Frontiers in Economics and Management Volume 6 Issue 6, 2025
ISSN: 2692-7608 DOI: 10.6981/FEM.202506_6(6).0014

Research on Influencing Factors of Residents' Willingness in Recycling of Expired Drug based on TPB and BRA Models

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Abstract

Recycling of expired drugs is one of the important measures to protect the ecological environment. To explore the influencing factors of residents' willingness to participate in the recycling of expired drugs can promote the recycling of expired drugs to a certain extent. The research is based on the planned behavior theory model (TPB) and Revenue risk analysis model to uses structural equation model to conduct empirical analysis and discusses the influencing factors of residents' participation in expired drug recycling behavior in China. The results prove that: economic cost and recycling attitude has a direct and significant impact on recycling intention, Perceived benefits and Information publicity through subjective norms and recycling attitude generate direct influence on recycling intention, perceived risk through perceptual behavior control generate direct and indirect influence on recycling intention, perceptual behavior and control subjective norms can not directly affect the recycling intention.According to research result, from Information publicity and government pushing and Improve the recycling system and other respects Make relevant suggestions, can effectively improve the willingness of Chinese residents to participate in the recycling of expired drugs.

Keywords

TPB Model; BRA Model; Recycling of Expired Drug; Recycling Intention.

1. Introduction

With the improvement of health awareness among Chinese residents, the number of stored medicines in households continues to increase, and the problem of improper handling of expired medicines is becoming increasingly serious. Public data shows that China's drug waste caused by expiration has reached 15000 tons per year[1]. In the face of a large number of expired drugs, China has actively implemented the concept of sustainable development and attached great importance to the construction of ecological civilization in recent years[2]. However, the level of attention paid to the recycling of expired drugs is still insufficient, and pharmaceutical products themselves have special characteristics. Once mishandled, they may pose potential hazards to the natural environment, the pharmaceutical market, and even life and health[3]. The recycling of expired drugs has also attracted widespread attention worldwide, and some countries and regions have adopted new ecological environment quality assessment standards, with drug residue content as one of the important indicators[4]. Present, China's regulations on the recycling of expired drugs stipulate that expired drugs and their packaging should be recycled as hazardous household waste, and drug packaging boxes should be separated from expired drugs for recycling and disposal. However, after surveying 1990 Chinese respondents, the China Youth Daily found that 99.6% of households had expired drugs that had not been disposed of. 56.6% of respondents would dispose of expired drugs together with regular garbage, 35.9% of respondents would dispose of sealed expired drug packages, and 73.6% of respondents said they did not know how to dispose of expired drugs[5]. At

ISSN: 2692-7608 DOI: 10.6981/FEM.202506_6(6).0014

present, the government's recommendation for the recycling of expired drugs in China is relatively slow, mainly because there are no specific regulations on the recycling of expired drugs in Chinese laws and regulations, and the responsible department for the recycling of expired drugs is not clear. At the micro level, due to the insufficient understanding of the hazards of expired drugs and the system for recycling expired drugs among Chinese residents, their recycling intention towards expired drugs is relatively low. Therefore, exploring the impact of residents' recycling intention on expired drugs is of practical significance for solving the problem of expired drug recycling in China.

Domestic and foreign scholars have paid attention to the recycling of expired drugs from different perspectives. Some scholars discuss how to improve the recovery rate of expired drugs, such as Lu Shengpeng[6] Research has shown that government departments, public welfare organizations, drug manufacturers, and distributors should be the main actors to effectively improve drug recycling rates through policy formulation, recycling channels, and funding support. Cao Yunchun[7] studied the construction of reverse supply chains for expired drugs from the perspective of blockchain. Starting from the end consumer level, enterprise level, industry level, and government level, they pointed out that enterprises participating in the drug supply chain are key, and other entities such as government agencies, consumers, and industry platforms should also actively participate. Some scholars have conducted research on how residents' cognition affects the recycling of expired drugs. Akici distributed questionnaires to understand residents' awareness and attitudes towards the hazards and disposal methods of expired drugs[8]. Most scholars' research mainly focuses on qualitative research, and most of them focus on the existing problems, relevant laws and regulations, and future improvement space of the expired drug recycling system. They hope to solve the problem of expired drug recycling through the efforts of the government, large pharmaceutical companies, and local medical institutions. However, there is still a lack of exploration on the micro level, that is, individual residents, and data support. From the perspective of consumer or resident waste recycling, domestic scholars have also conducted many studies[9-11]. However, most of them are focused on ordinary solid waste such as electronic waste, renewable resources, and waste household appliances. There is a lack of quantitative research on the recycling behavior of special waste such as expired drugs, and mature models have not been introduced. In the analysis process, descriptive statistical analysis is mainly used.

