Barriers from calling ambulance after recognizing stroke differed in adults younger or older than 75 years old in China

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Research article

Keywords: Aging; healthy behaviors; emergency medical services; awareness; family; health education

Posted Date: June 6th, 2019

DOI: https://doi.org/10.21203/rs.2.10088/v1

Version of Record: A version of this preprint was published on November 12th, 2019. See the published version at https://doi.org/10.1186/s12883-019-1480-6.

Abstract

Background As health behavior varies with increasing age, we aimed to examine the potential barriers in calling emergency medical services (EMS) after recognizing a stroke among 40-74- and 75-99-year-old adults. Methods Data were obtained from a cross-sectional community-based study (FAST-RIGHT) that was conducted from January 2017 to May 2017 and involved adults (age ≥40 years) across 69 administrative areas in China. A subgroup of residents (153675) who recognized stroke symptoms was analyzed. Multivariable logistic regression models were performed in the 40-74 and 75-99 age groups, separately, to determine the factors associated with wait-and-see behaviors at the onset of a stroke. Results In the 40-74 and 75-99 age groups, the rates of participants who chose “Self-observation at home” were 3.0% (3912) and 3.5% (738), respectively; the rates of “Wait for family, then go to hospital” were 31.7% (42071) and 33.1% (6957), respectively. Rural residence, living with one's family, low income (<5000 RMB per annum), having a single avenue to learn about stroke, and having friends with stroke were factors associated with waiting for one's family in both groups. However, unlike in the 40-74 age group, sex, number of children, family history, and stroke history did not influence the behaviors at stroke onset in the 75-99 age group. Conclusions Different barriers from recognizing stroke and calling an ambulance exist in the 40-74 and 75-99 age groups. Different strategies that mainly focus on changing the “Wait for family” behavior and emphasize on immediately calling EMS are recommended for both age groups.

Background

Stroke has become the leading cause of death and disability in China with its incidence increasing recently [1, 2]. Thrombolysis with intravenous alteplase reduces disability associated with acute ischemic stroke and improves patient outcomes. However, most patients fail to reach the hospital in time to qualify for reperfusion therapy [3, 4]. The main reason for this is the delayed presentation to the emergency department, as less than 25% of the patients arrive within 3 hours [3, 4]. Much evidence indicates that emergency medical services (EMS) use is crucial to reduce pre-hospital delay [4-7]. However, the use of EMS at the time of stroke involves a complex “knowledge-to-action” process [8, 9]. Although recognition of stroke symptoms may prompt the intent to call EMS [10, 11], knowledge of stroke does not necessarily imply that the concerned individual will call EMS [9, 12, 13]. Thus, only some of the individuals who recognize the onset of a stroke will call an ambulance [9, 10, 12-14], indicating a huge gap between the knowledge of stroke symptoms and appropriate action [6]. Our previous report of FAST-RIGHT also showed that 34.9% of adults recognized stroke onset but failed to call EMS [15]. Adults in the 75-99 age group have a significantly higher incidence of stroke [16], and are likely to experience stroke onset more frequently than those in the 40-74 age group. However, greater disability and cognitive impairment, and the poor use of health care in the older population may negatively affect their behavior towards stroke onset [17, 18]. The potential factors behind wait-and-see behaviors may be different in the 75-99 age group. Therefore, based on the FAST-RIGHT study, this study aimed to determine the risk factors

associated with rejecting an immediate ambulance call when identifying stroke onset, and whether these factors differed between the 40-74 and 75-99 age groups.

Methods

The data were derived from the FAST-RIGHT database, which is part of the China National Stroke Screening Survey (CNSSS). More details of the CNSSS can be found on the CNSSS official website [19], and have also been described in our previous publications [15, 20]. In brief, the CNSSS was a cross-sectional community-based survey with a 2-stage stratified sampling framework based on county-level demographic data that was conducted between January and May 2017. Recruiting 69 of the 221 administrative areas from the CNSSS, the FAST-RIGHT study only screened residents aged 40 years and above in each community [15]. All participants were screened by trained research staff using a standard face-to-face questionnaire that covered information about socio-demographic, medical and family history, lifestyle factors, and included four specific questions regarding stroke awareness (See Supplementary Appendix 2, Additional File 1). All screening data were transferred from questionnaires to an electronic database and checked centrally for completeness and errors by an experienced data manager. Finally, residents who recognized stroke symptoms in the FAST-RIGHT study were analyzed for our report. The FAST-RIGHT study was approved by the central ethics committee of Peking Union Medical College Hospital (the principal study center), and all participants provided written informed consent.

