International Education Forum, 2026, Volume 4, Issue 8
http://ojs.bbwpublisher.com/index.php/IEF
Online ISSN: 2981-8605
Print ISSN: 3083-4902

Effects of a Child-Mediated Family-Based Stroke Education Intervention on Public First Aid Knowledge and Attitudes

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Abstract: *Objective:* To investigate the current status of public knowledge and attitudes toward stroke first aid, and to explore the intervention effects of a child-mediated family health education model on stroke prevention. *Methods:* In March 2023, this study enrolled 264 fourth-grade students and their parents from two districts in Xiangyang City. A one-month child-mediated health education intervention was conducted, covering stroke risk factors, warning recognition, and emergency management. Professionally developed training videos were distributed digitally to schools and incorporated into weekly health education sessions (20-minute theoretical instruction + 20-minute practical training), followed by outcome evaluation. *Results:* Students' knowledge scores significantly improved from 29.55±17.80 to 92.48±5.49 (P<0.001). Among parents, post-intervention knowledge and attitude scores were from 43.49±9.92 to 80.27±14.03 and from 60.04±14.26 to 85.98±13.23(P<0.001), respectively. Among parents, post-intervention knowledge was affected by age, education level, occupation, chronic diseases, and child-mediated education participation (P<0.05), while attitudes were associated with education level, occupation, chronic diseases, and child-mediated education participation (P<0.05). *Conclusion:* Public knowledge of stroke first aid requires urgent improvement, with multiple influencing factors identified. The child-mediated family health education model significantly enhances residents' stroke health literacy.

Keywords: Stroke; Public; First-aid knowledge; Children; Family health education

Online publication: August 31, 2026

1. Introduction

Stroke is the leading cause of death and disability among adults in China [1–3]. In recent years, remarkable progress has been made in acute stroke treatment techniques such as intravenous thrombolysis and endovascular thrombectomy. Nevertheless, numerous patients delay medical consultation—some even assume their symptoms will subside—due to insufficient first-aid knowledge of stroke and ignorance of channels for prompt emergency care, which ultimately exacerbates their condition. Studies indicate that

82.52% of patients experience a pre-hospital delay of more than two hours from symptom onset to hospital arrival [4]. After recognizing stroke symptoms, 75.9% of participants choose to call an ambulance [5]; the second most common response (58.8%) is advising the patient to seek hospital care, while only 34.1% opt for immediate consultation with a physician. Conventional stroke health education mainly targets adult populations, yet its intervention effects are limited by obstacles including low willingness to absorb health information and rapid knowledge decay [6–8]. Child-Mediated Health Education (CMHE), an innovative health promotion model, has demonstrated unique strengths in chronic disease prevention and control in recent years. Child-mediated interventions have significantly improved family members' disease awareness and healthy behaviors in the management of hypertension, depression, and vaccination prevention [9–11]. Current research regarding children's role in boosting public capabilities for early stroke recognition and emergency response remains scarce, creating an urgent need to explore its feasibility and effectiveness. Accordingly, this study first investigates the public's awareness of early stroke identification and emergency management knowledge, then implements Child-Mediated Stroke Communication (CMSC), and evaluates the post-intervention outcomes of this health education program, so as to provide scientific evidence for optimizing stroke prevention and control strategies.

2. Subjects and methods

2.1. Study subjects

In March 2023, a total of 264 fourth-grade students and their parents from four classes across two districts of Xiangyang City were selected as research subjects for the survey. This study was approved by the Medical Ethics Committee of the hospital (Approval No. 2022KY012).

Inclusion criteria: (1) Clear consciousness, normal communication ability and basic comprehension capacity; (2) Normal listening, speaking, reading and writing skills, capable of cooperating with medical staff to complete questionnaires; (3) Informed of the research requirements and willing to participate in two rounds of questionnaire surveys.

Exclusion criteria: (1) Non-permanent local residents; (2) Individuals with mental illnesses; (3) Participants who withdraw midway; (4) Other conditions that prevent completion of the research.

