A Review of Cardiovascular Disease Risk Assessment and Communication Strategies for Primary Care Physicians (Post-print)

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Abstract

Cardiovascular diseases (CVDs) have become one of the leading causes of mortality globally and in China. With lifestyle changes and population aging, the prevalence of CVDs continues to rise, posing substantial challenges to public health. Primary care plays a vital role in the prevention and management of CVDs, with risk assessment and risk communication serving as core components. Primary care general practitioners conduct comprehensive evaluations of patients' health status. Leveraging their service characteristics of "first-contact, continuous, and accessible" care, they can dynamically monitor patient risk through long-term physician-patient relationships and achieve individualized risk assessment utilizing effective risk assessment tools (such as the China-PAR model, Framingham Risk Score, etc.). This primary care-based risk communication mechanism aligns with the "patient-centered" prevention strategies advocated by international guidelines from AHA and ESC, and through risk visualization, it facilitates health behavior modification and enhances medication adherence. However, primary care risk communication still faces multiple challenges. This paper examines the current status, applications, and challenges of primary care CVDs risk assessment and communication strategies, and proposes recommendations for improving primary care general practitioners' communication capabilities and implementation strategies, aiming to enhance CVDs prevention and control effectiveness through refined risk communication strategies, ultimately improving health management levels for primary care patients.

Full Text

Risk Assessment and Communication Strategies for Cardiovascular Diseases in Primary Care: A Review

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Abstract Cardiovascular diseases (CVDs) have become one of the leading causes of death globally and in China. With changes in lifestyle and an aging population, the prevalence of CVDs continues to rise, posing significant challenges to public health. Primary healthcare plays an important role in the prevention and management of CVDs, with risk assessment and risk communication being the core components. Grassroots general practitioners can dynamically track patient risks through long-term doctor-patient relationships by conducting comprehensive assessments of the patient's health status and utilizing effective risk assessment tools such as the China-PAR model and Framingham risk score to achieve personalized risk assessment, thanks to their service characteristics of "first visit, continuity, and accessibility". This grassroots risk communication mechanism is in line with the "patient-centered" prevention strategy advocated by international guidelines such as the American Heart Association (AHA) and the European Society of Cardiology (ESC). Through risk visualization, it helps change health behaviors and improve medication adherence. However, grassroots risk communication still faces multiple challenges. This article explores the current status, application, and challenges faced by risk assessment and communication strategies for grassroots CVDs, and proposes suggestions for improving the communication skills and implementation strategies of grassroots general practitioners. The aim is to refine risk communication strategies to enhance the prevention and control effectiveness of CVDs and ultimately improve the health management level of grassroots patients.

[**Key words**] Cardiovascular diseases; Risk assessment; Risk communication; General practitioners; Review; Editorial

1. Primary Prevention of Cardiovascular Diseases

Cardiovascular diseases have become one of the leading causes of death globally and in China. According to World Health Organization (WHO) data, approximately 17.9 million people die from CVDs annually, accounting for 32% of all deaths worldwide [1]. With population aging and lifestyle changes, the prevalence of CVDs in China continues to rise, with an estimated patient population exceeding 300 million and causing about 4 million deaths annually, making it the leading cause of death among urban and rural residents [2-3]. As a major public health challenge in China, CVDs require strengthened primary prevention, focusing on controlling major risk factors such as smoking, hypertension, dyslipidemia, and diabetes to reduce cardiovascular event risk [4]. Research shows that 40%-70% of the decline in CVD mortality can be attributed to effective control of these risk factors [5].

As the frontline force in CVD prevention and control, primary care general practitioners play a crucial role in the prevention and management of CVDs [6]. They not only undertake the tasks of screening and managing high-risk populations but also need to guide patients toward healthy lifestyles through effective communication while monitoring, diagnosing, and treating risk factors such as hypertension, dyslipidemia, and diabetes. Only by advocating healthy lifestyles throughout society and improving risk factor control among high-risk populations can we effectively reduce the incidence and mortality of CVDs.

