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Medication Adherence and Influencing Factors of Elderly Hypertensive Patients during the COVID-19 Period: A Cross-Sectional Study in Chengdu, China

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Abstract: *To investigate the medication adherence of elderly hypertensive patients in community during the COVID-19 period and analyze its influencing factors. 392 elderly patients with hypertension were selected from two communities in Chengdu, Sichuan Province, and were investigated by demographic characters, circumstances in COVID-19 period, Morisky Medication Adherence Scale. Chi-square test and binary logistic regression analysis were performed by SPSS 25.0 software. The medication adherence prevalence of elderly hypertensive patients from two communities in Chengdu was 43.37%. Binary logistic regression analysis showed that marital status, antihypertensive drug use during COVID-19 vaccination, antihypertensive drug use during COVID-19 treatment and emotional situation during the COVID-19 period were independent influencing factors of medication adherence of elderly hypertensive patients. During the COVID-19 period medication adherence among elderly hypertensive patients from two communities in Chengdu was poor.*

Keywords: *COVID-19 period; Elderly; Hypertension; Medication adherence; Influencing factors*

1. Introduction

Hypertension is defined as systolic blood pressure (SBP) ≥140 mmHg or diastolic blood pressure (DBP) ≥90 mmHg or taking medication for hypertension, which is one of the most common major chronic diseases in the world and the main risk factor for stroke, kidney disease, heart failure and other diseases[1]. As the world population ages, the prevalence of hypertension has reached 33% globally in 2019. However, it is concerning that only approximately one out of every five individuals with hypertension receive adequate treatment[2].

Apart from making lifestyle changes, pharmacological treatment is the most basic and convenient method to control hypertension. Following doctor's advice and regular medication over a long period of time can reduce the occurrence of long-term cardiovascular adverse events[3]. However, patients may fail to adhere to their antihypertensive drug regimen for various reasons across different periods. For instance, the medication adherence of patients worldwide was adversely impacted during the COVID-19 period[4-6].

Although countries around the world have adopted downgrade COVID-19 global treat level, COVID-19 has not disappeared but still infectious[7]. In particular, the elderly with chronic diseases such as hypertension are more vulnerable to be infected and the consequences are more serious[8-9]. Adherence to medication regimens and following medical advice are crucial in ensuring the best possible health outcomes for this vulnerable population[10-11].

Studies focusing on nonadherence with drugs for cardiovascular and cerebrovascular diseases have found that nonadherence with drugs is related to some demonstrable characters such as sex, race, socioeconomic status, and whether or not there is coinsurance[12-14], while some studies also found anxiety and depression can have negative impact on adherence[15-16]. During major infectious disease outbreaks, such as the novel coronavirus epidemic, there is a lack of research on the impact of public health emergencies on drug adherence among patients with chronic diseases, especially elderly patients with hypertension who require special attention. Therefore, in this study, we aim to not only investigate nonadherence caused by demographic characteristics but also analyze whether nonadherence can be explained by factors specific to the epidemic situation. By examining these factors, we hope to gain a better understanding of the challenges faced by elderly hypertensive patients in adhering to their medication regimens during public health emergencies.

ISSN 2706-6819 Vol.5, Issue 11: 55-62, DOI: 10.25236/IJFM.2023.051109

2. Objects and Methods

2.1. Study Subjects

A total of 392 elderly hypertensive patients were selected from two communities of Chengdu City from March to April, 2023. The inclusion criteria and exclusion criteria were as follows: Inclusion criteria, ⑴age ≥60 years old; ⑵Individuals who met the pharmacological antihypertensive treatment criteria recommended by WHO: Being confirmedly diagnosed with hypertension and systolic blood pressure ≥140 mmHg or the diastolic blood pressure ≥ 90 mmHg[17]; ⑶At least one antihypertensive drug is taken for a long time; ⑷Patients with clear consciousness, no cognitive function or communication disorder. Exclusion criteria, ⑴Patients with critical mental illness; ⑵Those who did not take antihypertensive drugs during the COVID-19 period after their blood pressure was controlled in a good way. Informed consent was obtained verbally from participants. We used anonymous data for all our analyses to protect participants' privacy.

2.2. Questionnaire

2.2.1. Demographic characters

The questionnaire includes include that follow items: sex, age, educational level, marital status, previous career, monthly income, course of hypertension, complications of hypertension. By including these items in the questionnaire, we aim to obtain a comprehensive understanding of the participants' demographic characteristics and medical history, which will help analyze the factors influencing medication adherence during public health emergencies.

