ABSTRACT

Introduction: Since a history of stroke or transient ischemic attack is a major risk factor for a recurrent event, lifestyle counselling during the hospital phase is an essential component of treatment and may increase the probability of lifestyle change.

Aims and objectives: To study the effect of Risk Factor Targeted Lifestyle Counselling Intervention on working-age stroke patients' adherence to lifestyle changes.

Design: A quasi-experimental, nonequivalent control group pretest-posttest design.

Methods: Stroke patients in an acute neurological unit were divided into a control group (*n*=75) receiving standard counselling and an experimental group (*n*=75) receiving risk factor targeted counselling. Lifestyle data and clinical outcomes were collected at hospital between January 2010 and October 2011, data on adherence to lifestyle changes 3, 6, and 12 months after discharge.

Results: The baseline lifestyle habits did not differ significantly other than in Alcohol Behaviour. Both groups increased their intake but the intervention group to a lesser degree. However, the experimental group significantly lost their weight during the first three and six months, at three months reduction in cigarette consumption and at six months significant increases in smoking cessation were also achieved. All improved some of their lifestyle habits. Intervention was associated with support from nurses as well as family and friends. Adherence scores were higher in the experimental group.

Conclusion: Some short term advantages in lifestyle habits due to the intervention were noted. Participants in both groups improved some of their lifestyle habits.

Keywords: Lifestyle habits, counselling, adherence, risk factors, intervention, quasi-experimental study, nursing.

INTRODUCTION

Stroke is globally the main cause of adult disability (1). It is often regarded as a one-time event and patients have little awareness of the risks of subsequent illness following stroke (2). Stroke happens when blood flow to an area of the brain is cut off resulting in cell death (3, 4). Transient ischemic attack (TIA) occurs when blood flow to part of the brain is blocked for a short period of time with stroke-like symptoms lasting less than twenty four hours before disappearing (4, 5, 6).

People experiencing a stroke or TIA are at significant risk of future stroke events, and a recurrent stroke is often more severe than the first one (7). Twenty-five percent of strokes recur within five years (8), and at 10 years following a stroke the cumulative risk of recurrence is 39.2% (9). TIAs do not generally cause permanent brain damage, they are a warning sign that a stroke may happen in the future, and require emergency treatment (7, 10, 11). More specific, 8.1% of strokes occur within 48 hours and 10-20 % within 90 days following TIA (12). However, risk factors for stroke are the same as those for TIA (13).

Stroke is caused by the interactions of many complex processes, and may be promoted by multiple closely intertwined risk factors. The incidence of stroke is particularly sensitive to lifestyle-related risk factors (14, 15) including alcohol consumption, physical activity, smoking, weight control, stress and diet, both by themselves and in combination (16). Advancing age increases the risk of stroke, but younger individuals are by no means immune; a quarter of people suffering a stroke are under the age of 65 (17). The focus of the study presented is on working-age people.

BACKGROUND

Since a history of stroke or TIA is the foremost cause of a new vascular event, lifestyle counselling during the hospital phase is an essential component of treatment. Counselling can be remarkably effective at preventing secondary stroke, potentially reducing its incidence by 80% (18). Main aims of counselling are to influence patients' lifestyle habits as well as life changes which ensue from stroke while preparing them for discharge (19, 20). Moreover, there is research evidence which shows that approximately half (52%) of the patients who had suffered a stroke couldn't mention any risk factors for stroke (21). Counselling in this context is understood as a method that is patient-centered and interactive, with a planned and adequately resourced implementation to provide information on secondary stroke risk factors in a way that will positively affect patient outcomes (22, 23).

According to previous research results, adherence to a combination of different healthy lifestyle behavior is connected to 90 % of reduced incidences of stroke (14). There is also a study which indicates that participants who were adherent to all included 5 low-risk factors had ~80% lower risk of ischemic stroke compared to those who showed no adherence. (24). In this context, adherence to lifestyle change means the stroke patient adopts a responsible, active and intentional process of self-care in which he/she acts to maintain his/her overall health in close co-operation with health care personnel (25, 26, 27).

The problem is that many stroke patients do not adhere to healthier lifestyle changes for a long period of time (28, 29). However, there is some evidence that starting counselling in the acute hospital phase and directly connecting the event to risk factors related to lifestyle may increase the probability of behavior change (28, 29, 30, 31). To our knowledge there has been no investigation into factors

describing adherence to lifestyle change and factors related to adherence among stroke patients such as that presented herein.

Aim

The aim was to study the effect of Risk Factor Targeted Lifestyle Counselling Intervention on working-age stroke patients' adherence to lifestyle change. The research question with four subordinate hypotheses was addressed:

Is Risk Factor Targeted Lifestyle Counselling Intervention more effective than standard counselling at improving stroke patients' adherence to lifestyle change?

Hypothesis 1. Adherence to lifestyle change (physical activity, alcohol behaviour, smoking, stress management, nutritional behaviour, and weight management) will differ between the experimental and control groups over the 12-month follow-up.

Hypothesis 2. Clinical outcomes (triglyceride, total cholesterol, high-density lipoprotein, low-density lipoprotein, and blood sugar content) will differ between the experimental and control groups over the 12-month follow-up.

Hypothesis 3. Factors describing and relating to adherence to lifestyle change (adherence to medication, adherence to lifestyle change, motivation, meaning of lifestyle change, support from the family and friends, support from the doctors, support from the nurses) will differ between the experimental and control groups.

