Education in stroke prevention: Efficacy of an educational counselling intervention to increase knowledge in stroke survivors

By Theresa Green, Eryka Haley, Michael Eliasziw and Keith Hoyte

Abstract

Background: Motivational interviewing and stages of change are approaches to increasing knowledge and effecting behavioural change. This study examined the application of this approach on stroke knowledge acquisition and changing individual lifestyle risk factors in an outpatient clinic.

Methods: RCT in which 200 participants were allocated to an education-counselling interview (ECI) or a control group. ECI group participants mapped their individual risk factors on a stage of change model and received an appointment to the next group lifestyle class. Participants completed a stroke knowledge questionnaire at baseline (T1), post-appointment, and three months (T3) post-appointment. Passive to active changes in lifestyle behaviour were self-reported at three months.

Results: There was a statistically significant difference between groups from T1 to T3 in stroke knowledge (p<0.001). While there was a significant shift from a passive to active stage of change for the overall study sample (p<0.000), there was no significant difference between groups on the identified risk factors.

Conclusions: Although contact with patients in ambulatory clinical settings is limited due to time constraints, it is still possible to improve knowledge and initiate lifestyle changes utilizing motivational interviewing and a stage of change model. Stroke nurses may wish to consider these techniques in their practice setting.

Background

Stroke continues to be the fourth leading cause of death and the leading cause of disability in Canada. In Alberta alone, 1,183 residents died from stroke in 1998, and for those individuals surviving stroke, rehabilitation may be difficult and costly. Albertans spend an estimated $200 million in health care costs, social services, and lost wages each year (Heart and Stroke Foundation of Alberta & N.W.T., 1999).

Stroke is treatable and ideally suited to prevention strategies with knowledge of risk factors and lifestyle modification fundamental to successful prevention. In a 1997 study of patients presenting to Cincinnati emergency departments with potential stroke, almost 40% did not know the signs, symptoms, or risk factors of a stroke (Kothari, Sauerbeck, Jauch, Broderick, Brott, Khoury, et al., 1997). Kothari et al. also reported that the elderly were less likely to know a single risk factor for stroke than their younger counterparts. Investigators in subsequent studies revealed that gaps in stroke knowledge still exist, particularly related to knowledge of stroke risk factors (Schneider, Pancioli, Khoury, Rademacher, Tuchfarber, Miller, et al., 2003; Robinson & Merrill, 2003). In 2003, the Heart and Stroke Foundation’s Annual Report Card on Canadians’ Health revealed that only one-third of Canadians could name either hypertension, elevated blood cholesterol, or family history as a risk factor for heart disease or stroke (HSFC, 2007). Media promotions aimed at educating the public of the modifiable stroke risk factors occur annually in many major Canadian centres (Heart and Stroke Foundation of Canada, 2006). However, little research has been conducted that measures the change in public knowledge following such media events. Given the number of risk factors reported in published research related to patients presenting to cardio and cerebrovascular secondary prevention clinics, it is reasonable to speculate that these messages remain largely unheeded (Rothwell, Coull, Giles, Howard, Silver, Bull, et al., 2004; Schneider et al., 2003; Rodgers, Atkinson, Bond, Suddes, Dobson, & Curless, 1999; Joseph, Babikian, Allen, & Winter, 1999). As well, many people often only consider the benefits of lifestyle changes to reduce the risk of stroke following an actual stroke event.

The published literature on patient education indicates ambiguous results, in that patients provided with limited teaching by a health care professional in acute care settings may or may not experience some increase in knowledge (Rodgers et al., 1999; Mant, Carter, Wade & Winner, 1998). Rodgers et al. (1999) did report, however, that with repeated contact in short, small group educational sessions, long-term stroke knowledge retention of patients and carers was more likely. Similarly, Clark, Rubenach and Winsor (2003) reported that combined education and counselling provided during the months immediately following stroke resulted in more positive patient and carer outcomes. Information provided at the hospital bedside also remains general in nature, and many patients articulate questions and concerns related to their own personal situation following their return home (Tang & Newcomb, 1998). Clinicians often feel that in a rushed outpatient clinic environment or physician’s office, specific nursing interventions to teach disease pathophysiology, risk factor modification, and healthy lifestyle are unrealistic. Thus, many ambulatory care clinics address patient education by providing freely available pamphlets in the patient waiting room. Because of the arms-length approach to teaching, many patients have expressed dissatisfaction with the information received during their stroke experience (Rodgers, Bond, & Curless, 2001).