Based on the above premise, this article combines the theory of planned behavior and the profit risk analysis model to construct the TPB-BRA integrated model. Different tests, confirmatory factor analysis, regression analysis and other methods are used to analyze the factors that affect the recycling intention of expired drugs among Chinese residents. From a micro level, it reveals how to solve the "difficult" problem of expired drug recycling from the perspective of individual residents, and proposes suggestions for future improvement directions of expired drug recycling to improve the low rate of expired drug recycling in China.

2. Theoretical Basis and Research Hypotheses

2.1. Theoretical Basis

2.1.1. Information Publicity

Situational factors refer to the objective environment that individuals face when performing a certain behavior[12]. Information publicity as a situational factor, it has a significant impact on the recycling of expired drugs.Yu Fumao[12] in an empirical study on the influencing factors of residents' electronic waste recycling behavior, it was found that the greater the perceived public opinion propaganda, the stronger the intention of recycling behavior among the respondents. This article expands on the above research, add Information publicity factor,Further explore Information publicity to recycling attitude, subjective norms.In this

ISSN: 2692-7608 DOI: 10.6981/FEM.202506_6(6).0014

study,Information publicity refers to the extent of residents' awareness of the recovery of expired drugs and the impact of the perceived social atmosphere at this stage (such as community bulletin boards, pharmacy activities, Internet publicity) on residents' personal participation in the recovery of expired drugs.

2.1.2. Benefit-Risk Analysis Model(BRA)

Scholars use the Benefit-Risk Analysis model (BRA) model as a framework when studying consumer behavior, which identifies the key factors that influence consumer choice behaviorperceived risk and Perceived benefits[13]. Zhang Hanpeng[14] When analyzing the purchase intention of online shopping consumers, it is found that consumers' Perceived benefits and perceived risks of online shopping directly affect their purchase intention. The situation that residents face when choosing whether to participate in the collection of expired drugs organized by the government, pharmaceutical companies, hospitals, and pharmacies is very similar to the situation that consumers face when making purchase choices. Perceived risk and Perceived benefits also exist in the recycling behavior[15]. LEE[16]Through the integration of TPB, perceived risk, and Perceived benefits, it is found that the perceived risk and Perceived benefits are important factors affecting the willingness of online banking to adopt. Wang Chang[15].Through the integration of TPB, perceived risk, and Perceived benefits, it is found that the perceived risk and Perceived benefits are important factors affecting the willingness of online banking to adopt.

2.1.3. Theory of Planned Behavior(TPB)

Ajzen and Fishbein jointly proposed the Theory of Reasoned Action (TRA). They believe that when individuals make decisions, they will try their best to meet their needs and goals in the optimal way, which usually involves a process of careful consideration, information acquisition, and rational weighing. This theory has been widely applied in psychology, economics, and decision science. However, the TRA theory is too idealistic and ignores the influence of emotions and psychological biases.After that, Ajzen[17] The Theory of Planned Behavior (TPB) was proposed in 1991, based on the Theory of Reasoned Action (TRA). It pointed out that the determinants of behavioral intention also include perceptual behavior control and subjective norms. Its research scope covers most general social participation behaviors. In recent years, many scholars have adopted the Theory of Planned Behavior when studying the recycling behavior of general solid waste[9-11]. Many domestic scholars have conducted detailed investigations based on the extended TPB model, studying individuals' willingness to participate and use in different environments[18-20]. In this study, the meaning of "recycling attitude" refers to whether residents' attitude towards the recycling of expired drugs is in favor or against. The higher the degree of approval, the stronger the "recycling intention"; conversely, the weaker the "recycling intention". The meaning of "subjective norms" means that residents will be influenced by the attitudes and participation of people around them towards the recycling of expired drugs during the participation process. The meaning of "perceptual behavior control" is residents' past experience of such recycling behaviors and their perception of what obstacles they will encounter, that is, the conditions that affect whether residents will take actual recycling actions.

2.1.4. Economic Cost

Economic cost has an impact on the residents' acceptance of participating in recycling activities, including their willingness to pay to participate in recycling and indirect costs such as transportation costs related to it. Chen Zhanfeng[21] using the structural equation model to explore the e-waste recycling behavior of residents in Beijing, it is found that when dealing with e-waste, residents will incur certain economic costs, and their recycling behavior is greatly influenced by economic costs. In this study, economic cost refers to the impact of residents' own income constraints on their participation in recycling behavior and their acceptance of

ISSN: 2692-7608 DOI: 10.6981/FEM.202506_6(6).0014

transportation costs to the recycling points in the special public welfare recycling field of expired drug recycling.

