Original Research Article

Utilizing cloud-based technology to construct a precise network management model for statin therapy in Alzheimer's disease - A meta-analysis

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Abstract

Purpose: *To investigate the use and applications of Internet cloud technology to construct a network management model for statin therapy in Alzheimer's disease in Hainan Province.*
Method: *Randomized controlled trials (RCTs) investigating the prevention and treatment of Alzheimer's disease (AD) with statins were employed in this study. Computerized searches were conducted using PubMed, EM-BASE, Cochrane Library, Chinese National Knowledge Infrastructure (CNKI), WANFANG Data, and Curriculum-Based Measurement (CBM) retrieval systems, with a retrieval timeframe of April 2012. After literature screening, data extraction, and quality evaluation, Meta-analysis was performed using Review Manager 5.1.0 software.*
Results: *A total of 827 publications were obtained, and 3 RCTs were included after the full texts were studied. While there was no significant advantage of statin use at 3 and 6 months after intervention, the study group exhibited higher Mini-Mental State Examination (MMSE) scores than the control group one year later (p < 0.05). Also, statin use did not have a significant effect on Activities of Daily Living (ADL) scores one year after intervention (p < 0.05). The occurrence of adverse reactions in the two groups was not statistically significant (p > 0.05).*
Conclusion: *The use of Internet cloud technology for building an Alzheimer's disease network management system simplifies the process of Alzheimer's disease diagnosis and treatment, and reduces the cost of Alzheimer's disease services.*

Keywords: *Internet cloud technology, Alzheimer's disease, Statins, Network management model*

INTRODUCTION

As China's economy and health services continue to develop, the country is gradually transitioning into an aging society. Unfortunately, this demographic shift has worsened the aging situation, resulting in chronic and age-related diseases, and putting significant pressure on the medical system [1]. Among all chronic diseases, neurological diseases have emerged as the most pressing issue. Specifically, dementia has become a serious health concern for the elderly

population, significantly reducing their quality of life [2].

Alzheimer's disease (AD) is the most common form of senile dementia and poses a substantial impact on affected patients. Given its prevalence and severity, AD will undoubtedly become a significant medical and social challenge. However, uneven distribution of health services and shortages of critical health care labor have hindered improved outcomes for the disease. Advancements in wearable medical devices, cloud computing, and the Internet are continuously evolving, along with medical technologies that leverage Internet technology [3]. These innovations hold promising prospects for the treatment of chronic diseases in the future. The linkage-type three-level management model based on the network management model of hospital-community-family effectively guides elderly people with chronic diseases to help them with a healthy management model [4].

There is evidence suggesting that network management model, based on hospital-community-family approach, significantly improves patients' moods and continuously enhances their quality of life. Additionally, mobile health offers advantages such as increasing medical adherence and patient follow-up rates, improving the quality of healthcare, reducing healthcare costs, and facilitating the transition from inpatient care to patient-centered home care [5]. In addition, mobile health providers promote the international cooperation of medical providers in different time zones and the sharing of high-quality medical service resources between developed and developing countries. Thus, in this study, the precise construction of a network management model for statin therapy in Alzheimer's disease using Internet cloud technology in Hainan Province was investigated.

METHODS

Patients

The Second Affiliated Hospital of Hainan Medical University was selected based on Internet cloud technology to construct the network management model in Hainan Province. The goal was to analyze the application and promotion of the model. A data collection and management project and mode of AD patients was designed along with an AD management app based on the medical and health data aggregation regional platform of medical big data built in the hospital. The training was conducted for AD patients and related clinicians to use and operate the app. The gradual inclusion of AD patients was carried out. As a preventive experiment, all participants with high-risk factors for AD, including hypercholesterolemia and carrying the apolipoprotein E-4 gene, were included.

Treatments were in line with the diagnostic standards of American neurology, language disorders, stroke, and senile dementia.