Hypothesis 4. There will be within group differences among the experimental and control groups in adherence to lifestyle change and clinical values.

METHODS

Design

A quasi-experimental, nonequivalent control group pretest-posttest design was used to test the effectiveness of the lifestyle intervention provided to the experimental group (32). Patients who were treated before the intervention was initiated constituted the control group and they received counselling with the prevailing counselling practice.

The Lifestyle data were collected from both groups before the intervention to establish a baseline and again (together with information on lifestyle change adherence) at 3, 6, and 12 months post-discharge. Adherence to lifestyle change data were only collected during the post-discharge period. The aim was to assess the impact of counselling on factors describing adherence to lifestyle change and factors relating to adherence (Figure 1).

Data collection and sample

Participants of the study were recruited in a neurological unit at a university hospital in Finland. Patients with TIA or ischemic stroke, aged between 18 and 65 years, who were assumed to be discharged from the hospital, were asked to participate in the study. It was obligatory that these patients were able to fill in the questionnaire by themselves and provide informed consent. Patients with confusion and aphasia or those incapable of communicating in Finnish were therefore excluded from the study.

The total number of stroke patients was 654. Of these patients, 190 fulfilled the criteria. Of the eligible patients 150 participated and 40 refused. Those who agreed to participate completed the questionnaire when their neurological status was stable. Baseline data collection started in January 2010 and finished in October 2011. Follow-up surveys were sent by the researcher. The study design and the flow chart of the participants are described in Figure 1.

The sample size of 150 was selected on the basis of examples from similar previous studies using the same instrument to measure adherence (33), and studies investigating lifestyle habits (e.g. 28, 34). Power analysis in this study was done after the data was collected (*post hoc*) indicating that the sample size was sufficient to provide meaningful results: 150 patients with achieved follow-ups formed an adequate number to detect clinically moderate differences when using ANOVA in most of the cases at 5% significance level and with at least 80% power, which is considered to be sufficient. Therefore, the effect was estimated from the data: from all the numerical variables used in the analysis (sum variables describing lifestyle habits, those describing and relating to adherence, and clinical values).

Figure 1. Study design and a flow chart of the participants

Instruments

Baseline lifestyle data were collected using the Lifestyle instrument (27, 35), and the Adherence to Lifestyle Change (ALC) instrument was used during the follow-up surveys conducted 3, 6, and 12 months post-discharge. The ALC is based on the Adherence to Care instrument (25, 26, 27) and the Lifestyle instrument. It includes both multiple choice and dichotomous questions concerning the background and respondents' weight control (3), smoking habits (5), nutritional habits (16), physical activity (11), stress management (2), alcohol consumption (4), and adherence to medication (4).

Additionally, it contained 5-point Likert-type scale (1=strong agreement, 3=indecision, 5=strong disagreement) about adherence to lifestyle change (8) and factors related to adherence such as motivation (4), perceived meaning of lifestyle change (5), support received from family and friends (4), and support received from doctors (2) and nurses (3) at the hospital. During the baseline data gathering process the researcher measured each participant's waist circumference, BMI and blood pressure levels. Blood sample data of the participants were gathered from the medical records. Adherence to lifestyle change during the follow-up period was also assessed by considering each participant's clinical condition. The clinical outcomes during this period were reported by the patients themselves, and patients were not specifically asked to go to clinics and submit to blood testing during the follow-up period.

Validity and reliability

The Adherence to Care Instrument has been used and tested in several studies on people suffering from long term conditions (25, 26, 27). The Lifestyle Instrument was initially developed for the large FINRISKI study that was initiated in the 1970s (36). Earlier studies have confirmed the reliability and validity (e.g. 27, 35). The contents of both instruments had to be modified slightly to make them suitable to measure stroke patients' adherence to lifestyle changes. The instruments' face-validity was thus verified in collaboration with stroke patients (2), nurses at the hospital (7), doctors (2) and nursing science experts (2) before beginning data collection.

Intervention

The Risk Factor Targeted Lifestyle Counselling Intervention was developed after collecting the control group data. The development work was performed by the main researcher in collaboration with representatives of the nursing staff and two medical doctors. The design of the intervention was based on the results of a literature review (source deleted for blinded review), clinical knowledge, and on the current recommendations of healthy lifestyle (13, 36).

All the nurses in the unit were given two days' training in stroke risk factors, including lectures delivered by specialized workers from the hospital, e.g. a tobacco free nurse and dietitian nutritionist. In addition, the researcher trained six nurses individually how to counsel patients by using pre-formulated risk factor conversations prior to discharge. A constructivism theory was used as an integrated approach when training and educating the nurses as it was based on their earlier knowledge and skills (e.g. 37, 38, 39). In addition, it was also used as a basis together with the counselling quality model by Kääriäinen (22) when planning the structured counselling conversation: the individual goal of the counselling was addressed together with the patient based on their earlier knowledge and experience about stroke risk factors.

To begin with, all of the patients were told about risk factors related to life-style habits, focusing on the importance of: 1) a healthy diet, 2) weight control, 3) the importance of regular exercise, 4) the need for moderate alcohol use, 5) stress management, and 6) stopping smoking after stroke. Particular attention was paid to those risk factors most relevant to the patient being counselled and to the importance of secondary stroke prevention.

