Family Medicine and Community Health
ORIGINAL RESEARCH

Ten year risk assessment of ischemic cardiovascular disease and intervention analysis among middle-aged residents with moderate risk and above in a Shanghai-based community

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Abstract

Objective: The exposure conditions with regard to 10-year ischemic cardiovascular disease (ICVD) risk among residents aged 45–59 years treated in Hudong Community Health Service Center were surveyed to provide an objective basis for further studies on the relation between risk factors and ICVD events.

Methods: The survey was conducted from October 2013 to March 2014 with use of the principle of cluster sampling. Our investigation involved questionnaire and laboratory tests. All residents were evaluated according to the table of National 10-Year Risk Assessment for ICVD to forecast the 10-year risk. The community intervention methods were medication and lifestyle intervention based on the relevant guidelines.

Results: The body mass index and smoking rate were significantly higher in men than in women. The 10-year ICVD risk was 6.1% for moderate risk or above. We performed intervention in such residents for 1 year, with the result that the blood pressure and total cholesterol levels were significantly decreased ($P<0.05$).

Conclusion: It is imperative that early prediction and intervention be conducted for the residents with risk factors. After the intervention, we found that the risk declined in 79.41% of the residents with moderate risk and or above and that the 10-year ICVD risk score decreased.

Keywords: Community health; ischemic cardiovascular disease; middle-aged assessment

Introduction

It is well recognized that ischemic cardiovascular disease (ICVD) is becoming the main reason for death worldwide; more importantly, the incidence rate and mortality rate are increasing year by year [1–5]. In 2006, deaths due to cardiovascular diseases accounted for 35% of all deaths in the United States [1]. European statistics in 2008 showed that deaths from cardiovascular diseases accounted for approximately 48% of all deaths [2]. In 2008 the China Ministry of Health issued a Statistical Chinese Health Development Bulletin showing that the deaths caused by cardiovascular diseases accounted for about 48% of all deaths in Chinese, being the leading causes of death in China, especially in young adults aged 35–54 years [3]. Therefore it is a priority to control the spread of cardiovascular diseases to improve people's health in the twenty-first century. In addition, there is a high incidence of stroke in China, with a

trend moving toward younger populations [4]. The morbidity and mortality with regard to acute stroke events increase significantly with age, especially in populations aged 45–54 years [5]. In the current investigation, we evaluated the epidemic status of risk factors and the 10-year risk score for ICVD among middle-aged residents aged 45–59 years in a Shanghai-based community. Furthermore, according to the results of the cross-sectional descriptive study, we conducted a 1-year community intervention on those with moderate risk or above so that we could make a comparison before and after the intervention.

Methods

Study design

A cross-sectional descriptive study was conducted, followed by a self-controlled study (Fig. 1).

Data sources

According to the principle of cluster sampling, we randomly selected 5 of 33 neighborhood committees, 138 people conforming to the age group from each neighborhood committee (Table 1). We calculated the data with the cross-sectional descriptive calculation formula.

Data collection

The data collection was conducted from October 2013 to March 2014. The survey was composed of three parts: questionnaire, physical examination, and laboratory examination. The questionnaire, completed by well-trained community family physicians using the approaches of community consultation, clinic interview, and telephone calls, covered living habits, health status, history, and basic personal information such as sex, age, neighborhood committee, and telephone number. The physical examination included height, weight, and blood pressure. The laboratory tests measured biochemical indicators such as blood glucose level, blood lipid level, and renal function. All residents without a history of coronary heart disease and stroke were evaluated according to the table of National 10-Year Risk Assessment for ICVD [6].

Diagnostic criteria

Diagnostic criteria for hypertension were established in accordance with the 2010 Chinese guidelines for the management of hypertension [7] and the 2004 NIH/NHLBI the seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure [8]: systolic blood pressure of 140 mm Hg (18.6 kPa) or greater and/or diastolic blood pressure of 90 mm Hg (12.0 kPa) or greater, previous hypertension diagnosis, and treatment with antihypertensive drugs.

