

Kids Identifying and Defeating Stroke (KIDS): Development and Implementation of a Multiethnic Health Education Intervention to Increase Stroke Awareness Among Middle School Students and Their Parents

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The Kids Identifying and Defeating Stroke (KIDS) project is a 3-year prospective, randomized, controlled, multiethnic school-based intervention study. Project goals include increasing knowledge of stroke signs and treatment and intention to immediately call 911 among Mexican American (MA) and non-Hispanic White (NHW) middle school students and their parents. This article describes the design, implementation, and interim evaluation of this theory-based intervention. Intervention students received a culturally appropriate stroke education program divided into four 50-minute classes each year during the sixth, seventh, and eighth grades. Each class session also included a homework assignment that involved the students' parents or other adult partners. Interim-test results indicate that this educational intervention was successful in improving students' stroke symptom and treatment knowledge and intent to call 911 upon witnessing a stroke compared with controls. The authors conclude that this school-based educational intervention to reduce delay time to hospital arrival for stroke shows early promise.

Keywords: *stroke; health disparities; Mexican Americans; social cognitive theory; school-based program*

► **BACKGROUND**

Stroke is the leading cause of disability in the United States and the third leading cause of death. Ischemic stroke accounts for 85% of all strokes. The only FDA-approved treatment for acute ischemic stroke, rt-PA, must be given within 3 hours of stroke onset. Stroke patients who receive rt-PA have been shown to have at least a 30% relative (11-13% absolute) chance of having minimal to no disability compared with those who receive placebo (Kwiatkowski, Libman, Frankel, & the NINDS rt-PA Stroke Study Group, 1999). This translates into higher rates of patients being discharged to home or rehabilitation rather

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than to a nursing home and has been shown to be a cost-saving treatment for stroke (Fagan et al., 1998). Yet, only a small percentage of the ischemic stroke population receives rt-PA (Brown, Lisabeth, Garcia, Smith, & Morgenstern, 2004). The major barrier to receiving therapy is arriving to the hospital within the 3-hour window (Barber, Zhang, Demchuk, Hill, & Buchan, 2001; Morgenstern et al., 2002). This is due, at least in part, to a lack of recognition of stroke signs and symptoms (Ferris, Robertson, Fabunmi, & Mosca, 2005), which are variable and include weakness, numbness, clumsiness, and visual loss, usually restricted to one side, as well as language disturbances and confusion. The method of arrival to the hospital is also important, as patients who arrive via emergency medical services significantly shorten their arrival time and time to head CT scan (Menon, Pandey, & Morgenstern, 1998; Morris, Rosamond, Madden, Schultz, & Hamilton, 2000), a critical

step prior to receiving rt-PA. However, stroke patients usually do not activate emergency medical services themselves (Wein et al., 2000) due to impairment of language, motor function, and cognition. Thus, to improve acute stroke therapy, it is imperative that close family and friends be able to recognize stroke symptoms and understand the urgency in seeking prompt medical care by activating emergency medical services. Education cannot focus solely on stroke symptoms but must also motivate behavioral action (calling 911) by explaining the efficacy of early acute stroke therapy. In one study, 29% of patients presenting after 3 hours recognized their stroke symptoms but chose not to seek medical attention quickly (Barber et al., 2001).

Hispanic Americans (HAs) are the largest minority in the United States today (Grieco & Cassidy, 2001), with those of Mexican origin being the largest subset (U.S. Census Bureau, 2005b). The incidence of both ischemic and hemorrhagic stroke is approximately 1.5 to 2 times higher in Mexican Americans (MA) than non-Hispanic Whites (NHWs), with higher rates seen at younger ages (Morgenstern et al., 2004). Conversely, stroke symptom recognition, although poor across all ethnic groups, is lowest among HAs (DuBard, Garrett, & Gizlice, 2006; Ferris et al., 2005), with Spanish-speaking HAs having the worst symptom recognition (DuBard et al., 2006). Given these facts as well as the large public health impact expected from the HA stroke burden (Brown et al., 2006), educational outreach programs must target this community with culturally specific interventions.