The goal of the conversation was to identify each patient's most crucial personal risk factors. If the patient requested help with achieving a particular lifestyle change, additional support was offered. For example, smokers were given the contact details of a tobacco nurse or invited to request a prescription for nicotine replacement therapy from a doctor. Patients were also given a follow-up booklet containing information about risk factors and their treatment; among other things, the booklet included follow-up tables for blood pressure, body weight, blood sugar, cholesterol, exercise, and alcohol consumption. Booklets were handed out to patients by their doctors during the discharge process, and after the patients had received their counselling, it was noted in their electronic patient records.

The control group patients received counselling according to the practice in use before the intervention. This counselling was not standardized, so its structure and content depended on the personal competences of individual nurses and doctors. In most cases, it only involved providing practical advice about prescribed medications, or general advice. The amount and quality of counselling provided was sensitive to a number of variables including the situation within the stroke unit.

Ethical considerations

Approval (ETMK: 83 /180/2009) to conduct the study was applied for from the Research Ethics Board and the Nursing Board of the local hospital district. The researchers of the study adhered to the ethical principles of the Declaration of Helsinki at all times (40). At the hospital, all the participants were informed about the purpose of the study and the principles of voluntary and anonymous participation before they gave their written informed consent to participate. The patients were identified via ID numbers to implement the data analysis and the results were reported anonymously.

However, the names and postal information had to be filed but only for the use of the main researcher to facilitate follow-up surveys. All the information concerning the patients were sealed in the researcher's computer with a password. The patients were informed about the procedure. Nevertheless, control groups' members all received counselling according to the prevailing practice in use before the intervention.

Data analysis

Data analysis was based on descriptive statistics and statistical tests using the Statistical Analysis Software (SAS Inc., Cary, USA, version 9.2). A PCA was carried out to construct summated variables describing and relating to adherence (32). Analysis was based on the knowledge gleaned from earlier studies (20, 25, 26, 33), thus summated variables were named according to their component factors. However, Cronbach's alpha was used to evaluate the reliability of the analysis: Physical Activity (α=0.69, 5 items), Nutritional Habits (α=0.67, 4 items), Alcohol Behavior (α=0.81, 3 items), Adherence to Medication (α=0.74, 3 items), Adherence to Lifestyle Change (α=0.80, 6 items), Motivation (α=0.69, 5 items), Meaning of Lifestyle Change (α=0.69, 5 items), Support from Family and Friends (α=0.74, 4 items), Support from Doctors at the Hospital (α=0.96, 2 items), and Support from Nurses at the Hospital (α=0.96, 3 items) were used in the analysis. Individual categorical variables which were not loaded on factors were used separately: weight control (2 items), smoking (2 items) and stress management (1 item). Missing values were coded as blanks, and complete case analysis was used with missing data (32).

Repeated measures analysis of covariance (ANCOVA) and Bonferroni-corrected contrast were used to assess the significance of changes in summated variables within the two groups or between the two groups at different measurement points, using time, BMI and sociodemographic factors (age and sex)

as covariates. Medication (6 categories) was also included as a covariate when modelling clinical outcomes. Multivariable ordinal logistic regression was applied when dealing with categorical variables (more than two categories).

Adherence to lifestyle change was assessed 3, 6, and 12 months after the intervention. Lifestyle habits and clinical values were compared to baseline data collected at the hospital. Factors describing adherence and those relating to adherence to lifestyle change were compared to the state at 3 months, respectively. To assess the sociodemographic homogeneity of the two groups at baseline t-test was used for continuous variable (age) and chi-square for categorical variables. Mean difference (MD, numerous variables), Odds Ratios (OR, categorical variables), 95% Confidence Intervals (CI) and *p*-values are presented. Values of $p < 0.05$ were regarded as statistically significant.

RESULTS

Participants' characteristics at baseline

The total sample (n=150) consisted of stroke and TIA patients divided into experimental (n=75) and control (n=75) groups. The mean age was 56.5 (range=20-65 years, ± 8.4). On average, patients in the control group were more highly educated ($p<0.001$) and there were more men ($p=0.001$) in the experimental group. Further information on the groups is presented in Table 1.

Table 1. Sociodemographic characteristics by group n (%) and group differences

Lifestyle habits during the follow-up period

It was hypothesized that adherence to lifestyle change would differ between the experimental and control groups. However, the hypothesis had to be rejected: no differences between the groups over the 12-month follow-up period with respect to Physical Activity, Nutritional Behaviour, current smoking, the number of cigarettes smoked per day, stress management, participants' own image of their weight, and with regard to self-estimated weight loss were achieved. Nevertheless, the groups did differ with respect to Alcohol Behavior over the follow-up period – specifically, alcohol intake of the experimental group was less than that of the control group (MD 6.79 p=0.027). However, it should be noted that the experimental group drank less than the control group at the baseline (MD 7.78 p=0.051). In general, the patients' alcohol consumption was on the increase at 12-months compared to that at the baseline (MD -3.52 p=0.006). Table 2 describes the changes in the participants' lifestyle habits during the follow-up in detail.

The hypothesis that there would be within group differences among the experimental and control groups in adherence to lifestyle change was partly accepted. Within the experimental group, the likelihood of smoking fewer cigarettes relative to baseline consumption was highest 3 months after discharge (OR 0.15 p=0.042), and the increase in smoking cessation was most significant 6 months after discharge (OR 0.24 p=0.024) respectively. The experimental group also exhibited significant changes in the likelihood of losing their weight at 3 months (OR 0.39 p=0.037) and at 6 months (OR 0.33 p=0.017). Furthermore, the stress of the control group was significantly less at the end of the 12-month follow-up period compared to the baseline value (OR 0.37 p=0.040).

