contained RCTs with sedentary behaviour outcomes in people with stroke.

The results of our searching activities are summarised in Figure 1. We applied the eligibility criteria, with the following results.

Figure 1.

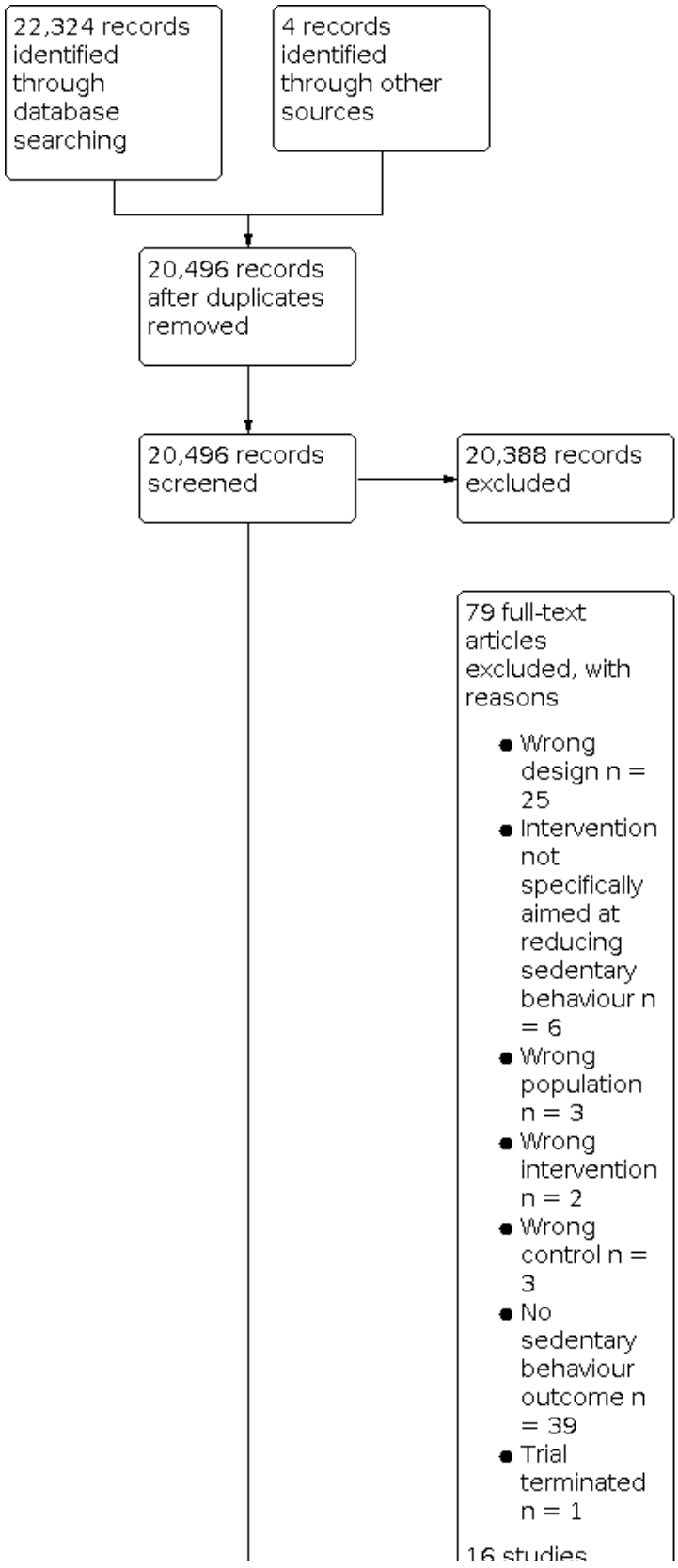
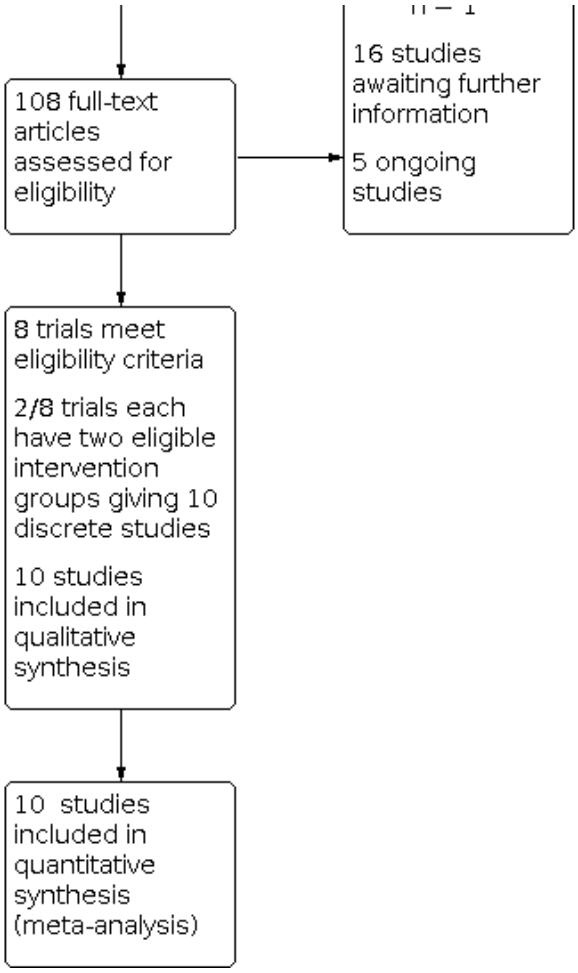


Figure 1. (Continued)



- We excluded 79 studies that did not meet the eligibility criteria (Characteristics of excluded studies).
- We identified 16 studies for which we require more information to establish eligibility, including those for which only the abstract is currently available (Characteristics of studies awaiting classification).
- We identified five ongoing studies (Characteristics of ongoing studies).
- We identified 10 studies that met the eligibility criteria (Characteristics of included studies).

Four of the included studies were derived from two trials, each of which had two intervention arms SPRITE I (arm 1) 2017; SPRITE I (arm 2) 2017 and SPRITE II (arm 1) 2019; SPRITE II (arm 2) 2019. These have been considered separate studies within this systematic review and appear separately in the meta-analyses.

In summary, when these adjustments are reconciled, this review includes a total of 10 studies with a total of 753 participants.

Included studies

Study design

Three studies were RCTs with an end-of-intervention outcome assessment (English 2016b; Krawcyk 2019; LAST 2018).

The SPRITE I pilot and SPRITE II feasibility trials each had one control group and two eligible intervention arms with end-of-intervention outcome assessment (SPRITE I (arm 1) 2017; SPRITE I (arm 2) 2017; SPRITE II (arm 1) 2019; SPRITE II (arm 2) 2019).

STARFISH 2018 included an end-of-intervention assessment and a six-month follow-up (i.e. two months following the end of the four-month intervention).

Vanroy 2019 included two sequential phases of an intervention, both of which are eligible, and each of which had an end-of-intervention outcome assessment. Phase I lasted three months and Phase II lasted a further nine months.

Wellwood 2004 included one-, three-, and six-month follow-up time points for outcome assessment. It was not clear how these time points corresponded with the end of intervention, as this was delivered during inpatient care, and may have been variable if patients were discharged.

Participants

The included studies were distributed among the following pre-planned subgroups based on participant characteristics.

- Time since stroke (acute, chronic)
  - Acute: 8/10 studies - Krawcyk 2019, LAST 2018, SPRITE I (arm 1) 2017, SPRITE I (arm 2) 2017, SPRITE II (arm 1) 2019, SPRITE II (arm 2) 2019, Vanroy 2019, and Wellwood 2004
  - Chronic: 2/10 studies - English 2016b and STARFISH 2018
- Ability to stand at baseline (independent, requires assistance)
  - Independent: 6/10 studies - LAST 2018, SPRITE I (arm 1) 2017, SPRITE I (arm 2) 2017, SPRITE II (arm 1) 2019, SPRITE II (arm 2) 2019, and STARFISH 2018 (we assumed that those able to walk would also be able to stand independently)
  - Unclear: 4/10 studies - English 2016b, Krawcyk 2019, and Wellwood 2004, with Vanroy 2019 reporting mixed levels of mobility among participants
- Ability to walk at baseline (independent, requires assistance)
  - Independent: 6/10 studies - LAST 2018, SPRITE I (arm 1) 2017, SPRITE I (arm 2) 2017, SPRITE II (arm 1) 2019, SPRITE II (arm 2) 2019, and STARFISH 2018
  - Requires assistance: 0/10 studies
  - Unclear: 4/10 studies - English 2016b, Krawcyk 2019, and Wellwood 2004, with Vanroy 2019 reporting mixed levels of mobility among participant

Interventions

The intervention parameters for all studies were documented using the TIDieR format (Hoffmann 2014), and these are summarised in (Table 2).

The duration of intervention varied occurring after six weeks (SPRITE I (arm 1) 2017; SPRITE I (arm 2) 2017), seven weeks (English 2016b), three months (Krawcyk 2019; SPRITE II (arm 1) 2019; SPRITE II (arm 2) 2019;Vanroy 2019), four months (STARFISH 2018), and 18 months (LAST 2018). The median duration was three months. Duration was unclear in one study (Wellwood 2004).

The included studies were distributed among the following subgroups based on intervention characteristics.

- Intervention duration (less than three months; three months or longer)
  - less than three months: 3/10 studies (English 2016b; SPRITE I (arm 1) 2017; SPRITE I (arm 2) 2017)
  - three months or longer: 6/10 studies (Krawcyk 2019; LAST 2018; SPRITE II (arm 1) 2019; SPRITE II (arm 2) 2019; STARFISH 2018; Vanroy 2019)
  - Unclear: 1/10 studies (Wellwood 2004)
- Intervention type (reduce sedentary time, interrupt sedentary time, reduce and interrupt sedentary time)
  - Reduce sedentary time: 9/10 studies (Krawcyk 2019; LAST 2018; SPRITE I (arm 1) 2017; SPRITE I (arm 2) 2017; SPRITE II (arm 1) 2019; SPRITE II (arm 2) 2019; STARFISH 2018; Vanroy 2019; Wellwood 2004)
  - Interrupt sedentary time: 0/10 studies
  - Reduce and interrupt sedentary time: 1/10 studies (English 2016b)
- Intervention type (sedentary behaviour, physical activity, or part of a multi-component lifestyle intervention)
  - Sedentary behaviour: 1/10 studies (English 2016b)
  - Physical activity: 5/10 studies (Krawcyk 2019; LAST 2018; STARFISH 2018; Vanroy 2019; Wellwood 2004)
  - Multi-component lifestyle intervention: 4/10 studies (SPRITE I (arm 1) 2017; SPRITE I (arm 2) 2017; SPRITE II (arm 1) 2019; SPRITE II (arm 2) 2019)

Comparisons

One study used an attention control with the exposure balanced to the dose of intervention exposure (English 2016b).

Three studies incorporated some attention control content in addition to usual care but these did not fully match the dose of intervention exposure (Krawcyk 2019; STARFISH 2018; Vanroy 2019).

Six studies incorporated no attention control in addition to any usual care (LAST 2018; SPRITE I (arm 1) 2017; SPRITE I (arm 2) 2017; SPRITE II (arm 1) 2019; SPRITE II (arm 2) 2019; Wellwood 2004).

Outcomes

Primary outcome data for death and recurrent events were accessible for most studies, although were only identified a priori as an outcome in the LAST 2018 trial.

As well as primary and secondary outcomes, we recorded the use of all types of other outcomes in the included studies (Table 1); these data were not analyzed.

- Impairments: 2/10 studies; measures of physical fitness were reported by Krawcyk 2019 and Vanroy 2019
- Activity limitations: 8/10 studies; specific measures included mobility, balance walking, and activities of daily living, and were reported by LAST 2018, SPRITE I (arm 1) 2017, SPRITE I (arm 2) 2017, SPRITE II (arm 1) 2019, SPRITE II (arm 2) 2019, STARFISH 2018, Vanroy 2019, and Wellwood 2004. Global scale measures of activity limitation were reported by LAST 2018, STARFISH 2018, and Wellwood 2004
- Participation restriction: 0/10 studies; no studies assessed this class of outcome
- Quality of life: 7/10 studies; recorded by LAST 2018, SPRITE I (arm 1) 2017, SPRITE I (arm 2) 2017, SPRITE II (arm 1) 2019, SPRITE II (arm 2) 2019, STARFISH 2018, and Wellwood 2004
- Psychosocial outcomes: 0/10; no studies assessed this class of outcome
- Mood: 6/10 studies; recorded by Krawcyk 2019, SPRITE I (arm 1) 2017, SPRITE I (arm 2) 2017, SPRITE II (arm 1) 2019, SPRITE II (arm 2) 2019, and STARFISH 2018
- Fatigue: 3/10 studies; English 2016b, Krawcyk 2019, STARFISH 2018
- Cognition: 1/10 studies; Krawcyk 2019
- Complications of immobility: 0/10; no studies assessed this class of outcome
- Other: chronic stress and pain pressure sensitivity was reported by Krawcyk 2019; Prochaska Stages of Change questionnaire relating to physical activity was reported by SPRITE I (arm 1) 2017, SPRITE I (arm 2) 2017, SPRITE II (arm 1) 2019, and SPRITE II (arm 2) 2019; pain and spasticity reported by English 2016b

Excluded studies

Amongst the excluded studies are a number of ongoing trials that are specifically connected to interventions for sedentary behaviour after stroke, such as ISRCTN10694741 and RECREATE 2018 (feasibility study). However, these ongoing studies form the early phases of intervention research, and as such are not simple trials of effectiveness. We excluded them as they do not meet the eligibility criteria for study design in this review.

ReTRAIN trial 2018 was a 'near miss' for inclusion. Sedentary behaviour estimates could be made, but would require re-analysis of the data, and these estimates would not align perfectly with the physical activity outcomes already reported. However, sedentary time could be estimated as the remaining proportion of the day not classified as time in bed or physical activity.

The Maguire 2012 trial was terminated because the trialists were unable to recruit enough participants to reach statistical power. In addition, the accelerometer device intended to measure sedentary behaviour was worn at the hip; it was not considered a valid tool to record sedentary time, as it is impossible to objectively determine a seated/standing posture.

The Physical Activity Score for the Elderly (PASE) outcome has been identified as a self-report tool for sedentary behaviour (Dall 2017). However, sitting time in PASE is restricted to leisure, household and occupation domains and it is clear that general 'quiet time' during sitting is a substantial contributor in people with stroke (English 2016a). Therefore, sedentary time data would be difficult to extract from PASE in a meaningful way.

Risk of bias in included studies

The results of the agreed 'Risk of bias' assessments are summarised in Figure 2 and Figure 3. In studies with no follow-up measurement, we did not assess risk of bias for the item labelled 'Incomplete outcome data (attrition bias): end of follow-up'; this results in some blank spaces in these figures.

Figure 2. 'Risk of bias' graph: review authors' judgements about each 'Risk of bias' item presented as percentages across all included studies. In studies with no follow-up measurement, we did not assess risk of bias for the item labelled 'Incomplete outcome data (attrition bias): end of follow-up'; this results in some blank spaces

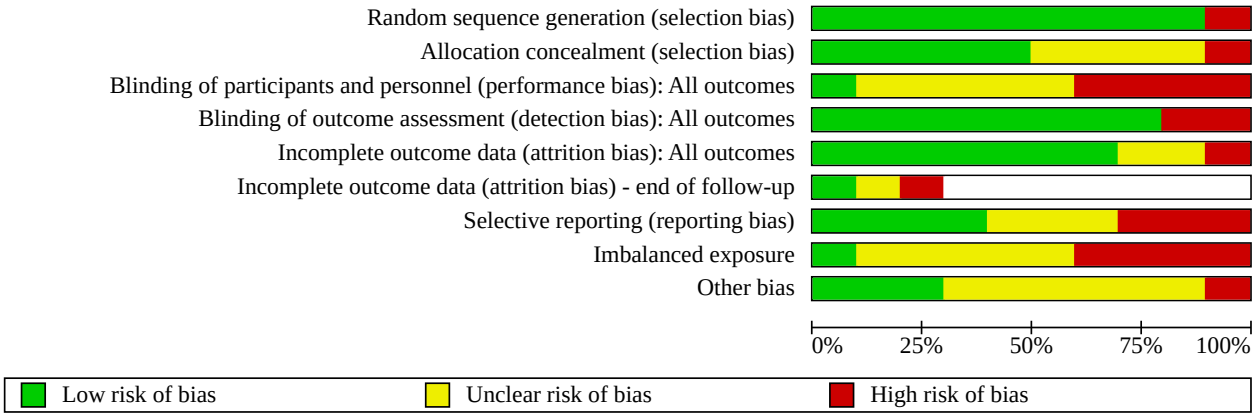
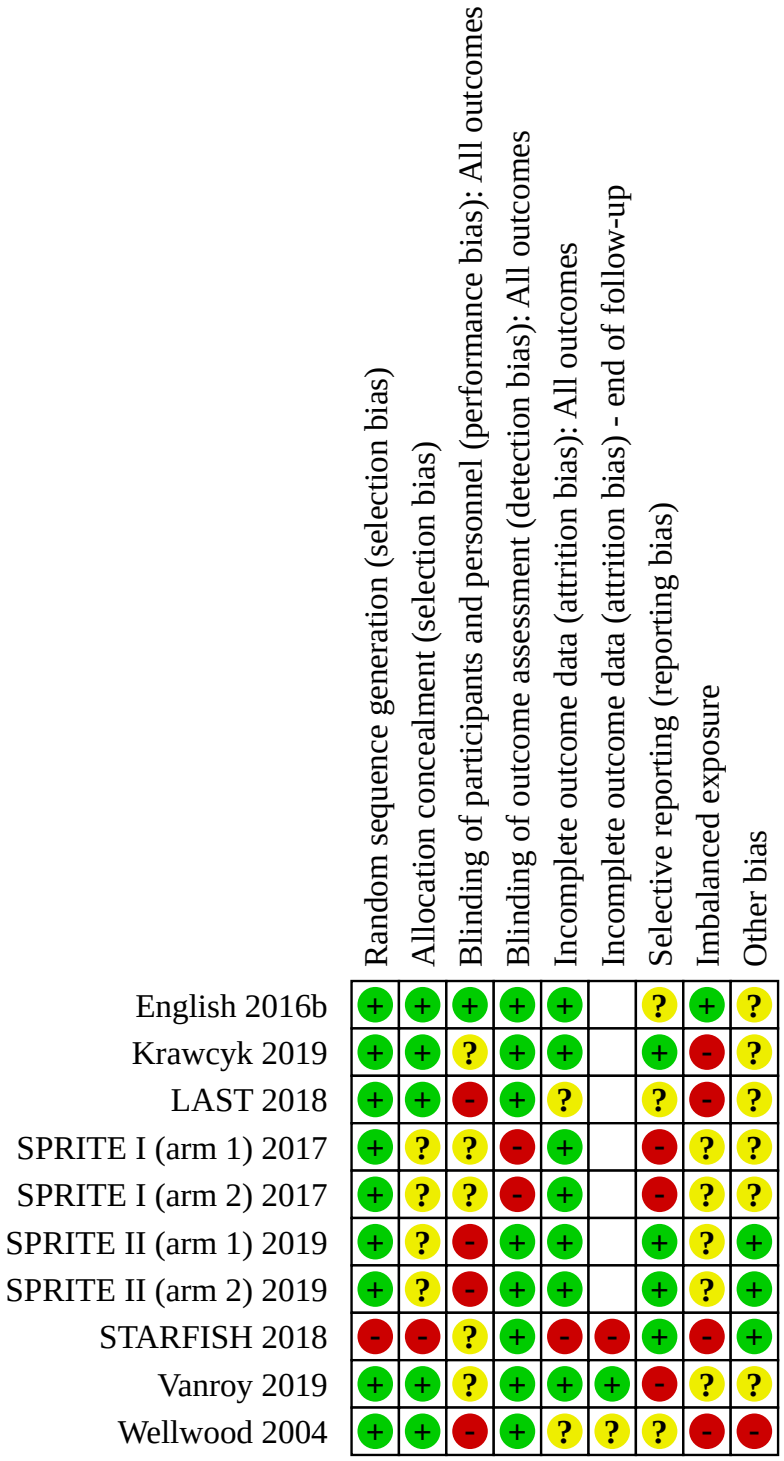


Figure 3. 'Risk of bias' summary: review authors' judgements about each 'Risk of bias' item for each included study. In studies with no follow-up measurement we did not assess risk of bias for the item labelled 'Incomplete outcome data (attrition bias): end of follow-up'; this results in some blank spaces .



Allocation

For nine of the 10 studies, there were no serious issues relating to problems with randomisation or allocation concealment (low or unclear risk of bias). For one trial, there were issues relating to the process of allocation which stemmed from unpredictable recruitment of participants (STARFISH 2018); this was judged to be at high risk of bias.

Blinding

Participant blinding (performance bias)

The nature of the interventions make true participant blinding impossible to achieve. Only one study described a concerted effort to balance exposure and conceal from participants the true nature of the comparisons being made; this was judged to be at low risk of bias (English 2016b). The remaining trials either had no control group exposure in addition to any usual care (high risk of bias: LAST 2018; SPRITE II (arm 1) 2019; SPRITE II (arm 2) 2019; Wellwood 2004), or had some control group exposure in addition to any usual care - but in a dose which was not equivalent to the intervention (unclear risk of bias: Krawcyk 2019; SPRITE I (arm 1) 2017; SPRITE I (arm 2) 2017; STARFISH 2018; Vanroy 2019).

Investigator blinding (detection bias)

For eight of the 10 studies, blinded outcome assessment was described and judged to be at low risk of bias. The small pilot study of SPRITE I (arm 1) 2017 and SPRITE I (arm 2) 2017 did not have a blinded assessor and was judged to be at high risk of bias. No studies reported data relating to the efficacy of blinding (e.g. inadvertent unblinding during assessment).

Incomplete outcome data

End of intervention

For seven of the 10 studies, there were no serious issues relating to attrition at the end of intervention and were considered at low risk of bias. Two studies had an unclear risk of bias, and one had a high risk of bias (STARFISH 2018). In one study, the amount and distribution of dropouts raises some concerns over a modest risk of bias (LAST 2018); this study had the longest intervention period (18 months); therefore, there will be a greater chance of accumulating losses to follow-up.

End of follow-up

The STARFISH 2018 study was considered at high risk of bias due to substantial, imbalanced losses to follow-up. Vanroy 2019 was judged to be at low risk, and Wellwood 2004 was judged to have an unclear risk of bias.

Selective reporting

For seven of the 10 studies, there were no serious issues relating to reporting biases and were judged to be at low or unclear risk of bias. Vanroy 2019 reported some sedentary behaviour outcome data, which was not indicated in the trial registry entry as being pre-planned. SPRITE I (arm 1) 2017 and SPRITE I (arm 2) 2017 reported some risk factor data (anthropometry and blood pressure) which was not in the trial registry; the impact of this for the review will be minimal as the SPRITE I trial as a whole is so small (total n = 15).

Other potential sources of bias

Imbalanced exposure

Only one of the 10 studies made an effort to balance the amount of exposure in both the intervention group and the control group and was at low risk of this source of bias (English 2016b). In five trials, there was some kind of control group exposure, but this did not match the dose of the intervention groups; these were judged to have an unclear risk of bias (SPRITE I (arm 1) 2017; SPRITE I (arm 2) 2017; SPRITE II (arm 1) 2019; SPRITE II (arm 2) 2019; Vanroy 2019). In four trials, there were no control group exposures, meaning these studies are at high risk of bias arising from amount of exposure. The effects of exposure/attention are then impossible to separate from any effects caused by the content of the exposure (Krawcyk 2019; LAST 2018; STARFISH 2018; Wellwood 2004). This source of bias affects some of the larger studies, which together account for 604/753 (80%) of all participants in this review's included studies.

Other biases

One trial was at high risk of a bias in terms of recruitment (Wellwood 2004). Eligible participants were excluded if there was insufficient capacity to deliver the intervention. The remaining nine trials were judged to be at low or unclear risk of bias.

