Original Article

Assessing Cardiovascular Health Using Life's Simple 7 in a Chinese Population Undergoing Stroke Prevention

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Abstract

Background: The American Heart Association/American Stroke Association proposed a metric called Life's Simple 7 (LS7) to define cardiovascular health (CVH). The presence of a large number of ideal components of CVH is associated with lower cardiovascular disease and all-cause mortality. We aimed to assess CVH using LS7 in a Chinese population undergoing primary and secondary stroke prevention.
Methods: Patients with either ischemic stroke or cardiovascular risk factors were enrolled in the study from October 2010 to July 2013. LS7 components were scored as poor (0 points), intermediate (1 point), or ideal (2 points). The overall LS7 score was categorized as inadequate (0–4), average (5–9), or optimal (10–14) CVH. The Chi-square test, Mann–Whitney *U*-test, and Kruskal–Wallis test were used.
Results: In total, 706 patients were enrolled. (1) The distribution of the overall LS7 score ($n = 255$) indicated that 9.4%, 82.4%, and 8.2% of the patients had inadequate, average, and optimal CVH, respectively. The proportion of patients with optimal CVH undergoing secondary stroke prevention was lower than that for patients undergoing primary stroke prevention (3.8% vs. 12.8%, $P = 0.005$). The vast majority of participants (76.1%) presented with ≤2 ideal health components. (2) The proportions of patients with poor, intermediate, and ideal status, respectively, for the following LS7 components were assessed: Total cholesterol ($n = 275$; 5.1%, 73.8%, and 21.1%), blood pressure ($n = 351$; 32.5%, 59.0%, and 8.5%), blood glucose ($n = 280$; 9.3%, 39.6%, and 51.1%), physical activity ($n = 540$; 90.7%, 8.7%, and 0.6%), diet ($n = 524$; 0.2%, 92.4%, and 7.4%), smoking ($n = 619$; 20.7%, 2.9%, and 76.4%), and body mass index ($n = 259$; 6.6%, 35.5%, and 57.9%).
Conclusions: Few Chinese patients undergoing stroke prevention had optimal CVH (determined using LS7). Additionally, fewer patients undergoing secondary prevention had optimal CVH than those undergoing primary prevention. In particular, physical activity and diet status in this population require improvement.

Key words: Cardiovascular Health; Life's Simple 7; Lifestyle, Risk Factors; Stroke Prevention

Introduction

Previous studies have demonstrated that the majority of strokes can be prevented and that the control of risk factors is an effective method to reduce the risk of stroke.[1-4]

In 2010, the American Heart Association/American Stroke Association (AHA/ASA) proposed an assessment of cardiovascular health (CVH) called Life's Simple 7 (LS7). The LS7 score includes 7 risk control factors, including 3 health factors (blood pressure [BP], total cholesterol, and blood glucose) and 4 health behavioral factors (body mass index [BMI], smoking, physical activity, and diet).[1] The LS7 metric categorizes CVH metrics as ideal, intermediate, and poor.[1]

Studies using community-based cohorts in America have reported about CVH status and have shown that better CVH is related to a lower incidence of cardiovascular events, including stroke, cognitive impairment, and total cardiovascular disease (CVD) mortality.[5-11]

Other recent studies have demonstrated that LS7 is associated with a lower risk of diabetes, heart failure, and venous thromboembolism.[12-15]

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The LS7 metric can be used to evaluate these 7 modifiable risk factors integrally, simultaneously, and quantitatively. This metric can also be used to promote stroke prevention, particularly via lifestyle changes.[2,5]

Due to differences in race, social economic status, and lifestyle, risk factors for CVD in the Chinese population may be dissimilar from those in United States populations. No previous studies have used the LS7 score to perform a quantitative assessment of CVD risk factors in a Chinese population. Our study measured CVH using LS7 in a Chinese population of patients undergoing primary and secondary stroke prevention.