2. The Role of Risk Communication in Cardiovascular Disease Prevention

Cardiovascular disease risk communication refers to the transmission of CVD risk information to individuals, communities, the public, or patients, and encouraging them to adopt effective preventive measures [7]. Risk communication plays a vital role in CVD prevention. Through effective risk communication, primary care general practitioners can not only help patients gain a deeper understanding of CVD risks but also promote accurate risk assessment, thereby assisting patients in making informed health management decisions. Research indicates that systematic risk communication, as an effective CVD intervention, can significantly improve clinical indicators of multiple core risk factors. In terms of biomedical indicators, systolic blood pressure (SBP) and diastolic blood pressure (DBP) achieved clinically meaningful reductions of 11.84 mmHg and 5.38 mmHg respectively ($P<0.01$), while random blood glucose levels decreased significantly from 143.36 mg/dL to 131.48 mg/dL, a reduction of 8.28% ($P=0.01$) [8]. Risk communication not only enhances patients' health management awareness but also effectively promotes lifestyle improvements. In secondary prevention of CVDs, risk communication also plays an important role. Studies show that patients in intervention groups who received risk communication and lifestyle interventions had adherence scores 1.63 points higher than control groups after follow-up (7.60 vs. 5.96, $P<0.01$), with the proportion of

high-adherence individuals (MMAS-8 $\geq$ 8) increasing by 24.2%, raising clinical medication adherence rates to 76.8%, thereby reducing the risk of cardiovascular event recurrence and all-cause mortality (intervention vs. control: 1.5% vs. 1.2%) [8]. This further demonstrates the positive role of risk communication in enhancing patient identification with treatment plans, improving medication adherence, helping prevent cardiovascular events, and reducing mortality. Additionally, risk identification enables patients to actively manage their health, allowing primary care general practitioners to optimize medical resource allocation based on risk levels, ensuring high-risk patients receive priority attention and more rational use of limited medical resources while avoiding waste [9-10]. In summary, CVD risk communication not only improves patient awareness of disease risks and promotes healthy behavior changes but also effectively enhances patient medication adherence, optimizes medical resource allocation, and ultimately significantly improves patient health status and quality of life.

3. Steps for Cardiovascular Disease Risk Communication

Effective CVD risk communication should follow a four-step process emphasizing personalization and patient participation [3,11]. First, by integrating clinical indicators such as age, gender, blood pressure, cholesterol levels, and smoking status, physicians quantify individual cardiovascular event probability using assessment models like China-PAR, Framingham, or PCE to provide a basis for subsequent decision-making. Second, general practitioners translate risk levels into specific numerical values to communicate with patients, combining risk factor analysis with preventive recommendations to help patients understand their health status and encourage lifestyle adjustments. Third, based on patient background, customized behavioral intervention strategies are developed, such as dietary optimization, exercise planning, and smoking cessation support, while explaining the necessity and potential side effects of pharmacotherapy to medium- and high-risk patients to enhance adherence. Finally, for high-risk groups, physicians and patients jointly develop personalized treatment plans that integrate medication regimens and lifestyle improvement goals, maximizing risk control and health management effectiveness through enhanced patient decision-making participation. The entire process follows a "assessment-education-intervention-decision" closed loop.

[Figure 1: see original paper] Risk communication process for cardiovascular diseases (CVDs)

4. Cardiovascular Disease Risk Assessment Tools

Common domestic and international CVD risk assessment tools, such as the Framingham Risk Score (FRS), Pooled Cohort Equations (PCE) model, and China-PAR model, provide scientific evidence for early identification and intervention of CVDs [12]. Foreign tools like Framingham Risk Score, SCORE, and QRISK are widely used in Europe and America, but since they were primarily

developed based on European and American population data, they may underestimate or overestimate risk in different ethnic groups, particularly requiring further validation and optimization for Asian populations. In contrast, domestic tools such as ICVD and China-PAR, developed based on specific Chinese population data, have stronger adaptability and better reflect CVD risk characteristics in Chinese populations. For example, in the Chinese Electronic Health Records Research in Yinzhou (CHERRY) cohort, the China-PAR model demonstrated outstanding performance in health benefits, while the WHO model with fewer predictive variables showed greater efficiency [13]. Therefore, although risk assessment-based intervention strategies have considerable application potential in developed regions of China, they still require further optimization and validation to adapt to broader populations and clinical needs. However, these tools still face certain challenges in widespread promotion and application, particularly regarding regional differences, uneven distribution of medical resources, and data updating and improvement, which urgently require continuous optimization and validation.