Effects of interventions

See: **Summary of findings 1** Interventions compared to control at end of intervention

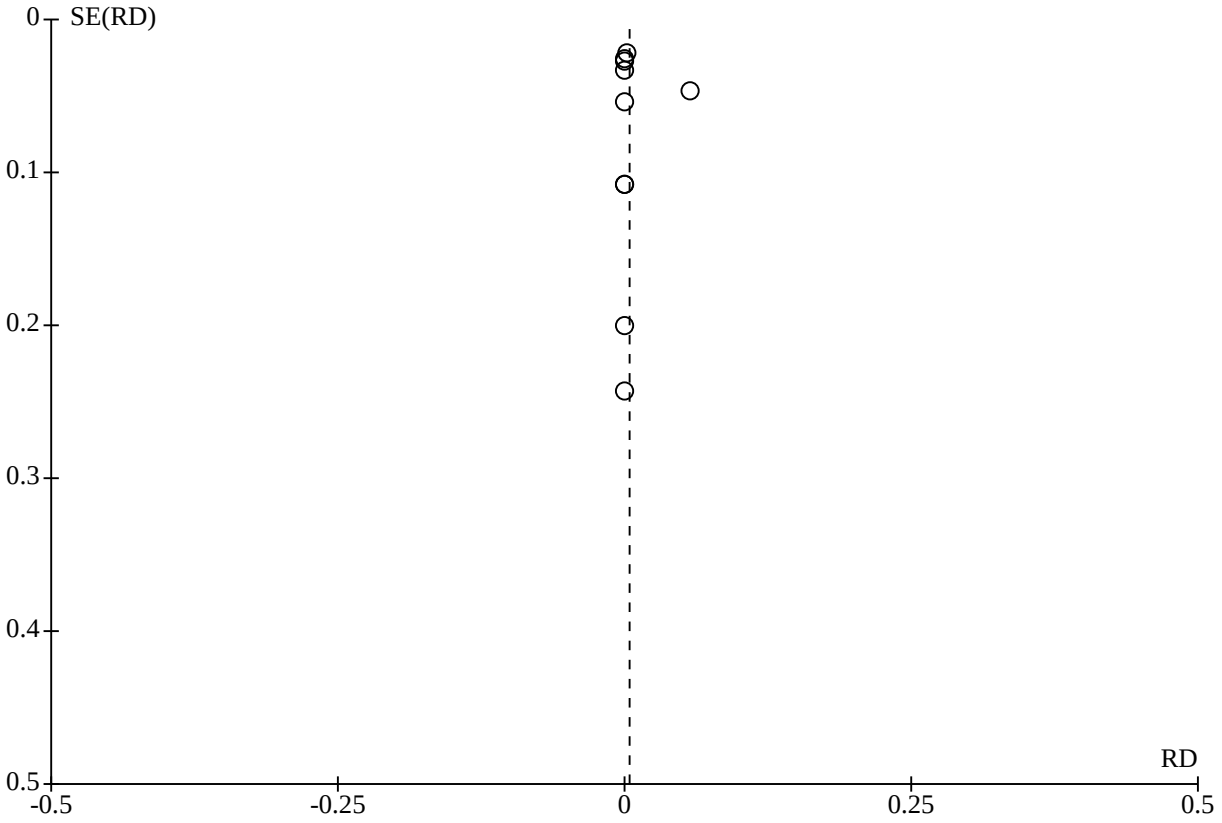
Primary Outcomes

Death

Only two studies reported that deaths had occurred (LAST 2018; Wellwood 2004). A total of 20/753 participants died (2.7%). There were 11/398 (2.8%) deaths in the intervention arms and 9/355 (2.5%) deaths in the control arms. The data for deaths in all included studies show no effect at the end of intervention (RD 0.00, 95% CI -0.02 to 0.03; P = 0.71; I^2 = 0%; 10 studies; 753 participants; Analysis 1.1). Although there are bias domains judged to be at high risk of bias, these are unlikely to affect the comparison in this estimate. However, there is low certainty in this estimate due to imprecision (low number of events) and indirectness (higher functioning patients) (Summary of findings 1). Higher function patients who can stand and walk independently and who participate in physical activity and exercise may not represent those who are most likely to benefit from interventions to reduce sedentary behaviour.

There is no suspicion of publication bias and no evidence of this within a funnel plot (Figure 4).

Figure 4.



As there were few events, no effect, and no heterogeneity, it was not necessary to perform subgroup analyses.

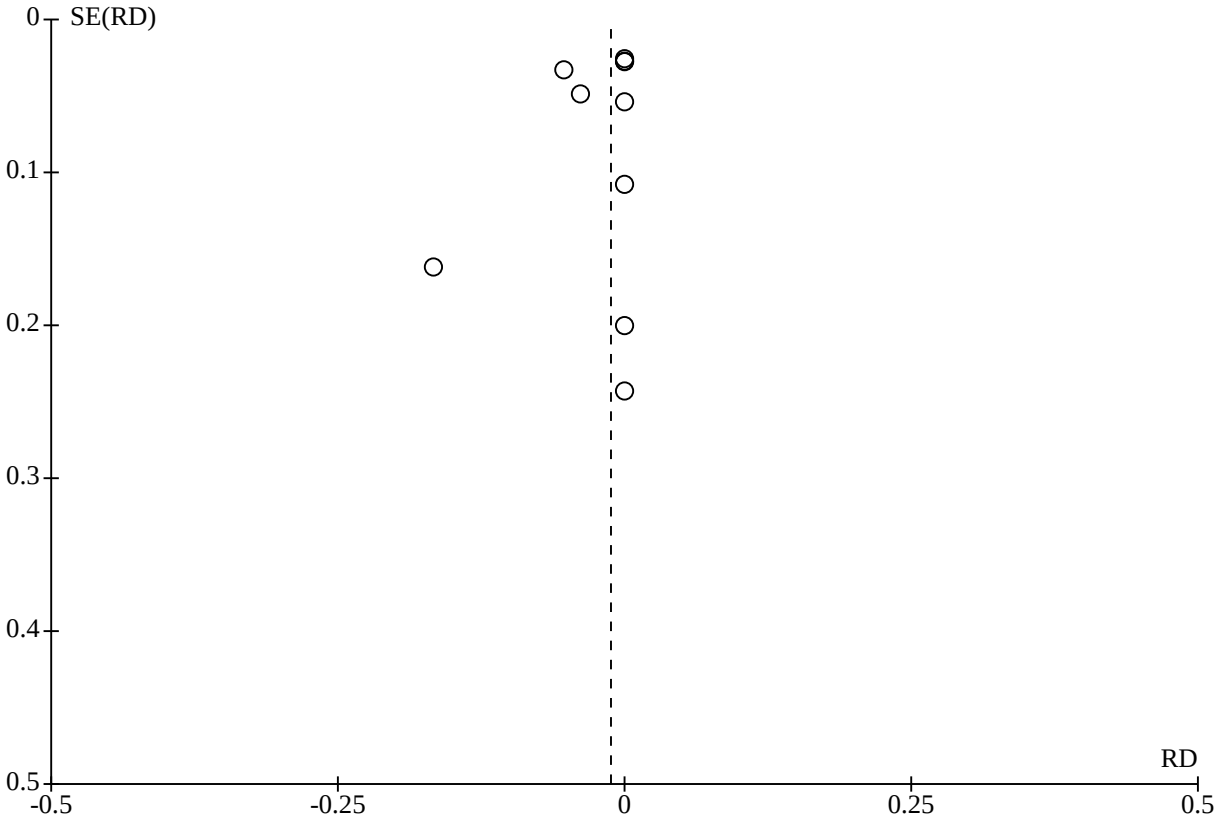
Only one study had a clearly defined follow-up time point and reported no deaths at end of follow-up (STARFISH 2018).

Recurrent cardiovascular or cerebrovascular events

Out of the 10 studies, only three studies had any recurrent events. The data for recurrent cardiovascular or cerebrovascular events in all included studies show no effect at the end of intervention (RD -0.01, 95% CI -0.04 to 0.01; P = 0.36; I^2 = 0%; 10 studies; 753 participants; Analysis 1.2). Although there are bias domains judged to be at high risk of bias, these are unlikely to affect the comparison in this estimate. However, there is low certainty in this estimate due to indirectness (higher functioning patients) and imprecision (low number of events) (Summary of findings 1).

There is no suspicion of publication bias and no evidence of this within a funnel plot (Figure 5).

Figure 5.



As there were few events, no effect, and no heterogeneity it was not necessary to perform subgroup analyses.

Only one study had a clearly defined follow-up time point and reported no dropouts due to health reasons at end of follow-up (STARFISH 2018).

Secondary Outcomes

Adverse events

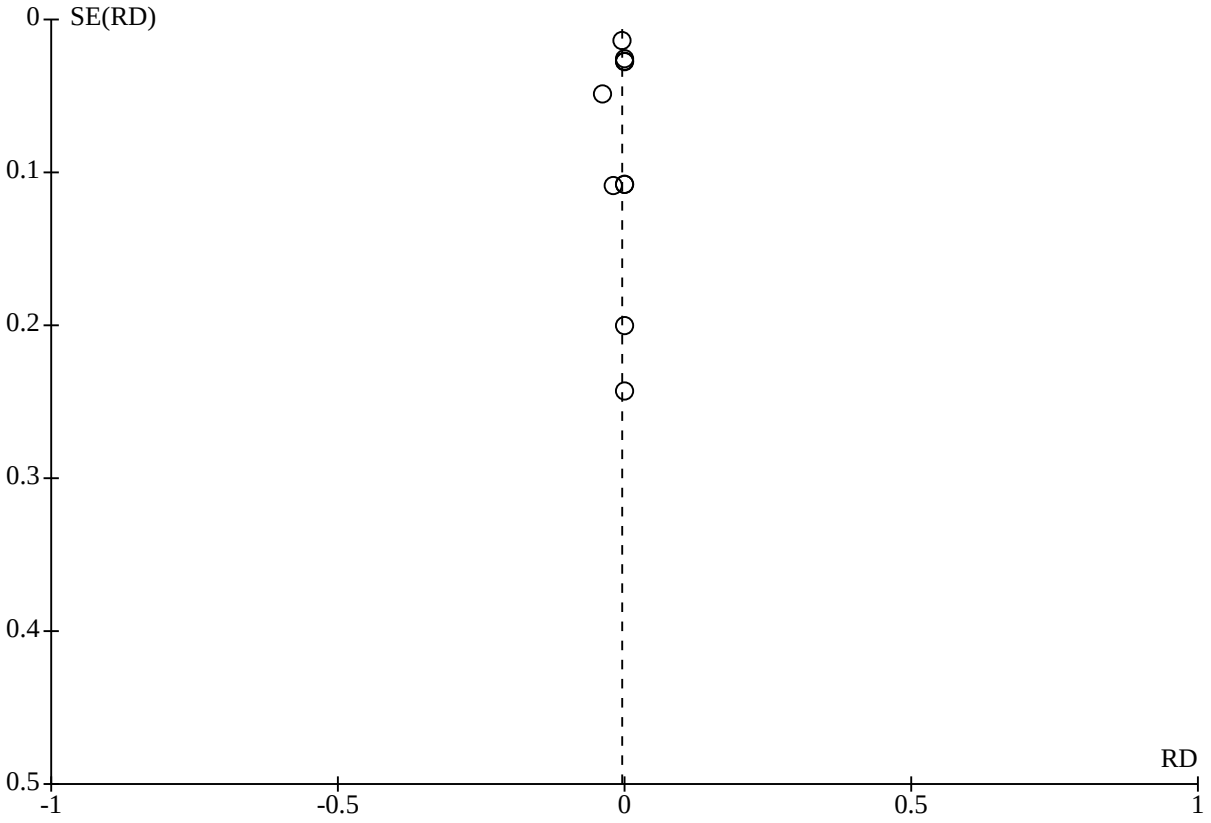
Falls

Only three studies reported any falls (English 2016b; LAST 2018; Vanroy 2019). There were a total of 12 falls among 753 participants (1.6%), 5/398 (1.3%) in the intervention arms and 7/355 (2%) in the control arms. The data for falls among participants in the included studies show no effects at the end of intervention (RD -0.00, 95% CI -0.02 to 0.02; P = 0.68; I^2 = 0%; 10 studies; 753 participants; Analysis 1.3).

Although there are bias domains judged to be at high risk of bias, these are unlikely to affect the comparison in this estimate. However, there is low certainty in this estimate due to indirectness (higher functioning patients) and imprecision (low number of events) (Summary of findings 1).

There is no suspicion of publication bias and no evidence of this within a funnel plot (Figure 6).

Figure 6.



As there were few events, no effect, and no heterogeneity it was not necessary to perform subgroup analyses.

Other adverse events

There was a range of adverse events recorded among the included trials. Not including falls, there were 51 reported other adverse events in the intervention groups and 50 in the control groups. There is no evidence that the interventions either increased or decreased the incidence of other adverse events. There is moderate certainty in this estimate due to indirectness (higher functioning patients) (Summary of findings 1).

English 2016b: there were no reported adverse effects relating to pain, spasticity, and fatigue.

Krawcyk 2019 reported that there were no adverse events in relation to the intervention. However, they reported that 5/63 (8%) of patients analyzed experienced severe adverse events (1/31 intervention; 4/32 control) which resulted in hospital readmission, but were unrelated to the intervention. The events included a new transient ischemic attack (TIA) (n = 2), chest pain (n = 1), and dizziness and malaise (n = 2), but it is unclear whether these were in the intervention or control group.

LAST 2018 reported data for unspecific cerebral symptoms (intervention 7/186 (3.8%), control 5/194 (2.6%)) and fractures (intervention 11/186 (5.9%), control 11/194 (5.6%)).

SPRITE I (arm 1) 2017 and SPRITE I (arm 2) 2017 contained no reporting of adverse events data.

SPRITE II (arm 1) 2019 and SPRITE II (arm 2) 2019 stated that no adverse events were reported.

STARFISH 2018 stated that no adverse events were reported during the study that were associated with the intervention.

Vanroy 2019 reported a number of different events at different time points in the study as follows.

After Phase I of the intervention was completed, half of the intervention participants were allocated to no intervention for Phase II. This group is referred to as "Nco-ACG" in the study: implanted pacemakers (n = 2), epileptic seizures (n = 2), fall incidents (n = 1), and musculoskeletal surgeries (n = 1). In our review, this is considered follow-up data, recorded a period of time after the end of intervention.

During the Phase II intervention (participants allocated to additional coaching, referred to as "Co-ACG" in the study): respiratory problems (n = 1), musculoskeletal surgeries (n = 2). In our review, this is considered intervention arm data, for Phase II.

In the control group (referred to as CG in the study) there were: respiratory problems (n = 1) and musculoskeletal surgeries (n = 2). In our review while this is considered control group data it is not stated whether these correspond to Phase I or Phase II of the intervention.

Wellwood 2004 reported no serious adverse events during the trial. The proportion of participants reporting complications was recorded (intervention 83% (n = 29) versus control 78% (n = 27)) and there was no difference in these or in the frequency of individual complications. The nature of complications included falls, pain, and fatigue but these were not identified in the data, but there were no serious adverse events during the trial.

Sedentary behaviour

Sedentary time

The data for sedentary time were pooled and showed no effect of the interventions (MD 0.13 hours per day, 95% CI -0.42 to 0.68; P = 0.64; I^2 = 0%; 7 studies; 300 participants; Analysis 1.4). This effect size is equivalent to just 7.8 minutes.

There is very low certainty in this estimate due to indirectness (higher functioning patients) and imprecision (low number of events) (Summary of findings 1).

As there was no effect and no heterogeneity, we did not perform subgroup analyses.

Within this analysis, two studies had objectively measured sedentary time (English 2016b; LAST 2018; both normalised to a 16-hour wake time). This was in the range of 11.5 (SD 2.08) hours/day (LAST 2018), to 10.9 hours/day (SD 2.40) hours per day (English 2016b). This is higher than values measured objectively in healthy people of a similar age (8.2 hours/day (SD 2.0); English 2016a).

English 2016b recorded sedentary time using objective ('activPAL') and self-reported (Multimedia Activity Recall for Children and Adults (MARCA)) measurement tools. The accelerometer data were included in the meta-analysis and are presented over 24 hours and normalised to a 16-hour waking time; we used the sedentary time data normalised to 16 hours in our meta-analyses. The MARCA data indicated a beneficial direction of effect on total sitting time favouring the intervention (9.88 hours/day (SD 2.83)) compared with the control group (11.1 hours/day (SD 3.62)). If, instead, these subjective data are included in the meta-analysis, the outcome is not changed (MD 0.04 hours per day, 95% CI -0.54 to 0.61; P = 0.56; I^2 = 0%; 7 studies; 300 participants).

Krawcyk 2019 reported sedentary time using both the Physical Activity Scale version 2.1 (PAS2) and objectively using accelerometer ('AX3'; Axivity Ltd, Newcastle upon Tyne, UK). The objective accelerometer data were presumably skewed, necessitating them being presented as median and interquartile range. In addition, there were only objective data available for 26/31 in the intervention group (16% lost to follow-up) and 26/32 in the control group (20% lost to follow-up) and these data may also include sleep (median sedentary behaviour approximately 18 to 19 hours per day). These objective data showed little difference in sedentary time (six minutes more in the intervention group; six minutes less in the control group). We decided to use the PAS2 data to capture sedentary time in the meta-analysis.

LAST 2018 recorded sedentary time using both an objective (accelerometer; 'activPAL') and self-reported (International Physical Activity Questionnaire (IPAQ) short) measurement tool. The sedentary time data for item 7 of the IPAQ short instrument (reported as hours of weekday sitting) was affected by large numbers of missing or “don’t know/not sure” responses. The 'activPAL' data were of very poor quality for one of the two study sites. However, better quality unpublished data for the other study site (St. Olav's Hospital, Trondheim, Norway) were provided by the study author. This contained time spent in a sitting/lying position during 24 hours and during waking hours (7 am to 11 pm). We decided to use the waking hours data. The IPAQ data appear to greatly underestimate sedentary time; therefore, we decided to use the 'activPAL' data for the analysis.

SPRITE I (arm 1) 2017 and SPRITE I (arm 2) 2017 recorded sedentary time using item 7 of the IPAQ sitting (reported as minutes per day). We converted this to hours per day in order that it could be included within our meta-analysis and divided the control participants across the two arms of the SPRITE I trial. There was an odd number of control participants (n = 5) so this cannot be done evenly; however, the overall participant number stays the same and whether participants are split 3/2 or 2/3 across the two arm makes no difference to the outcome of the meta-analysis.

SPRITE II (arm 1) 2019 and SPRITE II (arm 2) 2019 recorded sedentary time using item 7 of the IPAQ sitting (reported as minutes per day) and a wrist-worn accelerometer. We decided to exclude the accelerometer data in our meta-analysis because the wrist-worn device cannot objectively distinguish a standing posture from sitting, lying or reclining. We converted the IPAQ data to hours per day with the control group participants (n = 12) divided evenly across both arms of the SPRITE II trial. In addition, SPRITE II (arm 1) 2019 and SPRITE II (arm 2) 2019 recorded the number of participants sitting five or more hours per day. There was no change in the control group (8/12 participants) but in both interventions there was a positive direction of effect. In SPRITE II (arm 1) 2019, the number of participants sitting five or more hours per day was reduced from 11/14 at baseline to 8/14 at the end of intervention, while in SPRITE II (arm 2) 2019 the number of participants sitting five or more hours per day was reduced from 10/14 at baseline to 7/14 at the end of intervention.

STARFISH 2018 reported sedentary time data; however, this included sleep time. Therefore, these data were excluded.

Vanroy 2019 reported sitting as METs multiplied by minutes, so the time data were not accessible.

Wellwood 2004 used a device to record sitting/lying time, but these data were not accessible. However, they did report a beneficial direction of effect on the proportion (%) of time spent standing or walking, which was greater in the intervention group (8.0%) compared with the control group (4.8%). These data should be treated with caution, as they are only based on 41/70 (59%) of the randomised participants.

Sedentary pattern

English 2016b reported sitting time, which was accumulated in bouts of more than 30 minutes. There was little effect (P = 0.821) although the direction of effect favoured the control group (reduction of 44.2 minutes per day) over the intervention group (reduction of 36.2 minutes per day).

Two studies recorded sit-to-stand transitions (STARFISH 2018; Wellwood 2004). We did not pool these data, as the wear time period for the devices was unclear.

STARFISH 2018 recorded interruptions of sitting as the number of sit-to-stand transitions per day. The direction of effect favours the control group at both the end of intervention (change +3.2 transitions per day) and end of follow-up (change +1.2 transitions per day).

Wellwood 2004 recorded the number of sit-to-stand transitions per hour. A beneficial direction of effect was shown for the intervention group, making 2.6 (SD 1.2) transitions per hour, compared with the control group making 1.7 (SD 1.3) transitions per hour. This measurement only took place in 22/35 (63%) intervention group participants and 19/35 (54%) control group participants.

Risk factors

Physical activity - objective measures

Six included studies reported objectively measured indices of physical activity (English 2016b; Krawcyk 2019; SPRITE II (arm 1) 2019; SPRITE II (arm 2) 2019; STARFISH 2018; Vanroy 2019). Overall, interventions led to beneficial directions of effect on objectively measured physical activity in four of six studies.

- Three studies report effects on objectively measured MVPA (minutes per day) at the end of intervention with no evidence of effect (MD 5.61 minutes per day, 95% CI -21.32 to 32.53; P = 0.68; I^2 = 20%; 3 studies; 72 participants (English 2016b; SPRITE II (arm 1) 2019; SPRITE II (arm 2) 2019) (Analysis 1.5)
- Three studies report objectively measured step count data (Krawcyk 2019; STARFISH 2018; Vanroy 2019). The data from Krawcyk 2019 and STARFISH 2018 can be pooled but there is no effect at the end of intervention (MD -33.62 steps per day, 95% CI -1438.07 to 1370.83; P = 0.96; I^2 = 45%; 2 studies; 146 participants; Analysis 1.6). The Vanroy 2019 data have no SD data, so cannot be pooled, but there was a positive direction of effect at the end of the phase I intervention (three months) and at the end of phase II intervention (a further nine months).

Physical activity - subjective measures

Five included studies reported subjectively measured indices of physical activity (Krawcyk 2019; LAST 2018; SPRITE I (arm 1) 2017; SPRITE I (arm 2) 2017; Vanroy 2019). These data were not similar enough to pool.

- Krawcyk 2019 reported light, moderate, and vigorous physical activity hours per week recorded using PAS2. There was a beneficial direction of effect for vigorous physical activity, but not for light or moderate physical activity at the end of intervention.
- LAST 2018 reported MET-minutes per week for vigorous physical activity, moderate physical activity, and walking at six months, 12 months, and at the end of intervention (18 months) derived from IPAQ data. There was no effect on vigorous or moderate physical activity but there was a beneficial direction of effect on walking at the end of intervention.
- SPRITE I (arm 1) 2017 and SPRITE I (arm 2) 2017 reported IPAQ physical activity scores at the end of intervention and these show a beneficial direction of effect.
- Vanroy 2019 reported MET-minutes of light physical activity and moderate physical activity recorded using a coded diary. There was a beneficial direction of effect on both light and moderate physical activity at the end of Phase 1 and at the end of Phase II of the intervention. The MET-minutes were greater in the intervention groups than the control group at the time points corresponding to the end of phase I and phase II.

Overall, nine of the 10 included studies reported objective or subjective measures of physical activity outcomes, but these cannot be pooled in meta-analysis. Therefore, following guidance in the *Cochrane Handbook* (McKenzie 2021), we made a post hoc decision to use vote counting, based on direction of effect, to identify whether there is any evidence of an effect. This approach does not account for magnitude of effect or the relative sample sizes of the studies.

Anthropometry

Six studies reported anthropometric data (Krawcyk 2019; SPRITE I (arm 1) 2017; SPRITE I (arm 2) 2017; SPRITE II (arm 1) 2019; SPRITE II (arm 2) 2019; STARFISH 2018).

- Body mass index was significantly lower in the control group at the end of intervention (MD -1.31 kg/m^2, 95% CI -0.17 to -2.45; P = 0.02; I^2 = 0%; 6 studies, 200 participants; Analysis 1.7). However, in Krawcyk 2019 baseline differences exist in the data which are greater than the magnitude of pooled effect (-1.90 versus -1.31); this study is also weighted 33.7% of the pooled effect. When Krawcyk 2019 is excluded there is no significant difference between groups (MD 0.96 kg/m^2, 95% CI -0.44 to 2.36; P = 0.18; I^2 = 0%); we consider this to be the more reliable result.
- Waist circumference: the analysis showed no effect of intervention (MD 0.74 cm, 95% CI -7.36 to 8.84; P = 0.86; I^2 = 56%; 4 studies, 54 participants; Analysis 1.8)

Blood pressure

Six studies reported measures of blood pressure (Krawcyk 2019; SPRITE I (arm 1) 2017; SPRITE I (arm 2) 2017; SPRITE II (arm 1) 2019; SPRITE II (arm 2) 2019; STARFISH 2018). There were no effects.

- Systolic blood pressure: no effect of intervention (MD -5.88 mmHg, 95% CI -11.95 to 0.19; P = 0.06; I^2 = 41%, 6 studies, 200 participants; Analysis 1.9).
- Diastolic blood pressure: no effect of intervention (MD -1.92 mmHg, 95% CI -4.80 to 0.96; P = 0.19; I^2 = 0%, 6 studies, 200 participants; Analysis 1.10).

Cardiovascular markers

Krawcyk 2019 reported multiple endothelial function (reactive hyperaemia index (RHI)), arterial stiffness, lipid profile (total, low-density lipid (LDL) and high-density lipid (HDL) cholesterol; triglycerides), along with multiple cardiovascular, inflammatory and endothelial biomarkers. Overall, there were some small effects with inconsistent patterns of findings.

STARFISH 2018 reported multiple lipid profile (LDL and HDL cholesterol; non-fasting triglyceride), glucose tolerance (HBA1c), inflammation (C-reactive protein levels), as well as liver function markers. Overall, no effects were shown for any variables another than cholesterol where the effect direction favoured the control group.

Summary of findings

The primary outcome data, along with sedentary behaviour data at the end of intervention are incorporated in the 'Summary of findings table (Summary of findings 1).

There were too few data at the end of follow-up for a 'Summary of findings' table.

DISCUSSION

Summary of main results

The main findings of this review are that the included interventions did not increase or reduce the incidence of deaths (low-certainty evidence) and did not increase or reduce the incidence of recurrent cardiovascular or cerebrovascular events (low-certainty evidence), recorded at the end of intervention.

