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Choice intention for the national volume-based procurement drug and its associated factors: a cross-sectional study on patients with late-life depression in China

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Abstract

Background The national volume-based procurement (NVBP) policy has significantly decreased prices and increased the accessibility of NVBP drugs. Nevertheless, issues such as heightened adverse reactions and suboptimal efficacy have arisen. Concerns regarding the quality of low-cost medications and the absence of long-term research have been widely recognized. This has led to caution among patients with late-life depression (LLD) due to their delicate health and the severity of their condition. This study evaluated the choice intention for NVBP drugs and associated factors in older patients with LLD.

Methods A weighted sample of 408 participants between December 2022 and March 2023 were included. Data were collected via face-to-face interviews and questionnaires. To identify significant associated factors of choice intention, a multilevel logistic regression model was employed.

Results Over half (53.68%) of older patients with LLD intended to choose NVBP drugs. Associated factors included self-assessed poor economy, higher out-of-pocket expenses, monthly household income exceeding CNY 6000, absence of other non-communicable chronic diseases, ordinary registration, urban employee medical insurance, no requirements for brand-name drugs, adverse reactions after using NVBP drugs, and rejection of physicians' recommendation for NVBP drugs. The interaction effect between the real economic condition and patients self-assessed economy significantly influences choice intention for NVBP drugs. Among 124 patients with self-assessed poor economy, 75 showed a higher intention to use NVBP drugs. In these patients, age, medical insurance reimbursement, and brand awareness were significantly associated with choice intention.

Conclusion Economic factors, physical conditions, medical needs, and physician recommendations significantly influenced the choice intention for NVBP drugs. The choice intention can be improved by strengthening physician-

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patient communication, increasing the scope and proportion of medical insurance reimbursement, improving substitution studies, and conducting post-marketing re-evaluations of NVBP drugs.

Keywords National volume-based procurement, Late-life depression, Choice intention, China, Cross-sectional study

Introduction

Late-life depression (LLD) significantly contributes to disease burden and disability in older adults, profoundly impairing their quality of life [1]. With the acceleration of population aging in China, LLD is poised to become a prominent public health and social issue [2, 3]. Globally, approximately 14% of individuals over 55 experience depression, with 2% facing major depression [4]. The situation is more acute in China, where 2020 data revealed a 37.49% detection rate of depressive symptoms in nursing homes, including 8.54% with major depression [5]. According to the 2019 Global Burden of Diseases, depression ranked first in the burden of mental disorders in China, constituting 25.07% [6]. The economic impact of LLD on the aging population and society is substantial in China [7].

Epidemiological evidence indicates that patients with LLD frequently have comorbid conditions [8]. The high recurrence rate and prolonged treatment duration [9] result in over one-third of patients undergoing multidrug therapy [10]. The risk associated with such therapy escalate with age, leading to adverse medical events such as drug interactions, side effects, health deterioration, and hospitalization. Notably, 5-10% of hospitalizations among older patients are due to adverse drug reactions [11]. Consequently, it is imperative to focus on the therapeutic efficacy and potential drug interactions in older patients with LLD.

The rising health expenditure presents a significant challenge for many countries globally [12]. With the acceleration of population aging and the development of the social economy, health expenditure in China is rapidly increasing [13, 14]. Total health expenditure surged from 4097 billion in 2015 to 7230 billion in 2020, reflecting an annual growth rate of 12.03%. The percentage of total health expenditure in GDP is also rising [15]. As of 2018, total drug expenditure in China was 218.3 billion, accounting for 35.8% of health expenditure, significantly higher than the Organization for Economic Co-operation and Development-countries average of 17% [16].

In response to the escalating national medical expenditure, the Chinese government introduced the national volume-based procurement (NVBP) policy in 2018. This policy involves purchasing high-quality generic drugs, evaluated by national consistency, in large quantities through strong political commitment [17]. The policy aims to achieve economies of scale, establish volume-price linkage, promote the formation of a drug price market, reduce costs, and standardize drug procurement [18, 19]. Research and practice indicate that the NVBP policy has significantly lowered the prices of NVBP drugs [20], and increased their market share [21]. Consequently, the NVBP policy has markedly enhanced drug affordability and reduced patient cost [22].

Despite the benefits of the NVBP policy, certain limitations have emerged, such as increased adverse reactions and suboptimal effects. Widespread concerns persist regarding quality issues associated with low-cost medicines. As NVBP drugs gain widespread use in hospitals, patients, including older individuals with LLD, must choose between NVBP drugs and alternative medications. The fragility of health [23], weak economic foundations, severity and recurrence of the disease, and overlapping risk factors render older LLD patients particularly cautious about drug use [24, 25], especially NVBP drugs. Therefore, understanding the choice intention for NVBP drugs is pivotal for ensuring treatment compliance among this demographic.

To our knowledge, limited research exists on the choice intention for NVBP drugs in older LLD patients. Most studies on the NVBP policy have focused on its impact on drug prices and accessibility [26]. Only one qualitative study potentially revealed how factors such as family characteristics and health conditions may influence patients' attitudes towards NVBP drugs [27]. Family financial security and support can enable some participants to pursue better brand-name drugs rather than NVBP drugs. Additionally, patients who have experienced multiple diseases, especially those who have undergone severe illnesses, tend to show resistance to switching to NVBP drugs compared to patients with only one chronic disease. The severity of the disease is considered to be one of the major factors influencing patients' attitudes towards NVBP drugs. Moreover, the existing literature has mainly focused on the entire population, often neglecting stratified research on comorbidities [27], especially for this particularly vulnerable group of LLD. It is crucial to comprehend the choice intention for NVBP drugs and the underlying influencing factors in older patients with LLD, as it directly affects the policy's impact and evaluation. This understanding is essential for researchers and decision-makers alike. Hence, this study evaluated the choice intention for NVBP drugs and associated factors in older patients with LLD.

