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Educational Strategies for Secondary Stroke Prevention: An Integrative Literature Review

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ABSTRACT

Background: Stroke has the highest global burden of any neurological disease. Many studies investigate secondary stroke prevention strategies, but the outcomes remain poor, and the rates of recurrent stroke stay high.

Purpose: This review synthesizes the existing studies that focus on educational strategies for stroke survivors to reduce their risk of further stroke.

Methods: A systematic search of the literature was undertaken across PubMed, CINAHL Plus, PsycINFO and ERIC, for articles published from 2010 to 2020. The selected articles were critically appraised using tools from the Joanna Briggs Institute (JBI), before being thematically analyzed.

Results: A total of 20 studies were identified. Three main themes and sub-themes: 1) Focus (healthy behaviors, physical and psychological aspects, health literacy); 2) Types of intervention (program characteristics, structure and approach); 3) Future implications (positive values and challenges).

Discussions: Current programs are feasible and can have significant benefits on physical, psychological, and health literacy but are inadequate for improving smoking cessation, alcohol consumption and weight control behaviors.

Translation to Health Education Practice: How to reinforce healthy behaviors remains an issues to resolve. Understanding the stroke survivor's health literacy, the utilization of technology may offer the benefits of making education easily tailored to the individual's needs.

Background

Every year 15 million people worldwide experience stroke, more than one third die and another five million are left permanently disabled based on a systematic analysis from the current Global Burden of Disease study.[1] A quarter of these strokes are recurrent and this number has not changed over the last decade.[2] This places stroke as the highest global burden of neurological disease and indicates that implementing successful preventive strategies is still sub-optimal. Without significant changes in stroke prevention practices, the prevalence and costs of stroke care are anticipated to increase steadily.[3]

Stroke places a burden on the patient, their family and the community. Stroke survivors have different limitations and conditions than patients with no stroke history because stroke survivors frequently require ongoing rehabilitation and support from caregivers, which can result in among other things, loss of earnings.[4] In addition, stroke survivors and their caregivers are expected to manage more complex health care issues at home, adjust to a new life and handle the health and social care system.[4–6] This can make them more susceptible to worse outcomes and at higher risk of complications.[5]

Purpose

Despite many studies investigating secondary prevention strategies for stroke survivors, outcomes remain poor and rates of secondary stroke remain high. Many stroke survivors do not modify their health behaviors after stroke and it has been reported that appropriate medication adherence is difficult for many patients to achieve.[7] Thus, the purpose of this review was to explore the existing studies available that focus on educational strategies for patients with a focus on behavior modification after stroke in order to reduce their risk of secondary stroke.

Methods

A comprehensive and systematic search of the literature was undertaken across four databases: PubMed, Cumulative Index of Nursing and Allied Health (CINAHL) Plus, PsycINFO and ERIC for articles published from 2010 to 2020 using keywords and phrases related to secondary or recurrent stroke prevention education for patients and their family and/or caregivers as search terms. The search terms were combined using the Boolean logical operators AND/OR. Also, to strengthen the search strategy, truncation (*) was used.[8] The search terms used and how they were combined are summarized in Table 1. In addition, hand-searching for relevant articles using the reference lists of key articles was undertaken.

The initial search identified 2126 relevant primary resources; of these 2078 were duplicates and 1527 did not meet the inclusion criteria. The inclusion criteria were that articles must consider secondary stroke prevention with a focus on the patient and/or family/caregiver, have an education focus and be written in English. A further 514 full-text articles were excluded after reviewing the title and abstracts leaving 37 articles

Table 1. Search terms (* denotes truncation).

