

Adherence to medication and self-management in stroke patients

Beatrice Chapman and Vanessa Bogle

Abstract

Background: Stroke is the third most common cause of mortality and one of the leading causes of adult physical disability in England. Medical treatment is imperative for the management of stroke and the risk reduction of recurrent stroke. The success of a medical treatment is determined largely by adherence. However, research has shown that adherence to medication in patients who have had a stroke is often suboptimal. Self-management interventions have been shown to improve adherence in long-term conditions. The impact of self-management interventions specifically on adherence to stroke medication is unknown. **Objective:** To review systematically the impact that self-management interventions have on adherence to stroke medication. **Method:** The online databases that were systematically searched included PsychINFO, MEDLINE, EMBASE, Scopus, Cochrane Database of Systematic Reviews, CINAHL and Web of Science. Reference lists of retrieved studies were hand-searched. **Results:** Six studies met the criteria for inclusion in the systematic review. Self-management interventions for stroke patients were effective in improving adherence to stroke medication in the short term. However, in the longer term, these benefits were not maintained. **Conclusions:** Applying self-management interventions to improve medication adherence in stroke patients across integrated clinical settings shows promise. However, further development of such interventions and research is recommended, with more stringent methodologies and longer follow-up periods.

Key words: Stroke ■ Self-management ■ Adherence ■ Non-adherence ■ Intervention

Stroke is one of the leading causes of mortality and disability in the UK and can have a long-lasting and profound impact on a person's life (Chambers et al, 2011). A stroke occurs when there is a blood clot or bleed in the brain. In England, approximately 110 000 people have a stroke each year. The effects can vary widely and can result in damage to physical, cognitive and emotional functioning (Department of Health (DH), 2007). Some people may only be mildly affected, whereas others are severely affected (Brain Foundation, 2012). Effects will

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depend on the type of stroke and the area of the brain that is damaged (National Stroke Association (NSA), 2012). There are two main types of stroke—*ischaemic* and *haemorrhagic*. *Ischaemic* strokes occur when arteries carrying blood to parts of the brain are blocked. A *haemorrhagic* stroke occurs when a blood vessel ruptures. A *transient ischaemic attack* (TIA) is a 'mini-stroke' and similar to an *ischaemic* stroke, but symptoms usually pass within 24 hours. Those affected are at very high risk of a recurrent stroke, which may result in more severe outcomes. The overall possibility of a recurrent stroke for all types of stroke is high, with 30–43% of people likely to have one within 5 years (O'Carroll et al, 2011).

Stroke has been highlighted as a major challenge for the NHS, as emphasised recently by national guidance such as the National Stroke Strategy, and as an area requiring improvement (DH, 2012). It has been estimated that approximately 5% of total NHS costs are spent on treatment for stroke, amounting to approximately £9 billion a year (Saka et al, 2009). Age is a major risk factor for stroke and, with an aging population, the number of people at risk of stroke will continue to grow (Di Carlo, 2009). Therefore designing and evaluating interventions for the primary and secondary prevention of stroke that can be used easily in clinical practice is key to reducing costs, preventing occurrence and recurrence, and managing the condition better.

Over the past few decades, medical and technological advances have transformed our understanding of and treatment of stroke, which has led to opportunities to save lives and reduce disability. After a stroke has occurred, there are medical treatment options available that restore blood flow and enhance brain function when parts of the brain have been damaged (DH, 2007). These include anticoagulation and antiplatelet treatments (Alberts, 2011). Cholesterol and blood pressure medicines are also available. The Royal College of Physicians (2012) recommends that the management of patients after a stroke or TIA be the same. Research and clinical guidance therefore support the use of medicine to treat all types of stroke and to reduce the risk of recurrent stroke (DH, 2007). They should be started as early as possible to reduce further damage and improve patient outcomes (Menard et al, 2011).

Adherence

Adherence to a medical regimen is defined as the extent to which a person's behaviour corresponds with agreed recommendations from a health professional (Lehane and McCarthy, 2009). Medicine is the most frequent type of intervention used by patients with health problems and long-

term conditions, and is relied on heavily to improve health and manage illness (Picton and Wright, 2012). The success of a medical treatment is determined largely by adherence. But non-adherence to prescribed medication is widespread and perceived to be a significant problem (Horne, 2007; Chambers et al, 2011).

