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Randomised trial of a computer-generated tailored written education package for patients following stroke

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Abstract

Background: the ideal method of providing stroke patients with information has not been established.
Objectives: to evaluate the effectiveness of providing stroke patients with computer-generated tailored written information.
Design: randomised controlled trial with blinded assessor.
Setting: acute stroke unit.
Participants: 138 stroke patients.
Methods: patients were randomised to receive either computer-generated tailored written information about stroke or generic written information while in hospital. Three months following discharge, a blinded assessor evaluated the outcomes of knowledge about stroke, self-efficacy (Self-Efficacy to Perform Self-Management Behaviours Scale), anxiety and depression (Hospital Anxiety and Depression (HAD) Scale), perceived health status (COOP charts), satisfaction with content and presentation of the written information received (separate 10-point visual analogue scale for content and presentation), and desire for additional information.
Results: complete data were obtained for 133 (96.4%) patients. Patients in the intervention group were significantly more satisfied with the content (difference on a 10-point visual analogue scale was 1, 95% confidence interval 0.4 to 1.7, $P = 0.003$) and presentation (difference on a 10-point visual analogue scale was 1.2, 95% confidence interval 0.6 to 1.9, $P < 0.001$). Significantly, fewer patients in the intervention group desired additional information about stroke at follow-up than patients in the control group (4.5% versus 32.8%; $P < 0.001$). Anxiety change scores improved slightly more in favour of the control group (1.4 difference on the HAD subscale, 95% confidence interval 0.2 to 2.8, $P = 0.03$). No significant differences between the groups were observed for any of the other outcome measures.
Interpretation: providing stroke patients with computer-generated tailored written information improved satisfaction with the information that was received and was more effective in meeting patients' informational needs than non-tailored information, but had no effect on knowledge about stroke, self-efficacy, depression, or perceived health status.

Keywords: *stroke, patient education, elderly*

Introduction

Education should be an essential component of post-stroke management, yet the inadequacy of the education provided to stroke patients is widely acknowledged [1–4]. Most stroke patients want more information than they currently receive, and studies have found that the informational needs of patients are not met by current practice [1, 2, 5, 6]. The ideal method of providing stroke patients with information has not been established. Written materials are one method of providing information, although their use with stroke patients has been explored in only a few studies [7–9] and inconclusive results about the effectiveness of written materials on stroke patient outcomes were reported in these three studies. Although the results might have been compromised by low statistical power, it is also possible that the materials used in these studies did not meet the informational needs of the patients who received them.

There is great variation in the informational needs of patients following a stroke, with research showing that no two patients want to receive information about the same combination of topics [10]. Tailored information may be more effective than generic information in meeting patients' informational needs [6, 7, 11]. Tailored messages are more likely to be read and remembered [12, 13], and are more effective in changing health behaviours [12] and improving self-efficacy [14] than generic information. Computer technology has been used to tailor written information for other conditions but not stroke. We developed and piloted a system (the 'What you need to know about stroke' system) to provide computer-generated tailored information to stroke patients [15]. The primary aim of this study was to compare the effects of providing stroke patients with computer-generated tailored written information compared to generic written information.

Participants and methods

Study participants

All patients who were admitted to the stroke unit of a major metropolitan hospital in Brisbane, Australia, between June 2003 and February 2005 were considered for inclusion in the study. The eligibility criteria were that the patient: had a diagnosed stroke or transient ischaemic attack; had a reported English-proficiency level, corrected hearing and vision, and communication status adequate to participate in an interview and complete assessment tasks; did not have reported or observable dementia; lived within 50 km of the hospital for ease of follow-up; and was medically stable.

Ethical approval

The trial was approved by the hospital's ethics committee and one of the ethics committees of the University of Queensland. Patients provided informed written consent.

Recruitment and randomisation

On admission to the stroke unit, each patient's eligibility for the study was assessed by a research assistant. After a patient provided consent, the research assistant informed the stroke unit research nurse who entered the patient's name into the 'What you need to know about stroke' database and the database randomly assigned the patient to either the intervention or control group. One of the database tables contained a predetermined computer-generated randomisation sequence, thus ensuring concealed allocation. The randomisation sequence used a balanced block design where randomisation occurred in blocks of four.

Intervention groups

Following randomisation and the baseline assessment, patients were provided with written information by the research nurse. Participants in both groups also received the usual education practice provided to patients of this stroke unit. This consisted of informal verbal discussions with their treating health professionals, as needed, from admission through to discharge.