The purpose of this study, therefore, was to examine the impact of one-on-one brief (15- to 20-minute) nurse/patient interview on acquisition of knowledge of stroke and influence on lifestyle behaviour changes. The study protocol required
study personnel to utilize the transtheoretical model of change and motivational interviewing, with interviews conducted within the constraints of an ambulatory clinic setting, to effect change.

**Theoretical basis**

The Transtheoretical Stages of Change model (Prochaska & Velicer, 1997; Prochaska, DiClemente, & Norcross, 1993) and motivational interviewing (Miller & Rollnick, 2002) provided the theoretical underpinning for the intervention strategy. The stage of change model is a six-level scale in which clinicians assess readiness to change in a cyclical manner. The stages include precontemplation, contemplation, preparation, action, maintenance and relapse. In the precontemplation phase, the individual does not perceive a need for change. Contemplation implies that the individual does see a need for change and is seriously considering making some changes in the near future. In the preparation phase, the patient indicates that there is intention to change and takes some initial behavioural steps in the direction of change and action. This indicates that concrete activities, such as modification of behaviour or environment, have been undertaken. The maintenance phase entails active effort to sustain changes made in the action stage and in relapse phase, the individual is unable to sustain change(s). The individual may reenter the change cycle at any point during the risk modification process.

The study nurse used motivational interviewing (MI) in which each individual educational counselling interview (ECI) group participant and the study nurse identified a health behaviour needing change and barriers and facilitators to change. Motivational interviewing (MI) is defined by Rollnick and Miller (1995) as a client-centred counselling style in which clients are helped to explore and resolve ambivalence towards behaviour change. The intent of MI was not to get participants to make major changes, but to shift from one stage of change to the next. In setting goals, the acronym SMARTS was used: specific (the details of the individual's goal), measurable, action-oriented (an activity the individual will do), realistic (small enough to be achievable in a foreseen amount of time), time-oriented (the goal fits within the individual's life now), and sabotage (identifying potential obstacles and planning for them).

**Method**

**Setting and participants**

The researchers tested the effectiveness of the intervention in a randomized controlled trial. The study consisted of a convenience sample of 200 patients from an ambulatory stroke prevention clinic located in an acute tertiary care hospital. An average of 2,200 patient visits occurs each year in this clinic, with patients presenting with symptoms of minor stroke or transient ischemic attacks. The local research and ethics board provided approval for the study prior to any patient recruitment.

**Inclusion and exclusion criteria**

Investigators considered all patients seen in the clinic between January 1, 2003, and December 31, 2004, for inclusion in the study. Inclusion criteria included a mini-mental state examination (MMSE) score ≥ 24, able to read and speak English, able to complete self-administered in-person and phone questionnaires, able to attend a lifestyle class, and able to provide informed consent. Patients who did not understand English, were cognitively impaired such that ability to respond to and complete self-report survey questionnaires was affected (with surveys either self-administered in-person or by telephone interview), unable to physically attend a lifestyle class, or those unable to provide informed consent were excluded from the study.

**Recruitment methods**

Clinic nursing staff approached patients to elicit interest in study participation at the time of their initial clinic visit. The study coordinator then obtained informed consent and conducted a mini-mental state examination (MMSE) with each potential study participant. Each patient was then asked to complete a baseline 43-item self-administered stroke knowledge questionnaire. Clinic staff obtained demographic information, including age, sex, marital status, modified Rankin Scale (mRS), current symptoms, risk factors, education level, and employment status as part of the routine clinic documentation. Study personnel retrieved these data from the medical record. All clinic staff was experienced neuroscience nurses who received training in the administration of the modified Rankin Scale during their acute care orientation. The study nurse had extensive experience as a clinical staff and patient educator and demonstrated competence in the utilization of the MMSE and MI techniques in the ambulatory care setting.

