Editorial

Strengthening the Link

The Critical Role of Children in the Stroke Chain of Recovery

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See related article, pages 2809–2816.

Stroke remains a devastating disease killing someone every 3 to 4 minutes and leaving up to 30% permanently disabled according to the most recently available statistics.\(^1\) The estimated cost of this disease from 2005 to 2050 will exceed $2 trillion with most of this cost related to disabled survivors’ loss of earnings.\(^1\) Sadly, studies have revealed that most strokes cannot be treated due to delayed presentation to an emergency department well outside of thrombolytic treatment windows.\(^2,3\) Currently, only 2% to 6% of eligible patients receive lifesaving thrombolytic therapy.\(^4\)

In the quest to find a solution to this problem, researchers have studied factors that are associated with earlier emergency department arrival. This research has revealed that the majority of delayed presentation occurs during the first 2 steps in the stroke chain of recovery: identification and dispatch.\(^5\) Specifically, recognition of stroke signs and symptoms (identification) and activation of the emergency medical services system by calling 911 (dispatch) are both associated with less delay and concomitant earlier emergency department arrival for treatment.\(^6–9\) Most importantly, the presence of a bystander or other witness is also associated with earlier arrival\(^7,10\) perhaps, in part, because it is usually someone other than the stroke victim who initially calls 911 for help.\(^11\)

Recent demographic trends suggest that young children may increasingly be the family member or bystander present during the onset of stroke. There has been a steady increase in the number of children living with their grandparents (30% since 1990) with an estimated 5.7 million grandparents living with their grandchildren in 2000.\(^12\) Additionally, many individuals are delaying their births beyond age 30,\(^13\) resulting in more children with older parents present in the household. Therefore, many children may be in a prime position to call 911 and contribute to a stroke victim’s early arrival at the emergency department, which makes discovering the best methods for teaching children stroke recognition and response of crucial importance.

Although several studies have demonstrated efficacious stroke education programs with adults over the last decade, stroke educational initiatives with children are still very much in their infancy.\(^14,15\) A review of the literature reveals 3 successful stroke education programs with children to date:

- The FAST Stroke Prevention Educational Program for Middle School Students\(^14\);
- the Brain Child Project\(^15\); and,
- the Kids Identifying and Defeating Stroke (KIDS) Project.\(^16\) These programs coupled with the current “Hip-Hop” Stroke Program by Williams and Noble elucidate 3 primary factors that are potentially associated with successful stroke education among children: culturally appropriate contexts, live, recognizable persons, and recurring exposure to the message.

Williams and Noble used a cultural element specific to the participants’ area, hip-hop music, as part of the didactic curriculum in their study and achieved posteducation knowledge gains in children. Both the Brain Child Project\(^15\) and the FAST program\(^14\) involved somewhat brief, 1-day education sessions with the children, and both showed some knowledge loss, although very minimal, between the immediate posttest and long-term follow-up (−0.22% in the Brain Child Project and average point losses of 0.4 [warning signs] and 0.9 [risk factors] in the FAST program). The “Hip-Hop” Stroke Program involved 1-hour lessons over 3 days, but also found some slight diminishment in stroke knowledge at 3 months from the immediate posttest (stroke localization −7%, urgent action −2%, symptom recognition −0.1 point). In contrast, the KIDS Project involved 50-minute sessions given 4 times per year throughout grades sixth through eighth...
and demonstrated an increase in stroke knowledge in each knowledge domain at the end of eighth grade.

Given the positive impact on stroke knowledge demonstrated by the previously discussed child stroke education programs, assessing the impact that these programs have on actual behavior such as calling 911 and early presentation for treatment is the logical next step in the research continuum for these activities. Adult stroke education programs have previously demonstrated an increase in both frequency of visits and time to presentation for stroke\(^8\) as well as rates of thrombolytic treatment.\(^9\) In addition to these future research efforts, there are a few other program areas that still need to be addressed in the quest to find the most effective and lasting stroke educational program with children.

None of these child stroke education programs have yet been able to successfully demonstrate actively involving parents in the process, which has been identified as an element necessary for the successful education of children.\(^14\) In particular, the KIDS Project, which was the only program that included parents (although indirectly) in the curriculum, had a parental participation rate of 18% in the intervention group and 16% in the control group.\(^16\) Therefore, it is currently unknown whether these programs affect parental knowledge of stroke as well. The KIDS Project results suggest that actively including parents in the process, as opposed to having children take home material to teach the parents, may be a more effective approach.\(^16\)

The impact of these programs on knowledge of stroke risk factors has also been somewhat disappointing. There was better retention of stroke warning signs versus risk factors in the FAST program\(^14\) and better test performance on symptom recognition items as opposed to stroke prevention measure items in the current “Hip-Hop” Stroke Program. Miller and colleagues suggest that this situation may be due to the fact that stroke risk factors are more abstract than signs and symptoms and thus harder for children to remember.\(^14\) They further suggest that the FAST mnemonic (Face, Arm, Speech, Time to call 911) facilitates the retention of stroke symptoms and response knowledge. This supposition is supported by Williams and Noble’s results in which symptoms specifically contained within the FAST mnemonic were better retained at the long-term follow-up than other symptoms. More research could seek to develop a comparable mnemonic for stroke risk factors and test this theory.

Research should also be conducted on stroke education programs for the very young, because half of all grandchildren who live with their grandparents are younger than age 6.\(^12\) Specifically, data from the Brain Child Project showed that the biggest intervention effect was observed in the fifth grade, whereas the smallest was found among second graders.\(^15\) Williams and Noble’s “Hip-Hop” Stroke Program found success in grades fourth through sixth, and the FAST program’s\(^14\) average participant age was 13.25. Therefore, there is still a need for efficacious stroke recognition programs for very young children in kindergarten through third grade.

Finally, research is needed in rural and remote areas where the cultural elements that may lead to successful stroke educational programs for children may differ from the ones used in the reported studies. Regardless of their geographical location, however, changing societal demographics coupled with the importance of a bystander to stroke recognition and activation of the emergency medical services system highlight the critical link that children represent in the stroke chain of recovery. The successful results of the “Hip-Hop” Stroke Program coupled with the previous efforts of the FAST program, KIDS Project, and the Brain Child Project have truly demonstrated that this critical link can be strengthened.

**Disclosures**

None.

**References**


**Key Word:** educational campaigns
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