2.2.2. Experiences in COVID-19

In this section of the questionnaire, our objective was to investigate whether there were any specific experiences during the COVID-19 pandemic that may have had an impact on medication adherence. This includes factors such as stopping the intake of antihypertensive medication after receiving the COVID-19 vaccine, the ease of purchasing medication, and the emotional state during lockdown measures, and questions regarding the convenience of medication purchase and emotional well-being following the change in management category.

2.2.3. Morisky Medication Adherence Scale

This scale is used to evaluate medication adherence in patients with hypertension who are taking antihypertensive drugs. The scale consists of four questions, which assess different aspects of medication use. ①Have you ever forgotten to take drugs? ②Whether medication is not paid attention to sometimes? ③Whether to stop taking medicine when the subjective symptoms improve? ④Whether the medication was stopped when the subjective symptoms worsened? The answer "No" was counted as 1 point, and the answer "Yes" was counted as 0 point. A total score of 4 points indicated adherence, or else it was considered as nonadherence[18].

2.3. Data Acquisition

Unified trained investigators conducted one-on-one interviews with subjects who met the inclusion criteria, and filled in the questionnaire according to the contents of the interviews. Parallel double entry was performed using EpiData3.1 software.

2.4. Statistical Analysis

The statistical analysis of the collected data was performed using SPSS25.0 software. The chi-square test was used for inter-group comparisons of categorical variables, while binary logistic regression analysis was employed to investigate the potential factors affecting medication adherence. But to avoid possible multicollinearity with more independent variables, stepwise regression analysis was used to first examine the influence of the factors on medication adherence one by one, and then comprehensively examine the influence of all independent variables on the dependent variable. A significance level of 0.05 was used for all statistical tests.

ISSN 2706-6819 Vol.5, Issue 11: 55-62, DOI: 10.25236/IJFM.2023.051109

3. Results

3.1. Main result

Out of 400 respondents, 392 completed the full questionnaire. The adherent group consisted of 170 respondents, while the nonadherent consisted of 222 respondents. The prevalence of adherence was only 43.37%. Figure 1 shows the Morisky Medication Adherence Scale score of 392 respondents. A Chi-square test revealed significant differences in the answers to the four questions in the nonadherence group ($\chi 2$ =53.85, p<0.001), and the Bonferroni's multiple comparisons post hoc test indicated that the respondents were more likely to experience 'forgetting to take drugs' and 'not paying attention to taking medicine' than the other two nonadherence behaviors (p < 0.05) (See Figure 2).

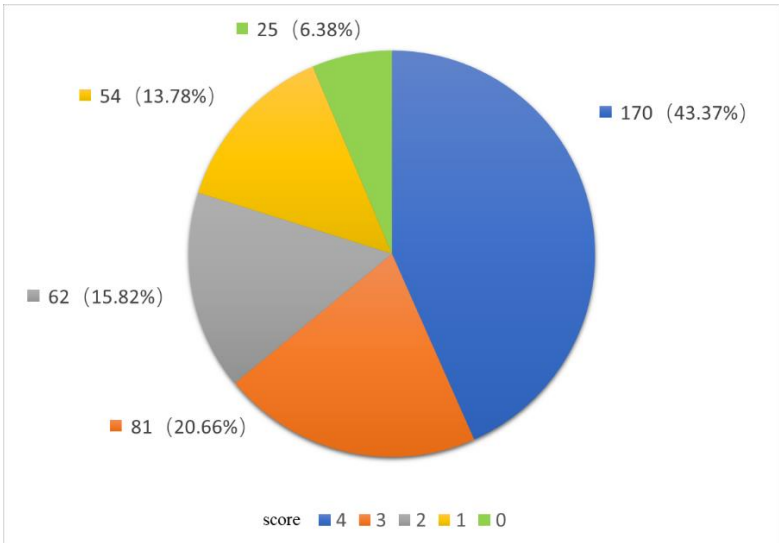

Figure 1:The score distribution of the Morisky Medication Adherence Scale of 392 respondents.