Although several community-based media campaigns have been reported in the literature to improve stroke knowledge (Beckera et al., 2001; Morgenstern et al., 2002; Silver, Rubini, Black, & Hodgson, 2003), a review of the literature did not identify any controlled trials of school-based interventions that target improvements in the emergency treatment of stroke through increased stroke knowledge and behavioral intention to call 911. In addition, few programs have targeted improved stroke knowledge among MAs or among children. This article describes the design, implementation, and interim results of the theory-based, multiethnic Kids Identifying and Defeating Stroke (KIDS) project designed to increase middle school students' and their parents' or other adult partners' knowledge of stroke symptoms and intention to call 911 immediately when witnessing a stroke.

► METHOD

Participants

The KIDS project was implemented in middle schools in Corpus Christi, Texas. An urban locale, Corpus Christi is located in Nueces County on the Texas Gulf Coast. The

Corpus Christi Metropolitan Statistical Area has a total population of 383,259, with 54% of the population of Hispanic origin and 40% NHW (U.S. Census Bureau, 2005a). MAs account for more than 80% of the Hispanic population. The MA population in Corpus Christi is predominantly second- and third-generation U.S. citizens; this is not an immigrant population.

The middle schools randomly selected to participate in the KIDS project are part of the Corpus Christi Independent School District (CCISD). Middle school enrollments total 8,682, with primarily HA (74%) students but also significant numbers of NHW (19%) and African American (6%) students (CCISD, 2005).

Procedures

The KIDS project was designed as a 3-year prospective, randomized, controlled, school-based trial. Six of the 12 Corpus Christi, Texas, middle schools were randomly selected and then randomized 1:1 to the intervention or control groups. Within each of the three intervention schools, one sixth-grade science or health teacher was randomly chosen. Students assigned to that teacher received the KIDS stroke education program taught by KIDS project staff, whereas the students in the control schools were given the standard health or science curriculum. In subsequent years (seventh and eighth grades), the students who received the intervention in the sixth grade were taken out of a regular classroom to attend the KIDS project lessons. The stroke education program was divided into four 1-hour classes each year during the sixth, seventh, and eighth grades. Each class session also included a homework assignment that involved the students' adult partners.

A pretest was administered to student participants 3 months before the sixth-grade lessons began. The day of the pretest, students were asked to identify two adults in their community with whom they were closest to participate in the KIDS follow-up tests and homework assignments. Whereas most students chose their parents as adult partners, other common adult partners included grandparents, aunts and uncles, and adult siblings. Pretests for adult partners were sent home with the students the same day; if they were not returned, a second copy of the test was mailed to the student's home 2 months later.

To provide guidance in developing the final year of the project, an interim test was given to students and adult partners following the seventh-grade KIDS intervention. In addition, a posttest was scheduled to be given to students and their adult partners 3 months following the eighth-grade KIDS intervention, followed by a persistence test 1 year after the intervention. The interim test, posttest, and persistence test are identical to the pretest.

The KIDS Project: Scope and Sequence

The KIDS curriculum was written 1 year at a time, with each successive year building on the previous year's experiences. Social cognitive theory (SCT) was used to guide curriculum development. Throughout the 3-year project, the KIDS Planning Committee met weekly to discuss the lessons as they were designed and implemented. In addition, each year's curriculum was pilot tested with middle school students and refined prior to implementation in the intervention schools.

The sixth-grade lessons provided a general introduction to the symptoms of stroke, availability of rt-PA, and the need to call 911 right away. The seventh-grade lessons were designed to provide more in-depth information on stroke symptoms and their relationship to the portion of the brain that is damaged. Students and their adult partners also began to explore common bystander reactions to witnessing a stroke and internal and external influences on behavior that would influence them to call 911 right away. The eighth-grade lessons included a more specific and in-depth look at influences on seeking immediate emergency care for stroke. Table 1 presents an overview of the KIDS curriculum.

► DEVELOPMENT OF THE KIDS PROJECT

The KIDS project was systematically developed using several specific types of information. Community surveys in East Texas and in Corpus Christi provided insights into stroke-related knowledge, attitudes, and behavioral intentions of both MAs and NHWs (Morgenstern et al., 2002; Smith, Risser, Lisabeth, Moyé, & Morgenstern, 2003). School-based focus groups added information essential to planning a culturally relevant intervention. SCT offered a framework for crafting an intervention that would increase stroke knowledge and motivation to contact emergency medical services when witnessing a stroke. Interim-test results from student participants provided important feedback for fine-tuning the final year of the KIDS project.