Widely used risk assessment tools for cardiovascular diseases (CVDs)

5. Advantages of Primary Care General Practitioners in Cardiovascular Risk Communication

Primary care general practitioners play a crucial role in CVD risk communication, particularly in the primary healthcare environment, with irreplaceable advantages including [17,21-22]:

5.1 Long-term Doctor-Patient Relationships and Personalized Intervention

Primary care general practitioners establish long-term and stable doctor-patient relationships, enabling them to dynamically track patients' physiological indicators (blood pressure/blood glucose/lipids), behavioral patterns (exercise, diet, tobacco and alcohol use), and social backgrounds (economic, educational, family support) through long-term follow-up, allowing precise identification of high-risk populations and design of individualized prevention and control programs (such as risk stratification and exercise prescriptions).

5.2 Comprehensive Health Management and Socioeconomic Assessment

Primary care general practitioners are responsible not only for cardiovascular risk assessment but also for providing comprehensive health management programs. They help patients adjust lifestyles, improve dietary structures, increase physical activity, control weight, quit smoking and limit alcohol consumption, and maintain mental health. These lifestyle improvements help reduce patients' cardiovascular risk (such as risk factors including hypertension, diabetes, and hypercholesterolemia). Additionally, the occurrence of cardiovascular diseases

is closely related to patients' socioeconomic status. Through assessment of patients' economic conditions, cultural backgrounds, and education levels, general practitioners can develop more practical intervention strategies based on actual circumstances. For low-income or economically disadvantaged patients, general practitioners can recommend low-cost health management programs and coordinate community resources (such as community health services and public health programs) to help patients overcome economic and social barriers in treatment. Through this personalized socioeconomic assessment and adjustment, physicians can effectively improve patient treatment adherence and disease management outcomes.

5.3 Multidisciplinary Collaboration and Continuous Management

The management of CVDs requires close multidisciplinary collaboration. Primary care general practitioners should establish collaborative relationships with cardiovascular specialists, nutritionists, psychologists, and other professionals to provide comprehensive health management services for patients. For CVDs with multiple risk factors (hypertension + diabetes, etc.): coordinate with specialists for definitive diagnosis and feedback on medication recommendations, with primary care performing long-term monitoring; regularly assess intervention effectiveness (such as carotid ultrasound re-examinations) and gradually adjust medication dosages and non-pharmacological intervention intensity. Additionally, future intelligent ASCVD risk assessment tool development provides innovative support at the technical level. For example, some currently used tools in certain regions can automatically extract system information and generate assessment reports, helping physicians provide individualized treatment recommendations and improve patient compliance. These tools are expected to be promoted nationwide, further advancing chronic disease prevention strategies and Healthy China initiatives, providing more precise and efficient support for clinicians and patients [25].

5.4 Doctor-Patient Consensus to Improve Compliance

Primary care general practitioners use risk visualization communication (such as 10-year incidence probability models) combined with patients' personal information to translate professional terminology into patients' cognitive frameworks, reducing "risk underestimation" or "treatment panic." Through risk visualization communication, they help patients understand risks and motivate them to actively participate in health management, thereby improving treatment adherence and quality of life. They can also develop tiered explanation programs for patients with different educational backgrounds (such as using a "traffic light" risk identification method for patients with low literacy). Additionally, introducing motivational interviewing techniques and training physicians to guide patients in actively identifying risk factors through open-ended questions (such as having smokers spontaneously state their motivation to quit) enhances patient participation.

6. Strategies to Improve Primary Care General Practitioners' Risk Communication Skills and Community Implementation

Primary care general practitioners in China play an extremely important role in CVD risk communication, particularly within the primary healthcare system [23]. To enhance their capabilities and effectiveness in CVD risk communication, we must focus not only on individual professional competence but also on translating these abilities into specific community implementation strategies to ultimately achieve CVD prevention across broad populations and deliver long-term health benefits. To this end, we propose the following recommendations:

