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Exploring the impact of three-dimensional patient satisfaction structure on adherence to medication and non-pharmaceutical treatment: a cross-sectional study among patients with hypertension in rural China

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Abstract

Background Hypertension is a chronic disease that requires strict adherence to therapeutic recommendations. While some studies have shown an association between hypertensive patient satisfaction and treatment adherence, research on the relationship between multi-dimensional satisfaction and patient adherence to medication as well as non-pharmaceutical treatment remains limited. This study aimed to examine the association among multiple dimensions of patient satisfaction and adherence among patients with hypertension in rural China.

Methods The research has a cross-sectional study design. A multi-stage, stratified random sampling approach was employed to survey a cohort of 2350 patients with hypertension in rural China. Patient satisfaction and adherence were measured using the instrument of European Task Force on Patient Evaluation of General Practice (EUROPEP) and the Treatment Adherence Scale for Hypertension Patients (TASHP). Multiple linear regression analysis was performed to identify factors influencing patient adherence, while structural equation modeling (SEM) was conducted to elucidate the relationships among various dimensions of patient satisfaction and adherence.

Results Our findings indicate that patient satisfaction with clinical behavior was positively associated with medication adherence ($\beta = 0.088$, $p < 0.05$) and non-pharmaceutical treatment adherence ($\beta = 0.152$, $p < 0.01$). Patient satisfaction with continuity and cooperation also had a positive influence on medication adherence ($\beta = 0.177$, $p < 0.01$) and non-pharmaceutical treatment adherence ($\beta = 0.134$, $p < 0.01$). However, although patient satisfaction with the organization of care had a negative impact on medication adherence (β=-0.259, $p < 0.01$), it did not affect non-pharmaceutical treatment adherence. Further, patient adherence was associated by region, age, level of education, course of the disease, and self-reported health status.

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Conclusions Our study highlights the importance of understanding the differential effects of patient satisfaction on adherence in rural China. To improve the management of patients with hypertension in rural areas, primary care institutions should focus on enhancing their capacity, improving the level and capabilities of their chronic disease management team members, promoting effective doctor-patient communication, and providing personalized health education.

Keywords Patient satisfaction, Adherence, Hypertension, Rural area, China

Background

Hypertension is a major global public health issue, one of the most important modifiable risk factors for all-cause morbidity and mortality, and has been associated with increased cardiovascular disease risks [1, 2]. The global burden of hypertension is estimated to have exceeded 1.4 billion cases and to affect 1.56 billion people by 2025 [3, 4]. In China, hypertension is ranked first in the incidence of chronic diseases. Its prevalence rate among residents aged ≥ 18 years has reached 27.9% [5], demonstrating a significant increase compared with the previous five national surveys [6]. However, the increase in hypertension rates in rural areas of China has been found to be even higher than that in urban areas.

China has currently placed a lot of emphasis on the management of patients with hypertension. The "national basic public health services project" has been implemented to address residents' fundamental health needs since 2009, particularly regarding hypertension [7]. However, most of the diagnosed high blood pressure remains poorly controlled despite recent advances in drug therapy. The most immediate reason is that patients do not strictly adhere to their medical recommendations, and even if some strictly follow the dosage and frequency of drug treatment, their blood pressure cannot be well-controlled unless they start implementing proper lifestyle adjustments [8]. Investigations on patients' adherence to hypertension therapeutic recommendations have confirmed that adherence is the primary reason affecting their medical outcomes, which has also been demonstrated that it could be encouragingly improved [9, 10].

According to the World Health Organization, patient adherence to treatment is defined as the extent to which an individual's behaviors to treatment are consistent with those recommended by health care providers, such as medication adherence, diet control and lifestyle improvement [11]. Suboptimal adherence to anti-hypertensive medication is a major contributor to poor blood pressure control [12]. Patients showing high medication adherence were 45% more likely to achieve BP control than those with medium or low adherence [13]. However, previous studies placed considerable importance on the assessment of medication adherence rather than paying careful attention to non-drug factors and effects [14, 15]. Chinese and international guidelines on the health management of hypertension suggest that adherence to non-drug treatment plays a significant role in enhancing blood pressure control and reducing complications, thereby directly affecting the progression of hypertension and treatment effects [5, 16]. Additionally, lifestyle interventions have definite anti-hypertensive effects. For instance, an average 67% reduction in alcohol intake could decrease SBP by 3.31 mmHg and DBP by 2.04 mmHg. The risk of hypertension was reported to be 1.18 to 1.55 times higher in people with mental stress than that in normal people, and was 1.16 to 1.28 times higher in overweight and obese people than in a normal-weight group [5, 6, 17]. Therefore, it is equally significant to evaluate medication adherence and non-pharmaceutical treatment for patients with hypertension.

Apart from patient-related factors, patients' behavior towards treatment is also closely related to doctor-patient cooperation and the effectiveness of communication [18], especially among patients with hypertension who need long-term follow-up management. The WHO also has defined five groups of factors contributing to non-adherence: (1) patient- and family-dependent factors, (2) illness-related factors, (3) treatment-related factors, (4) healthcare system-related factors, and (5) sociodemographic and economic factors [11]. Healthcare system-related factors include communication and satisfaction with treatment.