Non-adherence can be unintentional and intentional. Unintentional non-adherence occurs when someone intends to take the medication but something prevents them from doing so (for example, forgetting or a physical disability). Intentional non-adherence occurs when someone actually decides not to take the medication, or takes it in a way that is different from the recommended way due to their beliefs or illness perceptions (Horne, 2006; O'Carroll et al, 2011). For example, someone may not like the side-effects of a medication and intentionally not take it.

The negative consequences of non-adherence to medication are considerable and can include poor health outcomes, increased morbidity and substantial costs to the NHS (Horne, 2006). Around half of patients from developed countries who have one or more chronic conditions do not adhere to their medication as recommended (Horne, 2006). In the UK, it has been estimated that £230 million worth of medicines are returned to pharmacies. This cost does not take into account the waste by patients themselves (Horne, 2006). The cost of wastage coupled with loss of therapeutic benefit is of a huge concern (DiMatteo et al, 2002).

Despite the evidence that stroke medication is imperative for the management and prevention of recurrent stroke, adherence is frequently suboptimal (O'Carroll et al, 2011). It has been reported that adherence to stroke medication may be less than 50% (Ireland et al, 2010). Furthermore, half of patients starting antihypertensive medication following stroke stop taking it within one year (Adie and James, 2010). Randomised controlled trials (RCTs) have shown that the risk of recurrent stroke is reduced by up to 38% when antiplatelet agents are adhered to (Fan et al, 2010).

Self-management interventions

The National Stroke Strategy (DH, 2007) has emphasised that money should be invested in helping people who have survived stroke to live independently through the provision of support in the community and in helping them manage their condition. Reviews have found that self-management interventions are effective in improving outcomes in people with long-term conditions (Barlow et al, 2002). Self-management interventions aim to support people in managing their condition better. Generally, they comprise several components, including such things as provision of information, medication, problem-solving and support (Newman et al, 2004).

Stroke patients perceive the educational information they receive as inadequate (Rodgers et al, 2001). Inadequate education can damage adherence to preventative strategies and psychosocial outcomes (O'Mahoney et al, 1997). Conversely, studies have shown that combined educational and counselling interventions can improve adherence to medication; and interventions that include motivational interviewing, goal-setting and emotional support delivered face-to-face or over

the phone have been influential in helping people adhere to their medication (McManus et al, 2008; Ireland et al, 2010; Adie et al, 2010). There is no literature specifically on the outcome of medication adherence in stroke, which is thus one of the objectives of this systematic review.

An important issue for self-management interventions is ensuring that its effects are sustained. Maintaining long-term benefits following an intervention is essential to changing behaviour. It has been found that several factors influence long-term maintenance of behaviour change, including the use of problem-solving and coping skills (Newman et al, 2009). Booster sessions of an intervention have also been shown to be effective in maintaining long-term change (Newman et al, 2009). A systematic review found that interventions that were deemed more complex, in that they included a combination of information, support, reminders and self-monitoring, were more effective in sustaining medication adherence than more basic interventions, such as information-giving alone (Haynes et al, 1996).

With the knowledge that there is a pressing need to improve stroke care due to an ageing population, coupled with the evidence that adherence to stroke medication is suboptimal, the aim of this systematic review is to assess the effectiveness of self-management interventions aimed at improving adherence to medication in stroke patients. The outcome of adherence to medication was specifically focused on because it is one of the major factors influencing mortality and morbidity (DH, 2007) and is a major predictor of recurrent stroke (DH, 2007). The objectives of this systematic review were to:

- assess the effectiveness of self-management interventions on adherence to stroke medication
- assess the short-term (≤6 months) and long-term (≥6 months) impact of self-management interventions on adherence to stroke medication.

Method

Inclusion criteria

Studies that were eligible were those that:

- Were published in the English language
- Were quantitative studies
- Were published in peer-reviewed journals,
- Investigated an adult population (≥18 years of age)
- Investigated people who had had a stroke but were not severely cognitively impaired (i.e. they were able to remain independent)
- Applied pre-post and controlled trial design (i.e. outcomes were measured before and after the intervention) with follow-up at least 3 months after the intervention
- Included RCT or quasi-experimental design studies
- Included a self-management intervention
- Included interventions that measured medical adherence as an outcome in stroke.

