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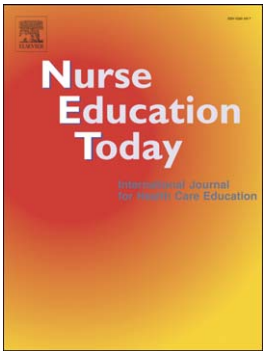

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THE IMPACT OF EDUCATION AND TRAINING INTERVENTIONS FOR NURSES AND OTHER HEALTH CARE STAFF INVOLVED IN THE DELIVERY OF STROKE CARE: AN INTEGRATIVE REVIEW

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Abstract

Objectives

The aim of this review was to explore the impact of stroke education and training of nurses and other health care staff involved in the delivery of stroke care.

Design

We performed an integrative review, following PRISMA guidance where possible.

Data sources

We searched MEDLINE, ERIC, PubMed, AMED, EMBASE, HMIC, CINAHL, Google Scholar, IBSS, Web of Knowledge, and the British Nursing Index) from 1980 to 2016.

Review methods

Any intervention studies were included if they focused on the education or training of nurses and other health care staff in relation to stroke care. Articles that appeared to meet the inclusion criteria were read in full. Data were extracted from the articles, and the study quality assessed by two researchers. We assessed risk of bias of included studies using a pre-specified tool based on Cochrane guidance.

Results

Our initial search identified 2850 studies of which 21 met the inclusion criteria. Six studies were randomised controlled trials, and one was an interrupted time series. Fourteen studies were quasi-experimental: eight were pretest-posttest; five were non-equivalent groups; one study had a single assessment. Thirteen studies used quality of care outcomes and eight used a patient outcome measure. None of the studies was identified as having a low risk of bias. Only nine studies used a multi-disciplinary approach to education and training and nurses were often taught alone. Interactive education and training delivered to multi-disciplinary stroke teams, and the use of protocols or guidelines tended to be associated with a positive impact on patient and quality of care outcomes.

Conclusions

Practice educators should consider the delivery of interactive education and training delivered to multi-disciplinary groups, and the use of protocols or guidelines, which tend to be associated with a positive impact on both patient and quality of care outcomes. Future research should incorporate a robust design.

BACKGROUND

Stroke is a leading cause of mortality and disability worldwide[1] and is recognised as a time-dependent medical emergency in which early presentation to specialist care reduces death and dependency[2]. Stroke survivors are known to have complex needs[3,4] with a commensurate requirement for knowledgeable and skilled rehabilitative and long-term support from appropriately trained staff. It has been demonstrated that the provision of care in a stroke unit improves outcomes for people who have experienced stroke[5]. The reasons for this are unclear, but are likely to be at least partly attributable to the presence of a multi-disciplinary team with specialised knowledge, skills and experience in stroke. The development and delivery of stroke-specific education is therefore of vital importance to the provision of high quality stroke care and to improve outcomes for people who have experienced stroke; to ensure this care from staff with the appropriate education and skills at all points on the stroke pathway (e.g. pre-hospital, emergency, rehabilitation, long-term care, and primary care).

In England, a report by the National Audit Office (NAO) highlighted that the limited number of health professionals with stroke-specific education and training could be a barrier to providing high-quality acute care and rehabilitation[2]. The National Stroke Strategy in England also highlighted the need for nationally recognised, quality assured and transferable education and training for stroke staff in order to ensure that the stroke workforce had appropriate knowledge and skills[6]. Consequently, a Stroke-Specific Education Framework (SSEF) was developed[7]. The SSEF consists of 16 elements of care, based on the quality markers in the National Stroke Strategy and related to the stroke strategies of all four UK countries, which cover the whole of the stroke care pathway. Each element contains key competencies, reflecting the knowledge and skills required by staff working in that area of stroke care delivery, that should be covered in any education and training package.

A previous review of education and training with nurses in stroke found a paucity of evidence, which was limited to stroke rehabilitation settings[8], and included only one study which directly examined the impact of education and training for nurses on outcomes of people who had experienced stroke[9]. This before and after study found that whilst there were some improvements in clinical practice, there was no significant difference between the two groups for Barthel index, Hospital Anxiety and Depression scale, occurrence of secondary complications, length of stay or inpatient and carer satisfaction[9].

As detailed in the National Stroke Strategy, stroke care extends prior to and after rehabilitation, which is only one of the key areas of the stroke pathway[6]. Moreover, a wide range of staff contribute to stroke care across the whole of the stroke pathway. If we are to fully understand the value of stroke education and training we need a comprehensive and systematic approach to synthesising relevant research evidence.

The aim of this review was to summarise the existing scientific literature exploring the impact of stroke education and training of nurses and other health care staff involved in the delivery of stroke care, using integrative review methodology. An integrative review utilises a systematic methodology for searching and appraisal to ensure that it is comprehensive and inclusive. However, unlike other systematic review approaches, integrative review enables the synthesis of research studies utilising diverse methodologies[10].