Computer-generated tailored written information (intervention group)

The 'What you need to know about stroke' system was designed so that the health professional providing the intervention (in this trial, the research nurse) communicates and collaborates with the patient to establish his or her informational needs. The system contains three tailoring features. Patients identify which topics they would like to receive information about, the amount of information (detailed or shortened) that they would like about each topic, and the font size that they would like the information to be printed in. There are 34 topics available, with topics covering issues such as how stroke occurs, risk factors, understanding and managing the effects of stroke, reducing stroke risk, treatment and rehabilitation, and managing after discharge. There are also five 'non-optional' topics that are incorporated into each booklet as it is generated. These are topics that patients would be unlikely to request if asked, such as the purpose of the booklet and the glossary, however, they were considered important to the overall completeness of the booklet. The content and design features of the written information were prepared according to best practice recommendations [16] for written health education materials. This includes features such as appropriate layout, organisation, and typography; appropriate use of illustrations; and the incorporation of features that facilitate learning and motivation. A detailed description of the intervention, the rationale for its design and development, and details of its piloting have been published previously [15]. The 'What you need to know about stroke' database can be accessed at the following website http://www.uq.edu.au./tru/strokebook/.

The research nurse interviewed patients in the intervention group and completed a paper-based checklist with them. In addition to establishing the patients' informational needs, this provided opportunities for the research nurse to elaborate on the topics and explain the relevance and importance of them to the patients. The identified needs, along with preferred font size, were then entered into the database and the tailored booklet was automatically generated in Microsoft Word. The research nurse then printed the booklet, placed it in a folder, personalised the cover page with the patient's name and the date, and distributed the booklet to the patient.

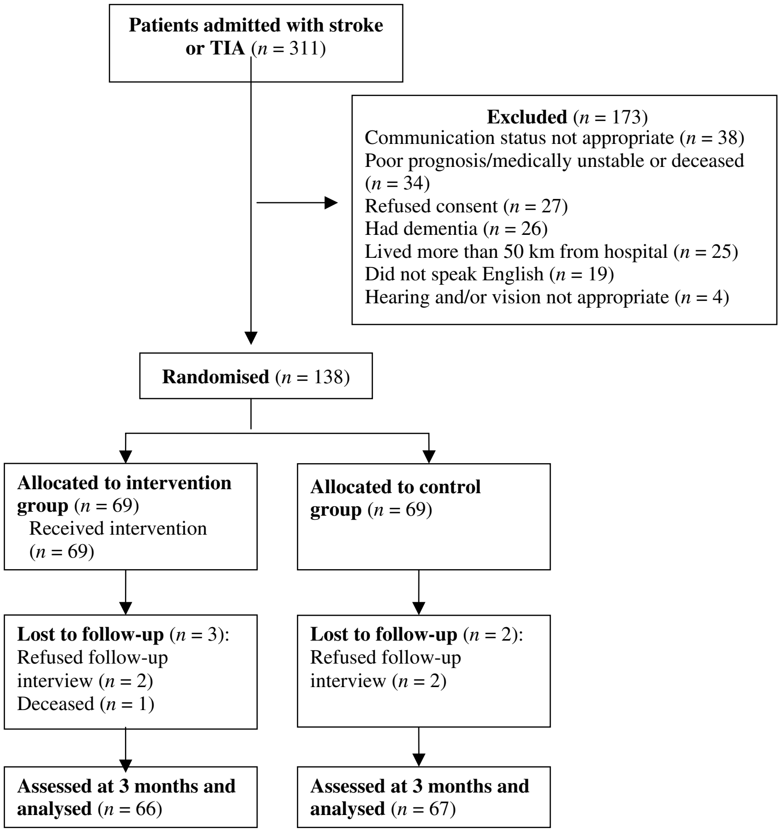

Figure 1. Flow chart of patients through the study.

Generic written information (control group)

The research nurse provided patients in the control group with a series of three stroke fact sheets produced by the Stroke Association of Queensland which covered topics such as how stroke occurs, risk factors, and physical, cognitive, and emotional changes following a stroke.

Data collection

An outcome assessor who was blind to patients' group allocation, conducted baseline interviews while the patient was in hospital, and follow-up interviews 3 months after discharge. Baseline information on sociodemographic and clinical variables was gathered from patients' medical charts and through interview. Four of the outcome measures (knowledge, self-efficacy, anxiety and depression, perceived health status) were administered at both baseline and follow-up. Two of the outcomes (satisfaction with information and desire for additional information) were assessed at follow-up only.

