ISSN 2616-5791 Vol. 6, Issue 8: 131-136, DOI: 10.25236/AJMHS.2025.060817

Pathway Mechanism Modelling of Health Behaviour Change in Type 2 Diabetes via Telehealth and Individual Behavioural Data

Zixi Yao

University of Cambridge, Cambridge, HU130TL, UK
2098572991@qq.com

Abstract: *This paper constructs a health behavior intervention model for type 2 diabetes mellitus (T2DM), which integrates telemedicine and individual behavior data, in order to explore the path mechanism of improving patients' health behavior. As a chronic disease that requires lifelong management, T2DM not only relies on short-term diagnosis and treatment, but also requires patients to adhere to long-term blood glucose monitoring and self-management. With the rapid development of network technology and big data artificial intelligence (AI), intelligent health management methods are gradually being applied in the medical field. This study proposes an AI based intervention model that dynamically monitors patients' daily behavior data, combined with remote medical services, to achieve personalized guidance and real-time feedback, thereby enhancing patients' self-management awareness and health behavior compliance. The research results indicate that the system can effectively improve the metabolic control level of T2DM patients, promote blood glucose stability, and significantly improve their quality of life. This study provides theoretical basis and practical support for promoting precise and personalized chronic disease management models.*

Keywords: *Telemedicine; Individual Behavior Data; Type 2 Diabetes; Healthy Behavior; Changing the Path*

1. Introduction

With the rapid growth of digital health technology, especially the widespread application of AI technology, many problems existing in traditional medical management models are expected to be fundamentally improved [1]. Especially in the field of T2DM management, AI technology not only provides the possibility to alleviate the pressure of limited medical resources, but also brings new technological support for achieving standardization and homogenization of medical services [2]. T2DM, as a chronic metabolic disease, has complex and diverse complications, which impose heavy psychological, social, and economic burdens on patients and their families [3]. Scientific and reasonable diet, regular exercise, timely medication, regular monitoring of blood sugar, and good emotional regulation can effectively delay or even avoid the occurrence of complications [4]. However, in the current medical model, medical staff can usually only adjust management plans for patients based on clinical experience through brief communication during outpatient visits, making it difficult to make timely and personalized intervention decisions based on individual real-time physiological data changes. This greatly limits the effectiveness of T2DM treatment and management [5].

Self management of T2DM refers to a series of behaviors adopted by patients in daily life that help control blood sugar, including dietary regulation, moderate exercise, following medical advice, regular blood sugar monitoring, and foot care [6]. Effective self-management not only stabilizes blood sugar levels, but also significantly reduces the risk of complications. Although traditional self-management education relies heavily on face-to-face guidance, this approach is often difficult to sustain in practice due to the tight allocation of medical resources [7]. With the development of mobile Internet and intelligent devices, telemedicine technology provides patients with more safe, convenient and efficient means of health management, which not only reduces the workload of medical staff, but also improves the enthusiasm and convenience of patients to participate in disease management [8]. In the face of the increasing number of T2DM patients and the trend of younger patient groups, various sectors of society and medical institutions urgently need to explore more efficient technological means and management models to improve the efficiency of T2DM diagnosis and treatment, reduce the burden on patients, and lower overall medical expenses.

ISSN 2616-5791 Vol. 6, Issue 8: 131-136, DOI: 10.25236/AJMHS.2025.060817

In this context, the application of telemedicine has gradually become an important path to solve the limitations of traditional healthcare. It utilizes electronic information technology and communication methods to provide remote consultation, diagnosis, and health monitoring services, enabling patients to receive continuous health management support even in remote areas. In recent years, the application of AI in China's healthcare sector has become increasingly widespread, gradually penetrating into various aspects of disease prevention, diagnosis, treatment, and rehabilitation. Especially in the self-management of T2DM patients, AI shows great potential. With the advancement of network technology, remote medical services have been widely promoted in urban and rural areas. More and more AI assisted tools are being applied to blood glucose monitoring and behavioral intervention in T2DM patients, effectively alleviating the problem of uneven distribution of medical resources. Based on this, this study proposes a health behavior intervention model that integrates AI and remote medical services. This model dynamically collects and analyzes patients' daily behavior data, combined with professional support provided by remote medical platforms, to achieve personalized guidance and real-time feedback for patients.