Subjects and methods

Study design and participants

The study utilized face-to-face interviews and questionnaires administered to elderly individuals with depression in China from December 2022 to March 2023. According to the characteristics of the geographical distribution of the elderly, we used a probability method proportional to different regions. We calculated the sample size required for each partition and selected participants in each region. Taking into account a margin of error of 5%, a sample size of 402 was calculated at a 95% confidence level and 5% allowable error. Considering the loss rate of 20%, the required sample was 503. Finally, 408 samples were recovered, and the overall response rate was about 81.11%. Inclusion criteria included LLD patients (depressive disorders in the elderly aged 60 years and older [28]) who had previously used NVBP drugs. Exclusion criteria included hearing impairment or communication difficulties.

Variables and measurements

Outcome measure

The outcome variable was the choice intention for NVBP drugs. In this study, patients were considered to have a choice intention for NVBP drugs if they indicated their willingness to use NVBP drugs during data collection. Conversely, if a patient clearly indicated that they would not use NVBP drugs, they were considered to have no choice intention for NVBP drugs. The drugs that patients were currently taking, whether brand-name drugs or NVBP drugs, were not included in this study as part of the patients' willingness.

Explanatory variables

To identify relevant factors, various independent variables were considered. The research team first reviewed NVBP-related literature [27, 29–32]and then established four primary influencing factors comprising 32 items: demographic characteristics, family and economic status, physical and medication condition, and NVBP-related medical behavior. These factors were utilized as independent variables in the "NVBP Drug Choice Intention and Its Associated Factors Questionnaire" for data collection. Those willing to participate in face-to-face interviews will undergo standardized interviews based on this questionnaire (Interview Guide in the Supplementary Appendix), while others will complete the questionnaire. The results were categorized according to the questionnaire type. Due to the non-normally distribution of the total variable, the median value was used as a cut-off point for the classification (Table S1 in the Supplementary Appendix).

Interview guide pilot testing

Standardized interviews aim to ensure all respondents receive the same questions and treatment, thereby ensuring consistency and comparability of research outcomes. The interview guide pilot testing included three different techniques: internal testing, expert assessment, and field-testing.

Firstly, we conducted internal testing with cooperation from survey team members to evaluate the preliminary interview guide [33]. One researcher acted as the participant while another conducted the interview, aiming to eliminate interviewer bias, clarify ambiguities, and remove inappropriate leading questions (Table S2 in the Supplementary Appendix), ensuring objectivity and consistency in the interview process.

Secondly, we invited relevant experts for professional assessment of the interview guide, including a medical researcher and a clinical psychologist, to optimize the appropriateness, comprehensiveness, logical flow, and clinical relevance of the research questions.

Subsequently, we proceeded with field-testing. We selected a small subset of eligible respondents, specifically elderly patients with LLD who had experience with NVBP drugs, to test the interview guide. Through this step, we assessed the performance of the interview guide in practical execution, including respondents' comprehension of the questions, the effectiveness of the research questions, the time required for the interview, and the method of recording responses.

Through these testing steps, we will ensure that our study accurately collects and analyzes data on the willingness of LLD patients to choose NVBP drugs, while maintaining the scientific rigor and clinical relevance of the research.

Data collection

Participants were recruited via research posters, oral presentations, and hospital staff referrals. For participants willing to be interviewed, the first author of this paper (male, Master's degree, pharmacist), who has received training, conducted structured interviews, which included outlining the study's purpose and administering a structured questionnaire. (Interview process and questions can be found in the supplementary document) Fifteen participants were interviewed and coded as P1-P15. The researcher and participants had no prior relationship. Each interview lasted approximately 20–25 min. The questionnaire was recorded after the interview concluded. The remaining participants received instructions from researchers on completing the questionnaire and were briefed on the study's objectives. Family members were permitted to read and assist participants in the completion of the questionnaire. In cases where participants were unable to complete the questionnaire,

family members filled it out based on the participants' responses.

Bias control

Three measures were used to control deviation. First, researchers maintained close communication with participants between data surveys. Second, this study adopted strict data management methods, such as double entry, cross-examination, and discussion of controversial data, which were discussed and traced by multiple professionals. Third, researchers check with participants after data collection to ensure accuracy and consistency of information transmission.

Statistical analysis

Logistic regression was employed to analyze choice intention and its associated factors. The independent variables considered comprised the following two categories: (1) those with statistically significant differences in univariate analysis ($p<0.05$, chi-square test) and (2) those without statistically significant differences but clinically deemed relevant to choice intention. The study did not include continuous independent variables; hence, a box-Tidwell transformation was unnecessary. Multicollinearity was evaluated by examining the variance inflation factor and tolerance in a multiple regression model. The overall significance of the model was assessed using the −2 log-likelihood ratio test. Descriptive statistics were utilized to assess the distribution of variables. Sample size was calculated using PASS version 15.0, and data analysis was conducted with SPSS version 26.0.

The association of demographic and family attributes, economic conditions, physical health, and medication use with participants' choice intention for NVBP drugs was evaluated. Three models were developed: Model I incorporated social factors (demographic and family attributes, economic conditions), Model II considered individual factors (physical health, medication use), and Model III integrated both social and individual factors. Model fit was assessed through the Hosmer-Lemeshow goodness-of-fit chi-square test and Omnibus Tests of Model Coefficients. The receiver operating characteristic curve was employed to evaluate model specificity and sensitivity. Ultimately, model III, encompassing all significantly different factors, emerged as the optimal model (Table S3 in the Supplementary Appendix). Adjusted odds ratios (AOR), with 95% confidence intervals (CIs) and p-values (Wald Test) under 0.05, identified factors linked to the choice intention for NVBP drugs.

Ethics approval and consent to participate

The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of The Affiliated Mental Health Center of Jiangnan University (WXMHCIRB2023LLky007). All participants, or their legal representatives if the participants were unable to write, signed informed consent.

Results

Characteristics of the participants

A total weighted sample of 408 older patients with LLD was enrolled in this study, including 179 males (43.87%) and 229 females (56.13%). Among them, the proportion of patients aged 60–69 years old (77.70%) was greater than those aged 70 years or older (22.30%). The marital status of the participants was as follows: unmarried (4.17%), married (74.75%), divorced (15.44%), and widowed (5.64%). Educational status was categorized as illiteracy (16.67%), primary school (57.11%), and junior high school and above (26.23%). Before retirement, 12.25% of participants had held professional positions such as doctors and teachers, 5.64% were military personnel, 27.70% were engaged in administrative management, 25.49% were service personnel, 19.85% were workers, and 6.62% were farmers (Table 1).

