Observational Study

Medicine

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Impact of multidisciplinary chronic disease collaboration management on self-management of hypertension patients

A cohort study

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Abstract

To explore the effect of the interdisciplinary chronic disease management (CDM) model on patients with hypertension.

In this intervention study, the subjects were divided into CDM and control groups. Blood pressure control was monitored in both groups. After 1 year of follow-up, the endpoint events of patients and their knowledge, confidence, and behavior in response to the disease were assessed.

When compared with the control group, patients in the CDM group obtained higher scores for self-perception and management assessment, and their blood pressure control was also better after discharge. The quality of life and the satisfaction level of patients in the control group were lower than those in the CDM group, while the unplanned readmission rate, incidence of complications, and the average length of hospital stay in the control group were higher than those in the CDM group.

CDM model was beneficial to blood pressure control in hypertensive patients. It had also improved the quality of life and the satisfaction level of the hypertensive patients. Our study highlights the importance of the CDM model in the prognosis of hypertensive patients.

Abbreviations: ALOS = average length of stay, CDM = chronic disease management, DBP = diastolic blood pressure, MDT = multidisciplinary treatment, NCDs = noncommunicable diseases, SBP = systolic blood pressure.

Keywords: blood pressure, chronic disease management, health education, hypertension, self-management.

1. Introduction

Chronic noncommunicable diseases (NCDs), also known as chronic diseases, include several types of late-onset diseases that last for long periods and take several years to develop. For several diseases in this category, there is no clear "cure" so far and there is a lack of clear evidence regarding their cause.[1,2] Common chronic diseases include cardiovascular diseases, diabetes, malignant tumors, and chronic obstructive pulmonary disease.[3] Hypertension is the most common chronic disease. It is an important cause and risk factor for the development of a variety of cardio- and cerebrovascular diseases that affect the structure and function of important organs such as the heart, brain, and kidney, ultimately leading to the failure of these organs.[4,5] Hypertension has also been identified as one of the main causes of death from cardiovascular diseases.

However, the rate of hypertension control is extremely low for several reasons, but one of the important reasons is the lack of awareness of hypertension among patients, which leads to poor compliance with the prescribed treatment.[6] Therefore, it is necessary to educate hypertensive patients and raise their awareness status regarding the importance of hypertension and the necessity of long-term treatment.

Since the 1950s, the prevalence of hypertension has considerably increased worldwide. The overall awareness level, treatment compliance, and control rates in hypertension patients in China are considerably low.[7] The blood pressure level and

Funding: General Project of Hubei Provincial Health and Family Planning Commission (WJ2017M108); Hospital project nursing fund of union hospital in Wuhan (02.03.2017-253).

Data availability statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Ethics approval: The Ethical Committee of the Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China, reviewed and approved our study protocol.

The authors have no conflicts of interest to disclose.

Supplemental Digital Content is available for this article.

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How to cite this article: Huang J, Xu Y, Cao G, He Q, Yu P. Impact of multidisciplinary chronic disease collaboration management on self-management of hypertension patients: a cohort study. Medicine 2022;101:28(e29797).

Received: 23 July 2021 / Received in final form: 20 April 2022 / Accepted: 26 May 2022

http://dx.doi.org/10.1097/MD.0000000000029797

the risk of stroke and coronary heart disease events are independent and directly correlated. Multidisciplinary treatment (MDT) mode, also known as multidisciplinary expert treatment mode, is a regular approach undertaken by multiple experts at a fixed time and placed to develop the optimal treatment plan for patients based on the comprehensive multidisciplinary opinions.[8] In recent years, MDTs have been widely implemented and accepted within patient care programs for chronic disease management (CDM).[9] By constructing a multidisciplinary and collaborative CDM model, scientific nursing interventions can be actively performed, disease-related knowledge can be shared, and patients' health awareness and concept of health can be enhanced to improve patients' health and quality-of-life.[10] This study aimed to evaluate the effectiveness of the CDM model for hypertensive patients in a clinical setting.