2.2. Research methods

2.2.1. Implementation procedures

A random sampling method was adopted in this study. Two fourth-grade classes were selected from each of the two administrative districts of Xiangyang City, covering four classes in total. One day after the spring semester began, investigators launched a one-month stepped intervention. Each training session combined on-site demonstration with verbal Q&A, limited to 40 minutes in total: 20 minutes for theoretical teaching and question answering, and another 20 minutes for hands-on practice by students. Training content covered stroke risk factors, the FAST mnemonic for early warning sign identification, and emergency management procedures. Dedicated staff recorded videos of all training modules and provided electronic copies to students. Students were guided to watch the videos together during weekly health education classes. Any questions raised by students were sent to corresponding investigators via WeChat messages, who delivered consolidated follow-up guidance the next day.

A three-stage evaluation system was applied:

(1) Assessments of stroke first-aid knowledge and attitudes among students (pre- and post-intervention) and parents (post-intervention only), including indicators such as the accuracy of risk factor recognition and standardization of emergency operations;

(2) Standardized score conversion: Standardized score = (actual score / total score) × 100%. A three-tier evaluation standard was set as follows [12]: ≥85 points = good, 60–84 points = moderate, and <60 points = poor.

Pre-intervention data collection was completed within one day after the semester started, while post-intervention data collection was finished within one day upon intervention termination. To guarantee data quality, independent quality control personnel collected and analyzed questionnaires under blind conditions. Meanwhile, investigators' teaching performance was monitored across dimensions including verbal expression and teaching pace to ensure the quality of intervention implementation.

2.2.2. Development of evaluation questionnaires

In accordance with the survey objectives and contents, the self-designed Public Questionnaire on Stroke First-Aid Knowledge (student version and parent version) was developed based on a literature review, after multiple rounds of expert consultation among specialists in emergency medicine, neurology, and nursing [13]. The questionnaire covered three modules: demographic characteristics, health history, and stroke first-aid knowledge and attitudes. A pretest-posttest design was adopted for the student version, with 5 knowledge items in both pretest and posttest (total score = 45). The parent version also included pretest and posttest assessments, consisting of two dimensions: knowledge (5 items, full score = 100) and attitudes (5 items, full score = 60). The knowledge dimension focused on core content, including the FAST identification mnemonic and golden therapeutic time window for stroke. The attitude dimension adopted a five-point Likert scale to measure respondents' willingness and beliefs regarding stroke emergency treatment. A pilot survey verified that the reliability and validity coefficients of all questionnaires were greater than 0.80.

2.2.3. Quality control

Prior to formal data collection, senior nurses with over 5 years of clinical experience in the neurology department of the hospital delivered standardized training to all investigators. The training highlighted research objectives, communication skills, and operational specifications to guarantee standardization and consistency in survey implementation, intervention delivery, and data collection.

2.2.4. Statistical analysis

Statistical analyses were performed using SPSS 26.0 software. Count data were described as frequencies (percentages), and intergroup comparisons were conducted via the Chi-square test. Measurement data conforming to normal distribution were expressed as mean ± standard deviation; the independent samples t-test was adopted for two-group comparisons, and one-way analysis of variance (one-way ANOVA) for multi-group comparisons. Multiple linear regression analysis was applied to analyze associated influencing factors. The significance level was set at $\alpha = 0.05$.

3. Results

3.1. Levels of public knowledge and attitudes regarding early stroke recognition and first aid

The results revealed that the total knowledge score of students was (29.55±17.80) points before intervention and (92.48±5.49) points after intervention, with a statistically significant difference between pre- and post-intervention (t = -54.89, P < 0.001) (**Table 1**). For parents, the pre-intervention total knowledge score was (43.49±9.92) points, and the post-intervention total knowledge score was (80.27±14.03) points. Their pre-intervention total attitude score was (60.04±14.26) points, and the post-intervention total attitude score was (85.98±13.23) points, with all differences statistically significant (all P < 0.001) (**Table 1**).

3.2. Univariate analysis of factors influencing public knowledge and attitudes toward early stroke recognition and first aid

Univariate analysis indicated that students' pre-intervention knowledge level was significantly correlated with age, baseline stroke awareness and recognition of emergency telephone numbers (P < 0.05), while only age remained an independent predictive factor after intervention (P < 0.01) (**Table 2**). Among parents, post-intervention knowledge level was associated with age, educational background, occupation, history of chronic diseases, participation in child-mediated education, and stroke knowledge delivered by children (P < 0.05). Their attitudes were jointly affected by educational background, occupation, being the primary caregiver of children, chronic disease history, participation in child-mediated education, and stroke knowledge transmission from children (P < 0.05) (**Table 3**; items with P > 0.05 were omitted from this table). All significant variables were further verified via multivariate adjustment, which suggested discrepancies in cognitive and behavioral patterns between the two populations.

