Analysis of the effect of health management on people with diabetes mellitus over 45 years of age

Xi Liu[1], Xinghao Xie[2], Xiaomeng Li[2], Tingting Li[2], Tao Jiang[2,*], Zhihong Wang[3,*]

[1]School of Public Health, Guilin Medical University, Guilin, 541199, China
[2]School of Humanities and Management, Guilin Medical University, Guilin, 541199, China
[3]Standardized Training Center for Resident Doctors, Shenzhen Second People's Hospital, Shenzhen, 518020, China
[*]Corresponding author: tj290uow@163.com

Abstract: The objective of this study was to evaluate the effectiveness of community health management interventions in patients with type 2 diabetes over 45 years of age. A one-year intervention was performed by including 184 patients with type 2 diabetes over the age of 45.Biochemical markers including fasting blood glucose, glycated hemoglobin, triglycerides, total cholesterol, low density lipoprotein, and high density lipoprotein were measured. Changes in health behaviour, such as smoking, alcohol consumption and physical activity, were recorded and screening for complications assessed. The results of the study showed that community health management significantly improved biochemical markers, including lower fasting blood glucose, glycated hemoglobin, triglycerides, total cholesterol and low density lipoprotein levels, while increasing high density lipoprotein levels. Health behavior changes include reducing smoking and alcohol consumption and increasing physical activity. The complication screening rate was significantly improved, especially the completion rate of urinary microalbumin and electrocardiogram. It is concluded that community health management has positive effects on the biochemical indexes, lifestyle and complication screening of type 2 diabetes patients over 45 years old, indicating that this model has potential application value in improving the overall health status of chronic disease patients.

1. Introduction

Diabetes mellitus is a chronic metabolic disease with a growing prevalence worldwide. According to the World Health Organization, as of 2023, more than 415 million adults worldwide have diabetes, and this number is expected to continue to grow in the coming decades. Especially in developing countries and regions, the prevalence of diabetes is increasing rapidly due to changing lifestyles, aging populations and accelerating urbanization[1-3]. In China, diabetes has become a serious public health problem. According to data from the Chinese Center for Disease Control and Prevention, the prevalence of diabetes in China has reached 10%, and among the elderly over 65 years old, the proportion is as high as more than 20% [4,5] .With the development of the economy and the acceleration of urbanization, people's dietary structure has undergone great changes, and

high-sugar, high-fat, and high-calorie diets have become the mainstream choices in daily life, which has led to a surge in metabolic diseases such as obesity and overweight, which in turn increases the risk of diabetes [6,7].

1.1. Important factor in the prevalence of diabetes

With the extension of people's life expectancy, the proportion of the elderly population is gradually increasing, and the prevalence of diabetes in the elderly population is relatively high, so the increase in the elderly population also directly promotes the epidemic of diabetes [1,2,8].The interaction of genetic factors and environmental factors also plays an important role in the occurrence of diabetes. Studies have shown that family history is one of the important risk factors for diabetes, and if a person has diabetes in their immediate family, then the risk of developing the disease is also greatly increased[9].Modern lifestyle changes are one of the main reasons for the rise in the prevalence of diabetes. Environmental factors, such as pollutants, chemicals, and stress, can also affect insulin secretion and utilization, which can exacerbate the onset and progression of diabetes.

1.2. Prevention and control of type 2 diabetes

The study by Lenzi et al. shows that comprehensive management is essential in diabetes prevention and control. This comprehensive management involves multiple aspects such as medication, dietary control, exercise planning, and psychological support, which can effectively control blood glucose levels, reduce the occurrence of complications, and improve the quality of life of patients[10].The study by Jiang Yin and Wang Ying introduces diabetes health surveillance and treatment strategies based on data management and eKTANG platform analysis. They pointed out that through digital data management and analysis, personalized treatment plans for patients can be realized, thereby improving treatment outcomes and reducing disease progression[3,5,7].The study by Yang et al. explored the role of patient activation and social support in the healthy management of diabetes. They found that improving patients' self-management skills and social support levels can significantly improve the health management outcomes of people with diabetes and reduce healthcare costs[1]. Bober et al. studied the factors associated with receiving diabetes self-management education and support, and proposed strategies focused on population health management, which can promote patients' self-management ability by providing more self-management education and support, so as to effectively control diabetes[1]. de Oliveira et al. proposed a data-driven digital health management program, namely the Klivo intervention program, which uses a digital platform to collect patients' health data and provide patients with personalized health management programs and monitoring services, effectively helping patients manage diabetes and improve treatment outcomes.