6.1 Strengthen Professional Training and Application of Risk Assessment Tools for Primary Care General Practitioners

To improve primary care general practitioners' capabilities in CVD risk assessment, we must first strengthen their professional training to ensure they master fundamental CVD knowledge and risk assessment tools (such as China-PAR model and Framingham Risk Score) [12]. The China-PAR model is particularly suitable for Chinese populations, combining Chinese epidemiological data to accurately assess individual CVD risk. Primary care general practitioners should master these tools proficiently to ensure accurate assessment results and conduct personalized risk assessments based on patients' lifestyles and social backgrounds, providing precise health intervention recommendations to improve CVD prevention effectiveness [24]. Furthermore, future intelligent ASCVD risk assessment tool development provides innovative support. For example, some currently used tools can automatically extract system information and generate assessment reports, helping physicians provide individualized treatment recommendations and improve patient compliance. These tools are expected to be promoted nationwide, further advancing chronic disease prevention strategies and Healthy China initiatives, providing more precise and efficient support for clinicians and patients [25]. We can gradually implement tiered training programs, enabling primary care general practitioners to proficiently use intelligent terminals for rapid data entry, master AI-assisted tools, optimize risk assessment through machine learning, while remaining vigilant about tool dependency risks. Physicians should complete monthly online-offline dual-mode assessment consistency tests to ensure effective interaction between intelligent tools and clinical judgment.

6.2 Improve Communication Skills and Focus on Patient Psychological Counseling

CVD risk assessment and communication is not only a process of information transmission but also involves emotional exchange. Primary care general practitioners should use language easily understood by patients, help them eliminate negative emotions such as anxiety and fear, establish trust relationships

through care and effective listening, and encourage patients to change unhealthy lifestyles through psychological counseling. Simultaneously, developing visual risk explanation tools enables primary care general practitioners to use charts and other visual aids to demonstrate curve changes in adverse event incidence rates over 10 years with blood pressure control, facilitating patients' intuitive understanding of risks and motivating their active participation in health management, thereby improving treatment adherence and quality of life. They can also develop tiered explanation programs for patients with different educational backgrounds (such as using a "traffic light" risk identification method for patients with low literacy). Additionally, introducing motivational interviewing techniques and training physicians to guide patients in actively identifying risk factors through open-ended questions (such as having smokers spontaneously state their motivation to quit) enhances patient participation.

6.3 Strengthen Multidisciplinary Collaboration and Comprehensive Health Management

The management of CVDs requires close multidisciplinary collaboration. Primary care general practitioners should establish collaborative relationships with cardiovascular specialists, nutritionists, psychologists, and other professionals to provide comprehensive health management services for patients. They should promptly identify high-risk patients and collaborate with relevant specialists to ensure patients receive professional treatment. Additionally, primary care general practitioners should develop personalized health management plans based on patients' specific conditions to improve treatment adherence and quality of life, ensuring multidisciplinary collaboration provides patients with comprehensive treatment and management.

6.4 Utilize Telemedicine and Community Support to Promote Health Management

With the development of information technology, promoting deep integration of smart wearable devices with primary healthcare enables primary care general practitioners to use telemedicine platforms and mobile health applications to monitor patients' health status in real-time, promptly identifying potential cardiovascular risk factors. Combined online and offline comprehensive management models can overcome geographical and time limitations, increase interaction between primary care general practitioners and patients, popularize knowledge about CVD risk factors and prevention, and achieve widespread CVD prevention and management with the support of community health. In future primary healthcare, risk communication strategies can be further refined, particularly for risk management in specific populations. Using diabetic patients as an example, targeted communication can be conducted by combining cardiovascular risk. Through concise language and specific cases, physicians can help patients understand the close relationship between diabetes and CVDs, and guide them to actively change lifestyles, particularly in diet control, exercise,

and medication adherence. This helps ensure diabetic patients can effectively control blood glucose while reducing the risk of cardiovascular events.

CVDs, as a major health threat globally and in China, urgently require strengthened prevention and intervention in primary healthcare. Primary care general practitioners have an irreplaceable role in CVD risk assessment and communication, particularly in early identification and intervention. By using risk assessment tools and personalized communication strategies, they help patients better understand CVD risks and actively change unhealthy lifestyles, thereby effectively reducing cardiovascular event incidence. Furthermore, strengthening professional training, communication skills, and multidisciplinary collaboration among primary care general practitioners is crucial for improving primary healthcare service quality. With the improvement of information technology application and community health management systems, CVD risk communication strategies in primary healthcare will become more refined and diversified, particularly in risk management for specific populations (such as diabetic patients), where personalized communication strategies can further improve treatment adherence and health management outcomes. The active involvement of primary care general practitioners can not only improve patients' health status and quality of life but also effectively reduce the socioeconomic burden of CVDs, contributing significantly to CVD prevention and health management in China.

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