Family members and economic conditions

Among 408 participants, 14.22% lived alone, 18.63% lived in nursing homes, and the remaining 67.16% lived with family members. More than half (52.94%) of the patients had a pension of less than CNY 2000. One-quarters (25.49%) of them had a total monthly household income of less than CNY 3000, while 19.12% of the participants had an income of more than CNY 6000. Additionally, 15.44% of the participants self-assessed their economic situation as rich, and 54.17% considered their economic status as average. A few participants (10.54%) were satisfied with their current life (Table 2).

Physical condition and medical condition

Approximately half (46.32%) of the participants had non-communicable chronic diseases, with 19.36% rating their health as good, and 22.55% taking medication for less than 5 years. The participants were covered by various medical insurance schemes, including civil servant medical insurance (MICS), urban employee medical insurance (MIUE), and urban resident medical insurance (MIUR). Notably, 40.20% had expert registration, and 44.85% could reach the nearest medical center within 20 min on foot. A small fraction (1.96%) drove to the hospital. Additionally, 40.69% had an out-of-pocket expenses below CNY 100. Less than half (43.38%) reported ease in obtaining brand-name drugs, and 47.30% purchased medicine from hospitals (Table 3).

Medication

A total of 42.40% of participants considered NVBP drugs to be as effective as brand-name drugs. Only 6.13%

Table 1 Individual characteristics of the participants (*N* = 408)

Characteristics	Categories	*n*	%	Attitude (%)		*p*
				Brand-name drug	NVBP drug	
Age (year)	60–69	317	77.70	43.53	56.47	0.035*
	≥ 70	91	22.30	56.04	43.96	
Sex	male	179	43.87	47.49	52.51	0.677
	female	229	56.13	45.41	54.59	
Marital status	Unmarried	17	4.17	41.18	58.82	0.248
	Married	305	74.75	46.23	53.77	
	Divorce	63	15.44	41.27	58.73	
	Widowed	23	5.64	65.22	34.78	
Educational level	Illiteracy	68	16.67	45.59	54.41	0.055
	Primary school	233	57.11	42.06	57.94	
	Junior high school and above	107	26.23	56.07	43.93	
Occupation before retirement	Professional (doctor / teacher)	50	12.25	70.00	30.00	0.001*
	Military personnel	23	5.64	26.09	73.91	
	Manager / General staff	113	27.70	52.21	47.79	
	Service personnel	104	25.49	45.19	54.81	
	Workers	81	19.85	33.33	66.67	
	Farmers	27	6.62	40.74	59.26	
	Other	10	2.45	40.00	60.00	

NVBP, national volume-based procurement

Asterisks mean a significant statistical difference according the p-value < 0.05 (chi-square test)

Table 2 Family and economic status of the participants (*N* = 408)

Characteristics	Categories	*n*	%	Attitude (%)		*p*
				Brand-name drug	NVBP drug	
Living conditions	Living alone	58	14.22	53.45	46.55	0.005*
	Together with family members	274	67.16	40.88	59.12	
	Nursing homes	76	18.63	60.53	39.47	
Personal pensions	< 2000	216	52.94	42.13	57.87	0.072
	≥ 2000	192	47.06	51.04	48.96	
Monthly household income	< 3000	104	25.49	45.19	54.81	0.040*
	3000–6000	226	55.39	42.48	57.52	
	> 6000	78	19.12	58.97	41.03	
Self-assessed economic conditions	Rich	63	15.44	60.32	39.68	0.026*
	General	221	54.17	46.15	53.85	
	Difficulty	124	30.39	39.52	60.48	
Self-assessment of life satisfaction	Satisfactory	43	10.54	37.21	62.79	0.318
	Average	225	55.15	49.78	50.22	
	Dissatisfied	101	24.75	41.58	58.42	
	Unable to answer	39	9.56	48.72	51.28	

NVBP, national volume-based procurement

Asterisks mean a significant statistical difference according the p-value < 0.05 (chi-square test)

perceived the side effects of NVBP drugs to be comparable to those of brand-name drugs. Among these patients, the preference for NVBP drugs was highest at 68.00%. Despite the prevalence of adverse effects, 42.40% reported no significant adverse reactions from NVBP drugs. Approximately one-third (32.60%) believed that the quality of NVBP and brand-name drugs was consistent. Additionally, 84.56% of participants noted lower cash expenditures for NVBP drugs compared to brand-name drugs, and around 72.30% felt NVBP drugs met their basic needs. Moreover, 18.38% had requirements for the brand of drugs; 88.48% found NVBP drugs easily accessible. Furthermore, 65.20% admitted to being influenced by choices, while 93.63% felt influenced by doctors. Comparatively, 77.70% reported being influenced by pharmacists. This trust in physicians likely stems from a general trust in medical professionals, compounded by limited public awareness of the NVBP policy, as 78.18% admitted to knowing little about it (Table 4).

Table 3 Physical condition and medical condition of the participants (*N* = 408)

Characteristics	Categories	*n*	%	Attitude (%)		*p*
				Brand-name drug	NVBP drug	
With other non-communicable chronic diseases	Yes	189	46.32	53.44	46.56	0.007*
	No	219	53.68	40.18	59.82	
Self-assessment of health status	Good	79	19.36	54.43	45.57	0.446
	General	151	37.01	45.03	54.97	
	Not good	176	43.14	43.75	56.25	
	Can not answer	2	0.49	50.00	50.00	
Duration of taking medication (in years)	< 5	92	22.55	36.96	63.04	0.084
	5–10	188	46.08	51.06	48.94	
	≥ 10	128	31.37	46.09	53.91	
Types of medical insurance	MICS	53	12.99	66.04	33.96	0.012*
	MIUE	153	37.50	39.87	60.13	
	MIUR	192	47.06	45.83	54.17	
	No health medical insurance	10	2.45	50.00	50.00	
Registration type	Expert	164	40.20	40.24	59.76	0.043*
	Ordinary	244	59.80	50.41	49.59	
Time to walk to the nearest medical center	< 20 min	183	44.85	49.18	50.82	0.297
	≥ 20 min	225	55.15	44.00	56.00	
Transportation	Driving	8	1.96	50.00	50.00	0.993
	Public transportation	211	51.72	46.45	53.55	
	Non- motorized vehicles	129	31.62	46.51	53.49	
	Walking	60	14.71	45.00	55.00	
Out-of-pocket expenses (each time)	< 100	166	40.69	51.81	48.19	0.066
	≥ 100	242	59.31	42.56	57.44	
Easy of obtaining brand-name drug	Yes	177	43.38	50.28	49.72	0.160
	No	231	56.62	43.29	56.71	
Ways to purchase medicine	Hospital	193	47.30	43.01	56.99	0.443
	Pharmacy	183	44.85	49.18	50.82	
	Other	32	7.84	50.00	50.00	