Many studies have shown an association between hypertensive patient satisfaction and treatment adherence. However, related surveys have focused mainly on drug adherence using questionnaires of the 8-item Morisky and neglected adherence to non-pharmaceutical interventions. For instance, Saarti et al. conducted a survey on 196 patients recruited from physician's practice offices and community pharmacies in Beirut and found that treatment satisfaction was significantly greater in patients with good adherence [19]. Jesús et al. found that satisfaction is conditioned by therapeutic adherence through an observational cross-sectional study conducted on 484 users of anti-hypertensive medication in a community pharmacy [20]. Sa'ed H Zyoud suggested that low treatment satisfaction might be an important barrier to achieving high medication adherence rates [21]. Additionally, measurements were limited to a single dimension in previous patient satisfaction-related studies. Natalia concluded that satisfaction with physician-patient communication significantly impacted

pharmaceutical adherence, based on a survey of 250 patients treated at a hypertension clinic [22]. Chang et al. analyzed the 2010 to 2017 Medical Expenditure Panel Survey, which involved 2571 Black adult patients, and reported that patient-clinician communication is an important predictor of optimal adherence to antihypertensive medication [23]. However, the nature of patient satisfaction is multi-dimensional because the patient evaluates distinct aspects of care in addition to the healthcare encounter as a whole [24]. The treatment of hypertension is not only about providing basic medical services but also about establishing a long-term relationship between doctors and patients, as well as the continuity and accessibility of services. Research on the influence of the multi-dimensional structure of patient satisfaction on adherence remains limited, and the relative contributions of different satisfaction dimensions to adherence have been inconclusive. Further, only a subgroup of ages has been investigated as many studies were only aimed at elderly patients and failed to comprehend that the trend of hypertension is becoming younger [25].

Our study subdivides the connotation of satisfaction and analyzes the influences of different aspects of medication and non-pharmaceutical treatment adherence in an integrated model. The instrument of European Task Force on Patient Evaluation of General Practice (EUROPEP) and the Treatment Adherence Scale for Hypertension Patients (TASHP) were adopted to measure patient satisfaction and adherence respectively [26, 27]. The two scales both have been examined in researches among patients in China, and were suitable for application in patients with hypertension in rural areas [27, 28]. We hypothesized that the internal dimensions of patient satisfaction among rural-based patients with hypertension would positively impact their medication (H1-H3) and non-pharmaceutical treatment adherence (H4-H6). The framework for our theoretical relationships is shown in Fig. 1. This study aimed to examine the relationship between these variables. And through the results, strategies that promote patient adherence to medication and non-pharmaceutical intervention and improve hypertension control in rural areas can be identified from the perspective of improving patient satisfaction with hypertension management services.

Methods

Research setting and participants

The multi-stage stratified random sampling method was used in this cross-sectional survey, which conducted in rural areas of China from 2017 to 2018. Patients with hypertension who were managed by rural primary-health-service institutions (township health centers, village clinics, community health service centers and community health service stations) were surveyed [29]. To ensure regional representation, three provinces—Zhejiang, Henan, and Shaanxi—were selected from eastern,

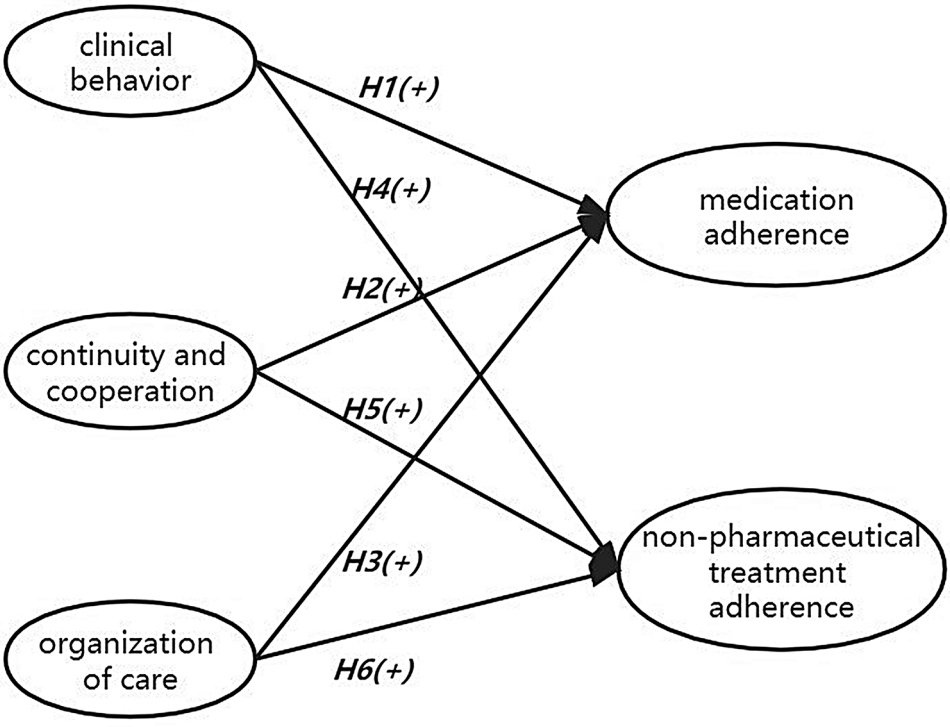

Fig. 1 Structural framework of the theoretical relationships

central, and western China. Two counties from each province were randomly chosen based on economic development (high and low). From each county, three townships were selected, categorized as economically developed, moderately developed, or underdeveloped. Then, three villages were chosen based on their proximity to township hospitals (far, medium, or close). Finally, 50 hypertension patients were randomly selected from each village using the hypertension management records of local primary healthcare institutions.