Explanatory and Outcome Variables

We defined recognition of stroke symptoms as a participant's unprovoked awareness of "facial droop," "arm weakness," and "speech disturbances" (slurred speech or word-finding difficulties) [21]. Calling EMS immediately after the onset of any of these symptoms was regarded as the correct action in response to stroke. "Self-observation at home" and "Call and wait for family member, and then go to hospital (Wait for family)" at the time of stroke were defined as detrimental "wait-and-see" behaviors. A reported history of stroke was confirmed by a neurologist or physician, who applied standard diagnostic criteria with any available brain neuroimaging data. The cardiovascular risk factors were hypertension, diabetes mellitus, dyslipidemia, atrial fibrillation (AF)/valvular heart disease, overweight/obesity, smoking, physical inactivity, and family history of stroke, based on standard definitions (See Supplementary Appendix 3, Additional File 1). Age wise, the participants were divided into the 40-74age group and the 75-99 age group [16].

Statistical Analysis

All participants who recognized their stroke symptoms in the FAST-RIGHT study were included in the analysis. We performed descriptive analysis for socio-demographic data and some other related

variables. Pearson's chi-squared tests were conducted to compare the detrimental wait-and-see behaviors (two types) between the subgroups. Multivariable logistic regression analysis was performed to identify the factors associated with different wait-and-see behaviors after stroke recognition in the total study population and the 40-74 and 75-99 age groups. Adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for each variable were calculated. All analyses were performed using SAS version 9.3, and a standard 2-sided P value (P <0.05) was considered statistically significant.

Results

Of the 187723 respondents in the FAST-RIGHT database, 153675 recognized the symptoms of stroke and were included in our final analysis. The rates of “Self-observation at home” and “Wait for family” were 3.0% (3912) and 31.7% (42071) in the 40-74 age group, and 3.5% (738) and 33.1% (6957) in the 75-99 age group), respectively (See Supplementary Table S2, Additional File 1). Table 1 presents the differences in the wait-and-see behaviors in both age groups. The rates of inappropriate responses to stroke varied across the socio-demographic subgroups, but the most frequent response was “Wait for family, then go to hospital.” In total population, 75-99 age group were less likely to stay at home (OR, 0.88; 95% CI, 0.81-0.97) for self-observation and wait for their family (OR, 0.88; 95% CI, 0.85-0.91) (See Supplementary Table S3, Additional File 1).

[TABLE 1. position]

The rate of living alone increased from 1.3% in 40-49 year-old group to 7.7% in 80-99 year-old group (See Supplementary Table S4-5, Additional File 1). However, about 30% did not intend to call EMS. Living alone showed low likelihood to wait for family, but was not related to rejecting self-observation at home (Figure 1-2).

The rates of staying at home for self-observation varied from 1.1%-8.5% across the different subgroups in the 40-74 age group, and 1.3%-8.2% in the 75-99 age group. Figure 1 shows the factors associated with “Self-observation at home” in the 40-74 age group, and 75-99 age group. Contrary to the 40-74 age group, income level and family history of stroke were not associated with staying at home in the 75-99 age group.

Figure 2 presents the associated factors with waiting for family. In the 40-74 age group, being male, living in a rural location, and having multiple children indicated waiting for the family, while these factors did not affect the intents in the 75-99 age group. Higher education markedly decreased the odds of waiting for the family in the 40-74 age group, but increased the same odds in the 75-99 age group. Participants with access to more avenues to learn about stroke were better at avoiding waiting across both age groups, while the avenues’ effects of reducing intent to wait were significantly stronger in the 40-74 age group (60%) than in the 75-99 age group (47%). Stroke history and family history reduced the likelihood of waiting in the 40-74 age group, but did not in the 75-99 age group.