Across the sample as a whole some improvements in lifestyle habits were discovered. Nutritional Behaviour generally improved over the 12-month follow-up period (I: MD 4.30 p=0.035, II: MD 6.77

p=0.001, III: MD 10.84 p=0.030). The likelihood of smoking fewer cigarettes relative to baseline consumption was highest 3 months after discharge (OR=0.11 p=0.011), and the likelihood of smoking cessation increased significantly (I: OR 0.55 p=0.027, II: OR 0.46 p=0.006, III: OR p=0.002) respectively. Generally the participants estimated they had significantly lost their weight relative to their weight in hospital at 3 months (OR 0.44 p=0.006) and 6 months (OR 0.50, p=0.036) after discharge. Moreover, the participants seemingly became less stressed over time (II; OR 0.50, p=0.023, III; OR 0.38, p=0.001).

Table 2. Changes in lifestyle habits after intervention. Mean change (95% Confidence Interval) and *p*- values for difference

Differences in the baseline lifestyle habits of the experimental and control groups

The baseline lifestyle habits of the two groups were mostly similar. However, there was a borderline-significant difference in their alcohol consumption with the experimental group drinking less than the control group (MD 7.78, p=0.051).

Clinical outcomes during the follow-up period

It was also hypothesized that clinical outcomes would differ between the experimental and control groups. A hypothesis was only partially supported with respect to total cholesterol (MD 0.45, p=0.004) and LDL cholesterol (MD 0.53, p=0.001) with control group exhibiting increase to worse.

Hypothesis that there would be within group differences among the experimental and control groups in clinical values was partly supported by the results. In both groups there were significant within group differences in BMI, waist circumference, systolic blood pressure and HDL cholesterol levels,

furthermore among the experiment group in diastolic blood pressure and triglyceride levels. Within the control group increased LDL levels were discovered, respectively. Table 3 shows the changes in clinical values in detail.

Table 3. Changes in clinical values after intervention. Mean change (95% Confidence Interval) and *p*- values for difference

Factors describing adherence to lifestyle change and factors relating to adherence

It was hypothesised that factors describing and relating to adherence to lifestyle change would differ between the experimental and control groups. This hypothesis was only partly accepted. Significant differences were observed in support from family and friends (MD 7.55, p=0.011) and nurses at the hospital (MD 13.85, p=0.002), experimental group receiving more support than participants in the control group. The experimental group perceived lifestyle change significantly more important than the control group six months after stroke (MD 9.82, p=0.012). Based on the mean rates of factors describing and those relating to adherence, the experimental group was slightly more adherent than the control group over the follow-up period. Table 4 shows the detailed results on factors describing and relating to adherence.

Table 4. Factors describing adherence to lifestyle change and factors relating to adherence. Mean difference (95% Confidence Interval) and *p*- values for difference

DISCUSSION

The Risk Factor Targeted Lifestyle Counselling Intervention only appeared to produce some short-term lifestyle habit improvements. The experimental group exhibited a significant change in the number of cigarettes smoked three months after discharge, and in smoking cessation six months after discharge. Additionally, experimental group were more likely to lose weight during the first three and six months after discharge. These findings are consistent with the results of previous studies on the short-term impact of lifestyle interventions for stroke patients (28, 34, 41, 42).

The only lifestyle habit variable for which the two groups differed significantly during the 12-month follow-up was Alcohol Behaviour: the experimental group drank significantly less than the control group. However, the meaning of this finding is somewhat debatable because the two groups' alcohol intake differed at their admission to hospital as well. Compared to the groups` own estimation concerning their alcohol consumption prior to the hospital phase there was a general increase in Alcohol Behaviour one year after discharge. Nevertheless, self-report bias in surveys of alcohol consumption is widely documented and might have affected the results (43, 44). The baseline was measured at the hospital after a stroke or a TIA, and therefore participants might have pictured their drinking habits healthier than they were.

No significant between-group differences were identified for any other lifestyle habit variable. This is consistent with the results of previous studies, which have indicated the lack of high quality studies supporting the impact of post-stroke and post-TIA lifestyle interventions on long-term risk factor profiles (31, 41, 45).

The results might also have been affected by the fact that there were significantly more men in the experiment group. Some of the earlier studies have proven that men do not adhere to healthier lifestyle as conscientiously as women do (46, 47). On the other hand, sometimes participants themselves might even have wrong impression of the reality of their lifestyle habits and weight, for instance (27, 48). Particularly women quite often underestimate their weight (49, 50, 51).

Nevertheless, the education level of the control group was also higher and this may have affected the results (e.g. 52, 53, 54). It is known that health ideals and general opinions may affect the estimation of one's own lifestyle and reporting them, particularly with regard to smoking, energy intake and alcohol behaviour (43, 44).

The experimental group's scores on factors describing adherence to lifestyle change and on factors related to adherence were higher than those of the control group`s even though there were no significant differences between the groups with respect to lifestyle habits during the follow-up period. Previous findings suggest that support from family and friends is important in encouraging people to adopt lifestyle changes and maintain a healthy lifestyle (55). During this study there were statistically significant differences between the groups concerning factors relating to adherence – specifically, support from family and friends and support from nurses at the hospital. Despite this, intervention group didn't report improved outcomes in lifestyle habits compared to control group. This may support the importance of continuity in lifestyle counselling and perhaps more practical advice during the recovery.

