Published in final edited form as:

J Stroke Cerebrovasc Dis. 2017 January ; 26(1): 139–142. doi:10.1016/j.jstrokecerebrovasdis.2016.08.045.

Community level measures of stroke knowledge among children: Findings from Hip Hop Stroke

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Abstract

Background and Purpose—Community-level determinants of stroke knowledge among children are unknown, but could meaningfully impact public stroke education campaigns. We explored for associations between community- and school-level quality measures relative to baseline stroke knowledge among children participating in the Hip Hop Stroke (HHS) program.

Methods—Baseline stroke knowledge assessments were performed in 2,839 fourth, fifth, and sixth grade students (ages 9–11 years) from November 2005–April 2014. Knowledge was assessed relative to School Performance Grade (SPG, graded A–F; a school-level measure determined by NYC Department of Education) and economic need index (ENI, range 0–2; a community-level, within-school measure of subsidized housing and meals with higher scores indicating more socioeconomic distress).

Results—Schools studied included those with SPG=B (n=196), SPG=C (n=1590), and SPG=D (n=1053) and mean ENI=0.85 (SD 0.23). A composite assessment of knowledge, including four stroke symptoms (blurred vision, facial droop, sudden headache, and slurred speech), was asked consistently since 2006. Overall, students correctly identified a mean of 1.74 stroke symptoms (95% CI: 1.70–1.79; possible range 0–4, expected value of chance response alone or no knowledge=2). For quartiles of ENI, mean knowledge scores ranged from ENI_{Q1}=2.00, ENI_{Q2}=2.09, ENI_{Q3}=1.46, ENI_{Q4}=1.56 (ENI_{Q3} and ENI_{Q4} v. ENI_{Q1}, p<0.001). For SPG, SPG=B schools: 2.09, SPG=C: 1.83, and SPG=D: 1.56 (SPG=C and SPG=D v. SPG=B schools: p 0.05).

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Disclosures: None

Conclusions—Children’s stroke knowledge was lowest in NYC communities with greater economic need and lower school performance. These findings could guide stroke education campaign implementation strategies.

Keywords

Stroke; cerebrovascular disease; stroke prevention; health literacy; health education; knowledge translation; socioeconomic position

Introduction

Race-ethnic disparities in stroke are linked to differential disease burden and morbidity, disease awareness, healthcare access, and quality of care.¹ Each stroke literacy determinant is an important target for intervention. Moreover, poor stroke recognition and delayed EMS activation are targets to impact acute stroke treatment disparities.^{2, 3}

In communities with low stroke knowledge, children may be an important link to improve stroke outcomes, critically serving as both witnesses of stroke⁴ and conduits of stroke education into their homes and communities.⁵ Since 2005, the Hip Hop Stroke (HHS) program has been a vehicle for delivering key stroke concepts, including stroke symptom recognition and developing urgent action plans, into at-risk communities.^{4–7} HHS programs are delivered in a diverse array of neighborhoods, with locations differing by geographic, race-ethnic, economic and other social factors. An unmet need in improving the efficiency in delivering stroke literacy programs is identifying which areas may have lower stroke knowledge at a neighborhood-level, and thus a greater need for stroke education programs. To this end, we explored data from HHS to identify community and school-level factors that may predict stroke knowledge in children. We hypothesized that school-based metrics of academic performance and socioeconomics could serve as predictors of baseline student stroke knowledge.

Methods

Data sources

HHS delivers stroke education through culturally-tailored, multimedia, interactive programs in local elementary schools over 3 consecutive days. Baseline stroke knowledge was assessed of 4th, 5th, and 6th grade New York City schoolchildren (ages 9–11 years old) enrolled in HHS programs between November 2005 and April 2014; data for these analyses only included these baseline stroke knowledge assessments, collected prior to delivery of any health education content or materials. Seven questions were consistently asked over the entire study period, including stroke localization, the term “brain attack” as another name for stroke, and five possible stroke signs or symptoms (including facial droop, speech impairment, visual loss, and sudden headache, as well as one distractor symptom—chest pain). Urgent action plan (calling 911) was not included in this study because the assessment was purposely changed mid-way through the study period to better reflect behavioral change.

Metrics of school quality and those related to the schools' neighborhood economics were obtained from the New York City Department of Education (NYC DOE) school quality reports, and were annually published publicly from 2006–2013. For this study we used data from the 2009–2010 academic calendar year (study mid-point) in our analysis, as these metrics do not substantially change year to year. We focused on two NYC DOE school quality indicators, the school performance grade (SPG) and economic need index (ENI), which represent summative measures of school performance and neighborhood economics respectively. SPG is provided as a letter grade (A–F), and reflects the proportion of students who reach or exceed proficiency on statewide English and Math exams, as well as the students' average score on these exams. The ENI (range=0–2) is calculated as the proportion of students in temporary housing, plus the proportion of students eligible for public assistance or free lunch. Higher ENI indicates greater economic need and socioeconomic distress.

Data analysis

To assess stroke literacy, two stroke symptom composites scores were created: 1) a four-symptom composite including only stroke symptoms blurred vision, facial droop, slurred speech and headache, and 2) a 5-symptom composite additionally including the chest pain distractor. For analyses, schools were divided into quartiles of ENI; SPG was assessed based on letter grade. Students' scores on individual questions and symptom composites were compared by SPG and ENI using Chi-Square and regression analyses. Analyses were performed using SPSS v 22.0 (SPSS, Inc, Chicago, Ill). This research was accomplished following approval from the Columbia University Medical Center Institutional Review Board (IRB); the NYC DOE IRB approved the individual studies comprising the final dataset.