Methods

Study participants and data collection

The participants included outpatients and inpatients of the Department of Neurology of Peking University Third Hospital from October 2010 to July 2013 who were diagnosed with ischemic stroke (IS, including transient ischemic attack [TIA]; secondary prevention group) or who had only vascular risk factors without IS or TIA (primary prevention group). This study was approved by the ethics committee of Peking University Third Hospital.

We used LS7 to assess these patients via interview or telephone in September and October 2013. The age, sex, height, weight, and education level of the participants were obtained, and histories of stroke and TIA, hypertension, diabetes mellitus, and hyperlipidemia, as well as the use of related medications and cigarette smoking were recorded. Physical activity and diet were recorded according to LS7.

Life's Simple 7

Each LS7 component was given a score of 0, 1, or 2 to indicate poor, intermediate, or ideal health, respectively.[5] The health factors included: (1) Total cholesterol – ideal (<200 mg/dl, without lipid-lowering medication), intermediate (200–239 mg/dl or treated to <200 mg/dl), and poor (≥240 mg/dl); (2) BP – ideal (BP <120/<80 mmHg without antihypertensive medication), intermediate (systolic BP [SBP] 120–139 or diastolic BP [DBP] 80–89 mmHg or reduced with antihypertensive medication to <120/<80 mmHg), and poor (SBP ≥140 or DBP ≥90 mmHg); and (3) blood glucose – ideal (<100 mg/dl, without antidiabetic medication), intermediate (100–125 mg/dl or reduced with antidiabetic medication to <100 mg/dl), and poor (≥126 mg/dl). Health behaviors included: (1) Physical activity – ideal (intense physical activity 4 or more times/week), intermediate (intense physical activity 1–3 times/week), and poor (no physical activity); (2) diet – ideal (4–5 components), intermediate (2–3 components), and poor (0–1 component); (3) smoking – ideal (never or quit >12 months ago), intermediate (former, quit ≤12 months ago), and poor (current); and (4) BMI – ideal (<25 kg/m^2), intermediate (25.00–29.99 kg/m^2), and poor (≥30 kg/m^2).[2,5]

Diet components included the consumption of: (1) Fruits and vegetables (≥4.5 cups/day), (2) fish (≥two 3.5-oz servings/week), (3) fiber-rich whole grains (≥three 1-oz-equivalent servings/d), (4) sodium (≥1500 mg/d), and (5) sugar-sweetened beverages (≤36 oz/week).[5]

An overall LS7 score was calculated (ranging from 0 to 14) and classified as inadequate (0–4), average (5–9), or optimal (10–14) CVH.[5]

Statistical analysis

SPSS version 19.0 (SPSS Inc., Chicago, IL, USA) was used for the data analysis. The quantitative data were expressed as the mean ± standard deviation (SD). The Chi-square test was used to compare the differences in the distribution of LS7 components between men and women and between different prevention types in addition to the differences in the distribution of each CVH category and in the number of ideal components of the LS7 of patients of different prevention types. The Mann–Whitney *U*-test was used to compare the differences between men and women and between different prevention types, and the Kruskal–Wallis test was used to compare the differences among different education levels in overall LS7 scores. A $P < 0.05$ was considered statistically significant.

Results

Demographic and clinical characteristics

In total, 706 patients were examined. Table 1 presents the baseline characteristics of the participants. The mean age of the study population was 68.12 ± 11.73 years. Nearly half of the participants (43.8%) had at least some college education. The study included participants who previously had an IS or TIA (245 [34.7%]) and those with no stroke history. Accordingly, the patients were classified into primary or secondary prevention groups.

Distribution of the Life's Simple 7 components

The distribution of the LS7 components is shown in Tables 2 and 3 and Figure 1. Most of the individuals were classified as having an intermediate or poor health status in

Table 1: Demographic and clinical characteristics

Characteristics	Results (*n* = 706)
Age, mean ± SD	68.12 ± 11.73
Men, *n* (%)	432 (61.2)
Native place: Beijing, *n* (%)	232 (32.8)
Education level, *n* (%)	
Illiteracy	13 (1.8)
Elementary school	28 (4.0)
Middle school	152 (21.5)
College or more	309 (43.8)
Not available	204 (28.9)
Prevention type, *n* (%)	
Primary	245 (34.7)
Secondary	461 (65.3)

SD: Standard deviation.