Nevertheless, both groups exhibited at least some improvement in their lifestyle habits. Previous studies have given evidence of significant changes in lifestyle habits for both control and intervention groups (56, 57), suggesting that it might be the stroke incident itself that increases patients'

willingness to change their behavior rather than the intervention. In addition, awareness of risk factors has been observed to effect lifestyle behavior change after stroke aimed at preventing secondary stroke (2).

On the other hand, stroke service interventions can be considered to be complex interventions since they have numerous interacting components and may need the adoption of organisational change, complex behaviours, and the assessment of numerous outcomes (58, 59). The limited differences observed between the control and experimental groups in this work may indicate that the pre-intervention counselling was sufficiently effective to provide as much benefit as can be expected realistically from counselling, or that the control group's participation in the study may have raised their awareness of risk factor related lifestyle issues even though they did not receive specific lifestyle-focused counselling. Patients' adherence may also be influenced by various kind of information that they receive from different sources after the hospital phase; no attempt was made to examine or account for this.

The clinical outcome variables for which the two groups differed significantly were total cholesterol and LDL cholesterol with control group exhibiting increase to worse. Increased HDL levels were discovered in both groups over the 12-month follow-up period. Both groups exhibited significant improvement in BMI, waist circumference and systolic blood pressure, but diastolic blood pressure decreased only within the experiment group. Promising blood pressure reductions have previously been achieved following multimodal lifestyle-focused interventions (31, 46).

It was assumed that the improved clinical outcomes for the two groups (other than those relating to BMI and waist circumference) were mainly due to their medication rather than the intervention. It was therefore impossible to draw meaningful conclusions concerning the impact of the intervention

on the clinical outcomes determined by blood sampling (i.e. total cholesterol, LDL-cholesterol, HDL-cholesterol, glucose, and triglyceride levels). This is consistent with the findings of a recent Cochrane review which indicated that there is no evidence that non-pharmacological interventions can improve modifiable risk factors such as lipid profiles and blood glucose levels (60).

LIMITATIONS OF THE STUDY

This study has increased our knowledge about stroke patient counselling. However, some limitations need to be addressed. The major limitation of the study is that the participants were not randomly allocated to different groups, which limits the confounding of our conclusions. The strength of quasi-experiments such as that reported herein is that they are practical in cases where full experimental rigor is impossible. However, it is important to recall that when a nonequivalent control group design is used there may be several uncontrolled rival variables that influence the outcome. The effect was tried to minimize by using covariates in analysis. However, the sample size limits the possibilities for more covariates to use, which could have been a more desirable thing to do. This would have enabled better control of potential confounders and improved the robustness of the study results.

It is also possible that changes in the hospital environment may have influenced the results because the control group was gathered and treated before the intervention was introduced. For example, implementing an intervention such as that examined in this work would be extremely challenging if nursing staff left or joined the unit during the intervention. That is why we educated six nurses who were anticipated to stay with the unit for at least the duration of the study.

There are limitations relating to the intervention as well, since it was heavily based on interactions between the stroke patients and the nurses. Even though the counselling session was structured and standardised in detail, individual variations had to be accepted in practice. However, this may not be any major limitation (or indeed a limitation at all) because the counselling was intended to be tuned to each individual patient's condition and circumstances.

It cannot be said the intervention was based on the evidence of earlier intervention studies as the literature review which was done described the content and characteristics of stroke patients counselling from a larger perspective, not only intervention studies. However, the content of education days was based on the evidence of a healthy lifestyle (13, 37). Nevertheless, the use of a theory could have strengthened the evidence of intervention (32, 61). In addition, as this was a quasi-experimental study, this may work as a pilot study for future studies (32).

A further limitation is that the participants represented a fairly small convenience sample of stroke patients from a single hospital in Finland. The age limitation also prevents the possibility to generalize the results beyond the study group. It would have increased the reliability of the study if power analysis had been done prior to data collection. Finally, all of the follow-up data were collected via self-reported questionnaires based on instruments with proven validity. To continue, self-reported outcomes for the clinical variables caused a major limitation as they were compared to baseline measures and blood tests obtained by clinicians. In addition, some of the participants didn't return all of their questionnaires. It is possible that the results would have been altered if a full set of responses had been received.

CONCLUSION

The Risk Factor Targeted Lifestyle Counselling Intervention implemented in the study appeared not to have long-term effect on stroke patients' adherence to lifestyle change even though there were between-group differences in factors which have been proven to relate to adherence to lifestyle change. However, the study suggests that some sort-term improvements were achieved. Some appreciable lifestyle improvements were achieved for both groups. That is, people at risk of secondary stroke benefit from lifestyle counselling at the hospital, which may on its best reduce their risk of secondary events, and improve their overall health. Consequently, further intervention studies to improve stroke patients' long-term adherence to lifestyle change are needed.

RELEVANCE TO CLINICAL PRACTISE

The findings of the study have implications for nursing practice. In order to help stroke patients, nurses should courageously bring up the risk factor related lifestyle habits towards the end of hospital phase and point out that there is a relationship between them and stroke incidence, and that secondary stroke can be prevented or made less likely by adopting a healthy lifestyle. Therefore, nursing staff should be educated about the risk factors for stroke. Lifestyle counselling should be patient-centered and implemented interactively between the nurse and the patient.

In addition, the results presented herein suggest that continued post-discharge counselling may also be beneficial. There is consequently a need to develop new methods for counselling stroke patients, who are becoming increasingly proactive and have the ability to seek out information on their conditions by themselves after hospitalization, using information technology. Because support from

nurses has been linked to lifestyle change adherence, effective counselling should be initiated within the hospital.

