Stroke Awareness and Knowledge Retention in Children: The Brain Child Project

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Background and Purpose—Efforts at public education to improve adults’ response to stroke symptoms continue to be disappointing, and very little has been developed to improve the knowledge base of children regarding brain attacks. Children may be able to exert a positive influence on adult behavior and to learn positive healthcare habits, which will also influence their own health.

Methods—A total of 561 children enrolled in grades kindergarten through eighth (K-8), participated in The Brain Child Project, which included (1) assessment of their knowledge of stroke awareness (including initiation of the emergency medical system [EMS]) using a multiple-choice questionnaire, (2) attendance at a multimedia educational program designed to increase stroke knowledge, followed by (3) immediate administration of the same questionnaire, and (4) a final administration of the same questionnaire 10 days later to measure retention of acquired learning.

Results—The results showed that these children had a limited understanding of stroke, but with a brief educational program, all grades significantly increased their scores on the average from 64% to 82%. The loss of knowledge between the posttest and the retention test was negligible.

Conclusions—The results of this study indicate that through brief education, children show significant improvement in their knowledge of and response to brain attacks. Future efforts in this direction may positively affect stroke prevention, response and outcomes. A national program could be implemented in the school systems much like heart disease programs, with the ultimate goal of greater public awareness and prevention of stroke. (Stroke. 2002;33:623-625.)

Key Words: awareness □ brain □ child □ education □ stroke

In the United States, annual stroke incidence has increased from 500,000 new cases to more than 750,000.1 Stroke ranks as the third leading cause of death, behind heart diseases and cancer, with 4.5 million survivors of stroke, two-thirds of whom are permanently disabled.2 In terms of medical care and economic losses, the annual direct and indirect costs for stroke care total $40 billion.3 With the proven efficacy of tissue plasminogen activator (tPA), which can reopen occluded arteries in acute ischemic stroke when given within 3 hours of symptom onset,4 public education regarding rapid delivery to the emergency room has become an important worldwide endeavor. Statistics show that on average, the public continues to be uninformed about stroke.5 Educational efforts boosted by the American Stroke Association, the National Stroke Association, local hospitals, and communities can and have improved stroke response overall; however, patients continue to arrive in the emergency department beyond the 3-hour window needed for the administration of tPA. These patients then go on to experience the devastating effects of long-term disability with vast economic ramifications both personally and nationally.

The Brain Child Project was an effort to examine the feasibility of introducing education about stroke at an earlier stage in the human learning process, specifically with elementary school–age children. To date, there is very little in the stroke awareness literature that has been focused on child education. On the basis of the belief that young children are exposed to people in their lives that may be at risk for stroke, ie, grandparents, teachers, and parents, what better time to introduce the warning signs of stroke and the appropriate response? At a time when children are learning basic first aid, appropriate use of the emergency system, and how to respond in a fire, introducing the concept of “brain attack” and how to adequately respond to the warning signs seemed like a worthwhile endeavor. These children might not only be in a position to assist an acute stroke victim, but also grow up to be aware of the signs of a brain attack in themselves, and thus respond appropriately.

Materials and Methods

The Brain Child Project consisted of the involvement of approximately 561 children, grades kindergarten through eighth, in a parochial school with 494 children successfully completing all 4 phases of the study. The demographics of the children varied not only in age, but also racially and socio-economically. The principal of the school was approached about the feasibility of anonymously surveying the entire school with the 3 distinct times: (1) 1 week prior...
to the educational program about stroke; (2) immediately following the educational program; and (3) 7 to 10 days following the program. After her consent, letters were distributed to all the teachers, with instructions regarding the appropriate administration of the upcoming questionnaires.

The multiple-choice questionnaire addressed the following questions:

1. What is a stroke?
2. What kind of things can cause a stroke?
3. What are the warning signs of a stroke?
4. What would you do if someone you knew had a stroke?
5. What can you do to keep from having a stroke?

The multiple choices ranged from obvious incorrect responses to simplified correct responses. The scoring involved weighted values with correct responses receiving a higher value than incorrect responses. Some credit was given if the student left an incorrect response unmarked. The 67 children who did not complete all 3 tests were not included in the study.

The teachers administered the questionnaires to the children, stressing the importance of independent answers no matter their knowledge base versus focusing on “correct” responses. The kindergartners were paired with a 7th or 8th grader who administered their test. The questionnaires were filled out at various times of the student’s day and collected. Students were identified by initials and gender.

