



Assessing willingness to pay for upgrading toilets in rural areas of Shaanxi and Inner Mongolia, China

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ABSTRACT

Unsanitary toilets are recognized worldwide as a threat to ground water and public health. In this research, we investigated villagers' willingness to pay to upgrade toilets in Shaanxi and Inner Mongolia. The study was based on data from 558 questionnaires collected in December 2017 and January 2018. The villages and villagers were randomly chosen. We observed that 42% of the respondents were willing to pay to upgrade toilets, and the key factors that affected willingness were dissemination, concern, gender, living time, and satisfaction. In addition, villagers who lived with children were more sensitive to pollution, especially water pollution. These findings could help the Chinese government's toilet revolution mission succeed by identifying and targeting villagers with high willingness.

Keywords: Rural area; Logit; Toilet; Children

1. Introduction

Unsanitary toilets are a threat to the environment [1–6] and public health [5,7–12]. Recognizing this fact, the Chinese government inaugurated the toilet revolution to improve unsanitary toilets in rural areas in October 2014. However, the population and districts of rural China are so large that government financing could not support the full cost. Therefore, the local governments required the villagers to provide labor and money for this mission. To achieve that goal, the local governments implemented a policy where part of the upgrading cost was paid by the government and the remainder was paid by the villagers. However, an insufficient number of villagers responded positively to the policy. One objective of this study was to explore the villagers' willingness to pay (WTP) to upgrade toilets and the

influencing factors. The second objective was to explore the reason behind the villagers' choices.

1.1. Literature review

Many researchers have focused on the WTP regarding toilets worldwide. Antara et al. suggested that 43.5% of rural residents never used latrines in Odisha and observed that the attitude of respondents was driven by age and household size [11]. Jenkins et al. suggested that 37% of households were willing to install toilets in Ghana [13]. Coffey et al. observed income, education, and improved housing could affect the attitude of rural Indian households to use in toilets [14]. Lamichhane et al. suggested that more than 60% of respondents were willing to pay for toilets in Hawaii and observed that gender, age, and income could affect the respondents' attitudes [15]. Yishay et al. observed that 60% of households who received microloans exhibited

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a WTP and 25% of households who did not receive micro-loans exhibited a WTP in rural Cambodia [16].

Shakya suggested that social contact would affect rural residents' willingness to build toilets in India [17]. Acey et al. observed that occupation, living time, trust, and support would affect the respondents' WTP in Kenya and 55% of respondents were willing to pay at least 1 dollar monthly [18]. Vasquez and Alicea-Planas suggested that dissatisfaction, health concerns, and current conditions had a major effect on the respondents' WTP in Nicaragua and that the affordable cost for respondents was between 2.8% and 3.2% of household income [19]. Jenkins et al. observed that defecation sites, social structure, road, and urban proximity played a critical role on the respondents' willingness to build toilets in rural Benin [20]. Novotný et al. observed that social norms, perception of finance, and attitude affected WTP for toilets in rural Jharkhand [21]. Other researchers have considered the influence of factors such as education, caste, location, social contacts, life-stage, travel experience, physical and social geography, defecation sites, and health education [22–27]. In summary, although the literature comprises many toilet studies, few studies have investigated the WTP for upgraded toilets in China's rural areas.

In this study, we used questionnaires and binary logit model; explored the factors that affected villagers' WTP toward upgrading toilets; and attempted to group the villagers and observe different performances of different factors in different groups. We assert that this study contributes to society and the literature because the results can assist decision-makers attempting to create effective policy to upgrade toilets in rural areas.

2. Materials and methods

2.1. Research site

The study area included Shaanxi and Inner Mongolia, which are less developed areas in Northwest China. These areas host 26.81 million rural inhabitants [28] over an area of 323,800 km². Shaanxi and Inner Mongolia have semi-arid climates [29,30]. Shaanxi is the cultural center of Northwest China and mainly inhabited by the Han nationality. Inner Mongolia is the ethnic cultural center of Northwest China and inhabited by ethnic minorities, including the Han nationality.