Community Surveys

In preparation for the KIDS project, a telephone interview survey was conducted in Nueces County, Texas, to determine differences in knowledge of stroke signs, risk factors, and treatment resources among MAs and NHWs (Morgenstern et al., 2002; Smith et al., 2003). This survey found that MAs were significantly less likely than NHWs to (a) recognize that a treatment was available for acute stroke, (b) indicate that there was a short time frame for being eligible to receive acute stroke treatment, and (c) say they would call 911 if they or a loved one were having a stroke. In addition, MAs were less able to recall stroke

TABLE 1
Summary of Kids Identifying and Defeating Stroke (KIDS) Middle School Curriculum by Year and Lesson

<i>Lesson</i>	<i>Year 1</i>	<i>Year 2</i>	<i>Year 3</i>
1	<i>Class:</i> Stroke is a medical emergency <i>Homework:</i> Stroke symptoms diagram	<i>Class:</i> Why doesn't everyone having a stroke have the same symptoms? <i>Homework:</i> Why these symptoms of stroke?	<i>Class:</i> What do you know about brain attacks? <i>Homework:</i> What do you know? quiz
2	<i>Class:</i> Can you recognize the symptoms of stroke? <i>Homework:</i> Stroke scenarios	<i>Class:</i> Making posters to teach adult partners about stroke <i>Homework:</i> Explain and display brain attack poster	<i>Class:</i> Understanding influences on seeking emergency care <i>Homework:</i> Review influences on calling 911
3	<i>Class:</i> How does a stroke happen? (artery models) <i>Homework:</i> Demonstrate artery models	<i>Class:</i> What influences someone to call 911? <i>Homework:</i> Influences adult partner interview	<i>Class:</i> Stroke: Risk and prevention <i>Homework:</i> Review stroke risk factors and symptoms bookmark
4	<i>Class:</i> Brain attack: What do you know? review game <i>Homework:</i> Review scenario answers (from Lesson 2)	<i>Class:</i> Coping with stress during emergencies <i>Homework:</i> Deep breathing practice with stress dots	<i>Class:</i> Treating strokes: A success story video <i>Homework:</i> Stroke success story fotonovela

symptoms and risk factors, although both groups' responses indicated a lack of knowledge. Neither MAs nor NHWs were able to identify rt-PA or a clot-busting drug when asked to name an acute stroke treatment.

Needs assessment data collected previously for another project, The TLL Temple Foundation Stroke Project (Morgenstern et al., 2002), were also helpful in planning the KIDS project. A random-digit-dialed telephone survey of 691 people in East Texas had found that the best predictors of individuals most likely to call 911 for a witnessed acute stroke included (a) being NHW; (b) having a perception that peers would call 911; (c) self-efficacy; (d) expecting that calling 911 would lead to a good outcome; and (e) reporting one would promptly go to the doctor when medical problems occur.

Taken together, these needs assessment data from two telephone interview studies in eastern Texas clearly indicated that self-efficacy, outcome expectations, perceived norms, and knowledge of stroke symptoms and treatment are critical components for a successful acute stroke health education intervention.

Cultural Relevance

In designing the KIDS curriculum, special care was given to reflect the Corpus Christi dominant MA culture, while also being appropriate for the needs of the NHWs

and African Americans. Hispanic cultures, especially MAs, place great value on the family—*familism* (Tacon & Caldera, 2001). It is common for HAs to have multiple generations living together in a household (Simmons, 2003). The KIDS project incorporated this multigenerational contact by teaching middle school-aged children about stroke and having them teach the information to adult partners at home through specific homework assignments.