We received a total of 2665 questionnaires from the 2675 surveyed patients, resulting in a 99.6% overall response rate. All participants satisfied the following inclusion criteria: (a) had received hypertension management for more than 1 year; (b) had a normal intelligence quotient; (c) did not have any brain trauma or brain disease, visual or auditory dysfunction, or psychiatric disorder; and (d) could speak or read Chinese [30]. During the one-on-one field surveys, the investigators assessed whether the hypertension patients had normal intelligence based on their response speed, comprehension ability, consistency of answers, and language expression skills. Additionally, the investigators determined the presence of any brain diseases by inquiring about the respondents' medical and injury history, and assessed the presence of functional and mental disorders through observation and communication. For the received questionnaires, 2350 had a completion rate of 90% and were regarded as efficient. The scores of efficient questionnaires were assessed, and missing data were replaced with the determined median.

Ethical considerations

Research Ethics Committee of Hangzhou Normal University reviewed and approved the study protocol. Before administering the questionnaires, oral informed consent was obtained from all patients, taking into account their age and education level. Participation in the study was voluntary, and none of the authors were involved in the care of the participants.

Measures

The survey was conducted by experienced teachers, graduate students, and undergraduates in the field of social medicine and health management, with a background in medical knowledge. Over a period of two years, they visited rural primary healthcare institutions and the houses of the management subjects in various regions. Questionnaires were distributed in paper format, and the investigators guided the respondents one-on-one to complete the questionnaires, which were collected immediately. All subjects were asked about their sociodemographic characteristics, including age, gender, marital status, level of education, per-capita annual household income, and health insurance. Additionally, they were asked about their self-reported health status and the distance to the nearest healthcare facility. Patient satisfaction with their PCPs' services and treatment adherence were measured using two 5-point Likert scales.

Patient satisfaction

Patient satisfaction was measured using EUROPEP, a comprehensive tool representative of international standards that measures service satisfaction and developed through a rigorous design process [26]. EUROPEP does not evaluate a specific visit or doctor, but rather, patient satisfaction with doctors regarding services provided "over the last 12 months", meaning that it was applicable to our study design for primary-health-care institutions. The scale contains 23 items with scores ranging from 1 to 5 (1 = "poor," 3 = "acceptable," 5 = "excellent") about five aspects of care (relation and communication [6 items]; medical care [5 items]; information and support [4 items]; continuity and cooperation [3 items]; organization of care [5 items]), that inquire of patients about their regular general practitioner [31, 32]. A revised Chinese version was created by Han [28], and the reliability and validity were verified.

All 23 items were entered into an exploratory factor analysis model. The principal component extraction method was used to extract the scale components, and three factors were extracted with eigen values > 1. Among them, 5 items with factor loadings < 0.4 were deleted ("Involving you in decisions about your medical care", "Keeping your records and data confidential", "Offering you services for preventing diseases", "Helping you understand the importance of following his or her advice", and "Waiting time in the waiting room"). Then, 18 items were adopted, and the connotation was consistent with the original scale, containing the following three dimensions: clinical behavior (11 items, such as "Making you feel you had time during consultations"), continuity and cooperation (3 items, such as "Preparing you for what to expect from a specialist or hospital care"), and organization of care (4 items, such as "Getting an appointment to suit you"). The three-component model was determined to explain 63.16% of the total variance. The Kaiser-Meyer-Olkin (KMO) test for sampling adequacy was 0.954, and Bartlett's test of sphericity $\chi 2$ was 24613.96 ($p < 0.001$), indicating that the scale contained good construct validity (Appendix 1). The Cronbach's α coefficients for the three dimensions ranged from 0.736 to 0.935.

Treatment adherence

The treatment adherence scale for hypertension patients (TASHP) was developed by Tang Hongying and was adopted in this study, which is the first Chinese indigenous adherence evaluation scale for hypertension

patients. It has relatively complete dimensions that contain 25 items assessing the following four dimensions: medication adherence (5 items), poor medication adherence (8 items), lifestyle management (10 items), and tobacco and alcohol management (2 items) [27]. In this study, the items of medication adherence were all adopted (such as "take anti-hypertensive drugs prescribed by your doctor"). Among the items of lifestyle management and tobacco and alcohol management, we retained 8 items, including diet, exercise, smoking, drinking, sleep, weight control, mood regulation and blood pressure monitoring, according to the suggestion of global hypertension practice guidelines [33] (such as "Pay attention to the intake of less salt and soy sauce, no or less salty foods like cured meat products"). The items were scored, ranging from 1 ("no or very little time") to 5 ("all the time") and entered into an exploratory factor analysis model. Consequently, the two-component model was determined to explain 61.19% of the total variance, named "medication" and "non-pharmaceutical treatment". Factor loadings for the scale were all higher than 0.6. The KMO test for sampling adequacy was 0.778, and Bartlett's test of sphericity $\chi 2$ was 19858.51 ($p < 0.001$), indicating that the scale contained good construct validity (Appendix 2). The Cronbach's alpha for the two dimensions were 0.943 and 0.846 in our study.