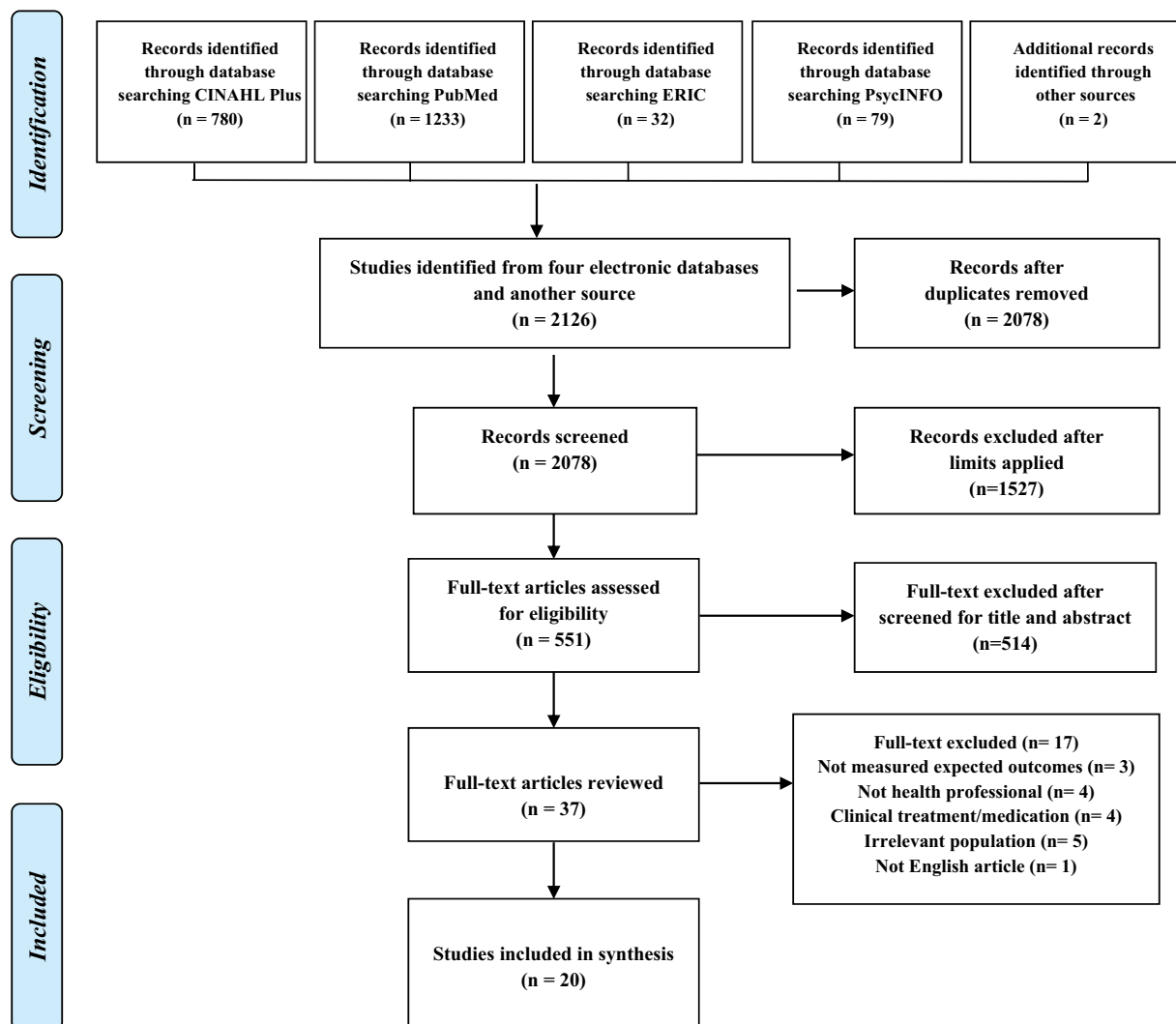| Secondary stroke prevention		Educational intervention		Person
stroke prevention	AND	educat*	AND	patient
OR		OR		OR
prevention of stroke		Information		person
OR		OR		OR
secondary stroke		education* program*		family
OR		OR		OR
recurrent stroke		Awareness		carer
				OR
				Caregiver
				OR
				Survivor

Figure 1. PRISMA Flow diagram of literature search process and study selection.

remaining. After reviewing the full text 17 articles were excluded due to not meeting the inclusion criteria, resulting in 20 full-text articles for this integrative literature review. Details of the literature search process are summarized in the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) flowchart (Figure 1).[9]

These 20 articles were then critically appraised using the Joanna Briggs Institute (JBI) checklists, one of the recognized evidence-based practice tools that support assessment of the quality of the methodology, the risk of bias, conduct of the research and analysis.[10] A summary of the 20 articles, with each JBI score is provided in Table 2. Of the 20 studies included in this review, 11 were randomized controlled trials (RCT),[11–21] four were one group pre-post studies[25,27,29,30] and six studies were non-randomized controlled intervention studies.[22–24,26,28] Overall, the quality of evidence from the RCT studies were rated higher than non-RCT and all studies scored medium to high rates; therefore none were excluded on the basis of quality.

Thematic analysis was conducted using the steps described by Braun and Clark.[31] The first step was reading and re-reading the chosen articles and noting key points. Then coding was applied to generate a potential theme. The initial themes were reviewed across all articles and refined until the final themes were decided. All final themes and sub themes, with their associated definitions, can be seen in Table 3.

Results

This integrative literature review exploring secondary stroke prevention education strategies for stroke survivors and their caregivers identified 20 studies that spanned ten years, from 2010 to 2020. The studies were conducted across five continents with six studies from North America,[18,19,25,27,28,30] five studies each from Asia and Australia[11,15,20,21,26] and two each from Europe[17,22] and Africa.[13,16] Most of the studies (90%; n = 18) were conducted using quantitative methods, while 10% (n = 2) used a mixed methods design.[24,28]

Thematic analysis identified three main themes, each with associated sub-themes (Table 3). The main themes were the focus of secondary stroke prevention, types of interventions, and future impact, and these are described fully below. Although these themes are presented separately, they are involved in a progressive interconnection, which starts with a problem-based focus, types of educational interventions to manage the problem, and the impact of educational interventions.

Theme 1: Intervention focus

All reviewed studies identified a specific focus for secondary stroke prevention. Three sub-themes were evident. First, healthy behaviors to promote health and well-being.[11–14,16,17,19,20,24,26,27,29,30,30] Second, educational interventions regarding physical[11,14–17,19,22,25,26] and psychological aspects of health.[13,15,18,22,25,26,29] Lastly, health literacy[12,18,21–27] and secondary stroke prevention awareness.[20,23,25–27]

Healthy behaviors

Healthy behaviors were the most dominant focus of secondary stroke prevention education and these behaviors aimed to maintain and improve the health and well-being of the stroke survivor. Specific behaviors were concerned with modifiable stroke risk factors such as blood pressure/hypertension management, medication adherence, smoking habits, diet or eating habits, alcohol consumption, body size and weight control, physical activity, self-management skills, medical check-ups, sense of control, and preventing hospital readmission.[11–14,16,17,19,20,24,26–30] Twelve studies discussed healthy behavior management but only eight studies reported significant outcomes, and these were for medication adherence,[11,17,26,28,30] exercise,[20,23] hypertension management,[28] diet related to fruit and vegetable consumption,[20] salt intake, fat and fiber intake,[24] self-management behaviors,[27] sense of control,[20] and preventing hospital readmission.[30]