Diagnostic criteria for diabetes mellitus were set in accordance with the China type 2 diabetes prevention and control guide (2013 edition) [9] of the Chinese Medical Association Diabetes Branch and the Standards of Medical Care in Diabetes – 2010 formulated by the American Diabetes Association [10]. The diagnostic criteria were as follows: symptoms of diabetes (dry mouth, polydipsia, polyuria, weight loss, blurred vision, skin itching) and random blood glucose level greater than or equal to 11.1 mmol/L or fasting blood glucose level greater than or equal to 7.0 mmol/L or 2 h glucose load test levels greater than or equal to 11.1 mmol/L. Asymptomatic participants were required to undergo a second examination.

Diagnostic criteria for dyslipidemia were set according to the 2012 ACCF/AHA focused update of the guideline for the management of patients with unstable angina/non-ST Elevation myocardial infarction [11] and the Guidelines for the prevention and treatment of dyslipidemia in Chinese adults [12]. Lipid levels were stratified as follows: suitable range (total cholesterol level <5.18 mmol/L, LDL cholesterol level <3.37 mmol/L, HDL cholesterol level ≥1.04 mmol/L, triglyceride level <1.70 mmol/L); marginal increase (total cholesterol level 5.18–6.19 mmol/L, LDL cholesterol level 3.37–4.12 mmol/L, triglyceride level 1.70–2.25 mmol/L); increase (total cholesterol level ≥6.22 mmol/L, LDL cholesterol level ≥4.14 mmol/L, HDL cholesterol level ≥1.55 mmol/L, triglyceride level ≥2.26 mmol/L); hypolipemia (HDL cholesterol level <1.04 mmol/L). Dyslipidemia was evaluated by means of blood lipid levels and risk factors.

Overweight was defined as BMI of 24 kg/m^2 or greater, obesity was defined as BMI of 28 kg/m^2 or greater [9], and smoking was defined as daily consumption of more than one cigarette, which lasted for more than 1 year. The corresponding scores were obtained for risk factors such as age, systolic blood pressure, BMI, total cholesterol level, smoking status, and history of diabetes mellitus from the table of National