Table 1. Comparison of knowledge and attitude scores among different groups before and after intervention

Category	Students(n=264)	Parents(n=264)	
	Knowledge Score	Knowledge Score	Attitude Score
Pre-intervention	29.55±17.80	43.49±9.92	60.04±14.26
Post-intervention	92.48±5.49	80.27±14.03	85.98±13.23
t	-54.89	33.961	22.334
P(95%CI)	<0.001(-65.193, -60.680)	<0.001(34.642, 38.906)	<0.001(23.654, 28.228)

Table 2. Univariate analysis of students' knowledge before and after intervention (n=264)

Category (Students)	Number of Participants	Pre-intervention Knowledge Score	*t/F*	*P*-value	95%*CI* Lower Limit	95%*CI* Upper Limit	Post-intervention Knowledge Score	*t/F*	*P*-value	95%*CI* Lower Limit	95%*CI* Upper Limit
Gender			-0.202	0.840	-4.770	3.881		0.847	0.398	-0.759	1.904
Male	136	29.33 ±17.62					92.76 ±5.60				
Female	128	29.77 ±18.07					92.19 ±5.37				
Age	264	10.24 ±0.54	17.735	<0.001	17.160	21.446	92.48 ±5.49	244.576	<0.001	81.578	82.902

Stroke Awareness			-10.161	<0.001	-30.839	-20.742
No	192	22.51 ±9.74				
Yes	72	48.30 ±20.70				
Knowledge of Emergency Call Number			-2.555	0.011	-46.285	-5.992
No	3	3.70 ±6.42				
Yes	261	29.84 ±17.68				

Table 3. Univariate analysis of parents' knowledge and attitudes after intervention (*n*=264)

Category (Parents)	**Number of Participants**	**Post-intervention Knowledge Score**	***t/F***	***P* value**	**95%*CI* Lower Limit**	**95%*CI* Upper Limit**	**Post-intervention Attitude Score**	***t/F***	***P* value**	**95%*CI* Lower Limit**	**95%*CI* Upper Limit**
Age (years)			3.224	0.023				1.546	0.203		
≤30	9	78.33 ±15.41			66.487	90.179	83.33 ±12.50			73.725	92.942
31–40	140	82.50 ±12.69			80.380	84.620	87.56 ±13.58			85.291	89.828
41–50	53	79.62 ±14.03			75.754	83.491	85.06 ±12.48			81.622	88.504
>50	62	76.05 ±15.89			72.012	80.084	83.60 ±12.98			80.307	86.898
Education Level			15.116	<0.001				8.789	<0.001		
Junior high school and below	32	69.69 ±15.81			63.988	75.387	80.73 ±13.46			75.876	85.582
High school/ vocational school	58	75.52 ±14.53			71.697	79.338	81.32 ±14.59			77.487	85.157
College	57	81.05 ±12.31			77.786	84.319	85.09 ±15.49			80.978	89.198
Bachelor's degree and above	117	85.13 ±11.68			82.990	87.267	90.17 ±9.58			88.417	91.925
Occupation			5.732	0.001				3.333	0.020		
Unemployed/ retired	17	76.47 ±14.98			68.771	84.170	81.37 ±15.46			73.424	89.321
Freelancer	63	76.35 ±14.40			72.722	79.976	85.05 ±11.12			82.253	87.852