Discussion

The analysis based on the FAST-RIGHT study shows that 34.7% of the study participants in the 40-74 age group, and 36.6% in the 75-99 age group did not call EMS first, [15] even though they had considered abnormal symptoms as “stroke onset.” Similar to our results, 18.9% in Spain, [11] 28% in Sweden [22], 33.6% in America [9], and 35.5% in a small study in China [12] avoided calling an ambulance despite recognizing stroke onset. In clinical practice in China, this rate showed a significant increase to 82.1% [10]. Although several studies have reported a weak association between recognition of stroke and calling EMS, there still was a gap between knowledge and action [10-12, 23]. The main “alternative response” to stroke was “Call and wait for family, then go to hospital,” which may result in inability to receive thrombolysis [4, 5]. We propose that both the rate of intent to use EMS and receiving thrombolysis would increase remarkably if targeted interventions were carried out to change the “Wait for family” behavior to an immediate call for ambulance assistance [24].

In low- and middle- income countries including China, people aged 75 years and older had stroke incidence, prevalence, and mortality rates that were 18.8, 11.3, and 35.6 times more than those seen in people younger than 75 years, respectively [16]. Similarly, in our study, the stroke prevalence in the 75-99 age group (5.6%) was nearly twice that in the 40-74 age group (3.2%). The markedly higher cardiovascular risk factors indicated a higher stroke recurrence rate. However, the intent to call EMS in 75-99 age group was slightly higher, inconsistent with their high stroke risk. Hence, there is still the concern that the two age groups are not identical, and the reasons influencing their behaviors may be different. In our study, the associated socio-demographic factors were examined in the 40-74 and 75-99 age groups, separately, and significant differences were found.

The population in the 40-74 age group with multiple sons and daughters, and those living with family or having relatives or friends who had experienced stroke onset tended to wait for their family. Therefore, it seems that family was a barrier to timely usage of EMS [15]. We identified several reasons for this hesitation. Participants considered their family members more reliable and private transportation to be more efficient and convenient. Another concern was that they were unable to handle transactions due to lack of money and caregivers in the emergency department as the services provided are prepaid in Chinese hospitals [3]. To change their understanding of stroke onset and dispel misgivings, the “Green Channel” of emergency network for stroke should be publicized among residents in addition to education regarding the critical importance of time and the benefits of EMS usage [6].

Living alone decreased the possibility of waiting for family, but did not naturally mean avoiding staying alone at home, in contrast to our hypothesis. Previous studies showed less than 7% patients activated EMS by themselves, and most ambulance calls were made by bystanders [24-26]. If we considered the high rate of living alone in 75-99 age group with high stroke risk, living alone was more detrimental than living with family to effective therapy at the time of stroke onset. Different from those living with family, ambulance call by themselves was the only avenue to activate EMS among individuals living alone. Direct education to improving the intent of using EMS among everyone living alone is reasonable.

Unexpectedly [13, 25, 27], those in the 75-99 age group with higher education levels were more likely to wait for the family than were those with low education levels, although the reasons for this finding are unclear. We speculate that they trusted their judgment too much but lacked the medical knowledge to inform it, and hence are of even greater concern. They probably considered the elapsed time as insignificant, underestimated the severity of stroke onset, and did not know the time required for the necessary diagnostic procedures before administration of recombinant tissue plasminogen activator [3, 14]. Different for the 40-74 age group, stroke history, number of children, sex and family history did not affect the “Wait for family” behaviors in the 75-99 age group. It seems that their behavior pattern was more fixed and not susceptible to other factors. Although multiple avenues to learn about stroke decreased the odds of waiting for the family, as shown by previous reports [28, 29], the reduction was markedly lower in the 75-99 age group. Moreover, they preferred a paper medium instead of the internet, although more than half of the individuals had a visual impairment [30]. Therefore, the effect of stroke education may be limited in the 75-99 age group.