The KIDS project staff included MA health professionals from Corpus Christi who provided guidance in developing lesson activities that incorporated aspects of the local MA culture. In addition, KIDS project staff conducted focus groups with volunteer students, parents, and teachers from Corpus Christi early in the planning process, as another way to ensure cultural sensitivity. Focus group questions addressed perceptions about preferred teaching methods and parents' previous experiences with participation in homework assignments. Students, parents, and teachers agreed that active learning strategies were preferred, with students noting that using technology is helpful. Parents and teachers revealed that parents are used to providing assistance on student homework assignments but have little or no experience with students being assigned to teach their parents. Parents suggested that homework activities such as interviews would be acceptable. Students believed that giving rewards for returning adult partner homework assignments might encourage

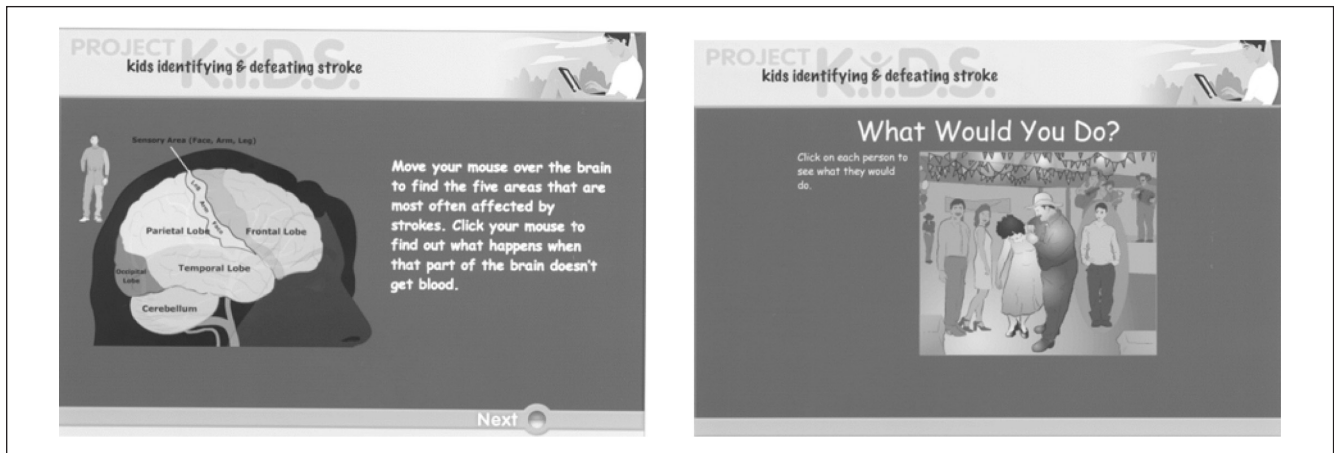


FIGURE 1 Kids Identifying and Defeating Stroke (KIDS) Web Activity: Brain Attack Symptoms and Tejano Dance Interactive Stroke Scenario

participation. Teachers pointed out that some parents spoke primarily Spanish, which would have implications for homework assignments.

All adult partner homework assignments were created in both English and Spanish. Role-play and Web-based scenarios were created to reflect the MA culture, using backgrounds such as the celebration of El Dia de los Muertos (The Day of the Dead) and a Tejano (Texas-Mexican) dance. Scenarios and role-plays were based in settings familiar to the students, such as the Corpus Christi waterfront. Interviewing was incorporated by having seventh-grade students interview their adult partners about personal and environmental influences on immediately calling 911. Incentives, ranging from gel pens to movie passes, were provided to students each year based on both their participation in classroom activities and the number of homework assignments returned.

Social Cognitive Theory

SCT focuses on the dynamic and reciprocal interactions between personal factors, environmental influences, and behavior as they relate to learning (U.S. Department of Health and Human Services, 2005), emphasizing that individuals can learn by observing the behaviors of others and the outcomes of those behaviors, as well as from personal experiences. Based on the needs assessment, SCT was chosen as the theoretical framework for the KIDS project. Behavioral capability, self-efficacy, and outcome expectations received special emphasis.

Behavioral capability. In SCT, behavioral capability refers to the knowledge and skills that are necessary to be able to

do the recommended behavior. The KIDS project focused on strengthening the behavioral capability of students and their adult partners by increasing their knowledge of symptoms of stroke and acute stroke treatment (rt-PA), as well as the need to get to the hospital within 3 hours after symptom onset. Throughout the project, information and training about the correct actions to take when witnessing a stroke were provided, including noting the time the symptoms started, calling 911 immediately, and giving the correct first aid while waiting for the ambulance.