Statistical analyses

Hierarchical linear regression analysis was conducted to examine the predictive effects of satisfaction dimensions on adherence, with patient medication and non-pharmaceutical treatment adherence as the dependent variable, the covariates selected from those with a p-value < 0.2 in univariate analyses as the independent variables in the first layer model [34], and the three dimensions of patient satisfaction as the independent variable in the second layer model. SEM was conducted to test our hypotheses. SEM can be used to measure latent variables, allowing the measurable and latent variables to be placed in a common model, which can include multiple dependent variables in one measurement, reducing the error of multiple linear regression analysis. Our analysis adopted Anderson and Gerbing's two-step strategy [35] to test the hypothesized model. First, the measurement model was confirmed using confirmatory factor analysis (CFA), then we performed SEM analysis to measure the fit and path coefficients of the hypothesized model. All analyses were conducted using the SPSS software v16.0 and AMOS software v22.0 (SEM).

Results

Descriptive analyses

A total of 2350 patients were included in this study. Over half (62.9%) were female, with the majority being middle-aged or older adults and only 29 patients (1.2%) under the age of 45. Most respondents were married (79.4%) and had lower than senior high school education at the survey time (96.4%). Since the survey was conducted in rural areas, most respondents' insurance was provided through the New Rural Cooperative Medical Scheme (67.6%), a rural dwellers' medical mutual helping system organized, guided and supported by their local government [36]. Specific data, including data for additional main characteristics, are presented in Table 1. And Table 2 shows the means and standard deviations of variables.

Table 1 Characteristics of the surveyed patients

Characteristics	*N*	%	Characteristics	*N*	%
Region (province)			Level of Education		
Eastern	739	31.4	Primary or lower	1894	80.6
Central	816	34.7	Junior high school or above	456	19.4
Western	795	33.8	Insurance type		
Gender			Medical Insurance for Urban Employees	37	1.6
Male	872	37.1	Medical Insurance for Urban Residents & Basic Medical Insurance for Urban and Rural Residents	710	30.2
Female	1478	62.9	New Rural Cooperative Medical Scheme	1588	67.6
Age			Other	15	0.6
< 45	29	1.2	Per-Capita Annual Household Income		
45–59	413	17.6	1 (≤ 1000 yuan)	529	22.5
60–74	1349	57.4	2 (1001–2000 yuan)	437	18.6
≥ 75	559	23.8	3 (2001–3916 yuan)	461	19.6
Marital Status			4 (3917–9600 yuan)	458	19.5
Married	1866	79.4	5 (> 9600 yuan)	465	19.8
Other	484	20.6			

Table 2 Means and standard deviations of variables

Variables	Mean	S.D.
1. Clinical behavior	23.229	6.555
2. Continuity and cooperation	7.040	1.901
3. Organization of care	9.652	2.393
4. Medication adherence	11.535	4.444
5. Non-pharmaceutical treatment adherence	22.866	5.704

Preliminary analyses

To measure the internal consistency reliability and convergent validity of the constructs in our proposed model, CFA analysis on the five constructs–three dimensions of patient satisfaction ("Clinical behavior", "Continuity and cooperation", and "Organization of care") and two dimensions of patients' adherence ("Medication" and "Non-pharmaceutical treatment") was performed (Table 3). The results revealed that each construct's composite

Table 3 Coefficients for the 5-factor measurement model

Construct	No. of items	Cronbach's a	Variable	Standardized Estimate	S.E.	C.*R.* (t-value)	AVE	Composite reliability
Clinical behavior	11	0.935	c1	0.656			0.567	0.935
			c2	0.754	0.027	40.174(**)		
			c3	0.759	0.034	32.545(**)		
			c4	0.78	0.034	33.296(**)		
			c5	0.751	0.033	32.262(**)		
			c6	0.795	0.034	33.792(**)		
			c7	0.811	0.034	34.347(**)		
			c8	0.799	0.035	33.958(**)		
			c9	0.697	0.035	30.287(**)		
			c10	0.779	0.034	33.259(**)		
			c11	0.681	0.034	29.695(**)		
Continuity and cooperation	3	0.822	c12	0.745			0.848	0.924
			c13	0.836	0.036	37.251(**)		
			c14	0.783	0.039	35.52(**)		
Organization of care	4	0.736	c15	0.61			0.421	0.742
			c16	0.643	0.044	23.871(**)		
			c17	0.56	0.052	21.591(**)		
			c18	0.765	0.048	26.474(**)		
Medication adherence	4	0.943	d1	0.957			0.764	0.927
			d2	0.994	0.009	116.944(**)		
			d3	0.776	0.014	55.56(**)		
			d4	0.741	0.015	50.345(**)		
Non-pharmaceutical treatment adherence	8	0.846	d5	0.657			0.404	0.844
			d6	0.589	0.034	24.151(**)		
			d7	0.6	0.039	24.508(**)		
			d8	0.598	0.035	24.45(**)		
			d9	0.654	0.03	26.332(**)		
			d10	0.742	0.035	28.95(**)		
			d11	0.64	0.04	25.876(**)		
			d12	0.59	0.033	23.843(**)		

Note *$p < 0.05$, **$p < 0.01$

Table 4 Assignment of demographic variables

Variable	Reference group	Assignment
Region	Western province	Central province = 1; Eastern province = 2
Insurance	Medical Insurance for Urban Employees	Medical Insurance for Urban Residents & Basic Medical Insurance for Urban and Rural Residents = 1; New Rural Cooperative Medical Scheme = 2; Other = 3
Level of Education	Primary or lower	Junior high school or above
Marital Status	Married	Other
Course of disease	≤ 3 years	4–10 years = 1; 10–20 years = 2; > 20 years = 3
Self-reported health status	Good	Neither good nor bad = 1; Bad = 2
Level of Education	Primary or lower	Junior high school or above

reliability (CR) ranged from 0.736 to 0.935, exceeding the 0.60 CR threshold value and providing evidence of internal consistency reliability [35, 37, 38]. The factor loadings of the individual items in the 5-factor model were all significant (all $p < 0.001$), indicating preliminary evidence for the convergent validity of the measurement model. Meanwhile, the average variance extracted (AVE) of all constructs ranged from 0.404 to 0.848, exceeding the 0.40 AVE threshold value, indicating that the convergent validity was acceptable.

