Prevent 2nd Stroke: a pilot study of an online secondary prevention program for stroke survivors

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Abstract

Objective: The prevalence of modifiable health risk factors and psychological distress following a stroke is high and markedly increase the chance of a second stroke. This study aimed to examine the usability and acceptability of an online secondary prevention program addressing modifiable psycho-behavioural risk factors for stroke survivors.

Methods: A pre–post pilot study was conducted in Australia between 2016 and 2017. Participants were recruited through the Australian Stroke Clinical Registry and completed measures of health-related quality of life, physical activity, smoking status, depression and anxiety, alcohol status, nutrition and internet use. Participants also used an online secondary prevention program (Prevent 2nd Stroke) over a two-week period. At follow-up, acceptability and usability of the program were assessed.

Results: A total of 18 out of 19 participants reported engaging in multiple health risk behaviours. Participants reported that they were interested in receiving an online program that provided health information (73.7%). Participants indicated Prevent 2nd Stroke was easy to use (63.1%) and that they would recommend the program to other stroke survivors (63.1%).

Conclusions: The results indicated that online programs are an acceptable way to address these health outcomes.

Implications to public health: Further research is needed to assess the effectiveness of these interventions using powered trials.

Key words: stroke, health behaviour change, online program, pilot study, stroke survivor

Stroke or transient ischaemic attack (TIA) survivors are at high risk of further strokes and around 30–40% of people will experience a subsequent stroke within five years of the first.[1] The prevalence of modifiable health risk factors among stroke survivors is high, including physical inactivity, unhealthy diet and smoking, which contribute to 90% of the risk of all strokes.[2,3] Furthermore, depression and anxiety are modifiable affective states that commonly follow a stroke event, and are associated with post-stroke morbidity and mortality.[4,5] While best practice guidelines[6] propose that prevention of further strokes should begin immediately following a stroke event, and continue indefinitely, it is estimated that 50% of stroke survivors are discharged from hospital without a plan and 67% of hospitals do not report having any protocols in place for reviewing stroke patients post-discharge.[7]

Few secondary prevention behavioural interventions for stroke survivors exist.[8,9] Lawrence et al.[8] found that secondary prevention lifestyle interventions designed to change lifestyle behaviours following stroke have positive effects in terms of positive behaviour change (for example, increasing time spent walking) and psychological outcomes (for example, depression). However, only four trials were included in Lawrence et al.'s review and the interventions described in these trials were resource and personnel intensive, making them costly and difficult to translate into practice into the community.

An internet approach for the prevention of second stroke has many advantages.[10,11] Using the internet to deliver health information and interventions is an attractive platform for health providers because it is cost-effective,[10,11] can be accessed by individuals who may live in remote locations in Australia[12] or be house-bound, and it is considered to be acceptable by users. Mawson et al.[13] developed and evaluated an information and communication technology for post-stroke rehabilitation. It was found that the interactive technology met the needs of carers and stroke survivors in both recovery and adaptation.[13] Online programs combining information and support have the potential to reduce need for services,[14] are convenient to use – being portable and accessible in locations with available internet – and are cost-effective.[15]

Smartphone apps have shown promising results as primary prevention self-management systems for stroke survivors; however, few secondary prevention apps are available to stroke survivors.[16,17] Feigin and Norrving[17] developed the Stroke Riskometer smartphone app as a primary stroke prevention approach. The app used novel and innovative features, including the ability for users to calculate their risk of stroke within the next five to 10 years, and to compare their risk of stroke to other

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people of the same age and gender of the general population. However, a validation study of the Stroke Riskometer app has shown that it is a poor predictor of stroke events.[18] Secondary prevention programs and apps for stroke survivors should differ from primary prevention programs, as cognitive and physical disability may affect the stroke survivors' ability to engage with the program. A smartphone secondary prevention program for stroke survivors developed by Sureshkumar et al.[16] was found to be acceptable and feasible by stroke survivors. Tailored and personalised technology self-management systems for stroke survivors have the potential to assist in achieving healthier lifestyles and reduce the chance of a second stroke.[13]