Research questions:

1. What types of stroke education and training interventions have been developed for nurses and other health care staff?
2. How has the impact of stroke education and training been assessed?

3. Is there evidence for the effectiveness of stroke education and training on quality of care or patient outcomes?

DESIGN

Primary research studies, using any methodology, assessing the impact of stroke education and training were included if they described education and training in relation to stroke, of health care personnel (including: emergency medical dispatchers, paramedics, ambulance technicians, nurses, health care assistants, doctors, physiotherapists, occupational therapists, speech and language therapists, pharmacists, social workers, trainees and multi-disciplinary groups). Studies that focused solely on the education and training of people who have experienced stroke or informal supporters (carers) were not included.

Studies were included if they reported an evaluation of the impact of the education or training on a measure of patient care, in terms of either a patient or quality of care outcome measure. Patient outcomes were defined as those that related to health status or health behaviour. Other measures of health status included mortality or a marker of morbidity such as discharge destination. Quality of care outcomes were defined by the research team as those that related to quality or timeliness of patient care delivery. Where a primary outcome was explicitly stated by the study authors, this was taken as the main outcome of the study. Where no primary outcome was stated and multiple outcomes were reported, the research team designated the main outcome through consensus. If present, a patient outcome was considered to be the main outcome; otherwise a quality of care outcome was selected.

Studies were included from any country, if they were published in full and in English.

Data sources

A search strategy was developed (see Supporting Information), including the MeSH terms stroke, education, and health personnel. The search strategy was adapted to search a range of databases (MEDLINE, ERIC, PubMed, AMED, EMBASE, HMIC, CINAHL, Google Scholar, IBSS, Web of Knowledge, and the British Nursing Index) from 1980 to July 2016.

Review methods

Citations were initially screened on title and then abstract. This process was undertaken independently by two trained researchers (SJ and CM). Any articles that met the inclusion criteria were read in full by two trained researchers (SJ, CM, JG, JL). Disagreements over the inclusion of any articles were discussed by the project steering group. Backward and forward citation searches were performed to test the quality of the search strategy.

Assessment of risk of bias in included studies

The inclusion of studies with varying methodologies required the development of a framework to assess study quality which could encompass a range of study designs. The Cochrane 'risk of bias' tool was used as the starting point to develop this method[11]. Selection, performance, detection, attrition and reporting biases were included in order to assess study quality.

Data extraction and management

We designed a data extraction form that summarised the following characteristics:

i. Study detail (author, year of publication, country of origin, study type);

ii. Staff participants (setting, professions, sample size);

iii. Type of education or training (content, format, method of delivery, by whom delivered, duration, frequency, barriers to implementation);

iv. Patient characteristics (stroke/TIA, sample size, age, sex);

v. Outcomes (primary/main outcome measures categorised as patient outcomes or quality of care outcomes), main results, inferential and descriptive statistics;

vi. Risk of bias (selection, performance, detection, attrition, reporting).

Method of delivery was categorised into didactic (e.g. lectures, videos, CDs, workbooks, protocols, on-line), or interactive (e.g. action plans, practical sessions, reflective practice, workshops, feedback). Data extraction forms were piloted using three of the included studies. The accuracy of data extraction was checked by a second independent extractor for all included studies.

We did not contact the study authors for missing data or for clarification.

Included studies were mapped against the SSEF Elements of care[7] to assess the breadth of stroke education and training delivery. The 16 elements are listed in Table 1 below.

Analysis

There was a great deal of heterogeneity between the study designs, the type and format of the education or training provided, and the outcomes reported, and therefore we were unable to perform a meta-analysis of the included randomised controlled trials. Consequently, we have described included studies narratively.

RESULTS

The search strategy initially identified 2850 articles. Following screening of the title, abstract or complete article, 21 studies met the inclusion criteria (see Figure 1).

Figure 1: Flow diagram.

Risk of bias

The proportion of studies demonstrating each type of bias can be seen in Figure 2 (Supporting Information). None of the studies was identified as having a low risk of bias across all five domains. Evidence for selection bias was unclear in a majority of studies, and two studies[12-13] were at high risk of selection bias. Performance bias was evident in all studies, although this is not unreasonable given the nature of education and training in health care. Detection bias was unclear for many studies, but where bias could be assessed, in most cases there was a low risk; only one study[13] had a high risk of detection bias. Evidence for attrition bias was unclear for the majority of studies. Two studies were at high risk for attrition bias[14-15] while seven had a low risk[12,16-21]. The risk of reporting bias was unclear in one study, while the other 20 studies were evenly split between low and high risk.