2. Methods

2.1. Study design

This intervention study included 750 patients with hypertension who were treated at the Cardiovascular Medicine inpatient unit of the Union Hospital (Wuhan, China) from December 2018 to December 2019. The patient inclusion criteria were as follows: (1) Resting blood pressure >140/90 mm Hg as confirmed by more than 2 measurements taken during hospitalization; (2) availability for follow-up and collection of medical records; and (3) >18 years of age. The patient exclusion criteria were as follows: (1) physical impairment; (2) severe cognitive dysfunction combined with depression and/or other mental illnesses; (3) patients with secondary hypertension. The patients were screened according to the inclusion and exclusion criteria before their recruitment.

The eligible participants were divided into 2 groups: CDM and control. According to the annual numbers of hospitalized hypertensive patients in the Cardiovascular Medicine inpatient unit, the recruitment process was completed within 8 months; the hospitalized hypertensive patients of the unit were selected from October 2018 to June 2019. For each patient enrolled in the CDM group, we included a patient of a similar age (±1) and the same gender at the same time in the control group. All included subjects were educated (high school education and above). The study subjects were urban residents from central China who were well-educated and promised good compliance, which was in line with our study objectives.

2.2. Intervention and control conditions

All patients received standardized training and testing on self-measurement of blood pressure during hospitalization to ensure that accurate measurement of blood pressure could be obtained after discharge. The control group only received nursing care for hypertension during hospitalization. When discharged from the hospital, they were given oral and written medical advice, including adherence to regular medications, time for recheck, and lifestyle intervention (such as dietary suggestion, exercise guidance, losing weight, quitting smoking, etc). Out-of-hospital treatment of hypertension was performed according to the personal wishes of the patients in the control group. The CDM group was subjected to a multidisciplinary collaborative chronic disease hierarchical management model for nursing intervention and multidisciplinary chronic disease collaboration management method, as detailed below:

The multidisciplinary collaborative team included hypertension physicians, nursing managers, clinical nurses, diabetes specialist nurses, clinical pharmacists, public nutritionists, psychological counselors, and a head nurse. All members played a different role in the intervention work. The head nurse was mainly responsible for the research and management of the hierarchical management model of hypertension and chronic diseases. Two hypertension nurses were mainly responsible for providing disease knowledge, monitoring lifestyle intervention, and performing follow-up work and data collection of patients discharged from the hospital. The hypertension specialist, psychological counselor, clinical pharmacist, and public nutritionist were responsible for antihypertensive drugs correction, psychological counseling, drugs supervision, and preparation of the diet plans for patients. By performing a scientific and systematic evaluation of the patients, the team could provide individualized and targeted multidisciplinary nursing interventions. Intervention work was performed every day during hospitalization and once a month after the discharge. All interventions were examined and recorded by 2 investigators independently to reduce the bias.

2.3. Assessment of self-management ability

Health education awareness was assessed based on the 5-point Likert scale that includes 6 items.[11] This form was used to allow the patients to document their understanding of hypertension knowledge using the Likert 5-level scoring method. The categories of "never," "limited," "moderate," "large," and "extensive" were assigned 1 to 5 points, respectively. The form design contained the following items: basic knowledge, disease-related knowledge, medications, a reasonable diet to control weight, reducing sodium intake, regular exercise, and emotional stability. The patients were evaluated once a month based on this form.

The patients' confidence in completing the self-management evaluation for hypertension was assessed using the 10-point chronic disease self-efficacy scale.[12] This scale included 6 items, and each item was scored on a scale of 1 to 10 points: 1 point indicated that the patient was not confident, whereas 10 points signified that the patient was completely confident. The higher the score, the better was the individual self-efficacy level. A self-efficacy score of ≥7 points signified that the patient was confident in managing hypertension by himself/herself. Therefore, in this study, we defined a self-efficacy score of ≥7 points as high level, >5 points but <7 points as medium level, and <5 points as low level.

Self-health management behavior assessment was performed using the 5-point Likert scale that included 10 items: sodium intake control, food control (salty, fat, and cholesterol content); weight control; smoking status; alcohol intake status; taking antihypertensive drugs on time and in doses as directed by the doctor; good emotional control; regular exercise; exercise duration of 30 to 60 minutes; whether blood pressure is monitored daily; and whether the patient follows up as required. Each item was scored on a scale of 1 to 5 points from "none," "limited," "moderate," "large," and "extensive." A higher score meant better self-health management behavior and habits.