**Randomization**

Following informed consent, participants were randomly assigned to either an intervention or usual care group. Investigators achieved concealed randomization by means of opening a sealed, numbered, opaque brown envelope. An independent clinic staff member kept the envelopes in a locked separate location, distributed the envelopes to the patient, and conveyed the patient allocation to the study coordinator. As the nurse clinician in the clinic provided the education intervention, blinding as to study group was not possible. However, the telephone interviewers at the three-month survey point and data entry personnel were blind as to the patient’s randomly assigned group. All patients received usual care from the time of admission to the clinic until randomization was complete.

**Intervention**

Patients randomized to the ECI group received nurse-mediated motivational counselling and an appointment for the next lifestyle class to which they agreed to attend. Conducted within the “normal” nursing component of an SPC visit (15 to 20 minutes), each individual interview consisted of a brief, patient-specific analysis of personal stroke risk factors, with subsequent discussion of appropriate lifestyle and risk management strategies. The educational material covered in this initial session also included information about causation, consequences, stroke recovery, and available community resources. Using MI techniques, the study nurse and each individual study participant identified a health behaviour needing change and identified barriers and facilitators to
change. The individual then mapped each goal to a stage of change (as it applied to the individual at that time) and a decision made either to maintain the status quo or to change the behaviour.

Following the individual MI session, the study nurse coordinated the class lifestyle appointment to occur within one to two months of the initial clinic visit. This class was open to both the patient and family members and generally ranged from 50 to 75 participants. The lifestyle class consisted of a three-hour interactive teaching session in which a nursing professional discussed causation, risk factors, medical management, and the importance of an active and healthy lifestyle. A nutritionist discussed dietary adjustments and healthy eating and a social worker focused on stress management tactics. Each patient received a lifestyle class manual, with print information reflective of the oral presentations.

Participants in the intervention group completed the knowledge questionnaire at baseline (immediately prior to clinic visit), post-clinic visit, and those who actually attended the lifestyle class completed the knowledge questionnaire by phone 24 to 48 hours after the class. All participants, regardless of attendance in the lifestyle class, completed the knowledge questionnaire by phone three months after the clinic visit.

Control group
The control group received the current standard of care in the stroke prevention clinic, which consisted of a brief discussion of stroke and an offering of freely available education pamphlets in the patient waiting room. The study nurse also offered control group participants an opportunity to attend the lifestyle class following the three-month interview. Participants in the control group completed the knowledge questionnaire at baseline, post-clinic visit, and three months post-visit.

Outcome measures
The primary outcome for this study was knowledge acquisition and retention, as measured by a 43-item, self-report survey questionnaire obtained from study investigators in the Kansas City Stroke Prevention and Community Education Project (Welch, Summers, Kelly, & Rymer, 1997). The questionnaire incorporated questions about causes of stroke, warning signs, stroke symptoms, risk factors, stroke outcomes, and actions to take if experiencing symptoms. Prior to using the survey tool in the present study, investigators tested the questionnaire with stroke program physicians and nursing staff to establish content and face validity, assess clarity and understanding of the questions, and formatting of the questionnaire pages for self-administration. This process revealed lack of consensus with two items in the original questionnaire, therefore study investigators removed these prior to patient administration.

A secondary outcome included a description of stage of change in relation to risk factor modifications for each lifestyle risk factor identified by the patient. Investigators defined lifestyle risk factors as smoking (none, quit in last five years, quit in last 10 years, quit more than 10 years ago), exercise (none; low: 10 to 15 minutes/1–2x/week; moderate: 15 to 30 minutes/3–4x/week; high: 30+ minutes/5–7x/week), and obesity (none, mild: 10 to 15 pounds; moderate: 15 to 30 pounds; high: 30+ pounds). As well, risk factors included alcohol intake (none; social: <1 drink per day; moderate: 1 to 2 drinks per day; excessive: ≥3 drinks per day), and stress (none, mild, moderate, high).