Table 2: Distribution of LS7 components for total and subgroup patients by sex and prevention type

Items	Cardiovascular health factors of LS7											
	BP (n = 351)				Fasting plasma glucose (n = 280)				Total cholesterol (n = 275)			
	Ideal	Intermediate	Poor	*P**	Ideal	Intermediate	Poor	*P**	Ideal	Intermediate	Poor	*P**
Total (%)	8.5	59.0	32.5		51.1	39.6	9.3		21.1	73.8	5.1	
Sex (%)												
Men	7.3	60.0	32.7	0.539	49.7	38.9	11.5	0.305	21.5	74.8	3.7	0.439
Women	10.7	57.3	32.1		53.0	40.9	6.1		20.5	72.3	7.1	
Prevention type (%)												
Primary	13.3	63.0	23.7	0.003	50.4	40.1	9.5	0.973	24.6	69.4	6.0	0.268
Secondary	5.6	56.5	38.0		51.7	39.2	9.1		17.7	78	4.3	

*A Chi-square test was used to compare the distribution of LS7 components by sex and prevention type. LS7: Life's Simple 7; BP: Blood pressure.

Table 3: Distribution of LS7 components for total and subgroup patients by sex and prevention type

Items	Cardiovascular health behaviors of LS7															
	Physical activity (n = 540)				BMI (n = 259)				Diet (n = 524)				Smoking (n = 619)			
	Ideal	Intermediate	Poor	*P**	Ideal	Intermediate	Poor	*P**	Ideal	Intermediate	Poor	*P**	Ideal	Intermediate	Poor	*P**
Total (%)	0.6	8.7	90.7		57.9	35.5	6.6		7.4	92.4	0.2		76.4	2.9	20.7	
Sex (%)																
Men	0.6	9.7	89.7	0.552	56.7	38 .0	5.3	0.464	5.6	94.1	0.3	0.087	77.5	2.9	19.6	0.685
Women	0.5	7.1	92.4		59.6	32.1	8.3		10.3	89.7	0		74.6	3.0	22.5	
Prevention type (%)																
Primary	0.5	10.5	89.0	0.529	61.8	32.1	6.1	0.432	5.7	94.3	0	0.388	72.0	2.4	25.6	0.088
Secondary	0.6	7.6	91.8		53.9	39.1	7.0		8.4	91.3	0.3		78.7	3.2	18.1	

*A Chi-square test was used to compare the distribution of LS7 components by sex and prevention type. LS7: Life's Simple 7; BMI: Body mass index.

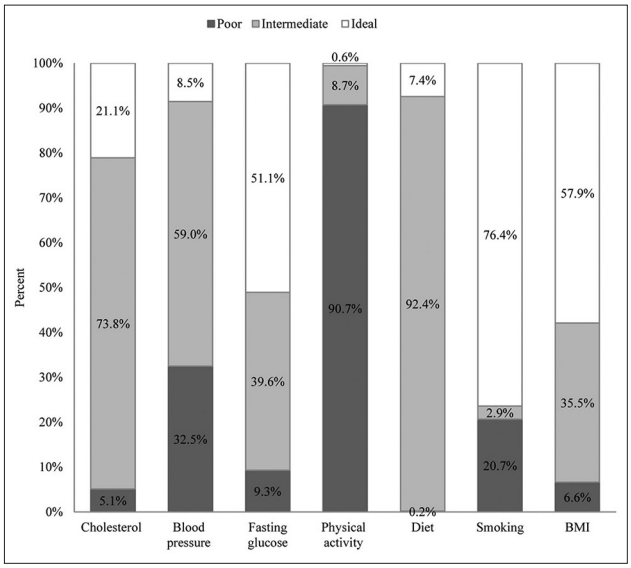

Figure 1: Distribution of Life's Simple 7 components among the participants.