The purpose and significance of this study is to evaluate the intervention effect of health management on patients with diabetes over 45 years of age, and to explore its role in disease management and prevention. Through in-depth research, it can provide a scientific basis for diabetes prevention and control, promote the promotion and application of health management models, and maximize the quality of life and health of diabetic patients[11].By evaluating the effects of health management interventions for people with diabetes, we can better understand the role of health management in diabetes management. Health management includes not only medical interventions, but also lifestyle changes, mental health concerns, and individualized treatment plans.

2. Methods

We followed a four-step process to extract and analyse data from the accreditation reports: (1) data sourcing and processing, (2) data extraction, (3) data labelling, and (4) data analysis.

2.1. Data sourcing and processing

In this paper, patients with type 2 diabetes in a community in Guilin, Guangxi Province were selected as the subjects of the study. These patients are not only the focus of research, but also the focus of community health management. These patients were selected because of the high prevalence of diabetes in the community and its impact on patients' quality of life and health. Through the study of these patients, it is hoped that a deeper understanding of their disease characteristics, management needs, and response to community health management interventions will be achieved.

2.2. Data extraction

Study subjects are required to meet a series of strict criteria:
1) The selected objects must meet the WHO diagnostic criteria for diabetes, and be clearly diagnosed with type 2 diabetes by a clinician from a secondary hospital or above. This is the first step in ensuring that the disease status of the study subjects is accurate and reliable.
2) The research focus on patients over the age of 45, because the incidence of diabetes in this age group is higher, and the need for community diabetes management is more urgent.
3) The selected objects must be registered patients in the community, including household registration and non-household registration residents, and live for more than half a year. The aim is to ensure that the participants studied have some community stability and facilitate long-term follow-up and intervention.
4) The research subjects are also required to have normal comprehension and self-care skills, and be able to communicate and express effectively. This is to ensure that they are able to participate in community health management and thus better evaluate the effectiveness of the intervention.

2.3. Data labelling

The survey method of this study is mainly based on the health management project of community patients with chronic diseases in a community in Guilin City, Guangxi Province, which has been carried out since 2011. Based on the data accumulation of this health management project, more than 6,000 patients with chronic diseases were selected as the research subjects in 2022 and 2023.

For the selection of research subjects, the electronic health records of community diabetic residents were used as the main data source. Through face-to-face methods, community general practitioners file patients with type 2 diabetes and collect their basic information, including education level, occupational type, marital status, type of medical insurance, past disease history, family history, living environment information, etc. At the same time, the doctor also recorded the patient's follow-up information, including general conditions such as disease symptoms, blood pressure, weight, and body mass index, as well as information such as lifestyle, biochemical indicators, and referrals.

2.4. Data analysis

SPSS21.0 software was used for data analysis in order to make a comprehensive and accurate evaluation of the study data. The data is tested for a normal distribution to determine if the data conforms to a normal distribution. For the data that did not conform to the normal distribution, the interquartile range was used to represent the blood glucose and lipid values of patients before and after community health management of type 2 diabetes. This method can more accurately reflect the distribution of the data and avoid the error of using parametric statistical methods for non-normally distributed data.

The Wilcoxon test was then used to compare the differences in fasting blood glucose, blood pressure, lipids and body mass index levels before and after the intervention. The Wilcoxon test is a nonparametric test method that is suitable for two sets of relevant samples and the data does not obey a normal distribution. This test allows for an assessment of the extent to which health management measures affect a patient's blood glucose, blood pressure, lipids, and body mass index.