Table 5 Results of hierarchical linear regression examining predictors of hypertensive patients' medication adherence

variable	The 1st level	The 2nd level
	Standardized beta	Standardized beta
Region (province)		
Western (reference group)		
Central	-0.245**	-0.237**
Eastern	-0.323**	-0.321**
Course of disease		
≤ 3 years (reference group)		
4–10 years	-0.103**	-0.109**
10–20 years	-0.186**	-0.185**
> 20 years	-0.119**	-0.122**
Self-reported health status		
Good (reference group)		
Neither good nor bad	0.054	0.048
Bad	0.088**	0.079*
satisfaction		
Clinical behavior		0.063*
Continuity and cooperation		0.077**
Organization of care		-0.108**
R^2	0.141	0.152
F	54.986**	41.943**
ΔR^2	0.141	0.011
ΔF	54.986**	10.025**
VIF_{max}	2.876	2.888

Note *$p < 0.05$, **$p < 0.01$

Table 6 Results of hierarchical linear regression examining predictors of hypertensive patients' non-pharmacheutical treatment adherence

variable	The 1st level	The 2nd level
	Standardized beta	Standardized beta
Region (province)		
Western (reference group)		
Central	0.294**	0.301**
Eastern	0.297**	0.284**
Course of disease		
≤ 3 years (reference group)		
4–10 years	0.042	0.031
10–20 years	-0.015	-0.016
> 20 years	-0.065**	-0.07**
Self-reported health status		
Good (reference group)		
Neither good nor bad	0.203**	0.183**
Bad	0.216**	0.196**
Age	0.076**	0.079**
Level of Education	-0.057**	-0.058**
satisfaction		
Clinical behavior		0.122**
Continuity and cooperation		0.142**
Organization of care		-0.103**
R^2	0.112	0.148
F	32.636**	33.675**
ΔR^2	0.112	0.037
ΔF	32.636**	33.675**
VIF_{max}	2.887	2.899

Note *$p < 0.05$, **$p < 0.01$

Hierarchical linear regression

The allocation of demographic variables is shown in Table 4. Tables 5 and 6 depicts the hierarchical linear regression analysis results. The results showed that the variance inflation factor (VIF) of each independent variable was less than 5, indicating that there was no obvious collinearity among the independent variables. ΔR^2 of the two layer were all significant in regression taking two dimensions of adherence as the dependent variable (Model 1:$\Delta R^2 = 0.141$, $\Delta F = 54.986$, $P<0.01$; $\Delta R^2 = 0.011$, $\Delta F = 10.025$, $P<0.01$ / Model 2: $\Delta R^2 = 0.112$, $\Delta F = 32.636$, $P<0.01$; $\Delta R^2 = 0.037$, $\Delta F = 33.675$, $P<0.01$). According to result of the second layer model, we found that the score of patient satisfaction with "clinical behavior" ($\beta = 0.063$, $p < 0.01$) and "continuity and cooperation" ($\beta = 0.077$, $p < 0.01$), having a bad self-reported health status ($\beta = 0.088$, $p < 0.01$) were associated with significantly higher medication adherence scores. In contrast, the score of patient satisfaction with the organization of care (β = -0.108, $p < 0.01$), a longer course of disease (4–10 years, β = − 0.103, $p < 0.01$; 10–20 years, β = − 0.186, $p < 0.01$; and > 20 years, β = − 0.119, $p < 0.01$), living in the central province (β = − 0.245, $p < 0.01$) and eastern province (β = − 0.323, $p < 0.01$) were associated with significantly lower scores. We also conducted a linear regression taking the non-pharmaceutical treatment adherence as a dependent variable, which showed that the scores of patient satisfaction with "clinical behavior" and "continuity and cooperation" were associated with significantly increased adherence score ($\beta = 0.122$, $p < 0.01$; $\beta = 0.142$, $p < 0.01$), while "organization of care" was associated with significantly decreased adherence score (β =-0.103, $p < 0.01$). The results of other variables in this model are shown in Table 6.

Structural model

"Clinical behavior", "Continuity and cooperation" and "Organization of care" were used as exogenous latent variables, while "Medication adherence" and "Non-pharmaceutical treatment adherence" were used as endogenous latent variables. The corresponding entries were considered observation variables to construct a structural equation model. The results of model fit showed that, the path of "Organization of care→ Non-pharmaceutical treatment adherence" is not significant. Thus in the modified model, this path was deleted. And the residual variables with larger modification indices, of which the relationship can be explained, are set to be related (e10 with e11, e21with e22, and e28 with