Few online prevention programs have been developed.[16,19,20] Two studies that used internet delivery were identified by Kraft et al.[21] in a recent review of telemedicine for the improvement of secondary prevention after stroke/TIA. Kim et al.[19] conducted a pilot study using an online stroke education program to target modifiable risk factors of stroke. They found improvements in health behaviours such as physical activity, increased fruit and vegetable consumption and lowered salt intake compared to the control group, who did not receive the program; however, these findings were not powered to detect meaningful changes in behaviour. Rochette et al.[20] conducted a randomised control trial (RCT) that used two methods of delivery for the intervention: 1) a secondary prevention multi-modal intervention using telephone, internet and paper support for stroke survivor; and 2) a telephone number that could be accessed at any time by stroke survivors. While no statistical differences in health outcomes were found, the researchers did acknowledge their small sample size. Furthermore, they noted that at six-months and 12-months follow-up, many stroke survivors still reported issues with mobility, relationships, work, recreation and health provider follow-up.[20] These findings indicate the potential positive effects that online programs could have on assisting stroke survivors to achieve healthier lifestyles, and further highlight the increasing need for further research in online secondary prevention programs for stroke survivors.

The Prevent 2nd Stroke Program (P2S) is an online secondary prevention program that aims to provide stroke survivors access to health-related information, and support lifestyle and behaviour changes to reduce the occurrence of a recurrent stroke. P2S is unique in that it incorporates all health risk behaviours and mental health issues for people who have had a stroke. Most existing programs are primary prevention programs for people in the general population who are still healthy.[18] P2S uniquely guides users through the program content, which is structured as a series of easy-to-navigate and easy-to-use modules.[22] P2S consists of one loading module, six modules that target the main contributors and modifiable risk factors for stroke, and one goals module. The six modules targeting health risk factors for stroke are: 1) Blood Pressure; 2) Smoking; 3) Alcohol Use; 4) Physical Activity; 5) Diet; and 6) Moods and Feelings. The My Progress module reports and tracks the progress on user health-related goals. P2S is the only program that incorporates health risk behaviours and mental health issues. Furthermore, the program is tailored specifically for the cognitive and physical disabilities that stroke survivors may be experiencing. For example, the Physical Activity module shows videos on exercises that stroke survivors may perform, taking into account potential physical disabilities. In addition, P2S promotes positive behaviour change by using theory-based behaviour change techniques (BCTs).[23,24] To set goals, users access the My Progress module and enter a goal on a health behaviour that they would like change (e.g. Smoking: "Set a quit date and quit smoking") and are provided with information and advice on how to achieve the goal. If a goal is met, the user receives positive reinforcement, encouraging them to continue with their positive behaviour change (e.g. "Congratulations! You are on your <number> day smoke-free!") P2S also extends on previous research of online education programs for stroke survivors[16,19] by adding to the knowledge of the acceptability, usability and potential effectiveness of web-based behaviour change programs for stroke survivors. This study aimed to examine the usability and acceptability of P2S.

Methods

Study design

A pre- and post-intervention pilot study with paper-based mail-out surveys was conducted. Participants were recruited through the Australian Stroke Clinical Registry (AuSCR). Data were collected between August 2016 and January 2017. The study received approval from the University of Newcastle Human Research Ethics Committee, Approval No. H-2016-0094. As this pilot study was not testing efficacy there was no control group, and the pre–post design was appropriate for testing the acceptability of the online intervention.[25]

Setting

The Australian Stroke Clinical Registry (AuSCR) is an opt-out registry of stroke patients located across Australia, which had 51 participating hospitals at the time of the pilot study (and includes 61 hospitals as of 31 January 2017).

Sample

Participants were eligible if they were 18 years or older, had been admitted to an AuSCR-registered hospital for care for acute stroke or TIA at least six-months post-stroke, were comfortable participating in English, and could use the internet with either a home device, such as an iPad, or were willing to use public internet services, such as those available in public libraries. Ischaemic, haemorrhagic, TIA and undetermined stroke events were included. Participants who had a willing carer to assist them in the survey were also included. Participants who reported to "never" use the internet were excluded from this study.