Narrative review

Description of eligible studies

Of the 21 included studies, six used a randomised trial design: two[12,21] were randomised controlled trials (RCTs), and four[16,18,22-23]were cluster RCTs. One study was an interrupted time series[24]. The remaining studies used quasi-experimental designs: eight were pretest-posttest[9,13,25-30], five were non-equivalent groups[15,17,19,20,31] and one was a post-test study[14]. Details of study characteristics are summarised in Table 2. Only 12 studies reported the numbers of staff who received education and training (total 1,190, median 99, range 12 to 345). Over half the studies involved the education or training of nurses (57%). All but one study[25] reported the number of patients included in outcome measurements, which totalled 9,913 across 20 studies (median 495, range 37 to 1696).

Of the 21 studies, 16 provided sufficient further detail to be able to categorise the method of education or training delivery (Table 3).

What types of stroke educational interventions have been developed for health care staff?

Twelve studies[9,12-17,22,25,28,31] entailed education or training programmes for a single health profession or occupational group. In most of these studies, nurses were the recipients of the education or training (Table 4). Twelve studies[9,12,15,17-20,23,27,31] delivered education or training using a range of approaches including face-to-face lectures, videos, workshops, protocols and reflective practice. Four studies used a single method of delivery[14,15,24,29], only one of which delivered an on-line course[24]. The remaining studies did not state the method of delivery[13,21,25,26,30]. In those studies that reported the duration and/or frequency of education or training[9,12,13,15,16,18,22-24,26-28,31], duration ranged from one hour to two working days, with most education or training sessions being delivered on one or two occasions.

In terms of the 16 Stroke-Specific Education Framework Elements of care, 12 studies focused on a single Element, of which seven were in specialist rehabilitation. Four studies focused on two Elements, four covered three Elements and one focused on five Elements. The included studies focused on urgent response (n=9), acute stroke assessment (n=6) and treatment (n=3), and specialist rehabilitation (n=11). There were fewer studies (two each) on seamless transfer of care, long-term care, and post-stroke review. No studies were identified on managing risk (in terms of primary prevention), information, user involvement, Treatment (TIA), end of life, participation in community, and return to work.

How has the impact of stroke education and training been assessed?

Eighteen of the 21 studies specified a main outcome measure. The majority of studies (n=11) used a quality of care outcome. The remaining six studies specified a patient measure as their main

outcome. The three remaining studies did not specify a primary outcome and had a main outcome designated by the research team for the purposes of this analysis. The main outcome measures were very diverse, with only three outcomes being assessed in more than one study: Identification of stroke[13,24,28,30]; thrombolysis rates[19,20]; patient position/posture[9,15] (see Table 5 in Supporting Information).

Is there evidence for the effectiveness of stroke education and training on outcome?

Eleven (52%) of the included studies reported a positive impact of education and training on patient or quality of care outcomes. Of the studies measuring patient outcomes none used the same outcome measure. Two of the studies that showed a positive impact on physical health utilised a cluster RCT design and provided interactive, mixed methods of delivery, but there were no further commonalities between the two studies[18,23]. Two further studies found a positive association between education and training and psychosocial[17] and health behaviour[12] outcomes, but again there were few commonalities between these studies. It is therefore difficult to assess adequately the extent to which education and training could lead to improved patient outcomes. Seven studies had a positive impact on quality of care outcomes. Of these studies, three related to the identification of stroke in pre-hospital settings[13,24,30], two measured the impact of thrombolysis rates[19,20]; whilst the remaining two papers looked at time to arrival at the Emergency Department[26] and correct positioning[15]. Again, there were few commonalities between studies in terms of study design (RCT[13], Quasi experimental[15,19,20], interrupted time-series[24], pre-post intervention study[26,30]); staff groups (mixed[19,20,26,30], nurses[15], EMS dispatchers[24], paramedics[13]); delivery mode (face-to-face practicals, protocols and feedback[19,20], manual and workbook[15], on-line[24], not stated[13,26,30]) and duration (one 4-hour session[13], one 2-hour session[15,24,26], not stated[19,20,30]).

DISCUSSION

This is the first review that has systematically synthesised the published literature on the impact of stroke education and training of nurses and other health care staff involved in the delivery of stroke care. Two of the studies reported positive patient outcomes in relation to the modified Rankin scale[18] and the Functional Independence Measure[23]. Both of these studies were considered high quality, utilising a cluster RCT design with lower risks of bias. One further study[24] reported a positive impact on a quality of care outcome (dispatcher recognition of stroke) in an interrupted time series study, and also had a lower risk of bias. Eight further studies, which reported positive patient or quality of care outcomes, were of less robust study design or at higher risk of bias, or both. The remaining 10 studies did not demonstrate positive findings for their main outcome.