We surveyed the villages of different ethnicities in these two areas and agriculture, animal husbandry, and migrant work were the main means of subsistence for the villagers. Similar to most toilets in Northwestern Chinese villages, toilets in the study area were characterized as unhygienic, humble, and unimproved traditional. Many villagers practice open defecation or use a dry pail latrine. A critical consequence of these unsanitary toilet habits is that the untreated waste is polluting the ground water and exacerbating pollution [31].

2.2. Data collection

The questionnaire was based on the contingent valuation method (CVM), contained double-bounded and open-ended questions, and was completed by each respondent.

The questionnaire comprised 23 questions: 14 questions collected demographic information, five questions collected information about toilets and environment characteristics, and four questions collected information about WTP, the reason behind the choice, and affordable cost for willing villagers (per household). The structure of the questionnaire was borrowed from similar studies [12,20,32].

To guarantee the WTP bid range for the CVM and validate the survey, we pre-tested the questionnaire with 60 villagers and amended the questionnaire after obtaining the results. The respondents were notified that the cost involved building eco-friendly toilets and purchasing equipment that could decontaminate feces and that the cost did not include maintenance and operations fees.

All the respondents provided their verbal informed consent. Throughout the survey, the respondents were encouraged to ask questions and to request clarification. To ensure the villagers' lifestyle did not negatively affect the integrity of the data collection, we interviewed respondents on weekdays, for half of one day, and on weekends, for the whole day. To avoid bias caused by presenting the questions in the same sequence during each interview, we changed the sequential order of questions. Every questionnaire was checked by the interviewer. If the answer was incomplete, the interviewer would ask the villagers to finish the answer. If the villager left the interview, the questionnaire was excluded. In the end, one of the authors checked all questionnaires and excluded the incomplete questionnaires. Additionally, we assessed the questions about the reason for the villagers' choice and the affordable cost for willing villagers. If the answers to these questions were contradictory, we excluded the questionnaire. Notably, the data might have contained bias generated by the researcher.

We conducted fieldwork in December 2017 and January 2018. We used stratified random sampling to choose 15 villages from the study area. According to the population size of the provinces, we choose two cities in Shaanxi province and one city in Inner Mongolia. Next, we proportionally choose survey villages by the population size of cities. Finally, we chose nine villages in Shaanxi province and six villages in Inner Mongolia.

Next, we chose 10% of villagers from each village randomly, that is, 30–50 villagers in each village. Finally, 669 villagers responded to the questionnaires. We obtained 266 questionnaires from Inner Mongolia, and 238 villagers from the survey answered all the questions in this study (responded rate = 89%). We obtained 433 questionnaires from Shaanxi, and 362 villagers from the survey answered all the questions (responded rate = 84%).

One of the authors trained nine interviewers in November 2017. One of the authors supervised the survey and did not conduct interviews during the survey. Respondents were asked for an interview and informed that the interview was voluntary. If the respondent refused, another respondent was selected. During the interview, the villagers were encouraged to ask for clarification. To avoid bias and maintain data quality, we excluded 42 questionnaires answered paradoxically. Of the respondents, 233 were female and 325 were male. This imbalanced gender segmentation was because of the large number of migrant workers in the study area [28,33].

2.3. Data analysis

This study used a binary logit model to explain the relationship between the factors. The two possible outcomes were represented by the response variable P , which was 1 if a resident was willing to pay and 0 if a resident was unwilling to pay. Therefore, the binary logit model was set as follows [34,35]:

$$\gamma = \text{Logit}(P) = \text{LN}\left(\frac{P_i}{1-P_i}\right) = B_0 + B_i X_i \quad (1)$$

where $\text{logit}(P)$ is the probability that a villager is willing or unwilling to pay; B_0 is the model constant; and B_i is the parameter estimates of the independent variables (X_i , $i = 1, \dots, n$ are the set of independent variables). The probability P ranged from 0 to 1, and the nature logarithm $\text{LN}\left(\frac{P_i}{1-P_i}\right)$ ranged from negative infinity to positive infinity.