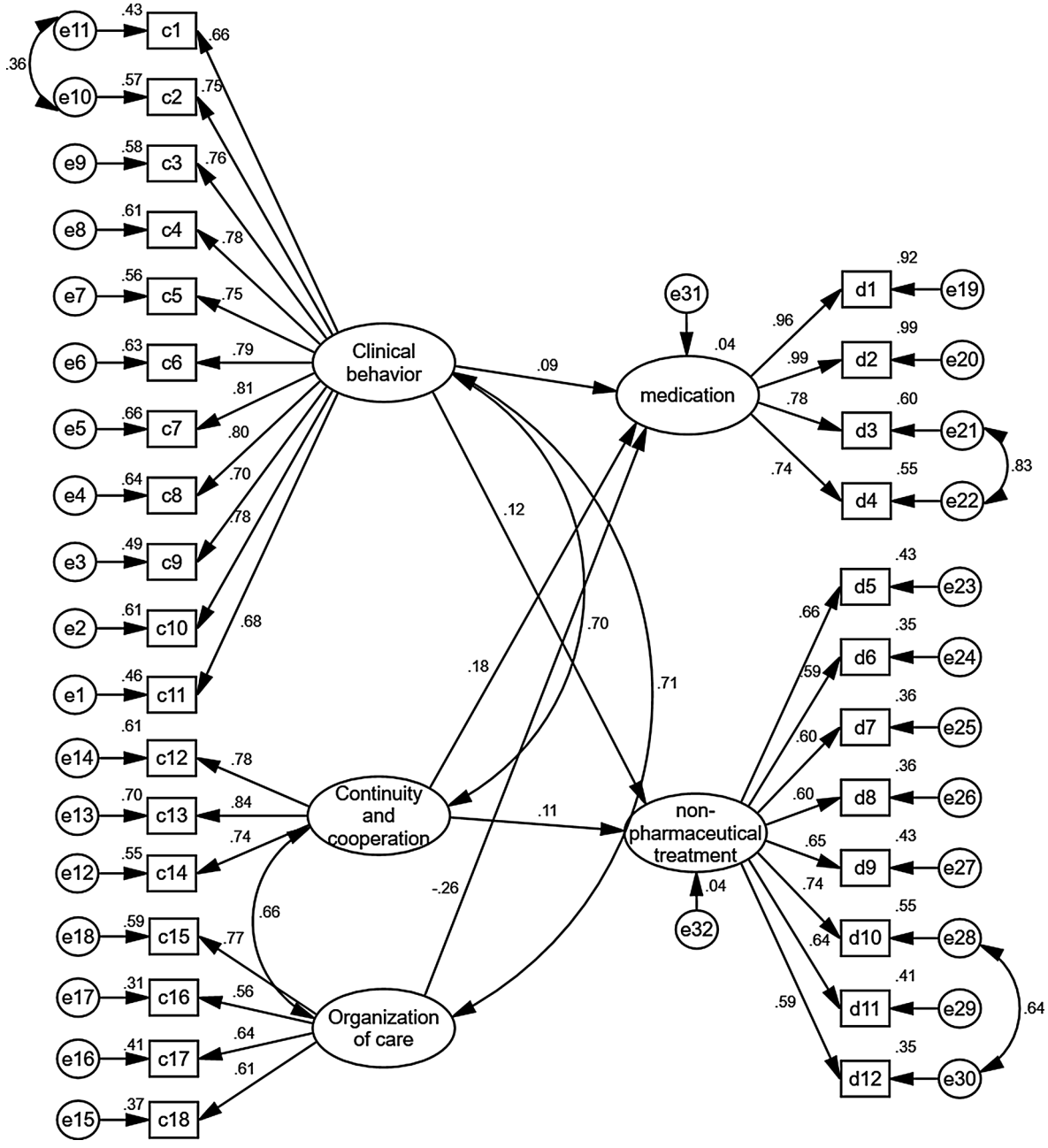

Fig. 2 Structural equation model of patient satisfaction and treatment adherence

Table 7 Goodness of fit index of structural equation model

Fit indices	Reference value	Model value	Overall model fit
χ^2/df	< 3	8.288	/
SRMR	< 0.080	0.044	Good
RMSEA	< 0.080	0.056	Good
GFI	> 0.900	0.907	Good
AGFI	> 0.900	0.890	Acceptable
TLI	> 0.900	0.929	Good
CFI	> 0.900	0.936	Good

e30). The final structural equation model is depicted in Fig. 2. The structural modeling results indicate that the hypothesized model fit the data well (GFI = 0.907, AGFI = 0.890, CFI = 0.936, TLI = 0.929, RMSEA = 0.056, and SRMR = 0.044; Table 7). The χ^2/df index is larger than reference value due to the large sample size of our study. The SEM results indicated that patient satisfaction with clinical behavior positively influenced medication adherence (0.09) and non-pharmaceutical treatment adherence (0.119), patient satisfaction with continuity and cooperation positively influenced medication adherence (0.179)

Table 8 The results of hypothesis verification

Hypothesis	Hypothesis supported
H1: Patient satisfaction with clinical behavior positively impact their medication adherence.	Yes
H2: Patient satisfaction with continuity and cooperation positively impact their medication adherence.	Yes
H3: Patient satisfaction with organization of care positively impact their medication adherence.	No
H4: Patient satisfaction with clinical behavior positively impact their non-pharmaceutical treatment adherence.	Yes
H5: Patient satisfaction with continuity and cooperation positively impact their non-pharmaceutical treatment adherence.	Yes
H6: Patient satisfaction with organization of care positively impact their non-pharmaceutical treatment adherence.	No

Table 9 Results of the structural equation modeling

Path	Unstandardized regression weights	Standardized regression weights	t
Clinical behavior→ medication adherence	0.196	0.09	2.31*
Continuity and cooperation→ medication adherence	0.445	0.179	4.723**
Organization of care→ medication adherence	-0.669	-0.264	-6.131**
Clinical behavior→ non-pharmaceutical treatment adherence	0.159	0.119	3.336**
Continuity and cooperation→ Non-pharmaceutical treatment adherence	0.166	0.109	2.937**

Note $*p < 0.05$, $**p < 0.01$

and non-pharmaceutical treatment adherence (0.109), and that patient satisfaction with the organization of care negatively influenced medication adherence (-0.264) but had no effect on non-pharmaceutical treatment adherence. The results of hypothesis verification and structural equation model are shown in Tables 8 and 9.