2. AI Based Intervention Model

2.1 The Application and Challenges of AI

With the exponential improvement of computing power, the continuous maturity of big data processing technology, and the continuous evolution of machine learning (ML) algorithms, AI is reshaping the healthcare field at an unprecedented speed [9]. In terms of patient health management, AI has shown great potential: through the collection and deep learning analysis of large-scale real-world data, intelligent health management systems and electronic medical record platforms are constructed, which not only improve the efficiency of medical services, but also significantly enhance the self-efficacy and self-management ability of chronic disease patients [10]. The application of AI is particularly prominent in the management of T2DM. One of its core functions is a blood glucose trend prediction and warning system. Due to various factors such as carbohydrate intake and insulin action, the blood glucose levels of T2DM patients usually fluctuate greatly daily. AI models can model blood glucose changes based on historical and real-time data, identify abnormal fluctuations in advance, and provide early warning signals for ineffective or inappropriate treatment.

In addition, AI can also be linked with continuous glucose monitoring (CGM) devices and insulin pumps to monitor the glucose concentration in tissue fluid in real time through glucose sensors. It can detect hidden hyperglycemia or hypoglycemia events that are difficult to detect by traditional methods in a timely manner, thus more comprehensively grasping the fluctuation pattern of patients' blood glucose and achieving accurate monitoring and intelligent prediction. For T2DM patients, AI can not only be used for disease risk assessment and auxiliary diagnosis, but also optimize clinical decision-making processes, improve the efficiency of hospital management and personalized health management. Currently, the development of most AI systems relies on the learning and training of massive real-world data, so the quality, integrity, and annotation accuracy of the data directly determine the performance and generalization ability of the model. However, there are still many challenges in practical applications, such as poor quality of raw data (such as blurry images), label errors, insufficient sample size or lack of representativeness, which can seriously affect the accuracy and stability of AI models.

In addition, the widespread application of AI in clinical practice may also bring a series of unforeseen problems. For example, excessive alarm prompts may cause "alarm fatigue" among medical staff; Complex system operations may increase the workload of medical personnel; Excessive reliance on AI may lead to reduced communication between doctors and patients, affecting the diagnosis and treatment relationship. More importantly, high-quality training data often has geographical limitations, and in order to improve the universality of the model, cross regional data sharing is needed. However, this sharing model faces multiple ethical and legal challenges such as unclear ownership of data, privacy protection, and data security.

2.2 Model Building

This article constructs a T2DM health behavior intervention model that integrates remote medical care and individual behavior data, aiming to achieve dynamic monitoring and intelligent decision support of patients' health status through advanced wireless sensor networks, data fusion technology,

ISSN 2616-5791 Vol. 6, Issue 8: 131-136, DOI: 10.25236/AJMHS.2025.060817

and big data AI methods. The model comprehensively uses multi-source heterogeneous sensor devices, mobile applications, Internet communication technology and AI algorithm to efficiently process, fuse analysis and intelligent inference of the collected physiological parameters and behavioral data, so as to improve the self-management level and clinical management efficiency of T2DM patients. The model mainly includes four core modules: multi-source health data collection, data fusion and visualization display, health status monitoring and early warning, and personalized decision suggestion generation. The system collects real-time physiological indicators such as blood glucose, blood pressure, and heart rate of patients through various wearable or portable sensor devices, and combines mobile applications to record their daily behavior information such as diet, exercise, and medication, forming a comprehensive individual health profile.

The collected data is presented intuitively in the form of charts, trend curves, etc. on the user end, helping patients to timely understand their own health status; At the same time, these data are transmitted to cloud servers through wireless sensor networks, and with the support of AI algorithms, fine-grained data cleaning, feature extraction, and pattern recognition are performed. Combined with remote medical services, personalized health assessment and intervention recommendations are provided. The processed data is stored on a cloud platform, forming dynamically updated personal health records that reflect the changing trends of various physiological indicators over time; On the other hand, the analysis results will also be synchronously pushed to users' mobile terminals and community medical institution databases, making it easier for doctors to remotely monitor changes in patients' conditions and provide data support for subsequent diagnosis and treatment. Ultimately, the system achieved comprehensive monitoring and personalized intervention services for the health status of T2DM patients by integrating remote medical resources and individual behavioral data, promoting the transition from "passive treatment" to "active management" and helping to build a more intelligent, efficient, and sustainable chronic disease management model.