Exclusion criteria

Studies were excluded that:

- Contained duplicate data
- Included patients who had been severely cognitively impaired by the stroke

- Did not include a measure of medical adherence
- Did not include a control group or pre-test measures.

Types of study

This review included only RCTs or quasi-experimental trials. Initially, only RCTs were going to be included, but due to the limited number of studies, quasi-experimental research design trials were included too. The review included published studies covering a 10-year period, 2002 to 2012.

Participants

The review included studies in which participants had been diagnosed as having had a stroke or TIA. Studies were excluded if they included participants who were at risk of having a stroke, but who had not actually had one. Of those who were included, the participants could not have been severely cognitively impaired as a result of stroke or TIA. Patients with severe cognitive impairment might not have been well enough to be included in the study, and might have experienced speech difficulties, which could have influenced their ability to give informed consent.

This review only included adults, defined as people aged 18 years or above. The causes, treatment and management of stroke in children and adolescents are different from those of adults (American Stroke Association, 2012). Interventions for children are tailored to their requirements and would be likely to include the role of a care giver. Hence, adults were only included in this review.

Participants were recruited through health or social care settings. Healthcare settings such as a hospitals offer unique opportunities to recruit and conduct interventions for stroke patients (Ovbiagele et al, 2004).

Self-management intervention components

Only self-management intervention studies were included. Self-management interventions have been described as including three components: information/education, problem solving/goal setting and support (Lorig and Holman, 2003). The studies did not always explicitly state that interventions were self-management interventions. However, if the intervention included all three components in some form, they were included—for example, a nurse-led intervention

that included information on stroke medication, support and strategies to cope with side-effects.

The studies included interventions that were delivered face-to-face on a one-to-one basis or in a group, or by telephone. Follow-up had to be measured at least 3 months post baseline to ensure an adequate length of time for behaviour change. The interventions included were carried out by health or social-care professionals, or researchers.

Outcome measures

The studies were included if the intervention measured adherence to stroke medication. Most of the studies measured other outcomes as well as medical adherence. As long as medication adherence was one of the outcomes, the studies were included. This systematic review focused only on medication adherence as an outcome, as it has been shown to be one of the biggest predictors of morbidity, mortality and recurrent stroke (DH, 2007). The measures could be self-report, medical markers and recorded incidences of non-adherence—for example, the medication compliance scale (Morisky et al, 2008), which is a self-reported scale to assess unintentional and intentional medication non-adherence; blood pressure (Ellis et al, 2005) and recording measures (i.e. the number of times a patient did not take their stroke medication).

Search strategy to identify studies

Between February 2012 and July 2012, a systematic review of the literature was done on several online databases: PsychINFO, MEDLINE, EMBASE, Scopus, CINAHL and Web of Science. The search terms used were (stroke OR 'cerebrovascular accident' OR 'cerebrovascular disease' OR 'transient ischaemic attack' OR 'TIA') AND (adherence OR 'non-adherence' OR compliance OR 'non-compliance' OR concordance) AND (intervention* OR trial OR programme OR program). The search was limited to adults (>18 years-old) and journal articles published in the preceding 10 years. Figure 1 shows the results of the database search. In addition, reference lists of retrieved studies were hand-searched, as were the Cochrane Database of Systematic Reviews and Database of Abstracts of Reviews of Effectiveness (DARE).

The search began by looking for self-management intervention studies that incorporated stroke medication adherence as an outcome measure. Eligible studies were obtained by reading abstracts. Where the search only generated a small number of studies, an age limitation was not required. However, if the search generated a large number of studies (as EMBASE did, for example), the age limitation was added. It was apparent from many of the abstracts that studies were evaluating the clinical efficacy of a drug rather than a behaviour change intervention. These studies were therefore excluded.

The studies that were deemed appropriate were then screened for type of intervention. Initially, only RCTs were going to be included, but just four studies were found. So the study type was expanded to include quasi-experimental trials, resulting in the finding of two more studies. Hence, pre and post (before and after) measures were a requirement, as was a control group. These requirements ruled out further studies.