Statistical analysis
Data were analyzed using SPSS statistical software (version 13.0; SPSS Inc., Chicago, IL, U.S.). Data analysis was by intention-to-treat and undertaken according to an analysis plan drawn up by the trial statistician and study investigators. The primary outcome for the proposed trial was the number of correct answers on the stroke survey questionnaire. The primary analysis was a two-group t-test comparing the mean number of correct answers at three months between the two groups. Secondary analyses consisted of a comparison of the mean number of correct answers at three months between the patients who actually attended the lifestyle class and the control group. As well, a paired t-test was used to compare the mean number of correct answers between baseline and immediately after the lifestyle class in the intervention group only. Finally, investigators examined what percentage of patients had a positive step forward in the stage of change model (dichotomized into moving from a passive to active stage), on any one or more of the lifestyle risk factors.

The final sample size was 200 participants per group. The primary outcome for the proposed trial is the number of correct answers on the stroke survey questionnaire. Based upon estimates from the Cincinnati experience, it was expected that participants in the control group would correctly answer 60% (i.e., 26 of 43) of the questions at three months. A sample size of 166 was determined to have 80% power to detect a difference of seven in mean number of correct answers, assuming a common standard deviation of 16 (from the Kansas City experience) using a two-group t-test with a 5% two-sided significance level. A mean increase of seven correct answers in the intervention group represents approximately a 25% relative increase. Considering that 20% of participants may have chosen not to attend their appointed lifestyle class, the final trial size was set at 200 patients.

Results
Sample characteristics
Clinic staff saw 2,602 patients in the SPC during the study period and from these, study investigators recruited 200 study participants, with 100 randomized to usual care, and 100 to the education intervention (Figure 1). The primary reasons for non-recruitment included having a non-stroke diagnosis, non-English speaking, not meeting study criteria, or refusal to participate. One patient died during the study (intervention group) and, of the 34 who did not complete the intervention, 20 voluntarily discontinued participation (four withdrew due to illness), 10 could not be reached, one moved out of area, and three were recruited in error. Thus, 164 participants completed the final assessment. Of those in the intervention group, 71% (n=53/75) actually attended the lifestyle class.
Baseline characteristics were similar in both groups with an overall average age of 66.75 years (range 27 to 91) and 42% of study participants being female. Based on independent t-tests, there were no significant differences between the ECI and control groups on any of the demographic characteristics (Table 1). In terms of risk factors for stroke, 23 participants in the overall group reported having no risk factors for stroke. Sixty-two participants reported having one to two risk factors, 83 identified three to four individual risk factors and 32 indicated ≥5 risk factors (range 5 to 7). The most frequently reported risk factors were a family history of stroke (n=124), hypertension and obesity (n=93 and n=74 respectively), followed closely by hypercholesteremia (n=71). There were no statistically significant differences between groups in the number of individual risk factors reported ($\chi^2 = 2.271$, $p=0.943$).

**Knowledge of stroke**

There was a statistically significant difference between groups from time one to time three on the knowledge questionnaire (stroke symptoms, risk factors, and actions) using McNemar’s $\chi^2$ comparing two proportions ($p = <0.001$), with three-month scores adjusted for baseline score using analysis of covariance. Based on intention-to-treat analysis, the intervention group scores changed from a mean percentage of 75.3 (SD 9.0) at baseline to 89.5 (SD 5.8) at three months ($p=0.001$). The control group scores changed from a mean of 77.6 (SD 9.1) at baseline to 81.1 (SD 7.3) at three months (Table 2). The mean percentage of correct answers on the knowledge questionnaire between time one and time three for those who actually attended the lifestyle class was 75.6 (SD 8.3) at baseline and 90.0 (SD 5.0) at time 3 ($p=0.001$). There was a mean change from baseline to three months of 14.4% (SD 7.5) in the intervention group.

