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A Study on Stroke Screening and Health Intervention for Residents in the Yellow River Delta (Binzhou) Region

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Abstract: *This study focuses on the implementation effect of stroke screening and health intervention for residents in the Yellow River Delta (Binzhou) region. Through the comprehensive use of cross-sectional surveys and intervention experiments, a comprehensive stroke risk assessment was conducted for residents in the region, and targeted health intervention measures were implemented. The study found that the proportion of residents at high risk of stroke in this area is relatively high, and they are mainly concentrated in the middle-aged and elderly groups, most of whom are accompanied by chronic diseases such as hypertension and diabetes. After a series of lifestyle adjustments, medication treatment, and comprehensive psychological health support interventions, the stroke risk factors of the intervention group residents were significantly improved, physiological indicators such as blood pressure and blood sugar were significantly reduced, and the lifestyle tended towards health. The psychological health status also improved. This achievement not only validates the effectiveness of early screening and targeted intervention in stroke prevention, but also provides valuable practical experience and scientific basis for the Yellow River Delta and similar areas. This study emphasizes that strengthening stroke screening, developing personalized intervention plans, enhancing health education and publicity, and establishing a sound follow-up management mechanism are key measures to reduce stroke risk and improve residents' health levels.*

Keywords: *Yellow River Delta; Stroke screening; Health intervention; Risk factors; Resident Health*

1. Introduction

The Yellow River Delta (Binzhou) region is located along the northeast coast of Shandong Province. In recent years, with the aging population structure and changes in lifestyle, stroke has become a major health issue facing this region. The brain is a disease that causes damage to brain tissue due to sudden rupture of blood vessels or blockage of blood vessels that prevent blood from flowing into the brain. It has the characteristics of rapid onset, fast progression, high disability and mortality rates. In the Yellow River Delta, with the intensification of the aging trend of the population, the incidence rate of basic diseases such as hypertension and diabetes is also increasing year by year, which are important incentives for stroke. Meanwhile, lifestyle changes such as high-fat diet and lack of exercise also increase the risk of stroke. According to statistics, stroke has become one of the main threats to the health of residents in the Yellow River Delta region[1]. The characteristics of high incidence rate, high disability rate and high mortality rate make stroke not only pose a serious threat to personal health, but also bring heavy economic and psychological burden to families and society. Therefore, it is particularly urgent to carry out stroke screening and health intervention research.

The purpose of stroke screening is to identify high-risk individuals for stroke early and provide them with timely prevention and treatment recommendations[2]. Through screening, basic diseases such as hypertension and diabetes can be found and controlled in time to reduce the risk of stroke. Meanwhile, for patients who have already experienced stroke events, screening can also help evaluate their recovery status and prevent the occurrence of secondary stroke. Health intervention is aimed at providing personalized health management plans for residents based on screening results. This includes lifestyle adjustments such as a balanced diet, moderate exercise, and necessary medication treatment. Health intervention can effectively reduce the incidence rate and recurrence rate of stroke and improve the quality of life of residents. Conducting resident stroke screening and health intervention research in the Yellow River Delta region not only helps improve the health level of local residents, but also

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provides important basis for the government to formulate public health policies. Through scientific screening and intervention methods, we can better prevent and control stroke, contributing to the construction of a healthy and harmonious society.

2. Research status

Significant achievements have been made in global research on stroke screening and health interventions. In foreign countries, multiple studies have successfully identified high-risk populations for stroke through comprehensive screening strategies and implemented effective intervention measures for them. These measures include improving lifestyle, controlling risk factors, providing early treatment, etc., thus significantly reducing the incidence rate and mortality of stroke. For example, a study screened and controlled stroke risk factors such as hypertension and diabetes, making the incidence rate of stroke in the experimental group significantly lower than that in the control group[3].

The importance of stroke screening and health management in China is also constantly increasing. Multiple regions and institutions have launched stroke screening programs, dedicated to early detection and treatment of potential patients. Although certain achievements have been made, in-depth research on specific regions and populations is still insufficient. The Yellow River Delta (Binzhou) region, as an important area for China's economic and social development, has unique and representative health conditions for its residents. Therefore, conducting stroke screening and health intervention research on residents in the region not only helps to fill the current research gap, but also provides more accurate and scientific basis for stroke prevention and control work[4].

Domestic and foreign studies have also shown that the effectiveness of stroke screening and health interventions is influenced by multiple factors, including the accuracy of screening methods, the specificity of intervention measures, and patient compliance. Therefore, when conducting stroke screening and health intervention research for residents in the Yellow River Delta region, it is necessary to comprehensively consider these factors and develop scientifically reasonable screening plans and intervention measures to ensure the effectiveness and practicality of the research[5].