To help students gain important knowledge about stroke symptoms, an interactive Web site was developed for the seventh-grade (year 2) curriculum. The KIDS class met in a school computer lab, where students participated in a Web activity that illustrated the specific signs and symptoms expected from damage to various parts of the brain (see Figure 1). When students moved the cursor over the different parts of the brain, the stroke damage for that part of the brain was highlighted both on screen and through audio dialogue. Students were given a handout with illustrations from the KIDS Web site to use when teaching their adult partners about the brain and stroke symptoms.

Role-playing emergency situations of stroke versus nonstroke were used to promote skill mastery. Students worked together in small groups to analyze each scenario and decide if symptoms of stroke were depicted. Student groups then acted out the scenarios for the class, calling 911 if stroke symptoms were present.

Self-efficacy. Self-efficacy refers to a person's belief in his or her capabilities and confidence in performing a specific behavior. It includes the belief that one can

choose to do the specific behavior under difficult circumstances. The KIDS project focused on increasing self-efficacy for recognizing the symptoms of stroke in an emergency when stress levels are high and calling 911 right away, even if bystanders make other suggestions for how to handle the emergency.

Individuals interpret several types of information to form their self-efficacy beliefs (Pajares, 2002). Mastery experiences are a strong influence on self-efficacy. Self-efficacy can also be influenced through vicarious learning, especially when the person modeling the behavior is similar to the individuals observing. Vicarious learning experiences were integrated throughout the KIDS curriculum. One example involved the KIDS Web site, where students observed a scene at a dance with Tejano music playing. A woman has sudden numbness and weakness in her right arm and leg while dancing (see Figure 1). As students move the mouse over the various bystanders, they hear a number of suggestions with regard to what the woman should do. The middle school-aged boy suggests calling 911 right away, modeling a MA youth recommending the correct behavior to adults. Students used a handout illustrating this scenario to teach their adult partners about how important it is to call 911 when witnessing a stroke, even when others suggest different actions.

Outcome expectations. In SCT, outcome expectations refer to beliefs about the consequences of performing the recommended behavior. Specifically, the KIDS lessons were designed to teach students and their adult partners that getting to the hospital in time to receive rt-PA increases the chances of having a better recovery and decreases the chances of disability from stroke. In the Tejano dance Web activity, students were asked to choose which bystander suggestion they thought was correct. Outcomes for each choice were given, including how much time it took to arrive at the hospital, whether the woman received rt-PA, and the level of disability she had when leaving the hospital. A worksheet highlighting the Tejano dance scenario was created, in both English and Spanish, for students to share with their adult partners.

► INTERIM EVALUATION

To provide feedback on the efficacy of years 1 and 2 of the intervention, an interim test was administered 4 months after the seventh-grade intervention to all students and adult partners. The test was identical to the pretest. Students in each intervention and control school were located and asked to leave their classes to complete the tests in a central location. Students were then asked to take the test home to their adult partners and return the completed tests to the school. Five-dollar movie passes were

given as incentives to students who returned tests from their adult partners.

The test was made up of 12 questions, divided into three domains of 4 questions each. Domain 1 tested knowledge of stroke pathophysiology. Domain 2 tested stroke signs recognition, and domain 3 assessed behavioral intent and treatment knowledge. The test was written by a stroke neurology professor and a health education professor who had stroke education experience. The KIDS project stroke educators were blind to the test questions so that they would not “teach to the test.” Prior to planning the eighth-grade KIDS lessons, interim results were shared with the KIDS stroke education staff by domain only, thus protecting the blinded test questions.

Interim Analysis Methods

The primary outcome measures were improvement among both students and adult partners in the three domains: knowledge of stroke pathophysiology, stroke signs recognition, and behavioral intent and treatment knowledge. The mean number of correct responses for the pretest and interim test were calculated for each domain for those individuals who completed both pre- and interim tests. A paired *t* test was used to compare mean number of correct responses (maximum = 4) on pre- and interim tests for the control and intervention schools. The relationship between intervention status and improvement in domain scores by at least 1 correct response was assessed with a chi-square test.

Interim Results

In year 1, 515 sixth-grade students (258 control, 257 intervention) and 454 adults (203 control, 251 intervention) enrolled in the study. Of the control students, 90% self-identified as Hispanic and 42% were male. Among the intervention students, 78% self-identified as Hispanic and 55% were male. Of the control adult partners, 89% self-identified as Hispanic, 38% were male, and 88% were between the ages of 30 and 49. Among the intervention parents, 68% self-identified as Hispanic, 37% were male, and 83% were between the ages of 30 and 49.