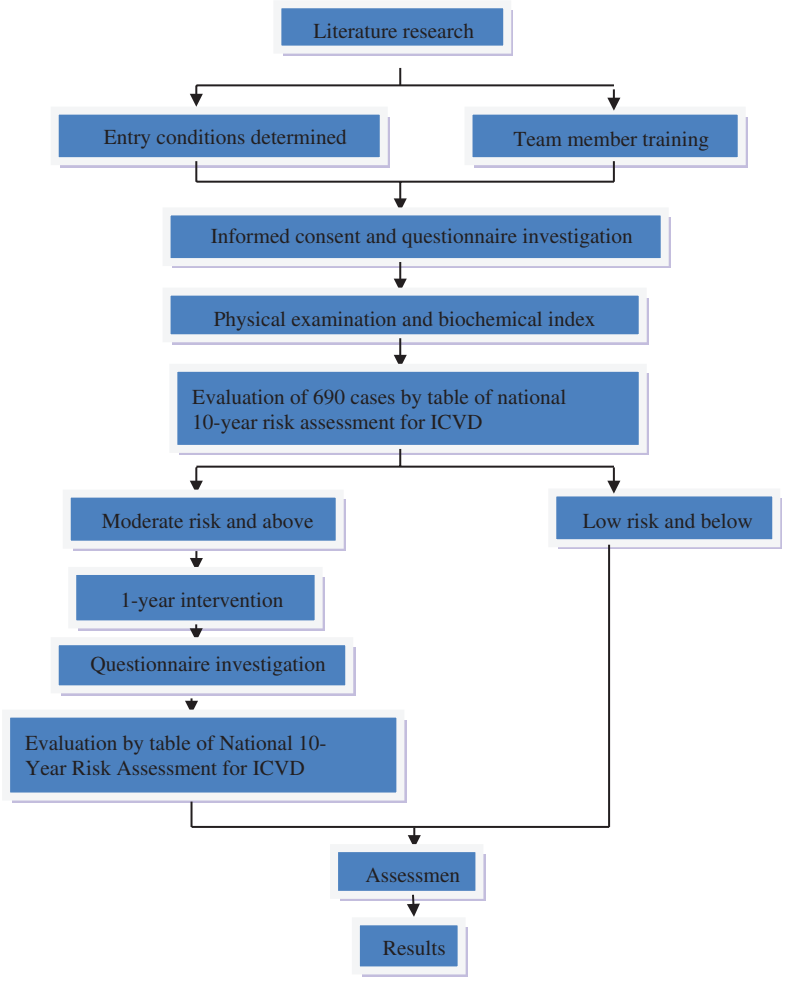

Fig. 1. Trajectory of research design. ICVD, ischemic cardiovascular disease.

Table 1. Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Residents living in Hudong community	Liver and kidney function or recent hepatitis
Permanent population residing for more than 6 months	Malignant tumor or mental illness
Residents aged 45–59 years	Diagnosis of coronary heart disease and ischemic stroke

10-Year Risk Assessment for ICVD [6], and the scores were summed. With the total score, we obtained the corresponding absolute risk value from the table again. The judgment of 10-year risk was as follows: less than 5% as extremely low risk, 5%–10% as low risk, 10%–20% as moderate risk, 20%–40% as high risk, and greater than 40% as extremely low risk [6]. On the basis of the 2012 American College of Cardiology Foundation/American Heart Association guidelines regarding unstable angina and non-ST-segment elevation myocardial infarction, those who have more than two risk factors should be evaluated for the 10-year risk and judged as to whether they need primary prevention (evidence level B) [11]. Accordingly, we defined residents with moderate risk or above as the groups for community intervention.

Intervention method

We judged the risk levels and performed the intervention program according to the results of qualitative and quantitative surveys and the health records established by the risk score. Those who had moderate risk or above needed to receive 1-year follow-up community intervention. The health record system was designed to automatically remind family physicians to follow up the target residents according to their different risk levels.

Intervention measures

All participants received the details for informed consent. We followed up the residents with moderate risk or above once per quarter, and those with high risk once per month. We compared the changes before and after the 1-year intervention.

We performed the individual intervention combined with the own-control using the approaches of clinical intervention and community education. The clinical intervention was conducted in accordance with the 2010 Chinese guidelines for the management of hypertension [7], the 2004 NIH/NHLBI the seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure [8], the China type 2 diabetes prevention and control guide (2013 edition) [9] of Chinese Medical Association Diabetes Branch, the Standards of Medical Care in Diabetes – 2010 formulated by the American Diabetes Association [10], the Guidelines for the prevention and treatment of dyslipidemia in Chinese adults [12], and the guidelines on managing abnormal blood lipid levels in Circulation [13].

Those who had concurrent diseases were referred to the specialist clinic within the hospital, and were followed up by family physicians when they had stable conditions. We offered community education according to the China residents dietary nutrient intake reference dose (2013 Revised Edition) [14]. Family physicians delivered regular lectures on primary prevention of chronic diseases in the community, especially on issues such as diet, smoking cessation, and regular workout. Meanwhile, they recommended aerobic exercises such as walking, jogging, swimming, and rope jumping no less than three times a week and for no less than 15 minutes each time, and proposed a control target heart rate of (220 – the current age) × 65%–85% on exercise [14]. At any time the family physicians would modify the lectures according to the feedback from the residents.