Discussion

This study found significant associations between several sociodemographic characteristics, such as region, age and level of education, self-reported health status, course of disease and therapeutic adherence regarding medication and non-pharmaceutical treatments. Additionally, the study also found that the influence of the three dimensions of patient satisfaction varied between medication and non-pharmaceutical treatment adherence.

Notably, we observed lower medication adherence among patients living in Eastern and Central provinces, which could be attributed to lower awareness of hypertension-related knowledge and lower levels of self-management in rural areas [39, 40]. Moreover, rural areas in the Eastern and Central regions tend to have better economic levels and accessibility to healthcare services [41]. As a result, patients in these areas prefer seeking treatment directly from healthcare personnel at basic medical and health service institutions, which could have led to an inadequate emphasis on strict adherence to medication dosage and frequency in their daily routines. Comparatively, patients in the Western regions had lower levels of non-pharmaceutical treatment adherence, possibly due to differences in dietary habits. A previous survey indicated that smoking and drinking rates in Western regions are higher than in Central and Eastern regions [42].

Furthermore, self-reported health status by patients negatively impacts hypertension treatment adherence. Patients who perceive themselves as having a better health status often display lower levels of medication and non-pharmaceutical treatment adherence as they are more likely to experience intermittent drug discontinuation and lifestyle laxity [43]. In addition, our research has shown that long-term disease course can cause a psychological and physical burden on patients, ultimately leading to decreased treatment adherence. Our results align with the findings from the study conducted by Zhang X and Agh T [44, 45]. Older patients were observed to demonstrate higher levels of non-pharmaceutical treatment adherence, consistent with the results of Xie Z's study, which was conducted on 148 patients with coexisting type 2 diabetes mellitus and hypertension [46].

The results of this study indicate that rural hypertensive patients' satisfaction with physicians' clinical behavior, which includes doctor-patient relationship and communication, medical care, information and support, positively impacted both their medication and non-pharmaceutical treatment adherence. Such observations could be multifactorial. First, medical services can immediately and significantly motivate patients to follow medical advice by relieving their symptoms [47, 48]. Second, the effectiveness of communication between doctors and patients directly affects patients' ability to correctly understand doctors' advice and regulations and execute them accordingly. Studies have shown that effective communication may increase patients' knowledge about their medications and medical conditions [23, 49]. Particularly in rural areas where patients' cultural knowledge and awareness of hypertension are relatively low, providing patients with adequate attention, respect and support, as well as encouraging them to take appropriate actions,

answering their questions patiently and alleviating their anxieties, can enhance their confidence for self-management of their disease in the long term [50, 51]. Therefore, by establishing a positive doctor-patient relationship and improving communication, patients' awareness and motivation to manage hypertension can be increased, their willingness and ability to adopt healthy behaviors can be improved, and thus their treatment adherence can be enhanced. These findings are consistent with a cross-sectional survey of 300 hypertensive patients in health care centers in Isfahan, Iran [52], and a survey of 250 hypertensive patients diagnosed according to European Society of Cardiology guidelines and treated at a hypertension clinic [22].

The satisfaction of hypertensive patients with medical service continuity and cooperation positively impacts both medication and non-pharmaceutical treatment adherence. In China, the management of hypertension patients is coordinated by township health centers, village clinics, or community health service centers and community health service stations. While the township health center or community health service centers is responsible for treating and adjusting prescriptions for patients diagnosed with hypertension and those with poor blood pressure management, village clinics or community health service stations are responsible for follow-up [53]. However, when patients receive treatment across different institutions, information gaps, cross-drug treatments and treatment inconsistencies might arise [54], leading to reduced treatment adherence [55, 56]. Thus, improving medical service continuity between different institutions can help the providers to better understand patients' condition and treatment history, develop continuous diagnosis and treatment plans, and ensure the coordination of drug treatment, lifestyle intervention and other management measures [57]. In addition, providing patients with cross-professional medical cooperation would ensure these patients have access to comprehensive medical services, including medication, nutritional counseling, rehabilitation therapy, and psychological support, thereby improving patients' satisfaction and adherence to medical service recommendations. In this regard, a study of 383 patients with type 2 diabetes and/or hypertension managed in the community of China showed that patients with access to multidisciplinary team management services had a higher degree of recognition, supporting the findings [58].

