Background and Purpose—Studies continue to reveal persistent gaps in stroke awareness despite existing stroke messages, especially when the length of time from message exposure increases. Therefore, there is a need to discover messages that promote long-term retention of stroke knowledge. We modified a standard stroke education poster using one health communications model, Extended Parallel Process, to assess its comparative effect on public stroke awareness and information retention.

Methods—This was a single blinded, randomized, pretest, posttest study using 2 age cohorts: younger (18 to 30 years) and older (50+ years). Stroke knowledge was measured by the 28-item Stroke Action Test taken before and after viewing either an Extended Parallel Process modified poster or a standard educational poster in widespread use and again 6 weeks later.

Results—Overall, there were 274 participants (222 younger and 52 older) with 139 randomly assigned to view the Extended Parallel Process poster and 135 assigned to view the standard poster. There was no significant difference (P>0.05) in the average Stroke Action Test score change between poster groups at all 3 testing intervals, although there was a nonsignificant greater drop in Stroke Action Test scores observed in the control group at the 6-week follow-up (−3.52 versus −2.60; P=0.46). The observed power for this difference was only 11% due to attrition of study participants (total 6-week follow-up, n=170). The younger group did significantly better on the Stroke Action Test from baseline to immediate posttest when viewing either poster (P<0.05).

Conclusions—A common stroke education poster modified according to the Extended Parallel Process model did not significantly increase stroke knowledge compared with a standard control. However, the Extended Parallel Process model may promote long-term stroke knowledge retention, although further studies are needed due to insufficient power from subject attrition. (Stroke. 2009;40:000-000.)

Key Words: acute stroke ■ cerebrovascular accident ■ education ■ educational campaigns ■ health communication theory ■ stroke awareness

Although strokes account for one in every 17 deaths in the United States (third among deaths from all causes) and are the leading cause of physical disability in adults,1 studies have shown that most groups, particularly those at highest risk, do not recognize the signs and symptoms of stroke or understand the need to call 911 immediately.2−7 Such lack of awareness is a major contributing factor to delayed presentation outside of the thrombolytic treatment windows8−12 with only 2% to 6% of eligible patients receiving this life-saving and life-preserving treatment.13,14 These statistics are particularly discouraging given the fact that several organizations, including the American Stroke Association and the National Institute for Neurological Disorders and Stroke, have created stroke education materials to help increase public stroke awareness and promote earlier patient presentation to the emergency department for life-saving thrombolytic treatment.15,16 Although several studies17−28 have demonstrated the ability to raise public stroke awareness by implementing stroke education programs using all or parts of these developed messages, these knowledge gains are somewhat modest (5% to 20% from baseline) and have been shown to diminish over time once the programs end. Therefore, there is a need to test whether stroke messages can be enhanced using health communication theory to promote both increased stroke awareness and long-term message retention.

Subjects and Methods
Morgantown, WV, has approximately 30 000 permanent residents and is the location of West Virginia University, a large, mid-Atlantic land grant institution with 30 000 students. West Virginians are at
particularly high risk for developing stroke because of the high prevalence of stroke risk factors, especially obesity (31.1%, third highest in the nation), smoking (26.4%, second highest), high blood pressure (33.2%, third highest), and diabetes (11.6%, first). The hospitalization rate after stroke is also much higher than the rest of the United States (32.1 per 10,000 versus 27.1 per 10,000, respectively) with women accounting for 6 in 10 of these hospitalizations.

This was a single blinded, randomized, before and after study examining the impact of an alternative stroke education poster on stroke knowledge among 2 age cohorts: younger (18 to 30 years) and older (50+ years) in West Virginia. Participants were randomly assigned to view either a standard stroke education poster (Figure 1) or a modified, Extended Parallel Process (EPP) poster (Figure 2) with the same graphical design but with adapted text. JMP software (Version 7.0; SAS Institute, Cary, NC) was used to create an age-stratified 1:1 randomization schedule to ensure that participants within each age group (younger or older) had an equal chance of viewing either poster. Study packets containing either the standard poster or the EPP poster were prepared according to each generated schedule for each age group. Packets were then consecutively distributed within each age group to maintain the randomization scheme. The West Virginia University Institutional Review Board for the Protection of Human Subjects granted expedited approval for this protocol.