The impact of education and training on patient outcomes in stroke is unclear. Although four studies reported a positive impact of education and training on patient outcomes[12,17,18,23] the strength of evidence was varied and none used the same outcome measure. There is a clearer picture when measuring the impact of education and training on quality of care outcomes. The results of these five studies suggest that the provision of education and training to improve recognition of stroke may lead to an increase in the identification of stroke by paramedics and call handlers[13,24,30] and raising awareness of stroke and protocols for its treatment in the Emergency Department may increase thrombolysis rates[19,20]. However, there is limited evidence from two further studies that education and training may improve onset to arrival times and positioning or posture[15,26].

The risk of bias varied across the included studies. The risk of attrition and selection bias was often unclear and could have been minimised by robust study design and reporting.

There were further limitations of the studies included. Methodologically, the 21 included studies all shared a common key limitation, in that none conducted comparisons of two or more methods of

educational delivery in order to determine the most effective delivery method(s). Studies often had small sample sizes with high attrition rates and unrepresentative samples. Almost half of the included studies did not report the number of health care personnel that received education and training, and very few reported rates of uptake and/or completion of education and training. Studies varied in the quality of the information reported regarding the content, delivery and duration of the education and training programmes provided. However, the two most recent studies[16,24] were both of higher quality. In numerous studies the educational programme was just one part of a multi-faceted intervention, of which education and training was only one component, making it difficult to evaluate the actual effectiveness of the education and training delivered.

Due to limited resources, only studies in the English language were included and authors of included studies were not contacted for clarification or further information. It is possible that some studies were excluded where they related to staff education and training in general settings (e.g. general medical or rehabilitation wards), where a proportion of the patients had had a stroke, but where study outcomes for people who had experienced stroke were not reported separately.

It is well established that stroke survivors whose care is provided by a multi-disciplinary team who specialise in stroke care are more likely to be alive, independent, and living at home one year after stroke[5]. It could be argued that an education and training programme that reflects the complex multi-disciplinary ethos of stroke care might be more effective in improving outcomes, than initiatives which focus on the delivery of profession-specific education and training for single staff groups. However, as reported in this review, only nine studies used a multi-disciplinary approach to education and training, and nurses in particular were often taught alone.

Continuing education and training in healthcare can be classified as a complex intervention[32]. As with any complex intervention, clearly defined implementation strategies may facilitate the

systematic uptake of educational interventions, and fidelity practices may increase the degree to which the constituent components of an education and training intervention are delivered as planned[33]. It is necessary to conduct robust implementation research in order to translate findings across disciplines and settings. However, only eight studies considered the barriers to the implementation of education and training interventions, and there was a dearth of reporting of detailed implementation strategies. It is recommended that future educational interventions are underpinned with explicit theory that details implementation processes.

The included studies used a variety of delivery methods, with the majority using interactive teaching methods rather than taking a purely didactic approach. Although few studies discussed the theoretical underpinning of their educational approach, the prevalence of the use of interactive methods is consistent with andragogic teaching philosophies[34]. Such approaches are appropriate for programmes of adult learning with health care staff.

Recent advances in the use of information technology as a tool for facilitating student learning (e-learning), particularly for those accessing courses from the practice setting[35], have the potential to transform continuing professional development in health care. Only one study reported the use of e-learning, although this is unsurprising in relation to the older studies included in this review.
In terms of the Stroke-Specific Education Framework Elements of care, the available evidence is dominated by studies of urgent response, acute stroke assessment and treatment, and specialist rehabilitation. There are few studies of seamless transfer of care, long-term care, and review, and no studies of managing risk, information, user involvement, treatment of TIA, end of life care, participation in community, and return to work. This dominance of the evidence base by studies in the pre-hospital, acute and rehabilitation stages of the stroke pathway, and lack of evidence in other aspects of stroke care, mirrors the distribution of research into stroke interventions themselves (not just educational interventions).

The effectiveness of different approaches for delivery will be related to the content, learner group, setting and mode of evaluation. Therefore it is not possible to recommend a concise summary of interventions, as this would be an over simplification. However, structured summaries of stroke-related knowledge and skills, according to professional role, are available from the SSEF website http://www.stroke-education.org.uk/.

Conclusions

Education and training can improve outcomes for people who have experienced stroke. Practice educators should consider the delivery of interactive education and training delivered to multi-disciplinary groups, and the use of protocols or guidelines which tend to be associated with a positive impact on both patient and quality of care outcomes. Although there were some studies that reported positive results, there was wide heterogeneity of design, interventions and outcomes. Future research should incorporate a robust design including publication of carefully selected patient and quality of care outcome measures, which reflect the educational intervention and facilitate future meta-analysis.

Competing interests

There are no competing interests to declare.