each of the components of the LS7, with the exception of smoking, BMI, and fasting plasma glucose, in which the ideal category (76.4%, 57.9% and 51.1%, respectively) was the predominant group. The percentage of participants in the ideal categories for physical activity, diet, BP, and total cholesterol consisted of only 0.6%, 7.4%, 8.5%, and 21.1% of the study population, respectively. For physical activity, the majority of the individuals exhibited a poor health status (90.7%); for diet, BP, and total cholesterol, most of the individuals had an intermediate health status (92.4%, 59.0%, and 73.8%, respectively).

The distributions of the LS7 components for subgroups of patients classified by sex and prevention type are shown in Table 2. The comparison between men and women regarding the distribution of LS7 components showed no significant differences. The comparison between prevention groups showed that the secondary prevention group had a poorer BP status than the primary group. The comparison of other LS7 components showed no significant differences between prevention groups.

Distribution of cardiovascular health categories and comparisons of overall Life's Simple 7 cores by sex, education, and prevention type

For patients with valid data (n = 255), the overall LS7 scores were calculated, and the distribution of each CVH category was analyzed [Table 4].

The proportions of patients with inadequate, average, and optimal CVH were 9.4%, 82.4%, and 8.2%, respectively. No significant differences were observed between men and women. A significant difference was observed between education levels. The proportion of patients in the optimal health category was lower in the secondary prevention group than in the primary prevention group (3.8% vs. 12.8%, P = 0.005).

The overall LS7 scores were compared between men and women, between different prevention types, and among different education levels [Table 5]. A significant difference was observed among education levels. The overall LS7 scores of patients whose education levels were not available were significantly lower than those patients whose education levels were illiteracy, middle school, or college or more. Other comparisons among different education levels showed no significant differences. Additionally, the overall LS7 scores were lower in the secondary prevention group than in the primary prevention group (5.75 vs. 7.00, $P = 0.026$).

Table 4: Distribution in each cardiovascular health category by sex, education, and prevention type

Items	Patients in each cardiovascular health category, *n* (%)			χ^2	*P*
	Inadequate	Average	Optimal		
All patient	24 (9.4)	210 (82.4)	21 (8.2)		
Sex					
Men	16 (10.7)	122 (81.3)	12 (8.0)	0.680	0.712
Women	8 (7.6)	88 (83.8)	9 (8.6)		
Education level					
Illiteracy	0 (0)	3 (100)	0 (0)	69.596	0.000
Elementary school	0 (0)	2 (100)	0 (0)		
Middle school	3 (10.0)	24 (80.0)	3 (10)		
College or more	7 (3.4)	180 (87.8)	18 (8.8)		
Not available	14 (93.3)	1 (6.7)	0 (0.0)		
Prevention type					
Primary	8 (6.4)	101 (80.8)	16 (12.8)	7.951	0.005
Secondary	16 (12.3)	109 (83.8)	5 (3.8)		

Table 5: Comparisons of overall LS7 score by sex, education, and prevention type

Items	Median	Lower quartile	Upper quartile	*Z*	*P*
All patients	7.00	6.00	8.00		
Sex					
Men	7.00	6.00	8.00	0.526	0.599*
Women	7.00	6.00	8.00		
Education level					
Illiteracy‡ ($n = 3$)	7.00	7.00		45.221	0.000†
Elementary school ($n = 2$)	6.00	5.00			
Middle school§ ($n = 30$)	6.00	5.00	8.00		
College or more‖ ($n = 205$)	7.00	6.00	8.00		
Not available ($n = 15$)	3.00	2.00	4.00		
Prevention type					
Primary	7.00	6.00	8.00	−2.228	0.026*
Secondary	5.75	6.00	8.00		

*The Mann–Whitney U-test was used to compare the differences between men and women and between different prevention types. †The Kruskal–Wallis test was used to compare the differences among different education levels. Except for the comparisons annotated below (‡,§,‖), the comparisons among different education levels showed no significant differences; ‡Compared to "not available," $Z = 2.985$, $P = 0.028$; §Compared to "not available," $Z = 4.200$, $P = 0.000$; ‖Compared to "not available," $Z = 6.482$, $P = 0.000$. LS7: Life's Simple 7.