2.2. Research Hypotheses

2.2.1. Research on the Impact of "Information Publicity" on Residents' Willingness to Participate in Expired Drug Recycling

Information publicity is widely used as a situational factor in research on the waste recycling field. Many scholars will add such variables for expansion on the premise of using TPB[21]. The recycling of expired drugs is a type of public welfare recycling with a relatively low level of popularity. The residents' awareness of this activity will directly affect their subjective norms, attitudes, and perceptual behavior control, thus influencing whether they participate in the recycling of expired drugs. In past research, Chen Zhanfeng[21] In past research, when Chen Zhanfeng[21] studied the recycling behavior of electronic waste, they found that Information publicity would have an impact on residents' recycling attitude and recycling intention.Chan[22] In the research on residents' recycling of waste, it was found that information publicity affects residents' recycling intention. Guo Yuenan[23] When studying the impact of information acquisition on farmers' pro - environmental behavior, it was found that information acquisition can have both direct and indirect effects on farmers' pro - environmental behavior, and it plays a negative moderating role in the process of the transformation of farmers' pro - environmental intention into behavior. Song Song[24] To sum up, this study proposes the following hypotheses:

H1: The impact of Information publicity on recycling attitude is positive.

H2: The impact of Information publicity on subjective norms is positive.

H3: The impact of Information publicity on recycling intention is positive.

H4: The impact of Information publicity on perceptual behavior control is positive.

2.2.2. Research on the Impact of Perceived Risk and Perceived Benefits on Residents' Willingness to Participate in Expired Medicine Recycling

In the BRA model, perceived risk and perceived benefits play an important role in predicting consumers' purchasing decisions. Scholars in the recycling field have also adopted this model as a research framework[15,25]. In the BRA model, perceived risk and perceived benefits play an important role in predicting consumers' purchasing decisions. Scholars in the recycling field have also adopted this model as a research framework. In previous studies, Jin Xuemei[25] In the research on the impact of perceived risk on consumers' purchase intention, it is shown that when residents make purchase decisions, they will perceive social pressure, and the subjective norms will be strengthened. The greater the subjective norms, the less likely the residents are to make a purchase. The main reason is that residents perceive a high level of risk in their purchasing behavior. When they feel greater social pressure, that is, when the subjective norms are strong, they will be less inclined to adopt this behavior. Wang Zixian, Lü Qinghua[26] Through the research on consumers' cross - border online shopping behavior, it is found that consumers' cross - border online shopping intention is significantly negatively affected by perceived risk.Chen[27] In the prediction of electronic toll collection services, it was found that perceived risk has a significant negative impact on individuals' attitudes and intentions. LEE[16] studied the acceptance of online banking by users and found that perceived risk affects attitude and intention. The higher the risk perceived by users towards online banking, the higher the perceived difficulty of using online banking, and at the same time, the greater the perceived social pressure. Zhang Yingyu[13], when exploring the purchase intention of fresh agricultural products in the O2O model, concluded that perceived risk has a negative impact on purchase intention. Wang Chang[15] conducted a study on residents' participation in "Internet + Recycling" based on the BRA model. The research results show that Perceived benefits have a

ISSN: 2692-7608 DOI: 10.6981/FEM.202506_6(6).0014

positive impact on residents' attitude and intention towards participating in "Internet + Recycling". The benefits perceived by residents in "Internet + Recycling" are also greater than those of the traditional offline recycling method. The higher the residents' Perceived benefits, the stronger the perceptual behavior control. And due to the influence of the people around the individual, the higher the individual's Perceived benefits, the stronger the subjective norms.To sum up, this study proposes the following hypotheses:

H5: The impact of Perceived benefits on recycling attitude is positive.

H6: The impact of Perceived benefits on subjective norms is positive.

H7: The impact of Perceived benefits on recycling intention is positive.

H8: The impact of Perceived benefits on perceptual behavior control is positive.

H9: The impact of perceived risk on recycling attitude is positive.

H10: The impact of perceived risk on subjective norms is positive.

H11: The impact of perceived risk on recycling intention is positive.

H12: The impact of perceived risk on perceptual behavior control is positive.