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Figure 1. Flow diagram of included studies

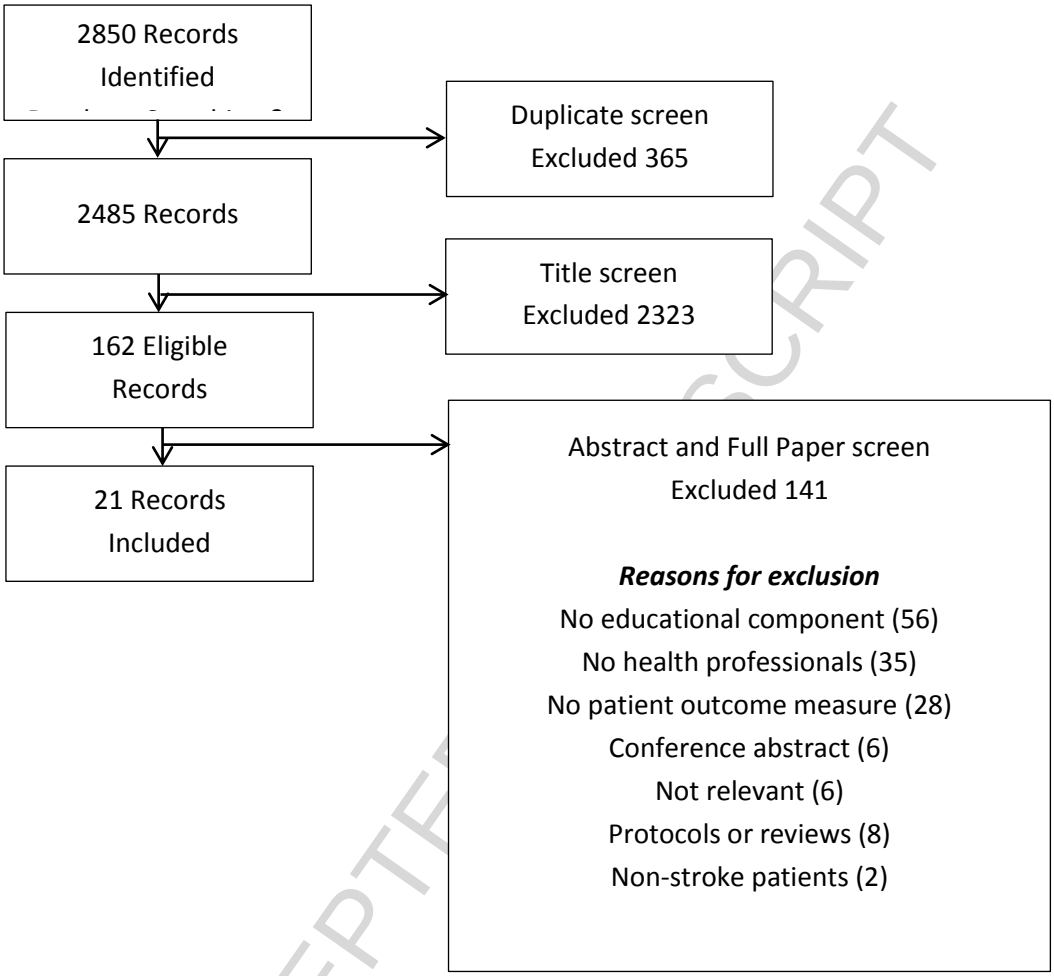

Figure 2. Risk of bias

	Selection bias	Performance bias	Detection bias	Attrition bias	Reporting bias
Amato 2006	Unclear	High	Unclear	Unclear	High
Behrens 2002	Unclear	High	Unclear	Unclear	High
Booth 2005	Unclear	High	Unclear	Low	High
DeLuca 2008	Unclear	High	Unclear	Unclear	High
Forster 1999	Unclear	High	Unclear	Unclear	Unclear
Forster 2013	Unclear	High	Low	Unclear	Low
Frendl 2009	Unclear	High	Unclear	Unclear	Low
Herr-Wilbert 2010	Unclear	High	Unclear	High	High
Hohmann 2009	Low	High	Low	Unclear	Low
Jones 1998	Low	High	Unclear	High	High
Jones 2005	Low	High	Unclear	Unclear	High
Kavanagh 2006	Unclear	High	Unclear	Unclear	High
Middleton 2011	Unclear	High	Low	Unclear	Low
Morgenstern 2002	Unclear	High	Low	Unclear	Low
Morgenstern 2003	Unclear	High	Low	Unclear	Low
Nikopoulou-Smyrni 2007	Unclear	High	Low	Unclear	Low
Nir 2006	High	High	Low	Unclear	High
Smith 1999	High	High	High	Unclear	Low
Strasser 2008	Low	High	Unclear	Unclear	Low
Watkins 2013	Unclear	High	Unclear	Unclear	Low
Wojner-Alexandrov 2005	Unclear	High	Unclear	Unclear	High