2.4. Follow-up

"First Assessment Form for the Management of Hypertension and Chronic Disease" was used to classify self-management of hypertension based on the following standards. Level 3 management: systolic blood pressure (SBP) ≥180 mm Hg or diastolic blood pressure (DBP) ≥110 mm Hg, with or without risk factors. Complications: SBP 140 to 179 mm Hg or DBP 90 to 109 mm Hg accompanied by more than 2 risk factors or complications. Level 2 management: SBP 140 to 179 mm Hg or DBP 90 to 109 mm Hg with 1 to 2 risk factors and no complications. Level 1 management: SBP 120 to 139 mm Hg or DBP 90 to 99 mm Hg without risk factors and complications.

The patients were followed up in outpatient clinics or via telephone or in-person health consultation (24 hours consultation service). The frequency of follow-up was determined according to the management level of blood pressure: level 3 management

patients were followed up once a month; level 2 management patients were follow-up once every 2 months, and level 1 management patients were follow-up once every 3 months. The blood pressure of these patients was collected during follow-up.

To ensure that the patients were appropriately followed up, the CDM team registered the telephone number and WeChat account of each patient and those of more than 2 family members of each patient in the contact information form. Before discharge, the patients themselves or their family members were added to a common WeChat group for unified management. During follow-up, the CDM team regularly informed the patients of the follow-up time via WeChat and instructed the patients or their family members on how to complete outpatient follow-up procedures with the physician in charge. For patients who were not available for outpatient follow-up, the team conducted telephonic follow-up. The patients were followed up at different durations according to the management level of blood pressure. All the patients in both groups were followed up on time, as planned.

2.5. Endpoint events

All endpoint events of patients during the follow-up were recorded. Endpoint events included quality of life, unplanned readmission, the incidence of major complications, mortality associated with hypertension and its complications, the average length of stay (ALOS), and treatment satisfaction.

Quality of life was evaluated by administering a short-form health survey (The MOS 36-item short-form health survey, SF-36). The SF-36 scale was developed based on the Medical Outcome Study Short Form-36 designed by Stewartse.[13] The scale measures 8 life quality aspects, including physical functioning, role physical, body pain, general health, vitality, social function, role emotional, and mental health. It is also a health change index. After testing, the scale showed good reliability and validity.

2.6. Statistical analyses

All assessments of scales and blood pressure were examined and recorded by 2 investigators independently to reduce the risk of any bias. The values are presented as N or means ±standard error of the mean. The student *t*-test was used to estimate the statistical difference between the 2 groups. One-way analysis of variance with Bonferroni test was used to evaluate variables between the groups. Statistical significance was defined as $P < 0.05$. All statistical analyses were performed using PASS 11.0 and SAS 9.1 software. The test performances of core indicators (i.e., evaluation index, chronic disease self-efficacy measurement, and self-health management behaviors assessment) were calculated as >80%.

2.7. Ethics approval and Informed consent

The study protocol was reviewed and approved by the ethics committee at the Union Hospital, Tongji Medical College, Huazhong University of Science and Technology. All personally identifiable information was removed to protect the patients' identities.

3. Results

3.1. General character of 2 groups

Our study identified a total of 796 patients hospitalized with hypertension (Figure S1, Supplemental Digital Content, http://links.lww.com/MD/G833). Of these records, 46 patients were excluded for the following reasons, including rejection to participate (n = 23), not available for follow-up and collection of medical records (n = 17), severe cognitive dysfunction combined with depression and/or other mental illnesses (n = 2), physical impairment (n = 2), and age <18 years (n = 2).

The CDM group consisted of 375 subjects, with 206 males and 169 females aged 18 to 85 years (average age: 48.2 ± 6.3 years). The control group consisted of 375 subjects, 214 males and 161 females, aged 19 to 83 years (average age: 47.6 ± 6.5 years). The characters of patients in 2 groups at baseline are shown in Table 1, including the age, gender, course of hypertension, hypertension risk classification, oral antihypertensive drugs, and complications. All patients in both groups were followed up for 1 year on time as planned.