**Stage of change**

Achievements in individual lifestyle modifications determined movement between stages of change. In this study, we were interested in examining the percentage of participants who shifted from a passive to an active stage of change (e.g. precontemplation or contemplation to action) in their selected goals. For example, while at the time of the initial clinic visit there were 45 smokers overall in the intervention (n=18) and control (n=26) groups, only 32 participants (intervention group n=12; control group n=20) identified this as a risk-reduction goal. Of these, 70.8% shifted from precontemplation or contemplation to action ($p=0.000$; 66.7% intervention group, 75.0% control group). Similarly, of the 127 patients who identified diet as a lifestyle risk factor, 83.15% made positive steps forward in addressing dietary concerns ($p=0.000$).

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**Figure 1. Trial profile**

- Assessed for eligibility (n=2605)
  - Excluded (n=1495)
    - Not meeting inclusion criteria (n=248)
    - Refused to participate (n=250)
    - Other reasons (n=997)
- Enrolment
- Randomization N=200
  - Allocated to intervention (n=100)
  - Received allocated intervention (n=75)
    - Did not receive allocated intervention (n=25)
    - Lost to follow-up (n=25)
      - 16 discontinued intervention
      - 1 deceased
      - 4 withdrew due to illness
      - 4 not meeting study criteria
  - Analyzed (n=72)
    - Excluded from analysis (n=3) as randomized in error with MMSE < 24
- Allocated to control group (n=100)
  - Lost to follow-up (n=8)
    - 3 withdrew consent
    - 5 discontinued intervention
- Analyzed (n=92)
While 134 participants considered their physical activity a lifestyle risk factor, only 67 identified this as a risk reduction goal, and 71.2% of these individuals shifted from a passive stage of change to active (p=0.000). In terms of weight, 87 participants identified this as a risk factor at the initial visit and 71.75% had made positive changes based on the stages of change model (p=0.000). However, while overall there was a significant difference in achieving a passive to active stage of change, there was no significant difference between intervention and control groups in stages of change for any of the identified risk factors (Table 3).

**Discussion**

Due to the increasing impact of chronic diseases (e.g. hypertension, diabetes) on society, prevention and health promotion has become increasingly important over the past few decades (Emmons & Rollnick, 2001). Consequently, behavioural outcomes (e.g. diet, smoking cessation, physical activity) have become the focus of much research activity (Chouinard & Robichaud-Ekstrand, 2005; Smith, Forster, & Young, 2004; Rodgers et al., 2001; Joseph et al., 1999). Health professionals recognize that in addition to providing patients with the skills needed to effect behaviour change, motivation to change is an important element in the overall process.

<table>
<thead>
<tr>
<th>Table 1. Characteristics of study participants</th>
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<tbody>
<tr>
<td>Participants</td>
</tr>
<tr>
<td>Age (years, SD)</td>
</tr>
<tr>
<td>Sex (% female, n)</td>
</tr>
<tr>
<td>Marital Status (%, n)*</td>
</tr>
<tr>
<td>Married</td>
</tr>
<tr>
<td>Single</td>
</tr>
<tr>
<td>Education (%, n)*</td>
</tr>
<tr>
<td>Elementary</td>
</tr>
<tr>
<td>Secondary</td>
</tr>
<tr>
<td>Risk Factors (%, n)*</td>
</tr>
<tr>
<td>Prior Stroke</td>
</tr>
<tr>
<td>Prior TIA</td>
</tr>
<tr>
<td>IHD</td>
</tr>
<tr>
<td>AF</td>
</tr>
<tr>
<td>Hypertension</td>
</tr>
<tr>
<td>Diabetes</td>
</tr>
<tr>
<td>Hypercholesteremia</td>
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<tr>
<td>Smoking</td>
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<tr>
<td>Obesity</td>
</tr>
<tr>
<td>Family History</td>
</tr>
<tr>
<td>MMSE (mean, SD)</td>
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<tr>
<td>mRS (%, n)</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>1-2</td>
</tr>
</tbody>
</table>

* numbers may not add up due to rounding; TIA = transient ischemic attack, IHD = ischemic heart disease, AF = atrial fibrillation, MMSE = MiniMental State Examination, mRS = modified Rankin Scale.