Knowledge about stroke was assessed using the Knowledge of Stroke Questionnaire (score 0 to 25) which was developed for this study, based partly on the Stroke Knowledge Questionnaire [7]. Six sections of the Self-Efficacy to Perform Self-Management Behaviours Scale [17] were used to measure self-efficacy. The items in each section are scored on a 10-point Likert scale and a mean score is calculated for each section, with higher scores indicating greater self-efficacy. The Hospital Anxiety and Depression (HAD) Scale [18] was used to measure anxiety and depression. The HAD Scale consists of separate subscales for anxiety and depression with the scores for each subscale ranging from 0 to 21, with lower scores indicating lower levels of the emotion being measured. The COOP charts [19] were used to measure perceived health status (range from 1 to 5, with lower scores indicating better health). At the follow-up interview, patients were asked if they had read the written information and if not, why. Patients who had read the information were asked to rate their satisfaction with the content and presentation (separately) of the written information received using a 10-point vertical visual analogue scale (with 1 = not at all satisfied and 10 = extremely satisfied). Patients' desire for additional information was also assessed by asking if they wanted any further information about stroke and if so, on which topics.

Sample size

It was determined that a clinically significant difference between the groups would require at least 0.5 SD difference on the self-efficacy measure which is equivalent to one point on the 10-point Likert scale. To detect this difference at the follow-up assessment, with $\alpha = 0.05$ and 80% power, 65 patients were required for each group, therefore we aimed to recruit a minimum of 130 patients.

Table 1. Baseline characteristics of patients in the intervention and control groups. Values are numbers (percentages) unless stated otherwise

Characteristic	Intervention group ($n = 66$)	Control group ($n = 67$)
Mean (SD) age (years)	67.2 (15.3)	69.1 (14.8)
Male	42 (63.6)	31 (46.3)
Mean (SD, range) years of formal education	10.5 (3.7, 4–19)	10.1 (3.0, 5–20)
Living alone	24 (36.4)	19 (28.4)
Mean (SD, range) duration (days) between stroke and hospital interview	8.3 (5.9, 1–38)	8.4 (4.8, 3–21)
Side of stroke:		
Right	37 (56.1)	37 (55.2)
Left	29 (43.9)	29 (43.3)
Bilateral		1 (1.5)
Type of stroke:		
Total anterior circulation syndrome	2 (3.0)	1 (1.5)
Partial anterior circulation syndrome	23 (34.8)	24 (35.8)
Posterior circulation syndrome	14 (21.2)	10 (14.9)
Lacunar syndrome	16 (24.2)	22 (32.8)
Haemorrhage	8 (12.1)	9 (13.4)
Transient ischaemic attack	3 (4.5)	1 (1.5)
First stroke	45 (68.2)	45 (67.2)
Aphasia	13 (19.7)	9 (13.4)
Stroke-related visual perceptual impairment	8 (12.1)	10 (14.9)
Stroke-related vision impairment	18 (27.3)	17 (25.4)

Data analysis

Data were analysed on an intention-to-treat basis. We used independent sample t-tests (two-tailed) to analyse change scores (follow-up scores minus baseline scores) in knowledge, self-efficacy, anxiety, depression, and perceived health status. Independent sample t-tests were used to analyse patients' mean satisfaction with the content and presentation of the information received. The percentage of patients in each group who desired additional information at post-intervention was analysed using Fischer's Exact Test. A P value of ≤ 0.05 was considered to be statistically significant in all comparisons.

Role of the funding source

The trial was funded by the Medical Benefits Fund (MBF) of Australia. The sponsor played no role in the trial's design, data collection, analysis, or interpretation.

Results

Figure 1 shows the flowchart of patients through the study. Of the 138 patients randomised, 133 (96.4%) completed the study. The baseline characteristics of the two groups were similar (Table 1), with the exception of gender where there was a higher proportion (63.6%) of males in the intervention group than in the control group (46.3%). To explore whether the baseline difference in gender may have been a confounding variable, a two-way ANOVA was performed for each of the outcomes, with group allocation as one factor and gender as the other. The F value did not change significantly in the presence of gender, indicating that gender did not influence any of the outcomes. The mean age of patients was 67.4 years and 55.1% were male. Baseline scores on the outcome measures were also similar for the two groups (Table 2).

Change in knowledge, self-efficacy, anxiety, depression, and perceived health status

We found no significant differences between patients in the intervention and control groups for change in knowledge about stroke, self-efficacy, depression, or perceived health status from baseline to follow-up (Table 2). Anxiety change scores improved slightly more in favour of the control group (1.4, 95% confidence interval 0.2 to 2.8, $P = 0.03$) (Table 2).