NVBP, national volume-based procurement; MICS, civil servant medical insurance; MIUE, urban employee medical insurance; MIUR, urban resident medical insurance
Asterisks mean a significant statistical difference according the p-value < 0.05 (chi-square test)

Choice intention for NVBP drugs

Among the participants, the overall choice intention for NVBP drugs was 53.68%, with significantly higher intention observed in patients aged 60–69 years compared to those aged 70 years and above. Pre-retirement career also significantly influenced intentions, with professionals exhibiting higher willingness to use NVBP drugs than others. Additionally, patients living with family showed significantly higher intentions compared to nursing home residents. A notable difference was observed in patients with a monthly household income of CNY 3000–6000, who were more inclined to choose NVBP drugs than those earning above CNY 6000. Higher choice intention was also recorded among patients with self-rated financial difficulties and those without other non-communicable chronic diseases. Patients with MIUE insurance, expert registration, and no significant adverse reactions to NVBP drugs demonstrated greater intentions. During the NVBP policy, patients who felt that NVBP drugs have less cash expenditure than brand-name drugs, who thought that NVBP drugs can meet basic needs, who had no requirements for the brand of drugs, and who were susceptible to doctors showed higher intentions for NVBP drugs.

Multilevel analysis of factors

Logistic regression was employed to examine factors associated with NVBP drugs choice intention in older LLD patients, using statistically significant indicators from univariate analysis as independent variables and choice intention as dependent variables (Fig. 1). The adjusted regression model indicated that families with self-rated financial difficulties exhibited a markedly higher intention for NVBP drugs compared to affluent families. Patients without comorbid condition demonstrated a greater propensity for NVBP drugs choice than those with such conditions. Additionally, patients with MIUE insurance were 3.833 times more inclined to select NVBP drugs over those with MICS insurance, attributable to differing medical expense reimbursement rates. Besides, patients without brand requirements were more likely to use NVBP drugs. On the contrary, patients with

Table 4 Medication of the participants ($N=408$)

Characteristics	Categories	*n*	%	Attitude (%)		*p*
				Brand-name drug	NVBP drug	
NVBP drugs are as effective as brand-name drugs	Yes	173	42.40	45.09	54.91	0.667
	No	235	57.60	47.23	52.77	
The side effects of NVBP drugs are the same as brand-name drugs	Yes	25	6.13	32.00	68.00	0.138
	No	383	93.87	47.26	52.74	
No significant adverse reaction from NVBP drugs	Yes	173	42.40	38.73	61.27	0.008*
	No	235	57.60	51.91	48.09	
The quality of NVBP drugs and brand-name drugs are consistent	Yes	133	32.60	43.61	56.39	0.444
	No	275	67.40	47.64	52.36	
Less cash expenditure than brand-name drugs	Yes	345	84.56	44.06	55.94	0.032*
	No	63	15.44	58.73	41.27	
NVBP drugs can meet basic needs	Yes	295	72.30	42.71	57.29	0.018*
	No	113	27.70	55.75	44.25	
Have requirements for the brand of drugs	Yes	75	18.38	82.67	17.33	< 0.001*
	No	333	81.62	38.14	61.86	
Easy to obtain NVBP drugs	Yes	361	88.48	44.88	55.12	0.979
	No	47	11.52	57.45	42.55	
People around can affect your drug choice	Yes	266	65.20	43.61	56.39	0.132
	No	142	34.80	51.41	48.59	
Physicians can affect your choice of NVBP drugs	Yes	382	93.63	43.72	56.28	< 0.001*
	No	26	6.37	84.62	15.38	
Pharmacists can affect your choice of NVBP drugs	Yes	317	77.70	44.48	55.52	0.163
	No	91	22.30	52.75	47.25	
Do you know the NVBP policy	Not at all	167	40.93	54.49	45.51	0.046*
	Rare	152	37.25	40.13	59.87	
	Several	60	14.71	36.67	63.33	
	More	26	6.37	50.00	50.00	
	Almost	3	0.74	66.67	33.33	

NVBP, national volume-based procurement

Asterisks mean a significant statistical difference according the p-value < 0.05 (chi-square test)

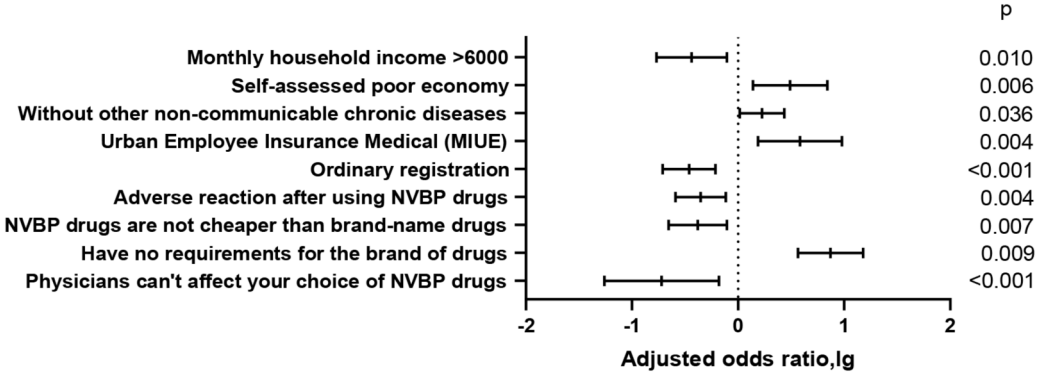

Fig. 1 Forest plot of choice intention related factors for NVBP drugs in depressed elders (Model 3, Wald Test)

a monthly household income above CNY 6000 were 63.5% less likely to choose NVBP drugs than those with a monthly household income of less than CNY 3000. The choice intention for NVBP drugs was significantly lower in patients who seek an ordinary doctor than in those who seek an expert. Patients who had experienced an adverse reaction after using NVBP drugs were 55.6% less likely to choose NVBP drugs again. Patients who felt that NVBP drugs are not cheaper than brand-name drugs and whose physicians were unable to change their drug selection showed significantly lower intention for NVBP drugs (Table 5).