The included interventions also did not increase or reduce the risk of falls (low-certainty evidence) or other adverse events (moderate-certainty evidence), recorded at the end of intervention. Taken alongside the death and recurrent events data, these findings suggest that the interventions studied can be delivered without causing harm.

The included interventions did not increase or reduce sedentary behaviours (very low-certainty evidence).

Overall completeness and applicability of evidence

Participants

The majority of participants in the included studies were able to independently stand and walk. This means they could be less sedentary than people with stroke who are not able to walk independently. However, Tieges 2015 showed that stroke survivors who have adequate mobility do not always translate this into physical activity and may lead largely sedentary lives. English 2016a found that physical ability (including walking ability) only explained a small amount of the variance in sitting time amongst a group of 50 people with stroke. This finding was confirmed in a recent individual participant data meta-analysis involving 274 people with stroke (Hendrickx 2019).

It is plausible also that those who are able to walk independently gain some degree of risk reduction from being more physically active. Although reducing sedentary time may be beneficial for all stroke survivors, this may have particular therapeutic potential in stroke survivors for whom other physical activity and exercise might be challenging, e.g. in those who are non-ambulatory. The cohorts of patients in the included studies under-represent those with greater levels of movement impairment, namely those who cannot walk or stand independently. In summary, the evidence is incomplete as there are not only too few studies overall, but the participants included also under-represent those with greater mobility restrictions.

Interventions

Only one study intervention specifically addressed sedentary behaviours and clearly described the behaviour change approach to doing this (English 2016b). This illustrates that there is a particular lack of data in relation to this type of intervention and a lack of reporting of how interventions are delivered. Table 2 summarises intervention details according to the Template for Intervention Description and Replication framework (TIDieR; Hoffmann 2014). Trialists should be encouraged to explain in much more detail the proposed mechanism (addressing content, dose) of action to achieve the therapeutic target of reduced sedentary behaviour, referring to behaviour change theories, for example COM-B (Michie 2011) or Theoretical Domains Framework (Michie 2005).

Four studies (derived from two studies) used multicomponent lifestyle interventions (SPRITE I (arm 1) 2017; SPRITE I (arm 2) 2017; SPRITE II (arm 1) 2019; SPRITE II (arm 2) 2019. These are small pilot/feasibility studies at an increased risk of bias. Multicomponent lifestyle interventions could include elements of sedentary reduction and physical activity, and remain under-investigated. In a recent priority-setting exercise, stroke survivors (n = 731) rated areas such as walking and balance, exercise for rehabilitation, as well as lifestyle for secondary prevention, within the top five priorities (Rudberg 2020). Therefore, there are very good reasons as to why including a combination of increasing physical activity and reducing sedentary behaviour alongside each other might be beneficial. Impaired balance and fear of falling have been identified by stroke survivors as a factor which increases sedentariness (Fitzsimons 2020; Hall 2020), and there is clear evidence that balance can be improved through physical activity such as walking training (Saunders 2020).

Five studies used physical activity-based interventions (Krawcyk 2019; LAST 2018; STARFISH 2018; Vanroy 2019; Wellwood 2004). It is plausible that multiple functional and other benefits could emerge after short interventions with a physical activity component. However, beneficial effects on death and recurrent events may require longer periods of intervention, coupled with longer periods of follow-up data, to become apparent.

Longer periods of intervention and follow-up are likely to be important for all intervention types as these would allow the effects of any risk reductions - if these occurred - the opportunity to influence the incidence of death and secondary events. Additionally, longer interventions and follow-up periods may be necessary to enable behaviour change to become established as a new routine. However, these designs are currently under-represented in the available data (median three months) with the exception of LAST 2018 (18 months) and Vanroy 2019 (12 months). Conclusions cannot be drawn about follow-up periods, as there are too few studies with usable data (STARFISH 2018; Vanroy 2019).

Outcomes

Sedentary behaviour interventions could reduce risk of death and recurrent events, yet the reporting of these interventions is surprisingly incomplete. Conclusions about effects on these primary outcome would rely on long-term intervention and follow-up.

The majority of stroke risk is attributed to the following 10 modifiable risk factors: hypertension, smoking, diabetes mellitus, physical activity, diet, psychosocial factors, abdominal obesity, alcohol, cardiac causes, and apolipoproteins (O'Donnell 2016). Reporting of risk factors within the included studies is currently very limited. Risk factor data are required to demonstrate the mechanism connecting behaviour change to primary outcomes of death and recurrent events.

Additionally, there are issues with objectively measured sedentary behaviour outcome data, and a lack of such data. Only two studies recorded sedentary time using accelerometer data that could be pooled in meta-analyses (English 2016b; LAST 2018). Three other studies used accelerometer devices to record sedentary time, but these data were either skewed and could not be pooled (Krawcyk 2019), were not reported in an analysable form (Wellwood 2004), or were excluded because the data included sleep time (Krawcyk 2019; STARFISH 2018), which is not classified as sedentary behaviour (Tremblay 2017). The data across studies (Analysis 1.4) and within studies (LAST 2018; 'activPAL3' and IPAQ data reported) suggests that self-report measures underestimate sedentary time. Therefore, while the physical activity and other components of interventions may have legitimate beneficial effects, one may not be able to attribute these to changes in sedentariness if this cannot be measured accurately. There is no currently accepted 'gold standard' measurement approach for sedentary behaviour (Young 2016). However, sedentary behaviour researchers are tending to favour objective measurement tools (i.e. accelerometers and thigh-worn inclinometers). This is not to say that self-report measures have no use, because they can provide information on the behavioural context of sedentary behaviour, as well as participants' perceptions of their behaviour; both of which objective measures cannot do.

In summary, there are not enough currently available data that are appropriate to address the objectives of this review.

Quality of the evidence

For the primary outcomes 'death' and 'recurrent events', there are clear issues around indirectness and imprecision, which affect the data as a whole. However, it is unlikely that the high risk of bias will have influenced the data differently in the intervention and control groups of the included studies. The main quality issue with these data is that they tended to be poorly reported.

For adverse events, including falls, high risk of bias items are unlikely to influence effects in a way that would change our conclusions. The main quality issue with these data is that they tended to be poorly reported.

For sedentary behaviour outcomes, the evidence is threatened by inconsistency, indirectness, and imprecision, However, risk of bias is also an issue here. The main quality issue is that these data are subjectively measured based on participant recall and are thus inherently inaccurate, especially when coupled with a missing or inadequate attention control (i.e. an 'imbalanced exposure').

A number of the studies were small feasibility or pilot studies with higher risk of bias and multiple outcomes (e.g. SPRITE I (arm 1) 2017; SPRITE I (arm 2) 2017; SPRITE II (arm 1) 2019; SPRITE II (arm 2) 2019). This means these data appear more 'visible' as they feature in multiple sections of the results. Conversely, large studies focused on limited numbers of outcomes may be less 'visible'. Small studies with multiple outcome measures are also more vulnerable to showing positive effects by chance if not adjusted for multiple comparisons.

Potential biases in the review process

Searching and study selection stage

We decided that the best way to address the objectives of this review was to expand the original objective of including studies with interventions specifically intended to reduce sedentary behaviour. We also included studies of interventions with the potential to reduce sedentary behaviour (e.g. physical activity, lifestyle interventions) providing there was still an outcome measure of sedentary time or sedentary pattern. Doing this will not have resulted in any relevant studies being excluded. This is justified as follows.

- Interventions to reduce sedentary time do, by definition, involve an increase in physical activity. There is scope here for authors differing in the terminology they use to describe their interventions and the aims of their trials.
- The importance of sedentary behaviour terminology is evidenced by production of the recent SBRN consensus on terminology (Tremblay 2017). There could be uncertainties around the terminology relating to sedentary behaviour, particularly in older papers such as Wellwood 2004.
- Multicomponent lifestyle interventions can legitimately include elements relating to sedentary behaviour; it is very important these are not missed in evidence syntheses.
- Early mobilisation interventions include the aims of getting people 'up and about'; conceptually it is not possible to legitimately separate this from reducing or interrupting sedentary or sitting behaviours and the authors may simply not refer to the language of sedentary behaviours, especially in studies preceding the SBRN consensus on terminology (Tremblay 2017).

It is possible that some relevant studies were missed. However, we used a very comprehensive search strategy, developed with Cochrane Stroke's Information Specialist, and ensured that every stage of including or excluding studies involved an independent consensus decision by two review authors.

Data extraction stage

Although a single author extracted study characteristics and outcome data, all of these data were checked by an independent review author. This was done after the data were entered into Review Manager 5, so there were was no opportunity for transcription errors after checking. 'Risk of bias' judgements were all made independently by two review authors who reached a consensus.

Data analysis stage

At the data analysis stage there could be publication bias and small-study biases that affected the conclusions. We did test for evidence of publication bias where a meta-analysis included 10 or more studies. There was no evidence of problematic publication bias.

Agreements and disagreements with other studies or reviews

We identified two reviews suitable for comparison that specifically addressed sedentary behaviours and included RCTs (Kringle 2020; Mackie 2019).

Kringle 2020 carried out a systematic review to examine the effect of interventions (non-pharmacological) on sedentary behaviour and physical activity (n = 31 studies; Kringle 2020). Their review had a broader scope and included uncontrolled and non-randomised studies as well as those with no sedentary behaviour outcomes, so the number of included studies differs from our review. Only two studies are shared between our review and that of Kringle 2020, and these are English 2016b and LAST 2018. For LAST 2018, we were able to access unpublished sedentary data. Therefore, the only study with sedentary behaviour data common to both reviews is English 2016b. We included eight other studies that Kringle 2020 did not include (Krawcyk 2019; SPRITE I (arm 1) 2017; SPRITE I (arm 2) 2017; SPRITE II (arm 1) 2019; SPRITE II (arm 2) 2019; STARFISH 2018; Vanroy 2019; Wellwood 2004). In addition, Kringle 2020 included studies which we decided to exclude for methodological reasons.

Mackie 2019 carried out a scoping review of the effects of interrupting prolonged sitting on risk factors associated with stroke. While this did suggest that blood pressure and glucose tolerance might benefit adults from different populations, the only included study based directly on stroke patients was English 2016b.

Overall, this systematic review is based on a synthesis of studies which contains studies beyond those included by other recent relevant systematic reviews into interventions to reduce sedentary behaviour after stroke. Despite the differences in review architecture between this systematic review, Kringle 2020, and Mackie 2019, there is clear consensus on the lack of data in relation to interventions to reduce sedentary behaviour after stroke.

The systematic review by Martin 2015 demonstrated that, in adults, interventions based on physical activity do not reduce sedentary time whilst multi-component lifestyle interventions and those targeted at sedentary behaviours can reduce sedentary time. In our review, five of 10 studies are physical activity interventions and four are lifestyle interventions. This could imply that half of the included studies lack the type of interventions most likely to reduce sedentary behaviour. However, we cannot conclude this from our review data, for several potential reasons. First, the study populations included (adults without stroke) were not representative of the general stroke population in terms of mobility characteristics; second, the lifestyle studies were small pilot/feasibility studies; and finally, the sedentary behaviour effects were of very low-certainty evidence, which meant that true effects could thus be dramatically different from the estimates.

AUTHORS' CONCLUSIONS

Implications for practice

Sedentary behaviour research in stroke is relatively new, and as a result, the evidence is currently incomplete. Findings from this review suggest that the interventions included did not affect the number of deaths or the incidence of recurrent cardiovascular or cerebrovascular events (low-certainty evidence). The interventions did not affect incidence of falls (low-certainty evidence) or other adverse events (moderate-certainty evidence), in more mobile patients. Evidence for their impact on sedentary behaviour itself, however, is currently inconclusive and of very low certainty, and requires strengthening. However, postponing implementation of interventions to reduce sedentariness in this population, which is largely sedentary and at increased risk of recurrent cardiovascular events and death, would place them at an even higher risk.

Given the recent World Health Organization (WHO) advice that adults living with disability, including those who have had a stroke, should limit the amount of time spent sedentary and that replacing sedentary behaviours with physical activity is beneficial (WHO 2020), practitioners could consider whether existing interventions for other therapeutic targets (e.g. increasing physical activity or mobility) can also be used to encourage reductions in sitting during daytime. Such judicious implementation would align with the WHO advice, and may help address the need of people with stroke to become less sedentary - until further evidence of effectiveness emerges.

Implications for research

In order for the evidence to progress there need to be more high-quality randomised controlled trials that:

- standardise terminology connected to sedentary behaviour, using the Sedentary Behaviour Research Network guidance (Tremblay 2017);
- include study participants who are unable to stand or ambulate independently, as well as those who are more mobile;
- report the level of standing and ambulatory ability more clearly;
- involve interventions that specifically target the behaviours of sedentariness, either wholly or in part; and where researchers explain proposed mechanisms of action, i.e. how these behaviour changes are thought to be achieved, base these explanations on relevant theories and frameworks;
- combine targeted sedentary behaviour reduction within multicomponent lifestyle interventions;
- include longer interventions and longer periods of follow-up in order to allow changes in risk factors to influence incidence of death and secondary events;
- use objective measures of sedentary behaviour alongside measures of physical activity, excluding sleep; and
- record risk factor data.

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Parts of the Background and Methods sections of this review include sections of verbatim template text because the approaches used correspond to the protocol of a connected review by some of the same author team investigating physical fitness training interventions after stroke (Saunders 2020). The approach is permitted by The Cochrane Publication Policy.

We are grateful to all the authors of trials who provided supplementary information including unpublished data.

We would be grateful if people who are aware of studies potentially relevant for this review could contact David Saunders.

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* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

English 2016b

Study characteristics	
Methods	RCT with end-of-intervention outcomes
Participants	• Number randomised: 35 • Recruitment mechanism: participants were recruited from outpatient clinics, databases of participants from previous trials, stroke exercise classes, and social media. Research staff repeatedly visited outpatient clinics and stroke exercise classes to identify potential participants. Flyers were also placed in clinics, and frequent phone calls were made to therapy staff within these centres to assist in recruitment • Country of study: Australia • Inclusion criteria: at least 6 months since last stroke; living at home for at least 3 months since last hospital discharge; some residual walking and/or balance deficits (self-reported); and sufficient cog-

English 2016b *(Continued)*

	nitive and language ability to provide informed consent and participate in the motivational interviewing sessions. • Exclusion criteria: not stated • Age: overall 66.9 years (SD 12.7), intervention 65.4 years (SD 12.3); control 67.8 years (SD 13.8) • Gender (overall, intervention group, control group): men 22 (62.9), 13 (68.4), 9 (64.3) • Type of stroke (overall, intervention group, control group): TACI 6 (17.1), 5 (26.3), 1 (7.1); PACI 13 (37.1), 9 (47.4), 3 (21.4); LACI 7 (20), 3 (15.8), 4 (28.6); hemorrhage 9 (25.7), 2 (10.5), 6 (42.9) • Time since stroke: overall 3.2 years (SD 3.4), intervention 2.8 years (SD 2.6); control 4.1 years (SD 4.3) • Stroke severity (overall, intervention group, control group): NIHSS: no symptoms (0) 6 (17.1), 3 (15.8), 3 (21.4); Mild (1-4) 20 (57.1), 11 (57.9), 7 (50.0); moderate/severe (> 4) 9 (25.7), 5 (26.3), 4 (28.6) • Ability to stand independently at baseline: not reported • Ability to walk independently at baseline (overall, intervention group, control group): use of walking aid: no aids 23 (65.7), 13 (68.4), 9 (64.3); walking stick 10 (28.6), 5 (26.3), 4 (28.6); frame 2 (5.7), 1 (5.3), 1 (7.1)
Interventions	Intervention • intervention type: sedentary behaviour intervention; counselling sessions (motivational interviews) with the main message being to sit less and move more, with encouragement to regularly break up sitting time with short bursts of light-intensity activity (standing, walking at a comfortable pace) • dose (e.g. time, intensity, frequency and overall programme duration): 4 counselling sessions over 7 weeks (week 0, 1, 3, 7) • intervention setting: home with initial session face-to-face then follow-up telephone calls • conditions under which the intervention took place (e.g. supervised): the counselling sessions were provided by 2 researchers both of whom were formally trained in motivational interviewing techniques through accredited courses • description of any usual care co-intervention exposure: not reported Comparison • control group participants received the same schedule of interviews, with a placebo message of increasing calcium for bone health. Data from a food frequency questionnaire were used to create personalised feedback for control participants. The food frequency questionnaire was used to reinforce the credibility of the attention-matched control group, and data were not analyzed
Outcomes	Death • not a pre-planned outcome Secondary events • not a pre-planned outcome Adverse events • falls • pain • spasticity • fatigue Sedentary behaviour • sedentary time: time spent sitting using ActivePAL3 in conjunction with sleep wake diary • sedentary time: time spent in screen time and passive transport as part of Physical activity; using Multimedia Activity Recall for Children and Adults (MARCA) • sedentary pattern: periods of prolonged, uninterrupted sitting of >30-minutes duration using ActivePAL in conjunction with sleep wake diary Risk factors

English 2016b *(Continued)*

- physical activity: time spent in at least moderate intensity physical activity using Actigraph GT3+ tri-axial accelerometer plus Sensewear monitor to determine non-wear time
- physical activity: using Multimedia Activity Recall for Children and Adults (MARCA)

Fatigue

- fatigue (included in trial as an adverse event); Checklist Individual Strength

Other

- feasibility: adherence to counselling sessions and completion of all assessments

Notes	Reasons for losses to follow not available from trialists

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "A 1:1 randomisation sequence was prepared by a statistician independent of the project" Allocation of n = 19 and n = 16 is not 1:1 so mechanism of allocation is unclear
Allocation concealment (selection bias)	Low risk	Quote "A research assistant independent of the project prepared a set of sequentially numbered, opaque, sealed envelopes with the group allocation inside"
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Quote "They were told only that this was a trial of healthy living after stroke." Quote "Data from a food frequency questionnaire were used to create personalized feedback for control participants. The food frequency questionnaire was used to reinforce the credibility of the attention-matched control group, and data were not analyzed."
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote "A trained assessor who was unaware of group allocation assessed participants at baseline (pre- intervention) and post-intervention"
Incomplete outcome data (attrition bias) All outcomes	Low risk	Quote "At baseline, 23 and 31 participants had 7 days of valid data from the activPAL3 and Actigraph monitors, respectively. All other participants had at least 4 days of wear time for both monitors, with the exception of 3 participants for whom the Actigraph monitor did not record any valid data on any days." Quote "At post-intervention, 33 and 25 participants had 7 days of valid data from the activPAL3 and the Actigraph monitors, respectively. All other participants had at least 4 valid wear days for both the activPAL3 and Actigraph monitors, with the following exceptions: 2 participants (both in the control group) did not complete the post-intervention assessment for reasons of ill health not related to the trial, and a further 3 participants did not have any valid wear days for the Actigraph monitor" There were 2/16 (12.5%) dropouts in the control group; this affects all outcomes
Selective reporting (reporting bias)	Unclear risk	Feasibility outcomes and adverse events (including falls) were described in trial registry entry, sedentary behaviour outcomes were not described in the trial registry entry

English 2016b *(Continued)*

Imbalanced exposure	Low risk	Quote "control group participants received the same schedule of interviews, with a placebo message of increasing calcium for bone health"
Other bias	Unclear risk	Quote "We did not formally evaluate the degree to which our intervention adhered to motivational interviewing principles, or if there were any differences related to the 2 individual counsellors delivering the intervention. This may also have contributed to the fact that the intervention expected to change behavior the most was not more effective"

Krawcyk 2019

Study characteristics	
Methods	Parallel randomised controlled trial
Participants	• Number randomised: 71 • Recruitment mechanism: daily screening of patient records of stroke unit inpatients • Country of study: Denmark • Inclusion criteria: age ≥ 18 years, imaging diagnosed lacunar stroke (first or recurrent) defined by the TOASTcriteria, stroke severity categorized as “mild” on the SSS (43–58 points), able to speak and read Danish, able to provide informed consent • Exclusion criteria: previous large-artery stroke, unstable cardiac condition, atrial fibrillation, pacemaker, uncontrolled hypertension, uncontrolled diabetes, artery stenosis > 50 %, symptoms or comorbidities not allowing exercise on a stationary bicycle, dyspnoea caused by heart or pulmonary disease, aphasia, or dementia that interfered with understanding the protocol and physical examinations • Age: intervention group 63.7 years (SD 8.9); control group 63.7 years (SD 9.2) • Gender: intervention group 23 men, 8 women; control group 26 men, 6 women • Type of stroke: lacunar • Time since stroke: recruited 6 days (SD 4) after stroke; baseline data collected 12 days (SD 7) days after admission; intervention group UN; control group UN • Stroke severity: SSS score 55 (SD 5) • Ability to stand independently at baseline: unclear • Ability to walk independently at baseline: unclear
Interventions	Intervention • intervention type: physical activity. High intensity interval training. Participant-selected exercise mode; stationary bicycle (n = 23), brisk walking (n = 1), stair stepping and outdoor cycling on different days (n = 2), running (n = 2), brisk walking combined with outdoor cycling on different days (n = 1), brisk walking combined with rehabilitation twice a week in the community (n = 1), and indoor rowing (n = 1). Patients asked to keep an exercise diary • dose (e.g. time, intensity, frequency and overall programme duration): 3 repetitions of 3 minutes with 2 minutes active recovery between; 5 days per week for 12 weeks. Intensity was 77 to 93% maximum heart rate, 14 to 16 on the Borg scale of perceived exertion, not able to speak comfortably. Intensity was progressed to by ensuring that participants were not able to speak comfortably • intervention setting: home • conditions under which the intervention took place (e.g. supervised): intervention programme unsupervised but it commenced with one home visit by the study coordinator plus weekly contact with study coordinator • description of any usual care co-intervention exposure: usual care plus a motivational talk with the study coordinator at baseline to encourage lifestyle change, and introduce an exercise catalogue of different aerobic exercise mode suggestions Comparison

Krawcyk 2019 *(Continued)*

- description of comparison intervention: usual care plus motivational talk with the study coordinator at baseline to encourage lifestyle change, and introduce an exercise catalogue of different aerobic exercise mode suggestions
- asked to resume habitual physical activity and record this in a exercise diary.