There are several limitations in our study. We used closed-ended questions to establish why residents did not call EMS after identifying stroke onset, while the underlying reasons were varied [9]. Calling a taxi, visiting general practitioners, providing first aid, or 'something else' were the possible choices [3, 9]. Moreover, mobility difficulties were more common in the 75-99 age group, which probably influenced their options during stroke. However, this fact was not considered in our analysis. Finally, the factors associated with not calling EMS could be biased by the non-random sampling design and selection from the CNSSS [15].

In summary, the rate of not immediately calling EMS after recognizing stroke onset was slightly higher in the 75-99 age group than in the 40-74 age group. Although the majority of wait-and-see behaviors involved waiting for family members, the barriers of calling ambulance were different in both age groups. The behavior pattern in the 75-99 age group seemed more fixed and less susceptible to family factors. This study emphasizes the need to bridge the gap between recognition of stroke symptoms and appropriate action [9]. Strategies should differ between both age groups, for instance, the stroke knowledge delivery may be more effective via newspaper in the 75-99 age group.

Declarations

Acknowledgments

We thank Baohua Chao, Lei Cao, Lingxiao Wang, and their team for crucial support in the undertaking of this program.

Funding

This study was funded by the Ministry of Finance of the People's Republic of China (Issued by Finance and Social Security [2016] Document No.50, Ministry of Finance).

Availability of data and materials

The data sets in this study are available from the corresponding author on reasonable request.

Authors' contribution

BP, LW, and LYC designed the study. SL, CY, GS, CA, and BP analyzed the data. CG finished data collection and management. SL wrote the paper. LYC, B P, and CA revised the paper.

Competing interests

Craig Anderson is employed by The George Institute China and has a National Health and Medical Research Council (NHMRC) of Australia grant. He is also a consultant for Takeda China and Amgen. The authors declare no financial or other conflicts of interest.

Consent for publication

Not applicable.

Ethics approval and consent to participate

The FAST-RIGHT study was approved by the central ethics committee of Peking Union Medical College Hospital (the principal study center), and all participants provided written informed consent.

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Tables

Table 1. Baseline characteristics and responses to stroke among residents recognizing stroke by demographic, and socio-economic variables

	40-74 age group			75-99 age group		
	Responses to stroke, N (%)			Responses to stroke, N (%)		
Variables	Self-observation at home	Wait for family	Call EMS	Self-observation at home	Wait for family	Call EMS
Sex						
Male	1858 (3.1)	19424 (32.2)	38988 (64.7)	313 (3.2)	3237 (33.4)	6141 (63.4)
Female	2054 (2.8)	22647 (31.3)	47688 (65.9)	425 (3.8)	3720 (32.9)	7156 (63.3)
Site						
Urban	2301 (3.4)	15835 (23.2)	50155 (73.4)	360 (3.4)	2909 (27.3)	7401 (69.3)
Rural	1611 (2.5)	26236 (40.8)	36521 (56.7)	378 (3.7)	4048 (39.2)	5896 (57.1)
Regions						
North + Northeast	143 (1.4)	3075 (30.1)	6991 (68.5)	16 (1.7)	291 (31.0)	633 (67.3)
East	1136 (2.7)	12447 (30.1)	27800 (67.2)	193 (3.5)	1796 (32.2)	3585 (64.2)
Central	1797 (4.4)	12645 (30.6)	26842 (65.0)	354 (4.9)	2346 (45.8)	4582 (62.9)
South	429 (3.2)	5108 (37.6)	8039 (59.2)	72 (2.1)	1019 (29.3)	2382 (68.6)
Southwest	254 (1.7)	3712 (25.3)	10698 (73.0)	64 (3.0)	687 (31.9)	1404 (65.1)
Northwest	153 (1.3)	5084 (44.1)	6306 (54.6)	39 (2.5)	818 (52.2)	711 (45.3)
Education						