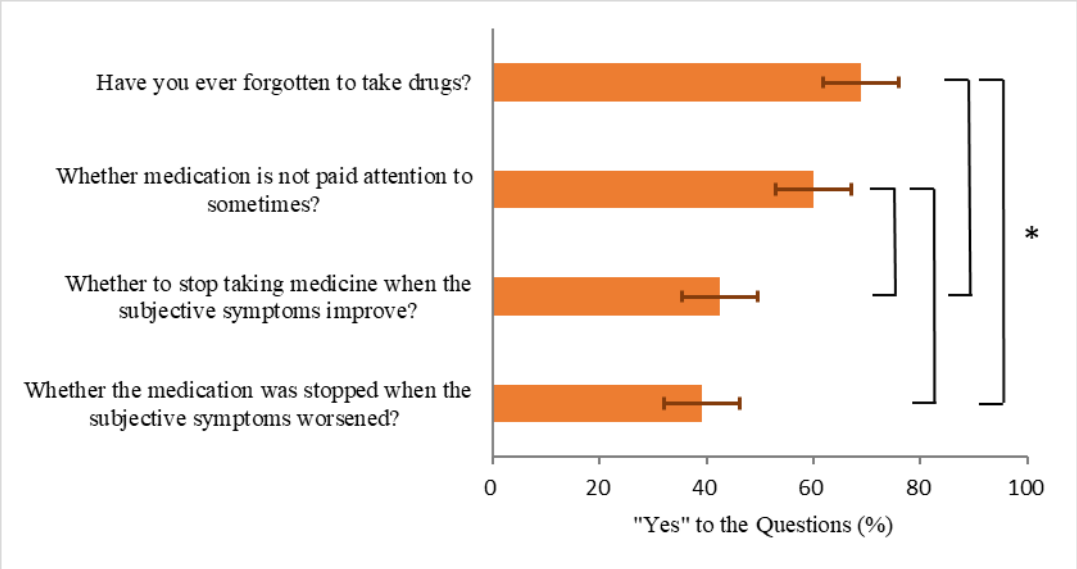

*Figure 2: Answers to the four questions of Morisky Medication Adherence Scale in nonadherence group. Error bars denote the standard error. *Denotes significant differences (chi-square, p < 0.05)*

3.2. Demographic Characteristics

Among the 392 respondents, the majority were female, accounting for 59.4% of the total sample. By using chi-square test, there were significant differences between adherence group and nonadherence group for two factors including age (P=0.004) and sex (P=0.010). Table 1 shows the demographic characteristics across adherent and non-adherent groups.

ISSN 2706-6819 Vol.5, Issue 11: 55-62, DOI: 10.25236/IJFM.2023.051109

Table 1: Demographic characteristics of adherent and nonadherent groups.

Variables	Adherence N=170 N (%)	Nonadherence N=222 N (%)	*P*-Value
Sex			0.149
Male	62 (39.0)	97 (61.0)	
Female	108 (46.4)	125 (53.6)	
Age			0.004*
60-	50 (33.1)	101 (66.9)	
70-	98 (51.0)	94 (49.0)	
80-88	22 (44.9)	27 (55.1)	
Education level			0.091
Junior high school/Lower	136 (44.6)	169 (55.4)	
Special secondary/High school	23 (34.3)	44 (65.7)	
Junior college/Bachelor	11 (61.1)	7 (38.9)	
Postgraduate/Higher	0 (0.0)	2 (100.0)	
Marital status			0.010*
Married	130 (46.9)	147 (53.1)	
Unmarried/Divorced	2 (17.9)	23 (82.1)	
Widowed	35 (40.2)	52 (59.8)	
Previous career			0.934
Medical related	4 (44.4)	5 (55.6)	
Not medical related	157 (43.1)	207 (56.9)	
Jobless	9 (47.4)	10 (52.6)	
Monthly income(CNY)			0.532
＜1000	32 (40.5)	47 (59.5)	
1000-	64 (48.5)	68 (51.5)	
2500-	35 (40.2)	52 (59.8)	
4000-	26 (45.6)	31 (54.4)	
5500-	13 (35.1)	24 (64.9)	
Hypertension course			0.101
＜3 years	14 (31.8)	30 (68.2)	
≥3 years	156 (44.8)	192 (55.2)	
Complications of hypertension			0.216
Yes	41 (38.3)	66 (61.7)	
No	129 (45.3)	156 (54.7)	

* Denotes significant difference (chi square, $P < 0.05$)

3.3. Experiences in COVID-19

Table 2: Experiences in COVID-19.