3.2. Assessment of self-perception and management in hypertensive patients

After 1 year of follow-up, we set the expected goal of CDM in patients with hypertension and assessed the knowledge, confidence, and behavior of these patients based on 3 aspects.

Patient education plays an important role in CDM. Health education awareness of patients in the 2 groups was assessed based on the 5-point Likert scale (Table 2). The evaluation index of patients was 27.60 ± 1.34 in the CDM group and 20.82 ± 2.11 in the control group. There was a significant difference between the 2 groups ($P < 0.05$).

Chronic disease self-efficacy measurement of patients in the 2 groups was assessed based on the chronic disease self-efficacy scale (Table 2). There was only 1 patient in the CDM group with a score of <5, 10 patients with a score of 6, and 364 patients with a score >6 (97.1%). There were 196 patients in the control group with a score of <5, 147 patients with a score of 6, and 32 patients with a score >6. There were significant differences in the number of patients with different scores between the 2 groups, and patients in the CDM group generally scored higher ($P < 0.05$).

Self-health management behavior of patients in the 2 groups was assessed using the 5-point Likert scale (Table 2). The average scores of self-health management behaviors assessment were 43.37 ± 3.053 in the CDM group and 30.93 ± 3.92 in the control group. There were significant differences between the 2 groups ($P < 0.05$).

Table 1

Characteristics of CDM and control subjects at the baseline.

Characteristics	CDM group (n = 375)	Control group (n = 375)	t/χ^2	*P*
Age (years), (±SD)	48.2 ± 6.3	47.6 ± 6.5	1.28	0.200
Male, n	206	214	0.35	0.556
History of hypertension (years)	8.9 ± 3.6	11 ± 4.8	−7.06	0.000
Smoking, n (%)	49(13.1)	44 (11.7)	0.31	0.580
Diabetes mellitus, n (%)	36 (9.6)	33 (8.8)	0.14	0.705
Oral antihypertensive drugs, n (%)	115 (30.1%)	105 (28%)	0.64	0.423
Coronary heart disease, n (%)	88 (23.5%)	93(24.8%)	0.18	0.670

Age, duration of hypertension, and SBP and DBP variables were tested by *t*-test, and other variables were tested by χ^2 test.

Table 2

Comparison of self-perception and management between the 2 study groups.

	CDM group (n = 375)	Control group (n = 375)	t/χ^2	*P*
Evaluation index (±s)	27.60 ± 1.34	20.82 ± 2.11	56.59	0.000
Chronic disease self-efficacy measurement				
≤5	1 (0.3%)	196 (52.3%)	590.91	0.000
6	10 (2.6%)	147 (39.2%)		
≥7	364 (97.1%)	32 (8.5%)		
Self-health management behaviors assessment (±s)	43.37 ± 3.053	30.93 ± 3.92	50.11	0.000

3.3. Effect of the interdisciplinary chronic disease collaboration management model on blood pressure control

The level of blood pressure control in hypertensive patients is an important monitoring index. The blood pressure levels in the 2 groups were monitored on the day of discharge, and at 3 months, 6 months, and 9 months after discharge. At all these testing time-points, the systolic and diastolic blood pressure levels in the CDM group were significantly lower than those in the control group, $P < 0.01$ (Fig. 1). Proportion of CDM patients (3.7%, n = 14) with poor blood pressure control is much lower than in control group (56.0%, n = 210) (Table 3).

The mixed linear effect model was also used to compare the difference in blood pressure control between the control group and the chronic disease management intervention group, and the blood pressure values of each patient at hospitalization were adjusted. In consistent with Figure 1, the comparison of blood pressure control effect between chronic disease management intervention group and control group after discharge (Table 4).

3.4. Effect of the interdisciplinary chronic disease collaboration management model on endpoint event evaluation

The data pertaining to the patients' quality of life and ALOS in the hospital for the 2 groups are shown in Figure 2. Our results suggest that the quality of life in the CDM group was significantly improved relative to that in the control group ($P < 0.05$). The ALOS in the hospital for the CDM group was 6.5 days, while that for the control group was 9.9 days ($P < 0.05$).