Significant progress has been made in research on stroke screening and health interventions both domestically and internationally, but there is still a problem of insufficient research targeting specific regions and populations. The purpose of this study is to provide scientific basis and practical guidance for reducing the incidence rate, disability and mortality of stroke in the Yellow River Delta (Binzhou) area through in-depth analysis of the incidence and high-risk factors of stroke among residents, and to develop effective screening strategies and intervention measures[6]. At the same time, this study will also provide useful references and inspirations for other regions to carry out similar work.

In order to gain a more comprehensive understanding of the latest research progress in stroke screening and health interventions both domestically and internationally, this study will also conduct in-depth analysis and review of relevant literature to ensure the forefront and innovation of the research[7]. By continuously summarizing and drawing on advanced experiences and practices at home and abroad, we believe that we can make positive contributions to stroke prevention and control in the Yellow River Delta region and even wider areas.

3. Materials and methods

This article combines two methods: cross-sectional survey and intervention experiment, and implements stroke screening and health intervention for residents in the Yellow River Delta (Binzhou) area. In the cross-sectional survey, we extensively collected stroke related data and health information from residents in the area to comprehensively understand the incidence of stroke and related risk factors. At the same time, based on the survey results, we designed a targeted health intervention strategy and verified its effectiveness through experiments [8].

Our innovation lies mainly in the following aspects: firstly, we have tailored a stroke screening program based on the geographical, economic, and cultural characteristics of the Yellow River Delta region. This plan not only considers the unique factors such as the lifestyle and dietary habits of the residents in the area, but also fully draws on advanced screening techniques and experiences from both domestic and foreign sources. Second, we have developed an effective health intervention strategy, which focuses on stroke prevention and combines health education, lifestyle guidance, medical resource allocation and other measures to reduce the incidence rate of stroke and improve the health

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level of residents. Through empirical research, we have verified the positive effects of this strategy in reducing stroke risk and improving residents' health literacy.

This study also constructed a theoretical framework for stroke screening and health intervention, which not only provides theoretical support for this study, but also provides reference and inspiration for subsequent related research. Our theoretical framework integrates knowledge from multiple disciplines such as epidemiology, health education, and public health, aiming to provide a comprehensive and systematic perspective to examine and address stroke prevention and control issues.

In the implementation process, we pay special attention to the collection and analysis of data. Through scientific data processing methods, we ensure the accuracy and reliability of our research results. At the same time, we have fully considered ethical and privacy issues to ensure the security of personal information for all participants. This study has achieved significant results in stroke screening and health intervention. We not only designed an effective screening program and intervention strategy based on regional characteristics, but also verified its effectiveness through empirical research. These achievements are of great significance for promoting stroke prevention and control in the Yellow River Delta region and even wider areas. In the future, we will continue to deepen research in this field and contribute more to improving residents' health levels and promoting the development of public health.

3.1 Stroke screening methods

Stroke screening is an important part of preventing and controlling the incidence of stroke, with various methods to ensure comprehensive and accurate identification of potential high-risk populations. These screening methods mainly include questionnaire surveys, physical examinations, laboratory tests, and imaging examinations.

In terms of questionnaire surveys, detailed questions covering personal basic information, lifestyle, medical history, family history, etc. are designed to assess an individual's stroke risk. This approach helps to preliminarily screen out individuals who may have stroke risk factors, providing a basis for further examination in the future.

Physical examination is a comprehensive evaluation of an individual's physiological condition through observation, palpation, auscultation, and other methods. This includes the examination of basic vital signs such as blood pressure, heart rate, and heart rhythm, as well as a preliminary assessment of neurological function. These tests help identify potential physiological abnormalities and determine whether there is a risk of stroke.

Laboratory tests play an important role in stroke screening. By collecting blood samples for biochemical analysis, the levels of key indicators such as blood glucose, blood lipids, and homocysteine in individuals can be understood. These indicators are closely related to the risk of stroke, so laboratory tests are of great significance for accurately assessing stroke risk. For example, hypertension is one of the important risk factors for stroke, and regular blood pressure measurement can timely detect and control hypertension, thereby reducing the risk of stroke. At the same time, high blood sugar and high blood lipids are also risk factors for stroke, and these abnormalities can be detected and intervened in a timely manner through blood sugar testing and blood lipid analysis.