Patient satisfaction with the written information received

Fifty-three (80.3%) patients in the intervention group and 48 (71.6%) in the control group reported reading the written information that they received. Patients in the intervention group (mean = 9.2, range 7–10) were more satisfied than patients in the control group (mean = 8.2, range 1–10) with the content of the written information received (difference 1, 95% confidence interval 0.4 to 1.7, $P = 0.003$). Patients in the intervention group (mean = 9.4, range 7–10) were also more satisfied than patients in the control group (mean = 8.2, range 1–10) with the presentation of the written information received (difference 1.2, 95% confidence interval 0.6 to 1.9, $P < 0.001$).

Desire for additional information

Three (4.5%) patients in the intervention group and 22 (32.8%) patients in the control group desired additional information about stroke at follow-up ($P < 0.001$).

Table 2. Baseline and change scores (from baseline to 3 months) on outcome measures for patients in the intervention and control groups

Outcome	Mean (SD) baseline scores Intervention group (*n* = 66)	Mean (SD) baseline scores Control group (*n* = 67)	Change scores (0–3 months) Intervention group (*n* = 66)	Change scores (0–3 months) Control group (*n* = 67)	95% CI	*P* value
Knowledge about stroke	16.0 (4.2)	15.9 (3.6)	1.5	1.6	−1.5 to 1.1	0.79
Self-efficacy:						
Section 1 (to get information about the disease)	8.1 (2.3)	7.9 (2.5)	0.2	0.7	−1.5 to 0.4	0.27
Section 2 (to obtain help from family, community, and friends)	7.9 (1.8)	8.1 (1.5)	0.0	0.2	−0.8 to 0.3	0.32
Section 3 (to communicate with the doctor)	8.6 (1.8)	9.1 (1.7)	0.3	−0.1	−0.2 to 1.1	0.20
Section 4 (to control/manage depression)	7.7 (2.0)	7.8 (1.8)	0.0	0.3	−0.8 to 0.2	0.27
Section 5 (to manage the disease in general)	7.8 (1.8)	8.0 (1.9)	0.4	0.3	−0.3 to 0.7	0.49
Section 6 (to manage symptoms)	7.3 (2.0)	7.7 (1.8)	0.0	−0.2	−0.5 to 0.9	0.64
HAD anxiety	6.4 (4.2)	6.9 (4.3)	−0.1	−1.5	0.2 to 2.8	0.03
HAD depression	5.0 (3.9)	4.7 (3.3)	0.4	0.3	−1.2 to 1.2	0.99
COOP charts:						
Chart 1 (Physical fitness)	3.5 (1.4)	3.6 (1.3)	0.4	0.4	−0.4 to 0.4	0.97
Chart 2 (Feelings)	2.3 (1.2)	2.4 (1.3)	−0.2	−0.3	−0.3 to 0.6	0.57
Chart 3 (Daily activities)	2.5 (1.2)	2.7 (1.4)	−0.1	−0.1	−0.5 to 0.6	0.96
Chart 4 (Social activities)	2.3 (1.4)	2.1 (1.9)	0.1	−0.1	−0.4 to 0.8	0.48
Chart 5 (Pain)	2.5 (1.5)	2.5 (1.3)	0.1	0.2	−0.6 to 0.6	0.93
Chart 6 (Change in health)	3.7 (1.2)	3.5 (1.3)	−1.4	−1.1	−0.8 to 0.3	0.34
Chart 7 (Overall health)	3.3 (1.0)	3.4 (1.1)	−0.4	−0.1	−0.6 to 0.2	0.34
Chart 8 (Social support)	1.9 (1.1)	1.8 (1.1)	−0.4	−0.2	−0.6 to 0.2	0.39
Chart 9 (Quality of life)	2.5 (1.0)	2.6 (1.1)	−0.2	−0.5	−0.1 to 0.7	0.15

Discussion

In this trial, stroke patients who received tailored written information during their acute hospital stay were more satisfied with the information that they received and had fewer unanswered stroke-related questions at 3 months following discharge. However, patients who received tailored written information had no greater change in knowledge about stroke, self-efficacy, depression, or perceived health status than patients who received generic written information. Patients who received the generic information experienced a slightly greater reduction in anxiety from baseline to follow-up, however, the size of the difference between the groups is small and unlikely to be of clinical significance. The reason for this is unclear but may reflect that the intervention group received more detailed information about stroke. Patients in the control group received a limited amount of information, yet this may have been sufficient to answer some of their basic questions about stroke and consequently reduce their anxiety.