A comparison of unplanned rehospitalization rate, complication rate, and patient mortality between both groups is given in Table 5. In the control group, 20 patients experienced unplanned readmissions. The unplanned readmission rate of patients in the CDM group was significantly lower than that in the control group ($P < 0.05$). In the CDM group, only 1 patient died of hypertension, amounting to a mortality rate of 0.27%, whereas 4 patients died in the control group, amounting to a mortality rate of 1.07% ($P > 0.05$). Major complications in both groups were recorded. The CDM group included 9 patients with major complications (5 patients with coronary heart disease, 1 patient with chronic renal insufficiency, 1 patient with cerebral infarction, 1 patient with heart failure, and 1 patient died). The control group included 21 patients with major complications (6 patients with coronary heart disease, 5 patients with heart failure, 3 patients with cerebral infarction, and 3 with chronic renal insufficiency, and 4 patients died). Incidences of major complications in the CDM group were much lower than those in the control group ($P < 0.05$).

3.5. Comparison of patient satisfaction

After follow-up, the patients in the 2 groups were asked to score treatment satisfaction, which was categorized into 3 levels: very satisfied, satisfied, and dissatisfied. Satisfaction rate = (very satisfied people + satisfied people)/number of people *100% (Table 6). There were statistical differences between both groups ($P < 0.05$). Compared with the control group, the satisfaction rate of patients in the CDM group indicated significant improvement.

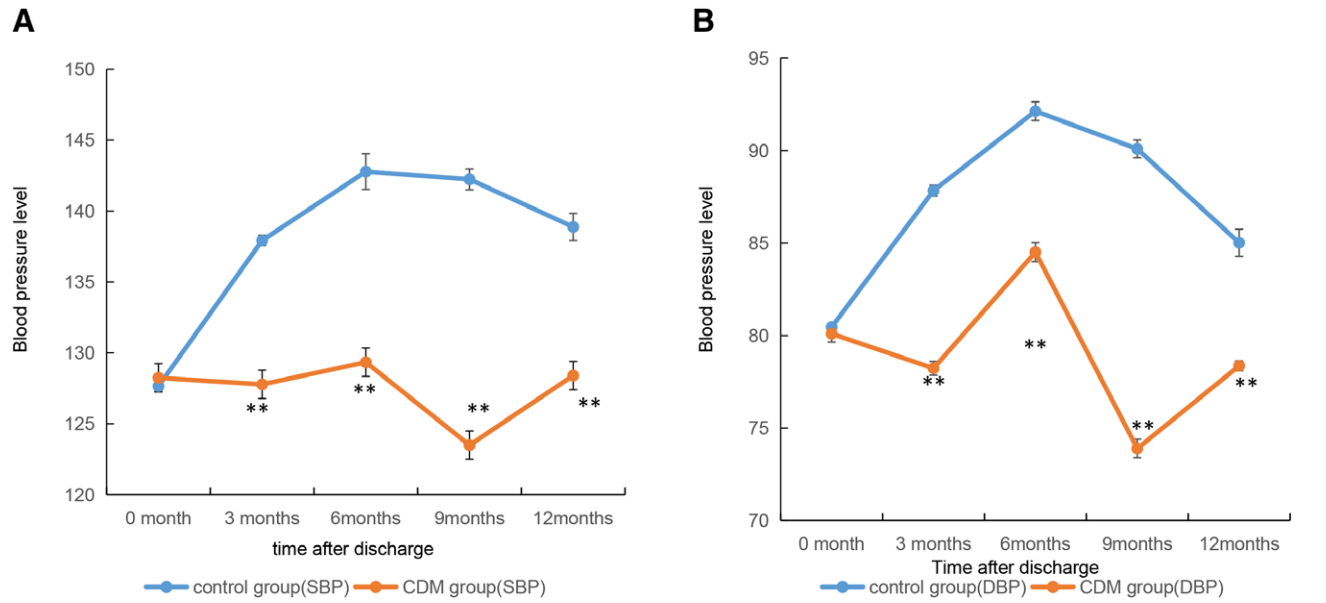

Figure 1. Comparison of SBP (A) and DBP (B) between the 2 groups after discharge. Data are represented as mean ± SEM. $^{**}P < 0.01$.