≤ Primary	1286 (2.5)	21065 (40.9)	29192 (56.6)	426 (3.1)	4802 (34.9)	8527 (62.0)
Middle/High school	2361 (3.3)	19060 (26.5)	50583 (70.2)	288 (4.6)	1842 (29.4)	4144 (66.1)
≥ College	265 (2.9)	1945 (21.4)	6900 (75.7)	24 (2.5)	312 (32.5)	624 (65.0)
Annual Income[a], US $						
< 731	911 (2.8)	14958 (46.5)	16314 (50.7)	253 (3.1)	3252 (40.2)	4588 (56.7)
731–2923	1322 (2.9)	15076 (32.7)	29705 (64.4)	229 (3.7)	2013 (32.1)	4019 (64.2)
> 2923	1679 (3.1)	12001 (22.1)	40653 (74.8)	256 (3.8)	1688 (25.5)	4685 (70.7)
Living Status[b]						
Alone	87 (3.0)	772 (26.3)	2075 (70.7)	38 (2.7)	424 (29.8)	960 (67.5)
With spouse	3501 (2.9)	38976 (31.8)	79941 (65.3)	569 (3.5)	5414 (33.5)	10175 (63.0)
With others	317 (4.6)	2241 (32.6)	4326 (62.8)	128 (3.8)	1104 (33.0)	2111 (63.2)
Children number						
0	29 (2.6)	300 (26.9)	785 (70.5)	3 (2.7)	36 (32.1)	73 (65.2)
1	1376 (3.3)	8712 (20.8)	31818 (75.9)	115 (6.6)	541 (30.9)	1096 (62.5)
2–3	1887 (2.4)	28847 (36.4)	48514 (61.2)	388 (3.1)	3969 (31.8)	8110 (65.1)
≥ 4	619 (6.1)	4176 (41.0)	5383 (52.9)	232 (3.5)	2407 (36.3)	3999 (60.2)
Stroke in others[c]						

No	2787 (2.6)	34582 (32.4)	69340 (65.0)	513 (3.1)	5545 (33.0)	10729 (63.9)
Yes	1125 (4.3)	7488 (28.9)	17336 (66.8)	225 (5.3)	1412 (33.6)	2568 (61.1)
Avenues[d]						
1	1790 (2.9)	24059 (38.9)	35987 (58.2)	355 (3.6)	3942 (39.8)	5605 (56.6)
2–3	2034 (3.2)	16518 (26.3)	44341 (70.5)	374 (3.6)	2817 (27.1)	7203 (69.3)
4–6	88 (1.1)	1471 (18.6)	6346 (80.3)	9 (1.3)	194 (28.0)	489 (70.7)
Family history of stroke						
No	3127 (2.7)	36348 (31.3)	76533 (66.0)	562 (3.1)	5975 (33.0)	11595 (63.9)
Yes	183 (2.0)	2501 (26.5)	6739 (71.5)	23 (2.3)	340 (34.4)	625 (63.3)
Unknown	600 (8.5)	3159 (44.4)	3350 (47.1)	153 (8.2)	636 (34.2)	1072 (57.6)
History of CVD[e]						
No	3839 (3.0)	40812 (31.8)	83761 (65.2)	714 (3.6)	6563 (33.1)	12533 (63.3)
Yes	71 (1.7)	1229 (29.4)	2875 (68.9)	24 (2.1)	391 (33.3)	758 (64.6)

[a] personal annual income

[b] With spouse includes living with spouse or both spouse and children; With others includes living with children, living in nursing home, and with other people. Those with other type of living status were classified as missing data.

[c] Relatives or colleagues who have suffered an acute stroke

[d] Avenues taken to learn about acute stroke

[e] CVD denotes cerebral vascular disease, including ischemic stroke, transient ischemic anemia, cerebral hemorrhage, and subarachnoid hemorrhage