Physiological and psychological aspects

Physiological and psychological aspects were also considered an essential focus and critical indicators of secondary stroke risk. Physiological indicators included management of activities of daily living (ADL), cardio-metabolic values such as blood pressure, body mass index (BMI), blood glucose, kidney function, and blood lipid levels.[11,14–17,19,22,25,26] Additionally, psychological indicators were identified related to anxiety and depression, satisfaction and quality of life of the stroke survivor and their caregiver/family.[13,15,18,22,24,25,29,30] Eighteen of 20 reviewed studies indicated physiological and psychological aspects as being important to include for secondary stroke prevention education. Deng (2020) was the only study which reported the effectiveness of the educational intervention on physiological health noting a Modified Barthel Index (MBI) ($p = .017$)[15] and psychological health with quality of life ($p = .002$). Other physiological indicators that significantly improved after the program were systolic blood

Table 2. Summary of articles reviewed.

No	Program, Author, year [ref], country	Type of study, Study design details and Study population	Duration, setting	Outcomes assessed	Relevant findings	JBI Score
1	Goal-setting telephone Follow-up, Wan et al., 2016,[11] China.	RCT: multicentre, assessor-blinded, parallel group. Pre-discharge education & 3 goal-setting follow-up. Ischemic stroke patients, intervention (n = 40), control (n = 40) onset ≤ 1 month), age>35; modified Ranking Scale (mRS) Score 0–3. Mean age 60.24 & 59.07 for 23 females & 57 males respectively.	6 months, hospital, home	Health behavior scale score (HPLP II), mRS score.	Significant medication adherence (p = .025). No significant differences in physical activity, nutrition, low-salt diet adherence, blood pressure monitoring, smoking abstinence, unhealthy use of alcohol, and mRS score.	13/13 (High)
2	Brief educational intervention, Eames, S., Hoffmann, T. C., & Phillips, N. F., 2014,[12] Australia.	RCT: multisite, parallel group. Brief educational intervention 3 times before (face-to-face) and 3 times in the 3 months after discharge (telephone). TIA/stroke, intervention (n = 40); control (n = 37). Mean age 64.1 & 57 for 36 females and 41 males.	3 months, hospital, home	Stroke patient's recall and recognition of risk factors. stage of change for stroke-risk related behaviors.	No significant differences in risk factor awareness and behavior change.	12/13 (High)
3	Enhanced secondary prevention, Gillham, S., & Endacott, R., 2010[13] UK.	RCT: single-blind. Patients with first minor stroke/TIA, received enhanced secondary prevention (additional advice, motivational interviewing and telephone support). Intervention (n = 26); control (n = 26). Mean age 68.3 for 15 women & 37 men.	3 months, hospital, home	Readiness to change health behavior, exercise frequency, fruit and vegetable consumption, hospital anxiety and depression scale, alcohol consumption and smoking behavior.	Statistically significant on exercise frequency (p = .007), fruit and vegetable consumption (p = .003). No difference in readiness to change behavior, hospital anxiety and depression, alcohol consumption and smoking status	7/13 (Medium)
4	Community-based intervention, Olaiya et al., 2017,[14] Australia.	RCT: parallel group. Evidence-based care plan and 3 education sessions. TIA/ Stroke patient (aged>18), intervention (n = 283), control (n = 280). Median age 70.1 years; men (65%).	18 months, home	Cardiometabolic target values: Blood pressure (BP), systolic blood pressure (SBP), Diastolic blood pressure (DBP), lipids (total cholesterol, HDL, LDL), smoking, body weight (BMI, waist circumference), blood glucose (HbA1c), kidney function (creatinine, protein excretion).	No significant difference in all cardiometabolic values.	13/13 (High)
5	Integrated transitional care, Deng, A., Yang, S., & Xiong, R., 2020,[15] China.	Pilot RCT with blinded assessment. Stroke unit-based treatment (acute medical treatment, early rehabilitation and health education) continued with ongoing rehabilitation at home by multidisciplinary team. Patient with acute cerebral hemorrhage or cerebral infarction. Intervention (n = 49), control (n = 49) mean age (61.4 ± 18.3) for 36 females and 62 males.	2 months, hospital, home	Short-Form Health Survey-36, Modified Barthel index and Caregiver Strain Index.	Statistically significant in quality of life (p = .002) and MBI (p = .017) and Caregiver Strain Index significant at 8 weeks (p = .008).	13/13 (High)
6	Telephone follow-up, Adie, K., & James, M. A., 2010,[16] UK.	RCT. Telephone follow-up intervention used a 20 minute counseling session at 7–10 days, 1, 2, and 4 months. Stroke patient (1st stroke ≤ 1 month), aged>18 years, intervention (n = 29), control (n = 27). Mean age was 72.5 years (54–90 years); female (54%).	6 months, home	SBP, number of BP meds, total cholesterol, mRS, HRQL, exercise, smoking status, medication knowledge.	No significant difference in SBP. Total cholesterol significantly lower (p < .001).	8/13 (Medium))
7	Motivational interviewing, Byers, A. M., Lamanna, L., & Rosenberg, A., 2010,[17] USA.	RCT. Used verbal and written stroke education protocol with motivational interviewing. Ischemic stroke/TIA (age 18 to 90 years), NIHSS 15 or less, MMSE score of 20 or above, mean age 58. Intervention (n = 5), control (n = 8); 6 females and 7 males.	1 month, hospital, home	Stroke Knowledge Test (SKT), patient satisfaction.	Improve Stroke Knowledge Test scores intervention vs control (95%: 73%) and better patient satisfaction (5 3.5).	9/13 (Medium)

(Continued)

Table 2. (Continued).