Worker/ employee of enterprises and institutions	166	81.02 ±13.76			78.916	83.132	85.89 ±13.84			83.772	88.015
Medical professional	18	90.56 ±7.25			86.948	94.163	94.44 ±8.57			90.180	98.709
Student Caregiver			1.710	0.090	-0.569	7.706		2.326	0.021	0.653	7.859
Parents	194	81.21 ±13.38					87.11 ±13.39				
Grandparents (maternal/ paternal)	70	77.64 ±15.50					82.86 ±12.36				
Chronic Disease			-2.264	0.024	-8.509	-0.593		-2.287	0.023	-8.068	-0.603
No	201	79.18 ±13.41					84.95 ±13.25				
Yes	63	83.73 ±15.48					89.29 ±12.74				
Knowledge Level of Stroke Before Receiving Student Education			5.335	0.005				9.513	<0.001		
Not aware at all	94	77.13 ±14.09			74.241	80.015	89.63 ±8.26			87.936	91.320
Slightly aware	154	81.40 ±13.56			79.238	83.555	83.12 ±15.12			80.709	85.525
Very aware	16	87.81 ±14.49			80.093	95.533	92.19 ±10.30			86.696	97.679
Knowledge Level of Stroke After Receiving Student Education			14.874	<0.001				12.463	<0.001		
Decreased	8	81.25 ±9.16			73.591	88.909	89.58 ±3.86			86.358	92.808
No change	7	85.00 ±10.00			75.752	94.249	86.90 ±16.57			71.583	102.227
Increased to some extent	99	73.38 ±15.05			70.383	76.385	79.97 ±15.61			76.853	83.080
Improved Significantly improved	150	84.53 ±11.82			82.626	86.440	89.72 ±9.91			88.123	91.322

3.3. Multivariate regression analysis of factors influencing public knowledge and attitudes toward early stroke recognition and first aid

Multiple linear regression analysis demonstrated that having heard of stroke and awareness of emergency telephone numbers were independent influencing factors for students' pre-intervention knowledge ($P < 0.05$) (table omitted). Age, educational background, occupation, chronic disease history, participation in child-

mediated education, and stroke knowledge conveyed by children were independent influencing factors for parents' post-intervention knowledge ($P < 0.05$) (**Table 4**). Educational background, occupation, chronic disease history, participation in child-mediated education, and stroke knowledge delivered by children served as independent influencing factors for parents' post-intervention attitudes ($P < 0.05$) (**Table 5**).

Table 4. Multiple linear regression analysis of parents' knowledge after intervention (n=264)

Categories	B	B Value (Standard Error)	*t* value	*P* value
(Constant)	64.410	5.100	12.629	<0.001
Age	-1.950	1.110	-1.756	0.080
Education Level	4.119	0.856	4.809	<0.001
History of Chronic Disease	6.062	2.038	2.974	0.003
Knowledge of Stroke Before Receiving Reverse Education	3.170	1.436	2.208	0.028
Knowledge Level of Stroke After Receiving Student-Transmitted Stroke Knowledge	3.964	1.138	3.484	0.001
Occupation (Reference: Unemployed/Retired)				
Freelancer	-3.925	3.678	-1.067	0.287
Worker/Employee of Enterprises and Institutions	-2.800	3.558	-0.787	0.432
Medical Professional	1.012	4.673	0.217	0.829

Table 5. Multiple linear regression analysis of parents' attitudes after intervention (n=264)

Categories	B	B Value (Standard Error)	*t value*	*P value*
(Constant)	73.331	4.161	17.624	<0.001
Education Level	3.663	0.782	4.685	<0.001
History of Chronic Disease	4.837	1.867	2.590	0.010
Knowledge of Stroke Before Receiving Reverse Education	-4.735	1.399	-3.385	0.001
Knowledge Level of Stroke After Receiving Student-Transmitted Stroke Knowledge	2.592	1.105	2.345	0.020
Occupation (Reference: Unemployed/Retired)				
Freelancer	1.370	3.480	0.394	0.694
Worker/Employee of Enterprises and Institutions	0.251	3.388	0.074	0.941
Medical Professional	9.718	4.481	2.169	0.031

4. Discussion

Stroke ranks as the second leading cause of death worldwide and the primary cause of disability in adults, constituting a major public health challenge in China [3, 14]. Statistical data indicate that approximately 3.94 million new stroke cases occur annually in China, the highest figure globally [15]. Stroke survivors suffer from sequelae including limb dysfunction, cognitive impairment, and post-stroke loneliness, imposing a heavy disease burden on families and society [16–19]. The concept that "time is brain" has been widely recognized in stroke emergency care [20]. On average, 10,000 neurons die every minute following stroke onset [21].

Surveys reveal that merely 26.8% of the general public can identify all stroke risk factors [22]. Compared with developed countries, China falls significantly behind in both the scale and quality of stroke prevention and rehabilitation services [23]. Conventional stroke health education relies on one-way communication targeting adults, such as community lectures and promotional leaflets [6, 24–27]. Restricted by low public willingness to absorb health information and rapid knowledge decay, such interventions fail to sustain long-term effects [28–29]. As an emerging intervention strategy, the CMSC model has exhibited unique strengths in chronic disease prevention and control in recent years.