Figures

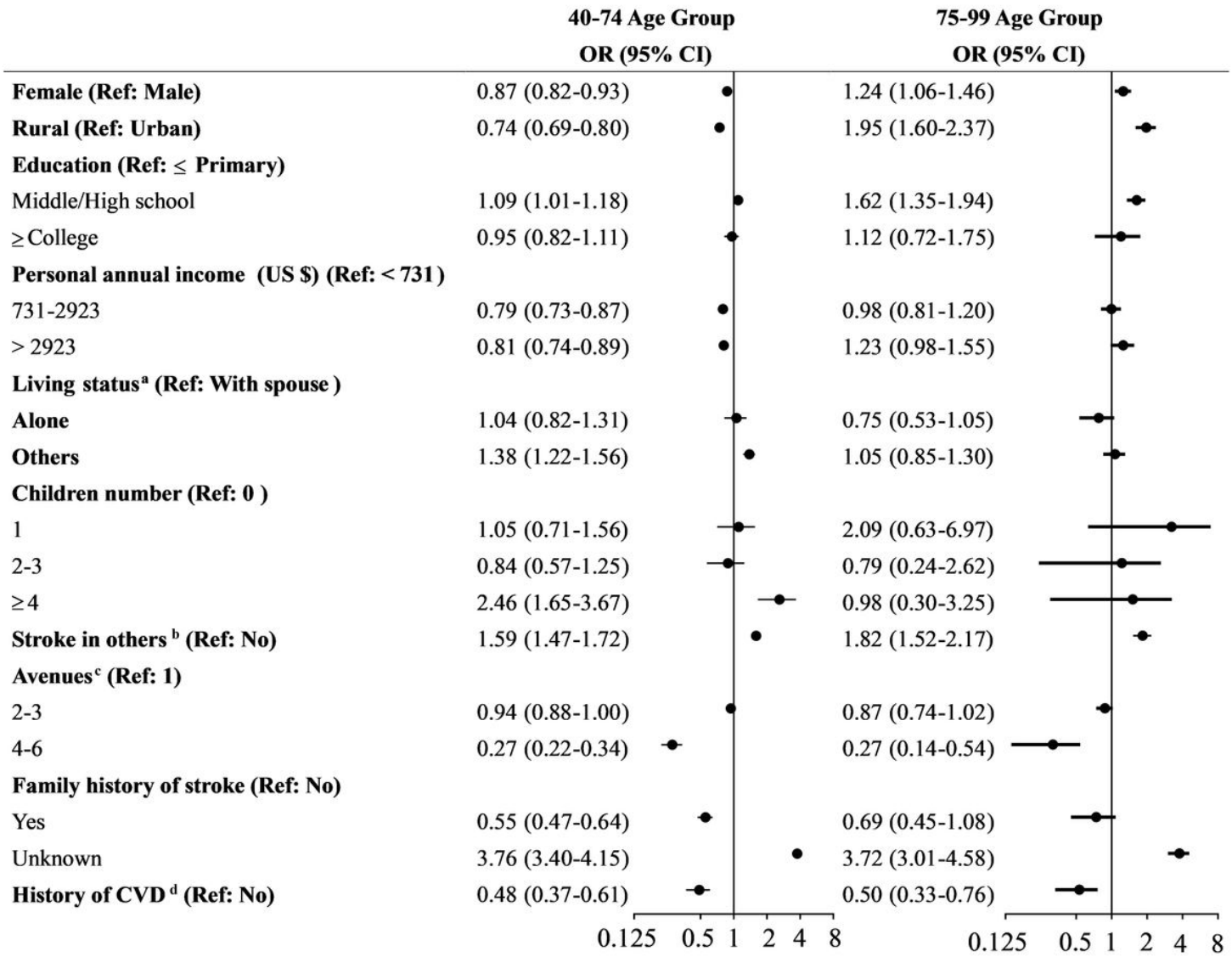

Figure 1

Logistic regression models of factors associated with self-observation at home among residents recognizing stroke This logistic model was adjusted by regions. a With spouse includes living with spouse or both spouse and children; With others includes living with children, living in nursing home, and with other people. Those with other type of living status were classified as missing data. b Relatives or colleagues who have suffered an acute stroke c Avenues taken to learn about acute stroke d CVD denotes cerebral vascular disease, including ischemic stroke, transient ischemic anemia, cerebral hemorrhage, and subarachnoid hemorrhage.