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Table 1. Sociodemographic characteristics by group n (%) and group differences

Variable	Experimental group (*n*=75)	Control group (*n*=75)	Total *n (%)*
Diagnosis			
TIA	29(19.3)	32 (21.3)	61(40.7)
Stroke	46 (30.7)	43 (28.7)	89 (59.3)
Age	Mean 56.7	Mean 56.4	Mean 56.5
First stroke or TIA	63(42)	66(44)	129 (86)
Gender			
Male	48 (64)	35 (46.6)	83 (55.3)
Female	27 (36)	40 (53.3)	67 (44.7)
Marital status			
Single	8 (5.3)	5 (3.3)	13 (8.7)
Courtship	4 (2.7)	5 (3.3)	9 (6)
Married/cohabitation/domestic partnership	56 (37.3)	52 (34.7)	108 (72)
Widowed	1 (0.7)	1 (0.7)	2 (1.3)
Divorced	6 (4)	12 (8)	18 (12)
Education			
Basic education (primary and lower secondary)	31 (20.7)	33 (22)	64 (43)
Upper secondary education (general or vocational)	22 (14.7)	15 (10)	37 (24.8)
Upper vocational degree	18 (12)	15 (10)	36 (24.2)
Polytechnic	0	3 (2)	3 (2)
Academic degree	4 (2.7)	8 (5.3)	12 (8)
Working status			
Working	40 (26.7)	29 (19.3)	69 (53.1)
Retired	18 (12.)	29 (19.3)	47 (36.2)
Unemployed or laid off	7 (4.6)	7 (4.6)	14 (10.8)
Other	10 (6.7)	10 (6.7)	20 (13.3)
Diagnoses during the last year			
High blood pressure (without medication)	31 (20.7)	31 (20.7)	62 (41.3)
High blood pressure (with medication)	15 (10)	19 (12.7)	34 (22.7)
Coronary heart disease	7 (4.7)	5 (3.3)	12 (8)
High cholesterol	23 (15.3)	16 (10.3)	39 (26)
Diabetes type one	5 (3.3)	12 (8)	17(11.3)
Diabetes type one, suspected	2 (1.3)	0	2 (1.3)
Cerebrovascular disorder	7 (4.7)	7 (4.7)	14 (9.4)
Cancer	1 (0.7)	0	1 (0.7)
Arthritis	10 (6.7)	14 (9.3)	24 (16)
Spine problems	15 (10)	8 (5.3)	23 (15.3)
Depression	6 (4)	11 (7.3)	17 (11.3)

$p<0.05$, t-test was used to detect differences between groups for continuous variable (age) and chi-square test for categorical variables

Table 2. Changes in lifestyle habits after intervention. Mean change (95% Confidence Interval) and *p*- values for difference.

Lifestyle variable	Change I*	Change II**	Change III***	*Change I*	*Change II*	*Change III*	Group difference at 12 months
				p	*p*	*p*	*p*
Physical Activity[1]	2.28 (-1.67, 6.25)	3.98 (-0.27, 8.12)	2.05 (-2.10, 6.22)	0.256	0.066	0.331	0.493
Experimental group	3.48 (-8.31, 15.27)	10.97 (-2.01, 23.95)	6.05 (-6.53, 18.64)	1.000	0.153	1.000	
Control group	5.70 (-6.79, 18.20)	6.39 (-6.17, 18.95)	4.42 (-8.48, 17.34)	1.000	1.000	1.000	
Nutritional Behaviour[1]	4.30 (0.29, 8.32)	6.77 (2.70, 10.84)	4.54 (0.42, 8.65)	0.035	0.001	0.030	0.524
Experimental group	6.09 (-5.46, 17.65)	10.23 (-1.94, 22.42)	6.05 (-6.47, 18.58)	0.197	0.158	1.000	
Control group	-1.86 (-15.15, 11.42)	3.86 (-8.79, 16.52)	-0.09 (-12.95, 12.77)	1.000	1.000	1.000	
Alcohol Behaviour[1]	-2.20 (-4.91, 0.50)	-2.66 (-5.44, 0.10)	-3.52 (-6.27, -0.77)	0.152	0.063	0.006	0.027
Experimental	-4.85 (-13.80, 4.06)	-2.60 (-11.93, 6.72)	-5.90 (-15.16, 3.36)	0.908	1.000	0.552	
Control	-0.12 (-9.43, 9.17)	-1.55 (-10.81, 7.70)	-2.30 (-11.49, 6.88)	1.000	1.000	1.000	
Current Smoking[2]	0.55 (0.32, 0.93)	0.46 (0.26, 0.80)	0.42 (0.24, 0.74)	0.027	0.006	0.002	0.624
Experimental	0.58 (0.20, 1.65)	0.24 (0.06, 0.89)	0.36 (0.11, 1.18)	1.000	0.024	0.141	
Control	0.55 (0.19, 1.61)	0.67 (0.23, 1.89)	0.49 (0.17, 1.41)	0.878	1.000	0.452	
The amount of smoked cigarettes per day[2]	0.11 (0.02, 0.68)	0.94 (0.18, 4.98)	0.20 (0.03, 1.25)	0.011	1.000	0.106	0.120
Experimental	0.15 (0.02, 0.95)	0.74 (0.08, 6.30)	0.29 (0.04, 1.91)	0.042	1.000	0.503	
Control	0.20 (0.02, 1.60)	0.40 (0.06, 2.37)	0.12 (0.01, 1.06)	0.249	1.000	0.061	
One's own image of weight[2]	0.73 (0.39, 1.36)	0.74 (0.39, 1.40)	0.84 (0.45, 1.59)	0.325	0.362	0.608	0.698
Experimental	1.08 (0.32, 3.59)	0.71 (0.20, 2.50)	0.74 (0.21, 2.52)	1.000	1.000	1.000	
Control	0.61 (0.18, 2.06)	0.95 (0.29, 3.16)	0.94 (0.28, 3.07)	1.000	1.000	1.000	
Weight during the follow-up[2]	0.44 (0.23, 0.83)	0.50 (0.26, 0.97)	0.90 (0.47, 1.71)	0.006	0.036	1.000	0.256
Experimental	0.39 (0.16, 0.96)	0.33 (0.12, 0.88)	0.50 (0.19, 1.30)	0.037	0.017	0.343	
Control	0.66 (0.26, 1.68)	0.94 (0.36, 2.45)	1.94 (0.74, 5.08)	1.000	1.000	0.394	
Stress management [2]	0.57 (0.32, 1.03)	0.50 (0.27, 0.90)	0.38 (0.21, 0.69)	0.063	0.023	0.001	0.576
Experimental group	0.83 (0.34, 2.06)	0.85 (0.33, 2.21)	0.79 (0.30, 2.05)	1.000	1.000	1.000	
Control group	0.58 (0.22, 1.50)	0.55 (0.20, 11.43)	0.37 (0.14, 0.97)	0.803	0.601	0.040	