Outcomes

Death

- not a pre-planned outcome

Secondary events

- not a pre-planned outcome

Adverse events

- pre-planned outcome. Any untoward and unintended response during the exercise intervention with serious adverse event or without hospital admission, which did not necessarily have a causal relationship to the intervention was registered. Adverse events were recorded weekly from start of the intervention until 2 weeks after the end of intervention

Sedentary behaviour

- sedentary time: objective measurement using tri-axial accelerometer (AX3, Axivity, York, UK) attached to right medial thigh. Data recorded over 8 days (and 7 nights)
- sedentary time: self-reported measurement using Physical Activity Scale version 2.1 (PAS2). Data recorded 2 weeks prior to baseline and end of intervention assessments

Risk factors

- endothelial function; reactive hyperemia index
- arterial stiffness; augmentation index
- blood pressure
- cardiovascular biomarkers, endothelial and inflammatory biomarkers
- BMI
- physical activity derived from same tools used to examine sedentary behaviour

Impairments

- cardiorespiratory fitness: Graded Cycling Test with Talk Test (GCT-TT) measured sub-maximal power output in watts

Mood

- Major Depression Inventory (MDI)
- mental well-being: World Health Organization-Five Well-being Index (WHO-5)

Fatigue

- Multidimensional Fatigue Inventory (MFI-20)

Cognition

- MoCA

OTHER

- Other: chronic stress; pain pressure sensitivity

Notes

Subjective PAS2 sedentary time data was reported in hours per week and was re-calculated by the reviewers as hours per day

Objective sedentary time data which is reported in hours/day

Krawcyk 2019 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "After completing all assessments at baseline, the patients were randomised into one of two groups: usual care and exercise intervention or usual care only. The randomisation procedure was based on equal allocation with randomly varying block size. The block-randomization was computer-generated (8 blocks of 10, mixed with 5 blocks of 4) and carried out by a research assistant not involved in the study." Patients randomised 1:1 ratio
Allocation concealment (selection bias)	Low risk	Quote: "Sealed opaque envelopes were made by the research assistant, stored, and administrated by health personnel not involved in the study. The outcome assessor, data analysts, and study coordinator were all blinded to the randomisation process. Immediately following baseline assessments, the study coordinator collected the next envelope from the health personnel. The consecutively enrolled patient opened the envelope and was allocated to either intervention group or usual care group."
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Participants could not be blinded and while there is no attention control both groups did participate in an element of physical activity Quote: "the usual care group was asked to resume their habitual level of physical activity and to track their physical activity in an exercise diary"
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Outcome assessor independent and blinded; participants given same brief about the study and both arms participated in physical activity
Incomplete outcome data (attrition bias) All outcomes	Low risk	Missing outcome data balanced in numbers across intervention groups, with similar reasons for missing data across groups Quote: "We analyzed complete outcome data according to the group the patients were randomised to, regardless of patient compliance. All available data for each patient were included in the analysis. Missing data were not imputed" Intention-to-treat approach used although the flowchart suggests a per protocol analysis
Selective reporting (reporting bias)	Low risk	The study protocol is available and all of the study's pre-specified (primary and secondary) outcomes that are of interest in the review have been reported in the pre-specified way
Imbalanced exposure	High risk	No attention control added to usual care of the control group. There was additional weekly telephone contact with intervention group
Other bias	Unclear risk	Quote: "the usual care group was asked to resume their habitual level of physical activity and to track their physical activity in an exercise diary" This means there could be additional physical activity in the control group

LAST 2018

Study characteristics

LAST 2018 *(Continued)*

Methods	Pragmatic parallel-group RCT performed at 2 centres
Participants	• Number randomised: n = 380 (intervention n = 186; control n = 194) • Recruitment mechanism: patients treated at the stroke unit screened and then recruited during out-patient care 10–16 weeks post-stroke • Country of study: Norway • Inclusion criteria: adults (aged ≥ 18 years), with confirmed first or recurrent stroke (infarction or intracerebral hemorrhage), discharged from hospital or inpatient rehabilitation, community dwelling, mRS score < 5, had no serious comorbidities that made the intervention difficult to perform, able to give consent • Exclusion criteria: serious medical comorbidity with short life expectancy, cognitive deficits (MMSE < 21 points or < 17 points for patients with aphasia), contraindication to participation in motor training, inclusion in another study • Age;: intervention 71.7 years (SD 11.9); control 72.3 years (SD 11.3) • Gender: intervention group - men 104, women 82; control group - men 127, women 67 • Type of stroke: intervention: infarction n = 172, hemorrhage n = 14; control: infarction n = 174, control n = 20 • Time since stroke: intervention 111.3 days (SD 24.5); control 112.0 days (SD 17.2) • Stroke severity: mRS: intervention 1.45 (SD 1.08); control 1.44 (SD 1.10) • Ability to stand independently at baseline: unclear, mobility measures suggest independence • Ability to walk independently at baseline: unclear, mobility measures suggest independence
Interventions	Intervention • intervention type: physical activity plus standard care • dose: 45–60 minutes exercise 1 day per week (intensity between 15 and 17 on Borgs scale of perceived exertion); 30 minutes of physical activity every day for 18 months • intervention setting: home and community, including community-based exercise groups • conditions under which the intervention took place: home-based, unsupervised apart from any exercise groups attended and monthly home visits • description of any usual care or co-intervention exposure: standard care Comparison • standard care alone
Outcomes	Death • pre-planned outcome. Information about deaths was collected from the hospital records or next-of-kin Secondary events • pre-planned outcome. Information about cardiovascular and cerebrovascular events collected from Norwegian Patient Registry Adverse events • serious falls, fractures, or any event of syncope or dizziness with unknown reason, resulting in hospitalisation, was collected from the Norwegian Patient Registry Sedentary behaviour • sedentary time: objective measure using accelerometer (ActivePAL). Mean hours in sitting/lying position over 24 hours and during daytime (7 am to 11 pm) for patients recruited at one of the trial centres (St Olavs Hospital at 18-month follow-up) • sedentary time.: self-reported sitting time using IPAQ item 7, recorded as hours of weekday sitting Risk factors

LAST 2018 *(Continued)*

- not reported

Activity limitations

- Motor Assessment Scale
- Barthel index
- Berg Balance Scale (item 14)
- Timed Up and Go
- 10 m maximum walking speed
- Six-Minute Walk Test

Quality of life

- Stroke Impact Scale

Other outcomes

- mRS

Notes	Author provided unpublished IPAQ sitting time data Author provided sedentary time data from ActivePAL accelerometer for patients recruited at one of the two study sites (St Olavs Hospital)

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "Randomisation was performed by a web- based randomisation system" Quote: "randomly assigned (1:1), in blocks of 2 and 4"
Allocation concealment (selection bias)	Low risk	Web-based system means allocation and randomisation done at same time Quote: "well-trained research assistants, blinded to the treatment allocation, screened patients for eligibility"
Blinding of participants and personnel (performance bias) All outcomes	High risk	No attention control means participants cannot be blinded to purpose of the interventions
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "A group of well-trained research assistants, blinded to the treatment allocation, screened patients for eligibility and did all assessments face-to-face at inclusion and at 18-month follow-up"
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Intention-to-treat analysis performed however intervention 33/184 (15%) lost to follow-up, control 32/194 (24%) lost to follow-up, overall 65/380 (17%) lost to follow-up. Missing outcome data balanced in numbers across intervention and control groups, with similar reasons reported for missing data across groups. Missing data have been imputed using appropriate methods. There is some risk of bias here but this may be modest
Selective reporting (reporting bias)	Unclear risk	Sedentary behaviour outcomes not published but these were available from author Several other outcomes planned which are not reported including, fitness, fatigue, quality of life, sit to stand, DS-14, cognition
Imbalanced exposure	High risk	Quote: "Participants randomised to the control group received standard care"

LAST 2018 *(Continued)*

		There is no attention control exposure
Other bias	Unclear risk	Unpublished data from authors suggested different approaches at the two sites as higher quality ActivePAL data are available from one site but not from the other

SPRITE I (arm 1) 2017

Study characteristics	
Methods	RCT: one control group and one of two intervention groups in this trial ('manual only')
Participants	• Number randomised: 15 overall in 2-arm trial; in this comparison intervention n =5, control n = 5 (shared in meta-analyses) • Recruitment mechanism: patients attending stroke clinics asked for consent to follow-up telephone call • Country of study: UK • Inclusion criteria: patients age ≥ 18 years, diagnosed with TIAs and 'minor' strokes attributed to atherosclerosis or small vessel occlusion, within 4 weeks of their first symptoms • Exclusion criteria: unstable cardiac conditions, contra-indications for exercise, unable to give informed consent, previous cerebrovascular event • Age: intervention group 1, 67.8 years; control group 76.2 years; SD unknown • Gender: intervention group 1: 4 men, 1 woman; control group 4 men, 1 woman • Type of stroke: TIA and minor stroke • Time since stroke: intervention group 1: 22.2 days (SD 9.18); control group: 19.8 days (SD 7.09) • Stroke severity: intervention group 1: mRS 0 to 3; control group mRS 0 to 4 • Ability to stand independently at baseline: unclear, but ambulatory • Ability to walk independently at baseline: unclear, but ambulatory
Interventions	Intervention • intervention type: usual care + 'Healthy Brain Rehabilitation Manual'; multi-component lifestyle intervention • dose: 6-week use of manual • intervention setting: home • conditions under which the intervention took place: (e.g. supervised) • description of any usual care or co-intervention exposure: standard post-TIA/minor stroke care as per current UK guidelines Comparison • description of any usual care or co-intervention exposure: standard post-TIA/minor stroke care as per current UK guidelines
Outcomes	Death • not a pre-planned outcome Secondary events • not a pre-planned outcome Adverse events • not a pre-planned outcome Sedentary behaviour

SPRITE I (arm 1) 2017 *(Continued)*

- sedentary time: self-reported measurement of sedentary time using IPAQ scale; hours of sitting per day

Risk factors

- nutritional intake (Mediterranean Diet Score, fruit and vegetable intake, alcohol intake)
- blood pressure
- anthropometry (body mass, BMI, waist circumference)
- physical activity derived from same tools used to examine sedentary behaviour (IPAQ)

Activity limitations

- walking: 2 minute walking test (metres per 2 minutes)

Quality of life

- quality of life: Euroqol EQ5D5L questionnaire

Mood

- anxiety: Hospital Anxiety and Depression Score
- depression: Hospital Anxiety and Depression Score

Other

- Prochaska stages of change questionnaire relating to physical activity

Notes	There are two SPRITE RCTs under the umbrella of the NCT02712385 trial (pilot and feasibility) Both SPRITE trials each have two intervention arms

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "Computer generated randomization was carried out prior to recruitment"
Allocation concealment (selection bias)	Unclear risk	Quote: "allocations were concealed in sealed, opaque envelopes until baseline assessments were completed." Consecutive numbering of envelopes not reported
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	There is some element of attention control Quote: "All participants, including Group 1, were telephoned at 1 and 4 weeks to answer any questions regarding their care or use of the manual and, for Group 3, NH encouraged participants to self-set step count targets"
Blinding of outcome assessment (detection bias) All outcomes	High risk	Quote: "Post-intervention assessments were undertaken by NH, who was not blinded to intervention allocation"
Incomplete outcome data (attrition bias) All outcomes	Low risk	100% retention of participants - no dropouts
Selective reporting (reporting bias)	High risk	The following outcomes are reported but are not in the trial registry risk factors including: nutritional intake (Mediterranean Diet Score, fruit and vegetable intake, alcohol intake), blood pressure, Aanthropometry (body mass,

SPRITE I (arm 1) 2017 *(Continued)*

		BMI, waist circumference), Hospital Anxiety and Depression Scales scores, Prochaska stages of change questionnaire relating to physical activity
Imbalanced exposure	Unclear risk	Quote: "All participants, including Group 1, were telephoned at 1 and 4 weeks to answer any questions regarding their care or use of the manual and, for Group 3, NH encouraged participants to self-set step count targets" There is some element of attention control
Other bias	Unclear risk	Pedometer group (Group 3) participants were not blinded to their step counts in the first week of the study, so that the baseline measure may be inflated and not a true reflection of levels of physical activity at this time in TIA and minor stroke patients. Small study bias

SPRITE I (arm 2) 2017

Study characteristics	
Methods	RCT: one control group and one of two intervention groups ('manual + pedometer')
Participants	• Number randomised: 15 overall in 2-arm trial; in this comparison intervention n = 5, control n = 5 (shared in meta-analyses) • Recruitment mechanism: patients attending stroke clinics asked for consent to follow-up telephone call • Country of study: UK • Inclusion criteria: patients age ≥ 18 years, diagnosed with TIAs and 'minor' strokes attributed to atherosclerosis or small vessel occlusion, within 4 weeks of their first symptoms • Exclusion criteria: unstable cardiac conditions, contraindications for exercise, unable to give informed consent, previous cerebrovascular event • Age: intervention group 2: 63.0 years; control group 76.2 years; SD unknown • Gender: intervention group 2: 2 men, 3 women; control group: 4 men 1 woman • Type of stroke: TIA and minor stroke • Time since stroke: intervention group 2: 19.6 days (SD 3.58); control group 19.8 days (SD 7.09) • Stroke severity: intervention group 2: MRS 0 to 4; control group MRS 0 to 2 • Ability to stand independently at baseline: unclear, but ambulatory • Ability to walk independently at baseline: unclear, but ambulatory
Interventions	Intervention • intervention type: usual care + 'Healthy Brain Rehabilitation Manual' + pedometer device or Fitbit Charge device; multi-component lifestyle intervention • dose: 6 week use of manual and pedometer/Fitbit device • intervention setting: home • conditions under which the intervention took place (e.g. supervised) • description of any usual care or co-intervention exposure: standard post-TIA/minor stroke care as per current UK guidelines Comparison • description of any usual care or co-intervention exposure: standard post-TIA/minor stroke care as per current UK guidelines
Outcomes	Death

SPRITE I (arm 2) 2017 *(Continued)*

- not a pre-planned outcome

Secondary events

- not a pre-planned outcome

Adverse events

- not a pre-planned outcome

Sedentary behaviour

- sedentary time: self-reported measurement of sedentary time using IPAQ scale; hours of sitting per day

Risk factors

- nutritional intake (Mediterranean Diet Score, fruit and vegetable intake, alcohol intake)
- blood pressure
- anthropometry (body mass, BMI, waist circumference)
- physical activity derived from same tools used to examine sedentary behaviour (IPAQ)

Activity limitations

- walking: 2 minute walking test (metres per 2 minutes)

Quality of life

- quality of life; Euroqol EQ5D5L questionnaire

Mood

- anxiety: Hospital Anxiety and Depression Score
- depression;:Hospital Anxiety and Depression Score

Other

- Prochaska stages of change questionnaire relating to physical activity

Notes	There are two SPRITE RCTs under the umbrella of the NCT02712385 trial (pilot and feasibility) Both SPRITE trials each have two intervention arms

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "Computer generated randomization was carried out prior to recruitment"
Allocation concealment (selection bias)	Unclear risk	Quote "allocations were concealed in sealed, opaque envelopes until baseline assessments were completed." Consecutive numbering of envelopes not reported
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	There is some element of attention control Quote: "All participants, including Group 1, were telephoned at 1 and 4 weeks to answer any questions regarding their care or use of the manual and, for Group 3, NH encouraged participants to self-set step count targets"

SPRITE I (arm 2) 2017 *(Continued)*

		Participants in the pedometer arm of the SPRITE trial were not blinded to their step counts in the first week of the study, so that the baseline measure may be inflated
Blinding of outcome assessment (detection bias) All outcomes	High risk	Quote: "Post-intervention assessments were undertaken by NH, who was not blinded to intervention allocation"
Incomplete outcome data (attrition bias) All outcomes	Low risk	100% retention of participants - no dropouts
Selective reporting (reporting bias)	High risk	A number of outcomes are reported but are not in the trial registry; risk factors including; nutritional intake, blood pressure, anthropometry (body mass, body mass index, waist circumference), Hospital Anxiety and Depression Scales scores, Prochaska stages of change questionnaire relating to physical activity These do include secondary review outcomes
Imbalanced exposure	Unclear risk	Quote: "All participants, including Group 1, were telephoned at 1 and 4 weeks to answer any questions regarding their care or use of the manual and, for Group 3, NH encouraged participants to self-set step count targets" There is some element of attention control
Other bias	Unclear risk	Pedometer group (group 3) participants were not blinded to their step counts in the first week of the study, so that the baseline measure may be inflated and not a true reflection of levels of physical activity at this time in TIA and minor stroke patients Small study bias

SPRITE II (arm 1) 2019

Study characteristics	
Methods	RCT: one control group and one of two intervention groups ('manual + GP support')
Participants	• Number randomised: 40 overall in 2-arm trial; in this comparison intervention 1 n = 14, control n = 12 (shared in meta-analyses) • Recruitment mechanism: patients attending stroke clinics asked for consent to follow-up telephone call • Country of study: UK • Inclusion criteria: patients age ≥ 18 years, diagnosed with TIAs and 'minor' strokes attributed to atherosclerosis or small vessel occlusion, within 4 weeks of their first symptoms • Exclusion criteria: unstable cardiac conditions, contraindications for exercise, unable to give informed consent, previous cerebrovascular event • Age:, intervention group 1: 65.7 years (SD 13.0); control group 69.7 years (SD14.7) • Gender: intervention group: 9 men 5 women; control group: 8 men 4 women • Type of stroke: 26 TIA; 14 minor stroke reported for whole trial SPRITE II (arm 1) 2019 and SPRITE II (arm 2) 2019 • Time since stroke: intervention group 1: 15.23 days (SD 7.8); control group 19.25 days (SD 8.9) • Stroke severity: unknown • Ability to stand independently at baseline: unclear, but ambulatory • Ability to walk independently at baseline: unclear, 1 participant was a wheelchair user

SPRITE II (arm 1) 2019 *(Continued)*

Interventions	Intervention • intervention type: usual care + 'Healthy Brain Rehabilitation Manual' + GP follow up support; multi-component lifestyle intervention • dose: 12 weeks • intervention setting: home • conditions under which the intervention took place: unsupervised with telephone support • description of any usual care or co-intervention exposure: standard post-TIA/minor stroke care as per current UK guidelines Comparison • description of any usual care or co-intervention exposure: standard post-TIA/minor stroke care as per current UK guidelines
Outcomes	Death • not a pre-planned outcome Secondary events • not a pre-planned outcome Adverse events • not a pre-planned outcome Sedentary behaviour • sedentary time: self-reported measurement of sedentary time using IPAQ scale; hours of sitting per day • sedentary time: objective measures of whether or not sitting for > 5hours per day • sedentary time: objective measure derived from Axivity AX3 wrist-worn triaxial accelerometer. There was no measure of posture therefore these data are not used Risk factors • nutritional intake (Mediterranean Diet Score, fruit and vegetable intake, alcohol intake) • blood pressure • anthropometry (body mass, BMI, waist circumference) • physical activity (IPAQ and Axivity AX3 wrist-worn triaxial accelerometer) Activity limitations • walking; 2 minute walking test (metres per 2 minutes) • timed up and go Quality of life • quality of life: Euroqol EQ5D5L questionnaire Mood • anxiety: Hospital Anxiety and Depression Score • depression: Hospital Anxiety and Depression Score Other • stroke severity: mRS • Prochaska stages of change questionnaire relating to physical activity
Notes	There are two SPRITE RCTs under the umbrella of the NCT02712385 trial (pilot and feasibility)

SPRITE II (arm 1) 2019 *(Continued)*

Both SPRITE trials each have two intervention arms

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "An independent statistician generated random permuted blocks of 3"
Allocation concealment (selection bias)	Unclear risk	Quote: "placed the allocations in sealed, opaque envelopes, opened only after completion of baseline assessments" Unclear whether sequential numbering used
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "blinding of participants, GP, and stroke nurses was not possible because of the nature of the intervention" There was no attention control used and thus no opportunity to blind purpose of the intervention
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "research nurse, blinded to intervention allocation, undertook post- intervention assessments"
Incomplete outcome data (attrition bias) All outcomes	Low risk	1/40 (2.5%) participant lost to follow-up, 3/40 (7.5%) accelerometers did not return valid data
Selective reporting (reporting bias)	Low risk	Reported as protocol
Imbalanced exposure	Unclear risk	Although no complete attention control all participants were telephoned at 1, 4, and 9 weeks, to address any concerns regarding their care
Other bias	Low risk	No relevant items

SPRITE II (arm 2) 2019

Study characteristics

Methods	RCT: one control group and one of two intervention groups ('manual + stroke nurse support')
Participants	• Number randomised: 40 overall in 2-arm trial; in this comparison intervention 2: n = 14, control n = 12 (shared in meta-analyses) • Recruitment mechanism: patients attending stroke clinics asked for consent to follow-up telephone call • Country of study: UK • Inclusion criteria: patients age ≥ 18 years, diagnosed with TIAs and 'minor' strokes attributed to atherosclerosis or small vessel occlusion, within 4 weeks of their first symptoms • Exclusion criteria: unstable cardiac conditions, contraindications for exercise, unable to give informed consent, previous cerebrovascular event • Age: intervention group 2: 63.3 years (SD 9.6) years; control group 69.7 years (SD14.7) • Gender: intervention group: 7 men, 7 women; control group: 8 men, 4 women • Type of stroke: 26 TIA; 14 minor stroke reported for whole trial SPRITE II (arm 1) 2019 and SPRITE II (arm 2) 2019 • Time since stroke: intervention group 2: 16.87 days (SD 7.3); control group 19.25 days (SD 8.9)

SPRITE II (arm 2) 2019 *(Continued)*

- Stroke severity: unknown
- Ability to stand independently at baseline: unclear, but ambulatory
- Ability to walk independently at baseline: unclear, one participant was a wheelchair user

Interventions	Intervention • intervention type: usual care + 'Healthy Brain Rehabilitation Manual' + stroke nurse follow-up support; multi-component lifestyle intervention • dose: 12 weeks • intervention setting: home • conditions under which the intervention took place: unsupervised with telephone support • description of any usual care or co-intervention exposure: standard post-TIA/minor stroke care as per current UK guidelines Comparison • description of any usual care or co-intervention exposure: standard post-TIA/minor stroke care as per current UK guidelines
Outcomes	Death • not a pre-planned outcome Secondary events • not a pre-planned outcome Adverse events • not a pre-planned outcome Sedentary behaviour • sedentary time: self-reported measurement of sedentary time using IPAQ scale; hours of sitting per day • sedentary time: objective measures of whether or not sitting for > 5hours per day • sedentary time: objective measure derived from Axivity AX3 wrist-worn triaxial accelerometer. There was no measure of posture therefor these data are not used) Risk factors • nutritional intake (Mediterranean Diet Score, fruit and vegetable intake, alcohol intake) • blood pressure • anthropometry (body mass, BMI, waist circumference) • physical activity (IPAQ and Axivity AX3 wrist-worn triaxial accelerometer) Activity limitations • walking: 2 minute walking test (metres per 2 minutes) • timed up and go Quality of life • quality of life: Euroqol EQ5D5L questionnaire Mood • anxiety: Hospital Anxiety and Depression Score • depression: Hospital Anxiety and Depression Score Other

SPRITE II (arm 2) 2019 *(Continued)*

- stroke severity: mRS
- Prochaska stages of change questionnaire relating to physical activity

Notes	There are two SPRITE RCTs under the umbrella of the NCT02712385 trial (pilot and feasibility) Both SPRITE trials each have two intervention arms

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "An independent statistician generated random permuted blocks of 3"
Allocation concealment (selection bias)	Unclear risk	Quote: "placed the allocations in sealed, opaque envelopes, opened only after completion of baseline assessments" Unclear whether sequential numbering used
Blinding of participants and personnel (performance bias) All outcomes	High risk	Quote: "blinding of participants, GP, and stroke nurses was not possible because of the nature of the intervention" There was no attention control used and thus no opportunity to blind purpose of the intervention
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "research nurse, blinded to intervention allocation, undertook post- intervention assessments"
Incomplete outcome data (attrition bias) All outcomes	Low risk	1/40 (2.5%) participant lost to follow-up, 3/40 (7.5%) accelerometers did not return valid data
Selective reporting (reporting bias)	Low risk	Reported as protocol
Imbalanced exposure	Unclear risk	Although no complete attention control all participants were telephoned at 1, 4, and 9 weeks, to address any concerns regarding their care
Other bias	Low risk	No relevant items

STARFISH 2018

Study characteristics

Methods	RCT Outcomes assessed at end of the 4-month intervention and after a further 2-month follow-up period
Participants	• Number randomised: n = 83: intervention (n = 53), control group (n = 31) • Recruitment mechanism: participants were recruited in groups of 8 from 4 NHS boards in Scotland and from stroke support groups • Country of study: Scotland • Inclusion criteria: survived a cerebrovascular event, no longer be receiving active rehabilitation, be able to walk independently with aids if required, and capacity to follow instructions

STARFISH 2018 *(Continued)*

- Exclusion criteria: uncontrolled hypertension (≥ 190/100 mmHg at screening), history of serious cardiac disease, participating in another stroke rehabilitation trial, having another neurological condition, or a musculoskeletal condition that could be exacerbated by walking
- Age (overall, intervention group, control group): 61 (SD 11.7), 59.9 (SD 12.1), 62.1 (SD 11.2) years
- Gender (overall, intervention group, control group): 45 men, 38 women; 30 men, 22 women; 15 men, 16 women
- Type of stroke i.e. side of body affected (overall, intervention group, control group): left 45, 28, 17; right 33, 21, 12; none specified 5, 3, 2
- Time since stroke (overall, intervention group, control group): 34.5 (SD 29.5), 35.0 (SD 33.6), 34.0 (SD 25.4) months
- Stroke severity (overall, intervention group, control group): not reported
- Ability to stand independently at baseline: not reported
- Ability to walk independently at baseline: able to walk independently with aids if required

Interventions	Intervention • intervention type: physical activity • dose (e.g. time, intensity, frequency and overall programme duration): daily individualised step count target based on baseline step count+10%; if target reached 5/7 days per week target was increased by 5% to a maximum of 3000 steps above their baseline; overall programme duration 4 months • intervention setting: home-based • conditions under which the intervention took place (e.g. supervised): the intervention was undertaken in groups of 4 linked by the app; group awarded if individual step targets were reached 5/7 days by all 4 group members; group members could see when others were walking • description of any usual care or co-intervention exposure: not reported Comparison • description of comparison intervention: including any usual care exposure: the control group received 1 individual session with the research physiotherapist where they were given literature published by Chest Heart and Stroke Scotland on the recommended PA guidelines, advice on how to take part in physical activity after surviving a stroke event, and the health benefits of PA post-stroke
Outcomes	Death • not a pre-planned outcome Secondary events • not a pre-planned outcome Adverse events • not a pre-planned outcome Sedentary behaviour • sedentary time: objective accelerometer (ActivePAL). Data not used because sleeping time was included • sedentary pattern: objective accelerometer (ActivePAL) recorded interruptions to sitting (number of sit-to-stand transitions per day) Risk factors • blood pressure • BMI • cardiovascular risk blood biomarkers • resting heart rate • physical activity (daily steps, standing time, stepping time)

STARFISH 2018 *(Continued)*

	Activity limitation • Six-minute walk test • 10 m walk tests • activities of daily life (Nottingham Extended Activities of Daily Living Scale) Quality of life • Stroke-specific QOL scale Mood • Hospital Anxiety and Depression Scale Fatigue • Fatigue Severity Scale
Notes	Although sedentary time is flawed they do report number of sit-to-stand transitions which is within our definition of SB outcomes Authors communicated that there were no deaths and no cardiovascular or cerebrovascular events in intervention or control groups

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Quote: "randomised equally to intervention and control groups using opaque envelopes. Overall, 16 blocks of 8 participants (N = 128) will be randomised" Quote: "Although we aimed to recruit in groups of 8 (4 intervention, 4 control) the STARFISH app needed four participants so when people failed to attend for baseline assessment participants were preferentially recruited to the intervention arm which resulted in unequal numbers in each group"
Allocation concealment (selection bias)	High risk	Quote: "when people failed to attend for baseline assessment participants were preferentially recruited to the intervention arm which resulted in unequal numbers in each group" Although use of opaque envelopes was described, the Investigators enrolling participants could possibly foresee assignments and thus introduce selection bias as preferential recruitment was used to allocate participants to the intervention group
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Quote: "Whilst the assessor will be blinded to group allocation, due to the nature of the intervention, it will not be possible to blind participants" Quote: " Participants in the control group received one individual session a the research physiotherapist where they were given literature published by Chest Heart and Stroke Scotland on the recommended PA guidelines, advice on how to take part in physical activity after surviving a stroke event, and the health benefits of PA post-stroke" There is some element of attention control
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "Outcome measures will be taken by the blinded assessor at baseline, four months (end of intervention), and 6 months (two-month post-intervention follow up)" Assessors were blinded but no information whether participants revealed their allocation to the assessors