Distribution of participants by number of ideal Life's Simple 7 components

For patients with valid data ($n = 255$), the distribution of the number of ideal LS7 components for each participant is shown in Figure 2.

No participants were classified as having ideal CVH (having ideal levels of all 7 components), and only 1 of the 255 participants achieved 6 ideal components. The vast majority of participants (76.1%) presented with ≤2 ideal health components. Additional subgroup analyses indicated no significant differences in the distribution of the primary groups ($P = 0.554$).

Discussion

The AHA/ASA proposed the LS7 population metric in 2010. Since then, studies of community-based cohorts in the United States have reported CVH according to the 7 components and concluded a low prevalence of ideal CVH.[2,5-11]

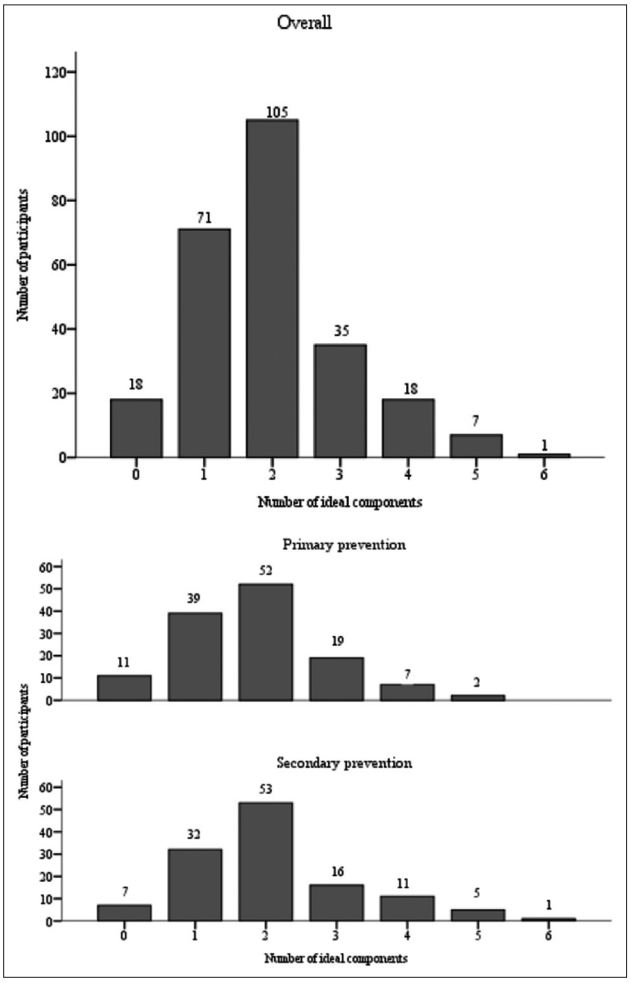

Figure 2: Distributions of participants by a number of ideal health factors overall (above) and of subgroups by prevention type (below).