Table 1: SSEF Elements of Care

1) Awareness Raising
2) Managing risk
3) Information
4) User involvement
5) Assessment – Transient Ischaemic Attack (TIA)
6) Treatment – TIA
7) Urgent response
8) Assessment – Stroke
9) Treatment – Stroke
10) Specialist rehabilitation
11) End of life care
12) Seamless transfer of care
13) Long term care
14) Review
15) Participation in the community
16) Return to work

Table 2: Summary of Included Studies

Author, Year; Country	Study Type	Setting	Staff Participants	Completion of training	Patient Participants	Mean Patient Age	% Patients Female; Male	Main Outcome Measure
Amato 2006; USA	Pre Post intervention observational (2 separate convenience samples)	Rehabilitation	Nurses, N not stated	NS	NS	NS	NS	Patient
Behrens 2002; Germany	Pre Post-test intervention study	Pre-hospital/ Acute	345, dispatchers, paramedics, doctors and neurologists	NS	143	NS	45%;55%	Quality of care
Booth 2005; UK	Quasi-experimental	Rehab	26 nurses	NS	37	NS	NS	Quality of care

Author, Year; Country	Study Type	Setting	Staff Participants	Completion of training	Patient Participants	Mean Patient Age	% Patients Female; Male	Main Outcome Measure
	non-equivalent control group design							
DeLuca 2008; Italy	Pre Post observational cohort study	Pre-hospital/ Acute	324, physicians, nurses, emergency health operators, drivers & ambulance technicians	NS	1295	NS	NS	Quality of care

Author, Year; Country	Study Type	Setting	Staff Participants	Completion of training	Patient Participants	Mean Patient Age	% Patients Female; Male	Main Outcome Measure
Forster 1999; UK	Pre Post intervention observational (2 separate convenience samples)	Rehab	13 qualified & non-qualified rehab nurses	NS	Pre = 26 Post = 24	Pre = 78 Post = 77	Pre = 54%;46% Post = 71%; 29%	Quality of care

Author, Year; Country	Study Type	Setting	Staff Participants	Completion of training	Patient Participants	Mean Patient Age	% Patients Female; Male	Main Outcome Measure
Forster 2013; UK	Cluster RCT	Acute/Rehab	54 (approx.) snr. physiotherapists, snr. occupational therapists, snr. nurses, staff nurses, consultant physicians, snr. speech & language therapists	NS	928	71	44%;56%	Patient
Frendl 2009; USA	Pre Post retrospective observational	Pre-hospital	Paramedics or EMT, N not stated	NS	154	67	56%;44%	Quality of care

Author, Year; Country	Study Type	Setting	Staff Participants	Completion of training	Patient Participants	Mean Patient Age	% Patients Female; Male	Main Outcome Measure
Herr-Wilbert 2010; Switzerland	Cohort	Rehab	16 nurses	NS	44	75	43%;57%	Patient
Hohmann 2009; Germany	Non-randomised controlled	Acute/rehab/community	23 community – based pharmacists	NS	Control = 165, Intervention = 90	Control = 68, Intervention = 68	Control = 35%;65%, Intervention = 34%;66%	Patient
Jones 1998; UK	Quasi-experimental	Rehab/ general wards	59 nurses and HCAs	59 (100%)	38	73	74%;26%	Quality of care
Jones 2005; UK	Cluster RCT	Rehab	All trained nurses and HCAs, N not stated	NS	120	Control = 71, Intervention = 75	Control = 50%;50%, Intervention = 63%; 37%	Patient

Author, Year; Country	Study Type	Setting	Staff Participants	Completion of training	Patient Participants	Mean Patient Age	% Patients Female; Male	Main Outcome Measure
Kavanagh 2006; USA	Pre Post intervention observational (2 separate convenience samples)	Acute	Mixed, N not stated	NS	41	64	55%;45%	Patient
Middleton 2011; Australia	Cluster RCT	Acute	Nurses, N not stated	NS	1696	<65 Control = 28%, Intervention = 31%	40%;60%	Quality of care
Morgenstern 2002; USA	Quasi-experimental comparison	Pre-Hospital/ Acute	Mixed, N not stated	NS	1189 (Phase 1 & 2)	72	20%;80%	Quality of care

Author, Year; Country	Study Type	Setting	Staff Participants	Completion of training	Patient Participants	Mean Patient Age	% Patients Female; Male	Main Outcome Measure
	group design with 2 communities							
Morgenstern 2003; USA	Quasi-experimental comparison group design with 2 communities	Pre-Hospital/ Acute	Mixed, N not stated	NS	238 (Phase 3)	72	57%;43%	Quality of care