Statistical analyses

The database was established with use of EpiData 3.0 and double entry after checking, and the data were processed by SAS 9.2. The measurement data were expressed as $\bar{x}\pm s$ and examined by a t test. The count data were expressed as the rate and constituent ratio and were examined by χ^2 tests; if they did not correspond to a normal distribution, the data were described by χ^2 tests and Fisher's exact probability method. The criteria for hypothesis testing were defined, and $P<0.05$ was considered to correspond to a statistically significant difference. The risk factors for different ages were compared through the Cochran–Armitage trend test, Z for the test statistic; $P<0.01$ was considered to correspond to a statistically significant difference.

Results

Study characteristics

We issued 690 questionnaires. With an exclusion of the patients with a history of ICVD and with incomplete physical examination data and laboratory examination data, we accepted 636 questionnaires, with an the efficiency rate 92.2%. The accepted questionnaires were from 262 men (41.2%) and 374 women (58.8%). Thirty-nine people needed intervention (an intervention rate of 6.1%), and 34 received the intervention, two of whom moved, one of whom was lost for the visit, and two of whom were out of town on business for a long period.

Main analysis

We compared the risk factors for ICVD in different age groups, and found that BMI≥24 kg/m^2 and smoking rate were both higher in men than in women, with a statistically significant difference ($P<0.05$), and without any significance for other risk factors ($P>0.05$; Table 2). The results from the Cochran–Armitage trend test showed that with an increase of age, the incidence of bad rate of control of hypertension increased in men, while in women, both bad rate of control of hypertension and high morbidity of hypercholesterolemia exhibited a statistically significant difference ($P<0.001$, Fig. 2).

We compared the 10-year ICVD risk score obtained from our study with the hazard assessment score that we obtained from the literature for different ages and sexes in our community, and found that the 10-year ICVD risk score was higher than the reference value in all age groups involved in our

Table 2. Comparison of the incidence of risk factors for ischemic cardiovascular disease between men and women [n(%)]

Sex	Number	SBP≥140 mm Hg	DM	TC≥5.18 mmol/L	BMI≥24 kg/m^2	Smoking rate
Male	262	105 (40.1)	68 (26.0)	153 (58.4)	171 (65.3)	157 (59.9%)
Female	374	123 (32.9)	82 (21.9)	234 (62.6)	206 (55.1)	17 (4.5%)
χ^2		3.462	1.388	1.125	6.623	237.748
P		0.062	0.239	0.289	0.010	<0.001

DM, diabetes mellitus; SBP, systolic blood pressure; TC, total cholesterol.

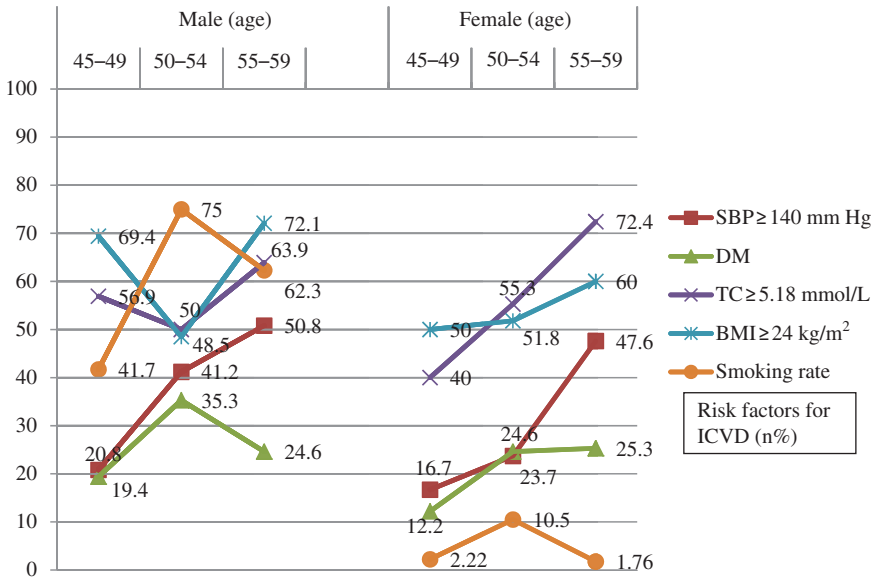

Fig. 2. Comparison of the incidence of risk factors for ischemic cardiovascular disease (ICVD) among different age ranges in male and female (%). DM, diabetes mellitus; SBP, systolic blood pressure; TC, total cholesterol.

survey, except in men aged 45–49 years, the difference being statistically significant (P<0.05; Table 3).