The research protocol was approved by The Second Affiliated Hospital of Hainan Medical University ethics committee (approval no. HN20201105) and was conducted following the principles of the Declaration of Helsinki [6].\

Procedures

A successful case registration system for multi-center AD was developed using an APP that is installed on a patient's mobile phone. Patients' information is uploaded to the cloud for data storage, processing and analysis through the APP, to realize the centralized storage and management of AD data and support the development of cross-regional medical service business. The design was sequentially developed (demand analysis - > hardware integration - > software design - > experimental simulation - > optimization model and algorithm - > detection stability - > system realization - > overall implementation of the system), and systematic research and development was carried out based on the idea of the whole life cycle. By selecting a more modular design scheme, the architecture module under the data center was coupled with the business module [2]. The designed APP incorporated the patient and physician component. The patient component obtains health education information, real-time consultation, uploading images, completing relevant questionnaires, online registration, and checking past medical information. The physician component uploads and views patient disease information, outpatient and inpatient medical records, and related auxiliary examination results (such as electrophysiology, imaging, laboratory test results, etc.), and also performs neuropsychological evaluation.

Preventive experiment

In this experiment, study group was administered a certain amount of statins for treatment, and same amount of placebo was given to the control group [3-4].

Therapeutic experiment

The study group was administered a certain amount of statin alone to improve their cognitive

function, and same amount was given to the control group.

Design

The network management model utilized was the hospital-community-family model. Medical staff within the hospital assisted in training community workers on the health management model. efficient use of the model. Trained community medical workers thereafter assisted patients in carrying out relevant network management models, became familiar with the general condition status of patients (such as medication and diet), and assisted patients in knowing the purpose of network management under Internet technology.

The Literature Information Extraction Form formulated by the Cochrane Handbook was used by two researchers to independently screen the literature, extract data, and cross-check them. In case of disagreement, a third party was consulted to assist in judgment. Irrelevant literature was excluded, and the full text of selected literature was read carefully. The content of data extracted includes; basic information about the studies, including research title, first author, and publication time; baseline characteristics of research subjects, including age, and MMSE score; specific implementation methods and treatment courses of intervention measures; key elements of risk of bias assessment; required outcome indicators and outcome measurement data.

Metric assessment

Review authors (2) assessed the following methodological indicators for inclusion against the risk of bias criteria specified in the Cochrane Handbook which includes: clarity of randomized method; concealment of distribution scheme; blind review, complete result, presence or absence of selective research reports; and other sources of bias. In the event of a disagreement, a third party was invited.

Statistical analysis

Rev Man 5.3 software was used for meta-analysis. The measurement data including MMSE, and ADL scores, were computed as mean ± standard deviation (SD) and were used to report effect of evaluation indicators. Each effect size was given its point estimate at 95 % confidence interval (CI). Chi-square (χ^2) and I^2 were used to quantitatively determine heterogeneity between studies at an alpha value of 0.1. A fixed-effect model was used for meta-

analysis to determine if differences were significant ($p > 0.1$, $I^2 < 50$ %). If there was statistical heterogeneity between study results, the sources of heterogeneity were further analyzed and meta-analyses were performed using random-effects model after excluding the effects of significant clinical heterogeneity. Significant clinical heterogeneity was managed using methods such as subgroup analysis or sensitivity analysis or was described alone.

RESULTS

Literature search

A total of 827 relevant documents were initially retrieved and similar papers were removed. Abstracts and titles of papers were further analyzed (Figure 1) [7-13].
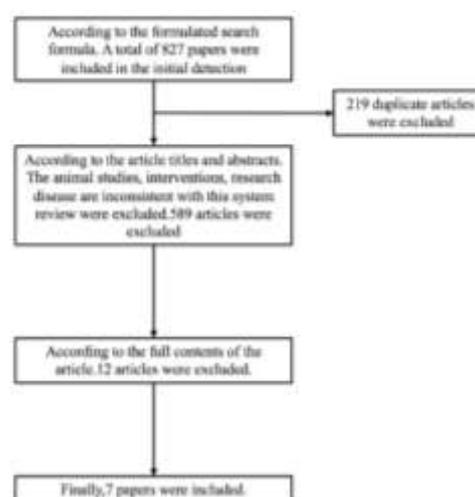

Figure 1: Literature screening process and results

Meta-analysis

There was no significant advantage in the use of statins at 3 months and 6 months after the intervention, but the MMSE score of the study group was significantly higher than that of the control group after 1 year of intervention ($p < 0.05$) (Figure 2).