Previous studies have analyzed the values of the different LS7 components without assigning a total CVH score.[6-10] The Atherosclerosis Risk in Communities Study (12,744 participants aged 45–64 years) reported the prevalence of ideal CVH in 1987–1989 and showed that only 0.1% of the participants had ideal CVH (all seven CVH metrics), 17.4% had intermediate CVH (at least one intermediate metric and no poor metrics), and 82.5% had poor CVH (at least one poor health metric).[7] The Northern Manhattan Study (2981 subjects, mean age 69 ± 10 years) showed that no participants had all 7 ideal CVH factors, only 4.4% of the cohort had 5 or 6 CVH factors, and the majority of the cohort (62.4%) had only 2 or 3 ideal factors.[6] The Heart Strategies Concentrating on Risk Evaluation study (1933 participants, mean age 59 years) found that 1 participant showed all 7 ideal components. Less than 10% of the participants had ≥5 ideal components in all subgroups (by race, sex, age, and income level). The vast majority of participants (80.9%) presented with ≤3 ideal components.[8]

When the CVH metric was released as LS7, it was first used in the Reasons for Geographic and Racial Differences in Stroke (REGARDS) study (30,239 black and white participants aged ≥45 years sampled from a US population from 2003 to 2007 who were free of stroke at baseline), which showed that a greater number of white participants were in the optimal CVH category and fewer were in the inadequate and average categories (19.4%, 73.0%, and 7.6%, respectively) compared with black participants (7.2%, 76.4% and 16.3%, respectively).[5]

In our study, only 8.2% of the patients had optimal CVH according to the total LS7 score; this finding was similar to that of the REGARDS study. Additionally, the analysis of the number of ideal LS7 components achieved by each participant showed that most participants (76.1%) presented with ≤2 ideal health components, which was similar to the results of other studies. The low prevalence of optimal CVH suggested substantial room for improvement, which requires cooperation among healthcare professionals, policy-makers, patients, and society.

Furthermore, our secondary prevention group showed a lower proportion of participants in the optimal CVH (3.8%) group compared with the primary group (0.013). This result suggested that the LS7 categories are related to stroke history and may be used to predict stroke; this conclusion is supported by the Northern Manhattan and REGARDS studies.[5,6] The Northern Manhattan Study showed a stronger gradient relationship between CVD (including stroke) and the number of ideal CVH metrics (0.73 [95% confidence interval: 0.60–0.89], 0.61 [0.50–0.76], 0.49 [0.38–0.63], and 0.41 [0.26–0.63] for individuals with 2, 3, 4, and 5–6 ideal CVH metrics, respectively) compared with those with 0–1 ideal CVH metrics (*P* for the trend <0.0001), which was similar among whites, blacks, and Caribbean Hispanics.[6] Additionally, the REGARDS study showed that each better health category of the LS7 score was associated with a 25% lower risk of stroke and that this association was similar for blacks and whites. A 1-point higher LS7 score was associated with an 8% lower risk of stroke.[5] These gradient associations should be further clarified in a Chinese population. Currently, a comprehensive, automated CVH assessment is being developed that may be easily applied to a large population.[16] LS7 was also used as an efficacy measure of an intervention program.[17]

In our study, the analysis of LS7 components showed low proportions of ideal status for physical activity and diet. Regarding physical activity, the majority of the individuals had a poor health status (90.7%); for diet, most of the individuals had an intermediate health status (92.4%).

In previous years, the prevention or control of BP, blood lipids, diabetes mellitus, smoking, and obesity were apparently well managed; however, physical activity and diet status required more attention, particularly in the older population.

Regular physical activity reduces the risk of total mortality, cardiovascular mortality, cardiovascular morbidity, and stroke.[1] *The 2008 Physical Activity Guidelines for Americans* concluded that physically active people have a 25–30% lower risk of stroke or death than the least active people. However, the dose–response relationship between the amount or intensity of physical activity and stroke risk is unclear, and a gender interaction is possible. Adults are recommended to engage in at least 150 min (2 h and 30 min) of moderate intensity or 75 min (1 h and 15 min) of vigorous-intensity aerobic physical activity per week or an equivalent combination of moderate and vigorous intensity aerobic activity. These guidelines also note that some physical activity is better than none and that adults who participate in any amount of physical activity gain some health benefits.[1,18]

Regarding diet, an appropriate energy balance in the overall dietary pattern is recommended, including, but not limited to, eating sufficient fruits and vegetables, fish, and fiber-rich whole grains, as well as controlling sodium and sugar intake.[19] Numerous problems regarding the evaluation and control of diet exist in China. These problems include insufficient knowledge, different eating habits, unit conversion difficulties, complicated diet assessment scales, and difficulty determining food composition. Due to the importance of improving diet, regulating and simplifying the evaluation methods, emphasizing the labeling of food ingredients, and strengthening dietary education are necessary.