No	Program, Author, year [ref], country	Type of study, Study design details and Study population	Duration, setting	Outcomes assessed	Relevant findings	JBI Score
8	PINGS (Phone-Based Intervention Under Nurse Guidance After Stroke), Sarfo et al., 2018,[18] Ghana.	Pilot 2-arm cluster RCT. Stroke patient <1 month and uncontrolled hypertension (SBP ≥140 mmHg), intervention (n = 30), control (n = 30) received a Blue-toothed UA-767 Plus BT BP Device and smartphone for monitoring and reporting BP and medication intake. Aged>18 years old, mean age 55 ± 13; 21 females and 39 males.	3 months, home	SBP, medication adherence, hypertension management competence, autonomous self-regulation.	Significant in medication possession rate ($p = .03$), self-autonomous regulation ($p < .0001$). No significant difference on SBP, hypertension management competence.	13/13 (High)
9	DESERVE (Discharge Educational Strategy for Reduction of Vascular events), Boden-Albala et al., 2019,[19] USA.	RCT. DESERVE using educational PowerPoint (ppt), motivational video &workbook by discharge; follow-up calls at 72 hours, 1 month and 3 months and follow up (in person visit at 6 and 12 months with check of BP, HbA1c & anthropometric data). White, black and Hispanic adults with mild/ moderate stroke/TIA, intervention (n = 237), control (n = 241), mean age 64.61; 281 women (51%).	1 year, hospital, home	SBP reduction.	No significant difference in SBP reduction at 12 months post discharge	13/13 (High)
10	A Web-based stroke education program, Kim, J. I., Lee, S., & Kim, J. H., 2013,[20] Korea.	Pilot RCT. Web-based stroke education program provided weekly for 9 weeks; 3 topics: understanding of stroke, recurrence prevention and family life Plus 15–20 mins video lectures, automatic feedback, e-mail service & links to website. Ischemic stroke patients within 12 months post stroke, normal cognitive function, mean age 66, intervention (n = 18), mean age 63.9, control (n = 18), mean age 67.4 for 23 males and 13 females.	3 months, home	Lipid profile (triglyceride and total cholesterol levels), health behaviors, sense of control (the Mastery Scale), The Health Motivation Scale, Care Giving Mastery Scale, & feasibility of the programme.	Significant differences on regular exercise ($p = .005$), diet ($p = .038$), fruit & vegetable consumption ($p = .018$) sense of control ($p = .003$), health motivation ($p < .001$) and caregiver mastery ($p < .001$). No significant difference for Triglyceride ($p = .282$) or cholesterol ($p = .646$). No changes in cigarette smoking ($p = .546$), alcohol consumption ($p = .546$) and medication adherence ($p = .089$).	10/13 (Medium)
11	SHEMA (Stroke Health-Education Mobile App), Kang et al., 2019,[21] Taiwan.	Single blind RCT. Using 12 health-education topics via SHEMA for 7–14 days and five minutes/day. Inclusion: ability to communicate, MMSE ≥ 24, use of a smartphone with experience using apps. First stroke, intervention (n = 30), control (n = 33). Mean age 47.9, for 23 females and 43 males.	1 month, home	Stroke knowledge, HRQOL	No significant difference in stroke knowledge ($p = .51$) and quality of life: EQ-5D Index ($p = .14$), EQ-5D VAS ($p = .71$).	13/13 (High)
12	Cognitive Rehabilitation, Abd-Elaziz, S., Khedr, E. M., Ahmed, H. A. E., & Ibrahim, H. D. F., 2015,[22] Egypt.	Non RCT, Quasi- experimental. Five practical and three health education sessions. Elderly patients (≥ 60), stroke (≥ 3 months), mild to moderate dementia. Intervention (n = 35), mean age 64.22, control (n = 35), mean age 65.14, 38 females and 32 males.	1 month, hospital	MMSE, Barthel Index scale, Logical memory, Digit span, Geriatric Depression scale	Significant difference on MMSE ($p = .000$), Barthel Index ($p = .000$), Logical memory ($p = .000$), Digit span ($p = .000$).	8/9 (High)
13	SASS (Stay Active and Stop Stroke), Gill, L., & Sullivan, K. A., 2011,[23] Australia.	Non RCT, mix method study with three 1-hour facilitator-led sessions/week over 3 consecutive weeks. First stroke survivor from 4 metropolitan stroke support groups, intervention (n = 14), mean age 60.21, control (n = 8), mean age 67.75. 11 females and 11 males.	3 weeks, home	Health belief and intention to exercise	Significant for two beliefs: susceptibility ($p = .005$) and self-efficacy ($p = .046$). No significant impact exercise intention ($p = .37$), readiness ($p = .105$), intention to exercise ($p = .37$)	9/9 (High)

(Continued)

Table 2. (Continued).