Table 3

Patients with poor blood pressure control in 2 groups.

	CDM group (n = 375)	Control group (n = 375)	χ^2	*P*
Patients with poor blood pressure control	14	210	244.53	0.000

4. Discussion

Hypertension is one of the most common chronic diseases affecting millions of people worldwide. In recent years, the incidence rate of hypertension has increased. Because of the increasing rates of complications associated with hypertension, it has not only become a public health problem but has also affected the quality of life for numerous patients.[14,15] Disease management is particularly effective in the managed care setting for improving blood pressure control and ensuring that important outcomes are monitored in hypertension patients.[16–18] Because of the regional differences in economic development, unbalanced distribution of medical resources, and gaps in the community medical systems, CDM has failed to develop in a standardized and systematic manner.[19,20]

The self-management education intervention for patients could lead to significant improvement in self-management of multiple diseases.[21] In CDM, patients need to understand and manage the disease themselves. Healthcare workers disseminate health information to patients, change patients' attitudes and beliefs about the disease, and thus change patients' daily behavior. In this study, patients in the CDM group scored higher in self-perception and management assessment than those in the control group, suggesting that our CDM model significantly improved self-perception and management of patients with hypertension.

In this study, a CDM team was established in the hospital that not only included specialized nurses for cardiovascular diseases but also specialized teams such as diabetes specialist nurses, psychological counselors, public nutritionists, and rehabilitation physiotherapists. Previous study also proved that the interprofessional education is improtent for the delivery of effective and efficient healthcare.[22] The core basis of our model is to improve patient education and disease management. Our strict management process and evaluation system demonstrates showed the overall responsibility of care and provided patients with a full range of high-quality services. In this study, the establishment of multidisciplinary chronic disease collaboration management for hypertension improved the quality of life of patients, reduced the rate of unplanned readmissions, the incidence of complications, and the average length of hospital stay. Consistent with these findings, patient satisfaction was significantly improved. These results indicate that this education model not only brings about an improvement in the prognosis of patients but also the education model itself is welcomed by patients.

Past studies have reported that the management of chronic diseases mainly focuses on intervention and guidance, follow-up, and health education of risk factors. However, less attention has been paid to the improvement of the skills of medical professionals, improvement in the quality of life, and communication among healthcare team members.[23] Moreover, CDM includes many challenges such as unclear team roles and responsibilities, and most of the work is performed by physicians, not a dedicated CDM team. In this study, we focused on multi-learning and collaboration, developed a strict management system, clarified the division of labor and cooperation, assigned responsibilities to individual team members, clarified

Table 4

Comparison of blood pressure control after discharge.

	SDP reduction		BDP reduction	
	β (95% CI)	P	β (95% CI)	P
Control group (n = 375)	Reference		Reference	
CDM group (n = 375)	−10.32 (−10.84, −9.81)	<.001	−7.68 (−8.07, −7.29)	<.001