Imaging examinations also play an important role in stroke screening. With the help of advanced medical equipment such as ultrasound, CT, MRI, etc., a comprehensive assessment of an individual's intracranial vascular condition can be conducted. These examinations can detect abnormal conditions such as vascular stenosis and plaque formation, providing strong support for the prevention and treatment of stroke. Especially neck vascular ultrasound examination, as a non-invasive and convenient examination method, is of great significance for early detection of carotid plaques and stenosis.

The methods and techniques for stroke screening cover multiple aspects such as questionnaire surveys, physical examinations, laboratory tests, and imaging examinations. The comprehensive application of these methods can comprehensively and accurately assess an individual's stroke risk, providing strong support for subsequent prevention and treatment. In practical operation, appropriate screening methods should be selected based on individual circumstances and needs to ensure the accuracy and reliability of screening results. Meanwhile, with the continuous advancement and development of medical technology, the methods and techniques for stroke screening in the future will also be constantly updated and improved, providing more effective means for stroke prevention and control.

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3.2 Health intervention strategies and measures

Effective health intervention strategies play a crucial role in stroke prevention and control. These strategies typically cover two aspects: lifestyle interventions and medication interventions. Lifestyle interventions focus on adjusting and improving individuals' unhealthy habits and behaviors in daily life, while medication interventions mainly target diagnosed patients and control disease progression through medical means.

In terms of lifestyle intervention, the focus is on managing and controlling modifiable risk factors. Hypertension, hyperglycemia, and hyperlipidemia are the three major controllable risk factors for stroke, and effective management of these factors can significantly reduce the risk of stroke. Through health education activities, knowledge about these risk factors can be disseminated to residents, enabling them to understand how to improve their health by adjusting their dietary habits, increasing physical exercise, and other means. For example, promoting a low salt, low-fat, and low sugar diet structure, encouraging residents to consume more fresh fruits, vegetables, and whole grain foods, and reducing the intake of saturated fat and cholesterol. At the same time, regular monitoring of blood pressure, blood glucose, and blood lipids is also essential to timely detect and control abnormal changes in these risk factors.

In addition to the metabolic risk factors mentioned above, smoking and excessive alcohol consumption is also important factors that increase the risk of stroke. Therefore, quitting smoking and limiting alcohol consumption should be important components of health interventions. By providing smoking cessation counseling, psychological support and supervision, as well as conducting health education on the dangers of alcohol, residents can be helped to quit these bad habits, thereby reducing the probability of stroke.

In terms of drug intervention, it is mainly aimed at patients who have been diagnosed with chronic diseases such as hypertension and diabetes. These patients need to use antihypertensive and hypoglycemic drugs in a standardized manner under the guidance of a doctor to control the progression of the disease and reduce the risk of stroke. Regular follow-up and monitoring of drug efficacy and side effects are crucial to ensure maximum treatment effectiveness and reduce the occurrence of adverse reactions.

Psychological health intervention cannot be ignored in stroke prevention. Long term psychological stress and negative emotions can have adverse effects on physical health and increase the risk of stroke. Therefore, providing psychological counseling and support services to help residents effectively cope with stress and improve their emotional state is of great significance for reducing the incidence of stroke. This can be achieved through conducting mental health lectures, providing individual or group psychological counseling services, and other means.

Health intervention strategies play a crucial role in stroke prevention and control. By integrating lifestyle and medication interventions, combined with psychological health interventions, we can more effectively reduce stroke risk and improve the overall health level of residents.

3.3 Construction of stroke screening and health intervention framework

A clear and practical theoretical framework is of great significance in guiding practical work in the field of stroke screening and health intervention. This article studies the theoretical framework of stroke screening and health intervention based on three core links: risk factor identification, health intervention implementation, and effectiveness evaluation feedback. The aim is to provide scientific and systematic health management guidance for residents in the Yellow River Delta (Binzhou) region.

The identification of risk factors is the starting point of the theoretical framework and the key to screening work. By utilizing various methods such as questionnaire surveys, physical examinations, laboratory tests, and imaging examinations, we can comprehensively and accurately identify high-risk populations for stroke. During this process, the detection of biochemical indicators such as blood pressure, blood glucose, and blood lipids, as well as the application of imaging technologies such as neck vascular ultrasound, provide us with rich data support, which helps to timely detect potential stroke risks.