The 10-year risk of ICVD was assessed in different age groups and sexes, the results showing that the extremely low risk and low risk scores for ICVD in men were 53.8% (141/262) and 40.5% (106/262) respectively and in women were 79.7% (298/374) and 13.9% (52/374) respectively (Table 3). We compared the intervention rates, and found no statistically significant differences between the sexes (χ^2=0.128, P=0.720), the intervention rates being 5.7% (15/262) in men and 6.4% (24/374) in women (Fig. 3).

Thirty-nine residents had moderate risk or above, and 34 received 1-year intervention, 13 men and 21 women. We compared blood pressure, BMI, and total cholesterol value before and after the intervention, and found that the blood pressure and total cholesterol value declined, the difference being statistically significant (P<0.001), but that there was no change in BMI. Long-term smoking behavior affected lipid metabolism and increased the prevalence of metabolic syndrome, which is one of the most important causes of cardiovascular diseases [15]. We conducted smoking cessation intervention, including counseling, advice, and follow-up. The smoking rate was 38.2% (13/34) before the intervention and 29.4% (10/34) afterward, with no significant difference (Table 4).

Thirty-four residents received the intervention, 13 men and 21 women, among whom there were seven with high risk and

Table 3. Comparison of the 10-year risk score for ischemic cardiovascular disease and the reference values for risk assessment among different age ranges in men and women ($\bar{x}\pm s$)

Sex	Number	Reference value	Risk score	*t*	*P*
Male					
45–49 years	72	1.9	3.11±1.63	1.970	0.096
50–54 years	68	2.6	4.43±2.29	2.770	0.018
55–59 years	122	3.6	7.3±5.8	27.500	0.002
Female					
45–49 years	90	0.6	1.23±0.83	2.400	0.040
50–54 years	114	0.9	2.8±2.0	370.500	<0.001
55–59 years	170	1.4	2.8±5.0	855.500	<0.001

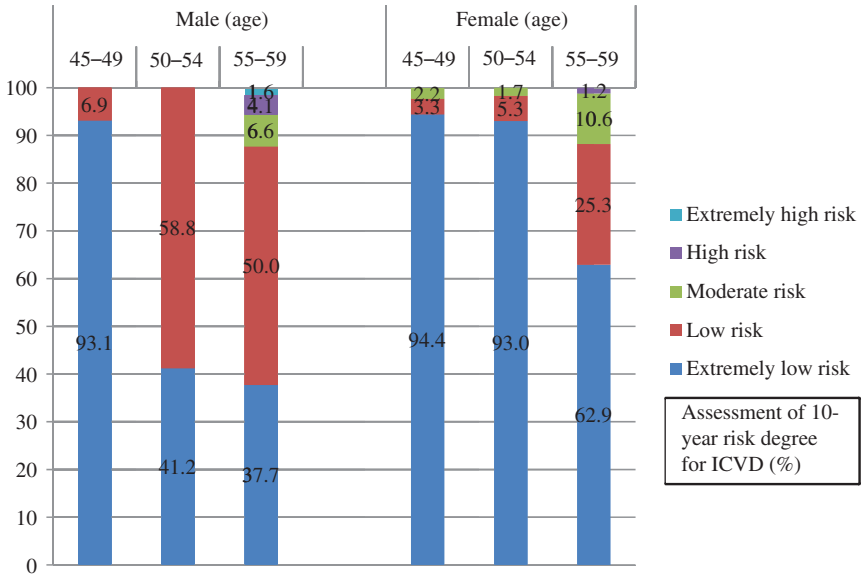

Fig. 3. Assessment of 10-year risk of ischemic cardiovascular disease (ICVD) among different age ranges in male and female (%).