One week following the initial survey, an all-school general assembly was held for the sole purpose of this stroke educational program. The Brain Child presentation began with a local TV personality, who briefly described his personal experience with stroke and asked the children to be sure to listen carefully to the presentation so that they might be able to help someone who was having a stroke. Then an 11-minute program was presented by a narrator, consisting of (1) a PowerPoint presentation (8 slides) of basic brain function and what happens during a stroke; (2) a live performance by actors “acting out” the warning signs of stroke and what to do following a stroke (actors held up cards with “9-1-1” on them); (3) and actors “acting out” how to prevent stroke. Along with the local TV personality (mid-60s, white male), the other actors included a well-known local “dad” (Hispanic, mid-40s), a 78-year-old white female, a white female in her mid-40s, a black female (mid-40s), and an 18-year-old white male (also well-known by the children). This group of actors was specifically chosen to portray a variety of age, sex, and racial composition.

At the end of the program, the school and children were thanked for their attention, and a life-size articulated skeleton was presented to the science department. The children were instructed to complete the questionnaire once they returned to their classrooms. Following the posttest, Stroke Warning Signs bookmarks, glowing brain balls, “gummy brains,” and certificates acknowledging them as a “Brain Child” (co-signed by the local celebrity) were distributed. Approximately 10 days later, they completed the questionnaire a third and final time.

The data were analyzed by paired \( t \) test method.

## Results

The overall knowledge of stroke among this group of grade-school children was limited, as the average score on the pretest was 64%. After the presentation, the average on the posttest was 82% (an improvement of 18%) and the average on the retention test was 81.78% (an improvement of 17.78%) (see Table). There was significant difference between the pretest and the posttest and also between the pretest and retention test (\( P<0.001 \)). There was less than half a point difference (0.22%) between the averages of the posttest and the retention test, showing no significant difference.

On the pretest, the eighth grade scored the highest with 71%, while the kindergarten scored the lowest with 55%. This pattern was also present for the posttest and the retention test averages (see Table).

Within each grade level there was significant difference between pretest and posttest and between the pretest and retention test of \( P<0.001 \) (Figure). The fifth grade class improved their scores by 22% (the highest among all grades) and the second grade improved their score by 12% (the lowest among all grades) (see Table).

### Scores of Pretest, Posttest, Retention Test, and Improvement by Grade Level

<table>
<thead>
<tr>
<th>Grade</th>
<th>Students, n</th>
<th>Pretest Mean (% ± SD)</th>
<th>Posttest Mean (% ± SD)</th>
<th>Improvement Mean (% ± SD)</th>
<th>Retention Test Mean (% ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>58</td>
<td>55 ± 0.16</td>
<td>76 ± 0.13</td>
<td>20 ± 0.18</td>
<td>76 ± 0.10</td>
</tr>
<tr>
<td>1</td>
<td>57</td>
<td>60 ± 0.14</td>
<td>76 ± 0.13</td>
<td>17 ± 0.16</td>
<td>76 ± 0.10</td>
</tr>
<tr>
<td>2</td>
<td>58</td>
<td>67 ± 0.15</td>
<td>79 ± 0.10</td>
<td>12 ± 0.13</td>
<td>79 ± 0.11</td>
</tr>
<tr>
<td>3</td>
<td>56</td>
<td>64 ± 0.13</td>
<td>82 ± 0.09</td>
<td>17 ± 0.13</td>
<td>83 ± 0.10</td>
</tr>
<tr>
<td>4</td>
<td>60</td>
<td>62 ± 0.12</td>
<td>82 ± 0.16</td>
<td>20 ± 0.12</td>
<td>82 ± 0.08</td>
</tr>
<tr>
<td>5</td>
<td>58</td>
<td>60 ± 0.13</td>
<td>82 ± 0.11</td>
<td>21 ± 0.11</td>
<td>82 ± 0.12</td>
</tr>
<tr>
<td>6</td>
<td>53</td>
<td>69 ± 0.09</td>
<td>84 ± 0.13</td>
<td>15 ± 0.16</td>
<td>86 ± 0.08</td>
</tr>
<tr>
<td>7</td>
<td>44</td>
<td>68 ± 0.12</td>
<td>88 ± 0.07</td>
<td>19 ± 0.13</td>
<td>86 ± 0.07</td>
</tr>
<tr>
<td>8</td>
<td>50</td>
<td>71 ± 0.11</td>
<td>89 ± 0.06</td>
<td>18 ± 0.10</td>
<td>86 ± 0.07</td>
</tr>
<tr>
<td>Total</td>
<td>494</td>
<td>64.00</td>
<td>82.00</td>
<td>17.66</td>
<td>81.78</td>
</tr>
</tbody>
</table>

There is significant difference between pretest and posttest and also between pretest and retention test (\( P<0.001 \)) for all grades combined and within each grade. Comparisons between posttest and retention test shows no significant difference (\( P>0.05 \)), except for the eighth grade (\( P=0.01 \)).