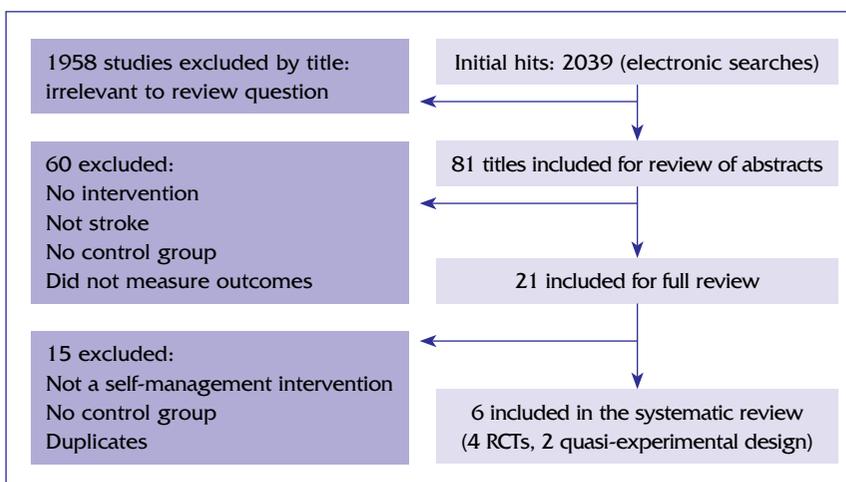


Figure 1. Overview of search process and identification of studies

Studies were excluded if they did not include a measure of medication adherence. Some of the studies only included measures for lifestyle adherence—i.e. adherence to an exercise or diet regimen. As this systematic review was concerned with assessing the effectiveness of self-management interventions on adherence to stroke medication, these eight studies were excluded. The studies were then screened to ensure they included self-management interventions. None of these studies were excluded.

The studies were then screened for participant type: adults who were not cognitively impaired. All studies described the type of stroke the participant had had, and limitations were in place so that only participants who were independent or had not been severely cognitively impaired were included. No studies were excluded. From this process, five studies were identified. One of these studies was a long-term follow-up RCT of a study that was already included. It was decided that this study should be included, as it was important to evaluate the long-term impact of the intervention and it had been published as a separate paper. A hand search of abstracts was also done for any more relevant papers; two more studies were found. One of these was missing the results and the author was contacted. However, the findings had not yet been published (Cheng et al, 2011). The other study identified in the hand search was included (Adie and James, 2010). In total, six papers were included in this systematic review (Table 1): Ellis et al, 2005; Claiborne, 2006; Sit et al, 2007; McManus et al, 2008; Hohmann et al, 2009; Adie and James, 2010.

Quality assessment

Quality assessment was done to highlight any bias that may have occurred. A quality assessment tool was designed for this systematic review and based on some of the criteria of the Quality Assessment Tool for Quantitative Studies (Jackson and Waters, 2005). The designed quality assessment tool used seven criteria. These included:

- Sample size
- Appropriateness of the population and description of stroke
- Drop-out rate
- Follow-up length
- Length of intervention
- Appropriate person delivering intervention
- Measurement of the appropriateness of the outcome of medication adherence.

Criteria were scored from 1 to 5 for quality, with 1 being low and 5 being high. The studies were independently assessed by two reviewers with the tool discussed. The total score was the average score of the two reviewers. Discrepancies in the scores were resolved by meeting if there was more than a two-point difference.

Overview of interventions

Adie and James's (2010) intervention was delivered over the telephone by a researcher. It included brief motivational interviewing, counselling, goal setting and educational material that was tailored to the patients' needs. Claiborne's (2006) intervention was delivered face-to-face by a social worker initially and subsequently via telephone. Problem solving—medication issues, education and enhancement of

self-care and counselling—was included. Ellis et al (2005) and McManus et al (2009) were nurse-led studies and included face-to-face visits. The patients received individual advice and counselling about medication adherence, and all verbal information was backed up with written educational information. Extra time was available for question-and-answer problem solving. Hohmann et al (2009) reported on a pharmacist-led intervention, delivered face-to-face. It included medication review, a counselling interview focusing on specific actions to be taken, side-effects, and detecting and solving stroke-drug-related problems. Lastly, Sit et al (2005) was led by nurses and delivered face-to-face. The sessions included teaching, experience sharing, individual goal setting and action planning, games, and reflection.

Results

Six studies met the inclusion criteria for this systematic review. Four were RCTs and two were quasi-experimental design studies. The quality rating of the studies was scored between 1 and 5; all the studies included in the systematic review were scored above three. A meta-analysis was not done as the studies used different measures of medication adherence. Similarities between the studies, as well as their differences, were also analysed and are presented in Table 1.