Procedure

A random sample of 200 AuSCR registrants who met the age and stroke event inclusion criteria were posted a study information statement, consent form and baseline survey. Individuals were asked to complete the consent form and survey and return via post to the research team. Participants who consented and screened positively for internet use were emailed a link to the online program and were contacted via telephone by the research team to discuss any issues with access and use. Participants could access and use P2S over a two-week period, after which they were posted out a follow-up survey.

Web-based P2S program

P2S is an online secondary prevention program for stroke survivors that can be accessed on a computer, laptop or mobile device on the internet. It targets key areas that are main contributors and modifiable risk factors for stroke: 1) blood pressure; 2) smoking; 3) alcohol use; 4) physical activity; 5) nutrition; and 6) moods and feelings. The program also consists of a loading survey and goals module, which is tailored to the user

and provides self-management opportunities. P2S provides evidence-based information and strategies that can help to reduce the risk of having another stroke as well as advice on addressing anxiety and depression.[5] The program incorporates behaviour change techniques,[24] such as goal setting and feedback on progress, and is also tailored to encourage positive behaviour change.

Participants were asked to use the online program as often as they chose over the two-week period. Navigation through the program is flexible, meaning the participant can focus on content areas of greatest interest or need. The language used in the text is suitable for grade five reading age and graphics and videos are used. Health education guidelines for people with dysphasia[26] were followed in the development of P2S. Formative research showed that stroke and TIA survivors were most interested in improving their nutrition, followed by increasing activity levels, reducing alcohol consumption and addressing smoking.

Measures

The measures were designed to be brief, accurate and validated to minimise fatigue for stroke survivors. At baseline, participants were asked about their quality of life, health outcomes and psychological distress. They were asked to indicate if they had ever had a stroke or TIA, the time since the event and if the event was the first event or a recurrence, and to provide information about their main carer at home. Participants were also asked to report internet use, including how often they used the internet, and which devices they used to regularly access the internet. Demographic information was also collected. At follow-up, the usability and acceptability of P2S was assessed.

Pre-test measures (baseline)

Demographics

Participants were asked about their demographics, including age and time after stroke. They were also asked about which state in Australia they were from, their gender, marital status, education, stroke status and who their main caregiver was.

Quality of life

Health-related quality of life was measured using the EuroQol-5D (EQ-5D),[27] which measures the five dimensions of mobility, self-care, usual activities, pain/discomfort, and mood. Participants responded to these dimensions on a five-point scale, which was calculated into two variables: 'No problems' – with a rating of 1; and 'Problems – including ratings from 2–5 on the EQ-5D.

Physical activity

Physical activity was assessed using the Godin Leisure-Time Exercise Questionnaire (GLTEQ).[28] The total number of occasions participants reported walking or performing moderate or vigorous activity were summed, as well as the total number of minutes spent in these activities. Unsatisfactory activity was defined as less than 150 minutes of physical activity or less than five sessions of physical activity in the last week.[29] To determine physical activity based on the GTLEQ, the number of metabolic equivalent or MET-minutes of exercise per week were then calculated, based on summing the weights given to the type of exercise (mild, moderate and vigorous).

Smoking status

Smoking status was assessed using a standard two-item measure.[30] The items were: "Do you currently smoke any tobacco products?"; and "Have you smoked at least 100 cigarettes or a similar amount in your lifetime?" The proportions of participants reporting current daily smoking, current occasional smoking, being an ex-smoker and being a non-smoker were calculated. Smokers were defined as current daily or occasional smokers.

Alcohol Status

Alcohol status was measured using the Alcohol Use Disorders Identification Test – Consumption (AUDIT-C).[31] The AUDIT-C is a brief, three-item screening tool that includes items about frequency of alcohol use, number of drinks on a typical drinking day and frequency of binge drinking. A score of four or greater indicates hazardous drinking behaviour or the possibility of active alcohol disorders. Participant responses on the AUDIT-C items were summed to produce a total score out of 12, with a score of four or more considered positive for alcohol misuse,[31] and this defined unsatisfactory alcohol use.