Variables	Adherence N=170 N (%)	Nonadherence N=222 N (%)	*P*-Value
Discontinuity of medication after COVID-19 vaccination			<0.001*
Yes	12 (21.4)	44 (78.6)	
No	158 (47.0)	178 (53.0)	
Not convenient to buy medicine during the lockdown management			0.001*
Yes	17 (25.4)	50 (74.6)	
No	153 (47.1)	172 (52.9)	
More convenient to buy medicine after Category B Management			0.002*
Strongly agree	10 (20.4)	39 (79.6)	
Agree	100 (49.5)	102 (50.5)	
Not clear	40 (42.6)	54 (57.4)	
Disagree	20 (44.4)	25 (55.6)	
Strongly disagree	0 (0.0)	2 (100.0)	
Emotional instability during the COVID-19 period			<0.001*
Yes	29 (26.1)	82 (73.9)	
No	141 (50.2)	140 (49.8)	
More stable emotional status after Category B Management			0.159
Strongly agree	12 (34.3)	23 (65.7)	
agree	71 (49.3)	73 (50.7)	
Not clear	53 (45.7)	63 (54.3)	
Disagree	32 (36.0)	57 (64.0)	
Strongly disagree	2 (25.0)	6 (75.0)	
Infection history of COVID-19			0.016*
Yes	98 (38.9)	154 (61.1)	
No	72 (51.4)	68 (48.6)	
Discontinuity of medication during COVID-19 treatment			<0.001*
Yes	9 (15.3)	50 (84.7)	
No	89 (46.1)	104 (53.9)	

* Denotes significant difference (chi square, $P < 0.05$)

Nearly 90% of the respondents reported no discontinuity in medical care after receiving the COVID-

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19 vaccination (85.7%) and no inconvenience in purchasing medicine during lockdown measures (82.9%). More than half of the respondents (51.5%) found it more convenient to buy medicine after the relaxation of Category B Management. Nearly 30% admitted experiencing emotional instability during the COVID-19 pandemic, while over 30% reported feeling emotionally more stable after the relaxation of Category B Management. 252 individuals (64.3%) had a history of COVID-19 infection, with 59 of them (23.4%) acknowledging the discontinuity of medication during COVID-19 treatment. Above all experiences except one, namely 'More stable emotional status after Category B Management', were presented by chi-square test to have significant differences between adherent and nonadherent groups. Table 2 shows these parameters about COVID-19 across adherent and non-adherent groups.

3.5. Result of Binary Regression Analysis

Three models were developed to test the effects of factors on the adherence, with the following results.

In the binary logistic regression analysis analyzed by applying forward selection with the demographic characteristics as the independent variables (Table 3), the result of Model 1 showed that people aged 70 to 80 years were less likely to be nonadherent (OR:0.463, 95% CI:0.294-0.729), while the unmarried or divorced were more likely to have medication nonadherence (OR: 3.838, 95% CI:1.402-10.507). However, after fully considering the eight variables in Model 3, the age was not included in it, while the effects of unmarried or divorced marital status remained significant (OR: 3.911, 95% CI: 1.051-14.555).

Table 3: Results of regression analysis with the demographic characteristics as the independent variables.

Variable	Model 1		Model 3	
	OR (95%CI)	*P*-value	OR (95%CI)	*P*-value
Age				
60-	1		..	
70-	0.463(0.294-0.729)	0.001*	..	..
80-88	0.566(0.284-1.127)	0.105	..	..
Marital status				
Married	1		1	
Unmarried/Divorced	3.838(1.402-10.507)	0.009*	3.911(1.051-14.555)	0.042*
Widowed	1.541(0.921-2.577)	0.099	1.716(0.831-3.545)	0.144

*$P<0.05$

Model 2 included three variables after applying six variables of experiences in COVID-19 in it, and so did Model 3 (Table 4). The results from both of the two models showed that people who experienced discontinuation of antihypertensive drugs during the vaccination with COVID-19 (Model 3, OR = 3.938, 95% CI: 1.273-12.182), emotional instability during the COVID-19 period (Model 3, OR = 2.287, 95% CI: 1.217-4.296), and discontinuation of antihypertensive drugs during the treatment in COVID-19 (OR = 2.911, 95% CI: 1.289-6.573) had a higher risk of medication nonadherence.

Table 4: Results of regression analysis with the demographic characteristics as the independent variables.

Variable	Model 2		Model 3	
	OR (95%CI)	*P*-value	OR (95%CI)	*P*-value
Discontinuity of medication after COVID-19 vaccination				
No	1		1	
Yes	3.806(1.245-11.635)	0.019*	3.938(1.273-12.182)	0.017*
Emotional instability during the COVID-19 period				
No	1		1	
Yes	2.358(1.266-4.392)	0.007*	2.287(1.217-4.296)	0.010*
Discontinuity of medication during COVID-19 treatment				
No	1		1	
Yes	3.329(1.495-7.412)	0.003*	2.911(1.289-6.573)	0.010*

*$P<0.05$

4. Discussion

In summary, the prevalence of non-adherence exceeded 50%, higher than in Asia (43.5%) before the

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COVID-19 period[19].