STARFISH 2018 *(Continued)*

Incomplete outcome data (attrition bias) All outcomes	High risk	Intervention: 3/52 (6%) lost to follow-up; control: 10/31 (32%) lost to follow-up. Major losses (not described) which are also imbalanced across the groups
Incomplete outcome data (attrition bias) - end of follow-up	High risk	Intervention: 8/52 (15%) lost to follow-up; Control: 12/31 (39%) lost to follow-up. Major losses (not described) which are also imbalanced across the groups
Selective reporting (reporting bias)	Low risk	Outcomes needed for the review in the trial registry are reported apart from death and secondary events
Imbalanced exposure	High risk	There is some attention control although there is a dosage/exposure difference. Intervention participants were exposed to the app continuously and met with the researcher on two occasions, whilst control participants had one meeting with a physiotherapist
Other bias	Low risk	No relevant items

Vanroy 2019

Study characteristics	
Methods	RCT: two phase intervention with 9-month follow-up period after end of in first intervention
Participants	• Number randomised: n = 59; intervention n = 31; control n = 26 • Recruitment mechanism: during inpatient care • Country of study: Belgium • Inclusion criteria: (1) first-ever stroke12 (2) age < 80 years; (3) between 3 and 10 weeks post stroke; (4) able to carry out simple instructions; and (5) able to pedal a MOTOmed viva2 leg trainer device (at 50 revolutions/minute) • Exclusion criteria: (1) pre-stroke neurologic disorders with impaired functionality; (2) pre-stroke Barthel Index < 50; and (3) absolute contraindications for exercise testing • Age: intervention 66.7 years (SD 8.8); control 63.8 years (SD 11.8) • Gender: intervention: 20 men, 13 women; control: 18 men, 8 women • Type of stroke: intervention: ischemic 29 (87.9%), haemorrhagic 3 (9.1%), bilateral 1 (3.0%); control: ischemic 22 (84.6%), haemorrhagic 4 (15.4%), bilateral 0% • Time since stroke: 50.5 days (SD 19.8); control 48.5 days (SD 19.2) • Stroke severity: NIHSS median (25th-75th percentile): intervention group 5 (3-7); control group 5 (2-10) • Ability to stand independently at baseline: not reported • Ability to walk independently at baseline: number able to walk 10m; intervention 13 (39.4%); control 12 (46.2%)
Interventions	Intervention • intervention type: 2 phases: (Phase 1) multi-component lifestyle intervention, seated cycling on a MOTOmed leg trainer plus lifestyle education; (Phase 2) coaching in exercise and behaviour change • dose: Phase 1: 3 times per week for 12 weeks at 60% HRR interval training in week 1 progressing to 75% HRR continuous training in week 12; 30 minutes of training total session within total session duration of 51 minutes in week 1 reducing to 40 minutes in week 12; phase 2: dose varied according to individually selected training modality • intervention setting: inpatient care and peoples home • conditions under which the intervention took place: some contact and home visits • given in addition to regular therapy

Vanroy 2019 *(Continued)*

	Comparison • passive mobilisation of the paretic hip and knee whilst supine: 30 minute per session, 3 times per week for 12 week. Given in addition to regular therapy
Outcomes	Death • not a pre-planned outcome Secondary events • not a pre-planned outcome Adverse events • not a pre-planned outcome Sedentary behaviour • sedentary behaviour recorded as METs * minutes recorded via a self-reported physical activity diary Risk factors • physical activity (step count, energy expenditure, Baecke Questionnaire of Habitual Physical Activity, Physical Activity Scale for Individuals with Physical Disabilities Impairments • indices of cardiorespiratory fitness, muscle strength Activity limitations • Functional ambulation categories, maximum walking speed (10 metres), comfortable walking speed (10 metres)
Notes	Additional information sought from author to ascertain the timing of the reported adverse events and whether these led to attrition

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "After baseline measure, patients were stratified according to the motor impairment severity, the type of stroke, and the aerobic capacity level. A permuted block design of four was used, generated by a computer random number generator"
Allocation concealment (selection bias)	Low risk	Quote: "Concealed allocations were achieved by contacting the holder of the allocation schedule who was 'off-site'."
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Cannot blind participants to this type of intervention although there was an element of attention control
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "The assessor was blinded to the group assignment" Study described as single-blind
Incomplete outcome data (attrition bias) All outcomes	Low risk	Intention-to-treat analysis not described however losses low and similarly distributed

Vanroy 2019 *(Continued)*

		Intervention: 2/33 (6%) lost to follow-up; control: 1/26 (4%) lost to follow-up before end intervention
Incomplete outcome data (attrition bias) - end of follow-up	Low risk	Intention-to-treat analysis not described however losses low and similarly distributed Intervention: 3/33 (9%) lost to follow-up; control: 3/26 (12%) lost to follow-up before end of follow-up
Selective reporting (reporting bias)	High risk	Trial registry entry (NCT01070459) does not correspond clearly to presented data, it states: Primary Outcome Measures: VO_2-peak, strength, walking, activities of daily living Secondary Outcome Measures: post-stroke fatigue, depression, lifestyle, cardiovascular risk factors Sedentary behaviour outcome reported but not planned. Fatigue and depression planned but not reported
Imbalanced exposure	Unclear risk	Quote: "The non-coaching group and patients in the control group were not visited and not asked to report all training moments in phase II." The control group received passive mobilisation therapy; three 30-minute sessions per week during the 3 months In phase I of the trial the control exposure amount is broadly the same as the intervention group exposure lacked the 4 x 1 hour education sessions is not balanced In phase II the non-coaching group and patients in the control group were not visited and not asked to report all training moments
Other bias	Unclear risk	Quote: "the SenseWear Pro2 Armband device showed frequent malfunctioning or loosening at the non-paretic arm, which could often not be resolved with the paretic arm"

Wellwood 2004

Study characteristics	
Methods	RCT
Participants	• Number randomised: n = 70 • Recruitment mechanism: recently admitted to one of three rehabilitation facilities • Country of study: UK (Scotland) • Inclusion criteria: clinical diagnosis of stroke < 6 weeks, able to tolerate and benefit from mobility rehabilitation • Exclusion criteria: exclusion reasons reported but criteria not described • Age: intervention: 68 years (SD 11); control: 67 years (SD 10) • Gender: intervention: 11 women, 24 men ; control: 18 women, 17 men • Type of stroke: intervention: right hemisphere stroke n = 15, TACI n = 6, PACI n = 15, LACI n = 10, POCI n = 2, other n = 2; control: right hemisphere stroke n = 15, TACI n = 7, PACI n = 18, LACI n = 8, POCI n = 1, other n = 1 • Time since stroke: intervention 22 days (SD 14); control 25 days (SD 18) • Stroke severity: only pre-stroke Rankin Score data available

Wellwood 2004 *(Continued)*

- Ability to stand independently at baseline: not reported
- Ability to walk independently at baseline: not reported

Interventions	Interventions • intervention type: physiotherapy: schedules based on Edwards 1991 • dose: additional 30-40 minutes direct physiotherapy (i.e. double, total 60-80 minutes) contact per day, 5 days per week, programme length unclear • intervention setting: inpatient rehabilitation • conditions under which the intervention took place: supervised by physiotherapist • description of any usual care or co-intervention exposure: conventional inpatient stroke services including conventional physiotherapy input (30-40 minutes direct physiotherapy contact per day, 5 days per week) Comparison • description of comparison intervention: including any usual care exposure: conventional inpatient stroke services including conventional physiotherapy input (30-40 minutes direct physiotherapy contact per day, 5 days per week)
Outcomes	Death • not a pre-planned outcome Secondary events • not a pre-planned outcome Adverse events • complications including falls: pre-planned outcome Sedentary behaviour • sedentary time: objective measurement device recorded sitting/lying time • sedentary pattern: objective measurement device recorded number of sit to stand transitions Risk factors • not a pre-planned outcome Activity limitations • time to achieve mobility outcomes of standing, walking 10 paces and walking 10 metres • Trunk Control Test • Motricity Index • Rivermead Mobility Index • Barthel index • Nottingham Extended Activities of Daily Living Quality of life • EuroQol
Notes	The paper does report numbers of transitions from sit-to-stand. Time spent sitting may be also available

Risk of bias

Bias	Authors' judgement	Support for judgement

Wellwood 2004 *(Continued)*

Random sequence generation (selection bias)	Low risk	Quote: "patients were randomly assigned (by a remote, independent centre offering a telephone randomisation service)" Quote: "Randomization was stratified by study site, age (above or below 75 years), and level of severity (Barthel Index (BI)16 (0-9 or 10-20)) at recruitment"
Allocation concealment (selection bias)	Low risk	Quote: "patients were randomly assigned (by a remote, independent centre offering a telephone randomisation service" Remote mechanism means no allocation to conceal, assignment could not be foreseen due to nature of randomization service
Blinding of participants and personnel (performance bias) All outcomes	High risk	Intervention dose cannot be blinded and there is no kind of attention control
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "therapist carried out blinded assessments of outcome" Not clear if any inadvertent un-blinding
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Quote: "All analyses were according to the intention-to-treat principle, using all available data for each measurement at the appropriate visit" Quote: "Follow-up was very satisfactory with only 14/280 (5%) of assessments being missed" Although it is unclear as to when the intervention ended, attrition is unlikely to present a source of bias Little patient attrition
Incomplete outcome data (attrition bias) - end of follow-up	Unclear risk	Quote: "All analyses were according to the intention-to-treat principle, using all available data for each measurement at the appropriate visit" Quote: "Follow-up was very satisfactory with only 14/280 (5%) of assessments being missed" Although it is unclear as to when the intervention ended, attrition is unlikely to present a source of bias. Little patient attrition
Selective reporting (reporting bias)	Unclear risk	Trial registry data not available
Imbalanced exposure	High risk	No attention control exposure. Participants in the intervention received almost twice the amount of minutes of physiotherapy compared to the control group Quote: "hours per weekday differed by 0.45 hours Standard (i.e., 62 versus 35 minutes)"
Other bias	High risk	Quote: "Eligible patients were not admitted in a regular manner and a few had to be excluded because we were unable to guarantee that we could provide the augmented physiotherapy input if they were randomised to the intervention arm of the trial"

BMI: body mass index
LACI: lacunar infarcts
MMSE: Mini-Mental State Examination
MoCA: Montreal Cognitive Assessment
mRS: modified Rankin Scale
NIHSS: National Institutes of Health Stroke Scale
PACI: partial anterior circulation infarcts
POCI: posterior circulation infarct

RCT: randomised controlled trial
SD: standard deviation
SSS: Scandinavian Stroke Scale
TACI: total anterior circulation infarcts
TIA: transient ischemic attack

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
ACTRN12610000864022	Wrong population
ACTRN12613000796785	Wrong design
ACTRN 12613000869774	No sedentary behaviour outcome
ACTRN12614000134628	Wrong design
ACTRN12616000325404	Wrong design
Barclay-Goddard 2012	Intervention not specifically aimed at reducing sedentary behaviour
Blennerhassett 2003	No sedentary behaviour outcome
Britton 2008	Intervention not specifically aimed at reducing sedentary behaviour
Brouwer Goossensen 2017	No sedentary behaviour outcome
BUST-Stroke 2018	Wrong design
Cadilhac 2010	No sedentary behaviour outcome
ChiCTR-TRC-08000201	No sedentary behaviour outcome
Connell 2018	Wrong control
Dean 2007	No sedentary behaviour outcome
Dean 2012a	No sedentary behaviour outcome
ExStroke Trial 2009	No sedentary behaviour outcome
Ezeugwu 2017	Wrong design
Ezeugwu 2018	Wrong design
Flynn 2018	Wrong design
Galvin 2011	No sedentary behaviour outcome
Givon 2016	No sedentary behaviour outcome
Gjelsvik 2013	Intervention not specifically aimed at reducing sedentary behaviour
Hamrin 1982	Wrong design

Study	Reason for exclusion
Haworth 2009	No sedentary behaviour outcome
Hendrey 2018	No sedentary behaviour outcome
Holmgren 2010	No sedentary behaviour outcome
ISRCTN10694741	Wrong control group
ISRCTN35516780	Wrong design
ISRCTN74167784	No sedentary behaviour outcome
Jones 2016	No sedentary behaviour outcome
Kanai 2019	Wrong design
Kim 2013	No sedentary behaviour outcome
Kono 2013	No sedentary behaviour outcome
Kringle 2019	Wrong design
Logan 2018	Wrong intervention
Mackie 2018	Wrong design
Macko 2005	Intervention not specifically aimed at reducing sedentary behaviour
Maguire 2012	Trial terminated
McManus 2009	No sedentary behaviour outcome
Mudge 2009	No sedentary behaviour outcome
NCT00018421	No sedentary behaviour outcome
NCT01646216	No sedentary behaviour outcome
NCT02285933	Intervention not specifically aimed at reducing sedentary behaviour
NCT02364232	Wrong design
NCT02587585	No sedentary behaviour outcome
NCT02681393	No sedentary behaviour outcome
NCT02798237	Wrong control
NCT02835313	No sedentary behaviour outcome
NCT03122626	No sedentary behaviour outcome
NCT03492957	Wrong design
NCT03985761	Wrong intervention

Study	Reason for exclusion
NCT04144556	No sedentary behaviour outcome
Oikarinen 2017	Wrong design
Olney 2006	No sedentary behaviour outcome
Palsdottir 2016	No sedentary behaviour outcome
Patomella 2019	Wrong population
Plummer DAmato 2012	Intervention not specifically aimed at reducing sedentary behaviour
Preston 2014	Wrong design
Preston 2017	Wrong design
RECREATE 2018	Wrong design
Reinthal 2012	Wrong design
ReTRAIN trial 2018	No sedentary behaviour outcome
Rosbergen 2017	Wrong design
Ruescas Nicolau 2015	No sedentary behaviour outcome
Saggini 2013	Wrong design
Schröder 2018	Wrong population
Simpson 2018	Wrong design
Sjoholm 2012	Wrong design
Song 2015	No sedentary behaviour outcome
STANDFIRM trial 2017a	No sedentary behaviour outcome
STARFISH PILOT 2016	Wrong design (not random)
Sun 2018	No sedentary behaviour outcome
Thayabaranthan 2012	Wrong design
Toledano Zarhi 2011	No sedentary behaviour outcome
Verma 2011	No sedentary behaviour outcome
Vloothuis 2015	No sedentary behaviour outcome
Wright 2018	No sedentary behaviour outcome
Yang 2007	No sedentary behaviour outcome
Yen 2020	No sedentary behaviour outcome

Characteristics of studies awaiting classification *[ordered by study ID]*

Aguiar 2018

Methods	RCT
Participants	N = 22; adults, > 6 months post-stroke, sedentary or insufficiently active
Interventions	Aerobic treadmill training
Outcomes	Primary outcomes: physical activity levels, time spent in low-energy expenditure activities (Multi-sensor SenseWear Mini® and Human Activity Profile) Secondary outcomes: cardiorespiratory fitness, endurance, depression, mobility, quality of life, participation
Notes	Conference communication only

AVERT II 2008

Methods	RCT; stage II
Participants	N = 71 people with acute stroke (< 24hours)
Interventions	Very early mobilisation
Outcomes	Primary outcome: death at 3 months Secondary outcomes: various adverse events
Notes	There was behavioural mapping data collected during the AVERT studies which contains some information about sedentary behaviours which potentially could be accessed at some stage

AVERT III 2015

Methods	RCT; stage III
Participants	N = 2104 people with acute stroke (< 24 hours)
Interventions	Very early mobilisation
Outcomes	Primary: mRS Secondary outcomes: deaths and number of non-fatal serious adverse events at 3 months. Change in Rankin score across the entire range of the scale; time taken to achieve unassisted walking over 50 metres and the proportion of patients achieving unassisted walking by 3 months
Notes	There was behavioural mapping data collected during the AVERT studies which contains some information about sedentary behaviours which potentially could be accessed at some stage

Grau-Pellicer 2020

Methods	RCT
Participants	N = 41 stroke survivors
Interventions	Multimodal rehabilitation with phone app
Outcomes	Primary outcomes: community ambulation, sedentary behaviour Secondary outcomes: walking speed (10MWT) and endurance (6MWT), 3 metre timed up-an- go; Barthel Index, Quality of life (Eq-5D5L) and participant satisfaction
Notes	Authors became aware of this trial too late to include in this version of the review

HEPAP 2012

Methods	RCT; single centre
Participants	N = 60 stroke patients
Interventions	Multicomponent: exercise intervention and lifestyle education
Outcomes	Cardiorespiratory fitness, SF-36, Profile of Mood States, Stanford Medical Centre Stroke Awareness Questionnaire, Hospital Anxiety and Depression Scale, IPAQ
Notes	IPAQ data are available - author emailed for sitting data

ISRCTN82280581

Methods	Multicentre cluster RCT
Participants	N = 1156 people with stroke; age > 16 years
Interventions	Complex intervention to target sedentary behaviour after stroke
Outcomes	Primary outcome: extended activities of daily living Secondary outcome: sedentary behaviour, cost-effectiveness, health status and occurrence of major vascular events
Notes	

Jovic 2017

Methods	RCT
Participants	N = 66 stroke patients
Interventions	Motion capture game-based exercises

Jovic 2017 *(Continued)*

Outcomes	ActivePAL used to determine; time in upright position, time performing standing and stepping tasks, activity levels during awake hours of the day
Notes	Conference communication only

Martins 2017

Methods	RCT
Participants	N = 36 community-dwelling stroke patients
Interventions	Task-specific training
Outcomes	Physical activity levels using objective and self-reported tools Mobility using 10m walk test
Notes	Trialists have collected data regarding sedentary behaviour via the Sensewear device in this study, but have not processed them yet. The trialists are planning to take a look at those data soon. The results of this RCT will be published in the Neurorehabilitation Journal. (Title: "Efficacy of task-specific circuit training on physical activity levels and mobility of people with stroke: A randomised controlled trial")

PHYS-STROKE 2014

Methods	RCT; phase III
Participants	N = 215 people with stroke; moderate to sever walking limitation
Interventions	Treadmill walking
Outcomes	Gait speed (in m/s, 10 m walk), Barthel Index, quality of life, sleep and mood, cognition, arm function, fitness (maximal oxygen uptake), cardiovascular risk factors (including blood pressure, pulse, waist-to-hip ratio, markers of inflammation, immunity and the insulin-glucose pathway, lipid profile, and others)
Notes	There is Actigraph data; still only protocol publications

PREVENT Trial 2010

Methods	RCT
Participants	N = 250 people with non-disabling stroke or TIA
Interventions	Multicomponent exercise and eduction
Outcomes	Primary outcomes: risk factors (blood pressure, waist circumference, 12-hour fasting lipid profile, and 12-hour fasting glucose/haemoglobin A1c) Secondary outcomes: exercise capacity, walking endurance, physical activity, cognitive function, depression, goal attainment and health-related quality of life

PREVENT Trial 2010 *(Continued)*

Notes	This has IPAQ data in protocol paper and refers to an accelerometer; there is no full paper

REHAB 2013

Methods	RCT
Participants	N = 90 people with stroke; ambulatory
Interventions	Multicomponent: home exercise plus motivational telephone calls
Outcomes	Ambulatory profile
Notes	Full paper not available

Sajatovic 2018

Methods	RCT
Participants	N = 38; stroke or TIA
Interventions	Self-management training in stroke risk
Outcomes	Blood pressure, glycosylated haemoglobin (HbA_{1c}), lipids, medication adherence, weight, health behaviours (diet, exercise, smoking, substances), depression and quality of life. Qualitative assessments evaluated the perspectives of intervention participants
Notes	The trial team are not currently resourced to reanalyse data to extract sedentary outcome

SUCCEED 2020

Methods	RCT
Participants	N = 487
Interventions	Behavioural care management including education sessions
Outcomes	Primary outcome: blood pressure Secondary outcomes: multiple risk factor outcomes
Notes	IPAQ data is available

Tyson 2017

Methods	RCT
Participants	N = 66

Tyson 2017 *(Continued)*

Interventions	Movement controlled games-based rehabilitation
Outcomes	Physical activity using ActivPAL accelerometer
Notes	Conference communication only; no full text accessible

VERITAS 2008

Methods	RCT; 3 intervention groups
Participants	N = 32
Interventions	Early active mobilisation, automated monitoring or early active mobilisation plus automated monitoring
Outcomes	Time to first mobilisation (attempt to get the patient out of bed, to sit, stand or walk), best level of mobilisation activity achieved (lying, sitting, standing, walking), number of physiological abnormalities recorded (using predefined definitions of pyrexia, hypoxia, tachycardia, bradycardia, hypotension/hypertension and hyperglycaemia), early medical complications and adverse events, patient activity (using automated activity monitor), neurological deterioration, Rivermead Mobility Index, walking speed, mRS, NIHSS, Barthel Index
Notes	http://isrctn.com/ISRCTN23817752 states time spent sitting recorded by activity monitors but this is not in the paper The main author clarified that record activity data was recorded using Activpal but this had quite a lot of technical problems; as a result the actual time recorded varied from patient to patient The main author recalled the % time spent in an activity ended up being more reliable and will re-examine the data

Zhao 2003

Methods	RCT
Participants	N = 300 inpatients with acute stroke
Interventions	Early mobilisation
Outcomes	Barthel index
Notes	Requires translation

mRS: modified Rankin Scale
NIHSS: National Institutes of Health Stroke Scale
RCT: randomised controlled trial
TIA: transient ischemic attack

Characteristics of ongoing studies *[ordered by study ID]*

ACTRN12613000744752

Study name	IMPACT RCT (Improving Physical Activity via Treadmill Training)

ACTRN12613000744752 *(Continued)*

Methods	Parallel RCT
Participants	N = 128 Inclusion criteria • within 2 months of stroke • aged over 18 years • able to walk independently for 10m with or without an aid • able to understand 3-stage commands Exclusion criteria • unable to walk independently prior to current stroke • have co-morbidities that might limit walking (e.g. arthritis, brain injury, Parkinson's Disease) • unstable cardiac status • unable to understand/follow instructions • unable to return for assessment or training • unable to give informed consent
Interventions	Multicomponent intervention comprising the following exposures over 8 weeks • treadmill walking: 30-minute sessions, 3 times a week for 8 weeks at 60% of heart rate reserve. Total dose of treadmill walking is 12 hours. Participants will be individually monitored throughout the treadmill sessions by a physiotherapist • CDSM: during the same 8-week period that participants are receiving treadmill training, they will also receive a CDSM programme. This will involve 5-10 minute sessions, 3 times a week for 8 weeks, delivered individually to the participants by the physiotherapists prior to or during the treadmill sessions. Participants will be taught behaviour change techniques such as goal setting and action planning to encourage initiation and maintenance of physical activity • usual care
Outcomes	Primary outcomes • physical activity: actual activity levels (steps per day) measured over a 4-day period using an accelerometer (ActivPal) Secondary outcomes • walking ability: 6-minute walk test • walking ability: 10m walk test • cardiorespiratory fitness ; VO_2 peak, heart rate, blood pressure and rate pressure product • cardiovascular risk: lipid profile (TC, HDL, LDL, TRG, TC/HDL) and inflammatory markers (hs-CRP) • self-efficacy of walking: Ambulatory Self Confidence Questionnaire • health-related quality of life: EuroQual-5D and VAS questionnaire • participation: Impact on Participation and Autonomy Questionnaire (IPAQ) • physical activity: Physical Activity Scale for Individuals with Physical Disabilities (PASIPD) questionnaire • depression; Hospital and Anxiety Depression Scale
Starting date	31 October 2013
Contact information	Sandra Brauer Therapies Building (84A) The University of Queensland St Lucia QLD 4072 Australia