### Comparative results of pretest (gray bars), posttest (black bars), and retention test (white bars) by grade level.
The third and sixth grades actually improved slightly on their retention test from their posttest.

Comparison between the posttest and retention test showed significant difference for only the eighth grade. There was no significant difference between the posttest and retention test within each grade except for the eighth grade ($P=0.01$).

**Discussion**

Educational intervention for brain attack awareness beginning at primary levels may be a worthwhile endeavor, having more and more national impact as these children age and as the “baby boomers” head for advanced age. The Brain Child educational program is brief, simple to present, and able to capture the interest of the youngsters as well as the older children. It could be easily modified according to the school’s student population. Repeating the program several times during their elementary education would most likely reinforce the information.

It was encouraging to see how well children of all the age groups were able to identify “stroke warning signs” once they had been educated. Part of this may be attributed to utilizing a visual and auditory aid of actors demonstrating the warning signs, ie, normal speech versus abnormal speech (excerpts from the *Cat in the Hat* were read correctly, then with stumbling, aphasic effort) or sudden severe headache (the individual grabbed his head and said “This is the worst headache I’ve ever had.”). Utilizing actors may have provided special emphasis on the oral and visual presentation. Currently, two-dimensional icons have been developed by stroke associations to depict the various warning signs and appear on various stroke awareness materials. Since many adults may be visual learners, commercials or photographs of actual people demonstrating the warning signs may be a more effective means of educating the public.

It was interesting to look at the students’ baseline knowledge of what stroke is, and further to assess their understanding of how to prevent future strokes. Most children were able to identify healthy behaviors like eating right, visiting the doctor regularly, and getting plenty of exercise. Once this information was presented as pertinent to stroke prevention as well, this reinforced healthy life habits they had already been exposed to by other means.

Future revisions of the program may include choosing a time of the year that may be more conducive to the school schedule, ie, health fair, science month, following an incident of stroke to related family member, etc. Scheduling issues could have accounted for the significant difference between the posttest and retention test for the eighth-graders who took the final questionnaire during their graduation week. Better school calendar planning could help in getting parents, teachers, and the administrative staff involved. The multiple-choice questionnaire could also be modified for easier scoring using a machine-aided system versus hand-scored tests, which we found tedious and time-consuming.

It might also be interesting to measure retention after several months or a year, which might identify areas in which further education or emphasis is needed. Stroke awareness programs like The Brain Child Project could simply be repeated at various intervals throughout students’ elementary years.

Another suggestion would be to utilize an “Ambassador Brain Child” who acted appropriately during a stroke. This would give the students a peer they could relate to and identify with should the same circumstance happen to them. The Ambassador Brain Child could tell the children what happened, how they felt, and what they did in the emergency. That child could then be publicly commended by a local health celebrity, or nationally through the Surgeon General or other healthcare organization. Further, the establishment of a National Registry through one of the stroke associations could help identify children who had acted appropriately in the face of a brain attack, recognize them for their quick thinking, and ultimately reinforce the importance of emergency response to stroke warning signs. Subject matter like this would pique the interest of the local health media.

It is hoped that children who have been exposed to quality stroke awareness programs will be growing up “Stroke Savvy” and will help to someday eliminate the awareness and response problem completely.

**Acknowledgments**

A special thanks to Wendall Anschutz, of KCTV5, Kansas City, Missouri, for describing his personal experience with stroke during the education presentation.

We would also like to acknowledge the following: St. Peter’s Catholic School, Kansas City, Missouri; American Stroke Association, Division of the American Heart Association; National Stroke Association; AstraZeneca; McKouen Sign Company; US Toy; and Barbara Rose, ARNP, for her enthusiastic support and assistance. We would like to thank Danhua Wang, MD, PhD, Senior Research Scientist at MidAmerica Neuroscience Institute, for her assistance in statistical analysis of the data and review of the project.

Special thanks to The Brain Child Project actors: Wendall Anschutz, Myrza Atchity, George Medina, Maggie Trout, Barbara Rose, and Kevin Marts.

A non-restricted educational grant was provided to the Mid-America Neuroscience Research Foundation, an affiliate of Mid-America Neuroscience Institute by Genentech, Inc.

**References**


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Stroke. 2002;33:623-625
doi: 10.1161/hs0202.102728

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