Results

Students included in the analyses attended 18 distinct NYC public schools. Of those schools, eight were in Manhattan, six in Queens, two in the Bronx, and two in Brooklyn. In 14 of the schools (78%), over 95% of enrolled students were black or Hispanic. Overall, 2,839 student baseline stroke assessments were collected, including 196 students attending two SPG=B schools, 1,590 students attending eight SPG=C schools, and 1053 students attending nine SPG=D schools (none were SPG=A schools). Mean ENI was 0.85 (Range: 0.18–1.06, SD 0.23; See Table).

Students in schools with the greatest ENI (highest socioeconomic distress) were significantly less likely to correctly identify stroke symptoms; (Figure 1, 4-symptom composite, mean number of symptoms correctly identified by quartile: $ENI_{Q1}=2.00$, $ENI_{Q2}=2.09$, $ENI_{Q3}=1.46$, $ENI_{Q4}=1.56$; ENI_{Q1} v. ENI_{Q3} or ENI_{Q4} , $p<0.001$). Paradoxically, higher ENI was associated with higher proportions of students correctly identifying stroke as occurring in the brain and relating stroke with “brain attack,” but no trends were identified across the quartiles (See Table).

Students in SPG=B or C schools were significantly more likely to correctly identify stroke as occurring in the brain and were more familiar with “brain attack” than students in SPG=D

schools (See Table). On average, students in SPG=B schools correctly identified more symptoms of stroke than those in either SPG=C or SPG=D schools (Figure 2; 4-symptom composite, mean number of symptoms correctly identified: SPG=B schools: 2.09, SPG=C: 1.83, SPG=D: 1.56; SPG=B v. SPG=C schools: $p<0.05$; SPG=B v. SPG=D schools: $p<0.001$; SPG=C v. SPG=D schools: $p<0.001$).

Discussion

School-level data may provide meaningful insight into indicators of school- and community-level stroke literacy. This study identified associations between stroke knowledge and indicators of school performance, but more consistently with measures of community socioeconomic status using an indicator of food and home fiscal security. These findings have relevance for implementation strategies in predicting changes in stroke literacy relative to an educational intervention. To maximize the benefit of targeted community-based stroke education interventions, further exploration of potential determinants of performance, including these indicators, is warranted.

While stroke symptom composite scores decreased with each letter grade drop in SPG, in contrast ENI appeared to have a more biphasic relationship to student scores, with 1st and 2nd quartile schools performing better than 3rd and 4th quartile schools. This finding reflects those observed among adults, where decreased stroke knowledge has been associated with lower income (earning less than \$35,000/year). When considering ENI, for a child to qualify for lunch assistance, a family of 4 must make less than \$31,005 for free lunch and \$44,123 for a reduced price lunch.⁸ Rather than assessing ENI on a continuum, it may be more logical to consider performance based on these critical threshold values, although family assistance qualification cannot be determined from available data.

Limitations of this study include: 1) its generalizability may be limited beyond NYC, 2) lack of individual-level data and an analysis based on group-level measures, 3) unavailability of data on behavioral intent to call 911, 4) the necessary but insufficient quality of knowledge alone to generate behavior change as it relates to stroke outcomes, and 5) although questions had a Flesch-Kincaid grade level of 5 and strong face validity, the questions used were not subject to formal psychometric analysis including construct validity and internal consistency.

Among adults, low socioeconomic status (SES),^{9, 10} lack of insurance,^{9, 10} and low educational attainment¹⁰ have been reported to predict low stroke literacy. To the best of our knowledge, no studies have examined predictors of stroke literacy in school-aged children. Given the potential role children may play in addressing deficits in community stroke knowledge and in the stroke chain of recovery, and the identification of schools as a viable target for public stroke education in recent stroke guidelines, understanding factors associated with children's stroke knowledge may help develop more effective targets for stroke education interventions. Our group is actively exploring ENI, SPG, and other measurements in an ongoing randomized controlled trial.¹¹

Acknowledgments

Sources of Funding: This work was supported by NIH (NINDS R01 NS067443).

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Figure 1. Mean score on question composite by economic need index quartile
 Relative to 1st Quartile Schools (ENI_{Q1}); *p<0.05, **p<0.005, ***p<0.001

Figure 2. Mean score on question composite by performance grade
Relative to SPG=B schools, * $p<0.05$, ** $p<0.005$, *** $p<0.001$

Table

Number of students correctly responding to questions, by economic need index quartile and School Performance Grade

Question	Economic Need Index (ENI) Quartile			
	1	2	3	4
Localization, n (%), Expected=25%	146 (21.5%)	202 *** (35.9%)	218 (24.5%)	201 *** (35.4%)
Brain attack, n (%), Expected=25%	98 (14.4%)	135 *** (26.5%)	170 * (19.6%)	124 *** (26.4%)
Question	School Performance Grade (SPG)			
	B	C	D	
Localization, n (%), Expected=25%	62 (35.6%)	573 (36.6%)	132 *** (13.8%)	
Brain attack, n (%), Expected=25%	21 (28.0%)	408 (28.5%)	98 *** (9.6%)	

Mean ENI and range of each ENI quartile:

ENIQ1=0.56 (range, 0.18–0.74; represents least economic need)

ENIQ2=0.86 (0.79–0.96)

ENIQ3=0.97 (0.97–0.97)

ENIQ4=1.03 (0.99–1.06, represents greatest economic need)

Relative to 1st Quartile Schools (ENI) or Grade B Schools (SPG);

* P<0.05,

*** P<0.001