According to the data, we easily inferred that the analysis was suitable and that the data of the variables followed the villagers' behavior. The Kaiser–Meyer–Olkin (KMO) result was 0.712, and the result of the Barlett test of sphericity was proven significant by using SPSS 20. For the cases of heteroscedasticity and fitting, we conducted tests, and Table 1 describes the main results of these tests. All statistical analyses were performed by Stata MP 14 except for the goodness-of-fit test, which was assessed through SPSS20. The results of the likelihood-ratio test showed that all groups passed this test except for the unhealthy group. The results of the goodness-of-fit test showed that all groups were fit. The results of White's test showed that all groups were heteroscedastic. Generally, the models indicated good agreement with all groups except the unhealthy group; however, we kept the unhealthy group for comparison.

3. Results

3.1. Explanatory variables for regression analysis

The results section presents the details of the initial individual variables to consider the variables that affected their willingness, and the villagers' subjective evaluations

are depicted. Table 2 shows the data of the variables that significant in the models.

Fig. 1 shows the percentage of villagers willing to pay for upgrading toilets and the affordable cost of each household. We observed that the percentage of willing villagers declined as the costs rose. The results of the estimations showed that the mean WTP of the villagers was estimated to be USD 73.12 per household in Inner Mongolia. The mean WTP of the willing villagers was estimated to be USD 63.95 per household in Shaanxi province. The mean WTP of all the willing villagers was estimated to be USD 68.29 per household.

3.2. Reason behind the choices

To provide the proper context for the factors that determine villagers' WTP, we asked further questions regarding the reason behind respondents' choices. The dominant reason for paying was convenience in Inner Mongolia. Of the total number of villagers in this survey, 44% of willing villagers paid for convenience; 33% of unwilling villagers did not want to pay because of the extra cost of upgrading toilets in Inner Mongolia; and 41% unwilling villagers refused to pay because they did not care about upgrading toilets. Additionally, a significant portion of unwilling villagers in Shaanxi did not want to pay because they did not care about upgrading toilets in Shaanxi.

3.3. Regression analysis

We considered the difference between the villagers and grouped villagers according to whether they lived with children and their health condition. In this manner, we attempted to discuss factors that could affect the attitudes of villagers in different groups. We used the binary logit model to analyze the relationship between the factors. Table 3 summarizes the results of each group. We observed that the results of R^2 were not very high, which may have been affected by the inclusion of the village fixed effects.

3.3.1. Total group

According to the marginal utility results, females may show more interest than males in upgrading toilets ($P <$

Table 1
Model fitting information

Model	Model fitting criteria		Likelihood-ratio tests			Goodness-of-fit (HL)			White's test			
	-2 LOG Likelihood	N	Chi-Square	df	Sig	Chi-square	df	Sig	Chi-square	df	Sig	
Total Group	-316.70	558	94.40	22	0.00	4.46	8	0.81	273.36	256	0.22	
Guardian	Without Children Group	-138.27	270	55.71	20	0.00	4.30	8	0.83	197.94	184	0.23
		With Children Group	-163.27	288	51.03	20	0.00	4.32	8	0.83	233.65	212
State of Health	Healthy Group	-264.10	468	81.16	21	0.00	7.74	8	0.46	231.75	227	0.40
	Unhealthy Group	-38.39	90	22.14	21	0.39	3.25	8	0.92	90.00	82	0.26

Fitting and heteroscedasticity information of each group. Total group contains all the villagers in this study. The guardian group refers to whether the villager lives with children. Therefore, the health group refers to the villagers' health condition. Due to the larger number of migrant workers, many children live with their grandparents. Thus, the with-children group contains the parents living with their children [36] and the grandparents living with their grandchildren. The without-children group contains all the villagers living without children. N is the number of villages in the group.