No	Program, Author, year [ref], country	Type of study, Study design details and Study population	Duration, setting	Outcomes assessed	Relevant findings	JBI Score
14	Masterstroke, White, J. H., Bynon, B. L., Marquez, L., Sweetapple, A., & Pollack, M., 2013,[24] Australia.	Non RCT, mixed method study. Master stroke program over nine week period with two 2-hr sessions weekly (1 hour for education, 1 hour for exercise). Chronic stroke survivors (n = 21). Mean age = 65.71 ± 11.01 (46– 85), 16 males and 5 females.	9 weeks, community	Timed Up and Go (TUG), Six Minute Walk Test (6MWT), Fat and Fiber Barometer, The Stroke and Aphasia Quality of Life Scale (SaQoL-39), salt intake and stroke knowledge. Patient perception	Significant in stroke knowledge ($p = .00$), TUG ($p = .00$), salt intake ($p = .01$), fat & fiber barometer ($p = .02$) and quality of life (QoL) ($p = .01$). Not significant in 6MWT ($p = .08$), HR ($p = .59$), waist circumference ($p = .73$).	8/9 (High)
15	Home-based Telerehabilitation, Dodaklan et al., 2017,[25] USA.	Non RCT. Home-based tele-rehabilitation: two 2-hr sessions daily (1 hour for exercise, games, education and 1 hour free play). Chronic hemiparetic stroke (3 to 24 months poststroke, stable arm motor deficits (n = 12), mean age 54 ± 17 for 6 males and 6 females.	28 days, home	Patient compliance, arm motor gain (FM Fugl-Meyer Score),	Excellent compliance (97.9%), significant gain in arm motor status ($p = .0015$), increase stroke prevention knowledge ($p = .007$).	8/9 (High)
16	Smartphone-based management, Kim et al., 2020,[26] Korea.	Prospective non randomized single- arm study. Smartphone-based management: BP measurement twice/day, Blood glucose and physical activity, stroke education program, exercise, medication management, and patient feedback. Ischemic & hemorrhagic stroke patient > 19 years, able to use smartphone (n = 99). Mean age 57.9 ± 10.8, 60 males and 39 females.	12 weeks, home	SBP, DBP, BMI, Waist circumference, system utilization and satisfaction, stroke awareness, depression, and health-related quality of life	Significant in stroke awareness ($p < .001$), Beck Depression Inventory- II (BDI), ($p < .001$), SBP and DBP ($p < .001$) without anti-hypertensive change; medication adherence ($p < .001$), no significant change in waist circumference, BMI or EuroQol-5 Dimensions (EQ-5D).	8/9 (High)
17	V-STOP (Videoconferencing for a programme of self-management to prevent stroke), Anderson, J., Godwin, K. M., Petersen, N. J., Willson, P., & Kent, T. A., 2013,[27] USA.	A pilot Non RCT. Six weekly session of self-management, classes and clinic via videoconferencing (30–60 min) with 1–2 telephone counseling at community based outpatient clinic. Veterans with a history of stroke and multiple risk factors of stroke, who have access to a telephone (n = 37), mean age 61. 36 males and 1 female.	6 weeks, clinic	Stroke risk knowledge, Self-management behavior, Self-efficacy and Quality of life	Significant in stroke-risk knowledge ($p < .001$), stroke-risk score ($p = .04$), Self-management behavior (cognitive symptoms management ($p < .01$), communication with health care providers ($p < .01$). Attendance (87%), satisfaction (4.7/5). No significant in self efficacy and quality of life.	8/9 (High)
18	Nurse Case Management (NCM), Ireland, S., MacKenzie, M., Gould, L., Dassinger, D., Koper, A., & LeBlanc, K., 2010,[28] USA.	A pilot prospective cohort mixed method study at a stroke prevention clinic. NCM: with monthly telephone call, additional clinic visits & two-hour stroke prevention class. Probable TIA/Stroke, Hypertension, MMSE <26, low self-efficacy (score<7) or pharmacist reported non-adherence to specific medication. Population (n = 20), mean age 67.5 (32–87), males (60%).	6 months, clinic	Medication knowledge gaps, gaps in transition of care communication, healthy lifestyle changes, hypertension management, medication self-efficacy & medication adherence.	Significantly improved on hypertension management SBP ($p = .000$), DBP ($p = .000$), medication self-efficacy ($p = .04$), and medication adherence ($p = .003$).	10/11 (High)
19	Web-based P2S (Prevent 2nd Stroke), Denham, A. M. J., Halpin, S., Twyman, L., Guillaumier, A., & Bonevski, B. 2018,[29] Australia.	Non-RCT study. Pre-post intervention, no control group. Flexible, two-week online secondary prevention program. Stroke or TIA (≥ 6 months), for people who can use the internet (n = 19), mean age 68.89 (41–88), 12 males and 7 females.	2 weeks, home	Usability and acceptability of an online secondary prevention program.	P2S is acceptable (73.7%) and usable (63.1%), recommend the program to other stroke survivors (63.1%).	8/9 (High)
20	STARS (Steps Against Recurrent Stroke Plus), Bretz et al., 2014,[30] USA.	A pilot non RCT. STARS: supportive telephone calls, scheduled delivery of educational materials and contact by healthcare provider. Outcomes evaluated at 30, 90, 180, and 365 days. Ischemic stroke patients (n = 93), mean age 63.18 (24–92). 111 were men and 82 were women.	1 year, hospital, home	Health related outcome SF-12 (Short-Form Health Survey), hospital readmission	Reduction in hospitalization, increased medication adherence, strong patient satisfaction	8/9 (High)

Table 3. Themes and sub-themes with definitions.