Nutrition

Nutrition was measured using the National Health Survey,[32-34] to determine daily fruit and vegetable consumption. According to the Australian Dietary Guidelines, adult men and women are recommended to consume five to six serves of vegetables per day and two serves of fruit per day. Items on the National Health Survey include: "How many serves of fruit do you usually eat each day?" and "How many serves of vegetables do you usually eat each day?", with descriptions of serves included. Unsatisfactory fruit and vegetable intake was defined as eating fewer than two pieces of fruit and five serves of vegetables each day.[33]

Depression and anxiety

Depression and anxiety were measured and screened using the Patient Health Questionnaire 4 (PHQ-4).[35] High scores indicate greater likelihood of underlying anxiety and depressive disorders. Participants were asked to respond to items such as: "feeling down, depressed or hopeless" on a four-item response scale ranging from "not at all" to "nearly every day". On anxiety and depression PHQ4 subscales, a total score of three or more (out of six) is considered a positive screening for anxiety or depression symptoms.[35]

Participant preference for learning and internet use

Participants were asked about their preferences for learning and internet use, such as their interest in receiving an online health information program, and their preference for learning about healthy lifestyle alone, or with a partner or spouse. Internet use was also measured, with responses including "None", "A few times per year", "Monthly", "Weekly", "Several times per week" and "Daily". Participants were also asked if they owned a mobile phone and were asked to identify the device that they used the most to access the internet, ranging from "Computer (desktop or laptop)", "Smartphone", "Tablet", "Device not owned by you (e.g. the library or work computer)" and "Other".

Post-test Measures

Usability and acceptability

The usability questions were adapted from the System Usability Scale (SUS).[36] Measures of usability testing are further described by Faulkner[37] with components recommended by Norman and Panizzi.[38] Examples of items included: "I think that I would like to use the P2S program frequently" and "I would imagine that most people would learn to use the P2S program very quickly". All of the responses to items in the SUS were on a five-point scale, ranging from "Strongly disagree" to "Strongly agree". To measure acceptability, items such as: "It is appropriate to provide

lifestyle advice to stroke survivors through the internet" and "It would be good to have a program like P2S for my family and friends who help care for me" were used. Participants responded to these items on a five-point scale, ranging from "Strongly disagree" to "Strongly agree".

Participant qualitative feedback on P2S

Participants were given the opportunity to discuss their thoughts on online secondary prevention programs for stroke survivors. Participants were also asked open-ended questions that they could elaborate on with a member of the research team, including items such as: "What are the major difficulties for stroke survivors to use a program like Prevent 2nd Stroke?", "What do you think are the best aspects of the Prevent 2nd Stroke program?" and "What aspects of the program didn't work so well?" This feedback will be incorporated in the further development and refinement of the Prevent 2nd Stroke program.

Statistical analyses

Descriptive statistics were calculated for all demographic and health-related variables. The proportion of participants who screened positive for anxiety and/or depression symptoms was calculated. For each health behaviour, a dichotomous variable of 'satisfactory' or 'unsatisfactory' was calculated.

Usability, acceptability and participant preference for learning and internet use proportions were calculated on the self-reported acceptability. To analyse qualitative responses, thematic analysis was used. Thematic analysis is a research method used for identifying, analysing and reporting patterns, also known as themes, within data.[39] The Stroke Association defines young stroke survivors as people who are working age and under the age of 65 years old.[40] Participants who were aged between 18 and 65 were categorised as young stroke survivors and participants over the age of 65 were categorised as older stroke survivors. Using that statistical software package SPSS,[41] an independent samples t-test was performed to assess any differences in acceptability and usability ratings between age groups.

Results

Sample

Of the 200 people who were contacted through AuSCR during the study period, 110 people (55%) responded and 40 (20%) were eligible to participate in the study. Of those who were eligible, 33 (82.5%) people consented and 19 (47.5%) people completed both the baseline and follow-up (see Figure 1).

As indicated in Table 1, participants were aged between 41 and 88 years. The majority of participants were male (63.2%) and married (73.7%). Time since participants' most recent stroke event ranged from 9 to 18 months (M=12.11, SD=2.28), and the majority of stroke survivors (84.2%) reported that they had only experienced one stroke event.

