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Exploring Public Health Strategies Related to Chronic Diseases: Taking Type 2 Diabetes As an Example

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Abstract: As life becomes better and food becomes more abundant, the number of people with some nutritional and chronic diseases is also rising. In order to enhance people's health status, China, the nation with the highest number of diabetics worldwide, needs to identify the best disease prevention and control procedure within the "prevention-health care-treatment-diagnosis-rehabilitation" cycle of the health management system. Population-based public health should dominate here. In today's era of big data, China has opened a smart health management system that is "combined with science and technology", gradually improving the informatization and intelligence level of chronic disease detection and management, so as to empower the health management cycle. In current studies, not enough attention has been paid to disease prevention and control. Taking type 2 diabetes mellitus as an example, this paper discusses the public health strategies related to chronic diseases based on the analysis of literature research survey data, summarizes the public health policies related to diseases at home and abroad, puts the policy methods and importance of disease prevention and control under the objective data test, analyzes its limitations, and helps to optimize the measures in the future.

Keywords: T2DM, public health, food nutrition and hygiene

1. Introduction

The issues of "not enough to eat" and "not warm to wear" are no longer concerns for individuals due to society's ongoing development, but because of the better life and the increasingly various types of food, the number of some nutritional diseases and chronic diseases has also increased. The National Cancer Center, the National Center for Cardiovascular Diseases, and the report on the status of nutrition and chronic diseases of Chinese residents (2020) were developed based on the findings of the National Health Commission's new round of chronic disease and nutrition monitoring of Chinese residents, which was coordinated by the Chinese Center for Disease Control and Prevention. With central cerebrovascular illnesses, cancer, and chronic respiratory diseases accounting for 80.7% of deaths, chronic disease-related causes accounted for 88.5% of China's total deaths in 2019. Overweight and obesity affect more than half of adults in both urban and rural settings, and they are more common in children and adolescents aged 6-17 and younger than 6 years old (19% and 10.4%, respectively). These rates are rising across all age groups. Compared to 2015, chronic obstructive lung disease, diabetes, high blood pressure, high cholesterol, and cancer have all become more common.[1].

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In today's society, people's discussions on nutrition and chronic diseases mostly come from how to treat them, focusing on controlling the disease by regulating the diet and dispensing various drugs after the disease. However, in the prevention-care-treatment-diagnosis-rehabilitation health management system cycle, there is not enough attention are paid to the prevention and control of diseases, which are of high importance. So how to use public health strategies improve the situation in order to reduce the incidence of chronic diseases effectively is crucial. The discussion of these issues has great significance for disease prevention and public health management.

Taking type 2 diabetes mellitus (T2DM) as an example, this study discussed the public health strategies related to chronic diseases based on the analysis of literature research survey data, summarized the public health policies related to diseases at home and abroad, and put the policy methods and importance of disease prevention and control under the objective data test.

This study will analyze the existing public health strategies in detail, classify and discuss the risk factors of type 2 diabetes and their appropriate prevention and management policies, and analyze their limitations and optimization measures.

2. Pathogenesis of T2DM

2.1. Genetic factors

T2DM has multiple etiological factors that collectively contribute to the development of diabetes in individuals. The pathogenesis of T2DM often stems from impaired glucose regulation and increased metabolic disorders caused by unsafe and unhealthy environmental and dietary factors. However, depending on their genetic background, people have different capacities for metabolizing poisons. The CP2C gene family is involved in the genetic components of diabetes and may be a prospective target for cancer treatment. It is essential for cell proliferation, cell cycle, and differentiation, including hematopoiesis, immunological response, and neurodevelopment. Important members of the CYP2C family, CYP2C8 and CYP2C9, have polymorphisms that can influence a person's vulnerability to a number of metabolic diseases and some types of cancer [2]:The CP2C gene is generally ubiquitously expressed at low levels, yet it is prominently expressed in specific cancers and has been implicated as a para-oncogene in oncogenic addiction in cancer cells [3]. On the other hand, the epigenome of human tissues is also impacted by non-genetic risk factors for type 2 diabetes, including age, a poor diet, and physical inactivity. According to data from certain researchers, epigenetics plays a major part in the pathophysiology of T2DM. In skeletal muscle, adipose tissue, liver, and islets, T2DM patients' DNA methylation and gene expression differ from those of non-diabetic controls, according to numerous research. When comparing T2DM patients to non-diabetic controls, they discovered differences in DNA methylation and gene expression in the skeletal muscle, adipose tissue, liver, and pancreatic islets [4]. In recent years, researchers have conducted studies on the calculation, prediction, outcomes, and applications of genetic risk scores (GRS) to reduce the incidence of T2DM via early detection of high-risk groups and the application of efficient therapies [5]. Combining genetic factors with traditional clinical risk factors can also provide ideas for future individualized and precise prevention of T2DM. However, while the use of GRS improves the prediction of T2DM, their predictive utility is lower compared to non-genetic factors [6].