Table 2
Descriptive statistics

Variable	Question	Options	Total	Inner Mongolia	Shaanxi
			N (%)	N (%)	N (%)
Gender	What's your gender?	Female	558 (100%)	211 (100%)	347 (100%)
		Male	233 (42%)	85 (40%)	148 (43%)
Dissemination	Do you ever receive dissemination of toilet knowledge?	No	325 (58%)	126 (60%)	199 (57%)
		Yes	558 (100%)	211 (100%)	347 (100%)
Health	What's your health condition?	No	390 (70%)	140 (66%)	250 (72%)
		Yes	168 (30%)	71 (34%)	97 (28%)
Child	Are you living with a child or grandchild who age 15 years or younger?	Unhealthy	558 (100%)	211 (100%)	347 (100%)
		Healthy	90 (16%)	40 (19%)	50 (14%)
Occupation	What's your occupation?	Farmer	468 (84%)	171 (81%)	297 (86%)
		Shopkeeper (in village)	558 (100%)	211 (100%)	347 (100%)
Living time (month/year)	How much time do you spend in the village per year? (month/year)	No	270 (48%)	93 (44%)	177 (51%)
		Yes	288 (52%)	118 (56%)	170 (49%)
Income (USD/year)	How much is your annual household income?	Farmer	558 (100%)	211 (100%)	347 (100%)
		Shopkeeper (in village)	133 (24%)	51 (24%)	82 (24%)
Concern	Please choose your level of concern for the public affairs of your village.	service personnel (in village)	22 (4%)	12 (6%)	10 (3%)
		Migrant worker	64 (12%)	17 (8%)	47 (14%)
Pollution	Is your village suffering pollution?	Other	160 (29%)	60 (28%)	100 (29%)
		Other	179 (32%)	71 (34%)	108 (31%)
Soil pollution	Please choose the level of soil pollution in your village.	(0–3)	558 (100%)	211 (100%)	347 (100%)
		(3–6)	216 (39%)	83 (39%)	133 (38%)
Water pollution	Please choose the level of water pollution in your village.	(6–9)	48 (9%)	25 (12%)	23 (7%)
		(9–12)	21 (4%)	8 (4%)	13 (4%)
Income (USD/year)	How much is your annual household income?	Greater than 6020	273 (49%)	95 (45%)	178 (51%)
		Less than 2006	65 (12%)	35 (17%)	30 (9%)
Concern	Please choose your level of concern for the public affairs of your village.	(2006–3344)	84 (15%)	36 (17%)	48 (14%)
		(3344–4682)	59 (11%)	17 (8%)	42 (12%)
Pollution	Is your village suffering pollution?	(4682–6020)	51 (9%)	19 (9%)	32 (9%)
		Greater than 6020	299 (54%)	104 (49%)	195 (56%)
Soil pollution	Please choose the level of soil pollution in your village.	Highest	558 (100%)	211 (100%)	347 (100%)
		Higher	211 (38%)	74 (35%)	137 (39%)
Water pollution	Please choose the level of water pollution in your village.	Moderate	134 (24%)	56 (27%)	78 (22%)
		Lower	113 (20%)	49 (23%)	64 (18%)
Pollution	Is your village suffering pollution?	Lowest	49 (9%)	16 (8%)	33 (10%)
		Lowest	51 (9%)	16 (8%)	35 (10%)
Soil pollution	Please choose the level of soil pollution in your village.	No	558 (100%)	211 (100%)	347 (100%)
		Yes	357 (64%)	125 (59%)	232 (67%)
Water pollution	Please choose the level of water pollution in your village.	Highest	201 (36%)	86 (41%)	115 (33%)
		Higher	558 (100%)	211 (100%)	347 (100%)
Soil pollution	Please choose the level of soil pollution in your village.	Moderate	23 (4%)	9 (4%)	14 (4%)
		Lower	36 (7%)	19 (9%)	17 (5%)
Water pollution	Please choose the level of water pollution in your village.	None	33 (6%)	18 (9%)	15 (4%)
		None	22 (4%)	9 (4%)	13 (4%)
Soil pollution	Please choose the level of soil pollution in your village.	None	444 (80%)	156 (74%)	288 (83%)
		Highest	558 (100%)	211 (100%)	347 (100%)
Water pollution	Please choose the level of water pollution in your village.	Higher	33 (6%)	13 (6%)	20 (6%)
		Moderate	51 (9%)	25 (12%)	26 (7%)
Water pollution	Please choose the level of water pollution in your village.	Lower	34 (6%)	16 (8%)	18 (5%)
		Lower	30 (5%)	13 (6%)	17 (5%)
Water pollution	Please choose the level of water pollution in your village.	None	410 (74%)	144 (68%)	266 (77%)
		None	410 (74%)	144 (68%)	266 (77%)

(Continued)