No	Themes and definitions	Sub-themes and definitions
1	Intervention focus Focus on aspects of secondary stroke prevention.	• Health behaviors: Actions and activities related to recurrent stroke prevention and improving health and wellbeing. • Physical and physiological aspects related to secondary stroke risk factors. • Health literacy: Stroke survivor's cognitive capacity and awareness of secondary stroke prevention.
2	Types of intervention Description of planned and structured interventions identifying design and techniques to reach specific goals.	• Programme characteristics: Different types and methods of secondary stroke prevention interventions. • Structure and approach: Details about delivering the intervention includes the technology utilization.
3	Future implication Priority aspects for successful secondary stroke prevention education.	• Positive values: current significant secondary stroke prevention outcomes • Challenges: Identified issues and problems that might influence secondary stroke prevention outcomes.

pressure (SBP) and diastolic blood pressure (DBP),[26,28] total cholesterol level,[16] arm motor status[25] and MBI.[22] Psychological indicators noted were depression,[26] quality of life[15,24] and patient satisfaction.[18,29,30] None of the reviewed studies reported significant outcomes of secondary stroke prevention programmes on BMI, blood glucose or kidney function.

Health literacy

Health literacy was identified as a sub-theme for healthy behaviors for secondary stroke prevention noted by more than half of the reviewed studies.[12,18,20,21,23–29] Health literacy specifically related to knowledge and awareness of stroke risk factors and prevention.[12,18,21,23,27] Furthermore, health literacy was linked to action that might be taken by the stroke survivor. For example, health motivation/fighting spirit/immediate action, health beliefs and self-efficacy.[20,23,25–28] From 11 studies, nine reported significant improvement on knowledge,[18,22,24,25] awareness,[26] motivation,[20,29] health beliefs,[23] and self-efficacy[20,23,25–28] following the secondary stroke educational programme.

Theme 2: Types of intervention

The literature on secondary stroke prevention education indicated that active participation by the stroke survivor, with their caregiver/family was essential. Those programmes that were well-planned and structured to assist the stroke survivor and their caregivers reach their specific goals were beneficial and showed positive outcomes. Findings from all studies indicated two sub-themes: The programme's characteristics, such as the type and method of secondary stroke prevention interventions[11–17,19,20,23–30] and the structure and approach, including technology utilization.[11–21,23–30]

Programme characteristics

Nine out of the 20 reviewed articles used an abbreviation or acronym to describe their specific intervention. Examples include the Shared Team Approach between Nurse and Doctors for improved Risk Factor Management (STAND FIRM),[14] Phone-based Intervention Under Nurse Guidance After Stroke (PINGS),[17] Discharge Educational Strategy for Reduction of Vascular Events (DESERVE),[19] Stroke Health Education Mobile Apps (SHEMA),[21] Educational brochure plus activities designed to enhance beliefs about stroke (Enhanced),[23] Video-conferencing for a programme of self-management to prevent stroke (V-STOP),[27] Nurse Case Management (NCM),[28] Prevent 2nd Stroke (P2S)[29] and Steps Against Recurrent Stroke (STARS).[26]

Fifteen articles (75%) described the advantages of technology, either for digital monitoring using smartphones, Bluetooth sphygmomanometer, home blood pressure monitoring,[17,24,26] or using information and communication devices when delivering or supporting educational interventions (such as telephone follow-up, periodic phone calls, telephone-based counseling, web-based and telephone interviews, the use of a stroke health-education mobile app, e-booklet, video conferencing, e-mail, web and smart phone-based communication.[11–16,19–21,27–30] But those studies were not superior compared to the other five studies using a more traditional educational approach. Interventions using direct contact showed significant outcomes as well. However, the studies were conducted about five to ten years ago, when technology may have been less commonly used.[17,22–24,28]

Structure and approach

The structure of secondary stroke programmes were similar. For example, the type of education session (whether it was a theory or practical session)[12–14,18,20–27,29,30] where

the intervention was conducted (hospital, home or both),[20–22,24,27,28] when the implementation was delivered (before discharge),[12,19] at the time of discharge[18–20] or after discharge,[11–15,19] who was involved in the programme delivery (one person or using a joint multidisciplinary team approach)[14,15,18,19,24,28] and frequency and length of time the intervention was implemented, evaluated and followed-up (several times, daily, weekly, over multiple weeks, monthly, bimonthly, three-monthly, quarterly, every six months, and annually).[11,13,15–23,25–30] Nonetheless, the outcomes of different types of educational interventions were not determined by the frequency or length of the intervention. A short intervention period (14 days),[25] (28 days),[17] 1 month[30] or a longer intervention (1 year)[21] all showed positive and significant outcomes. In contrast, one study where the intervention ran for one and a half years[21] and another for one month did not show significant outcomes.[11]

How the programmes were conducted also varied, ranging from direct contact (using face-to-face consultation, a home visit, clinic visit or focus group discussion)[11–16,20,23–25,27–30] or indirect contact using a device and media (for example text messaging, smartphone use, telephone follow-up mobile app or telehealth).[11–17,19,20,25–30] Additionally, there were programmes that used a combination of both direct and indirect contact.[11–16,20,25,27–30] According to the reviewed articles, it does not matter how the program is delivered, as direct, indirect or mixed programmes produced similar outcomes. For direct contact, stroke survivors reported a key benefit related to attending a stroke specific program with other stroke survivors as this provided an opportunity to compare themselves to other group members.[20] Moreover, there were benefits reported by the participants, with nearly 100% patient satisfaction.[26] It was also found that 73% of stroke survivors were interested in online programs and 63% reported the programme was easy to use and they would recommend it to other stroke survivors.[25]