<table>
<thead>
<tr>
<th>Table 2. Knowledge acquisition and retention</th>
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<tbody>
<tr>
<td>Intervention</td>
</tr>
<tr>
<td>Baseline</td>
</tr>
<tr>
<td>Adjusted 3 month †</td>
</tr>
<tr>
<td>Adjusted Absolute Increase over 3 months</td>
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</tbody>
</table>

*χ² McNemar’s test comparing two proportions
† Adjusted for baseline score using analysis of covariance
In this study, we used a focused educational (motivational) counselling intervention, specific to each individual patient’s situation, to improve knowledge about stroke, including signs and symptoms, risk factors, and actions to take upon recognition that a stroke is occurring. The study nurse delivered the individualized intervention within the confines of a busy, ambulatory care clinic, in which time with patients is often limited. The results of this study support motivational counselling techniques as effective in increasing knowledge acquisition and retention in an at-risk stroke population, delivered within the time constraints of a clinic setting. These results are reflective of those reported on a randomized, controlled trial conducted to evaluate the impact of MI on patients’ mood three months post-stroke (Watkins, Auton, Deans, Dickinson, Jack, Lightbody, 2007). These authors suggested that MI led to an improvement in patients’ mood three months after stroke.

This study also provided support for independent nursing practice within the setting of stroke prevention. There is an increasing interest in exploring nurse management models of care for chronic and acute illness as workloads increase in primary and acute health care settings (Butler, Rees, Kinnersley, Rollnick, & Hood, 2001). Butler et al. described the effects of a specially trained practice nurse managing upper respiratory tract infections in a general practice in the U.K. as including a less frequent consultation rate and reduced use of antibiotics. These authors concluded that although the nurse utilized longer consultation time at the outset, there were positive effects on patients’ self-care and health-seeking behaviours. Chouinard and Robichaud-Ekstrand (2005) also reported that a tailored inpatient smoking cessation program administered by a nurse, with telephone follow-up post-discharge, significantly increased smoking cessation at six months.

Timing of educational interventions following stroke has been the focus of several research studies over the past decade (Clark et al., 2003; Rodgers et al., 1999; Joseph et al., 1999). Our findings add to the growing body of literature that supports the idea that timing of educational interventions leads to improvement in functional outcomes, lifestyle change, and knowledge acquisition (Rodgers et al., 1999). Our patients currently receive their appointment to the stroke prevention clinic within two weeks of their stroke event, thus they are more likely to be receptive to receiving information and counselling regarding their risk factors. However, we cannot account for the situational factors that may come into play in their home environment. If, for example, the family is not supportive or receptive to making dietary or physical activity changes, the patient may not achieve lifestyle modifications they have identified as being necessary. We also did not factor in any individual learning strategies that patients may have employed in the home, such as accessing the internet or contacts and discussions with fellow stroke survivors, family, friends, or neighbours.

Whereas awareness and knowledge of stroke improved significantly over the intervention period, improvements in lifestyle risk factors were not significant statistically, although still clinically relevant. In demonstrating a shift in personal readiness to change, this finding is reflective of research that suggests that although personalized support and information improves knowledge and satisfaction with care, there is limited effect on achieving actual lifestyle changes if only administered once (Allen, Hazelett, Jarjoura, Wickstrom, Hua, Weinhardt, 2002; Joseph et al., 1999; Dennis, O’Rourke, Slattery, Staniforth, & Warlow, 1997). Patients may require individual interactions with a health care professional that are more frequent and over an extended period in order to achieve desired lifestyle changes (Forster & Young, 1996). Steptoe, Kerry, Rink and Hilton (2000) conducted a randomized trial examining the impact of behavioural counselling on risk factors for coronary heart disease in the primary care setting. These researchers reported brief behavioural counselling interventions based on stage of change, administered by a trained nurse who interacted with the patients at three time points, were effective in modifying risk behaviour. Conversely, a randomized trial conducted by Smith, Forster, and Young (2004) was designed to evaluate the effectiveness of a multidisciplinary inpatient education program for patients with stroke and their carers. Although participants attended stroke education meetings biweekly while hospitalized, researchers did not find knowledge of stroke significantly improved by the intervention strategy. This may reflect participants’ focus on