Baseline health and wellbeing outcomes

Health outcomes are presented in Table 2. At baseline, most (95%) participants (n=18) reported engaging in multiple health risk behaviours following a stroke event.

Baseline participant preference for learning and internet use

Table 3 shows participant preference for learning and internet use.

Usability ratings of P2S

Table 4 presents participant ratings of the usability/acceptability of P2S. The majority of participants (n=12, 63.1%) reported that P2S was easy to use and 42.1% (n=8) thought that most people would learn to use P2S very quickly. Eight participants agreed that they would like to the use P2S frequently (42.1%). Furthermore, nine (47.4.7%) participants agreed that they felt confident using the program. All participants (n=19, 100%) completed the loading survey. The most used module was the My Progress module, which

Figure 1: Study recruitment.

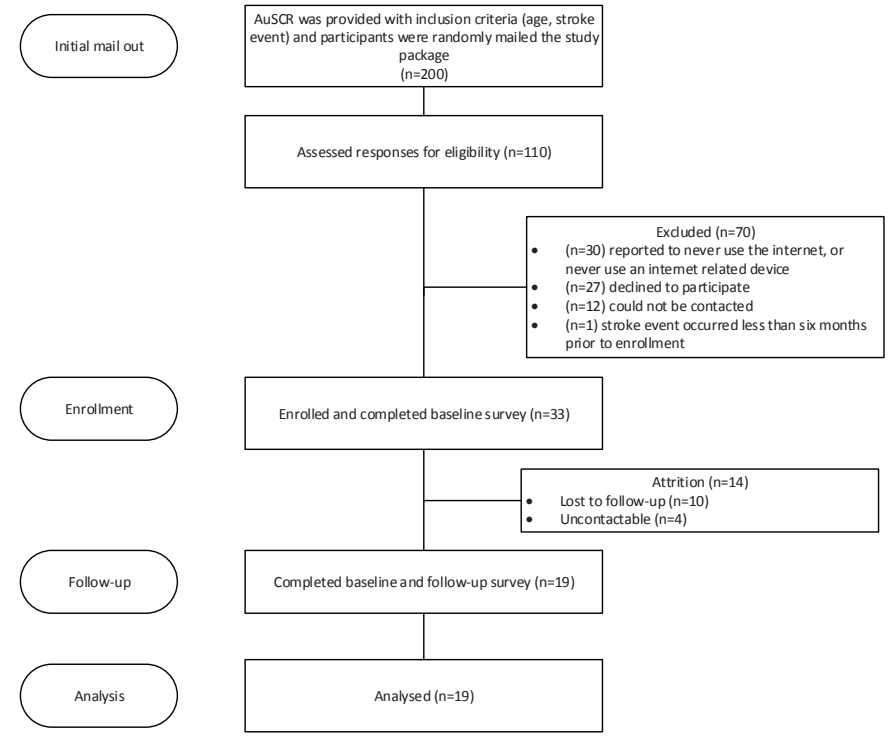

Table 1: Stroke survivor demographics, n = 19.

	Range	Mean (SD)
Age in years (n=19)	41 to 88	68.89 (12.72)
Time after stroke (months) (n=19)	9 to 18	12.11 (2.28)
	n	**%**
State of residence in Australia (n=19)		
New South Wales	1	5.3
Queensland	8	42.1
Tasmania	2	10.5
Victoria	8	42.1
Gender (n=19)		
Male	12	63.2
Female	7	36.8
Marital status (n=19)		
Married	14	73.7
Defacto, or living with a partner	3	15.8
Separated or divorced	1	5.3
Never married or single	1	5.3
Education (n=19)		
Up to Year 10	5	26.3
Years 11-12	5	26.3
TAFE	5	26.3
University	4	21.1
Stroke status (n=19)		
First time stroke or TIA	16	84.2
Had a stroke before	2	10.5
Had a TIA before	1	5.3
Main carer (n=19)		
Partner/Spouse	12	63.2
Other	7	36.8

was used 15 times by eight participants (42.1%). The module that had the most unique participants was the Diet module, which was used by 12 participants (63.2%). The least used module was the Moods and Feelings module, which was used three times by three participants (15.8%). The majority of participants were categorised into the older stroke survivor group (n=10, 52.6%); however, numbers were almost equal in the young stroke survivors group (n=9, 47.4%). There were no significant differences reported in any usability and acceptability ratings by age groups ($p>0.05$).