ACTRN12613000744752 *(Continued)*	s.brauer@uq.edu.au
Notes	

ACTRN12616000325404 2016

Study name	PPASS RCT
Methods	Parallel RCT
Participants	N = 50 Inclusion criteria • adults (age ⩾ 18 years) after haemorrhagic or ischemic stroke • to be discharged home from an acute medical/stroke unit within one month of stroke onset • able to walk 10m across flat ground without an aid at greater than or equal to 0.8m/s. (12.5s on 10MWT) • score greater than or equal to 24 on the MMSE • perform fewer than 30 minutes of moderate activity most days a week Exclusion criteria • stroke survivors with moderate to severe receptive aphasia (i.e. < 25/30 on the Frenchay Screening Aphasia Test)
Interventions	A standardized protocol for the self-management intervention has been developed incorporating elements important to behaviour change, 2008), and will be implemented in 5 sessions by trained physiotherapists. All sessions will be allocated 60 minutes and will be implemented in collaboration with the participant in the participant's home. The first 2 intervention sessions will be delivered at 1-week intervals, the third after a 2-week interval, and the fourth and fifth after 4-week intervals • Session 1 includes education about the importance of physical activity, completion of an physical activity preferences questionnaire and generation of a list of goals, barriers and potential solutions • Session 2 includes revision of goals, barriers and solutions, development of a weekly physical activity schedule, selection of self-monitoring strategies, and implementation of the initial physical activity session • Session 3 includes feedback about initial measurement outcomes, revision of goals and self-monitoring strategies, revision of the physical activity schedule, encouragement and praise • Session 4 includes revision of goals and self-monitoring strategies, relapse prompting, encouragement and praise • Session 5 includes feedback about 3-month measurement outcomes, revision of physical activity, relapse prompting, encouragement and praise The intervention is self-management, not physical activity prescription, so participants will decide on the type, intensity, duration, and mode of physical activity individually. These elements will not be prescribed. Participants will be informed that 150 minutes of physical activity a week is recommended by Australia's Physical Activity and Sedentary Behaviour Guidelines (Department of Health, 2014). Participants will also be guided to select a strategy for monitoring their physical activity, which again will be decided by the participant. Adherence to the self-management program will be determined by attendance at self-management sessions
Outcomes	Primary outcomes • proportion of participants who meet Australia's Physical Activity and Sedentary Behaviour Guidelines: Actigraph activity monitor

ACTRN12616000325404 2016 *(Continued)*

	Secondary outcomes • time spent in moderate activity: Actigraph activity monitor • walking ability: 6-minute walk test • participation using the IPAQ • health-related quality of life using the EuroQual-5D (EQ-5D) • self efficacy: Self-efficacy for Exercise scale • health status: measured via Australian absolute cardiovascular risk calculator • walking ability; 10MWT • daily step count: Actigraph activity monitor
Starting date	25 March 2016
Contact information	Elisabeth Preston University of Canberra Discipline of Physiotherapy Faculty of Health Building 12 Moana St Bruce ACT 2617 Australia elisabeth.preston@canberra.edu.au
Notes	https://www.anzctr.org.au/Trial/Registration/TrialReview.aspx?id=370208

NCT03873467

Study name	GLB-CVA
Methods	Parallel RCT
Participants	N = 65 Inclusion criteria • 18 to 85 years of age • BMI ≥ 25 • all types of stroke • at least 12 months post first stroke • physician approval Exclusion criteria • low cognition • not fluent in the English language • conditions for which physical activity is contraindicated • taking medication for type 2 diabetes • residing in a hospital, acute rehabilitation setting, or skilled nursing facility • pregnancy • pre-existing diagnosis of an eating disorder
Interventions	The Group Lifestyle Balance (GLB) program is a self-management intervention that has been shown to result in weight-loss and reduce the risk for type 2 diabetes through increased physical activity and healthy eating behaviours in the general population. The GLB is designed for delivery in a group-based, community setting, and has resulted in weight-loss in a variety of settings, such as

NCT03873467 *(Continued)*

	community centres, churches, worksites, and healthcare systems. The GLB curriculum used in this study has been adapted for people with stroke The GLB program, adapted for individuals with stroke, will be delivered to participants over a 12-month period, divided into 22 in-person or virtual, group sessions. The intervention promotes 5-7% weight-loss by reducing calories and increasing exercise (150 minutes of moderate physical activity per week)
Outcomes	Primary outcome measures • change in weight Secondary outcome measures • physical activity: Actigraph • arm circumference • blood pressure • cholesterol • risk of diabetes: The Framingham Heart Study diabetes risk score • 10MWT • 6 Minute Walk Test • perceived social support: Multidimensional Scale of Perceived Social Support • self-reported activities of health: Self-Rated Abilities for Health Practice scale • neighbourhood walkability using Walk Score • resting metabolic rate • behavioral risk factor surveillance • participant quality of life: Stroke Impact Scale • stressful life events: Holmes and Rahe Stress Inventory • executive function and cognition: Montreal Cognitive Assessment • habit formation: Self-Reported Habit Index • stroke severity: mRS • pain interference: Pain Interference-Short Form taken from the Patient-Reported Outcomes Measurement Information System • sleep disturbance: Sleep Disturbance-Short Form 4a taken from the Patient-Reported Outcomes Measurement Information System • waist circumference • HbA1c • triglycerides • blood glucose • biomarker analysis: (Isrin, Angiogenic factors (VEGF), Total Homocysteine, Lipoprotein-associated phospholipase A2 (Lp-PLA2), ICF-1, Brain derived neurotrophic factor (BDNF), and Tau proteins (total and phosphorylated) • stages of change: modified version of Prochaska and DiClemente's Stages of Change model • metabolic score calculator • CoRonavIruS Health Impact Survey) V0.3 Adult Baseline Form • Patient-Reported Outcomes Measurement Information System Social Isolation Short Form 4a; taken from the Patient-Reported Outcomes Measurement Information System • Media Questionnaire: to assess media exposure and fear of media exposure during COVID-19 we have added 6 questions. These are asked "over the past two weeks." These questions address time spent watching the television, listening to radio, reading the newspaper, and searching the internet and social media. In addition, a 6th question related to fear is asked using a 5-point Likert scale
Starting date	8 July 2019
Contact information	Simon J Driver

NCT03873467 *(Continued)*

	Baylor Scott & White Institute for Rehabilitation Dallas, Texas, United States, 75246
Notes	Driver S, McShan E, Swank C, Grobe K, Calhoun S, Bailey R, Kramer K. Creating an appropriate adaptation of a healthy lifestyle intervention for people after stroke. Brain Inj. 2020 Sep 18;34(11):1497-1503. doi: 10.1080/02699052.2020.1808703. Epub 2020 Aug 19. Driver S, Swank C, Froehlich-Grobe K, McShan E, Calhoun S, Bennett M. Weight Loss After Stroke Through an Intensive Lifestyle Intervention (Group Lifestyle Balance-Cerebrovascular Accident): Protocol for a Randomized Controlled Trial. JMIR Res Protoc. 2019 Oct 18;8(10):e14338. doi: 10.2196/14338.

NCT04011202

Study name	None
Methods	Parallel RCT
Participants	Inclusion criteria • have had a stroke (confirmed by CT scan or MRI), are an inpatient receiving stroke rehabilitation for an expected length of stay of 14 days or longer, are at least 19 years of age or older, are able to provide informed consent, have clearance from a physician to participate in the study, are able to understand English Exclusion criteria • have a visual or hearing impairment, have a planned surgical intervention, are not medically stable, have a significant musculoskeletal or other neurological condition, severe aphasia
Interventions	Participants will receive3 x 20-30 minute sessions of VR-gaming per week for the duration of their inpatient stay Participants will select VR games/program in categories of: relaxation; leisure sport and activities; or action/adventure The VR-gaming program will be implemented one-on-one, face-to-face by a clinician using the commercially-available Oculus Go system
Outcomes	Primary outcome measures • depressive symptoms: Hospital Anxiety and Depression Scale Secondary outcome measures • anxiety symptoms: Hospital Anxiety and Depression Scale • stress: Perceived Stress Scale • motivation: Situational Motivation Scale • happiness: Subjective Happiness Scale • stroke severity: mRS • sedentary time: measure of older adults' sedentary time. Participant estimate of weekly time in activities including sedentary behaviours Other outcome measures • feasibility indicators: recruitment rate, retention rate, perceived benefit of the VR Training Program, treatment fidelity, participant and tester burden, trainer burden, ease of using equipment
Starting date	21 August 2019

NCT04011202 *(Continued)*

Contact information	Brodie Sakakibara Occupational Science & Occupational Therapy Faculty of Medicine T325 - 2211 Wesbrook Mall Vancouver, BC Canada V6T 2B5 brodie.sakaibara@ubc.ca
Notes	

NCT04069767

Study name	None
Methods	Parallel RCT
Participants	N = 100 Adults (age 18-85) with a stroke diagnosis who can sit for 10 seconds without support, Trunk Impairment Scale-Norwegian version (TIS-NV) < 14 and pre-stroke mRS 0-3
Interventions	The intervention starts with an assessment by the physiotherapist to identify the patient's movement problems in order to choose among the 48 exercises in the intervention. Each session lasts for 60 minutes + exercises 5-10 minutes outside of therapy and is performed 5-6 days/per week in the rehabilitation units, and 3 sessions/week + home exercises 30 minutes 3 days per week in home based or outpatient treatment during the 12-week period To allow for individualisation, each exercise contains 5 levels of difficulty. All exercises demand enhancement of dynamic trunk stability and functional movements
Outcomes	Primary outcome measures • Trunk Impairment Scale Norwegian Version • physical activity and number of steps: ActiGraph WgtX-BT Secondary outcome measures • Swedish Postural Assessment Scale For Stroke Norwegian Version • pro-and reactive balance in standing and walking: MiniBESTest • distribution of weight during sitting: Bodyfitter seat sensor system • postural sway: Amti Force Platform • 10MWT • 2 minute walk test • quality of life: EQ-5D-3L • quality of life: Stroke Specific Quality of Life Scale
Starting date	9 September 2019
Contact information	Britt Normann +4799614941 mailto:britt.normann%40nordlandssykehuset.no?subject=NCT04069767, StrokeCoreDIST, Innovative Physiotherapy in Stroke Rehabilitation Karl B Alstadhaug +4775534429

NCT04069767 *(Continued)*	
	mailto:karl.bjornar.alstadhaug%40nlsh.no?subject=NCT04069767, StrokeCoreDIST, Innovative Physiotherapy in Stroke Rehabilitation
Notes	Can the ActiGraph WgtX-BT record sedentary time?

10MWT: 10 metre walk test
BMI: Body Mass Index
CDSM: chronic disease self management
IPAQ: Impact on Participation and Autonomy Questionnaire
MMSE: Mini Mental State Examination
mRS: modified Rankin Scale
RCT: randomised controlled trial
VR: virtual reality

DATA AND ANALYSES

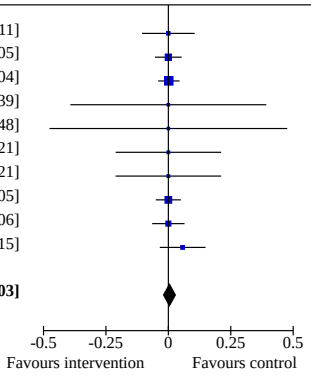
Comparison 1. Interventions versus control at end of intervention

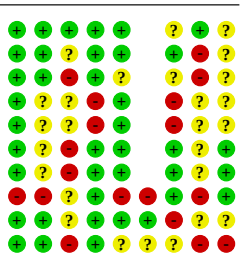
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1.1 Death	10	753	Risk Difference (M-H, Random, 95% CI)	0.00 [-0.02, 0.03]
1.2 Recurrent cardiovascular or cerebrovascular events	10	753	Risk Difference (M-H, Random, 95% CI)	-0.01 [-0.04, 0.01]
1.3 Adverse events - falls	10	753	Risk Difference (M-H, Random, 95% CI)	-0.00 [-0.02, 0.02]
1.4 Sedentary behaviour - sitting time hours per day	7	300	Mean Difference (IV, Random, 95% CI)	0.13 [-0.42, 0.68]
1.5 Risk factors - physical activity - MVPA	3	72	Mean Difference (IV, Random, 95% CI)	5.61 [-21.32, 32.53]
1.6 Risk factors - physical activity - step count	2	146	Mean Difference (IV, Random, 95% CI)	-33.62 [-1438.07, 1370.83]
1.7 Risk factors - anthropometry - Body Mass Index	6	200	Mean Difference (IV, Random, 95% CI)	1.31 [0.17, 2.45]
1.8 Risk factors - anthropometry - waist circumference	4	54	Mean Difference (IV, Random, 95% CI)	0.74 [-7.36, 8.84]
1.9 Risk factors - blood pressure - systolic	6	200	Mean Difference (IV, Random, 95% CI)	-5.88 [-11.95, 0.19]
1.10 Risk factors - blood pressure - diastolic	6	200	Mean Difference (IV, Random, 95% CI)	-1.92 [-4.80, 0.96]

Analysis 1.1. Comparison 1: Interventions versus control at end of intervention, Outcome 1: Death

Study or Subgroup	Experimental Events	Experimental Total	Control Events	Control Total	Weight	Risk Difference M-H, Random, 95% CI
English 2016b (1)	0	19	0	16	5.0%	0.00 [-0.11 , 0.11]
Krawcyk 2019	0	35	0	36	19.6%	0.00 [-0.05 , 0.05]
LAST 2018	9	186	9	194	30.5%	0.00 [-0.04 , 0.04]
SPRITE I (arm 1) 2017 (2)	0	5	0	3	0.4%	0.00 [-0.39 , 0.39]
SPRITE I (arm 2) 2017 (3)	0	5	0	2	0.2%	0.00 [-0.48 , 0.48]
SPRITE II (arm 1) 2019 (4)	0	14	0	6	1.2%	0.00 [-0.21 , 0.21]
SPRITE II (arm 2) 2019 (5)	0	14	0	6	1.2%	0.00 [-0.21 , 0.21]
STARFISH 2018 (6)	0	52	0	31	22.1%	0.00 [-0.05 , 0.05]
Vanroy 2019 (7)	0	33	0	26	13.2%	0.00 [-0.06 , 0.06]
Wellwood 2004 (8)	2	35	0	35	6.7%	0.06 [-0.03 , 0.15]
Total (95% CI)		**398**		**355**	**100.0%**	**0.00 [-0.02 , 0.03]**
Total events:	11		9			

Heterogeneity: Tau² = 0.00; Chi² = 1.40, df = 9 (P = 1.00); I² = 0%
Test for overall effect: Z = 0.37 (P = 0.71)
Test for subgroup differences: Not applicable





Footnotes

(1) No deaths reported at end of intervention although there were some unexplained losses to follow-up
(2) Intervention arm 1: '*Healthy Brain Rehabilitation manual*' alone; 3/5 control participants (cannot split odd number evenly)
(3) Intervention arm 2: '*Healthy Brain Rehabilitation manual*' plus pedometer; 2/5 control participants (cannot split odd number evenly)
(4) Intervention arm 1: '*Healthy Brain Rehabilitation Manual*' plus GP support; 6/12 (50%) of the control group participants
(5) Intervention arm 2: '*Healthy Brain Rehabilitation Manual*' plus Stroke Nurse support; 6/12 (50%) of the control group participants
(6) Data communicated by authors
(7) No deaths reported at either the end of Phase I intervention or Phase II intervention
(8) Unclear whether deaths in intervention group occurred at 1, 2 or 6 months

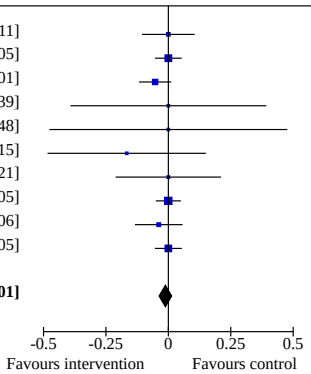
Risk of bias legend

(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Incomplete outcome data (attrition bias) - end of follow-up
(G) Selective reporting (reporting bias)
(H) Imbalanced exposure
(I) Other bias

Analysis 1.2. Comparison 1: Interventions versus control at end of intervention, Outcome 2: Recurrent cardiovascular or cerebrovascular events

Study or Subgroup	Experimental Events	Experimental Total	Control Events	Control Total	Weight	Risk Difference M-H, Random, 95% CI	Risk of Bias A	B	C	D	E	F	G	H	I
English 2016b (1)	0	19	0	16	5.7%	0.00 [-0.11 , 0.11]	+	+	+	+	+		?	+	?
Krawcyk 2019 (2)	0	35	0	36	22.3%	0.00 [-0.05 , 0.05]	+	+	?	+	+		+	-	?
LAST 2018	17	186	28	194	15.3%	-0.05 [-0.12 , 0.01]	+	+	-	+	?		?	-	?
SPRITE I (arm 1) 2017 (3)	0	5	0	3	0.4%	0.00 [-0.39 , 0.39]	+	?	?	-	+		-	?	?
SPRITE I (arm 2) 2017 (4)	0	5	0	2	0.3%	0.00 [-0.48 , 0.48]	+	?	?	-	+		-	?	?
SPRITE II (arm 1) 2019 (5)	0	14	1	6	0.6%	-0.17 [-0.48 , 0.15]	+	?	-	+	+		+	?	+
SPRITE II (arm 2) 2019 (6)	0	14	0	6	1.4%	0.00 [-0.21 , 0.21]	+	?	-	+	+		+	?	+
STARFISH 2018 (7)	0	52	0	31	25.2%	0.00 [-0.05 , 0.05]	-	-	?	+	-	-	+	-	+
Vanroy 2019 (8)	0	33	1	26	7.0%	-0.04 [-0.13 , 0.06]	+	+	?	+	+	+	-	?	?
Wellwood 2004	0	35	0	35	21.7%	0.00 [-0.05 , 0.05]	+	+	-	+	?	?	?	-	-
Total (95% CI)		**398**		**355**	**100.0%**	**-0.01 [-0.04 , 0.01]**									
Total events:	17		30												

Heterogeneity: Tau² = 0.00; Chi² = 6.41, df = 9 (P = 0.70); I² = 0%
Test for overall effect: Z = 0.92 (P = 0.36)
Test for subgroup differences: Not applicable



Footnotes

(1) No recurrent events reported although there were some unexplained losses to follow-up
(2) New transient ischaemic attack occurring in two patients but it is unclear whether these are in the intervention or control group
(3) Intervention arm 1: '*Healthy Brain Rehabilitation Manual*' alone; 3/5 of the control group participants (cannot split odd number evenly)
(4) Intervention arm 2: '*Healthy Brain Rehabilitation Manual*' plus pedometer; 2/5 of the control group participants (cannot split odd number evenly)
(5) Intervention arm 1: '*Healthy Brain Rehabilitation Manual*' plus GP support; 6/12 (50%) of the control group participants. 1/12 (8.3%) stroke event in the shared control group.
(6) Intervention arm 2: '*Healthy Brain Rehabilitation Manual*' plus Stroke Nurse support; 6/12 (50%) of the control group participants. 1/12 (8.3%) stroke event in the shared control group.
(7) Data communicated by authors. No adverse events associated with the intervention, but there were dropouts due to health reasons.
(8) Unclear whether this single reported event occurred during the phase I or the phase II intervention period

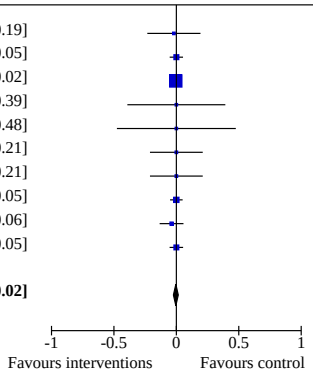
Risk of bias legend

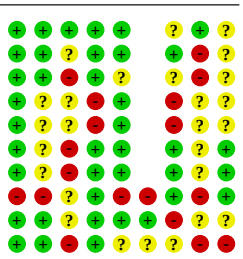
(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Incomplete outcome data (attrition bias) - end of follow-up
(G) Selective reporting (reporting bias)
(H) Imbalanced exposure
(I) Other bias

Analysis 1.3. Comparison 1: Interventions versus control at end of intervention, Outcome 3: Adverse events - falls

Study or Subgroup	Experimental Events	Experimental Total	Control Events	Control Total	Weight	Risk Difference M-H, Random, 95% CI
English 2016b (1)	2	19	2	16	0.8%	-0.02 [-0.23 , 0.19]
Krawcyk 2019	0	35	0	36	13.3%	0.00 [-0.05 , 0.05]
LAST 2018	3	186	4	194	51.8%	-0.00 [-0.03 , 0.02]
SPRITE I (arm 1) 2017 (2)	0	5	0	3	0.2%	0.00 [-0.39 , 0.39]
SPRITE I (arm 2) 2017 (3)	0	5	0	2	0.2%	0.00 [-0.48 , 0.48]
SPRITE II (arm 1) 2019 (4)	0	14	0	6	0.8%	0.00 [-0.21 , 0.21]
SPRITE II (arm 2) 2019 (5)	0	14	0	6	0.8%	0.00 [-0.21 , 0.21]
STARFISH 2018	0	52	0	31	14.9%	0.00 [-0.05 , 0.05]
Vanroy 2019 (6)	0	33	1	26	4.1%	-0.04 [-0.13 , 0.06]
Wellwood 2004	0	35	0	35	12.9%	0.00 [-0.05 , 0.05]
Total (95% CI)		**398**		**355**	**100.0%**	**-0.00 [-0.02 , 0.02]**
Total events:	5		7			

Heterogeneity: Tau² = 0.00; Chi² = 0.64, df = 9 (P = 1.00); I² = 0%
Test for overall effect: Z = 0.41 (P = 0.68)
Test for subgroup differences: Not applicable





Footnotes

(1) Non-injurous falls
(2) Intervention arm 1: '*Healthy Brain Rehabilitation Manual*' alone; 3/5 of the control participants (cannot split odd number)
(3) Intervention arm 2: '*Healthy Brain Rehabilitation Manual*' plus pedometer; 2/5 of the control participants (cannot split odd number)
(4) Intervention arm 1: '*Healthy Brain Rehabilitation Manual*' plus GP support; 6/12 (50%) of the control participants
(5) Intervention arm 1: '*Healthy Brain Rehabilitation Manual*' plus Stroke Nurse support; 6/12 (50%) of the control participants
(6) Unclear whether the fall in the control group relates to Phase I or Phase II of the intervention

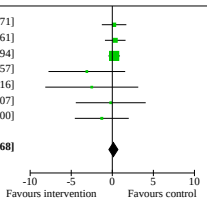
Risk of bias legend

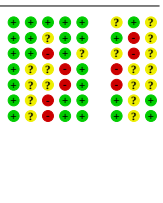
(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Incomplete outcome data (attrition bias) - end of follow-up
(G) Selective reporting (reporting bias)
(H) Imbalanced exposure
(I) Other bias

Analysis 1.4. Comparison 1: Interventions versus control at end of intervention, Outcome 4: Sedentary behaviour - sitting time hours per day

Study or Subgroup	Experimental Mean [hours per day]	Experimental SD [hours per day]	Experimental Total	Control Mean [hours per day]	Control SD [hours per day]	Control Total	Weight	Mean Difference IV, Random, 95% CI [hours per day]
English 2016b (1)	11.5535	2.08	19	11.33667	2.218333	14	13.6%	0.22 [-1.27 , 1.71]
Krawcyk 2019 (2)	6.01429	2.6	31	5.65714	2.47143	32	19.2%	0.36 [-0.90 , 1.61]
LAST 2018 (3)	11.0882	1.9989559	69	10.856667	2.4031999	80	60.4%	0.23 [-0.48 , 0.94]
SPRITE I (arm 1) 2017 (4)	3.2	1.3	5	6.3	4	3	1.4%	-3.10 [-7.77 , 1.57]
SPRITE I (arm 2) 2017 (5)	3.8	1.3	5	6.3	4	2	0.9%	-2.50 [-8.16 , 3.16]
SPRITE II (arm 1) 2019 (6)	6.31	5.79	14	6.5	3.73	6	1.7%	-0.19 [-4.45 , 4.07]
SPRITE II (arm 2) 2019 (7)	5.22	2.61	14	6.5	3.73	6	2.8%	-1.28 [-4.56 , 2.00]
Total (95% CI)			**157**			**143**	**100.0%**	**0.13 [-0.42 , 0.68]**

Heterogeneity: Tau² = 0.00; Chi² = 3.62, df = 6 (P = 0.73); I² = 0%
Test for overall effect: Z = 0.47 (P = 0.64)
Test for subgroup differences: Not applicable





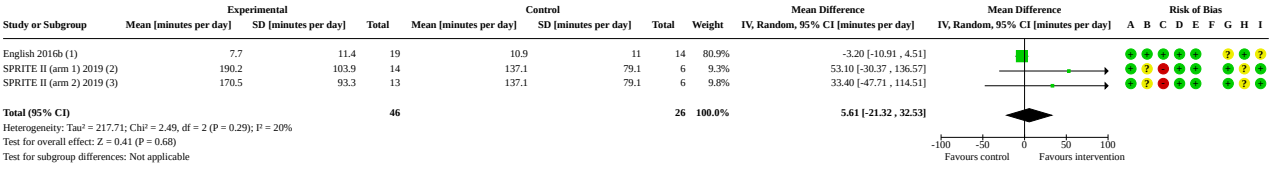
Footnotes

(1) ActivePAL accelerometer data normalised to wear time (16h waking time); recalculated from minutes to hours per day
(2) Physical Activity Scale version 2.1(PAS2) data in publication recalculated from hours per week and expressed as hours per day. Accelerometer (AX3, Axivity) data is not included.
(3) ActivePAL accelerometer data provided by author represents hours daytime (7am to 11pm) sitting/lying position for patients recruited at one of the two study sites (St. Olavs Hospital)
(4) IPAQ item 7 data: Intervention arm 1: "*Healthy Brain Rehabilitation Manual*" alone; 3/5 control participants (cannot split odd number)
(5) IPAQ item 7 data: Intervention arm 2: "*Healthy Brain Rehabilitation Manual*" plus pedometer; 2/5 control participants (cannot split odd number)
(6) IPAQ item 7 data: Intervention arm 2: '*Healthy Brain Rehabilitation Manual*' plus Stroke Nurse support; 6/12 (50%) of control group participants
(7) IPAQ item 7 data: Intervention arm 1: '*Healthy Brain Rehabilitation Manual*' plus GP support; 6/12 (50%) of control group participants