Most of the studies analysed the data with t-tests or ANOVA/ANCOVA, and chi-squared tests, and stated the version of SPSS that had been used. There was enough information to report effect sizes in most of the studies.

Of the six studies, three reported that the intervention had an effect on adherence to stroke medication. This was true of Claiborne (2006), in which the intervention was led by a social worker ($p < 0.05$). Hohmann et al (2009), by contrast, found no impact on medication adherence of the pharmacy-led intervention (no p value reported). Ellis et al (2005) reported that the stroke nurse specialist (SNS) intervention lowered blood pressure and reported significance at 5 months ($p < 0.05$; CI -13.1 to -2.6). In Sit et al (2007), the nurse-led intervention also had a significant effect on medication adherence ($p < 0.001$). McManus et al (2009), who carried out a long-term follow-up of SNS intervention, found no statistical significance ($p > 0.05$). Last, Adie and James (2010) found no significant effect of the telephone intervention on medication adherence ($p > 0.05$). However, they did report an increase in medication knowledge.

Most of the studies described the sample in detail, including descriptive variables such as age, gender, ethnicity and socio-economic variables. There was a total of 789 participants in the included studies, with an average age of 67 years; 57% were male and 43% female (determined from the available data). Sit et al (2007) had a sample that had a high level of education, so generalisability may be limited. All the studies described the type and severity of stroke. Although different measures were used to assess severity of stroke damage, it was clear across the studies that participants were only included if they were not severely cognitively damaged. For example, 'patients with impairment (defined as an Abbreviated Mental Test (AMT) score < 5 on screening) were excluded from involvement' (Ellis et al, 2005). The studies also stated when the participants had had the

Table 1. Characteristics of the included studies

Authors/location	Design	Participants
Adie and James (2010) Study done in UK	RCT: participants were randomly assigned to intervention or controls by block randomisation at the end of their first stroke visit Sample size: N=56 I=29 C=27 Did not discuss drop-out rate, but follow-up data show no drop-outs	Mean age: 72.5 years, range 54–90 years Gender: 54% female Health and medications: 57% had had a minor stroke, 43% had had a TIA Participants were taking a median of two stroke medications a day Participants had had a minor stroke and were living at home—no dementia or significant disability
Claiborne (2006) USA	RCT: participants were randomly assigned to intervention or controls Sample size: N=28 I=16 C=12 Drop-out rate was low (n=5)	Mean age of the intervention group was 70; of the control group, 65 Gender: chi-square analysis showed there were significantly more women in the intervention group (7 men, 9 women) than in the control group (10, 2) Ethnicity: in both groups, the sample was predominantly white Socioeconomic data: most of the participants were married and had private health care. Household income was approximately US\$36 000 Participants were not severely cognitively damaged
Ellis et al (2005) UK	RCT: participants were randomly assigned to intervention or controls via a computer-generated random sequence Sample size: N=192 I=94 C=98 Drop-out rate was low (n=4)	Mean age of the intervention group was 64.3; of the control group, 65.8 Gender: 54% of the intervention group was male; of the control group, 50% Condition: diagnosis of TIA or stroke Socioeconomic: 76% smoked. No other factors stated Participants were excluded if cognitively impaired according to Abbreviated Mental Test score (score <5)
McManus et al (2009) UK	RCT: same intervention as Ellis et al (2005) but it was a long-term follow-up study and separately published paper Sample size: N=102 I=49 C=53 No drop-outs recorded after recruitment for follow-up	Mean age of the intervention group was 64.3; of the control group, 65.8 Gender: 54% of the intervention group was male; of the control group, 50% Condition: diagnosis of TIA or stroke Socioeconomic: 76% smoked. No other factors stated Participants were excluded if cognitively impaired according to Abbreviated Mental Test score (score <5) Good description of initial study, but follow-up descriptives less clear: patients were recruited via letter initially and then via telephone to arrange an appointment Excluded patients who were now in nursing homes
Hohmann et al (2009) Germany	Quasi-experimental design: patients were assigned either to intervention or controls, depending on type of local pharmacy to which patient belonged Sample size: N=255 I=90 C=165 Drop-out rate was fair (n=25)	Mean age of the intervention group was 68.2; of the control group, 68.1 Gender: 35% of the intervention group was female; of the control group, 58% Medication: twice daily administration of stroke medication Patients were only included if not severely cognitively impaired (based on the Barthel index over 30 points at time of discharge, clear level of condition and sample)
Sit et al (2005) Hong Kong	Quasi-experimental design: participants were assigned to intervention group or controls Sample size: N=147 I=77 C=70 Drop-out rate was high (n=44)	Mean age of the intervention group was 62.8; of the control group, 64 Gender: 55% of the intervention group was male; of the control group, 50% Socioeconomic variables: the majority of participants were married (70.9%); the majority also had a high educational level with most achieving at least secondary-school-level education; most were retired and lived with family Level of stroke was minor and participants were medically stable, cognitively intact and independent in activities of daily living