Theme 3: Future implications

While most of the studies highlighted the benefits and challenges for a successful secondary stroke prevention intervention implications for continuing or improving the programmes were also shared. Many positive elements were found among the secondary stroke prevention programmes.[11–13,15,19,20,22–28] However, some issues and problems were observed which might influence secondary stroke prevention outcomes that should be addressed.[14,19,21]

Positive values

Most of the studies reported the benefits of the programs for stroke survivor's outcomes, such as improved stroke prevention knowledge[12,18,24,25,27] patient satisfaction[18,26,27,29,30] improved patient's quality of life,[15,24] greater medication adherence,[11,26,28,30] reduced hospital readmissions[26,30] and improved healthy behaviors, such as better hypertension management,[17,28] taking regular exercise[13,20,24] and improved diet.[13,16,20] In particular, 11 of the 20 studies reported significant outcomes for specific interventions. These included the Chinese study with 98 rurally based participants who received an integrated transitional care program,[15] the use of motivational interviewing,[17] Phone-based Interventions under Nurse Guidance after Stroke (PINGS),[18] cognitive rehabilitation,[22] the Master Stroke program,[24] home-based tele-rehabilitation,[25] smartphone-based management,[26] Video conferencing for a programme of Self-management TO Prevent stroke (V-STOP),[27] Nurse Case Management (NCM),[28] Prevent 2nd Stroke (P2S)[29] and the Steps Against Recurrent Stroke (STARS) intervention.[30] These studies used different approaches suggesting that no specific intervention can claim to be the most effective.

Challenges

The studies reviewed reported challenges that need to be considered to improve any future secondary stroke prevention programmes. For example, one study reported internal factors related to the individual's stage of change and personal barriers and facilitators to change[12] and the stroke survivors' uptake of behavioural/lifestyle interventions.[14] External factors were also identified and these were wider issues, such as difficulties implementing evidence-based recommendations,[21] the discharge planning setting,[18] the length of the intervention,[29] Internet connection issues in isolated areas,[17] how to best apply culturally tailored, skills-based education[19] and a lack of cost-effective analysis.[15]

Discussion

This integrative literature review identified a number of secondary stroke prevention education strategies for stroke survivors and their caregivers. Even though the studies had a similar focus on education, looking at healthy behaviors, physiological and psychological manifestations and stroke health literacy, none of the studies reported significant outcomes for all three foci. Maintaining healthy behaviors was the most challenging

aspect for stroke survivors. Residual challenging behaviors that were not resolved by any of the secondary stroke prevention education programs were alcohol consumption, smoking habits,[11,20] poor weight control with larger waist circumference and higher BMI.[14,26] This difficulty is reflected in the wider literature where studies have shown that stroke survivors have problems improving their healthy habits, even after a stroke[32,33] and may engage in poorer health behaviors.[34] For example, a study in the United Kingdom in 2000 reported that 22% of stroke survivors still smoked cigarettes, 36% were obese and 4% still drank excessive amounts of alcohol.[35] As more than 90% of the stroke burden is linked to modifiable risk factors the global burden of stroke will never be reduced until more effective interventions are available.[36]

Recent studies indicated that unhealthy behavior is negatively associated with lower health literacy.[37–39] Individuals who score lower on health literacy report much more difficulty managing their condition.[40] In order to help stroke survivors better manage their health, it is essential to enhance their health literacy through secondary stroke prevention education. Studies reveal that health literacy is an influential factor in controlling blood pressure,[40,41] risk factors, complications, treatment and lifestyle modification.[40,42] A 2018 US study highlights that health literacy is a very potential focus for maintaining healthy behaviors, particularly for those with chronic conditions.[43]

The findings from this literature review demonstrate that stroke prevention education has been conducted in different ways ranging from more traditional face-to-face health education, for example during discharge planning in hospital, to health education provided using technology that allows the stroke survivor and their family/caregiver to connect with their health care providers. Both approaches signal promising results as 90% of reviewed studies reported positive outcomes. For example, medication adherence significantly improved following telephone/smartphone follow-up[11,17,28,30] and health education was found to increase stroke prevention knowledge.[18,24,25,27]

On the other hand, poor health behaviors remain a serious concern particularly related to lack of physical activity, poor nutrition, maintaining a low-salt diet, lack of blood pressure monitoring, smoking cessation and excessive alcohol use.[11,17] Literature suggests that specific lifestyle behaviors may need more skills-based interventions than theoretical sessions.[44] One of the skills-based interventions which can be provided via a telephone or the internet is life style coaching, which has been found effective in cardiovascular disease reduction.[45]

While the search strategy to identify literature spanned four databases a relatively small number of articles were found, despite the importance of secondary stroke prevention. Additionally, most of studies had a small number of participants, so the validity and reliability of the outcomes could be impaired. Also, comparison between studies was difficult as each study measured different outcomes. While some studies focused on only one outcome, others investigated multiple outcomes. The characteristics of each intervention also differed, further contributing to making comparison difficult. A large, multi-center site study would address this issue.