The EPP model is a theory that is rooted in a large body of research that demonstrates the efficacy of health messages when receivers are motivated to action because (1) they perceive their health is personally at risk (which elicits fear owing to perceived vulnerability to and severity of the health issue); (2) they perceive that there is an action they can readily take to minimize or resolve the threat to their health (self-efficacy); and (3) that the resultant treatment will be effective (treatment efficacy). In the absence of fear, self-efficacy, and treatment efficacy, both reception of the message and motivation to act and/or change behavior based on the message are unlikely to occur. These 3 message elements have proved effective in communicating various health issues, including...
skin cancer, teen pregnancy, genital warts, breast cancer, radon awareness, and tractor safety. In this study, the alternative poster’s language was modified to include higher levels of these message elements. For instance, to increase perceived vulnerability, the alternative poster stressed that strokes can occur across all age groups by adding the language, “They happen to people of all ages, even to those in their 20s and 30s!” We also reiterated the instruction to “call 911 immediately” on the brain image to reduce the threat’s severity by providing an action that can be readily taken to reduce the threat (self-efficacy) and emphasized that a treatment should be received within 3 hours of first stroke symptoms (treatment efficacy).

Before finalizing the EPP poster, we conducted a manipulation check to make sure that our modification (“manipulation”) had truly resulted in higher levels of the 3 EPP elements in the modified poster. In essence, this procedure is similar to pilot testing a survey before widespread dissemination. The strength of the 3 EPP elements in the modified poster was tested using 7-point Likert scale questions (“strongly disagree” to “strongly agree”) adapted from previous EPP research and tested with groups of college students. For example, one question testing perceived vulnerability was: “I could have a stroke in the near future.” Differences in answers provided by participants viewing either the standard or the EPP poster were tested using the Student t test. If these differences failed to cross the significance threshold (P<0.05), the EPP poster’s language was modified (“manipulated”) and another manipulation check on a different group of subjects was conducted. In all, 3 manipulation checks were conducted, and the numbers (Ns) in each test group varied between 8 and 18 participants. The first 2 EPP poster versions did not elicit scores on these dimensions that were significantly different, statistically speaking, from the standard poster. The alternative poster was finalized after the third manipulation check, when the differences between the 2 posters on 2 of the EPP message elements (vulnerability and self-efficacy) reached strong significance (P=0.01 for vulnerability and P=0.002 for self-efficacy) and one (treatment efficacy) approached significance (P=0.11). Despite this
latter result, the researchers chose to proceed with the experiment given the small manipulation check sample size and the progress made in message differentiation between the 2 posters over the 3 iterations.

To assess the impact of each poster on stroke knowledge, participants took the 28-item Stroke Action Test (STAT) at 3 intervals: before viewing the poster, immediately after viewing the poster, and again 6 weeks after viewing the poster. The STAT test measures stroke awareness by testing the ability of individuals to associate the correct response (call 911/emergency department) from among a range of responses (wait 1 day, wait 1 hour, immediately call doctor’s office, immediately call 911/go to emergency department) with an identified stroke symptom. Therefore, awareness is not measured as only the ability to identify stroke symptoms, but rather the ability to both identify the symptoms and associate the symptoms with the correct response. Twenty-one of the 28 items are stroke symptoms representing all 5 warning sign groups as reported by the American Stroke Association and others. The remaining 7 items are for nonstroke symptoms and are included to broaden responses and prevent the possibility of individuals merely choosing an immediate response for every item. A correct answer is given a score of 1, whereas an incorrect answer is given a score of 0. Answers are totaled to produce an overall measure of stroke awareness and can be presented as a percentage or raw number. Survey responses that contained blank answers to any of the 28 STAT items were included in the analysis with each missing item recoded as an incorrect response. Due to the skewed STAT scores, the Mann-Whitney U test was used to compare the average change in STAT score by poster group at each of the 3 testing intervals. An a priori power analysis based on previous data yielded 129 participants per poster group to have 90% power to detect a 20% difference in STAT scores at the immediate posttest (our main outcome). Secondary outcomes explored: group differences between the posttest and 6-week follow-up surveys and between the baseline and follow-up surveys as well as survey differences by gender, age, and previously knowing someone who had a stroke.

Results

Demographics
Overall, there were 274 participants (222 younger and 52 older). The average age of younger participants was 20.68 years (95% CI, 20.38 to 20.98) versus 76.37 years (95% CI, 73.95 to 78.78) for older participants. The majority of participants were female (58%). More than 6 in 10 participants (64%) reported knowing someone who had been a victim of stroke (usually a family member). Older participants had a higher knowledge of stroke at baseline compared with younger participants (13.69 average STAT score versus 7.61, respectively).

Main Outcome
Random assignment yielded 139 in the modified poster group and 135 in the standard poster group. There was no significant difference (P > 0.05) in the average STAT score change between poster groups at the immediate posttest (Figure 3).