Acceptability ratings of P2S

Seven participants (36.8%) agreed that it is appropriate to provide lifestyle advice to stroke survivors and two participants (10.5%) disagreed that it is appropriate to provide this advice via the internet; nine (47.4%) were neutral. Nine participants (47.4%) reported the program would help stroke survivors to change their lifestyle behaviours. The majority of participants (63.1%) also reported that they would recommend P2S to other stroke survivors, and a further ten participants (52.6%) agreed that it would be good to have a program like P2S for the friends and family members who help to care for the stroke survivor.

Participant qualitative feedback on P2S

Challenges to using online programs identified by stroke survivors

Participants were given the opportunity to elaborate on their thoughts about P2S with open-ended questions. Participants identified that the biggest challenges for stroke survivors to use a program like P2S were the abilities to use a computer, access the internet and address physical and attitude problems. Cognitive difficulties associated with stroke, such as difficulties concentrating and retaining information, were also reported as a challenge for stroke survivors using the online program. Participants felt that the majority of stroke survivors are very interested in programs that address lifestyle behaviours; however, one participant reported that some stroke survivors might be reluctant to participate in these types of programs for fear of embarrassment and/or unfamiliarity with the online platform.

A relevant and useful program for stroke survivors

Participants were generally positive towards P2S and reported that they liked the simple layout and navigation of the website, and further expressed that they thought the program was helpful and very informative regarding lifestyle changes. Participants generally expressed that they focused on a few modules that were relevant to them, such as the diet module or physical activity module. They also appreciated the practical tips included in the modules (e.g. healthy recipes). Many of the participants were minimally affected by their stroke, and commented that the program would be extremely helpful for someone who had experienced a particularly "bad" stroke.

Suggested improvements to the program by stroke survivors

Participants also suggested that the program could be improved by simultaneously running a telephone service with the program for stroke survivors who may not be familiar with the internet. Additionally, participants thought that the program could be developed to take into account exercise/physical ability limitations or restrictions due to other comorbidities. Participants

Table 2: Baseline self-reported quality of life issues, health behaviours and depression and anxiety of stroke survivors, n = 19.

	n (%)
Quality of Life (n=19)	
Mobility	14 (73.7)
Personal care	4 (21.1)
Usual activities	10 (55%)
Pain/discomfort	10 (55%)
Anxiety and depression	6 (31.5)
Smoking (n=19)	
Current smoker	1 (5.3)
Ex-smoker	8 (42.1)
Never smoker	10 (52.6)
Alcohol (n=19)	
Safe levels of alcohol consumption	7 (36.8)
Unsafe levels of alcohol consumption	7 (36.8)
Never drinks	5 (26.3)
Diet/nutrition (n=19)	
Satisfactory fruit and vegetable consumption	1 (5.3)
Unsatisfactory fruit and vegetable consumption	18 (94.7)
Physical Activity (n=19)	
Satisfactory physical activity	4 (21.1)
Unsatisfactory physical activity	15 (78.9)
Depression and Anxiety (n=19)	
None	16 (84.2)
Mild	2 (10.5)
Severe	1 (5.3)

Table 3: Self-reported internet use of stroke survivors, n = 19.

	n	%
Those interested in receiving health information via an online program	14	73.7
Preference for learning about healthy lifestyles (n=19)		
Alone	10	52.6
With a partner or spouse	3	15.8
No preference	6	31.6
Internet use (including email) (n=19)		
Weekly	1	5.3
Several times per week	5	26.3
Daily	13	68.4
Those who own a mobile phone (n=19)	17	89.5
Most used device to access the internet (n=19)		
Computer (desktop or laptop)	14	73.7
Smartphone	2	10.5
Tablet	3	15.8

Table 4: Ratings of the usability/acceptability of the Prevent 2nd Stroke Program, n = 19.