Table 2 (Continued)

Air pollution	Please choose the level of air pollution in your village.		558 (100%)	211 (100%)	347 (100%)
		Highest	30 (5%)	9 (4%)	21 (6%)
		Higher	35 (6%)	16 (8%)	19 (5%)
		Moderate	50 (9%)	26 (12%)	24 (7%)
		Lower	23 (4%)	11 (5%)	12 (3%)
		None	420 (75%)	149 (71%)	271 (78%)
Satisfaction	Please choose the level of satisfaction about the toilets in your house.		558 (100%)	211 (100%)	347 (100%)
		Highest	65 (12%)	26 (12%)	39 (11%)
		Higher	92 (17%)	33 (16%)	59 (17%)
		Moderate	141 (25%)	56 (27%)	85 (24%)
		Lower	206 (37%)	76 (36%)	130 (37%)
		Lowest	54 (10%)	20 (9%)	34 (10%)
Willingness	If the government were to reimburse you for part of the expenses used to upgrade household toilets, would you be willing to pay?		558 (100%)	211 (100%)	347 (100%)
		Unwilling	324 (58%)	107 (51%)	217 (63%)
		Willing	234 (42%)	104 (49%)	130 (37%)

We also set factors such as age, education level, whether villagers understood the dangers of unsanitary toilets, age of child, whether villagers worked in the village government, and income level. However, none of these factors were significant in any of the groups. To make this manuscript succinct, we showed only the significant factors in the models. All exchange rates to USD were 6.67 because the data were collected from 2017.

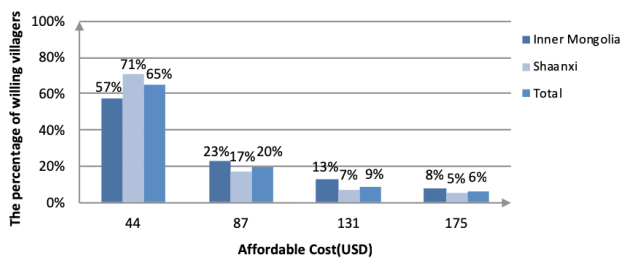


Fig. 1. Affordable cost for willing villagers (per household).

0.05). The coefficient of dissemination was observed to be positive ($P < 0.01$). For occupation, shopkeeper ($P < 0.05$), service personnel ($P < 0.05$), and other ($P < 0.10$) all had negative coefficients. Additionally, living time ($P < 0.10$) and income ($P < 0.01$) showed a negative impact on willingness. The villagers more involved in public affairs may have been more likely to pay ($P < 0.10$). Finally, satisfaction showed a negative impact on the villagers' willingness ($P < 0.05$).

3.3.2. Without Children Group

According to the results of the logit model, dissemination also showed a positive impact ($P < 0.01$) in this group. For the factor of occupation, service personnel and other had a negative coefficient ($P < 0.05$). Living time and satisfaction showed a negative impact at the 10% level, and income showed a negative impact at the 1% level.

3.3.3. Children Group

Sociodemographic characteristics also influenced villagers' choice in this group. The coefficient of gender was observed to be negative ($P < 0.05$). Dissemination showed a stable positive impact ($P < 0.01$). For occupation, shopkeeper ($P < 0.05$) and service personnel ($P < 0.10$) had negative coefficients. Income ($P < 0.05$) and water pollution

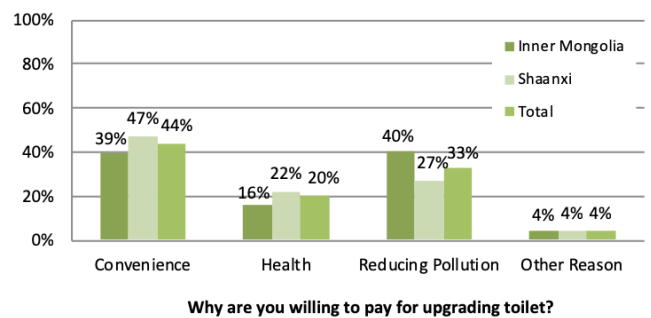


Fig. 2. Reasons provided by willing villagers.