*Mean change between hospital and 3 months

**Mean change between hospital and 6 months

***Mean change between hospital and 12 months

[1] Summated variables analysed with repeated measures of ANCOVA and Bonferroni corrected contrast

[2] Individual categorical variables, analysed with multivariate ordinal logistic regression

Statistical significance $p < 0.05$

Results were adjusted with age, sex, BMI and time

Table 3. Changes in clinical values after intervention. Mean change (95% Confidence Interval) and *p*- values for difference

Clinical variable	Change I*	Change II**	Change III***	*Change I* *p*	*Change II* *p*	*Change III* *p*	Group difference at 12 months *p*
BMI	0.21 (-0.37, 0.81)	0.11 (-0.47, 0.69)	0.26 (-0.34, 0.87)	1.000	1.000	0.893	0.707
Experimental group	-3.46 (-6.21, -0.71)	-3.38 (-6.16, -0.59)	-3.46 (-6.32, -0.60)	0.005	0.008	0.008	
Control group	-2.70 (-5.35, -0.05)	-3.07 (-5.68, -0.45)	-2.43 (-5.08, 0.21)	0.043	0.011	0.092	
Waist circumference	-5.27 (-8.18, -2.35)	-5.00 (-7.88, -2.12)	-5.03 (-8.03, -2.03)	<.001	<.001	<.001	0.941
Experimental group	-16.21 (-24.54, -7.89)	-15.41 (-23.75, -7.07)	-16.95 (-25.51, -8.40)	<.001	<.001	<.001	
Control group	-13.38 (-21.47, -5.28)	-14.18 (-22.32, -6.03)	-13.21 (-21.60, -4.83)	<.001	<.001	<.001	
BP- systolic	-20.42 (-31.05, -9.78)	-21.94 (-32.58, -11.29)	-23.64 (-34.64, -12.64)	<.001	<.001	<.001	0.724
Experimental group	-35.71 (-49.39, -22.029	-39.20 (-53.45, -24.61	-39.36 (-54.11, -24.61)	<.001	<.001	<.001	
Control group	-18.39 (-32.13, -4.66)	-18.66 (-32.27, -5.05)	-21.51 (-35.44, -7.58)	0.002	<.001	<.001	
BP –diastolic	-5.70 (-11.43, 0.01)	-6.91 (-12.64, -1.18)	-5.33 (-11.28, 0.60)	0.050	0.011	0.093	0.729
Experimental group	-8.02 (15.54, -0.51)	-10.0 (-17.82, -2.17)	-7.87 (-17.82, -2.17)	0.029	0.004	0.066	
Control group	-5.46 (-12.99, 2.07)	-6.33 (-13.80, 1.14)	-6.06 (-13.70, 1.57)	0.331	0.151	0.216	
Glucose (fingertip)	-0.40 (-1.22, 0.42)	-0.60 (-1.30, 0.17)	-0.61 (-1.45, 0.22)	0.723	0.186	0.232	0.547
Experimental group	-0.45 (-1.55, 0.64)	-0.89 (-1.96, 0.18)	-0.66 (-1.81, 0.49)	1.000	0.168	0.774	
Control group	-0.78 (-1.90, 0.32)	-0.70 (-1.72, 0.31)	-0.85 (-1.98, 0.27)	0.364	0.400	0.276	
Cholesterol - total	1.07 (0.23, 1.91)	0.95 (0.14, 1.76)	0.92 (0.08, 1.77)	0.007	0.015	0.026	0.004
Experimental group	1.06 (-0.19, 2.32)	0.90 (-0.28, 2.09)	0.95 (-0.25, 2.17)	0.152	0.259	0.223	
Control group	1.72 (0.54, 2.90)	1.71 (0.59, 2.83)	1.89 (0.72, 3.05)	<.001	<.001	<.001	
HDL	0.38 (0.06, 0.70)	0.36 (0.03, 0.68)	0.44 (0.10, 0.77)	0.012	0.023	0.005	0.973
Experimental group	0.81 (0.18, 1.43)	0.62 (0.00, 1.24)	0.84 (0.21, 1.47)	0.004	0.045	0.002	
Control group	0.30 (-0.28, -0.90)	0.65 (0.07, 1.23)	0.79 (0.19, 1.39)	1.000	0.017	0.002	
LDL	0.6 (-0.06, 1.41)	0.59 (-0.12, 1.32)	0.63 (-0.12, 1.39)	0.087	0.141	0.136	0.001
Experimental group	0.91 (-0.34, -2.17)	0.82 (-0.38, 2.03)	0.96 (-0.28, 2.21)	0.325	0.428	0.248	
Control group	1.46 (0.28, 2.26)	1.13(-0.00, 2.26)	1.27 (0.07, 2.46)	0.006	0.050	0.031	
Glucose (blood)	0.00 (-0.72, 0.72)	0.02 (-0.73, 0.78)	0.25 (-0.40, 0.98)	1.000	1.000	1.000	0.255
Experimental group	-0.12 (1.68, 1.43)	-0.07 (-1.81, 1.66)	0.02 (-1.64, 1.68)	1.000	1.000	1.000	
Control group	-0.35 (-2.08, 1.37)	-0.53 (-2.18, 1.11)	-0.10 (-1.73, 1.39)	1.000	1.000	1.000	
Triglyceride	-0.54 (-1.02, -0.06)	-0.52 (-1.01, -0.039	-0.57 (-1.08, -0.07)	0.020	0.033	0.018	0.347
Experimental group	-0.81 (-1.97, 0.34)	-1.04 (-2.18, 0.09)	-1.18 (-2.35, -0.01)	0.006	0.015	0.007	
Control group	-0.34 (-1.43, 0.75)	-0.45 (-1.57, 0.66)	-0.56 (-1.68, 0.55)	0.403	0.280	0.182	