Author, Year; Country	Study Type	Setting	Staff Participants	Completion of training	Patient Participants	Mean Patient Age	% Patients Female; Male	Main Outcome Measure
Nikopoulou-Smyrni 2007; UK	RCT	Acute	12 doctors, nurses, physiotherapists and occupational therapists	12 (100%)	49	NS	NS	Quality of care
Nir 2006; Israel	Pre Post Intervention	Rehab	Senior nursing students, N not stated	NS	155	73	48%;52%	Quality of care
Smith 1999; USA	RCT	Pre-hospital	22 paramedics	22 (100%)	121	NS	NS	Quality of care

Author, Year; Country	Study Type	Setting	Staff Participants	Completion of training	Patient Participants	Mean Patient Age	% Patients Female; Male	Main Outcome Measure
Strasser 2008; USA	Cluster RCT	Rehab	227 rehabilitation Unit staff: medicine, nursing, occupational therapy, speech and language pathology, physical therapy, social work.	NS	1374	67	27%;73%	Patient
Watkins 2013; UK	Interrupted time series	Pre-hospital	69 emergency medical dispatchers	69 (100%)	464	75	52%;48%	Quality of care

Author, Year; Country	Study Type	Setting	Staff Participants	Completion of training	Patient Participants	Mean Patient Age	% Patients Female; Male	Main Outcome Measure
Wojner-Alexandrov 2005; USA	Pre Post intervention observational	Pre-hospital/ acute	Mixed, N not stated	NS	1522	69	56%;44%	Quality of care

N: number; NS: not stated; RCT: randomised controlled trial; snr: senior

Table 3: Summary of education and training interventions

Author, Year	Who Received Education and Training	Content of Education and Training	Format of Delivery	Method of Delivery	Who Delivered Education and Training	Frequency and Duration	Barriers To Implementation Considered
Amato 2006	Nurses	Restraint reduction and falls	Face-to-face	NS	Clinical nurse specialist	Ongoing, duration not specified	Y
Behrens 2002	Mixed (Including Paramedics/ technicians, Dispatchers, Doctors)	Stroke symptoms, taking medical histories, pre-alerting, stroke as a medical emergency	Face-to-face	NS	Member of the stroke project team	One, 2 hour session (repeated)	NS
Booth 2005	Nurses	Handling and positioning patients	Face-to-face lectures, videos, demonstrations	Didactic & Interactive	Senior physiotherapists and Occupational therapists	Two, 3.5 hour sessions (repeated)	NS

Author, Year	Who Received Education and Training	Content of Education and Training	Format of Delivery	Method of Delivery	Who Delivered Education and Training	Frequency and Duration	Barriers To Implementation Considered
De Luca 2008	Mixed (Including Paramedics/ technicians, Dispatchers, Nurses, Doctors).	Emergency stroke care pathways	Face-to-face lectures, videos, reflective practice, on-the-job support	Didactic & Interactive	Emergency care pathway co-ordinators	Multiple sessions, duration not specified	Y
Forster 1999	Nurses	Pathology, skeletal knowledge, normal movement, positioning upper limb/lower limb, gait, aids and appliances	Face-to-face lectures, videos, demonstrations, workshops/ group discussion	Didactic & Interactive	Physiotherapy lecturer and 3 senior physiotherapists	Multiple sessions, duration not specified (repeated)	Y

Author, Year	Who Received Education and Training	Content of Education and Training	Format of Delivery	Method of Delivery	Who Delivered Education and Training	Frequency and Duration	Barriers To Implementation Considered
Forster 2013	Mixed (Including Nurses, Doctors, Physiotherapists, Occupational therapists, Speech and language therapists)	14 core carer competencies	Face-to-face, lecture, training CD, manual/ workbook, workshops/ group discussions	Didactic & Interactive	Members of the MDT who were part of the study implementation team	Two, 1 day sessions	NS
Frendl 2009	Paramedics/ technicians	Stroke recognition and the use of the Cincinnati Pre-hospital Stroke Scale (CPSS)	Face-to-face, videos, workshops/ group discussion	Didactic & Interactive	NS	One, 1 hour session	NS

Author, Year	Who Received Education and Training	Content of Education and Training	Format of Delivery	Method of Delivery	Who Delivered Education and Training	Frequency and Duration	Barriers To Implementation Considered
Herr-Wilbert 2010	Nurses	Anatomy, physiology and pathology of the urinary tract, urinary incontinence (UI) and treatments, identifying risks and signs of UI	Manual/ workbook	NS	NS	NS	Y
Hohmann 2009	Pharmacists	Stroke, risk factors, symptoms, pharmaceutical care, secondary prevention	Face-to-face, workshop/ group discussion	NS	NS	Multiple sessions, duration not specified	NS
Jones 1998	Nurses, HCAs	Aetiology of stroke, factors influencing	Face-to-face, manual/ workbook	Didactic	Nursing lecturer	Two, 2 hour sessions (repeated)	N