*N=total number of participants, I=intervention group, C=control group. Quality assessment was scored on a scale of 1 to 5 (low to high quality)

Intervention	Medical adherence outcome	Findings	Quality score
<p>Telephone intervention that targeted patient's goals and discussed medicine. Educational material was given, tailored to individual patient's support needs</p> <p>Usual care group had GP appointments. Intervention had 20-minute telephone support at 7–10 days, then at 1 month, 2 months and 4 months (therefore four calls)</p> <p>Intervention was delivered by a researcher</p> <p>Started within one month of stroke or TIA; follow-up was at 6 months</p>	<p>Medical marker: blood pressure</p> <p>Differences in medication-taking: implies self-reported</p> <p>Effect size: 0.93</p>	<p>Intervention did not improve blood-pressure control over 6-month follow-up in primary care after stroke/TIA. There was an increase in medication knowledge</p>	3.8
<p>Managed across health services and led by social workers with the aim of integrating the intervention into coordinated care</p> <p>Intervention involved additional social care as well as usual treatment, which were medication and medical appointments. Additional social care included problem solving, education, holistic care and practical solutions for addressing barriers to treatment</p> <p>Involved weekly telephone interventions for up to 1 hour for 3 months. Started within 2 weeks of discharge; follow-up was at 3 months</p>	<p>Self-report: number of incidences in which a patient did not follow their medication regimen</p> <p>Effect size: -0.61</p>	<p>There was significant improvement for the intervention group. The study showed effect of medication adherence</p>	3.07
<p>Involved individual advice on lifestyle and medication compliance. All information was discussed and then written for patients; targets were decided (self-care planning); education and counselling were also included</p> <p>Intervention delivered by SNS</p> <p>Control group had care as usual, generic advice in outpatient clinic only, and GP appointments</p> <p>If a risk factor was found (for non-adherence) then patient advised to contact GP for 30-minute appointment (GPs were aware of study)</p> <p>Started at discharge and involved monthly reviews by a SNS for 3 months/once a month in hospital</p> <p>Baseline pre-study (week 1) and follow-up was at 5 months</p>	<p>Medical markers: blood pressure</p>	<p>Intervention was effective in lowering systolic blood pressure</p>	4.07
<p>As above</p> <p>Baseline pre-study (week 1) and follow-up was 3.6 years</p>	<p>Mixed: checked medication for out-of-date tablets</p> <p>Patients asked if they considered themselves to be taking medication regularly</p> <p>Inconsistent medicine checked</p> <p>Effect size: 0.19</p>	<p>The intervention did not have any long-term benefit on medication adherence</p>	3.56
<p>Led by community-based pharmacies. Intervention involved counselling/discussion of side-effects and medication, and goal setting with a local pharmacist in the community. Participants had one hospital session with a clinical pharmacist and then further sessions in the community with a pharmacist</p> <p>Patients were assigned to at least one session of the intervention every 3 months. The length of the intervention was not stated. The control patient had standard care, not individualised support. Standard care included advice from a pharmacist, but did not include counselling</p> <p>Baseline measured at the stroke unit at week 1; follow-up was at 12 months</p>	<p>Medical markers: hypertension (prescribed in accordance with the Deutsche Gesellschaft für Neurologie (DGN) and the Deutsche Schlaganfall-Gesellschaft (DSG))</p> <p>Effect size: 0.54</p>	<p>Findings show that although pharmacists may have a positive impact on quality of life and satisfaction, there was no impact on stroke medication adherence</p>	4.12
<p>Conducted in the community and led by nurses. It included individual goal setting and action plans, problem sharing and discussion of experiences in a group setting. This was incorporated into written action plans, which were reviewed in sessions. Each group had 10–12 participants</p> <p>Included eight weekly 2-hour sessions with a focus on goal setting and action plans or control (only medicine)</p> <p>Baseline was measured at week 1 with follow-up at 3 months</p>	<p>Mixed: blood pressure</p> <p>Medication compliance scale (Morisky et al, 1986)</p> <p>Effect size: 0.23</p>	<p>Found a 3-month effect of stroke medication adherence in participants who undertook the nurse-led intervention</p>	4.15