Secondary Outcomes
Between the posttest and the 6-week follow-up surveys, 104 subjects were lost to attrition, yielding 170 participants who completed all 3 surveys (88 in the modified poster group and 82 in the standard poster group). Data from these 170 participants revealed a trend toward better performance by the alternative poster group, which had a greater positive change in the STAT score from baseline to the 6-week follow-up test in comparison to the control poster group (+3.68; 95% CI, 2.59 to 4.74 versus +2.89; 95% CI, 1.36 to 4.40, respectively). This difference was not statistically significant (P = 0.529), and had an observed power of only 13% due to participant attrition. The modified poster group also had a lower drop (also nonsignificant) in their average STAT score at the long-term follow-up period in comparison to the standard poster group (−3.52 versus −2.60; P = 0.46) with an observed power of 11% (Figure 4).
The younger group did significantly better on the STAT from baseline to immediate posttest when viewing either poster in comparison to older participants. Youth viewing the control poster increased their STAT score on average by 7.82 points versus older participants who increased their STAT score on average by 4.94 points (P<0.026). Similarly, youth viewing the modified poster increased their STAT score on average by 8.01 points versus older participants who increased their STAT score on average by 3.64 points (P<0.046).

There were no significant differences in average STAT score changes in either poster group between genders and between those who knew someone with a stroke versus those who did not know a stroke victim (data not shown).

**Discussion**

Modification of a common stroke awareness poster according to the tenets of the EPP theory did not increase overall stroke awareness. A nonsignificant trend in greater knowledge acquisition and retention among individuals exposed to the modified poster was observed.

Many stroke educational messages, including the one we modified in our study, use the 5 “suddens” created by the Brain Attack Coalition over a decade ago (see the bottom of Figures 1 and 2). Researchers using this message in their own educational campaigns have reported empirical increases in stroke knowledge, including 2 large mass media studies conducted in Canada. These studies demonstrated postintervention increases from baseline of 12% and 20% in the proportion of individuals able to name at least 2 specific stroke symptoms. In comparison, participants exposed to the modified poster in our study reported a knowledge gain of 6.21 STAT points out of a possible 28 (22.2%) at the immediate posttest, and those exposed to the traditional poster had an average gain of 7.18 points (25.6%). Additionally, in the most recent Canadian study, stroke knowledge declined 5 months after a media blackout period. This result was similar to the trend seen in the ability to name at least one stroke symptom, which dropped 13% 5 months after cessation of an emergency medical services-based community intervention. Although the end point assessments varied from study to study (ie, ability to name at least one, at least 2, or other specific stroke symptoms), these observed modest knowledge gains coupled with a frequent decline in long-term retention of stroke knowledge highlight the importance of seeking to strengthen the core educational messages.

Although we did not find a significant difference between the 2 poster versions in our study, we did observe a nonsignificant trend toward better long-term knowledge by those individuals exposed to the EPP poster. There may be a number of reasons why the EPP poster was not more effective. One is that the standard stroke poster used was developed by the Advertising Council, which is comprised of volunteer advertising agencies that develop these advertisements on a pro bono basis for selected causes. The Council conducts “extensive research and review . . . during a campaign’s formative stage . . .” and also tests advertisements with consumers before launch. Therefore, although their poster does not include EPP elements, it likely was demonstrated effective on basic awareness and knowledge levels. Thus, both experiment groups showed improvements. Second, although the messages used in the experiment differed in their levels of vulnerability and susceptibility emphases, the vast majority of our sample was a young population, who may feel impervious to stroke, and therefore their motivation in processing the information may have remained relatively low. Also, it may be that EPP elements are not enough in the short term to affect long-held prevailing beliefs.

Subject attrition is a plausible contributor to the lack of observed statistical difference between the average STAT scores at the 6-week follow-up survey in our study. In
addition to the possible explanations posited previously, it is also possible that the alternative poster’s parallel process elements could be further modified to exhibit greater statistical differences from the standard poster during the pilot testing phase. We were unable to obtain the $P<0.05$ threshold difference for one of the 3 constructs: treatment efficacy. To strengthen this concept, the poster might include more information about the specific benefits of prompt versus delayed treatment (eg, the resultant ability to perform a common cognitive and/or physical task or not). Such a goal might be accomplished by adding language such as: “People treated within 3 hours are more likely to be able to walk, talk, and feed themselves at 3 months compared with those who receive delayed treatment.”