3. Algorithms and Experiments

3.1 Algorithm Principle

Naive Bayes classification (NBC) is a probabilistic classification method based on Bayes' theorem and assuming that features are independent of each other. This classification algorithm is concise and efficient, and is widely used in the fields of data mining and machine learning. Bayes' theorem is an important theorem in probability theory, used to calculate the posterior probability of an event occurring under known conditions. Let X be a data tuple, typically consisting of n measured values of attributes; H is a specific assumption, such as the sample belonging to a certain category. According to Bayes' theorem, the posterior probability $P(H \mid X)$ is the probability that H holds under the condition of observing data X, and its calculation formula is as follows:

$$P(H \mid X) = \frac{P(H \mid X)P(H)}{P(X)} \tag{1}$$

In the formula, $P(H)$ is the prior probability of assuming H, representing the probability of assuming H holds before there is any observed data; $P(X)$ is the probability of the occurrence of data tuple X, which can be regarded as a normalization constant. In the process of building a classification model, the first step is to conduct in-depth analysis of the attribute features of the target dataset, and to reasonably divide the dataset based on these features. Subsequently, based on the maximum likelihood estimation method and combined with Bayes' theorem, the frequency of occurrence of each sample in each category and the prior probability of each category in the training set were calculated separately in the target dataset.

In addition, when the data distribution of physical sign samples is complex, traditional clustering methods may find it difficult to find the globally optimal clustering results, and may easily fall into local optimal solutions, affecting the clustering effect. To address this issue, the "Bisecting K-means" strategy can be introduced. The basic idea of this method is to first divide the entire dataset into two sub clusters, and then select one cluster from them to continue the division, repeating the process until the preset number of clusters is reached or specific stopping conditions are met. At each partition, the

ISSN 2616-5791 Vol. 6, Issue 8: 131-136, DOI: 10.25236/AJMHS.2025.060817

quality of clustering is evaluated by calculating the sum of squared errors (SSE) of each sub sample set. The sum of squared errors is an important indicator for measuring the degree of clustering closeness. The smaller its value, the higher the clustering degree of the sample within the cluster, and the better the clustering effect. The formula for calculating the sum of squared errors is as follows:

$$SSE = \sum_{i=1}^{k} \sum_{p \in C_i} |p - m_i|^2 \quad (2)$$

Among them, k is the number of clusters, p is the sample, and m_i is the center point of the i cluster.

3.2 Experimental Result

To verify the effectiveness of the constructed model, relevant experiments were conducted in this paper. As shown in Figure 1, comparing the blood glucose stability of patients before and after using the model, it can be found that after applying the intervention model, the blood glucose fluctuations of patients were significantly reduced, and the overall stability was significantly improved. This indicates that the model has a positive effect in promoting healthy behavior change and improving disease management effectiveness. This model integrates remote healthcare and individual behavioral data, relying on AI technology to dynamically monitor patients' daily behavior and provide personalized real-time feedback and health management guidance. Through this mechanism, not only has the patient's awareness of their own health status been enhanced, but their self-management ability and behavioral compliance have also been strengthened, effectively improving the effectiveness of blood glucose control. The experimental results verify the feasibility and practicability of the AI based health behavior intervention model in the management of type 2 diabetes, and provide strong support for the intelligent and personalized management of chronic diseases in the future.