stroke—for example, within the preceding 3 months. All the interventions were started soon after the stroke had occurred, which was positive, since guidance suggests intervening as soon as possible (Menard et al, 2011).

The sample sizes across the studies differed largely. Some studies, such as Claiborne (2006), had a very small sample size of 28 participants, whereas other studies had much larger sample sizes, such as Hohmann et al (2009) with 255. Withdrawals and drop-outs in most of the studies were also discussed in detail. Drop-out rates were overall fairly mixed in relation to sample sizes. They ranged from zero (0%) (Claiborne, 2006; Adie and James, 2010) to 23% (Sit et al, 2005). Drop-out rates were a limitation for some of the studies. The longer-term studies (>6 months) had higher drop-out rates and larger sample sizes. Given the nature of stroke, during the long-term follow-up period, some participants' conditions had deteriorated and some participants had died.

The method of randomisation was clearly stated. All the studies that were RCTs—four of the six—stated how they had been randomised and, in the main, it was computerised. In accordance with the inclusion criteria for this review, the remaining studies had quasi-experimental design and included pre and post (before and after) measures and a control and intervention group. These two studies assigned participants to a control group in the form of 'standard care' or to an intervention group, which was clearly explained.

The designs of the self-management interventions were of good quality. The main components of the interventions were consistent. For example, they all included advice about stroke, self-care planning, goal setting, personalised feedback, education and support. In the interventions, participants could discuss medication issues they were having and then put strategies in place to overcome them. Although the components were described, they were not described in detail.

All but one of the interventions included face-to-face visits. The remaining intervention was delivered over the telephone (Adie and James, 2010). This study did not have an effect on medication adherence. One study (Claiborne, 2006) began with a face-to-face visit, but then subsequent sessions were delivered over the telephone, which did improve medication adherence. Including at least one initial face-to-face visit may be beneficial, but further research is needed before firm conclusions can be drawn.

There was variation in the frequency of the interventions. One was done monthly via face-to-face interaction or via telephone (Ellis et al, 2005; McManus et al, 2008; the latter was the long-term follow-up of Ellis et al). Another (Adie et al, 2010) was sporadic, whereby an initial telephone conversation was followed by conversations at 1 month, 2 months and 4 months. Other interventions were weekly (Claiborne, 2006; Sit et al, 2005). Some were less frequent, such as every 3 months (Hohmann et al, 2009). The two that were the most frequent, weekly, had a significant effect on medication adherence (Claiborne, 2006; Sit et al, 2005). These same studies also involved more time—sessions lasted 1 or 2 hours—whereas some of the studies that had poorer outcomes involved 20-minute sessions (Adie et al, 2010). The third study that had a significant finding involved a single intervention, which lasted 5 months, so although it

was less frequent, it was longer in duration, which may have been advantageous. Overall, those that were less frequent were also less effective.

The timespan in which baseline to follow-up was measured differed. Some interventions measured follow-up at 3 months post intervention (Sit et al, 2005; Claiborne, 2006). One measured follow-up at 5 months (Ellis et al, 2005). The remaining studies measured longer-term follow-up—i.e. post 6 months (McManus et al, 2008; Hohmann et al, 2009; Adie and James, 2010). The studies that measured follow-up in the shorter term, i.e. 3 to 5 months, had better outcomes compared with those that measured follow-up in the longer term, indicating the effects were lost over time.

The studies' measurement of medication adherence differed. Some used biological markers such as blood pressure, whereas others used self-report measures such as the Medical Compliance Questionnaire (Morisky et al, 2008), which is a widely used scale that identifies whether or not people take their medication. Others measured the number of times people did not take their medication (Claiborne, 2006). There are limitations with all the different measures that were used. For example, self-report measures may be unreliable because of patient recall and bias, and using blood pressure as a measure of adherence may be influenced by confounding factors such as weight loss or physical activity. Because different measures were used, a meta-analysis was not possible.