Our study revealed an interesting finding that patient satisfaction with the organization of care negatively impacted medication adherence but did not affect non-pharmaceutical treatment adherence. Previous research has shown that the quality and satisfaction of healthcare organizations, such as prompt response and seamless referrals, can enhance medication adherence [9, 59]. However, convenient healthcare services may result in patients underestimating the importance of drug therapy, overlooking precautions and side effects, and reducing their subjective sense of responsibility, which can reduce their medication adherence [60]. Additionally, the American Heart Association states that various factors contribute to non-adherence [9]. Even if the service organization's procedures are smooth and of high quality, service providers may still be deficient or limited in terms of inadequate medical resources and outdated medical equipment, particularly in rural areas where medical facilities are relatively inferior to urban areas [61]. These factors can also lead to a decline in patient medication adherence. Patients' satisfaction with the organization of care did not affect their non-pharmaceutical adherence, possibly because it primarily relies on personal willpower and behavioral habits. Most negative habits, such as poor dietary habits, smoking, alcohol consumption, sedentary lifestyle and lack of sleep, are developed over the long term and might be difficult to modify through external influences [62]. Thus, improving the organization of care might only provide convenient conditions for patients and could be insufficient to alter their behavior.

It is important to note that simply considering the rapid, low-cost, and low-threshold improvement of service organization satisfaction may not be sufficient to enhance patients' awareness of hypertension self-management while providing personalized and professional medical guidance and maintaining high service quality are also critical [8, 13]. For instance, some patients prefer to see the same doctor consistently rather than switch between doctors. Therefore, even if patients are satisfied with the service organization and can conveniently access a doctor's response or switch to another doctor, if the doctor's attitude towards service provision is perfunctory or the ability is inadequate, patient adherence may not improve. In these scenarios, patients must receive high-quality hypertension management services from their doctors rather than solely relying on the convenience provided by the service organization [63].

There were also several limitations in this study. The study relied solely on self-report measures, and future research may consider using electronic devices to measure patient adherence more accurately. The regression models had low goodness of fit index (R^2), indicating a limited ability to explain variations in the dependent variables, although it was still within an acceptable range. However, it is important to note that our primary aim was not to predict patient adherence but to identify the influence of different dimensions of patient satisfaction on adherence. Despite these limitations, our use of SEM has contributed to the current literature on the relationships between satisfaction and adherence among rural Chinese patients with hypertension, clarifying the

influencing mechanism of the internal dimension. This study utilizes data from 2017 to 2018, which may not accutately reflect the situation 7 years later. However, given that the research subjects are rural hypertensive patients, primary healthcare institutions still play the frontline role of hypertension prevention and management. These institutions remain primarily responsible for hypertension detection, registration, treatment, and long-term systematic management [64]. Nevertheless, the public health infrastructure in rural areas is relatively underdeveloped, and patients exhibit limited awareness of hypertension prevention and treatment, leading to patients' poor adherence [65]. Consequently, an in-depth exploration of how various aspects of patient satisfaction affect their adherence to both medication and non-pharmaceutical treatments provides a novel and practical perspective for hypertension management research in rural China.

Conclusion

This study showed that treatment adherence among rural Chinese patients with hypertension was associated with several sociodemographic characteristics, including region, age and self-reported health status. Based on these findings, we suggest tailored interventions to improve patient adherence within the sociodemographic groups with low adherence levels. Efforts could be made to integrate medical resources to ensure adequate treatment quality across regions and provide personalized health education.

Patient satisfaction with clinical behavior, continuity and cooperation of medical service were found to positively influence patients' adherence to medication and non-pharmaceutical treatment. Therefore, we suggest improving the construction of rural hypertension management teams, enhancing cooperation among regional primary care institutions, improving information sharing and coordination, and strengthening doctor-patient communication and joint decision-making to establish a scientific, standardized, convenient and effective hypertension management mechanism.

Regarding the research results that patient satisfaction with the organization of care negatively affects medication adherence but does not affect non-pharmaceutical treatment adherence, the future management of rural patients with hypertension should not only focus on the accessibility of medical services and referral convenience but also strengthen the self-construction of primary care institutions' capacity. This includes improving the treatment environment and facilities, promoting the medical expert team's professional ability and communication skills, and providing personalized and professional medical guidance and education. These steps would comprehensively improve patients' satisfaction with rural primary hypertension management services, guide them toward scientific treatment and self-management, and ultimately improve treatment adherence.

Abbreviations

BP	Blood Pressure
SBP	Systolic Blood Pressure
DBP	Diastolic Blood Pressure
EUROPEP	European Task Force on Patient Evaluation of General Practice
TASHP	Treatment Adherence Scale for Hypertension Patients
WHO	World Health Organization
KMO	Kaiser-Meyer-Olkin test
PCP	Primary Care Physician
SEM	Structural Equation Model
CFA	Confirmatory Factor Analysis
CR	Composite Reliability
AVE	Average Variance Extracted
SRMR	Standardized root mean square residual
RMSEA	Root mean-square error of approximation
GFI	Goodness of fit index
AGFI	Adjusted goodness of fit index
TLI	Tucker-Lewis fit index
CFI	Comparative fit index

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

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Author contributions

MZ and WC conceived the paper, led the design of structural equation model. YX and JF were responsible for data collection. XL, YL and LS contributed to the literature search. WC conducted the data analyses and wrote the manuscript. MZ, JF and YX helped with revisions of the manuscript. All authors read and approved the final manuscript.

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Data availability

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

Declarations

Ethics approval and consent to participate

Research Ethics Committee of Hangzhou Normal University reviewed and approved the study protocol (approval number: 2015-032). Considering the age and the education level of patients in our study, verbal-only informed consent, which had been approved by the ethics committee, was obtained from all patients. All procedures were performed in accordance with the Declaration of Helsinki and the ethical standards of the ethics committee of Hangzhou Normal University.

Consent for publication

Not applicable.

Competing interests
The authors declare no competing interests.

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