3. Results

3.1. Basic condition of the patient

The study identified 200 eligible patients from the community-based registration who were the subjects of interest. After a year of community health management, 184 patients were finally included for the final analysis. Of the 184 patients, 38.0% were males and 62.0% were females. This sex ratio reflects the prevalence of women compared to men in the community for type 2 diabetes. The mean age was 69 years, with an age range ranging from 60 to 88 years, indicating that the study subjects were predominantly older people. In addition to diabetes, comorbidities of other chronic diseases were noted in many patients. Hypertension was present in 49.5% of these patients, suggesting the complexity of disease management in these patients. In addition, a small number of patients have comorbid stroke and coronary atherosclerotic heart disease, complications that increase the difficulty and risk of treatment.

3.2. Comparison of biochemical indicators before and after community health management

The study collected data on biochemical markers before and after the intervention, including fasting blood glucose, glycosylated haemoglobin, triglycerides, total cholesterol, LDL, and HDL (see Table 1). These indicators are important parameters for evaluating blood glucose and lipid metabolism in diabetic patients. After the community intervention, the fasting blood glucose, glycosylated hemoglobin, triglycerides, total cholesterol and LDL levels of the patients were observed to decrease compared with those before the intervention, and this change was statistically significant (P<0.05). This indicates that community health management measures have achieved positive results in improving patients' glycemic control and lipid metabolism. In addition, a trend of elevation of HDL after the intervention was also observed, and this change was also statistically significant (P<0.05). An increase in HDL is often thought to be a beneficial biological response, which helps remove cholesterol from the body and reduces the risk of atherosclerosis. In addition, it was also found that the fasting blood glucose and glycosylated hemoglobin attainment rates were increased after community intervention, which was statistically significant (P<0.05)(see Table 2) ,indicating that community health management measures could effectively improve the blood glucose control level and reduce the incidence of hyperglycemia.

Table 1: Comparison of biochemical indexes before and after intervention

Indicator	2022	2023	Z Value	P Value
Fasting blood glucose (mmol/L)	8.05(7.15,9.34)	7.16(6.58,7.79)	-0.857	<0.05
Glycosylated hemoglobin (%)	7.30(6.8,8.10)	7.1(6.43,7.38)	-6.337	<0.05
Triglycerides (mmol/L)	1.64(1.20,2.62)	1.56(1.10,2.23)	-3.155	0.002
Total cholesterol (mmol/L)	4.99(4.26,5.95)	4.78(4.19,5.47)	-6.049	<0.05
Low-density lipoprotein (mmol/L)	2.93(2.38,3.59)	2.89(2.38,3.41)	-2.045	0.041
High-density lipoprotein (mmol/L)	1.19(0.99,1.43)	1.26(1.08,1.48)	-2.514	0.012

Table 2: Comparison of blood glucose indexes before and after intervention

Indicator	2022 n(%)	2023 n(%)	Z Value	P Value
Fasting blood glucose target	36(19.6)	68(37.0)	13.725	<0.05
Glycosylated hemoglobin meets the target	62(33.7)	78(42.4)	2.951	0.086

By comparing the biochemical indicators before and after the intervention, it can be concluded that the community intervention had a significant improvement effect on the biochemical indicators of patients, including reducing fasting blood glucose, glycosylated hemoglobin, triglycerides and total cholesterol levels, increasing HDL levels, and increasing fasting blood glucose and glycosylated hemoglobin attainment rates.

4. Discussion

The effect of the community health management model in patients with type 2 diabetes is multifaceted, from the measurement indicators, biochemical indicators, life behaviors to the screening of complications, all of which show the significant effect of the model. In terms of measurement indicators, the implementation of the community health management model has led to a decrease in the patient's body mass index, and a decrease in systolic and diastolic blood pressure. This suggests that the model has been effective in helping patients manage their weight and lower their blood pressure. This improvement helps reduce the risk of cardiovascular disease and other complications and improves the overall health of patients.