Discussion

This systematic review assessed the effectiveness of self-management interventions on medication adherence in stroke patients, and their short-term and long-term impact. Overall, half of the findings support self-management strategies becoming an integral part of stroke management, but because half do not, firm conclusions cannot be drawn.

The studies in this review that had significant findings had regular and frequent interventions—this is one of the review's main findings. It is also in line with the literature that has found that increased exposure to an intervention is associated with improvements and increased likelihood of positive effects (Rubak et al, 2005). Future self-management interventions for stroke that target medication adherence are strongly recommended to be started soon after the stroke and delivered frequently (weekly or monthly).

The impact that self-management interventions had on medication adherence in stroke patients was mixed, with half having an effect. All the studies included in this review incorporated education, problem solving, counselling and medication advice. Previous literature has found that a combination of lifestyle changes and medicines management is successful in improving patient outcomes (Powers et al, 2011). Although the evidence from this review does not point to a firm conclusion, all the studies that were effective included all of these components, and had frequent and regular interventions. Therefore self-management interventions incorporating a combination of these components, as well as being delivered frequently, show promise.

A further objective of this systematic review was to ascertain the impact of the interventions on short-term

and long-term medication adherence in stroke. Overall, the interventions were effective in improving adherence in the short term, but not in the long term. This may have been due to the frequency of the interventions. For example, one study was effective in the short term, but 3 years later, the positive outcomes were not sustained. Implementing booster sessions may sustain them: for example, Newman et al (2009) found that self-management interventions that have booster sessions are more effective in the long term than those that do not. But further research is needed.

This systematic review found that, from the descriptions given, the studies at hand did not appear to be explicitly grounded in theory. According to Horne (2007), there is a lack of interventions that have been developed using theoretical models. Many are developed with ad-hoc approaches, making them insufficiently comprehensive. For example, there is evidence that interventions targeting social support are more effective (Di Matteo, 2004). Although some of the studies may have incorporated strategies aimed at promoting social support, the strategies were more a part of the design, rather than clearly defined. More use, and clearer definitions of, the theoretical models are recommended.

It is important to highlight some limitations of this systematic review. The studies in this review were carried out in different countries, including the UK, Germany, USA and Hong Kong. The generalisability of the findings therefore may be limited. Some of the studies did not have sufficient sample sizes and some had high drop-out rates too. Future studies with adequate sample sizes are highly recommended.

This systematic review only examined medication adherence because this is one of the biggest influencers of recurrent stroke and poor medical outcomes; with an aging population, these issues will continue to grow (Fan et al, 2010). In addition, interventions that improve medication adherence have been highlighted as a priority for people with long-term conditions and stroke guidance accords with this (Haynes et al, 2008; O'Carroll et al, 2011). As the interventions' main outcome measure was not always adherence, this may have affected the findings.

A further limitation was that the studies used different measures of medication adherence. According to Fairman and Motheral (2000), although there are a variety of methods that can be used to measure medication adherence, there is no 'gold standard'. In all the literature searched, studies and systematic reviews measured adherence to medication differently.

Practice implications

Previous literature has found that there is a lack of evidence-based interventions for prevention and management of stroke (Wei et al, 2010; Cheng et al, 2011). There is no doubt that further research is needed. Many of the negative health and social effects of stroke are preventable and treatable, and can be greatly reduced with appropriate medical interventions that are integrated into clinical practice (Saka et al, 2009). It was interesting to see the range of health and social-care settings to which self-management interventions incorporating medication adherence can be successfully applied. It is important for future interventions

KEY POINTS

- Self-management interventions aimed at supporting adherence to stroke medication are invaluable
- Integrating such interventions into existing clinical practice is effective and potentially cost-efficient
- To be effective, self-management interventions for improving medical adherence in stroke patients need to be delivered regularly and frequently
- Booster sessions are recommended to uphold long-term benefits
- Further development is needed of interventions that are grounded in theory and have stringent methodologies

to be integrated into existing primary and secondary clinical practice; to be grounded in theory; to include several components of self-management; and to be delivered regularly and frequently—i.e. weekly or monthly. For long-term benefits to be upheld, investigating the impact of booster sessions is recommended. With an aging population, the time is apt to start improving health outcomes and reducing healthcare costs. BJN

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