The implementation of health interventions is to develop and implement personalized intervention measures for identified high-risk populations. In this stage, we focus on the organic combination of lifestyle intervention and medication intervention. Through health education, dietary guidance, exercise

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and other methods, guide residents to change their unhealthy habits and reduce the level of controllable risk factors. At the same time, for patients with chronic diseases such as hypertension and diabetes that have been diagnosed, we emphasize standardized drug use to control the progress of the disease and reduce the risk of stroke. In addition, we also pay attention to the mental health status of residents, and through psychological counseling and support, help them reduce their psychological burden and improve their quality of life.

Effect evaluation feedback is a closed-loop link in the theoretical framework, aimed at evaluating the effectiveness of health interventions and continuously adjusting and improving intervention strategies based on feedback results. Through regular follow-up, data collection, and analysis, we can timely understand the actual effectiveness of intervention measures and the improvement of residents' health status. These feedback information not only provide us with valuable practical experience, but also provide scientific basis for the formulation of subsequent intervention strategies.

The theoretical framework of "risk factor identification health intervention implementation effectiveness evaluation feedback" constructed in this article fully reflects the systematic, scientific, and practical nature of stroke screening and health intervention work. This theoretical framework not only provides strong theoretical support for stroke prevention and control work for residents in the Yellow River Delta (Binzhou) region, but also provides useful reference and inspiration for other regions to carry out similar work.

4. Results

4.1 Analysis of stroke screening results

The results of stroke screening conducted in the Yellow River Delta (Binzhou) area show that the proportion of high-risk groups of stroke in this area is relatively high, which may be related to the aging trend of the population, residents' living habits, chronic disease incidence rate and other factors in this area. At the same time, the screening results also revealed certain regional distribution differences, which may be related to factors such as the level of economic development, allocation of medical resources, and residents' health awareness in different regions. This study selected a total of 15683 individuals in the community from 2022 to 2024 as the survey subjects. Among them, 7972 males accounted for 50.83%, and 7711 females accounted for 49.17%. Age distribution: The number of people aged 50-59 is the highest (6962, 44.46%), followed by those aged 60-69 (6553, 41.78%), and the number of people aged ≥ 70 is the lowest (2168, 13.82%). There are 14142 Han people and 1562 people from other ethnic groups. The highest number of students have a primary school education or below (7233, 46.12%), a primary to high school education (6956, 44.35%), and the lowest number have a college/university education or above (1494, 9.53%). According to the stroke risk rating grouping criteria, it is divided into two groups based on whether it is high-risk: high-risk group and non high risk group. Research has shown that the proportion of high-risk individuals in males is higher than that in females ($X2=902.488$, $P<0.001$), and there are statistically significant differences in the proportion of high-risk individuals at different ages. The proportion of high-risk individuals increases with age ($X2=353.277$, $P<0.001$), and there are statistically significant differences in the proportion of high-risk individuals between groups with different levels of education. The proportion of high-risk individuals decreases with increasing levels of education ($X2=75.33$, $P<0.001$).

Further analysis revealed that most high-risk individuals have a history of chronic diseases such as hypertension and hyperglycemia. This suggests that in health interventions targeting high-risk stroke populations, we should focus on middle-aged and elderly populations and strengthen the management and control of their chronic diseases. In addition, neck vascular ultrasound examination, as an effective screening method, has found varying degrees of vascular stenosis or plaque formation abnormalities in some high-risk populations, further confirming their high-risk status. The early detection of these abnormal situations provides important basis for timely and effective intervention measures.

In response to the above screening results, we need to conduct in-depth analysis of the underlying reasons and influencing factors in order to provide scientific basis for developing more precise and effective health intervention strategies. At the same time, we should strengthen health promotion and education for residents, enhance their awareness of stroke risk and self-care consciousness, so as to better prevent and control the occurrence of stroke. In future research, we can further explore how to combine advanced screening techniques with health intervention strategies to improve the effectiveness and efficiency of stroke prevention and control.

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4.2 Evaluation of health intervention effectiveness

In the evaluation of the effectiveness of health interventions, this study focuses on the improvement of stroke risk factors among residents in the intervention group. By comparing and analyzing the data before and after the intervention, we found that the stroke risk factors of the intervention group residents were significantly improved.

In terms of physiological indicators, the intervention group residents showed a significant decrease in average blood pressure and blood glucose levels. This change not only reflects the effectiveness of health interventions, but also indicates a reduction in the risk of stroke among residents in the future. Blood pressure and blood sugar are important risk factors for stroke, and through effective intervention measures, we have successfully helped residents control these indicators, safeguarding their health.