Risk of bias legend

(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Incomplete outcome data (attrition bias) - end of follow-up
(G) Selective reporting (reporting bias)
(H) Imbalanced exposure
(I) Other bias

Analysis 1.5. Comparison 1: Interventions versus control at end of intervention, Outcome 5: Risk factors - physical activity - MVPA

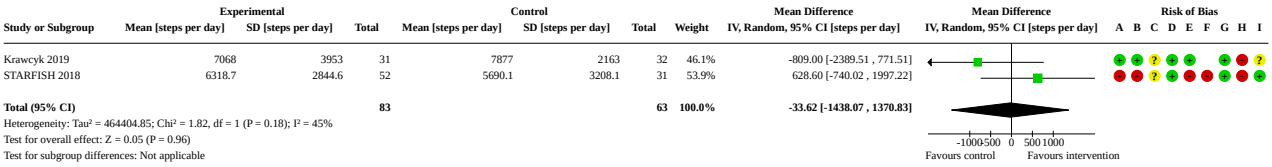


Heterogeneity: Tau² = 217.71; Chi² = 2.49, df = 2 (P = 0.29); I² = 20%
Test for overall effect: Z = 0.41 (P = 0.68)
Test for subgroup differences: Not applicable

Footnotes
(1) ActivePAL accelerometer data normalised to wear time (16h waking time); recalculated from minutes to hours per day
(2) IPAQ item 7 data: Intervention arm 1: '*Healthy Brain Rehabilitation Manual*' plus GP support; 6/12 (50%) of control group participants
(3) IPAQ item 7 data: Intervention arm 2: '*Healthy Brain Rehabilitation Manual*' plus Stroke Nurse support; 6/12 (50%) of control group participants

Risk of bias legend
(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Incomplete outcome data (attrition bias) - end of follow-up
(G) Selective reporting (reporting bias)
(H) Imbalanced exposure
(I) Other bias

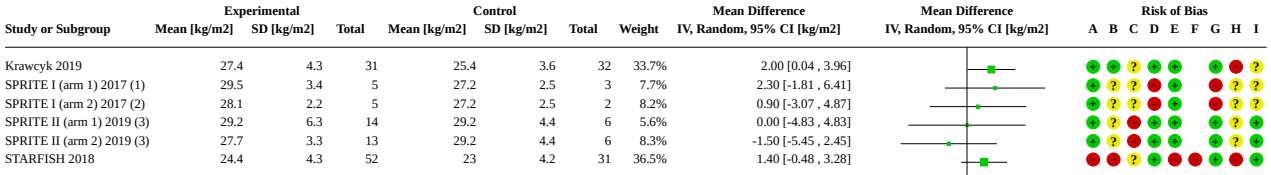
Analysis 1.6. Comparison 1: Interventions versus control at end of intervention, Outcome 6: Risk factors - physical activity - step count



Heterogeneity: Tau² = 464404.85; Chi² = 1.82, df = 1 (P = 0.18); I² = 45%
Test for overall effect: Z = 0.05 (P = 0.96)
Test for subgroup differences: Not applicable

Risk of bias legend
(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Incomplete outcome data (attrition bias) - end of follow-up
(G) Selective reporting (reporting bias)
(H) Imbalanced exposure
(I) Other bias

Analysis 1.7. Comparison 1: Interventions versus control at end of intervention, Outcome 7: Risk factors - anthropometry - Body Mass Index



Heterogeneity: Tau² = 0.00; Chi² = 2.97, df = 5 (P = 0.70); I² = 0%
Test for overall effect: Z = 2.26 (P = 0.02)
Test for subgroup differences: Not applicable

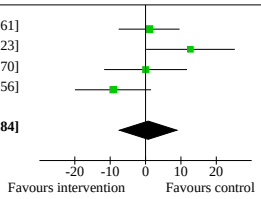
Footnotes
(1) 3/5 control participants (cannot split odd number)
(2) 2/5 control participants (cannot split odd number)
(3) 6/12 (50%) of control group participants

Risk of bias legend
(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Incomplete outcome data (attrition bias) - end of follow-up
(G) Selective reporting (reporting bias)
(H) Imbalanced exposure
(I) Other bias

Analysis 1.8. Comparison 1: Interventions versus control at end of intervention, Outcome 8: Risk factors - anthropometry - waist circumference

Study or Subgroup	Experimental Mean [cm]	Experimental SD [cm]	Experimental Total	Control Mean [cm]	Control SD [cm]	Control Total	Weight	Mean Difference IV, Random, 95% CI [cm]
SPRITE I (arm 1) 2017 (1)	98.7	6.5	5	97.7	5.7	3	29.9%	1.00 [-7.61 , 9.61]
SPRITE I (arm 2) 2017 (2)	110.4	11.1	5	97.7	5.7	2	21.7%	12.70 [0.17 , 25.23]
SPRITE II (arm 1) 2019 (3)	102.8	14	14	102.8	11.4	6	23.2%	0.00 [-11.70 , 11.70]
SPRITE II (arm 2) 2019 (3)	93.6	10.5	13	102.8	11.4	6	25.1%	-9.20 [-19.96 , 1.56]
Total (95% CI)			**37**			**17**	**100.0%**	**0.74 [-7.36 , 8.84]**

Heterogeneity: Tau² = 37.84; Chi² = 6.78, df = 3 (P = 0.08); I² = 56%
Test for overall effect: Z = 0.18 (P = 0.86)
Test for subgroup differences: Not applicable



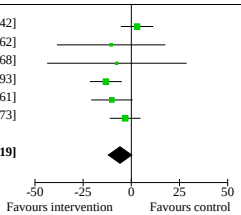
Footnotes
(1) 3/5 control participants (cannot split odd number)
(2) 2/5 control participants (cannot split odd number)
(3) 6/12 (50%) of control group participants

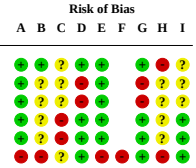
Risk of bias legend
(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Incomplete outcome data (attrition bias) - end of follow-up
(G) Selective reporting (reporting bias)
(H) Imbalanced exposure
(I) Other bias

Analysis 1.9. Comparison 1: Interventions versus control at end of intervention, Outcome 9: Risk factors - blood pressure - systolic

Study or Subgroup	Experimental Mean [mmHg]	Experimental SD [mmHg]	Experimental Total	Control Mean [mmHg]	Control SD [mmHg]	Control Total	Weight	Mean Difference IV, Random, 95% CI [mmHg]
Krawcyk 2019	144	18	31	141	16	32	24.2%	3.00 [-5.42 , 11.42]
SPRITE I (arm 1) 2017 (1)	128	2	5	138.5	24.8	3	4.2%	-10.50 [-38.62 , 17.62]
SPRITE I (arm 2) 2017 (2)	131	12.9	5	138.5	24.8	2	2.6%	-7.50 [-43.68 , 28.68]
SPRITE II (arm 1) 2019 (3)	127.6	10	14	140.8	8	6	24.6%	-13.20 [-21.47 , -4.93]
SPRITE II (arm 2) 2019 (3)	130.7	15.8	13	140.8	8	6	18.8%	-10.10 [-20.81 , 0.61]
STARFISH 2018	131.7	15.9	52	134.9	18.9	31	25.5%	-3.20 [-11.13 , 4.73]
Total (95% CI)			**120**			**80**	**100.0%**	**-5.88 [-11.95 , 0.19]**

Heterogeneity: Tau² = 21.16; Chi² = 8.41, df = 5 (P = 0.14); I² = 41%
Test for overall effect: Z = 1.90 (P = 0.06)
Test for subgroup differences: Not applicable

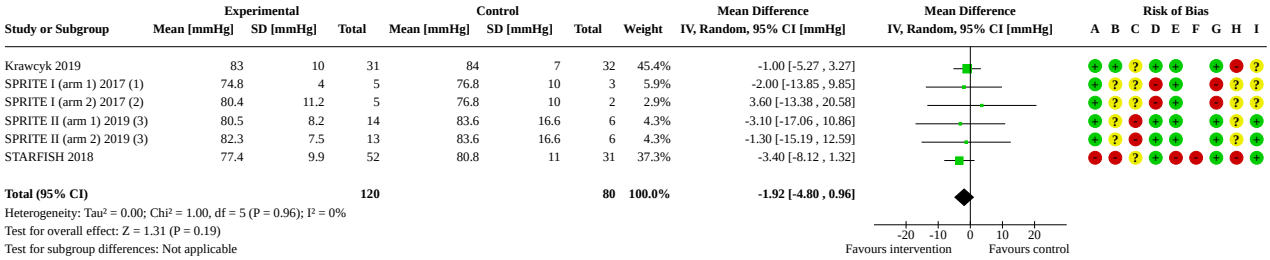




Footnotes
(1) 3/5 control participants (cannot split odd number)
(2) 2/5 control participants (cannot split odd number)
(3) 6/12 (50%) of control group participants

Risk of bias legend
(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Incomplete outcome data (attrition bias) - end of follow-up
(G) Selective reporting (reporting bias)
(H) Imbalanced exposure
(I) Other bias

Analysis 1.10. Comparison 1: Interventions versus control at end of intervention, Outcome 10: Risk factors - blood pressure - diastolic



Footnotes
(1) 3/5 control participants (cannot split odd number)
(2) 2/5 control participants (cannot split odd number)
(3) 6/12 (50%) of control group participants

Risk of bias legend
(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Incomplete outcome data (attrition bias) - end of follow-up
(G) Selective reporting (reporting bias)
(H) Imbalanced exposure
(I) Other bias

ADDITIONAL TABLES

Table 1. Outcome measures classification

Outcome		Type or domain
Primary outcomes	Death[1]	Any cause
	Recurrent non-fatal events[1]	Cardiovascular
		Cerebrovascular
Secondary outcomes	Adverse events[1]	Falls
	Sedentary behaviour[1]	Time
		Pattern
	Risk factors	
Other outcomes	Impairments	Physical fitness
		Balance
	Activity limitations	Specific
		Generic
	Participation restriction	
	Quality of life	
	Psychosocial	

Table 1. Outcome measures classification *(Continued)*

	Mood
	Fatigue
	Cognition
	Complications of immobility

1 Outcome categories to be included in the 'Summary of findings' table

Table 2. Summary of intervention details for each TIDieR item

Author (year)	(1) Brief name	(2) Why	(3) What: materials	(4) What: procedures	(5) Who provided	(6) How	(7) Where	(8) When and how much	(9) Tailoring	(10) Modifications	(11) How well: planned	(12) How well: actual
English 2016b	Breaking up sitting time with physical activity	Breaking up sitting time with periods of light intensity physical activity leads to reductions in cardiovascular disease risk factors and mortality. Therefore, interventions aimed at reducing daily sitting time may be a promising new target for reducing recurrent stroke risk	Four counselling sessions with the main message being to sit less and move more, with encouragement to regularly break up sitting time with short bursts of light-intensity activity (standing, walking at a comfortable pace)	Motivational interviewing to elicit behaviour change. At the first session, participants were presented with an individualized written report which provided feedback regarding daily sedentary time and breaks in sedentary time based on the baseline hip-worn accelerometer data. This report was used as the starting point for discussions. The counselling sessions used key motivational interviewing techniques (decisional balance sheets, importance and confidence rulers) to initiate and reinforce change talk. Action plans, goals, and strategies were elicited from the participants, rather than im-	The counselling sessions were provided by 2 researchers, both of whom were formally trained in motivational interviewing techniques through accredited courses	The first session was provided face-to-face, follow-up counselling sessions were delivered by phone	First face-to-face session was delivered at the participant's home	Follow up sessions occurred 1, 3, and 7 weeks after the initial session	Motivational interviewing was used to strengthen each participant's own motivation and commitment to change. At the first session, participants were presented with an individualized written report which provided feedback regarding daily sedentary	n/a	Feasibility was assessed via adherence to counselling sessions (actively engaged in all scheduled counselling sessions) and completion of all assessments at baseline and post intervention, including activity monitor wear time	There was 100% compliance with counselling sessions (ie, all participants engaged in all scheduled counselling sessions). Compliance with wearing the activity monitors was high. At baseline, 23 and 31 participants had 7 days of valid data

Table 2. Summary of intervention details for each TIDieR item *(Continued)*

		posed by the counsellors	time and breaks in sedentary time based on the baseline hip-worn accelerometer data. This report was used as the starting point for discussions. Action plans, goals, and strategies were elicited from the participants, rather than imposed by the counselors	from the activPAL3 and Actigraph monitors, respectively. All other participants had at least 4 days of wear time for both monitors, with the exception of 3 participants for whom the Actigraph monitor did not record any valid data on any days. At post intervention, 33 and 25 participants had 7 days of valid data			

Table 2. Summary of intervention details for each TIDieR item *(Continued)*

	from the activPAL3 and the Actigraph monitors, respectively. All other participants had at least 4 valid wear days for both the activPAL3 and Actigraph monitors, with the following exceptions: 2 participants (both in the control group) did not complete the post intervention assessment for reasons of

Table 2. Summary of intervention details for each TIDieR item *(Continued)*

												ill health not related to the trial, and a further 3 participants did not have any valid wear days for the Actigraph monitor
Krawcyk 2019	Early home-based high intensity interval training (HIIT)	HIIT offers a low time commitment exercise intervention which could overcome barriers to physical activity, improve fitness and influence risk factors	a) Indoor exercise equipment including cycle ergometer, rowing machine or stairs and /or b) Outdoor exercise access to places in which to walk, run or cycle c) Exercise catalogue containing various suggested modes of exercise	HIIT was performed 9 minutes per day for 12 weeks at home via a mode(s) of exercise selected from a catalogue. Participants were encouraged to exercise at a high intensity such that they were unable to speak comfortably	The HIIT programme was unsupervised but the trial coordinator was in regular contact	a) Trial coordinator provided a talk at baseline which was an education session about lifestyle changes including exercise b) Trial coordinator made one home visit to introduce the exercise pro-	Home and/or outdoors in the community	Each session comprised 3 x 3 minutes exercise with 2 minutes active recovery between Sessions occurred 5 days per week for 12 weeks. Exercise intensity 77 to 93% maximum heart rate, 14 to 16 on	a) Participants could choose their mode of exercise from among stationary bicycle, brisk walking, stair stepping, outdoor cycling, running, other rehabilitation and indoor rowing. Mode could be alone or in combination.	n/a	a) Participants had a laminated standardized text passage (cue card) to guide exercise intensity. b) Participants wore a stop watch to time the 3 minute exercise intervals. c) Participants kept an exercise	Participants exercised for an average of 56 out of 60 planned days (93% adherence) 10 of 31 patients (32%) exercised >5 days per week (>100% adherence) 24 of 31 patients (77%) exercised ≥4 days per

Table 2. Summary of intervention details for each TIDieR item *(Continued)*

			d) Laminated standardized text passage (cue card) to guide exercise intensity e) Stop watch to time the exercise intervals f) Exercise diary to record mode duration and intensity			gramme and the talk test (for exercise intensity) c) Trial coordinator made weekly telephone calls to check progress		the Borg scale of perceived exertion, not able to speak comfortably. Exercise intensity progressed by ensuring that participants were not able to speak comfortably.	b) Exercise intensity was tailored for each participant		diary to record mode duration and intensity. d) Trial coordinator made weekly telephone calls to check progress	week (≥80% adherence)
LAST 2018	Individualised coaching in exercise and physical activity	Tailored counselling is known to improve participation in physical activity after stroke	a) a standardized questionnaire to register individual physical activity preferences and list 1 to 3 individual goals b) outpatient, private, and community-based treatment groups, individual physiotherapy,	a) Based on the preferences and goals, a schedule for physical activities and exercise was set for the next month. b) participants offered access to outpatient, private, and community-based treatment groups, individual physiotherapy, or home training if preferred c) participants were trained how to complete the	Physiotherapist	Monthly coaching and scheduling by physiotherapist based on preferences and goals established using the Goal Attainment Scaling approach	Home including community based groups and exercise classes	Exercise; 45–60 minutes per session, 1 day per week for 18 months at an intensity between 15 and 17 on Borg scale of perceived exertion Physical ac-	Individualised coaching involved identification of individual exercise/activity modes and identification of individual goals. Intensity of exercise was tailored	n/a	Clear RPE guidelines given Training diary to monitor progress and advise on next phase	> 60% of participants complied with 150 min/week physical activity 50 - 57% of participants complied with 45min/week exercise

Table 2. Summary of intervention details for each TIDieR item *(Continued)*

			or home training c) training diary	training diary and record the amount and intensity of each day's activities. d) Training diaries were reviewed, and the schedule was reassessed according to individual needs, including progression for the next month. e) Monthly Meetings Month 1-6 face-to-face in the participants' home. Month 7-12 alternate home/phone meetings Month 13-18 4 phone and 2 home meetings				tivity; 30 minutes per day, every day for 18 months	using the Borg scale of perceived exertion Exercise/physical activity reviewed and reassessed for the next month			Average exercise RPE achieved 14.0 - 14.3 Attendance at more than 50% of coaching meetings; 38 - 58% of participants
SPRITE I (arm 1) 2017	Home-based cardiac rehabilitation programme modified for stroke	Cardiac rehabilitation benefits mortality and morbidity and home delivery improves adherence. Shared common risk factors mean this intervention may also be bene-	a) '*The Healthy Brain Rehabilitation Manual*' containing information about stroke, setting lifestyle change goals and cardiovascular risk. Content included (smoking, physical and	Participants were informed of the UK national physical activity guidelines as well as how to achieve moderate and vigorous physical activity intensity. This was explained to participants at baseline assessments, in the manual and during telephone follow-up	Health professional (General Practitioner)	Healthy Brain Manual and telephone follow-up support carried out by health professional	Home	'*The Healthy Brain Rehabilitation Manual*' was provided for 6 weeks Telephone follow-up took place in week 1 and week 4	Participants were able to set their own goals	n/a	Strategies to improve fidelity: Participants provided '*The Healthy Brain Rehabilitation Manual*' to refer to Telephone	100% retention of participants in the study

Table 2. Summary of intervention details for each TIDieR item *(Continued)*

		ficial for stroke and TIA	sexual activity, mental health, community resources (e.g. smoking cessation support; exercise classes), diet and secondary prevention medication. b) Telephone follow-up involving motivational interviewing based on the theory of planned behaviour and adopting the '5 As' approach to behaviour change. c) Guidance on how to achieve moderate intensity physical activity using the 'talk/sing test'								support provided	
SPRITE I (arm 2) 2017	Home-based cardiac rehabilita-	Cardiac rehabilitation benefits mortality and	a) '*The Healthy Brain Rehabilita-*	Participants were informed of the UK national physical	Health professional (Gener-	Healthy Brain Manual and telephone	Home	'*The Healthy Brain Rehabilitation*	Participants were able to set their	n/a	Strategies to improve fidelity:	100% retention of participants

Table 2. Summary of intervention details for each TIDieR item *(Continued)*

	tion programme modified for stroke which is delivered either with pedometer	morbidity and home delivery improves adherence. Shared common risk factors mean this intervention may also be beneficial for stroke and TIA Use of a pedometer promotes physical activity by providing feedback and allowing goal setting and monitoring of activity levels	*tion Manual*' containing information about stroke, setting lifestyle change goals and cardiovascular risk. Content included (smoking, physical and sexual activity, mental health, community resources (e.g. smoking cessation support; exercise classes), diet and secondary prevention medication. b) Telephone follow-up involving motivational interviewing based on the theory of planned behaviour and adopting the '5 As' approach to behaviour change.	activity guidelines as well as how to achieve moderate and vigorous physical activity intensity. This was explained to participants at baseline assessments, in the manual and during telephone follow-up. Encouraged to use pedometers to set step count targets based on previous week's self-reported daily step counts	al Practitioner)	follow-up support carried out by health professional	*Manual*', with a pedometer, was provided for 6 weeks Telephone follow-up took place in week 1 and week 4	own goals	Participants provided '*The Healthy Brain Rehabilitation Manual*' to refer to Telephone support provided Pedometers to keep a daily step count diary	in the study Not all participants able to use Fitbit pedometer and changed to the Yamax pedometer instead

Table 2. Summary of intervention details for each TIDieR item *(Continued)*

			c) Pedometer device (either Yamax Digi-Walker CW-701 or Fitbit Charge) to record daily step count and allow participants to set and monitor goals to increase their physical activity levels d) Guidance on how to achieve moderate intensity physical activity by adopting a cadence of 100 steps/min								
SPRITE II (arm 1) 2019 and SPRITE II (arm 2) 2019	Home-based cardiac rehabilitation programme modified for stroke which is delivered either with or with-	Cardiac rehabilitation benefits mortality and morbidity and home delivery improves adherence. Shared common risk factors mean	a) '*The Healthy Brain Rehabilitation Manual*' containing information about stroke, setting lifestyle change goals and cardiovascular risk. Content	At baseline participants given '*The Healthy Brain Rehabilitation Manual*', a wrist-worn pedometer, step count and physical activity diary. At baseline participants were informed about physical activity guidelines and how	SPRITE II (arm 1) 2019 Health professional (General Practitioner)	Healthy Brain Manual and telephone follow-up support carried out by health professional	Home	Healthy Brain Rehabilitation Manual, with or without pedometers, was provided for 12 weeks Telephone	Participants were able to set their own goals	n/a	Strategies to improve fidelity: Participants provided a healthy brain rehabilitation manual	Three participants believed the pedometer under-counted their steps Five participants lost their

Table 2. Summary of intervention details for each TIDieR item *(Continued)*

	out telephone support from either a GP or stroke nurse	this intervention may also be beneficial for stroke and TIA	included (smoking, physical and sexual activity, mental health, community resources (e.g. smoking cessation support; exercise classes), diet and secondary prevention medication. b) Telephone follow-up involving motivational interviewing based on the theory of planned behaviour and adopting the '5 As' approach to behaviour change. c) Wrist worn pedometer device (Yamax Digi-Walker CW-701) to record daily step count and allow participants to set and monitor	to achieve moderate and vigorous physical activity intensity, reduce sedentary time, and set and monitor physical activity goals using the pedometer During weeks 1, 4, and 9 participants were telephoned to address any concerns, report weekly average step counts and encouraged to set step count targets via motivational interviewing in standardised format. Participants were telephoned by either a) GP b) Stroke Nurse	SPRITE II (arm 2) 2019 Health professional (Stroke Nurse)	follow-up took place in weeks 1, 4 and 9	to refer to Participants provided with pedometers and kept a daily step count diary Telephone support provided	pedometer One participant discontinued using pedometer due to skin irritation. 1/28 participants dropped out

Table 2. Summary of intervention details for each TIDieR item *(Continued)*

			goals to increase their physical activity levels d) Daily step count and physical activity diary									
STARFISH 2018	Increasing physical activity in stroke survivors using STARFISH, an interactive smartphone application: a randomised controlled trial	Stroke survivors are less physically active and have higher sedentary time than healthy matched controls. Low levels of PA and poor cardiovascular fitness are modifiable risk factors for secondary stroke. Novel methods of supporting PA and exercise programmes following stroke should be developed. Mobile devices can	a) Samsung GalaxyTM smartphone containing the STARFISH application. STARFISH uses the inbuilt triaxial accelerometer of the phone to record the participant's step count and data is uploaded to the STARFISH server. b) Literature on post-stroke PA	Each member of the intervention group was given a smartphone. For the first week STARFISH recorded the step count of each participant to calculate the individual step count target for the following week. At the end of the week the four members of intervention group- met with the researcher. At this visit, individualised step count target for each participant was determined. Thereafter individual step targets were reviewed from data on the STARFISH server and updated automatically. During the intervention period if a participant reached their target on five out of	The researcher	a) Phone with app given at the start b) after week 1, group of 4 participants meet to set step count target for each individual in the group c) after 2 months progress discussion with researcher d) after 4 months researcher collects phones and 2nd assessment by	Home	App was provided for 4 months Progress discussion after 2 months	- Initial step count target set 10% above individual baseline step count -if a participant reached their target on 5/7days their step count target was increased by 5% the following week, up to a maximum increase of 3000 steps above baseline.	n/a	- Data uploaded to the server automatically - Meeting at 2 months to discuss progress - Constant feedback via the app	Baseline intervention n= 52 (31 control) 4 month assessment n= 49 (21 control) 6 month follow up assessment n= 44 (19 control)

Table 2. Summary of intervention details for each TIDieR item *(Continued)*

	provide real-time feedback, allow individualised content, and facilitate social support	seven days in a week, their target was increased by 5% for the following week to a maximum of 3000 steps above their baseline. The group met again with the researcher two months after baseline, to discuss progress and address any concerns. Control group participants received one individual session with the research physiotherapist where they were given literature published by Chest Heart and Stroke Scotland on the recommended PA guidelines, advice on how to take part in physical activity after surviving a stroke event, and the health benefits of PA post-stroke. At completion of the trial the control group participants received a summary of their outcome measures and a pedometer	blinded assessor	- if a participant did not reach their target then the next week their target remained unchanged. -If all four members of the group reached their daily step count target on 5/7 days then a reward was administered (i.e. a creature was added to the group's virtual fish tank)