We aimed to conduct a rigorous randomised trial, and strengths of this study include the use of a blinded outcome assessor, concealed allocation, a high level of patient follow-up, and intention-to-treat analysis. However, there are several weaknesses in this study. Although the sample size was of a size similar to or larger than the majority of studies that have examined the provision of education to patients following a stroke, the number of patients was still rather small and it is likely that the trial had limited power to detect a modest effect in some of the outcomes. It is also questionable whether some of the outcome measures used (knowledge, self-efficacy, and perceived health status) were sensitive enough to detect changes if they existed. There is no uniform agreement on the most important outcomes to measure when evaluating educational interventions and few validated outcome measures are available to assess the effects of a written educational intervention on patient outcomes. The choice of educational outcome measures that are designed for use with stroke patients is even more limited. A further limitation of this study is that participants were recruited from one metropolitan hospital and only English-speaking patients who had the communication, cognitive, visual, and hearing skills necessary to complete interview tasks were included. Therefore, the results of this study may not be generalisable to other settings and all stroke patients. However, the intervention is clearly described and the patients in the study are typical of those to whom it would be appropriate to provide written information following a stroke.

This is the first randomised trial to evaluate the effects of providing stroke patients with tailored written information. Previous trials of non-tailored written information [7, 8] have found inconclusive evidence about the value of providing stroke patients with written information, with inadequate power and the use of generic information suggested as reasons for this. Although the general effectiveness of providing information to stroke patients has not been conclusively demonstrated, the trials that have shown the most promising results have evaluated a multi-component intervention such as supplementing written information with meetings with the multidisciplinary team [20] or counselling visits post-discharge [21]. Written information should not be provided as a stand-alone intervention and the 'What you need to know about stroke' database evaluated in this trial was designed to facilitate communication between the health professional and the patient. However, the finding in this study that patients who received the tailored information were more satisfied with the information they received and their informational needs were better met than patients who received non-tailored written information, may reflect that the intervention consisted of more than just the straightforward distribution of tailored written material. In order to complete the checklist for the database, the research nurse spent time talking with and interviewing patients in the intervention group. This one-on-one time with a health professional may have contributed to the greater satisfaction and better met informational needs that were reported by patients in the intervention group.

Although verbal reinforcement of the written information at and after the time of providing it to patients was encouraged in this trial, it was not emphasised in this trial. Future research could investigate the effectiveness of providing tailored written information and supplementing it with verbal education, not only when the written information is initially provided but also after the patient has been discharged. Patients continue to have informational needs beyond discharge [5] and the effectiveness of providing this support by telephone could be explored. Improved outcomes were found in a trial where arthritis patients were provided with tailored written information on a number of occasions [14], with new tailored information building on previous information and patients' responses to questionnaire items. Research into the effectiveness of providing multiple tailored messages over time to stroke patients is warranted, as is exploration into whether fine-grained tailoring of the information, such as according to details from the patient's medical record, is more effective than the coarse-grained tailoring that was used in this trial.

The system that was designed for this study is simple and inexpensive to install and operate, and stroke units could consider supplementing information that is provided verbally with tailored written information as a means of better meeting the informational needs of patients who have had a stroke.

Key points

- In a randomised controlled trial of computer-generated tailored written information for stroke patients, patients who received the tailored information were more satisfied with the information they received and their informational needs were better met than patients who received non-tailored written information.
- The tailored written information was no more effective in improving knowledge about stroke, self-efficacy, depression, and perceived health status than the standard written information.

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Conflict of interest declaration

We have no conflicts of interest to declare.

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Intelligence in early adulthood and life span up to 65 years later in male elderly twins

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Abstract

Background: previous research has reported that greater intelligence in early life is associated with longer lifespan. Whether this relationship is mediated by genetic factors or environmental factors, some of which could be modified by an individual, is unclear.

Objective: we examined the association between intelligence test scores, obtained during the 1940s, and age at death in a group of 492 male twin pairs, members of the National Academy of Sciences - National Research Council Twins Registry of WWII veterans.

Design: using self-report information collected in the 1960s, we examined whether modifiable risk factors for mortality, such as use of tobacco and alcohol, cardiovascular disease, and body mass index altered the association between intelligence and longevity.

Results: when each member of a twin pair was treated as an independent observation, higher intelligence test scores were associated with longer life span ($P = 0.0002$). Modifiable risk factors were associated with life span as expected. However, in co-twin control analyses in which one twin served as the control for the other twin, neither intelligence nor any modifiable risk factors showed a significant association with life span.

Conclusion: our findings suggest that genetics and early life environmental factors contribute heavily to lifespan and when one controls for these factors using twins, the effect of intelligence on longevity is diminished.

Keywords: *intelligence, survival, twins, risk factors, elderly*