2.2.3. Research on the Influence of Subjective Norms, Recycling Attitude, and Perceptual Behavior Control on Residents' Willingness to Participate in Expired Drug Recycling

The TPB model incorporates the variable of perceptual behavior control, which is also what differentiates it from the TRA theory. When an individual believes they possess resources that are more advantageous compared to others, the fewer obstacles they expect to encounter, and the more likely the behavior is to be induced[11]. The TPB model also indicates that an individual's evaluation of a specific behavior will influence their behavioral intention. Subjective norms directly affect behavioral intention, representing the influence of social pressure and others' expectations on an individual's adoption of a certain behavior. If an individual feels the support and expectations from those around them, they are more likely to engage in the relevant behavior[28]. Perceptual behavior control also affects behavioral intention. If an individual believes they can easily control and execute a certain behavior, then they are more likely to adopt this behavior[29]. In previous studies, Wan Xin[30]integrated the TPB and NAM models to study the influencing factors of public participation willingness in waste - to - energy projects and found that the key factors influencing public participation willingness were perceptual behavior control, attitude, and subjective norms. Among them, attitude and subjective norms had the strongest positive impact on public participation willingness. Lan Ying[9] pointed out in an empirical study on the influencing factors of consumers' participation in waste household appliance recycling that the significant factors affecting the recycling behavior were behavioral attitude and subjective norms. Wang Chang[15] found in the study of the influencing factors of residents' willingness to participate in "Internet + recycling" that subjective norms had a direct or indirect effect on recycling intention. Wei Jie[31] pointed out in the analysis of the influencing factors of the "Internet +" recycling intention of renewable resources that among the influencing factors of residents' recycling intention, recycling attitude had the strongest influence, followed by subjective norms. In summary, this study proposes the following hypotheses:

H13: The impact of subjective norms on recycling intention is positive.

H14: The impact of recycling attitude on recycling intention is positive.

H15: The impact of perceptual behavior control on recycling intention is positive.

2.2.4. Economic costResearch on the Influence of Residents' Willingness to Participate in the Recycling of Expired Medicines

At present, most of the expired drug recycling in China is a public welfare recycling behavior led by the government or pharmaceutical companies. Therefore, the economic cost of this study

ISSN: 2692-7608 DOI: 10.6981/FEM.202506_6(6).0014

is the transportation cost of residents participating in expired drug recycling. The higher the transportation cost borne by residents participating in expired drug recycling, the lower their willingness to participate in expired drug recycling. Chen Zhanfeng[21] pointed out in the study of electronic waste of Beijing residents that economic cost has a significant impact on behavioral intention. Xu Minli[32]found in the empirical study of residents' willingness to participate in "Internet + recycling" that transaction costs will negatively affect residents' willingness to participate in Internet recycling. Hong Xiumin[33]found that infant and toddler care support significantly affects the fertility intention, especially affected by factors such as economic cost, when exploring the relationship between the family's "three-child" fertility intention and infant and toddler care support.In summary, this study proposes the following hypotheses:

H16: The impact of economic cost on recycling intention is positive.

To sum up, based on the research results of predecessors, this paper combines the actual situation in China, integrates TPB and BRA, takes into account the impact of the objective environment on residents' participation in expired drug recycling behavior, adds situational factors (Information publicity, economic cost), selects a total of eight variables including Information publicity, Perceived benefits, perceived risk, recycling attitude, subjective norms, perceptual behavior control, economic cost, and recycling intention to construct an integrated model, and studies the influencing factors of residents' participation in expired drug recycling. The specific integrated model is shown in Figure 1.

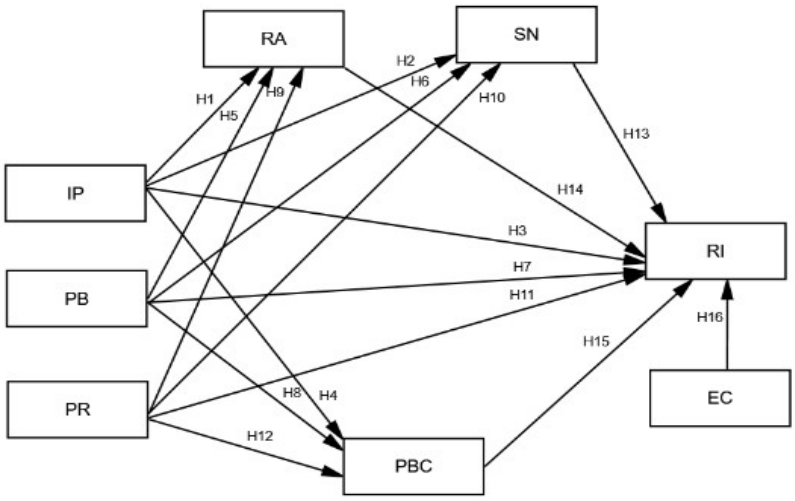


Fig. 1 Theoretical Model of Willingness to Participate in Expired Drug Recycling

3. Research Design

3.1. Sample Distribution and Data Collection

This study collected data through a questionnaire survey. The survey subjects included residents of different categories. From July to September 2024, a total of 445 questionnaires were collected through the Wenjuanxing platform. After eliminating invalid questionnaires, 303 valid questionnaires were obtained, with a valid questionnaire rate of 68.1%. The sample covered provinces such as Anhui, Guangdong, and Jiangsu. Descriptive statistics show that among the surveyed group, the proportion of males is 47.5% and the proportion of females is 52.5%, indicating a relatively balanced male-female ratio and good gender representativeness of the survey data. In terms of age, the survey subjects are mainly young people, with those aged 18 - 25 accounting for 54.1%, those aged 26 - 32 accounting for 25.4%, those aged 33 - 40

ISSN: 2692-7608 DOI: 10.6981/FEM.202506_6(6).0014

accounting for 5.6%, those aged 41 - 49 accounting for 4.3%, those aged 50 - 59 accounting for 6.3%, and those aged over 60 accounting for 4.3%.