Table 4. Comparison of blood pressure, BMI, total cholesterol level, and smoking rate after 1-year intervention

	BP (mm Hg)	BMI (kg/m^2)	TC (mmol/L)	Smoking rate (%)
Before	155±13	27.4±1.6	5.87±0.67	38.2 (13/34)
After	146±9	27.2±1.4	5.21±0.53	29.4 (10/34)
t/χ^2	5.50	1.68	5.41	0.59[a]
P	<0.001	0.102	<0.001	0.442

BP, blood pressure; TC, total cholesterol.

[a]The value was analyzed by the paired *t* test.

27 with moderate risk. After 1-year intervention, the numbers changed to one with high risk and six with moderate risk. Still, 20.6% of the residents with moderate risk or above needed to undergo further intervention (Fig. 4).

Discussion

All epidemiological data at home and abroad show that both morbidity and mortality with regard to ICVD are increasing year by year [1–5]. However, there is little literature on the risk factors for ICVD in community populations in China, and it is obvious that focus is placed not on prevention but on treatment. Therefore our current investigation mainly focused on the early evaluation of the asymptomatic individual. On the basis of the community-based epidemiological data, our study can help us make a community-based evaluation, so as to be more persuasive and pertinent with regard to health intervention and education as a whole [16], and to provide an objective basis for further preventive interventions such as lifestyle change. The rate of smoking and the BMI were significantly higher in men than in women. Moreover, the smoking rate of both sexes aged 50–54 years was higher than that of those aged 45–49 years and 55–59 years, although it was not significantly different. The results indicate that the risk factors were closely related to lifestyle, suggesting that community education and intervention are imperative in terms of obesity-associated diseases and tobacco control, especially in middle-aged men.

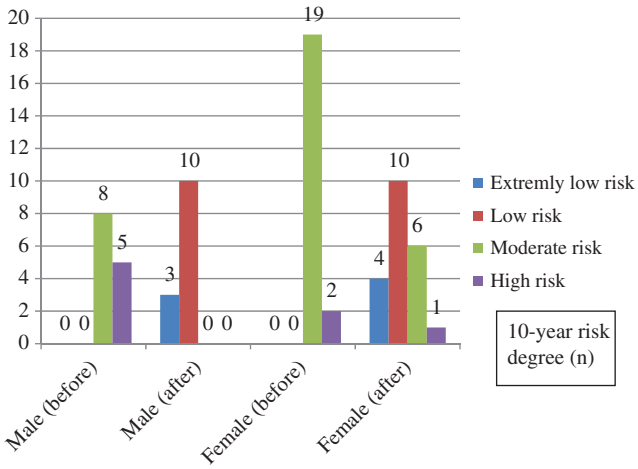

Fig. 4. Comparison of 10-year risk before and after 1-year intervention (n).

The bad rate of control of hypertension increased with age in men. In women, both the bad rate of control of hypertension and the incidence of hyperlipidemia increased with age. The results were tested by Cochran–Armitage statistical methods, the results showing that the bad rate of control of blood pressure with age showed a linear trend in middle-aged men and a line trend between the risk factors of blood pressure and blood lipid level and age in middle-aged women. The findings suggest that with increase of age, ICVD risk factors caused by bad control of persistent blood pressure existed in middle-aged men, and that focus should be placed on the long-term management of blood pressure and cholesterol in women, which was in agreement with the conclusion based on the previously reported results [17]. Hypercholesterolemia treatments need to be stratified according to the risk factor assessment instead of being based on laboratory data, because only a few residents knew about hypercholesterolemia, which can be one of the reasons for the poor effect of the risk factor management. This needs to be strengthened in further community education.