Interim tests were completed by 181 control students and 149 intervention students. School transfers resulted in the loss of 60 intervention and 27 control students, who thus did not complete an interim test. Interim tests were completed by 98 control and 39 intervention adult partners. Student transfers accounted for lack of interim test completion for 30 intervention and 6 control adult partners.

The results of the student pretest and interim test are shown in Table 2. Students in the intervention group had

TABLE 2
Student Interim Test Results

Question Domain	Control Group (n = 181)			Intervention Group (n = 149)			Comparison of Improvement in Scores by ≥ 1 Between the Control and Intervention Groups
	Pretest	Interim Test	Change in Scores	Pretest	Interim Test	Change in Scores	
Stroke pathophysiology	1.2	0.8	$p < .001$	1.2	1.5	$p = .006$	$P < .001$
Symptom recognition	0.9	1.2	$p = .007$	1.2	2.1	$p < .001$	$P < .001$
Behavioral intent and treatment	1.3	1.5	$p = .004$	1.5	2.7	$p < .001$	$P < .001$

significant improvement in their interim test scores, compared with their pretest score in all domains; students in the control group had smaller but significant improvement in domains 2 and 3 and deterioration in domain 1 scores. Intervention students were more likely to improve their scores by greater than or equal to 1 correct response. Too few adult partner interim tests were returned to provide meaningful results.

► DISCUSSION

Interim results indicated that the KIDS project intervention did have an effect on student knowledge and behavioral intention. Specifically, the first 2 years of this school-based educational intervention were successful in improving student knowledge of stroke pathophysiology, recognition of symptoms of stroke, stroke treatment, and intent to call 911 upon witnessing a stroke. Although even the control students improved their knowledge in the latter two domains, their improvement was not as robust as that of the intervention students. The minimal improvement of the control students likely reflects the general accumulation of health knowledge as children age.

The interim results were helpful in guiding the design of the final year of the intervention. Students in the intervention group scored the highest on behavioral intention to call 911 and understanding that treatment for acute stroke is available. Although students showed significant improvement in their knowledge of stroke symptoms, it was clear that additional instruction was needed. The 3rd-year curriculum was designed to reinforce learning about stroke symptoms. A Corpus Christi teacher who had experienced a positive outcome after receiving rt-PA for a stroke agreed to share her story with the KIDS project. A short rt-PA success story video, which highlighted symptoms of stroke, calling 911, receiving rt-PA, and a positive

recovery, was produced and shown to students. A fotonovela based on the video was created to help students share the story with their adult partners.

Through teaching the students and reviewing adult partner homework assignments in the first 2 years of the intervention, we learned of additional barriers to seeking urgent medical care for stroke. Students and parents were fatalistic with regard to efficacy of early stroke treatment and worried about negative consequences of activating emergency medical services if the witnessed symptoms are not due to a stroke. These misconceptions were also addressed in planning the eighth-grade (year 3) lessons. Specifically, a lesson was designed to discuss the results of the students' seventh-grade parent interviews on influences that might cause someone to delay calling 911. Following the discussion, students were asked to demonstrate their understanding of these influences by creating public service announcements designed to influence others to call 911 right away when they witness symptoms of stroke.

Limitations of this study have become apparent. Student attrition, defined as the percentage of students who took a pretest but did not take an interim test, was high between intervention years 1 and 2 (42% in the intervention group and 30% in the control group). A large proportion of those students lost was due to transfers out of the schools. No factors have been identified to explain the imbalance in the transfer rates between control and intervention schools. A large proportion of students remaining in the schools simply did not return an interim test (24% of the intervention students, 26% of the control students). The distribution and collection of interim tests was difficult and time-consuming in both intervention and control schools as each student had to be individually located. This is a function of the cohort design of the study. With standard middle school course scheduling issues, it was

necessary in year 2 (seventh grade) to ask students to miss an elective class on the days KIDS lessons and the interim test were given. Some teachers were unwilling to allow students to miss class for participation in KIDS. Once this problem was identified, KIDS staff members worked with the schools and teachers to educate them on the importance of participation and identify times to deliver the year 3 (eighth grade) KIDS lessons and posttest that would be the least disruptive to student schedules. The interim-test process thus served as a pilot for the posttest process, alerting KIDS staff members to potential student and parent/adult partner attrition issues that could be addressed prior to administering the posttests and persistence tests.