3.2. Variable Design

This study involves a total of eight concepts, namely perceived risk, Perceived benefits, perceptual behavior control, recycling attitude, recycling intention, economic cost, Information publicity, and subjective norms. Based on ensuring that the data has good reliability and validity, this paper adopts mature scales. Three measurement items are designed for each variable to measure from different perspectives. In order to accurately measure the degree of approval or opposition of the respondents to different measurement items, all measurement items use the Likert five - level scale scoring method for statistics, including strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree. The measurement items are assigned values of 1, 2, 3, 4, and 5 respectively. The specific measurement items are shown in Table 1.

Table 1. Variables in the questionnaire and their measurement items

Variable	Measurement items
Information publicity[18]	1. I know that expired drugs can pollute the environment or endanger human health
	2. I know the disadvantages of the informal disposal mode of expired drugs
	3. I think it is very important to publicize the recall of expired drugs
economic cost[18]	1. I am able to accept the transportation cost of sending expired medicines to the recycling outlets
	2. I can accept to participate in the recycling and pay the processing fee
	3. I don't think it will be a financial burden for me to participate in the recall of expired drugs
Perceived benefits[15]	1. I think that through the existing drug recycling methods, I can save my time in dealing with expired medicines
	2. I think the existing drug recycling methods can provide me with a wider range of services
	3. I think that the existing drug recycling methods are beneficial to the environment, and using the existing drug recycling methods to recycle will make me feel face-saving
perceived risk[15]	1. I am worried that my personal account information will be leaked or resold for sale
	2. I am worried that the recycling procedures of the recycling point are not standardized, and there will be problems when using them
	3. I am worried that the recycler will not be able to handle expired drugs involving privacy very professionally, resulting in my privacy and information leakage
subjective norms[23]	1. I understand the laws and regulations regarding the recall of expired drugs
	2. I think that if your neighbors and friends are involved in the recycling of expired medicines, you should also participate
	3. I am aware that the relevant regulations have stipulated that residents are responsible for the recycling process
perceptual behavior control[23]	1. I think the surrounding drug recycling facilities are incomplete
	2. I don't think I have time to send expired medicines to the collection point myself
	3. I don't think I have the ability to send expired medicines to the collection point myself
recycling attitude[23]	1. I think the existing drug recycling method is a good way
	2. I think it would be a pleasant experience to recycle expired medicines using existing drug recycling methods
	3. I think it is wise to recycle expired drugs through existing drug take-back methods
recycling intention[23]	1. I am willing to try to use the existing drug recycling methods to recycle
	2. If there are expired drugs to be recalled, I will give priority to the existing drug recycling methods
	3. I am willing to recommend the existing methods of recycling expired medicines to my relatives and friends

ISSN: 2692-7608 DOI: 10.6981/FEM.202506_6(6).0014

4. Measurement Items

4.1. Reliability and Validity Analysis

This study used SPSS 26.0 to conduct a reliability analysis of the variables in the integrated model. The detection method used was the Cronbach's Alpha coefficient proposed by Lee Cronbach in the middle of the last century. As shown in Table 2, the Cronbach's alpha coefficients of all dimensions were greater than 0.7, meeting the standards of this study, indicating that the questionnaire had good reliability and stability.

After the reliability analysis, we used AMOS 26.0 to conduct a validity test of the scale, including KMO and Bartlett's sphericity test, goodness-of-fit validity, convergent validity, and discriminant validity. As shown in Table 3, the KMO value was greater than 0.7, indicating that the structural validity of the questionnaire was good and the Bartlett's sphericity test with a significance level (Sig) of 0.05 was passed. In terms of goodness-of-fit validity, the goodness-of-fit index $\chi 2/df = 1.982$ (less than 3), RMSEA = 0.057 (less than 0.8), CFI = 0.946, TLI = 0.933, and IFI = 0.946 (all greater than 0.9), indicating that the overall goodness-of-fit validity of the factor analysis model was good and passed the test.