Results presented in **Table 2** and **Table 3** demonstrated that the total scores of public stroke-related first-aid knowledge were significantly elevated ($P < 0.001$). Compared with conventional adult-oriented health education, the CMSC model significantly improved family members' learning engagement and knowledge retention by taking children as an emotional bond. This finding is consistent with the research outcomes of Lwin et al. on hypertension health education [9]. Children's innocent nature reduces adults' psychological defensiveness, and knowledge transmission during parent-child interactions strengthens learning efficacy. As "health change agents" within families, children can effectively facilitate adults' acquisition of health knowledge and behavioral modification [10].

The findings of this study indicated that respondents' mastery of stroke risk factors, stroke symptoms, and emergency coping capabilities varied across groups. Having heard of stroke and awareness of emergency hotlines were independent influencing factors for students' pre-intervention knowledge ($P < 0.05$). Age acted as an independent significant predictor of post-intervention knowledge ($P < 0.01$). For students, older age was correlated with greater stroke awareness, higher knowledge scores, and better emergency response proficiency.

Age, educational background, occupation, history of chronic diseases, participation in child-mediated education, and stroke knowledge delivered by children were independent influencing factors for parents' post-intervention knowledge ($P < 0.05$). Educational background, occupation, chronic disease history, participation in child-mediated education, and stroke knowledge conveyed by children were independent influencing factors for parents' post-intervention attitudes ($P < 0.05$). With advancing age, longer years of schooling and longer tenure in mental work, individuals tend to pay more attention to personal health knowledge, gain broader exposure to early disease identification and first-aid skills, and utilize diverse channels to acquire stroke-related information. They also demonstrate stronger ability to absorb and comprehend disease knowledge, achieve better mastery of relevant content, develop a deeper understanding of disease severity, and attach greater importance to identifying early stroke symptoms [30]. Workers, professional technical staff, and administrative personnel in enterprises and institutions generally possess broader horizons and stronger comprehension and reading capabilities. Moreover, employees of enterprises and institutions have relatively more opportunities to access first-aid knowledge in daily work, which enables them to attach corresponding importance to such information. People with a prior history of chronic diseases tend to improve their medical literacy by reading abundant health materials. Those with a medical background exhibit superior command of stroke knowledge due to the special nature of their professions. Meanwhile, the survey results also revealed that participants who received stroke training achieved better mastery of stroke knowledge and held more positive attitudes compared with untrained participants. This indicates that training on stroke knowledge and skills can expand the public's stroke knowledge reserve and may offer assistance when sudden illnesses or accidental injuries occur. Therefore, targeted training

should be provided for personnel across all occupations, and diversified forms of health education should be organized regularly. These measures can improve the public's mastery of stroke-related health knowledge and emergency response capacity, raise their awareness of first-aid knowledge and skills, and ultimately enhance their overall proficiency in emergency treatment.

5. Conclusion

The CMSC model significantly improves the public's knowledge level and positive attitudes regarding early stroke recognition and emergency management. Health information disseminated via child-mediated communication stimulates family members' sense of responsibility and fosters a shared goal of "protecting family health." This finding expands the theoretical framework of conventional health education. The results of this study provide empirical evidence for the family-centered health promotion model highlighted in the Healthy China 2030 initiative. By leveraging children's unique role within the family, this innovative model overcomes the limitations of traditional health education and offers novel strategies for stroke prevention and control.

Funding

Project funded by Xiangyang Science and Technology Bureau (Grant No. 2022YL35B); Science and Technology Innovation Project of Xiangyang No.1 People's Hospital (Grant No. XYY2023NT05)

Disclosure statement

The authors declare no conflict of interest.

Author Contributions

Jie Wang was responsible for study design, project implementation, quality control, manuscript revision, and submission. Jinping Sai conducted project implementation as well as data collection and sorting. Zhenzhen Rao undertook project design and implementation, data collation, statistical analysis, manuscript drafting, revision, and submission. Dongmei Zhao, Yanli Tao, and Haoying Yang participated in project implementation. Jianying Peng was in charge of project design and manuscript revision.

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