ADL score

Clinically, a combination of statins and conventional drugs reduced ADL score. The reduced ADL score of the experimental group was significantly better than that of the control group, and the ADL score decreased the most during the 3rd month of intervention. In addition, ADL score under statin use at 1 year of intervention had no significant effect ($p < 0.05$) (Figure 3).
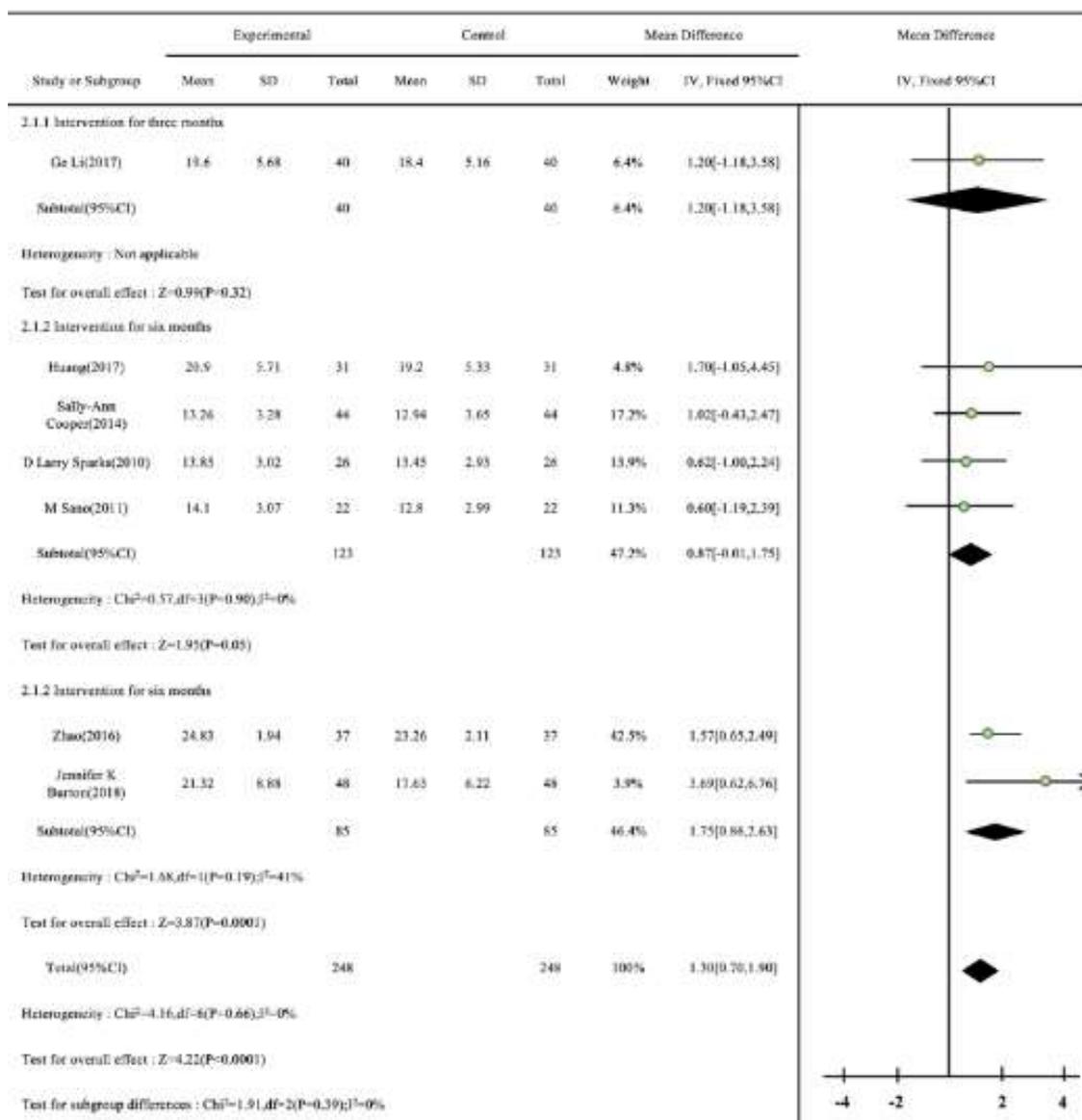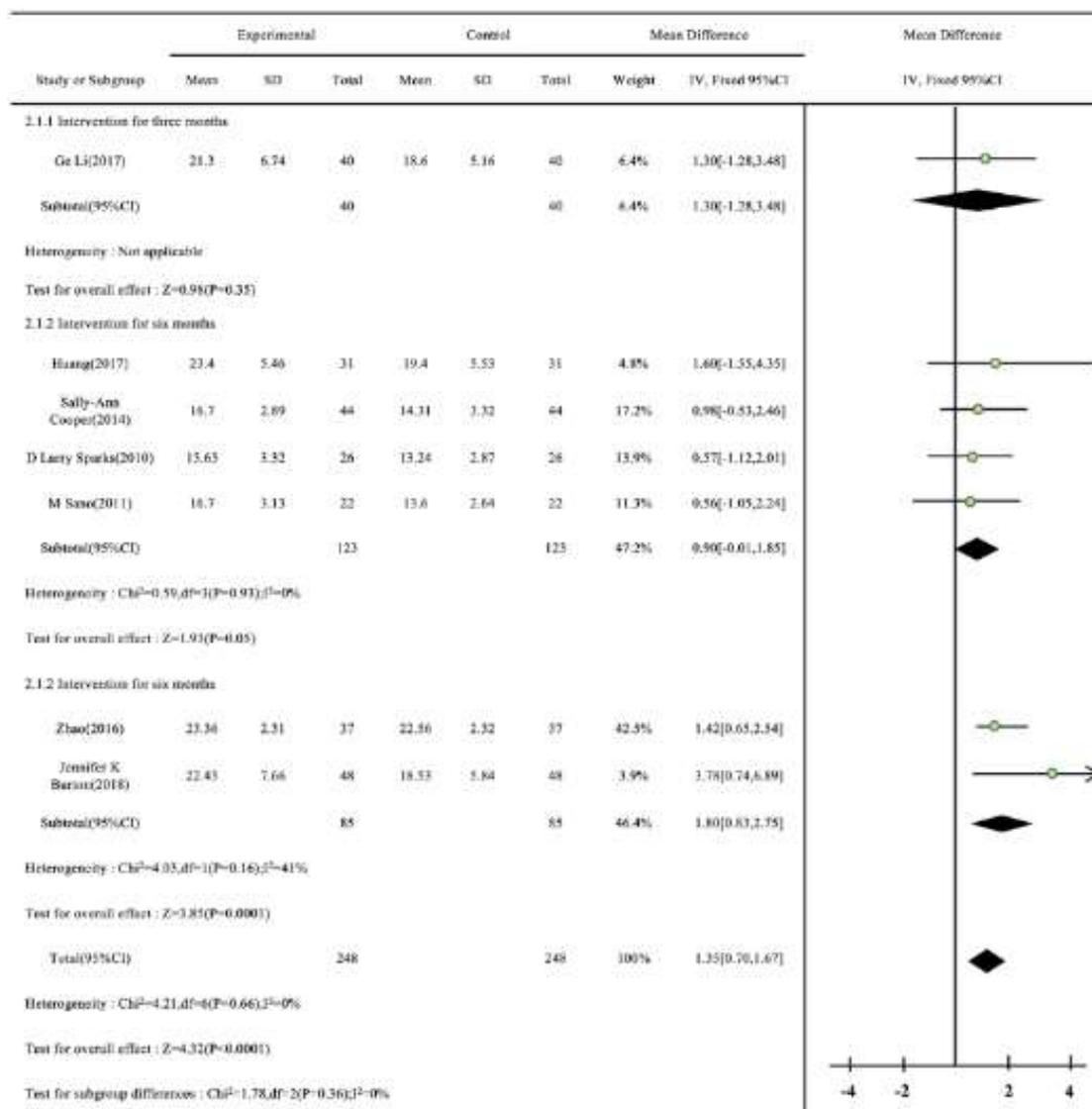
Figure 2: Meta-analysis (subgroup analysis) of conventional treatment and statin combined with conventional treatment on the improvement of MMSE