The measurement of convergent validity included factor loadings, the composite reliability (CR) of each dimension, and the average variance extracted (AVE). As shown in Table 2, the factor loadings and AVE values of all variables were greater than 0.5, and the composite reliability was greater than 0.7, indicating that the sample data had good convergent validity. In Table 4, the square root of the AVE of each variable was greater than most of the correlation coefficients of this variable with other variables, indicating that the model had good discriminant validity.

Table 2. Validity and Reliability Data

Variable	Path	Estimate	AVE	CR	Cronbach's
Information publicity	Q1	0.691	0.517	0.762	0.762
	Q2	0.778			
	Q3	0.685			
subjective norms	Q4	0.815	0.603	0.819	0.814
	Q5	0.664			
	Q6	0.839			
perceptual behavior control	Q7	0.574	0.582	0.802	0.786
	Q8	0.885			
	Q9	0.795			
Perceived benefits	Q10	0.787	0.660	0.853	0.844
	Q11	0.893			
	Q12	0.751			
perceived risk	Q13	0.740	0.612	0.825	0.820
	Q14	0.771			
	Q15	0.833			
recycling attitude	Q16	0.785	0.675	0.861	0.861
	Q17	0.805			
	Q18	0.872			
economic cost	Q19	0.758	0.578	0.804	0.802
	Q20	0.729			
	Q21	0.792			
recycling intention	Q22	0.812	0.591	0.812	0.814
	Q23	0.758			
	Q24	0.734			

ISSN: 2692-7608 DOI: 10.6981/FEM.202506_6(6).0014

Table 3. KMO and Bartlett's Test

KMO and Bartlett **Test**		
Kaiser-Meyer-Olkin		0.926
Bartlett's Test of Sphericity	Approximate Chi-square	4191.068
	df	276
	Sig	0.000

Table 4. Discriminant Validity

Variable	Information publicity	subjective norms	perceptual behavior control	Perceived benefits	perceived risk	recycling attitude	economic cost	recycling intention
Information publicity	**0.517**							
subjective norms	0.679	**0.603**						
perceptual behavior control	0.101	0.247	**0.582**					
Perceived benefits	0.467	0.652	0.213	**0.660**				
perceived risk	0.562	0.522	0.282	0.623	**0.612**			
recycling attitude	0.573	0.629	0.140	0.771	0.630	**0.675**		
economic cost	0.601	0.656	0.131	0.712	0.711	0.835	**0.578**	
recycling intention	0.604	0.716	0.201	0.828	0.761	0.908	0.913	**0.591**
AVE square root	0.719	0.777	0.763	0.813	0.782	0.822	0.760	0.769

4.2. Hypothesis Testing

The study used AMOS 26.0 to establish a structural equation model based on the proposed research hypotheses, and used AMOS 26.0 to test the hypotheses. The results of the original structural equation model are shown in Fig. 2. After substituting the questionnaire data into the model and fitting, it was found that several fit indices such as CFI, GFI, and AGFI did not reach the acceptable standards, and the model fit was not high. The P-values of the six paths of recycling intention←Information publicity, perceptual behavior control←Information publicity, recycling intention←Perceived benefits, perceptual behavior control←Perceived benefits, recycling attitude←perceived risk, and subjective norms←perceived risk were greater than 0.05, not reaching the significance level and not being key paths. The model should be revised. Therefore, in order to further optimize the original model and ensure that the key paths of the model are not missing, this study made revisions by deleting some non-significant paths and using the MI index adjustment method. After several revisions, a revised model was re-established the model fitting results are shown in Table 5: the chi-square degree of freedom ratio is less than 3, the RMSEA value is less than or equal to 0.08, and the values of IFI, CFI, etc. are all close to 0.9, indicating that the model has good structural validity. Based on the model complexity and sample size, the overall fit is acceptable, and the fit of the revised model is better than that of the original model.

As shown in Table 6: ① Information publicity has a significant impact on recycling attitude and subjective norms, that is, hypotheses H1 and H2 are established. ② Recycling attitude and subjective norms are significantly affected by Perceived benefits, and perceived risk not only has a significant impact on perceptual behavior control but also directly affects recycling intention, that is, hypotheses H5, H6, H11, and H12 are established. ③ There is a significant correlation between recycling attitude and intention, H14 is established, but the direct effects of perceptual behavior control and subjective norms on recycling intention are not significant,

ISSN: 2692-7608 DOI: 10.6981/FEM.202506_6(6).0014

that is, H14 and H15 are not established. ④ There is a significant correlation between economic cost and recycling intention, that is, H16 is established.