In this study, we found that divorced and unmarried patients were less likely to comply with medication regimens. This observation is consistent with a previous study conducted by Marcum, Z. A et al that indicated significant independent associations between being unmarried and nonadherence[20]. However, few literatures have focused on if the divorced are more prone to be nonadherence[21]. The variation in findings among the studies may be attributed to differences in sample characteristics, methodologies employed, and cultural factors. Further research is warranted to better understand the relationship between marital status and medication adherence in hypertensive patients.

Moreover, the results of our study have revealed that emotional instability during the COVID-19 period had a significant negative impact on medication adherence. This finding is comparable with that reported by Said B et al[22], in which patients with anxiety had poorer medication adherence during the COVID-19 period. Although studies have established a connection between negative emotions such as anxiety and depression and their impact on medication adherence, what is worth paying attention to is the limited social interaction of elderly due to the lockdown, and a large number of positive infected patients with fever, cough and other symptoms appeared in the early stage of the implementation of the Category B management policy for epidemic prevention and control in COVID-19 in China. Such approaches may have contributed to the emergence of anxiety, depression and other mental problems in elderly patients[23]. As for these negative emotions, an earlier study has shown that, compared with those who feel unhealthy about their physical status, people rating themselves as sub-health or better state have lower risk in anxiety[23]. As such, it would of importance to aid patients in enhancing their satisfaction with blood pressure management so as it may prove beneficial in alleviating their negative emotions during public health emergencies and positively impact their medication adherence.

Another relatively underexplored area is the experience of healthcare activities conducted during COVID-19. Our research had discovered that individuals who discontinued their antihypertensive medication following vaccination or during COVID-19 treatment were more susceptible to nonadherence. However, our binary regression analysis did not report direct negative effects of vaccination and COVID-19 treatment on medication adherence. One potential explanation for this might be that many of the patients who stopped their medication did so because they experienced side effects after getting the vaccine. More significantly, there appears to be a lack of communication with their family doctors or clinicians. Some respondents in our study acknowledged that the onset of a fever after vaccination led them to stop taking their medication. Still, they didn't share this with their family doctor, or they were even unaware of having a family doctor. As early as before vaccination, the occurrence of adverse reactions generally caused people to hesitate to vaccinate, especially the elderly with chronic health issues showed more concern[24-26]. In cases like this, without proper guidance and encouragement from family doctors, the elderly with hypertension may choose to stop taking drugs by force of concerns about adverse reactions after vaccination. Effective doctor-patient communication and close doctor-patient relationship have been proved to build trust and help them to make correct decisions[27-29]. Although medical resources are scarce during the COVID-19, non-face-to-face follow-up visit like telephone or video conference is still necessary.

On the other hand, although our results showed that people who stopped taking drugs during COVID-1 treatment were more likely to show medication nonadherence, it's still a matter of debate whether hypertension patients should stop taking antihypertensive medications. The International Society of Hypertension and the European Society of Cardiology have recommended that patients with hypertension should continue taking their regular ACE inhibitors or ARB, despite concerns about COVID-19 infection[30-31]. However, in another study conducted between 2021 and 2022, in 7 countries found that critically ill patients using ACE inhibitors or ARB had a lower likelihood of surviving in the hospital[32]. Therefore, we hypothesis that since there is a significant relationship between health literacy and medicine compliance, it is not surprising that such a debate and social media reports can makes it difficult for the elderly with lack of ability to process health information, distinguish whether they should take drugs and finally make inappropriate health decisions. This finding paves the way for future implementation of health education, emphasizing the need for robust strategies to help people acquire and comprehend health information.

There are several limitations should be considered to this study. First of all, some of our questions require respondents to recall their previous experiences, which may introduce a memory bias. Secondly, our findings were based on a cross-sectional survey of two communities in Chengdu. As a result, causality could not be determined and it might not be generalized to all elderly hypertensive patients during the COVID-19 pandemic from other countries. Therefore, the present study suggested conducting a more extensive survey that includes the elderly from different backgrounds.

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5. Conclusion

Only less than half of the respondents was adherent to antihypertensive medication, and the prevalence of nonadherence exceeded 50%. Marital status, emotional instability during the COVID-19 period, discontinuation of antihypertensive medication during the vaccination and treatment in COVID-19 were found to be the main factors affecting adherence. In the event of public health emergencies, such as pandemics of infectious diseases, disease management strategies and methods for chronic diseases such as hypertension should be adjusted and improved in a timely manner. Special attention should be paid to key protected groups, such as elderly patients, and a comprehensive approach to prevention and treatment of chronic diseases should be implemented effectively.

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