We do not know if we were successful in transmitting stroke knowledge and behavioral intention to call 911 to the parents and other adult partners, as we were unable to collect an adequate number of adult interim tests for analysis. Incentive prizes were used to increase the return rates of adult partner interim tests, but the percentage returned was still too low. Most of the adult partners (83% intervention and 88% control) were between the ages of 30 and 49. It is possible that these adult partners did not participate because they didn't perceive themselves to be at risk for stroke due to their young ages. To address this, a lesson was added in year 3 to teach the students and their adult partners about stroke risk factors, including the increased stroke risk for MAs at an earlier age. The KIDS project also stressed that a person having a stroke is often physically not able to call 911 for himself or herself and must rely on family members or other bystanders to call 911.

Evaluating adult partners is a critical piece of this educational outreach. To correct for low response rates prior to completion of the intervention, greater efforts were planned for distributing and collecting adult posttests and persistence tests. For example, a banquet for the students and their adult partners was scheduled for the end of the project at each of the schools with an opportunity to complete and turn in posttests at the banquet. Because the persistence test occurs during the students' 1st year of high school, it is being mailed to students and adult partners, preceded by a notification postcard and accompanied by monetary incentives. Both of these survey strategies have been shown to increase return rates (Dillman, 2000).

CONCLUSION

Targeting the younger generation for stroke education is one way to improve community knowledge of stroke symptoms and the need for urgent evaluation, in particular in the MA community where rates of stroke are higher

and occur at earlier ages, and family units are cohesive with frequent contact between multiple generations. This is especially important considering that less than 5% of stroke patients call 911 themselves due to an inability to speak or dial the telephone. Family members are most likely to be in a position to recognize the symptoms of stroke and call 911 immediately, increasing the chances that the stroke patient may receive acute stroke therapy.

A culturally specific stroke education intervention for middle school children so far appears to increase children's knowledge of stroke pathophysiology, stroke symptoms, stroke treatment, and intent to call 911 upon witnessing a stroke. This could be a model for middle school-based stroke education in multiethnic communities. Using homework assignments to transmit this knowledge to parents of middle school students may or may not be effective and requires further study.

Ultimately, the determination of the success of projects aimed at reducing delay time of hospital arrival for acute stroke must involve surveillance of stroke cases in a community. This community has such a system, the Brain Attack Surveillance in Corpus Christi (BASIC) study (Morgenstern et al., 2004). We were not able to use this system to monitor the effect of KIDS due to the small proportion of students participating in the study. The study's next phase, an intervention involving all middle school students, may well use the BASIC system.

REFERENCES

- Barber, P. A., Zhang, J., Demchuk, A. M., Hill, M. D., & Buchan, A. M. (2001). Why are stroke patients excluded from rt-PA therapy? An analysis of patient eligibility. *Neurology*, *56*, 1015-1020.
- Beckera, K. J., Fruina, M. S., Goodinga, T. D., Tirschwell, D. L., Lovea, P. J., & Mankowskia, T. M. (2001). Community-based education improves stroke knowledge. *Cerebrovascular Diseases*, *11*, 34-43.
- Brown, D. L., Boden-Albala, B., Langa, K. M., Lisabeth, L. D., Fair, M., Smith, M. A., et al. (2006). Projected costs of ischemic stroke in the United States. *Neurology*, *67*(8), 1390-1395.
- Brown, D. L., Lisabeth, L. D., Garcia, N. M., Smith, M. A., & Morgenstern, L. B. (2004). Emergency department evaluation of ischemic stroke and TIA: The BASIC project. *Neurology*, *63*, 2250-2254.
- Corpus Christi Intermediate School District. (2005). *Brief facts about Corpus Christi Independent School District 2005-2006*. Retrieved October 4, 2006, from <http://ccisd.us/ccisd/default.aspx?page=1549>
- Dillman, D. A. (2000). *Mail and Internet surveys: The Tailored Design Method*. New York: John Wiley.
- DuBard, C. A., Garrett, J., & Gizlice, Z. (2006). Effect of language on heart attack and stroke awareness among U.S. Hispanics. *American Journal of Preventive Medicine*, *30*(3), 189-196.
- Fagan, S. C., Morgenstern, L. B., Petitta, A., Ward, R. E., Tilley, B. C., Marler, J. R., et al. (1998). Cost-effectiveness of tissue plasminogen activator for acute ischemic stroke. *Neurology*, *50*, 883-890.