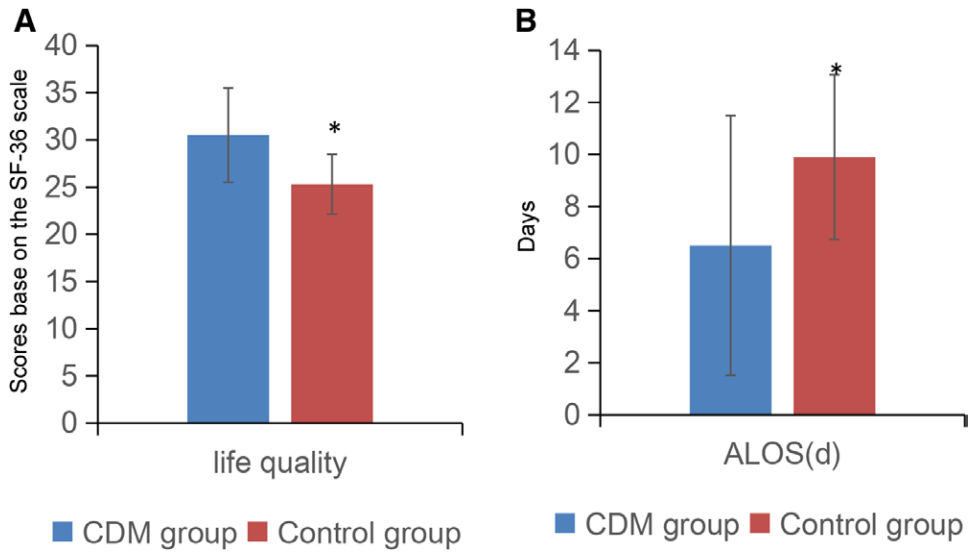

Figure 2. (A) The patient quality of the 2 study assessed base on the life SF-36 scale; (B) The average length of stay (ALOS) in the hospitals of the 2 study groups. Data are represented as mean ± SEM. *$P < 0.05$.

Table 5

Evaluation of the endpoint events.

Endpoint events	CDM group (n = 375)	Control group (n = 375)	χ^2	*P*
Unplanned readmission (n)	7	20	6.49	0.011
Mortality associated with hypertension and its complications(n)	1	4	1.81	0.178
Incidence of major complications (n)	9	21	5.17	0.023

Table 6

Comparison of the satisfaction level.

Treatment satisfaction	CDM group (n = 375)	Control group (n = 375)	χ^2	*P*
Very satisfied	348	268		
Satisfied	24	65	58.40	0.000
Dissatisfied	5	42		

the respective responsibilities of each member, and established exchange and interactive platform to share information about patients promptly. We also established a complete CDM process, and a strict evaluation and feedback system. Our CDM team members included specialist nurses and full-time staff in relevant professions, and all members had undergone rigorous training to ensure utmost professionality. Because of this personalized management, our CDM model was found to be more acceptable to patients and helped achieve better results.

In general, the need for disease information and patient–physician communication is high in patients with chronic diseases. Providing information and communicating with physicians and patients can reduce anxiety, which is necessary for patients to participate in decision-making and treatment. Previous studies have shown that the provision of comprehensible information by the medical staff is critical for improving patient anxiety, maintaining doctor–patient communication, and improving the health outcomes for patients.[24] In our study, results of patient satisfaction scores, patient education surveys, and patient endpoint events also suggest that providing medical information through patient education can improve patient outcomes as well as increase satisfaction pertaining to the received information. Therefore, information provision and emotional support should be combined as much as possible to benefit patients.

To date, only a few studies have been performed that have evaluated the extent of disease information, educational status, and the needs of patients with chronic diseases. Patient-specific expectations regarding the content and methods of information provision, how patient information is processed, the effect of cultural background, physicians' communication strategies, and various sources of information used by patients are very important for CDM; however, further research is warranted on how to improve these aspects.

4.1. Limitations

This study also has its limitations. First, the assessment of self-management in this study was performed and compared once, but more evaluations are needed to observe the effect of this model. Second, the follow-up time is only 1 year, which should be longer for chronic diseases. Thirdly, the quality of life and other assessments were measured after 1 year of treatment, which may lead to bias. Fourthly, the risk score of clinical characters should be calculated to make the results more accurate. Finally, this study is a single-center, prospective cohort study. Further in-depth studies including multicenter clinical studies are, therefore, needed to confirm the findings of our study.

4.2. Conclusions

In this study, we established a scientific and multidisciplinary CDM model for collaborative hypertension management to facilitate better and more effective blood pressure management in patients with hypertension. Through systematic medical interventions, we can improve patients' self-management ability and help them treat their underlying diseases, thereby improving the quality of life of the patients. We thus believe that our MDT model can be effective in managing other chronic diseases.

Author contributions

Conceptualization: PL. Y and JD. H; formal analysis, investigation; methodology, project administration, resources, and software: JD. H, YL X, GL C, Q H, and PL. Y; supervision; validation, visualization and writing – review; PL. Y and JD. H.; funding acquisition: JD. H.

Acknowledgments

The authors would like to thank Dr Jing Wu for the help in editing and statistical work, and MJEditor (www.mjeditor.com) for its linguistic assistance during the preparation of this manuscript. All authors declare no competing financial interests.

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