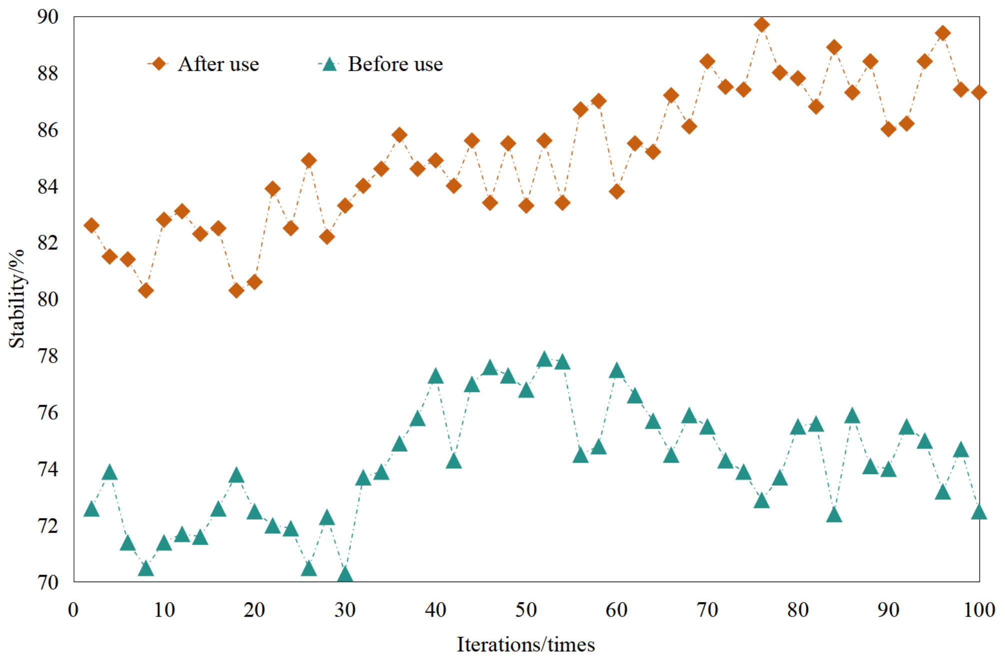

Fig.1 Stability comparison

As shown in Figure 2, comparing the patient satisfaction scores before and after using the intervention model, it can be found that the overall satisfaction of patients significantly improved after applying the intervention model. This shows that the model has good user experience and practical effect in improving diabetes management. This model achieves personalized guidance and real-time feedback by dynamically monitoring patients' daily behavior data, combined with remote medical services and AI technology, effectively improving patients' participation and compliance. By continuously intervening in healthy behaviors such as diet, exercise, and medication, the model not only helps improve the metabolic control level and promote blood glucose stability of T2DM patients, but also significantly improves their quality of life. It can be seen that the AI based health behavior intervention model has a good application prospect in diabetes management, which can meet the individual needs of patients, enhance the health management effect, and achieve higher user satisfaction.