Sensitivity analysis

Considering the stability of efficacy, diabetic patients are less likely to change their treatment medications on their

Table 5 Factors associated with choice intention of NVBP drugs among participants (*N* = 408)

Characteristics		Model 1	Model 2	Model 3	
		AOR (95%CI)	AOR (95%CI)	AOR (95%CI)	p (Model 3)
Monthly household income	< 3000	ref		ref	
	3000–6000	0.921 (0.528,1.608)		1.027 (0.554,1.903)	0.932
	> 6000	0.431 (0.214,0.868)		0.365 (0.170,0.784)	0.010*
Self-assessed economy conditions	Rich	ref		ref	
	General	2.167 (1.038,4.520)		1.773 (0.825,3.812)	0.143
	Difficulty	2.041 (0.946,4.400)		3.094 (1.382,6.927)	0.006*
With other non-communicable chronic diseases	Yes		ref	ref	
	No		1.670 (1.028,2.714)	1.679 (1.035,2.723)	0.036*
Types of medical insurance	MICS	ref		ref	
	MIUE	2.696 (1.275,5.703)		3.833 (1.546,9.505)	0.004*
	MIUR	1.565 (0.739,3.315)		1.583 (0.717,3.496)	0.255
	No health medical insurance	1.251 (0.280,5.586)		1.474 (0.277,7.854)	0.649
Registration type	Expert	ref		ref	
	Ordinary	0.450 (0.267,0.758)		0.345 (0.195,0.611)	< 0.001*
No significant adverse reaction after using NVBP drugs	Yes		ref	ref	
	No		0.394 (0.222,0.700)	0.444 (0.257,0.768)	0.004*
Less cash expenditure than brand-name drugs	Yes		ref	ref	
	No		0.493 (0.264,0.924)	0.417 (0.222,0.785)	0.007*
Have requirements for the brand of drugs	Yes		ref	ref	
	No		6.596 (3.285,13.246)	7.414 (3.639,15.104)	< 0.001*
Physicians can affect your choice of NVBP drugs	Yes		ref	ref	
	No		0.165 (0.050,0.549)	0.190 (0.055,0.660)	0.009*

AOR, adjusted odds ratios; CI, Confidence Internal; MICS, civil servant medical insurance; MIUE, urban employee medical insurance; MIUR, urban resident medical insurance; NVBP, national volume-based procurement

Asterisks mean a significant statistical difference according the p-value < 0.05 (Wald Test)

own. We analyzed whether the main outcome would change significantly if participants with diabetes mellitus were excluded: the sensitivity analysis was done for 341 patients (after the exclusion of the 67 individuals with diabetes mellitus). In addition, patients with a history of self-discontinuation have lower treatment adherence and exhibit greater arbitrariness in adjusting their medications. Therefore, we performed an additional sensitivity analysis excluding the participants with a history of self-discontinuation of drugs: the analysis was done for 369 patients (after the exclusion of the 39 individuals with a history of self-discontinuation of drugs). The primary outcome of the two sensitivity analyses did not change materially. (Tables S4-S11 in the Supplementary Appendix)

Baseline characteristics and factors in patients with self-assessed poor economy

A stratified analysis of individuals with self-assessed poor economic status indicated that 75 patients (60.48%) preferred NVBP drugs. Notably, significant disparities were observed in marital status, education level, residence, life satisfaction self-assessment, transportation, ease of obtaining brand-name drugs, drug efficacy, quality consistency, and the influence of surrounding individuals compared to the overall population (Table 6). Patients who did not self-assessed economic difficulties, those who self-assessed economic affluence, and those who reported an average economic status are detailed in the supplementary file. (Tables S12-S14 in the Supplementary Appendix)

Related factors of choice intention for NVBP drugs among participants with self-assessed poor economic status were as follows (Table 7).

Interaction effect between the monthly household income and patients self-assessed economy conditions

Subgroup analysis based on monthly household income revealed that for patients with a monthly household income of less than CNY 3000, there was no significant difference in NVBP drug choice intention based on self-assessed economic conditions. However, for patients with a monthly household income of CNY 3000 or more, significant differences in NVBP drug choice intention were observed based on self-assessed economic conditions (Table 8). The interaction effect between monthly

Table 6 Individual characteristics of the participants with self-assessed poor economy ($N = 124$)