Table 2. Summary of intervention details for each TIDieR item *(Continued)*

Vanroy 2019	Aerobic cycling plus education, followed by coaching	Improved aerobic fitness should increase activities of daily living and physical activity. Educational content aimed to stimulate active behaviour and compliance with intervention through behaviour change techniques. Coaching at the end of an aerobic fitness programme should facilitate carry-over into a more physically active lifestyle. Coaching strategies were derived from sev-	**Phase 1 of study** a) Stationary cycle ergometer that enables passive, motor-assisted or active resistive training (MOTOmed leg trainer) b) MOTOmed chip card c) Polar pulse watch and chest strap d) Educational sessions for patients and relatives or friends e) Individual 'movement contract' with patient's decision about how to continue the training	**Phase 1** In addition to usual care the participants performed seated cycle training using the MOTOmed ergometer with the intensity guided by the heart rate monitor and the session recorded on the MOTOmed chip card. Education sessions were delivered during this phase Movement contract was set up between researcher and participant	**Phase 1** Researcher set up the movement contract Unclear who delivered the education sessions	**Phase 1** The exercise was delivered individually with face-to-face supervision by researcher Education delivered unclear with regard individual/group format	**Phase 1** Inpatient rehabilitation centre	**Phase 1** a) Exercise; 3 times per week for 12 weeks. Training sessions consisted of 30 minutes of active cycling, progressing from interval (weeks 1-8) to continuous (weeks 9-12) training. b) Education; information sessions given 4 times for 60 minutes in weeks 3, 6, 8 and 12	**Phase 1** Exercise intensity was tailored as it was individualised based on HRR Movement contract was individualised Education component not individualised	n/a	**Phase 1** To facilitate compliance the sessions were recorded on the MOTOmed cards and a movement contract was agreed	No data available reporting compliance, attendance, adherence
			Phase 2 of study	**Phase 2** a) Participant performed their choice	**Phase 2** A well-trained	**Phase 2** Freely chosen	**Phase 2** At home	**Phase 2** Exercise; dose not	**Phase 2**	n/a	**Phase 2** To facilitate	No data available reporting com-

Table 2. Summary of intervention details for each TIDieR item *(Continued)*

		eral theoretical backgrounds such as the Trans theoretical Model of behavior change and the self-determination theory	a) Visits by researcher b) Choice of exercise mode c) Movement contract d) Means of recording training	of aerobic exercise and recorded what they did b) Researcher visited participants to review the intervention and the movement contract. Several behavioral strategies were included in the coaching approach: goal setting, discussing barriers, increasing autonomy, self-monitoring and social support, and motivational interviewing	and experienced physiotherapist was appointed as the coach	exercise could involve some group activity; no face to face exercise delivery by researcher Review of exercise performed face to face		standardised but selected by each participant Review visits; 1 visit per month for 9 months; time unclear	Training was self chosen Movement contract was individualised Review visits were individualised		compliance, the researcher undertook monthly review visits	pliance, attendance, adherence
Wellwood 2004	Doubled dose of physiotherapy	a) Additional inpatient physiotherapy should speed up the recovery including mobility b) Specific functional objectives included the establishment of independent dy-	a) Three rehabilitation units delivering representative physiotherapy representative of normal approaches UK practice b) Pre-existing model for physiotherapy treatment schedules c) Mechanism for	Physiotherapy delivered was based on outline treatment schedules described by Edwards 1991	Staff included senior and junior qualified physiotherapists, occasionally supervised physiotherapy students	Face to face inpatient rehabilitation delivered during inpatient care. Trialists considered it impossible to designate in advance a standard	Three rehabilitation facilities	Intervention comprised an additional 30-40 minutes contact per day, five days per week	Unclear; UK physiotherapy model would include tailoring of elements	n/a	a) Pre-existing model of treatment schedules used as basis for intervention b) 1:1 Therapist input c) Delivered during	Augmented physiotherapy target of 2:1 ratio was not met Augmented physiotherapy delivery was 1.6:1

Table 2. Summary of intervention details for each TIDieR item *(Continued)*

	namic sitting balance, standing balance, upper limb function and walking, and other functional mobility tasks	recording the structure of delivered therapy	treatment for all patients but outline treatment schedules were discussed (based on Edwards et al. 1991) by the trial management group to ensure consistency of treatment categories			inpatient care d) Mechanism to record delivered therapy	

APPENDICES

Appendix 1. Cochrane Central Register of Controlled Trials (CENTRAL)

#1 MeSH descriptor: [Cerebrovascular Disorders] this term only
#2 MeSH descriptor: [Basal Ganglia Cerebrovascular Disease] this term only
#3 MeSH descriptor: [Brain Ischemia] explode all trees
#4 MeSH descriptor: [Carotid Artery Diseases] explode all trees
#5 MeSH descriptor: [Cerebral Small Vessel Diseases] explode all trees
#6 MeSH descriptor: [Intracranial Arterial Diseases] explode all trees
#7 MeSH descriptor: [Intracranial Embolism and Thrombosis] explode all trees
#8 MeSH descriptor: [Intracranial Hemorrhages] explode all trees
#9 MeSH descriptor: [Stroke] explode all trees
#10 MeSH descriptor: [Vasospasm, Intracranial] this term only
#11 MeSH descriptor: [Vertebral Artery Dissection] this term only
#12 (stroke* or poststroke or apoplex* or cerebral vasc* or brain vasc* or cerebrovasc* or cva* or SAH):ti,ab,kw (Word variations have been searched)
#13 (((brain* or cerebr* or cerebell* or intracran* or intracerebral) near/5 (ischemi* or ischaemi* or infarct* or thrombo* or emboli* or occlus* or hypoxi*))):ti,ab,kw (Word variations have been searched)
#14 (((brain* or cerebr* or cerebell* or intracerebral or intracran* or subarachnoid) near/5 (haemorrhag* or hemorrhag* or hematoma* or haematoma* or bleed*))):ti,ab,kw (Word variations have been searched)
#15 MeSH descriptor: [Hemiplegia] this term only
#16 MeSH descriptor: [Paresis] explode all trees
#17 MeSH descriptor: [Gait Disorders, Neurologic] explode all trees
#18 (hemipleg* or hemipar* or paresis or paraparesis or paretic):ti,ab,kw (Word variations have been searched)
#19 {or #1-#18}
#20 MeSH descriptor: [Life Style] this term only
#21 MeSH descriptor: [Sedentary Lifestyle] this term only
#22 MeSH descriptor: [Posture] this term only
#23 MeSH descriptor: [Motor Activity] this term only
#24 (((uninterrupted or long* or prolong* or extend* or bout or continu* or protracted or sustain* or period* or duration* or time*) near/5 (posture or sitting or sit or sat or seat* or lying))):ti,ab,kw (Word variations have been searched)
#25 ((sedentar* or stationary or nonexercise or non-exercise or inactiv* or reclin*)):ti,ab,kw (Word variations have been searched)
#26 (((screen* or transport* or travel* or car* or train* or bus or buses or media or indoor* or desk*) near/3 (time* or period* or duration*))):ti,ab,kw (Word variations have been searched)
#27 {or #20-#26}
#28 #19 AND #27

Appendix 2. MEDLINE

1. cerebrovascular disorders/ or exp basal ganglia cerebrovascular disease/ or exp brain ischemia/ or exp carotid artery diseases/ or exp intracranial arterial diseases/ or exp "intracranial embolism and thrombosis"/ or exp intracranial hemorrhages/ or stroke/ or exp brain infarction/ or stroke, lacunar/ or vasospasm, intracranial/ or vertebral artery dissection/

2. (stroke or poststroke or post-stroke or cerebrovasc$ or brain vasc$ or cerebral vasc$ or cva$ or apoplex$ or SAH).tw.

3. ((brain$ or cerebr$ or cerebell$ or intracran$ or intracerebral) adj5 (isch?emi$ or infarct$ or thrombo$ or emboli$ or occlus$)).tw.

4. ((brain$ or cerebr$ or cerebell$ or intracerebral or intracranial or subarachnoid) adj5 (haemorrhage$ or hemorrhage$ or haematoma$ or hematoma$ or bleed$)).tw.

5. hemiplegia/ or exp paresis/

6. (hemipleg$ or hemipar$ or paresis or paretic).tw.

7. or/1-6

8. Lifestyle/ or Sedentary Lifestyle/

9. Posture/

10. Motor activity/

11. ((uninterrupted or long$ or prolong$ or extend$ or bout or continu$ or protracted or sustain$ or period$ or duration$ or time$) adj5 (posture or sitting or sit or sat or seat$ or lying)).tw.

12. (sedentar$ or stationary or nonexercise or non-exercise or inactiv$ or reclin$).tw.

13. ((screen$ or transport$ or travel$ or car$ or train$ or bus or buses or media or indoor$ or desk$) adj3 (time$ or period$ or duration$)).tw

14. or/8-13

15. randomized controlled trial.pt.

16. controlled clinical trial.pt.

17. randomized.ab.

18. placebo.ab.

19. randomly.ab.

20. trial.ab.

21. groups.ab.

22. or/15-21

23. 7 and 14 and 22

Appendix 3. EMBASE

1. cerebrovascular disease/ or exp basal ganglion hemorrhage/ or exp brain hematoma/ or exp brain hemorrhage/ or exp brain infarction/ or exp brain ischemia/ or exp carotid artery disease/ or cerebral artery disease/ or exp cerebrovascular accident/ or exp intracranial aneurysm/ or exp occlusive cerebrovascular disease/
2. stroke patient/ or stroke unit/
3. (stroke or poststroke or post-stroke or cerebrovasc$ or brain vasc$ or cerebral vasc$ or cva$ or apoplex$ or SAH).tw.
4. ((brain$ or cerebr$ or cerebell$ or intracran$ or intracerebral) adj5 (isch?emi$ or infarct$ or thrombo$ or emboli$ or occlus$)).tw.
5. ((brain$ or cerebr$ or cerebell$ or intracerebral or intracran$ or subarachnoid) adj5 (h?emorrhage$ or h?ematoma$ or bleed$)).tw.
6. hemiparesis/ or hemiplegia/ or paresis/ or neurologic gait disorder/ or hemiplegic gait/
7. (hempar$ or hemipleg$ or brain injur$).tw.
8. or/1-7
9. lifestyle/ or sedentary lifestyle/
10. sitting/
11. body position/ or sitting/ or supine position/
12. physical activity/
13. ((uninterrupted or long$ or prolong$ or extend$ or bout or continu$ or protracted or sustain$ or period$ or duration$ or time$) adj5 (posture or sitting or sit or sat or seat$ or lying)).tw.
14. (sedentar$ or stationary or nonexercise or non-exercise or inactiv$ or reclin$).tw.
15. ((screen$ or transport$ or travel$ or car$ or train$ or bus or buses or media or indoor$ or desk$) adj3 (time$ or period$ or duration $)).tw.
16. or/9-15
17. Randomized Controlled Trial/ or "randomized controlled trial (topic)"/
18. Randomization/
19. Controlled clinical trial/ or "controlled clinical trial (topic)"/
20. control group/ or controlled study/
21. clinical trial/ or "clinical trial (topic)"/ or phase 1 clinical trial/ or phase 2 clinical trial/ or phase 3 clinical trial/ or phase 4 clinical trial/
22. Crossover Procedure/
23. Double Blind Procedure/
24. Single Blind Procedure/ or triple blind procedure/
25. placebo/ or placebo effect/
26. (random$ or RCT or RCTs).tw.
27. (controlled adj5 (trial$ or stud$)).tw.
28. (clinical$ adj5 trial$).tw.
29. ((control or treatment or experiment$ or intervention) adj5 (group$ or subject$ or patient$)).tw.
30. (quasi-random$ or quasi random$ or pseudo-random$ or pseudo random$).tw.
31. ((control or experiment$ or conservative) adj5 (treatment or therapy or procedure or manage$)).tw.
32. ((singl$ or doubl$ or tripl$ or trebl$) adj5 (blind$ or mask$)).tw.

33. (cross-over or cross over or crossover).tw.
34. (placebo$ or sham).tw.
35. trial.ti.
36. (assign$ or allocat$).tw.
37. controls.tw.
38. or/17-37
39. 8 and 16 and 38

Appendix 4. CINAHL

This search strategy uses the highly sensitive search filter (S19-S32) to identify reports of controlled clinical trials within CINAHL Plus (Glanville 2019).

S33 S11 AND S18 AND S32

S32 S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S29 OR S30 OR S31

S31 TI (Clinical AND Trial) or AB (Clinical AND Trial) or SU (Clinical AND Trial)

S30 MH Clinical Trials

S29 TI Placebo* or AB Placebo* or SU Placebo*

S28 S26 AND S27

S27 TI blind* or AB mask* or AB blind* or TI mask*

S26 AB (singl* or doubl* or trebl* or tripl*) or TI (singl* or doubl* or trebl* or tripl*)

S25 TI (stroke or poststroke or post-stroke or cerebrovasc* or brain vasc* or cerebral vasc or cva or apoplex or SAH) or AB (stroke or poststroke or post-stroke or cerebrovasc* or brain vasc* or cerebral vasc or cva or apoplex or SAH)

S24 MH Placebos

S23 TI (crossover or cross-over) or AB (crossover or cross-over) or SU (crossover or cross-over)

S22 AB "latin square" or TI "latin square"

S21 TI random* or AB random*

S20 TI ("multicentre study" or "multicenter study" or "multi-centre study" or "multi-center study") or AB ("multicentre study" or "multicenter study" or "multi-centre study" or "multi-center study") or SU ("multicentre study" or "multicenter study" or "multi-centre study" or "multi-center study")

S19 MH Random Assignment or MH Single-blind Studies or MH Double-blind Studies or MH Triple-blind Studies or MH Crossover design or MH Factorial Design

S18 S12 OR S13 OR S14 OR S15 OR S16 OR S17

S17 TI ((screen* or transport* or travel* or car* or train* or bus or buses or media or indoor* or desk*) N3 (time* or period* or duration*)) AND AB ((screen* or transport* or travel* or car* or train* or bus or buses or media or indoor* or desk*) N3 (time* or period* or duration*))

S16 TI (sedentar* or stationary or nonexercise or non-exercise or inactiv* or reclin*) OR AB (sedentar* or stationary or nonexercise or non-exercise or inactiv* or reclin*)

S15 TI ((uninterrupted or long* or prolong* or extend* or bout or continu* or protracted or sustain* or period* or duration* or time*) N5 (posture or sitting or sit or sat or seat* or lying)) OR AB ((uninterrupted or long* or prolong* or extend* or bout or continu* or protracted or sustain* or period* or duration* or time*) N5 (posture or sitting or sit or sat or seat* or lying))

S14 (MH "Motor Activity") OR (MH "Sitting")

S13 (MH "Posture") OR (MH "Balance, Postural")

S12 (MH "Life Style, Sedentary+")

S11 S1 OR S2 OR S5 OR S8 OR S9 OR S10

S10 TI (hemipleg* or hemipar* or paresis or paretic) or AB (hemipleg* or hemipar* or paresis or paretic)

S9 (MH "Hemiplegia")

S8 S6 and S7

S7 TI (haemorrhage* or hemorrhage* or haematoma* or hematoma* or bleed*) or AB (haemorrhage* or hemorrhage* or haematoma* or hematoma* or bleed*)

S6 TI (brain* or cerebr* or cerebell* or intracerebral or intracranial or subarachnoid) or AB (brain* or cerebr* or cerebell* or intracerebral or intracranial or subarachnoid)

S5 S3 and S4

S4 TI (ischemi* or ischaemi* or infarct* or thrombo* or emboli* or occlus*) or AB (ischemi* or ischaemi* or infarct* or thrombo* or emboli* or occlus*)

S3 TI (brain* or cerebr* or cerebell* or intracran* or intracerebral) or AB (brain* or cerebr* or cerebell* or intracran* or intracerebral)

S2 TI (stroke or poststroke or post-stroke or cerebrovasc* or brain vasc* or cerebral vasc or cva or apoplex or SAH) or AB (stroke or poststroke or post-stroke or cerebrovasc* or brain vasc* or cerebral vasc or cva or apoplex or SAH)

S1 (MH "Cerebrovascular Disorders+") or (MH "stroke patients") or (MH "stroke units")

Appendix 5. PsychINFO

1. cerebrovascular disorders/ or cerebral hemorrhage/ or exp cerebral ischemia/ or cerebrovascular accidents/ or subarachnoid hemorrhage/
2. (stroke$ or post stroke or poststroke or post-stroke or apoplex$ or cerebral vasc$ or cerebrovasc$ or cva or SAH).tw.
3. ((brain$ or cerebr$ or cerebell$ or intracran$ or intracerebral) adj5 (isch?emi$ or infarct$ or thrombo$ or emboli$ or occlus$)).tw.
4. ((brain$ or cerebr$ or cerebell$ or intracerebral or intracran$ or subarachnoid) adj5 (h?emorrhage$ or h?ematoma$ or bleed$)).tw.
5. hemiparesis/ or hemiplegia/
6. (hemipleg$ or hemipar$ or paresis or paretic).tw.
7. or/1-6
8. lifestyle/
9. sedentary behavior/ or screen time/
10. posture/
11. ((uninterrupted or long$ or prolong$ or extend$ or bout or continu$ or protracted or sustain$ or period$ or duration$ or time$) adj5 (posture or sitting or sit or sat or seat$ or lying)).tw.
12. (sedentar$ or stationary or nonexercise or non-exercise or inactiv$ or reclin$).tw.
13. ((screen$ or transport$ or travel$ or car$ or train$ or bus or buses or media or indoor$ or desk$) adj3 (time$ or period$ or duration $)).tw.
14. or/8-13
15. clinical trials/ or treatment effectiveness evaluation/ or placebo/
16. (random$ or RCT or RCTs).tw.
17. (controlled adj5 (trial$ or stud$)).tw.
18. (clinical$ adj5 trial$).tw.
19. ((control or treatment or experiment$ or intervention) adj5 (group$ or subject$ or patient$)).tw.
20. (quasi-random$ or quasi random$ or pseudo-random$ or pseudo random$).tw.
21. ((control or experiment$ or conservative) adj5 (treatment or therapy or procedure or manage$)).tw.
22. ((singl$ or doubl$ or tripl$ or trebl$) adj5 (blind$ or mask$)).tw.
23. (cross-over or cross over or crossover).tw.
24. (placebo$ or sham).tw.
25. trial.ti.
26. (assign$ or allocat$).tw.
27. controls.tw.
28. or/15-27
29. 7 and 14 and 28

Appendix 6. Web of Science (WoS)

# 14 #13 AND #9 AND #5
Indexes=CPCI-S Timespan=1900-2019
# 13 #12 OR #11 OR #10
Indexes=CPCI-S Timespan=1900-2019

# 12 TS=(random* or trial or group*)
Indexes=CPCI-S Timespan=1900-2019
# 11 TI="controlled clinical trial"
Indexes=CPCI-S Timespan=1900-2019
# 10 TI="randomized controlled trial"
Indexes=CPCI-S Timespan=1900-2019
# 9 #8 OR #7 OR #6
Indexes=CPCI-S Timespan=1900-2019
# 8 TS=((screen* or transport* or travel* or car* or train* or bus or buses or media or indoor* or desk*) near/3 (time* or period* or duration*))
Indexes=CPCI-S Timespan=1900-2019
# 7 TS=(sedentar* or stationary or nonexercise or non-exercise or inactiv* or reclin*)
Indexes=CPCI-S Timespan=1900-2019
# 6 TS=((uninterrupted or long* or prolong* or extend* or bout or continu* or protracted or sustain* or period* or duration* or time*) near/5 (posture or sitting or sit or sat or seat* or lying))
Indexes=CPCI-S Timespan=1900-2019
# 5 #4 OR #3 OR #2 OR #1
Indexes=CPCI-S Timespan=1900-2019
# 4 TS=(hemipleg* or hemipar* or paresis or paretic)
Indexes=CPCI-S Timespan=1900-2019
# 3 TS=((brain* or cerebr or cerebell* or intracerebral or intracranial or subarachnoid) near/5 (haemorrhage* or hemorrhage* or haematoma* or hematoma* or bleed*))
Indexes=CPCI-S Timespan=1900-2019
# 2 TS=((brain* or cerebr* or cerebell* or intracran* or intracerebral) near/5 (ischaemi* or ischemi* or infarct* or thrombo* or emboli* or occlus*))
Indexes=CPCI-S Timespan=1900-2019
# 1 TS=(stroke or poststroke or post-stroke or cerebrovasc* or brain vasc* or cerebral vasc* or cva* or apoplex* or SAH)
Indexes=CPCI-S Timespan=1900-2019

Appendix 7. PEDro

1. neurology in the <Subdiscipline> field
2. clinical trial in the <Method> field
3. (sedentar* OR stationary OR nonexercise OR non-exercise OR inactiv* OR reclin*) in the <Title & Abstract> field
4. 1 AND 2 AND 3

Appendix 8. US National Institutes of Health Ongoing Trials Register ClinicalTrials.gov (www.clinicaltrials.gov)

sedentary OR inactive OR non-exercise OR posture OR reclining OR screen time | Interventional Studies | (Brain Infarction OR Intracranial Hemorrhages OR Carotid Artery Diseases OR Brain Ischemia OR Cerebral Hemorrhage OR Cerebrovascular Disorders OR Stroke)

Appendix 9. World Health Organization International Clinical Trials Registry Platform (apps.who.int/trialsearch)

stroke AND sedentary OR stroke AND inactive OR stroke AND non-exercise OR stroke AND posture OR stroke AND reclining OR stroke AND screen time

Appendix 10. ProQuest Dissertations and Theses Global

(ti,ab(sedentar* OR stationary OR nonexercise OR non-exercise OR inactiv* OR reclin*) OR ti,ab((uninterrupted OR long* OR prolong* OR extend* OR bout OR continu* OR protracted OR sustain* OR period* OR duration* OR time*) NEAR/5 (posture OR sitting OR sit OR sat OR seat* OR lying)) OR ti,ab((screen* OR transport* OR travel* OR car* OR train* OR bus OR buses OR media OR indoor* OR desk*) NEAR/3 (time* OR period* OR duration*))) AND (ti,ab(stroke OR poststroke OR "post-stroke" OR cerebrovasc* OR brain next vasc* OR cerebral next vasc* OR cva* OR apoplex* OR SAH) OR ti,ab((brain* or cerebr* or cerebell* or intracerebral or intracranial or subarachnoid) NEAR/5 (haemorrhag* or hemorrhag* or hematoma* or haematoma* or bleed*)) OR ti,ab((brain* or cerebr* or cerebell* or intracran* or intracerebral) NEAR/5 (ischaemi* or ischemi* or infarct* or thrombo* or emboli* or occlus*)) OR ti,ab(hemipleg* OR hemipar* OR paresis OR paretic))

HISTORY

Protocol first published: Issue 4, 2018

CONTRIBUTIONS OF AUTHORS

D Saunders
Protocol: design, writing, and editing.
Review: screening studies, extracting data, checking data, risk of bias assessment, analysis, writing and editing.

C Fitzsimons
Protocol: design, writing, and editing.
Review: screening studies, checking data, writing and editing.

P Kelly
Protocol: design, writing, and editing.
Review: screening studies, checking data, writing and editing.

C English
Protocol: design, writing, and editing.
Review: screening studies, writing and editing.

O Verschuren
Protocol: design, writing, and editing.
Review: screening studies, writing and editing.

K Backx
Protocol: Not involved at that stage
Review: screening studies, extracting data, checking data, risk of bias assessment, writing and editing.

F van Wijck
Protocol: design, writing, and editing.
Review: checking data, writing and editing.

GE Mead
Protocol: design, writing, and editing.
Review:screening studies, writing and editing.

DECLARATIONS OF INTEREST

D Saunders: none known.

C Fitzsimons: *Grants and contracts*: (1) Programme grant to develop and evaluate strategies to reduce sedentary behaviour in patients after stroke and improve outcomes (ongoing until September 2024), National Institute for Health Research, (2) Research grant for a qualitative study to explore sedentary behaviour in stroke survivors and inform intervention development (completed), Chief Scientist Office of the Scottish Government, (3) Research grant for a feasibility study to explore how to provide feedback and remote monitoring to stroke survivors on their sedentary behaviour (completed), Edinburgh and Lothians Health Foundation.

P Kelly: none known.

C English: Author of one of the included studies (English 2016b) and was not included in screening, data extraction or analysis of the study.

O Verschuren: none known.

K Backx: none known.

F van Wijck: none known.

GE Mead: *Grants and contracts*: (1) Grant holder in a study of sedentary behaviour after stroke, Chief Scientist Office, Scottish Government, (2) Grant holder in RECREATE trial, NIHR UK. *Royalties or licenses*: (1) Course on exercise after stroke, Later life training, (2) Book on physical fitness training after stroke, Elsevier.

SOURCES OF SUPPORT

Internal sources

- University of Edinburgh, UK

  Funding from University of Edinburgh to cover input from author Karianne Backx

External sources

- New Source of support, Other

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

Expanded the scope of the review to meet the objectives

The objectives were changed to also capture studies examining interventions with the potential to reduce sedentary behaviour as well as those specifically intended to reduce sedentary behaviour.

Search Strategy

The following resources were identified as being redundant by the Cochrane Stroke Group Information Specialist.

- ISRCTN Registry (www.isrctn.com/)
- Stroke Trials Registry (www.strokecenter.org/trials/)

Subgroup and sensitivity analyses

The planned subgroup and sensitivity analyses were amended to clarify that they pertain to any eligible outcome measure.