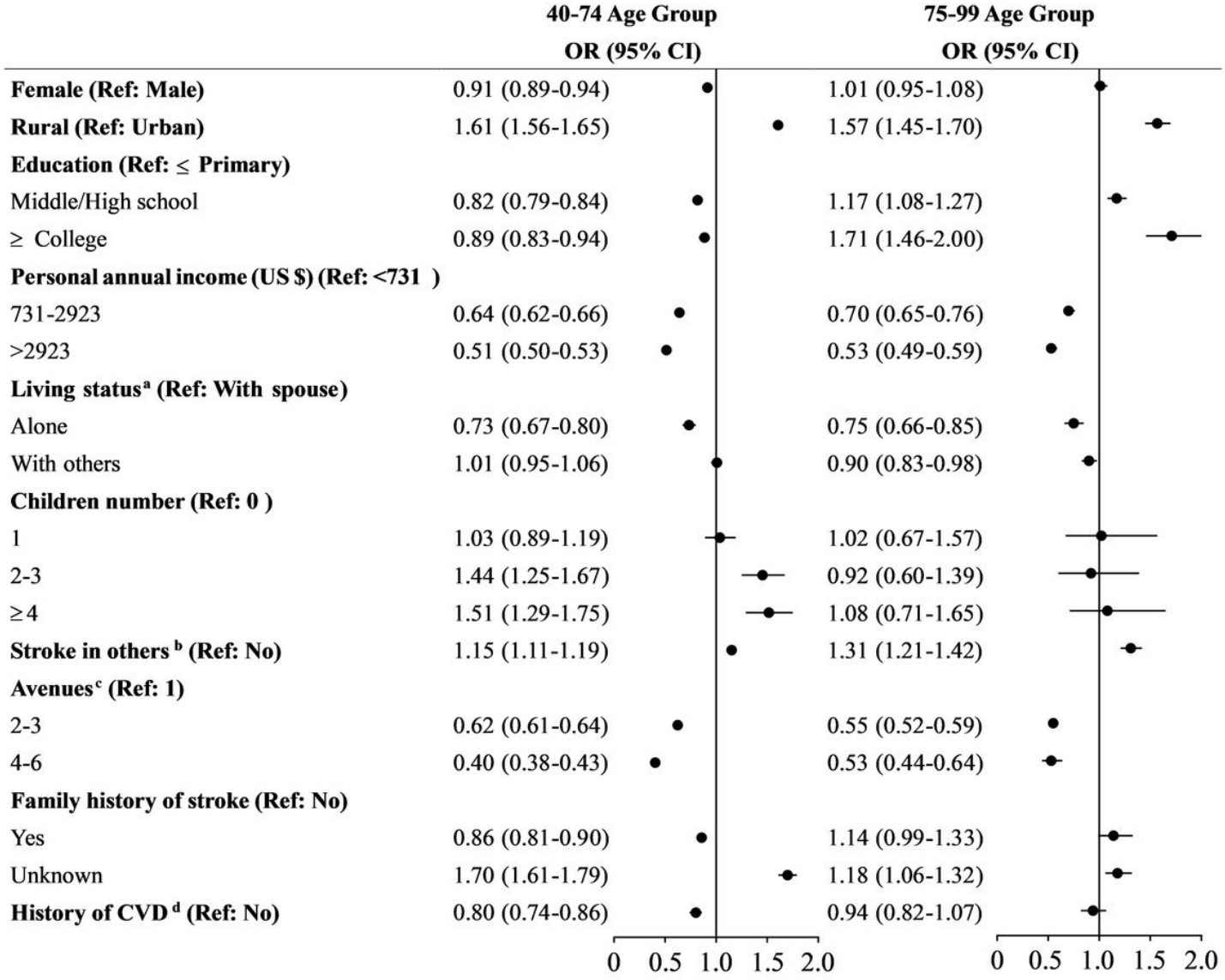

Figure 2

Logistic regression models of factors associated with waiting for family among residents recognizing stroke This logistic model was adjusted by regions. a With spouse includes living with spouse or both spouse and children; With others includes living with children, living in nursing home, and with other people. Those with other type of living status were classified as missing data. b Relatives or colleagues who have suffered an acute stroke c Avenues taken to learn about acute stroke d CVD denotes cerebral

vascular disease, including ischemic stroke, transient ischemic anemia, cerebral hemorrhage, and subarachnoid hemorrhage

Supplementary Files

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- supplement1.pdf