Due to the low cost of controlling lifestyle behaviors such as diet and physical activity, great social and economic benefits can be obtained by promoting healthy lifestyles that reduce the risk of stroke and other CVDs.

This study is the first to investigate the LS7 score in a Chinese population to evaluate patients' CVH by this integral, simultaneous, and quantitative assessment of 7 modifiable risk factors. Thus, we verified the improvable potential and the realistic objectives among these 7 preventable risk factors. Meanwhile, this assessment enhanced patients' and

their family's awareness of CVH and ameliorated stroke prevention.

However, this preliminary study has some limitations. First, LS7 was developed by AHA/ASA; thus, its applicability in Chinese populations remains uncertain. For example, the criteria for BMI in China differ from those in Western countries. We used this scale without any adjustment, which may affect the results. Further studies should use Chinese criteria. Furthermore, the assessment of diet is similar to that of BMI. Because the unit of food in LS7 is according to US standards, this assessment must undergo a complicated transfer into Chinese units. Further development of diet assessment standards for Chinese stroke prevention populations is necessary. Additionally, the components of fiber, sugar, and sodium are not usually indicated on the labels of many foods in China. Thus, the intake of these components is difficult to assess. A cooperative effort from Chinese society, media, and government is required to promote knowledge regarding the proper diet for ideal CVH and to standardize the food components strictly to improve people's diet structure. Second, LS7 has been applied in population-based studies, while our study is in a single center. Our study enrolled 706 patients, among whom only 255 provided complete data. Thus, the typicality of this study is impaired. Further studies should enlarge patient enrollment and prospectively investigate the association of score and stroke incidence and recurrence. However, our study found that the overall LS7 scores of patients whose education levels were not available were significantly lower than those of other patients, which implied that these patients may not care about their health condition and may need to be the focus of our attention. Finally, some CVH components including total cholesterol and BP may be not applicable for secondary prevention populations. Further studies are warranted for developing an integral, simultaneous, and quantitative scale for secondary prevention populations.

In conclusion, few patients had optimal CVH (as determined using the LS7 assessment) in this Chinese population study of stroke prevention. Additionally, fewer patients had optimal CVH in the secondary prevention group compared with the primary prevention group. Physical activity and diet status warrant particular improvement. The low prevalence of optimal CVH suggests substantial room for improvement, which requires cooperation among healthcare professionals, policy-makers, patients, and society.

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Conflicts of interest

There are no conflicts of interest.