Statement (n=19)	n (%)		
	Strongly disagree/ disagree	Neutral	Strongly agree/ agree
I think that I would like to use the Prevent 2nd Stroke program frequently.	2 (10.5)	9 (47.4)	8 (42.1)
I found the Prevent 2nd Stroke program complex.	9 (47.4)	9 (47.4)	1 (5.3)
I thought the Prevent 2nd Stroke program was easy to use.	0	7 (36.8)	12 (63.1)
I would imagine that most people would learn to use the Prevent 2nd Stroke program very quickly.	0	11 (57.9)	8 (42.1)
I found the Prevent 2nd Stroke program cumbersome to use.	12 (63.1)	6 (31.6)	1 (5.3)
I felt very confident using the Prevent 2nd Stroke program	0	10 (52.6)	9 (47.4)
It is appropriate to provide lifestyle advice to stroke survivors.	0	4 (21.1)	15 (79.1)
It is appropriate to provide lifestyle advice to stroke survivors through the internet.	2 (10.5)	9 (47.4)	7 (36.8)
The content of the Prevent 2nd Stroke program was relevant to stroke survivors.	0	8 (42.1)	11 (57.9)
The Prevent 2nd Stroke program would help stroke survivors to change their lifestyle behaviours?	0	10 (52.6)	9 (47.4)
I would recommend the Prevent 2nd Stroke program to other stroke survivors.	0	7 (36.8)	12 (63.1)
It would be good to have a program like Prevent 2nd Stroke for my family and friends who help care for me?	2 (10.5)	6 (31.6)	10 (52.6)

also reported that it would be useful and helpful to receive information in the online program for their friends, family and carers. These suggestions included being provided information on the importance of support networks and relationships for stroke survivors, and also an education module for the carers, family and friends to learn more about stroke-related health behaviours and outcomes.

Discussion

This pilot study found that an online program may be an acceptable way to address health and psychological outcomes in stroke survivors following a stroke or TIA event as a secondary prevention program. Participants rated the program highly on measures of usability and acceptability and provided feedback for the further development and refinement of P2S. However, it should be noted that only a small proportion of AUSCR registrants approached were eligible to participate; 27.3% of those contacted did not have access to the internet.

The current results correspond with previous pilot studies that have investigated online secondary prevention for stroke survivors.[16,19] Specifically, participants indicated P2S was simple and easy to use, and appropriate and relevant for stroke survivors. Participants also indicated that P2S was not complex and not cumbersome. In qualitative feedback, participants commented that P2S was effective in helping those who had experienced a stroke to monitor their health behaviours. Participants also reported that they would recommend the program to other stroke survivors, and that it would be beneficial for their friends, family and carers. Participants also reported a willingness to use an online program and identified their most-used internet devices.

Participants reported engaging in multiple health risk behaviours that are likely to increase the risk of a second stroke. All but one participant engaged in at least two health risk behaviours.[3]. Similar to previous studies, the majority of participants reported unsatisfactory levels of vegetable and fruit consumption, physical activity and alcohol consumption. Anxiety and depression was markedly low in our sample compared to previous literature,[4,5] with only one participant reporting severe psychological distress. Quality of life was consistent with previous literature, in which stroke survivors have reported problems with mobility, pain/discomfort and difficulty engaging in their usual activities. While the pilot P2S program does not address quality of life outcomes that appeared in the findings of this study, determining if there is the potential to increase post-stroke care provision through web-based platforms will guide the development of P2S care provision into line with current care recommendations, increase the quality of life of users and prevent further ill-health. These findings emphasise the need to develop effective health behaviour interventions for stroke survivors that can assist them to achieve healthier lifestyles and increase their quality of life.