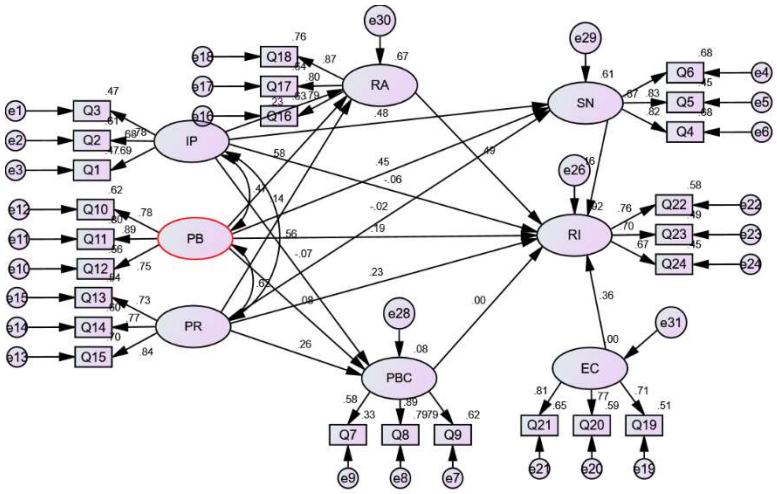


Fig.2 Original Structural Equation Model

Table 5. Fitting Results of the Revised Model

Indicator	x2/df	RMSEA	CFI	GFI	AGFI	IFI	TLI
The results of this study	2.934	0.080	0.887	0.856	0.811	0.888	0.868

Table 6. Path Coefficients

Path	Estimate	S.E.	C.R.	P
Information publicity→recycling attitude	0.409	0.096	4.263	***
Information publicity→subjective norms	0.776	0.130	5.952	***
perceived risk→perceptual behavior control	0.381	0.100	3.800	***
Perceived benefits→subjective norms	0.440	0.066	6.659	***
Perceived benefits→recycling attitude	0.621	0.064	9.664	***
recycling attitude→recycling intention	0.495	0.071	6.983	***
perceived risk→recycling intention	0.214	0.058	3.717	***
economic cost→recycling intention	0.325	0.066	4.886	***
perceptual behavior control→recycling intention	0.004	0.029	0.140	0.889
subjective norms→recycling intention	0.121	0.052	2.331	0.020

Note: *** indicates P < 0.01, ** indicates P < 0.05 (two-tailed test).

5. Conclusion

5.1. Research Results and Discussion

Information publicity can influence subjective norms and recycling attitude to a certain extent, and further affect residents' willingness to participate in expired drug recycling. Information publicity in the process of expired drug recycling mainly includes publicity about recycling points, the harm of expired drugs to human body and environment, and the prohibition of selling drugs to drug dealers. High - quality Information publicity can create a good atmosphere for expired drug recycling in society. Residents are more likely to accept the opinions of people around them, that is, residents' subjective norms are strengthened under the influence of Information publicity. The more and higher - quality Information publicity residents receive during their participation in expired drug recycling, the higher their awareness and trust in

ISSN: 2692-7608 DOI: 10.6981/FEM.202506_6(6).0014

expired drug recycling will be, thus improving residents' recycling attitude and recycling intention.

Perceived risk can affect perceptual behavior control and indirectly affect recycling intention. Perceived risk directly affects residents' willingness to participate in expired drug recycling. Perceived benefits can affect subjective norms and recycling attitude, thus indirectly affecting residents' recycling intention. Residents' perceived risk of participating in expired drug recycling is an important factor affecting their willingness to participate. In the process of expired drug recycling, it will inevitably involve the handling of sensitive drugs and the protection of personal privacy. At present, there are many deficiencies in the handling of expired drugs in China. In recent years, the online recycling method has gradually emerged, and residents can recycle expired drugs without leaving home. Facing the situation of recyclers coming to the door for recycling, residents know little about the whereabouts and handling of drugs, and their concern about privacy leakage in expired drug recycling is reasonable. Residents' Perceived benefits of participating in expired drug recycling mainly refer to the contributions they feel they have made to society and the environment. Residents' Perceived benefits of expired drug recycling will affect their personal subjective norms, recycling attitude, and recycling intention, which indirectly shows that Chinese residents' attention to environmental protection has been increasing day by day. The impact of "recycling attitude" on "recycling intention" is the most significant. There is no direct impact between residents' "perceptual behavior control", "subjective norms" and "recycling intention". In previous research in the recycling field, Wang Chang pointed out that "perceptual behavior control" has no significant impact on residents' willingness to participate in "Internet + recycling". Chen Zhanfeng showed through research that the relationship between "subjective norms" and behavioral intention of Beijing residents in e-waste recycling is not significant. Based on previous research and the results of this study, we speculate that the "collectivism" tradition in Chinese culture has an important impact on residents' "recycling intention". Currently, the participation rate of domestic expired drug recycling activities is not high. When facing expired drug recycling, residents are largely influenced by the collective and thus exhibit conformist behavior. In addition, the popularity of expired drug recycling activities in China is still insufficient. The number of large-scale collective recycling activities held is not large, and there are still deficiencies in the supervision and standardization of expired drug recycling activities. This has led to insufficient awareness of the public welfare nature of expired drug recycling in society as a whole and low enthusiasm for participation.