According to the comparative results of biochemical indicators, the implementation of the community health management model led to a decrease in fasting blood glucose levels and glycosylated hemoglobin levels, while triglycerides, total cholesterol and low-density lipoprotein levels also decreased, while high-density lipoprotein levels increased. This suggests that the community health management model can help improve the patient's glycemic control and blood lipid metabolism, and reduce the risk of atherosclerosis and cardiovascular disease.

From the perspective of complication screening, the implementation of the community health

management model has significantly increased the screening rate of urine microalbumin and electrocardiogram. This helps in the early detection and control of complications in patients, which further improves their health. The effect of the community health management model in patients with type 2 diabetes is significant, not only in terms of biochemical indicators and lifestyle, but also in the screening of complications.

5. Conclusion

Community health management has a significant effect on the biochemical indexes of patients with type 2 diabetes. The results of the study showed that after the intervention, the fasting blood glucose level of the patients decreased significantly, and the glycosylated hemoglobin level also showed a decreasing trend. This result reflects that community health management can effectively control patients' blood glucose levels, which can help reduce the risk of diabetes and complications. In addition, triglycerides, total cholesterol and low-density lipoprotein also decreased after the intervention, while high-density lipoprotein showed a trend of increasing, indicating that community health management also had a positive effect on improving patients' lipid levels. By effectively controlling blood glucose and lipid levels, promoting health behavior change, and strengthening screening for complications, community health management is expected to improve the overall health of patients, reduce the burden of disease, and improve quality of life. Therefore, the community health management model has broad application prospects in the management of patients with chronic diseases, and is worthy of promotion and application in a wider range.

Acknowledgments

Author contributions

T.J. conceived the idea of the study. T.J. performed the experiments. L.X, XH.X, and T.J. analyzed the data and wrote the paper.

References

[1] Huang S J, Shao Y, Miao Y, et al. Prevalence and influencing factors of chronic diseases among the elderly aged 65 and above in Fengqing County in 2022 [J].Journal of Occupational Health and Injury, 2018,39(03): 147-153.
[2] Ge Shanshan, Min Yue, Wang Yiwen, et al. Research progress of comprehensive health management of re-employed elderly by human resources [J]. Chinese Journal of Gerontology, 2019, 44(06): 1532-1535.
[3] Yang J. Interview survey and analysis of health self-management experience of elderly diabetic hypoglycemic coma patients in rural areas [J].Modern Health Preservation, 2019, 24(06): 463-466.
[4] Yang Yang, Wu Fei, Li Li, et al. Health management status and countermeasures of empty-nest elderly diabetic patients in rural areas [J]. Health Vocational Education, 2024, 42(06): 115-118.
[5] Zhang Ruoyan, Zhang Jinjia, Zhang Qilong, et al. Study on the effect of general practice-community combination on the health management of elderly patients with hypertension/diabetes mellitus in the community [J].Chinese Medicine, 2019,19(03): 346-350.
[6] Lenzi J, Messina R, Rosa S, et al A multi-state analysis of disease trajectories and mental health transitions in patients with type 2 diabetes: A population-based retrospective cohort study utilizing health administrative data[J]. Diabetes Res Clin Pract, 2024, 209: 111561.
[7] Sun H J. Clinical effect of individualized health management and nursing in elderly patients with type 2 diabetes mellitus [J].Chinese Journal of Health Care, 2019,42(04): 124-127.
[8] Yao A L. Lifestyle intervention in health management [J]. Health for All, 2024(04): 91.

[9] Deng X J. The effect of diabetes care outpatient document education management model on blood glucose control in diabetic patients [J].Marriage, Fertility and Health, 2018,30(02): 181-183.

[10] Li Dianjiang, Pan Enchun, Sun Zhongming, et al. Study on the relationship between health management compliance and blood glucose control standard in community patients with type 2 diabetes mellitus [J].Modern Preventive Medicine, 2018,51(02): 273-278.

[11] Yang Yuqing, Chen Quan, He Qile, et al. Study on self-management level and its influencing factors of elderly diabetic patients in Dongcheng District, Beijing [J].Journal of Medical Informatics, 2019,45(01): 59-63.