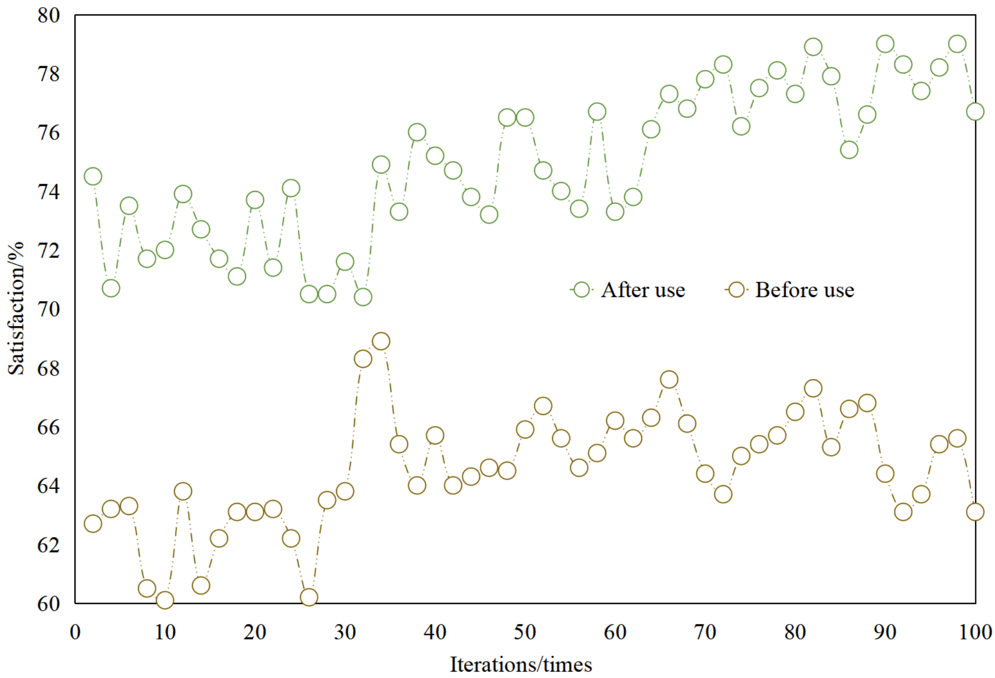

Fig.2 Satisfaction comparison

4. Conclusions

This study developed an AI based health behavior intervention model aimed at enhancing the self-management ability of T2DM patients. This model dynamically monitors patients' daily behavior data, combines remote medical services, and utilizes AI technology to achieve personalized guidance and real-time feedback, effectively enhancing patients' awareness and compliance with disease management. The research results indicate that the system has demonstrated good performance in practical applications: it not only significantly improves the patient's metabolic control level, promotes blood sugar stability, but also effectively enhances their overall quality of life. This indicates that the intervention model integrating AI and telemedicine has strong feasibility and application value in chronic disease management. However, this model still has certain limitations. For example, in terms of data collection, relying on wearable devices and user self reporting may result in data missing or errors; In addition, the promotion of the model is still limited by the level of technological popularization and individual differences. Future research will further optimize algorithm performance, expand application scenarios, and explore applicability in a wider population to promote the continuous development and improvement of intelligent health management systems.

References

[1] Du Yingxiang, Lou Qiuying, Tao Yuexian. Research progress on the application of telemedicine system in blood glucose management of patients with type 2 diabetes[J]. Contemporary Nurses (First Ten Day Journal), 2023,30 (11): 10-13.

[2] Lu Minting, Huang Jiewei. Research progress on the application of telemedicine in the management of type 2 diabetes[J]. Evidence based nursing, 2023,9 (13): 2356-2361.

[3] Li Chunhua, Jiang Lingyu, Wang Qi, et al. Progress in the application of mobile medicine in self-management of type 2 diabetes[J]. New World of diabetes, 2024,27 (04): 187-189+194.

[4] Chai Dongyan, Wang Bingkun, Duan Hongyan, et al. Effect of resident pharmacists on risk management of atherosclerotic cardiovascular disease in diabetes patients[J]. Chinese Journal of Hospital Pharmacy, 2025, 45 (04): 467-471.

[5] Tang Yan, Feng Xiaohui. Application progress and challenges of artificial intelligence in diabetes

ISSN 2616-5791 Vol. 6, Issue 8: 131-136, DOI: 10.25236/AJMHS.2025.060817

health management[J]. Chinese Medical Journal, 2024,59 (12): 1296-1298.
[6] Jin Yizhou, Zhou Li, Xu Mingzhi. Research progress in the application of artificial intelligence in health management of type 2 diabetes[J]. Modern Medicine and Health, 2023,39 (24): 4242-4247.
[7] Feng Yingqian, Wang Mengjun, Lv Siqing, et al. Application of medical artificial intelligence in health management of type 2 diabetes[J]. China Health Care, 2023,41 (21): 11-16.
[8] Wang Miao, Huang Min, Jiang Bei, et al. Construction and application of online diagnosis and treatment platform for Kawasaki disease based on Internet hospital[J]. Shanghai Medical Journal, 2022,45 (08): 561-564.
[9] Li Qiang, Yang Bin. Construction and application of "Internet plus" emergency rescue system based on 5G and AI technology[J]. China Digital Medicine, 2024,19 (09): 27-32.
[10] Wei Donghai, Steven Stumpf,Louis Rubino, et al. The evolution of medical digitalization from telemedicine to Internet+AI medicine[J]. China Research Hospital, 2022,9 (05): 64-76.