The impact of "economic cost" on "recycling intention" is significant. Because the current expired drug recycling activities in China have the characteristics of public welfare, residents only incur transportation costs to the recycling points during the expired drug recycling process. If handling fees are charged to residents, it will seriously affect residents' enthusiasm for recycling, causing most residents to hold a reserved attitude towards participating in expired drug recycling.

Demographic statistical variables will have an impact on residents' willingness and attitude towards participating in expired drug recycling. The specific manifestations are as follows: ① Gender has a significant impact on "Perceived benefits", "economic cost" and "Information publicity". Women's perception of "Perceived benefits", "economic cost" and "Information publicity" is more obvious than that of men. ② Age has a significant impact on all variables of expired drug recycling. The "recycling intention" of older residents is less than that of younger residents. ③ The level of education has a significant impact on "Information publicity". The higher the education level of residents, the higher their understanding and acceptance of information. ④ Residents' occupation has a significant impact on variables such as "perceived risk" and "Perceived benefits". The "recycling intention" of retirees and other professionals for expired drugs is less than that of mainstream professionals. ⑤ Monthly income has a

ISSN: 2692-7608 DOI: 10.6981/FEM.202506_6(6).0014

significant impact on "perceptual behavior control", "Perceived benefits" and "recycling attitude". The higher the income of residents, the higher their willingness to participate in expired drug recycling.

5.2. Management Suggestions and Limitations

Strengthen information publicity and education to further enhance residents' awareness of environmental protection and alleviate the current situation where residents have insufficient awareness of expired drug recycling. In the research, we learned that at present, the relationship between subjective norms and residents' recycling intention of expired drugs is not significant, and residents' awareness of expired drug recycling is not high. The government should take this opportunity to conduct publicity through multimedia channels to let residents understand the details and significance of expired drug recycling. It can also recruit volunteers, focus on the middle - aged and elderly groups, eliminate misunderstandings and prejudices, and encourage more residents to participate in the recycling of expired drugs.

Maintain the public - welfare and service - oriented nature of expired drug recycling. Do not implement a charging system for the time being and provide certain subsidies to participants. Given that residents are very sensitive to economic costs in expired drug recycling activities, it is too early to implement paid recycling. A cumulative - point system can be adopted for residents who participate in expired drug recycling, and appropriate material rewards can be given to residents who actively participate in expired drug recycling to attract more residents to participate, so that residents can develop the habit of sending expired drugs to regular recycling points and create a good social atmosphere for expired drug recycling.

In expired drug recycling activities, adhere to the government - led approach, encourage enterprises to participate, and improve service levels. Chinese residents attach great importance to personal privacy. Whether it is an expired drug recycling activity organized by the government or an enterprise, it is necessary to improve service and privacy protection, strengthen the training of recycling personnel, improve their professional knowledge and quality, and provide a detailed explanation of the whereabouts and treatment methods of expired drugs, so as to improve the safety of the recycling activity and reduce residents' concerns about privacy leakage.

Establish a more complete expired drug recycling system, improve relevant laws and regulations, and make the work of expired drug recycling law - based. Create an expired drug recycling model that meets residents' preferences. China's existing laws stipulate that expired drugs belong to hazardous household waste, not medical waste. Expired drugs and their packaging should be recycled as hazardous household waste. After destroying the drug packaging boxes, they should be discarded separately with household waste and recycled by category. However, currently, in China, the number of enterprises that can handle expired drugs and have the handling qualifications is small, and the handling capacity is insufficient. Due to environmental protection restrictions, the direct incineration method is also rarely adopted, resulting in many expired drugs being unable to be destroyed in a timely manner and causing backlogs. The treatment of medical waste is more professional and the management is more stringent, which is of great significance for relieving the pressure of expired drug treatment. Therefore, expired drugs should be included in the category of medical waste, and at the same time, the main department responsible for expired drug recycling should be clearly defined, which can make the existing expired drug recycling system more complete.

There are some problems in the design of this research. Since the sample is mainly composed of young students, its representativeness is not strong. Subsequent scholars can avoid this aspect in their research and try to expand the variables in the field of expired drug recycling. In addition, we learned from the research that information publicity has the most significant

ISSN: 2692-7608 DOI: 10.6981/FEM.202506_6(6).0014

impact on recycling intention. Future research can focus on exploring the mechanism of the effect of information publicity on residents' participation intention.

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