2.2. Environmental factors

Unhealthy environments can further lead to the development of diabetes. The environment includes not only the natural surroundings of an individual but also the economic environment they are in. Factors such as aging, lifestyle, whether there is excess nutrition, whether there is sufficient physical activity, the intrauterine environment and stress, chemical toxins, etc., need to be considered. Some researchers believe that "high urbanization" is an important factor in the increased risk of diabetes:

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on one hand, the air and chemical pollution it brings can increase the likelihood of endothelial dysfunction, inflammation, and insulin resistance; traffic noise can suppress insulin secretion and reduce peripheral insulin sensitivity; the heat island effect caused by high urbanization can lead to poorer glucose metabolism and reduced brown adipose tissue; increased nighttime lighting may also cause blood glucose levels to rise. In addition, sedentary habits associated with poor economic conditions may lead to long-term life stress, and over time, the body may develop inflammatory responses that further increase the risk of diabetes [7].

2.3. Nutritional/dietary factors

The main factor causing T2DM is nutritional factors. Imbalanced and discordant nutrition, as well as unhealthy lifestyles, are the primary causes of diabetes, hence nutritional therapy is the foundation of diabetes treatment and will be passed throughout the entire treatment process. Nutritional therapy plays a significant role in achieving blood glucose, blood pressure, and lipid control targets, maintaining target body weight, and preventing or delaying diabetic complications.

2.3.1. Elderly patients

For the elderly patient population, it is essential to assess the nutritional status of elderly diabetic patients and use nutritional screening tools to identify patients' nutritional risks. Since malnutrition in elderly patients can lead to prolonged hospital stays, increased medical expenses, and higher readmission rates, early identification and management of malnutrition can help prevent and delay the development of complications. Carbohydrates are the primary energy source for elderly Chinese diabetic patients, so monitoring carbohydrate intake is an important means to achieve blood glucose targets. For elderly diabetic patients with long-term unbalanced food intake, attention should be paid to supplementing vitamins and minerals. The goal is to avoid excessive restriction of energy intake, emphasize a balanced diet and balanced nutrition, be vigilant against malnutrition in elderly diabetic patients, conduct regular nutritional screenings to confirm patients' nutritional risks, and intervene early [8].

2.3.2. Pregnant patients

In terms of preventing diabetes in pregnant women, nutritional therapy also plays a role. Researchers have found in population studies that simultaneously supplementing vitamin E and zinc can significantly improve the insulin metabolism of women with gestational diabetes by upregulating peroxisome proliferator-activated receptor γ and low-density lipoprotein receptors [9]. Studies have also shown that vitamin D is nonlinearly related to the risk of GDM, and when serum 25(OH)D levels $\geqslant$30 ng·mL-1 can significantly reduce the risk of GDM [10].

3. Analysis of existing public health strategies

With an ageing population and rapidly changing lifestyles, chronic noncommunicable diseases such as diabetes have become a major global public health challenge. In order to address this challenge, governments around the world have developed public health policies for diabetes prevention, which aim to reduce the incidence of diabetes and improve the health of the population through a series of measures. The main objectives of the policy include increasing the awareness, treatment and control rates of diabetes and reducing the morbidity and mortality of diabetes.

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3.1. Community policy

Based on management theories and new health concepts derived from health management, community health management encompasses the entire process of thorough documentation, monitoring, analysis, evaluation, prediction, intervention, prevention, maintenance, and development of personal and family health skills of both disease groups and healthy individuals in the community. It serves all residents of the community, in the community and family, using existing health resources and appropriate technology, focusing on the health needs of the elderly, patients with chronic diseases, women, children, etc., providing general practitioner and family doctor services, integrating health-related medical treatment, prevention, health care, rehabilitation, and health education, and comprehensively developing primary health services [11]. The theoretical framework is presented in Figure 1.



Figure 1: Community Health Management Theory.

Practical experience in United States and Japan has shown [12] that health management in the community can effectively prevent and treat 80% of diseases. Only about 10% of all patients need to be treated by specialists, and with qualified general practitioners, family physicians, and community health managers as the backbone, community health service personnel can tackle more than 80% to 90% of the population's basic health issues. According to the World Health Organization, lifestyle is the primary risk factor influencing health, and poor lifestyle choices can lead to disease problems. This is evident from the health formula, which reads: health = 15% genetics + 10% social factors + 8% medical + 7% climatic factors + 60% lifestyle. It is evident that community health management helps the people who live in the area, and its advancement has become critically necessary.