Characteristics	Categories	*n*	%	Attitude (%)		*p*
				Brand-name drug	NVBP drug	
Age (year)	60–69	80	64.52	27.50	72.50	< 0.001*
	≥ 70	44	35.48	61.36	38.64	
Marital status	Unmarried	1	0.81	0.00	100.00	0.024*
	Married	89	71.77	32.58	67.42	
	Divorce	15	12.10	46.67	53.33	
	Widowed	19	15.32	68.42	31.58	
Educational level	Illiteracy	24	19.35	25.00	75.00	0.002*
	Primary school	93	75.00	38.71	61.29	
	Junior high school and above	7	5.65	100.00	0.00	
Occupation before retirement	Professional (doctor / teacher)	4	3.23	75.00	25.00	0.160
	Military personnel	3	2.42	0.00	100.00	
	Manager / General staff	26	20.97	57.69	42.31	
	Service personnel	15	12.10	33.33	66.67	
	Workers	46	37.10	32.61	67.39	
	Farmers	21	16.94	33.33	66.67	
	Other	9	7.26	44.44	55.56	
Living conditions	Living alone	6	4.84	0.00	100.00	0.001*
	Together with family members	85	68.55	32.94	67.06	
	Nursing homes	33	26.61	63.64	36.36	
Monthly household income	< 3000	26	20.97	53.85	46.15	0.028*
	3000–6000	93	75.00	33.33	66.67	
	> 6000	5	4.03	80.00	20.00	
Self-assessment of life satisfaction	Satisfactory	16	12.90	12.50	87.50	0.024*
	Average	72	58.06	50.00	50.00	
	Dissatisfied	27	21.77	29.63	70.37	
	Unable to answer	9	7.26	33.33	66.67	
With other non-communicable chronic diseases	Yes	55	44.35	61.82	38.18	< 0.001*
	No	69	55.65	21.74	78.26	
Types of medical insurance	MICS	7	5.65	85.71	14.29	0.017*
	MIUE	31	25.00	25.81	74.19	
	MIUR	84	67.74	41.67	58.33	
	No health medical insurance	2	1.61	0.00	100.00	
Registration type	Expert	14	11.29	35.71	64.29	0.757
	Ordinary	110	88.71	40.00	60.00	
Transportation	Driving	3	2.42	0.00	100.00	0.003*
	Public transportation	65	52.42	49.23	50.77	
	Non-motorized vehicles	37	29.84	43.24	56.76	
	Walking	19	15.32	5.26	94.74	
Easy of obtaining brand-name drug	Yes	47	37.90	21.28	78.72	0.001*
	No	77	62.10	50.65	49.35	
NVBP drugs are as effective as brand-name drugs	Yes	70	56.45	25.71	74.29	< 0.001*
	No	54	43.55	57.41	42.59	
No significant adverse reaction occurred after using NVBP drugs	Yes	34	27.42	20.59	79.41	0.008*
	No	90	72.58	46.67	53.33	
The quality of NVBP drugs and brand-name drugs was consistent	Yes	52	41.94	28.85	71.15	0.039*
	No	72	58.06	47.22	52.78	
Less cash expenditure than brand-name drugs	Yes	104	83.87	34.62	65.38	0.011*
	No	20	16.13	65.00	35.00	
NVBP drugs can meet basic needs	Yes	93	75.00	32.26	67.74	0.004*
	No	31	25.00	61.29	38.71	

Table 6 (continued)

Characteristics	Categories	*n*	%	Attitude (%)		*p*
Have requirements for the brand of drugs	Yes	15	12.10	93.33	6.67	< 0.001*
	No	109	87.90	32.11	67.89	
People around can affect your drug choice	Yes	84	67.74	33.33	66.67	0.041*
	No	40	32.26	52.50	47.50	
Physicians can affect your choice of NVBP drugs	Yes	116	93.55	36.21	63.79	0.004*
	No	8	6.45	87.50	12.50	
Do you know the NVBP policy	Not at all	88	70.97	40.91	59.09	0.081
	Rare	28	22.58	28.57	71.43	
	Several	4	3.23	100.00	0.00	
	More	3	2.42	33.33	66.67	
	Almost	1	0.81	0.00	100.00	

NVBP, national volume-based procurement; MICS, civil servant medical insurance; MIUE, urban employee medical insurance; MIUR, urban resident medical insurance

The same results as overall (*N* = 408) are not listed

Asterisks mean a significant statistical difference according the p-value < 0.05 (chi-square test)

Table 7 Factors associated with choice intention of NVBP drugs among participants with self-assessed poor economy (*N* = 124)

Characteristics		AOR	*p*	95% CI
Age	60–69	ref		
	≥ 70	0.270	0.019*	0.090,0.807
Types of medical insurance	MICS	ref		
	MIUE	1.411	0.002*	0.639,3.116
	MIUR	1.071	< 0.001*	0.257,4.467
	No health medical insurance	2.551	0.200	1.031,3.178
Have requirements for the brand of drugs	Yes	ref		
	No	2.291	0.009*	1.219,3.559

AOR, adjusted odds ratios; CI, Confidence Internal; MICS, civil servant medical insurance; MIUE, urban employee medical insurance; MIUR, urban resident medical insurance

Asterisks mean a significant statistical difference according the p-value < 0.05 (Wald Test)

household income and self-assessed economic conditions was illustrated in Fig. 2.

Discussion

Currently, with the constriction on national medical insurance and the implementation of NVBP policy, the availability and substitution rate of NVBP drugs in clinical settings are expected to rise [34]. However, the selection preference for NVBP drugs among older patients with LLD significantly influences their clinical adherence and efficacy stability [35]. Consequently, it is imperative to assess the choice intention and associated factors of this demographic to inform future policy adjustments. This research filled this gap by revealing that economic factors, health status, medical needs, and doctor recommendations influence the choice intention of NVBP drugs among patients with LLD.

Our study demonstrated that more than half (53.68%) of the participants tend to choose NVBP drugs, which is similar to the findings of Sintayehu Alemu [36]. Patients'

Table 8 Subgroup analysis of monthly household income (*N* = 408)

Characteristics	Categories	*n*	%	Attitude (%)		*p*
				Brand-name drug	NVBP drug	
monthly household income < 3000 (*N* = 104)						
Self-assessed economic conditions	Rich	33	8.09	39.39	60.61	0.537
	General	45	11.03	44.44	55.56	
	Difficulty	26	6.37	53.85	46.15	
monthly household income 3000–6000 (*N* = 226)						
Self-assessed economic conditions	Rich	9	2.21	88.89	11.11	0.003*
	General	124	30.39	45.97	54.03	
	Difficulty	93	22.79	33.33	66.67	
monthly household income > 6000 (*N* = 78)						
Self-assessed economic conditions	Rich	21	5.15	80.95	19.05	0.022*
	General	52	12.75	48.08	51.92	
	Difficulty	5	1.23	80.00	20.00	

Asterisks mean a significant statistical difference according the p-value < 0.05 (chi-square test)