The amount of use of the P2S program over the two-week period could have been increased. In a larger trial of the P2S program, we will include texts and e-mails to remind participants to engage in the P2S program over the study period. It was also difficult to assess the effectiveness of the P2S program in behaviour change. To address this in the future trial, the following will be implemented: 1) a powered sample of participants to detect behaviour change will be recruited; 2) a control group will be used to compare the effectiveness of P2S in health behaviour change; and 3) the intervention period will be for a longer period, and participants will be followed up after six months to assess long-term behaviour change. With these changes implemented, the results of the larger trial will determine the effectiveness of P2S as a health behaviour change intervention

Implications

The results of this pilot study suggest that stroke survivors engage in multiple health risk behaviours that increase the chance of a second stroke. Our findings highlight that this intervention is acceptable and usable as a secondary prevention program for stroke survivors across all age groups. A systematic review reported that stroke survivors have high rates of adherence to health and wellbeing outcomes including diet counselling, smoking cessation counselling and exercise counselling at three months post-stroke.[42] The stroke survivors in this study were six months post-stroke, which suggests over time they return to unhealthy practices that increase the risk of a second stroke. Barriers to engaging in a healthy lifestyle post-stroke may be due to a lack of awareness of risk factors that contribute to a second stroke event and a lack of monitoring of stroke survivors by health care professionals.[42]

In the sample we were able to recruit, the results of our study suggest that while stroke survivors are willing to participate in online research, they may not be able to access the internet. The majority of our eligible participants were excluded based on their reporting that they never used the internet or an internet-related device; however, the Australian Bureau of Statistics has reported that internet use is increasing in older age groups over time.[12] While internet use is increasing and allowing researchers and clinicians to reach a large range of stroke survivors, it is possible that this type of intervention is best used in addition to options such as telephone counselling and face-to-face methods. In order for a program like P2S to be integrated into routine practice for stroke survivors, internet use and willingness to use internet-related devices needs to increase in this population.

P2S may assist stroke survivors in addressing health risk behaviours and psychological distress to positively change outcomes. The delivery of online programs to address health risk behaviours on accessible platforms such as the National Stroke Foundation (NSF) website and advertisements on social media could provide a feasible and cost-effective platform to assist in monitoring stroke survivors' health. This could potentially provide the opportunity to intervene and assist stroke survivors with health plans that are tailored to their specific needs.

Strengths and limitations

This pre–post pilot study was highly valuable in evaluating the acceptability and feasibility of P2S in a nationwide Australian setting. Furthermore, valuable data was collected regarding the internet use and preferences of Australian stroke survivors. The pilot data indicates that P2S could be an effective intervention to reduce the risk of second stroke and could potentially reach and assist many stroke survivors nationally through the online platform. The data collected from this study will help to inform a larger, powered, long-term RCT that will test the effectiveness of online programs aimed at improving stroke survivor wellbeing and health outcomes.

This pilot study did not examine differences in health outcomes. Adequately powered controlled trials would provide better evidence of effectiveness in health behaviour change. Furthermore, due to the short two-

week follow-up period and unpowered trial, the results of this study may underestimate the potential effects and/or benefits of the program.

A third limitation of this study is likely to be the population of the study. To be able to use P2S, participants had to be comfortable participating in English, and have the ability and willingness to engage in self-management strategies and use an online platform. Therefore, this study may not be generalisable to survivors of strokes that have caused serious cognitive effects, and/or it may not be suitable for other populations of people with severe cognitive or physical disabilities (e.g. people who have dementia).

Conclusions

Our findings support that online secondary prevention programs for stroke survivors are acceptable and feasible. As stroke survivors are still engaging in unhealthy behaviours post-stroke, more research is needed to determine the effectiveness of P2S as a health behaviour change intervention. Therefore, the next step in this research is to conduct an effectiveness trial. If effective, online programs have the potential for widespread dissemination to the public through website of peak organisations such as the NSF. The NSF has a consumer portal in which stroke survivors can find support through resources about stroke and can also access an online community of stroke survivors who share their experiences. As a large percentage of stroke survivors are discharged from hospital without a plan, the P2S could be provided to stroke survivors following discharge. The program could be accessed through the NSF portal, and assist in the promotion of positive lifestyle changes. Furthermore, P2S could also allow stroke survivors to receive professional and communal support to reduce the risk of having a second stroke.

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