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Intervention n=97</th>
<th>Control n=100</th>
<th>Overall sample change p value‡</th>
<th>Change between study groups p value‡</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking (n, %)</td>
<td>12* (66.7)</td>
<td>12* (75.0)</td>
<td>0.000</td>
<td>1.00</td>
</tr>
<tr>
<td>Dietary Change (n, %)</td>
<td>35 26* (74.3)</td>
<td>28 24* (85.7)</td>
<td>0.000</td>
<td>0.35</td>
</tr>
<tr>
<td>Physical Activity (n, %)</td>
<td>45 32* (71.1)</td>
<td>49 35* (71.4)</td>
<td>0.000</td>
<td>1.00</td>
</tr>
<tr>
<td>Weight Loss (n, %)</td>
<td>34 23* (67.7)</td>
<td>34 19* (55.9)</td>
<td>0.000</td>
<td>0.45</td>
</tr>
</tbody>
</table>

†Number of participants with identified risk factor; * number of participants who identified risk factor as a reduction goal; ‡ level of significance set at 0.05
biophysical elements and tasks associated with early stroke recovery (Brauer, Schmidt, & Pearson, 2001). However, Smith et al. did report patient and carer anxiety at six months post-stroke onset was significantly reduced following the program. It may be that the frequency and timing of the interactions, relevant to the participants’ current life situation, was effective in achieving this reduction.

It is worth emphasizing that we were also observing motivation to change over a relatively short period of three months. During this time, patients may have focused their attention primarily on adapting to post-stroke biopsychosocial sequelae of stroke, not on incorporating lifestyle behavioural changes into daily routines. It must also be noted that the investigators conducted the present study in a specialty stroke clinic located in a tertiary care facility, thus the results may not be generalizable to non-teaching, community-based clinics.

Conclusions
This is important preliminary work in assessing the impact of one secondary stroke prevention strategy on knowledge acquisition; one in which we also saw temporal shifts between stages of change in lifestyle management. However, translating the intention to change into actual sustained, measurable behavioural changes in lifestyle risk factors often requires longer periods of intervention with repeated contacts between participants in the change process. Therefore, further research to explore the sustainability of lifestyle changes over longer periods is required. Similarly, additional research that explores the structure and format of educational interventions also needs to be undertaken. For example, would repeated in-person individual counselling versus combined contact formats (e.g. in-person, telephone, internet) result in sustainable increases in knowledge of stroke, risk awareness, and lifestyle modifications? As well, to affect policy changes at the organizational level supporting the nursing agenda in secondary stroke prevention, cost-effectiveness and efficiency elements of nurse-directed intervention strategies need to be addressed. Finally, additional research related to the unplanned use of health resources post-intervention, cost analysis of intervention strategies, and impact on participant quality of life will further support the efficacy of nurse-patient risk reduction efforts.

The primary therapeutic modality to stroke prevention is modification of risk factors. Therefore, the importance of decreasing stroke risk factors cannot be understated (Ryan, Combs, & Penix, 1999). Health education provides the advantage of reduced demand on the health care system, with the resulting benefit of reduced costs, and the potential for increased productivity for the stroke survivor (Fries & McShane, 1998). Health care professionals are in a position to provide opportunities for effective stroke prevention through counselling, education, treatment, and risk reduction planning, offered in short, individualized interactions. The most effective strategy appears to involve early individual risk management interventions in patients presenting with minor stroke or transient ischemic attack, supported by formal education programs and follow-up. This study demonstrates that although contact with patients in ambulatory clinical settings is limited due to time constraints, it is still possible to improve knowledge and initiate lifestyle changes utilizing motivational interviewing techniques.

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