- Ferris, A., Robertson, R. M., Fabunmi, R., & Mosca, L. (2005). American Heart Association and American Stroke Association national survey of stroke risk awareness among women. *Circulation, 111*(10), 1321-1326.
- Grieco, E. M., & Cassidy, R. C. (2001). *Overview of race and Hispanic origin* (C2KBR/01-1). Washington, DC: U.S. Census Bureau.
- Kwiatkowski, T. G., Libman, R. B., Frankel, M., & the NINDS rt-PA Stroke Study Group. (1999). The NINDS rt-PA Stroke Study: Sustained benefit at one year. *New England Journal of Medicine, 340*, 1781-1787.
- Menon, S. C., Pandey, D. K., & Morgenstern, L. B. (1998). Critical factors determining access to acute stroke care. *Neurology, 51*, 427-432.
- Morgenstern, L. B., Smith, M. A., Lisabeth, L. D., Risser, J.M.H., Uchino, K., Garcia, N., et al. (2004). Excess stroke in Mexican Americans compared with non-Hispanic Whites: The Brain Attack Surveillance in Corpus Christi Project. *American Journal of Epidemiology, 160*(4), 376-383.
- Morgenstern, L. B., Staub, L., Chan, W., Wein, T. H., Bartholomew, L. K., King, M., et al. (2002). Improving delivery of acute stroke therapy: The TLL Temple Foundation Stroke Project. *Stroke, 33*, 160-166.
- Morris, D. L., Rosamond, W., Madden, K., Schultz, C., & Hamilton, S. (2000). Prehospital and emergency department delays after acute stroke: The Genentech Stroke Presentation Survey. *Stroke, 31*, 2585-2590.
- Pajares, F. (2002). *Overview of social cognitive theory and of self-efficacy*. Retrieved November 14, 2004, from <http://www.emory.edu/EDUCATION/mfp/eff.html>
- Silver, F. L., Rubini, F., Black, B. A., & Hodgson, C. S. (2003). Advertising strategies to increase public knowledge of the warning signs of stroke. *Stroke, 34*, 1965-1969.
- Simmons, T.D.J. (2003). *Grandparents living with grandchildren: 2000* (C2KBR-31). Washington, DC: U.S. Census Bureau.
- Smith, M. A., Risser, J.M.H., Lisabeth, L. D., Moyé, L. A., & Morgenstern, L. B. (2003). Access to care, acculturation and risk factors for stroke in Mexican Americans: The Brain Attack Surveillance in Corpus Christi Project. *Stroke, 34*, 2671-2675.
- Tacon, A. M., & Caldera, Y. M. (2001). Attachment and parental correlates in late adolescent Mexican American women. *Hispanic Journal of Behavioral Sciences, 23*(1), 71-87.
- U.S. Census Bureau. (2005a). *American community survey 2003 data profile: Corpus Christi, TX MSA*. Retrieved October 4, 2006, from <http://www.census.gov/acs/www/Products/Profiles/Single/2003/ACS/Tabular/380/38000US18801.htm>
- U.S. Census Bureau. (2005b). *Hispanic or Latino origin by specific origin* (B03001). Washington, DC: U.S. Census Bureau.
- U.S. Department of Health and Human Services, National Institutes of Health. (2005). *Theory at a glance: A guide for health promotion practice*. Retrieved October 29, 2006, from <http://cancer.gov/cancerinformation/theory-at-a-glance>
- Wein, T. H., Staub, L., Felberg, R., Hickenbottom, S. L., Chan, W., Grotta, J. C., et al. (2000). Activation of emergency medical services for acute stroke in a nonurban population: The T.L.L. Temple Foundation Stroke Project. *Stroke, 31*(8), 1925-1928.