Limitations

The subjects from this study were drawn from collegiate classes and area senior centers in one mid-Atlantic rural community, which may inhibit the external validity of these findings to other settings and locales. The relatively low numbers of elderly individuals in our study limits somewhat our conclusions regarding the impact of the modified poster on this high-risk cohort. We included both age groups because studies have demonstrated that the presence of a bystander or family member during a stroke increases the probability that a person will present for treatment within 3 hours.9,10 However, further studies should seek to enroll more elderly individuals given their high stroke risk. In addition, some intervening local media coverage related to February’s heart month occurred in the local community newspaper, which could have reinforced some information across groups prior to the 6-week posttest.

Conclusions

Although a common stroke education poster modified according to the EPP model did not significantly increase stroke knowledge among our study participants immediately after exposure, there was a trend toward the alternative poster participants having greater long-term stroke knowledge retention. However, further studies are needed to explore this finding due to insufficient power. Using health communications theory to strengthen existing stroke awareness messages or discover new messages is a feasible approach. Ultimately, the most effective messages will both increase stroke awareness and promote long-term retention of awareness.

Acknowledgments

We thank P.I. Reed School of Journalism graduate student Justin McLaughlin for his assistance with this project.

Disclosures

None.

References


Manipulation Check Procedure and Instrument

As discussed at our last meeting, we first need to determine that the two instruments are indeed different in terms of perceived threat of having a stroke and perceived efficacy of treatment and ease of self-response.

Therefore, we will use a previous manipulation check, administered in the study by Thomas D. Gore and Cheryl C. Bracken, ‘Testing the Theoretical Design of a Health Risk Message: Reexamining the Major Tenets of the Extended Parallel Process Model,’ published in Health Education & Behavior 32(1): 27-41 (February 2005), as a model for our test.

It is recommended that my class of 20 students be randomly assigned 1 of the 2 stroke posters (the AHA poster or our manipulated version). The students will be instructed to read the poster, then hand it in before opening an attached envelope, which will have the questionnaire inside. (This is so they don’t refer back to the poster to get the right answer.) The questionnaire will have a letter or number (eg 1 or 2 or A or B) to represent the version of the poster that each student saw.

Students will be asked to respond to the following statements via a 7-point Likert scale, with 1 being strongly disagree and 7 being strongly agree.

Please see the questionnaire below, which is modeled after the one used in the study reference above and includes other items to test the EPPM message components:

Note:
Questions 1, 2, 3, and 6 reflect perceived vulnerability.
Questions 4, 8, and 9 reflect treatment efficacy.
Question 10 reflects self-efficacy.
The other Likert-scale questions (5, 7) reflect learning the key message (call 9-1-1).
The last question (11) reflects learning/recognizing symptoms.

Individual means of the responses for each question of each version will be compared using a t test. If desired, scale reliabilities will be constructed to demonstrate concept consistency among concept questions (vulnerability, efficacy), and if strong, can be grouped as an index and concept means compared.

The open-ended question can be compared by giving a point for each correct symptom recollected and subtracting a point for each incorrect symptom (students may just guess, as they do on real tests and exams). A t test can then be run on the means of the 2 groups.

Figure I.

Manipulation Check Questionnaire

On a scale of 1 to 7, with 1 indicating strong disagreement and 7 indicating strong agreement, select a number to represent how much you agree or disagree with the following statements:

1. Senior citizens are most vulnerable to strokes.

<table>
<thead>
<tr>
<th>1 strongly disagree</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7 strongly agree</th>
</tr>
</thead>
</table>

2. Strokes are serious, but are not considered medical emergencies.

<table>
<thead>
<tr>
<th>1 strongly disagree</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7 strongly agree</th>
</tr>
</thead>
</table>

3. Middle-aged people, like my parents, don’t often have strokes.

<table>
<thead>
<tr>
<th>1 strongly disagree</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7 strongly agree</th>
</tr>
</thead>
</table>

4. Rapid medical treatment can not only save the lives of stroke victims, but can also protect their quality of life as well.

<table>
<thead>
<tr>
<th>1 strongly disagree</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7 strongly agree</th>
</tr>
</thead>
</table>

5. If someone you know is having stroke symptoms, you should wait at least an hour or two to see if the symptoms subside before seeking medical assistance.

<table>
<thead>
<tr>
<th>1 strongly disagree</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7 strongly agree</th>
</tr>
</thead>
</table>

Figure I.
The Impact of the Extended Parallel Process Model on Stroke Awareness. Pilot Results From a Novel Study
Stephen M. Davis, Diana Martinelli, Brian Braxton, Kyle Kutrovac and Todd Crocco

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