The results indicated that the 10-year ICVD risk scores were all higher in men aged 50–54 years and 55–59 years and in women aged 45–49 years, 50–54 years, and 55–59 years than the risk assessment scores. No difference in the rate of intervention was observed in the different sexes. The rate of 10-year moderate risk or above was 6.1% (39/636). Therefore we conclude that early identification and discrimination of potential risk factors can contribute to early intervention and prevention of cardiovascular diseases in the community. In 2011, Carrying Out the Family Doctor Service System was formulated and issued by Shanghai Health Bureau, which points out that the current reforms should transform the service items from medical to integrated, and the service process from incoherent services to comprehensive health management [18]. Thus it is imperative that with the comprehensive services and health management administered as the working target, the community-based epidemiological data be used as the objective basis for the job evaluation.

A retrospective study using multivariate logistic regression analysis revealed that high blood pressure and BMI were the most important risk factors for ICVD in men [19], which was consistent with the conclusion from the current investigation. It has been reported that with every 10 mm Hg decrease in

systolic blood pressure, the risk of stroke and coronary heart disease were reduced by one-third and one-sixth respectively [15, 20]. The view has been widely accepted that dyslipidemia is one of the most important and independent risk factors for cerebral apoplexy, and with every 1 mmol/L decrease in total cholesterol level, the risk of coronary disease and cerebral apoplexy can be reduced by one-quarter [20]. The combined effect of multiple risk factors can increase the risk of cardiovascular disease, which was the reason we performed the early detection of the risk factors to prevent ICVD occurring, as indicated by the previously reported 1-year primary prevention and intervention in the community-based residents with moderate risk or above, such as control of blood pressure, blood lipid levels, and blood glucose level combined with lifestyle intervention [21]. After the 1-year intervention, the self-controlled trail showed that blood pressure and total cholesterol level decreased significantly, the difference being statistically significant.

Several prediction models of cardiovascular diseases showed that total cholesterol level and obesity are the important risk factors for ICVD [22]. Long-term smoking as the most important risk factor for cardiovascular disease can interfere with lipid metabolism. Moreover, smoking has been proven to be closely related to some malignant tumors and chronic respiratory diseases [23, 24]. All these risk factors should be noted by family physicians [25]. According to the Global adult tobacco survey (GATS) China 2010 country report, there were 3 million adult smokers (28.1%) in China, the smoking rate being 52.9% in men and 2.4% in women, with an inconspicuous decrease in the rate in recent years [26], which was consistent with our survey results. Our study showed that there were no significant changes in BMI and smoking rate before and after the 1-year intervention. Previous studies indicated that the risk factors for ICVD are related to unhealthy lifestyle, and that once the risk factors were present, there is little probability of returning to the normal levels [27]. All those results suggest the critical importance of conducting early community education on dietary balance, smoking cessation, regular exercise, weight control, psychological balance, etc. ICVD is a preventable disease; effective risk factor control can delay or prevent the development of atherosclerosis into clinical cardiovascular disease, and reduce both mortality and morbidity. When it comes to ICVD, prevention is more effective and economic than treatment [28].

Conclusion

In the past, our community intervention mainly involved senior citizens aged more than 65 years, most of them having already had ICVD or already developed related complications such as limb disabilities, dementia, and other disabilities. Our study showed that the risk of ICVD existed in the middle-aged residents in our community, some of whom needed intervention. These findings suggest that family physicians should focus on and strengthen early individual assessment in those asymptomatic residents. We suggest that the primary prevention of ICVD should be stricter, and the age range for the prevention should be lower, which should be considered as the major points of ICVD prevention in the community.

Limitations

As limitations, the sample size was not big enough in terms of the intervention, the results of the self-controlled trial could be used only as a preceding experiment for further community standard intervention studies, and the effect of smoking cessation intervention was not satisfactory because of a lack of supplementary smoking cessation medications in the community.

Conflict of interest

The authors declare no conflict of interest.

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