3.2. Policies related to high-sugar foods

One study included 60 systematic reviews and meta-analyses of dietary patterns in diabetes. The results of the review showed that a high intake of whole grains, low-fat dairy products, yogurt, olive oil, chocolate, fiber, magnesium, and flavonoids, as well as healthy eating practices like the Mediterranean and Dietary Approaches to Stop Hypertension (DASH) diets, significantly decreased the incidence of type 2 diabetes. However, the risk of type 2 diabetes was considerably raised by diets high in glycemic index and glycemic load, as well as by consuming large amounts of processed and red meat, sweets, or beverages sweetened with artificial sugar. Therefore, some policies and propaganda to control the intake of high-sugar diet are necessary for the prevention of diabetes [13].

Dietary approaches like the US Diabetes Association recommend low-calorie, low-fat, and Eastern Mediterranean diets for individuals with prediabetes [14]. Certain food groupings can be derived from these eating patterns. For example, the Eastern Mediterranean diet includes an abundance of fruits, vegetables, cereals, seafood, legumes, nuts, and oils such as olive oil that are unsaturated. Furthermore, it frequently involves consuming fewer meat and dairy items [15].

The application of evidence-based nutrition care therapy by a registered and certified dietician to patients with illnesses is known as medical nutrition treatment. Patients with diabetes receive

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nutritional therapy reports using less oral hypoglycemic medication. Furthermore, compared to diabetic patients who get basic nutrition knowledge (BE), those who receive comprehensive nutritional instruction from a trained dietician show notable improvements in clinical outcomes.

All things considered; diabetic patients may be able to lessen the long-term impacts of the disease by making minor but meaningful dietary changes. Furthermore, applying nutritional treatments to diabetics effectively may be a lucrative way to enhance health outcomes and diabetes control [16].

3.3. Data-based management

At the 2024 China Conference on the Prevention and Control of Chronic Diseases, the word "science and technology" was frequently mentioned. In many parts of China, the power of science and technology is constantly helping to move forward the threshold of early screening of chronic diseases and help residents take the initiative to manage their health. For example, an interconnected chronic disease monitoring and key chronic disease screening and intervention platform has been built and put into use, and the electronic health record management of residents of "one person, one code, one file" has been implemented, and self-service inquiries have been opened to residents; We will build a health management service platform and a large medical model, launch data products such as disease screening models, health portrait models, and personalized diagnosis and treatment management programs, and actively monitor and screen.

Encourage intelligent diabetes care, fully utilize AI and other information technologies to improve diabetes care practices and encourage the adoption of wearable technology and the Internet of Things; examine the development of a standardized system for primary diagnostic and treatment support by utilizing big data, artificial intelligence, and other state-of-the-art information technologies. This year, the National Health Commission presented its implementation strategy for the prevention and treatment of chronic respiratory diseases and diabetes, which includes a promotion of new health management technologies. From risk assessment and intervention based on clinical data, whole-process health monitoring based on IoT devices, to precise management based on medical imaging and genetic data, and comprehensive population prevention and control based on daily life data, multimodal big data fusion and analysis can help the whole process of obesity prevention and control.

For the comprehensive prevention and control of chronic diseases, China has constructed 488 national demonstration zones to date. In the next step, the demonstration zone should be further upgraded, improve the informatization and intelligence level of chronic disease monitoring and management, and highlight the leading role of scientific and technological innovation. China has launched four major scientific and technological projects for preventing and managing long-term illnesses in 2030, focusing on basic theoretical research and cutting-edge technology development, clinical research and epidemiological research, and the demonstration and promotion of effective chronic disease prevention and control systems, so as to empower the prevention and control of chronic diseases with science and technology [17].

4. Conclusion

Taking T2DM as an example, this paper examines the risk factors that lead to the onset of T2DM and analyzes their analysis, as well as the public health strategies for this type of diabetes mellitus at home and abroad. Diabetes mellitus is a disease caused by a combination of factors, such as genetics, environment, and dietary habits. Since pharmacological approaches for treating T2DM are only partially successful in managing the disease over the long term, both pharmacological treatments and substantial lifestyle modifications are required to ensure that the condition is adequately managed. All countries have adopted public health measures for the prevention and control of this major disease. These include not only allowing medical staff or professionals to carry out changes in patients'

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personal physical activities, dietary adjustments, management of stress or related factors, and supervision of sleep patterns, but also further integration with technology and the use of artificial intelligence and other big data technologies to grasp the whole process of chronic disease prevention. This discussion will help to optimize and improve the follow-up public health strategy. However, there is no systematic discussion of the endocrine and other mechanisms of diabetes mellitus and public health strategies such as medication.

In the future, the public health policy on diabetes prevention will continue to deepen and improve, strengthen cross-departmental collaboration and resource integration, and encourage the use of cutting-edge science and technology in the prevention and management of diabetes. The basic medical care system should be strengthened, and primary medical institutions should be better equipped to avoid and treat diabetes and realize the early diagnosis and whole-process health management of diabetes. In addition, international cooperation and exchanges will be strengthened, and international advanced experience and technical means will be drawn on to jointly address the challenges of chronic non-communicable diseases such as diabetes.

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