Translation to Health Education Practice

Current secondary stroke prevention programmes are inadequate as many do not result in significant change in modifiable stroke risk factors. Future strategies in this area could concentrate on comprehensive lifestyle intervention, particularly on chronic diseases.[46] Specifically, the National Commission for Health Education Credentialing Inc. (www.nchec.org) responsibilities and competencies as outlined within the Health Education Specialist Practice Analysis II 2020 (HESPA II 2020) Competencies and Sub-Competencies.[47] The relevant aspects of these responsibilities and competencies are identified and described as follows:

Area I: Assessment of needs and capacity

Identify existing and available resources, policies, programs, practices, and interventions within each country. Each country has their own resources and strengths, which is shown in the report about major inequalities in acute stroke treatment between and within European countries.[48] A Certified Health Education Specialist (CHES) should consider mapping the strengths and weaknesses of their current secondary stroke prevention program and where improvements can be made.

1.3.1 Determine the health status of the priority population(s): Accurate information about stroke survivor's health status is needed to inform health educationalists about the major problems experienced by stroke survivors to give clues and direction to identify the most appropriate secondary stroke prevention education. It can be useful to differentiate between stroke survivors based on their current health status. For example, consideration of the presence of one or more vascular risk factors.[49]

13.2 Determine the knowledge, attitudes, beliefs, skills and behaviors that impact the health and health literacy of priority populations. The health status and

health literacy of stroke patients can be influenced by their knowledge, attitudes, beliefs, skills and behavior, but it is then important to identify which aspects need and can be improved so that any stroke education will be optimal. Sanders et al. (2014) suggest that inadequate health literacy lowers the stroke survivor's capacity to retain contents taught in stroke education programs, which impacts their ability to maintain their health and therefore prevent recurrent strokes.[50]

13.3 Identify the social, cultural, economic, political, and environmental factors that impact the health and/or learning processes of the priority population(s): Understanding the stroke survivors community is essential to determine whether the system they live in is already adequate enough or where further strengthening is needed. Folet et al. found that perceived social support can predict social participation in individuals living in the community 6 months or greater post-stroke.[51]

13.6 List the needs of the priority population(s): Stroke survivors have different needs. By considering their needs, health educators can facilitate stroke survivors and caregivers to choose the appropriate secondary stroke prevention program for the individual.

Area II: Planning

2.3.1 Select planning model(s) for health education and promotion: Many different options of secondary stroke prevention education are available for stroke survivors and their caregivers. CHES should encourage stroke survivors and caregivers to choose the most relevant program to meet their needs, expectations and be culturally and linguistically compatible.[52]

23.2 Create a logic model: Ongoing development and refinement of existing models of care for stroke survivors and caregivers based on their needs and capacity assessment is needed. This will help CHES to identify any changes needed to the program to enhance desired outcomes.

Area III: Implementation

3.1.2 Arrange for implementation services: CHES are recommended to involve stroke survivors and caregivers in any implementation of secondary stroke prevention program. Awareness of a program will engage stroke survivors and caregivers allowing them to participate more fully. Collaboration between stroke survivors, caregivers, healthcare providers, health services, and existing community stroke support structures has been found to lead to an empowerment approach for stroke rehabilitation.[53]

32.4 Deliver health education and promotion as designed: Consistency in stroke rehabilitation is important. By conduct the health education program as designed. CHES would be a good role model to build this consistency among stroke survivors and caregivers.

Area IV: Evaluation and research

4.1.1 Any program needs an evaluation plan that aligns with the intervention goals and objectives: CHES use particular intervention goals and objectives in their evaluation plan because stroke survivors and their caregivers will have different goals, needs and capacity. The evaluation period can also be adjusted as needed.

Area V: Advocacy

5.4.2 It is important to use the results of the evaluation to inform future steps: CHES may give advice for further developments based on the results of the evaluation. This can also be an opportunity to explore potential barriers and facilitators for stroke survivors and caregivers and this information can be used in planning particularly about the focus of interventions, type of interventions and future options.

Area VI: Communication

6.1.2 Identify the assets, needs, and characteristics of the audience(s) that affect communication and message design (e.g. literacy levels language, culture, and cognitive and perceptual abilities). Most of individuals who have had a stroke present with some degree of residual cognitive and/or perceptual impairment.[54] Therefore it is recommended that CHES use appropriate communication methods and design specific resources for stroke patients.

6.4.2 Select communication channels, including current and emerging technologies that are most appropriate for the audience(s) and message(s). CHES together with stroke survivors and caregivers should decide the most preferred, available and effective media for communication.

Area VII: Leadership and management

7.2.1 Develop culturally responsive content. Each country may have a different culture/s, healthcare system and approaches. It is therefore important that CHES pay attention to culture and norms before content development and finalizing a program.[55]

Area VIII: Ethics and professionalism

8.1.5 Use evidence-informed theories, models, and strategies: CHES can adopt appropriate secondary stroke prevention programs based on evidence-informed theories, model and strategies that have been evaluated and tested. Clarke and Foster consider that stroke team members adopt a consistent and evidence-based approach to rehabilitation practices.[56]

In summary, the findings of this integrative literature review demonstrate there are various stroke prevention education strategies and programs in use internationally. These programs are feasible and have significant benefits on physical and psychological well being, and health literacy but are inadequate for some health behaviors such as smoking cessation, reducing alcohol consumption and BP control. It implies that health behaviors are critical issues to resolve for successful secondary stroke prevention education and rehabilitation in the future. The HESPA II 2020 Competencies and Sub-Competencies provide a useful tool to consider how to develop and improve stroke prevention education strategies.

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