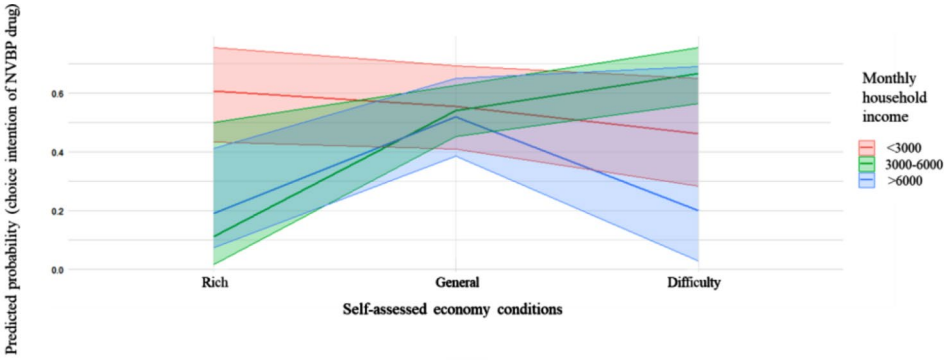

Fig. 2 Probability plot of interaction effects among monthly household income and self-assessed economic conditions

preference for NVBP drugs has not been reported yet, especially in older patients with LLD. However, a recent generic drugs survey in China showed that the subjects' tendency to choose generic drugs was 71.4%, which is higher than in our research [37]. Existing studies on patients with rheumatic disease [38], physicians [39], pharmacists [40], and patients and caregivers reported choice intention [41] ranging from 47.83 to 84.90%. Several factors, such as participants characteristics, different measurement tools, sampling differences, age range heterogeneity, sample size, policy system, and socio-cultural variations may explain the different attitude in these studies.

Economic factors significantly influence drug selection in older patients with LLD [42]. In this study, family monthly income and self-assessed economic conditions impacted drug choice. Participants with self-assessed poor economic status were 3.094 times more likely to choose NVBP drugs than their wealthier counterparts, likely due to the lower cost of NVBP drugs. Families with a monthly income of exceeding CNY 6000 exhibited a relatively negative attitude toward NVBP drugs, aligning with previous research conducted in China. The study revealed that patients without a fixed occupation and those with chronic diseases were more price-sensitive when choosing drugs, whereas those with higher incomes were less influenced by drug prices [43]. Given the higher cost of brand-name drugs, patients with better economic conditions showed a preference for these options, supported by their families' financial resources [44].

Medical insurance and cash expenditure are also associated with the choice intention for NVBP drugs. Participants with MIUE insurance had a 3.833 times higher likelihood of selecting NVBP drugs compared to those with MICS insurance, likely due to MIUE's lower reimbursement ratio [45]. In China, MICS offers higher drug reimbursement percentage and broader coverage than MIUE due to improved civil service benefits. Consequently, MIUE-insured patients incur higher out-of-pocket costs and prefer cheaper NVBP drugs. However, when NVBP drugs are excluded from the insurance catalog, leading to increased cash expenditure, the propensity to choose NVBP drugs diminishes. In other words, patients are more likely to accept lower out-of-pocket medical plans, which is in line with the findings of a study conducted in the United States. The study indicated that when drug prices rise, increased out-of-pocket costs reduce the payment willingness of the patients [46].

The current study indicated that older patients with LLD without chronic diseases were 1.679 times more likely to choose generic drugs under the NVBP policy, contrary to findings from a Swiss study [47]. This discrepancy may stem from the diminished efficacy of antidepressants in older patients compared to younger ones [48], coupled with notable differences in pharmacokinetic properties [49]. At the same time, older patients with LLD and chronic diseases require long-term medication. Due to the high proportion of medical insurance reimbursement for certain chronic diseases in China, the choice of NVBP drugs does not significantly reduce their out-of-pocket costs. Although NVBP drugs substantially reduce total drug costs, for some older patients, out-of-pocket expenses may not reduce for some older patients, and the therapeutic effect may be suboptimal, potentially exacerbating existing conditions. Consequently, these patients are cautious about using NVBP drugs and prefer brand-name drugs with long-term clinically proven results. Moreover, some patients prefer brand-name drugs when facing long-term treatment, especially for chronic diseases [50]. Conversely, patients without chronic diseases view NVBP drugs positively, perceiving them as effective and cost-saving over long-term use.

Interestingly, patients with ordinary registration demonstrated a lower propensity to choose NVBP drugs, seemingly contradicting the relationship between financial status and NVBP drug selection. This paradox may be attributed to the higher trust and compliance observed among patients consulting medical experts compared to those seeing ordinary practitioners [51]. Due to policy, physicians typically recommend NVBP drugs in

hospitals, and patients presented with treatment plans by medical experts generally exhibit high acceptance. In contrast, those with ordinary registration may lack such trust in their physicians. Nevertheless, patient trust in doctors remains pivotal for treatment adherence [52].

The study indicated that adverse reactions to NVBP drugs significantly reduced patient willingness to use them. Adverse reactions have been proven to be one of the most common obstacles affecting patients' medication behavior [53], which seriously affects patients' compliance. Older patients with LLD are less inclined to choose NVBP drugs again if they experience adverse reactions, and this reluctance persists even after the reactions subside [54]. Moreover, injection pain [55] and drug interactions [56] can diminish willingness.

The present study identified that brand preference significantly influences the choice intention for NVBP drugs. Older patients with LLD, who had no requirements for drug brands, often prefer NVBP drugs. Prior to the NVBP policy, China implemented an evaluation of generic drugs' treatment and efficacy consistency, focusing on quality and bioequivalence with brand-name drugs, to standardize quality and ensure efficacy. Generic drugs that passed this consistency evaluation could replace brand-name drugs, forming the basis of NVBP. Thus, NVBP drugs are suitable for older patients with LLD who do not require brand of drugs. Conversely, patients who prioritize brand-name drugs perceive NVBP drugs as cheaper but inferior in quality and efficacy. Additionally, a small cohort of patients who experienced side effects or poor efficacy with generic drugs exhibit hesitation toward NVBP drugs. Their trust in brand-name drugs makes them reluctant to use NVBP drugs to avoid potential dosage form and specification confusion. Evidence exhibited that patients' attitudes toward generic drugs influence final prescriptions [57]; fortunately, this attitude is gradually shifting [58].