Author, Year	Who Received Education and Training	Content of Education and Training	Format of Delivery	Method of Delivery	Who Delivered Education and Training	Frequency and Duration	Barriers To Implementation Considered
		recovery, MDT role in rehabilitation					
Jones 2005	Nurses, HCAs	Moving, handling, and positioning of patients	Face-to-face lectures, manual/ workbook, practical workshops/ group discussion	Didactic & Interactive	2 nursing lecturers	One, 1 day session plus two, 0.5 day sessions	NS
Kavanagh 2006	Mixed (Not Specified)	American Stroke Association (ASA) guidelines	Face-to-face, practical, feedback	Interactive	Nurse educators	NS	Y

Author, Year	Who Received Education and Training	Content of Education and Training	Format of Delivery	Method of Delivery	Who Delivered Education and Training	Frequency and Duration	Barriers To Implementation Considered
Middleton 2011	Nurses	Clinical treatment protocols for fever, sugar and swallowing	Face-to-face, lectures, training CD, protocol, practical, on-the-job support, workshops/ discussions	Didactic & Interactive	NS	Two sessions, duration not specified	Y
Morgenstern 2002	Mixed (Including Doctors, Primary care/GP)	Increasing awareness of stroke treatment protocols in the ED	Face-to-face, protocol, practical, feedback	Didactic & Interactive	NS	NS	Y

Author, Year	Who Received Education and Training	Content of Education and Training	Format of Delivery	Method of Delivery	Who Delivered Education and Training	Frequency and Duration	Barriers To Implementation Considered
Morgenstern 2003	Mixed (Including Doctors, Primary care/GP)	Increasing awareness of stroke treatment protocols in the ED	Face to face, protocol, practical, feedback	Didactic & Interactive	NS	NS	Y
Nikopoulou-Smyrni 2007	Mixed (Including Nurses, Doctors, Physiotherapists, Occupational therapists)	Clinical reasoning in the assessment of stroke	NS	NS	NS	NS	NS
Nir 2006	Nursing students	Chronic and rehabilitative care, communication,	Manual/ workbook, practical	NS	Member of study team	One, 2 hour session	NS

Author, Year	Who Received Education and Training	Content of Education and Training	Format of Delivery	Method of Delivery	Who Delivered Education and Training	Frequency and Duration	Barriers To Implementation Considered
		clinical nutrition, correct use of medication therapy.					
Smith 1999	Paramedics/ technicians	Stroke anatomy and physiology, stroke symptoms, National Institutes of Health Stroke Scale (NIHSS)	NS	NS	NS	One, 4 hour session	NS

Strasser 2008	Mixed (Including Nurses, Doctors, Physiotherapists, Occupational therapists, Speech and language therapists, Social workers	Team working, problem solving, and quality of care skills	Face-to-face workshop, written action plans, telephone and videoconferences.	Interactive	30 Team leaders (Physicians, Osteopaths, Nurses, Physiotherapists, Occupational therapists, Kinesiotherapists, Social workers, Speech and language therapists, Administrators)	One, 2.5 day session	NS
Watkins 2013	Dispatchers	Recognition of stroke, risk factors, stroke symptoms, stroke	On-line course	Didactic	EMS trainers trained to cascade the	One, 2 hour session	NS

Author, Year	Who Received Education and Training	Content of Education and Training	Format of Delivery	Method of Delivery	Who Delivered Education and Training	Frequency and Duration	Barriers To Implementation Considered
		mimics, effective communication with callers			programme on-line.		
Wojner-Alexandrov 2005	Mixed (Including Paramedics/ technicians)	Brain Attack Coalition (BAC) and American Stroke Association (ASA) guidelines, Los Angeles Pre-hospital Stroke Screen (LAPSS)	NS	NS	NS	NS	NS

Table 4: Type of staff participating and the number of studies in which they were included

Staff type	**Number of studies**	**Number of studies where staff group taught alone**
Mixed group	9[16, 19, 20, 21, 23, 26, 27, 29, 30]	n/a
Doctors	7[16, 19, 20, 21, 23, 26, 27]	0
Nurses (including Students & Health Care Assistants)	12[9, 12, 14, 15, 16, 18, 21, 22, 23, 25, 27, 31]	8[9, 12, 14, 15, 18, 22, 25, 31]
Physiotherapists	3[16, 21, 23]	0
Occupational Therapists	3[16, 21, 23]	0
Speech and Language Therapists	2[16, 23]	0
Pharmacists	1[17]	1[17]
Social work	1[23]	0
Primary Care		
Physicians/ General Practitioners	2[19, 20]	0
Paramedics/technicians	5[13, 26, 27, 28, 30]	2[13, 28]
Dispatchers	3[24, 26, 27]	1[24]

Highlights

- Education and training can improve outcomes for people who have experienced stroke
- Education and training should be interactive and multi-disciplinary
- Supporting protocols or guidelines are associated with a positive impact on outcome