References

1. Goldstein LB, Bushnell CD, Adams RJ, Appel LJ, Braun LT, Chaturvedi S, *et al.* Guidelines for the primary prevention of stroke: A guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke 2011;42:517-84.
2. Lloyd-Jones DM, Hong Y, Labarthe D, Mozaffarian D, Appel LJ, Van Horn L, *et al.* Defining and setting national goals for cardiovascular health promotion and disease reduction: The American Heart Association's strategic Impact Goal through 2020 and beyond. Circulation 2010;121:586-613.
3. Stamler J, Stamler R, Neaton JD, Wentworth D, Daviglus ML, Garside D, *et al.* Low risk-factor profile and long-term cardiovascular and noncardiovascular mortality and life expectancy: Findings for 5 large cohorts of young adult and middle-aged men and women. JAMA 1999;282:2012-8.
4. Vasan RS, Sullivan LM, Wilson PW, Sempos CT, Sundström J, Kannel WB, *et al.* Relative importance of borderline and elevated levels of coronary heart disease risk factors. Ann Intern Med 2005;142:393-402.
5. Kulshreshtha A, Vaccarino V, Judd SE, Howard VJ, McClellan WM, Muntner P, *et al.* Life's Simple 7 and risk of incident stroke: The reasons for geographic and racial differences in stroke study. Stroke 2013;44:1909-14.
6. Dong C, Rundek T, Wright CB, Anwar Z, Elkind MS, Sacco RL. Ideal cardiovascular health predicts lower risks of myocardial infarction, stroke, and vascular death across whites, blacks, and Hispanics: The Northern Manhattan study. Circulation 2012;125:2975-84.
7. Folsom AR, Yatsuya H, Nettleton JA, Lutsey PL, Cushman M, Rosamond WD, *et al*. Community prevalence of ideal cardiovascular health, by the American Heart Association definition, and relationship with cardiovascular disease incidence. J Am Coll Cardiol 2011;57:1690-6.
8. Bambs C, Kip KE, Dinga A, Mulukutla SR, Aiyer AN, Reis SE. Low prevalence of "ideal cardiovascular health" in a community-based population: The Heart Strategies Concentrating on Risk Evaluation (Heart SCORE) study. Circulation 2011;123:850-7.
9. Ford ES, Greenlund KJ, Hong Y. Ideal cardiovascular health and mortality from all causes and diseases of the circulatory system among adults in the United States. Circulation 2012;125:987-95.
10. Yang Q, Cogswell ME, Flanders WD, Hong Y, Zhang Z, Loustalot F, *et al.* Trends in cardiovascular health metrics and associations with all-cause and CVD mortality among US adults. JAMA 2012;307:1273-83.
11. Thacker EL, Gillett SR, Wadley VG, Unverzagt FW, Judd SE, McClure LA, *et al.* The American Heart Association Life's Simple 7 and incident cognitive impairment: The Reasons for Geographic and Racial Differences in Stroke (REGARDS) study. J Am Heart Assoc 2014;3:e000635.
12. Folsom AR, Shah AM, Lutsey PL, Roetker NS, Alonso A, Avery CL, *et al.* American Heart Association's Life's Simple 7: Avoiding Heart failure and preserving cardiac structure and function. Am J Med 2015;pii: S0002-9343(15)00318-6. doi: 10.1016.
13. Olson NC, Cushman M, Judd SE, McClure LA, Lakoski SG, Folsom AR, *et al.* American Heart Association's Life's Simple 7 and risk of venous thromboembolism: The Reasons for Geographic and Racial Differences in Stroke (REGARDS) study. J Am Heart Assoc 2015;4:e001494.
14. Folsom AR, Olson NC, Lutsey PL, Roetker NS, Cushman M. American Heart Association's Life's Simple 7 and incidence of venous thromboembolism. Am J Hematol 2015;90:E92.
15. Fretts AM, Howard BV, McKnight B, Duncan GE, Beresford SA, Mete M, *et al.* Life's Simple 7 and incidence of diabetes among American Indians: The Strong Heart Family Study. Diabetes Care 2014;37:2240-5.
16. Murphy MP, Coke L, Staffileno BA, Robinson JD, Tillotson R. Improving cardiovascular health of underserved populations in the community with Life's Simple 7. J Am Assoc Nurse Pract 2015;doi: 10.1002/2327-6924.12231.
17. Foraker RE, Shoben AB, Lopetegui MA, Lai AM, Payne PR, Kelley M, *et al.* Assessment of Life's Simple 7 in the primary care setting: The

Stroke Prevention in Healthcare Delivery EnviRonmEnts (SPHERE) study. Contemp Clin Trials 2014;38:182-9.
18. US Department of Health and Human Services. 2008 Physical Activity Guidelines for Americans. Washington, DC: US Department of Health and Human Services; 2008.
19. US Department of Health and Human Services, US Department of Agriculture. Dietary Guidelines for Americans, 2005. 6th ed. Washington, DC: US Government Printing Office; 2005.