In terms of lifestyle, the dietary structure of the intervention group residents has become more reasonable, and exercise has become increasingly regular. These changes have positive implications for preventing stroke. Reasonable diet and moderate exercise are important factors in maintaining physical health. Through health interventions, we have successfully guided residents to develop good living habits, which will undoubtedly have a profound impact on their health status.

We have also achieved significant results in terms of mental health. The psychological burden of residents in the intervention group was significantly reduced, and their quality of life was significantly improved. Psychological health is an important component of physical health. By providing psychological counseling and support, we help residents relieve stress, improve their psychological state, and further reduce the risk of stroke.

We also compared and analyzed the intervention effects between the low-risk group and the high-risk group. The results showed that the improvement in the high-risk group was more significant. This discovery suggests that health interventions targeting high-risk populations are more targeted and effective. By providing personalized intervention plans for high-risk populations, we can more effectively reduce their risk of stroke and improve their quality of life.

The health intervention in this study has achieved significant results. We not only successfully improved the physiological indicators, lifestyle, and mental health status of the intervention group residents, but also verified the importance and effectiveness of health interventions for high-risk populations through comparative analysis. These achievements provide strong support for us to further promote stroke screening and health intervention in the Yellow River Delta region in the future.

5. Discussion

This study achieved significant results in resident stroke screening and health intervention in the Yellow River Delta (Binzhou) region, further confirming the importance of early screening and targeted intervention in stroke prevention. Through in-depth analysis of screening data, we found that the high-risk population for stroke is mainly concentrated in the middle-aged and elderly population, and is often accompanied by a history of chronic diseases, which is consistent with the conclusions of relevant research at home and abroad. We have implemented comprehensive health interventions for these high-risk groups, including lifestyle adjustments, medication treatment, and mental health support. After a period of intervention, we observed a significant improvement in stroke risk factors among residents in the intervention group. Not only have their physiological indicators decreased, but more importantly, their lifestyle and mental health have also significantly improved. This result fully demonstrates the effectiveness and necessity of health interventions. Any research has its limitations, and this study is no exception[9]. Firstly, due to resource constraints such as time, manpower, and material resources, our sample size is relatively small and the geographical distribution is not wide enough, which may have some impact on the universality of the results. In order to more comprehensively reflect the stroke risk situation of residents in the Yellow River Delta region, future research needs to further expand the sample size and cover a wider geographical range. This study mainly focuses on the short-term effects of health interventions, and the evaluation of long-term effects is still insufficient. Therefore, in the future, we will strengthen long-term tracking and follow-up work to more accurately evaluate the long-term effects and sustainability of health interventions. This will help us gain a deeper understanding of the dynamic changes in stroke risk and provide strong support for developing more scientifically effective intervention strategies[10]. This study provides useful exploration and practical experience for stroke prevention and control among residents in the Yellow River Delta (Binzhou) region. By constantly improving research methods and expanding research scope, we are expected to make greater contributions to reducing the incidence rate of stroke and improving the health level of residents in this area.

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6. Conclusion

This study conducted in-depth analysis and empirical research on stroke screening and health intervention among residents in the Yellow River Delta (Binzhou) region, and obtained a series of practical guidance results. Based on these findings, we propose the following suggestions and practical guidance plans, aiming to provide reference for stroke prevention and control work in the region and even wider areas[11].

We emphasize the importance of strengthening stroke screening work. By expanding screening coverage, not only can more high-risk stroke populations be identified in a timely manner, but more precise target groups can also be provided for subsequent health interventions. Meanwhile, improving the accuracy and timeliness of screening is also crucial, which requires relevant departments to continuously optimize the screening process and methods to ensure that every resident can receive timely and accurate screening services. Developing personalized health intervention plans is crucial. There are differences in stroke risk factors among individuals, therefore, implementing personalized intervention measures for different high-risk populations will be more effective. This includes but is not limited to customized dietary plans, exercise routines, and necessary medication treatments. Furthermore, strengthening health education and promotion is also an important measure to reduce the risk of stroke. By increasing residents' awareness and importance of stroke prevention and control, they can be guided to actively participate in health interventions, thereby forming good self-management habits. In addition, health education can help residents identify and correct unhealthy lifestyles, further reducing the risk of stroke. In addition, to ensure the sustainability and stability of health intervention effects, it is essential to establish a sound follow-up management mechanism. Through regular follow-up and evaluation, problems that arise during the intervention process can be identified and resolved in a timely manner, ensuring that the intervention measures can continue to be effective.。

Author contributions

All authors have designed the study, developed the methodology, performed the analysis, and written the manuscript. All authors have read and agreed to the published version of the manuscript.

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