BMI= body mass index, HDL= high-density lipoprotein, LDL= low-density lipoprotein, BP= blood pressure. Statistical significance $p<0.05$

*Mean change between hospital and 3 months, **Mean change between hospital and 6 months, ***Mean change between hospital and 12 months

Table 4. Factors describing adherence to lifestyle change and factors relating to adherence. Mean difference (95% Confidence Interval) and *p*- values for difference.

Adherence variable	Mean I*	Mean II*	Mean III*	Difference between group means at 3 months	Difference between group means at 6 months	Difference between group means at 12 months	I** *p*	II** *p*	III** *p*	Mean change at 12 months (95%CI)	Group difference at 12 months *p*
Adherence to medication[1]	46.53	49.81	47.76							9.09 (-0.82, 19.02)	0.071
Experimental group	53.76	56.31	54.28	8.86	10.03	8.88	0.420	0.401	0.570		
Control group	44.90	46.28	45.40	(-5.60, 23.33)	(-6.07, 26.13)	(-7.44, 25.21)					
Adherence to lifestyle change[1]	47.92	47.45	47.97							5.67 (-2.44, 13.80)	0.165
Experimental group	52.27	49.54	52.97	10.64	4.65	3.69	0.212	1.000	1.000		
Control group	41.6	44.89	49.28	(-3.54, 24.83)	(-9.22, 18.52)	(-9.43, 16.83)					
Motivation[1]	62.17	62.10	62.85							2.93 (-2.20, 8.07)	0.259
Experimental group	64.09	64.79	65.79	1.42	4.76	2.97	1.000	0.591	1.000		
Control group	62.66	60.03	62.81	(-6.70, 9.56)	(-4.12, 13.65)	(-5.60, 11.56)					
Meaning of lifestyle change[1]	61.42	60.99	66.50							4.30 (-0.31, 8.93)	0.067
Experimental group	63.86	63.50	66.60	3.43	9.82	-0.79	0.998	0.012	1.000		
Control group	60.43	56.67	66.14	(-5.12, 11.99)	(1.63, 18.02)	(-9.08, 7.48)					
Support from the family and friends[1]	60.02	60.70	60.78							7.55 (1.77, 13.33)	0.011
Experimental group	64.01	63.58	65.00	6.18	5.43	7.70	0.285	0.457	0.174		
Control group	57.83	58.14	57.30	(-2.72, 15.08)	(-3.71, 14.58)	(-2.06, 17.46)					
Support from the doctors[1]	95.73	93.01	94.84							6.32 (-0.67, 13.33)	0.076
Experimental group	98.67	95.70	97.41	6.46	5.80	2.64	0.350	0.503	1.000		
Control group	92.21	89.90	94.77	(-3.43, 16.36)	(-4.30, 15.90)	(-7.77, 13.05)					
Support from the nurses[1]	50.43	52.14	50.23							13.85 (4.91, 22.79)	0.002
Experimental group	57.53	58.30	61.41	12.41	11.72	19.50	0.069	0.103	0.002		
Control group	45.12	46.57	41.90	(-0.69, 25.51)	(-1.57, 25.02)	(5.47, 33.53)					

Analysed with repeated measures of ANCOVA and Bonferroni corrected contrast. Adjusted with age, sex, BMI and time.

[1] Summated variable; higher scores indicated better adherence

* Mean scores of adherence at 3 months (I), 6 months (II) and 12 months (III)

** Significance of difference between group means at 3 months (I), 6 months (II) and 12 months (III)

Statistical significance $p<0.05$