DISCUSSION

According to the survey results, since the beginning of 2013, about 18 million elderly people are older than 60 years old every year, but at the same time, the number of newborns is less than 13 million each year [14]. The current situation is that the specific growth rate of the birth population lags far behind the aging rate. The incidence of AD itself is increasing with the increase in elderly population [15]. Currently, 6 - 8 million people are more susceptible to AD disease as their age increases. Even after the age of 85, about one in 3 – 4, elderly people have AD. The high incidence of Alzheimer's disease, poor education, compliance, and awareness, have led to numerous challenges in diagnosis and treatment of AD [16]. In China,

various Internet technologies, and cloud computing have been rapidly improved, and relevant medical institutions are more likely to have the characteristics of big data [17]. Medical data (such as clinical diagnosis and treatment, laboratory examination data), various medical images, public health records, and medical knowledge data, etc., are large in volume and of various types. The included studies were all focused on the treatment of AD. Meta-analysis results showed that the effect of improving MMSE scores and reducing ADL scores in the statins combined with conventional drug therapy group was better than the control group, and average MMSE score increased by 1.3 points. This means that it has better effectiveness and safety.

Figure 3: Meta-analysis (subgroup analysis) of conventional therapy and statins combined with conventional therapy on ADL improvement

When compared with 3 months and 6 months of intervention, the MMSE score increased significantly at 1 year of intervention by 1.75 points. Furthermore, ADL score showed the best effect at 3 months of intervention by 7.8 points. However, as the intervention time increased, the ADL reduction score gradually decreased, and there was no difference between the two groups at 1 year of intervention. In addition, the MMSE score has a significant effect 1 year after intervention with statins. Since January 4, 2010, the State Council has issued several opinions on promoting the construction and development of Hainan International Tourism Island which was a welcomed development. As a major development strategy in China, tourism, transportation, and health undertakings have begun to flourish, but the permanent population and tourist numbers in the province have shown rapid growth, which has brought great challenges to the medical and healthcare staff. Currently, the permanent population has exceeded 10 million, in addition to residents. Most of its foreign population are mainly elderly, middle-aged, tourists and high-end groups with strong medical and health care needs. The current, diagnosis and treatment capacity of age-related diseases are seriously imbalanced, which is not conducive to the construction of Hainan International Tourism Island. The purpose of this project research was to build a precise network management model, carry out network management, and strengthen diagnosis and treatment level of Alzheimer's disease in Hainan province.

The efficient AD precision medicine data platform recognizes the epidemiology of AD, according to cloud technology statistics, builds AD risk prediction models, and provides disease prediction, and AD preventive measures. In

addition, through network and information means, Alzheimer's disease patients are provided with health consultation, remote consultation, appointment registration, guidance for individualized treatment, medication management, condition assessment, family life nursing guidance and real-time communication and other services, effectively solving the problem of difficulty in seeing a doctor. This promotes China's family-community medical model, and provides a good reference for the establishment of mobile medical system and new models of medical cooperation in the future.

Limitations of this study

The advantage of this meta-analysis over other meta-analyses is that the analysis of results may be more comprehensive than the number of studies included in this study. However, this study has some limitations. The quality of the included literature in this study is low, and most of the included studies are small sample studies, so the conclusions drawn should be explained in combination with clinical practice, and more and higher quality randomized controlled trials are needed to verify the outcomes. Also, the number of included studies was small and lacked the basis for subgroup analysis of multiple factors, so the conclusions reached, correspondingly had low confidence, conclusions or bias. In addition, outcome measure did not use the more reliable ADAS-cog, but the MMSE score was the main research instrument, it could only roughly describe the improvement of symptoms and was not the best tool for monitoring efficacy. Furthermore, the randomization method of some studies was unclear, and none of the included studies described allocation concealment and blinding, which may be at risk of bias. In the same manner, the outcome indicators of this study were influenced by many factors, which may lead to attribution bias.

CONCLUSION

The use of Internet cloud technology to build an Alzheimer's disease network management system optimizes and simplifies the diagnosis and treatment service process of Alzheimer's disease, realizes regional medical information sharing, instantaneous communication, reduces service cost of Alzheimer's disease, and the operating cost of the administrative management system. This improves the epidemiological investigation of Alzheimer's disease, effectively promotes the network management mode of Alzheimer's disease, and provides a set of standardized diagnoses and treatment. This is conducive to the research of Alzheimer's

disease. At the same time, the networked management model of hospital-community-family has obvious effects. Local indicators are influenced by several factors, which may lead to attribution bias.

DECLARATIONS

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Conflict of Interest

No conflict of interest associated with this work.

Contribution of Authors

The authors declare that this work was done by the authors named in this article and all liabilities pertaining to claims relating to the content of this article will be borne by them. Chaosheng Zeng and Huaijie Xing contributed equally to this work.

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