The analysis demonstrated that physicians' recommendations significantly influenced patients' attitudes toward NVBP drugs. To meet NVBP drug usage targets [59], many hospitals have reduced the availability of brand-name drugs. Patients more inclined to choose NVBP drugs were more likely to accept physician advice to switch. Conversely, patients accustomed to original brand-name drugs exhibited reluctance due to the stable efficacy of these medications. Older patients with LLD and severe conditions expressed concerns that NVBP drugs might exacerbate their symptoms, leading to rejection of physicians' recommendations. This reluctance is reinforced by studies questioning the clinical efficacy and safety of generic drugs, indicating a need for further clinical validation on generic substitutions [60]. Additionally, social influences and concerns about NVBP drugs further impacted patients' acceptance of physician-recommended NVBP drugs.

Individuals with self-assessed poor economic status displayed heightened price sensitivity, a factor confirmed by the current study. Stratified analysis revealed that patients with MIUE and MIUR insurance were 1.411 and 1.071 times more likely to select NVBP drugs compared to those with MICS insurance. The lower reimbursement ratios of MIUR and MIUE compared to MICS imply that these patients incur higher out-of-pocket expenses for the same medications, thus preferring the more affordable NVBP drugs to minimize cash expenditure. Additionally, brand recognition influences their drug selection intention; patients indifferent to brand names were more inclined to choose NVBP drugs than those concerned with brand identity. However, patients over 70 exhibited reduced willingness to opt for NVBP drugs, likely due to an increased reliance on medications and a preference for trusted brand-name drugs as they age [61].

Through the interaction analysis of choice intention for NVBP drugs based on different levels of self-assessed economic status and monthly household income, we found significant interactions between them. When self-assessed economic status was affluent, patients with a monthly household income more than CNY 3000 showed lower choice intention for NVBP drugs. Conversely, when self-assessed economic status was difficult, only patients with a household monthly income more than CNY 6000 showed lower choice intention for NVBP drugs. Additionally, for those with a household monthly income less than CNY 3000, there is a relatively higher choice intention of NVBP drugs, with no significant difference between the subgroups based on self-assessed economic status. When monthly household economic income ranged from CNY 3000 to 6000, choice intention for NVBP drugs gradually increased with self-assessed economic status shifting from affluent to difficult. Interestingly, patients with a monthly household income more than CNY 6000 exhibited lower choice intention for NVBP drugs despite self-assessed economic difficulty. One possible reason is that despite their self-assessed difficulty, their actual income is relatively high. Their mismatched assessments may be related to symptoms of LLD, including delusion of poverty [62]. Therefore, their self-assessment may include more disease factors. Their willingness to choose NVBP drugs is more related to actual household monthly income. This is similar to a study in Denmark, which suggests that people with a socially advantaged background may use alternative medications because they have more choices [63].

Our study was the first to reveal the choice intention for NVBP drugs and its associated factors among older patients with LLD. Most prior studies focused on attitudes toward generic drugs and NVBP efficacy. In the

face of national compulsory substitution of brand-name drugs, few studies have paid attention to the willingness of older patients with LLD to choose NVBP drugs. This study addresses this gap by identifying the choice intention and influencing factors among older patients with LLD, offering valuable insights for policymakers. Older patients with LLD prioritize medical insurance reimbursement policies and their responses to medication when choosing NVBP drugs. Additionally, family economic factors and disease status significantly influence their choice intention. The interaction effect between actual economic condition and self-assessed economic condition highlights the differences in choice intention among various subgroups. Considering the audience for NVBP drugs, we conducted a stratified study focusing on economically disadvantaged groups to obtain more detailed influencing factors. Moreover, we excluded participants with diabetes mellitus and those with a history of self-discontinuation of drugs for sensitivity analysis, and found a similar choice intention for NVBP drugs. When extended to other groups, our results can also partially explain patient's choice intention for NVBP drugs and associated factors, including economic factors, physical condition, NVBP policy, and medical behavior.

Strengths and limitations

Although presenting the choice intention for NVBP drugs and related factors among LLD patients, our study still had some limitations. First, the small sample may not be representative of the entire data of depressed elders in China. Second, since the dataset spans a relatively short period of time, the 4-months data may not be sufficient to fully evaluate the choice intention of LLD patients. However, prior to the promotion of NVBP, our ongoing observations of patients' intention about generics and, to our knowledge, the absence of uncontrolled potential time-varying confounding factors suggest that our findings on the basis of available information are valid. Third, the survey was cross-sectional in nature; consequently, causality cannot be inferred. Future surveys would expand the sample size and survey time to validate the findings.

Conclusion

Choice intention for NVBP drugs among older patients with LLD was moderate after the NVBP policy. Economic factors, medical insurance, out-of-pocket expenses, combined chronic diseases, registration type, adverse reactions, brand requirements and physician recommendations were significantly associated with the choice intention. Public health decision-makers can enhance awareness of NVBP drugs among older LLD patients through professional medical services and improved physician-patient communication. Additionally, expanding the scope and proportion of medical insurance reimbursement, advancing substitution studies, and conducting post-marketing re-evaluations can increase patients' willingness to choose NVBP drugs.

Abbreviations

NVBP	national volume-based procurement
LLD	late-life depression
CNY	Chinese Yuan
AOR	adjusted odds ratio
MICS	Civil servant medical insurance
MIUE	Urban Employee medical insurance
MIUR	Urban Resident medical insurance
AOR	adjusted odds ratios
CI	confidence internal

Supplementary Information

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Supplementary Material 1

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Author contributions

JW and LQ conceived the study; JW and WX carried out the data analysis and interpretation of the results; QZ and YS performed literature searching and summary; JW contributed to writing the first draft of the manuscript, and JL edited and revised the manuscript. All authors read and approved the final manuscript.

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Data availability

The original contributions presented in this study are included in the article material, further inquiries can be directed to the corresponding authors.

Declarations

Ethics approval and consent to participate

The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of The Affiliated Mental Health Center of Jiangnan University (WXMHCIRB2023LLky007). All participants or their legal representatives (if participants don't have the ability to write) signed informed consent.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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