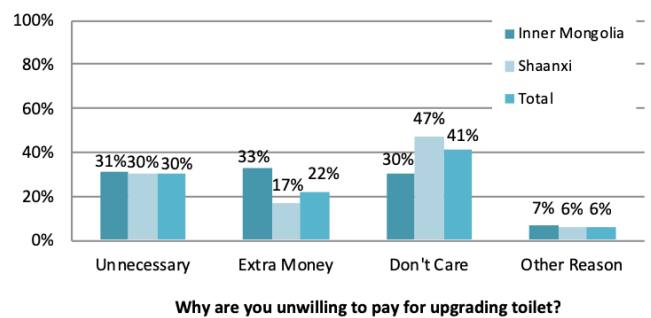


Fig. 3. Reasons provided by unwilling villagers.

($P < 0.1$) had negative impacts. Concern ($P < 0.05$) and pollution ($P < 0.10$) had positive coefficients.

3.3.4. Healthy Group

In this group, dissemination ($P < 0.01$) and concern ($P < 0.05$) showed a positive impact on the villagers' willingness. Shopkeepers may have had less WTP than farmers ($P < 0.05$). Living time, income, and satisfaction were statistically significant in the logit at the 5% level and had a negative impact.

Table 3
Logit regression of the willingness to pay

Variables	Total Group	Guardian		State of Health	
		Without Children Group	With Children Group	Healthy Group	Unhealthy Group
Gender	−0.11** (−2.20)	−0.05 (−0.64)	−0.18** (−2.40)	−0.074 (−1.302)	−0.30* (−1.89)
Dissemination	0.31*** (5.69)	0.42*** (4.89)	0.23*** (2.93)	0.340*** (5.430)	0.43** (2.10)
Child	0.12 (−1.35)			0.064 (0.643)	0.42 (1.43)
Occupation (shopkeeper)	−0.34** (−2.47)	−0.17 (−0.49)	−0.42** (−2.43)	−0.392** (−2.116)	−0.37 (−1.17)
Occupation (service personnel)	−0.24** (−2.53)	−0.29** (−2.02)	−0.26* (−1.95)	−0.128 (−1.211)	−0.69** (−2.09)
Occupation (migrant worker)	0.00 (−0.02)	−0.18 (−1.58)	0.12 (1.01)	−0.016 (−0.179)	0.15 (0.41)
Occupation (other)	−0.13* (−1.83)	−0.21** (−2.12)	−0.07 (−0.62)	−0.067 (−0.837)	−0.50** (−2.20)
Living time	−0.04* (−1.92)	−0.05* (−1.76)	−0.05 (−1.54)	−0.044** (−1.962)	−0.08 (−0.79)
Income	−0.07*** (−3.37)	−0.08*** (−2.73)	−0.07** (−2.55)	−0.056** (−2.537)	−0.13** (−2.15)
Concern	0.04* (1.81)	0.00 (−0.01)	0.07** (2.32)	0.045** (−2.006)	−0.05 (−0.96)
Pollution	0.09 (1.07)	−0.01 (−0.01)	0.23* (1.80)	0.032 (0.338)	0.59* (1.95)
Soil pollution	−0.03 (−1.02)	−0.04 (−0.81)	0.02 (0.45)	−0.020 (−0.656)	−0.17 (−1.42)
Water pollution	−0.03 (−1.19)	0.00 (0.07)	−0.07* (−1.73)	−0.049 (−1.605)	0.05 (0.45)
Air pollution	0.04 (−1.57)	0.03 (0.61)	0.06 (−1.62)	0.033 (−1.091)	0.20* (−1.88)
Satisfaction	−0.05** (−2.13)	−0.05* (−1.72)	−0.05 (−1.48)	−0.061** (−2.355)	0.04 (0.61)
Constant	0.21 (−0.67)	0.57 (1.17)	0.16 (0.46)	0.362 (1.034)	−0.55 (−0.64)
Pseudo R ²	0.17	0.22	0.18	0.172	0.37

The coefficient is the marginal effect coefficient. The number under the coefficient and in brackets is the result of the t test of the coefficient. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$. As we set dummy variables for occupation, and the variable occupation was separated into occupation (farmer), occupation (shopkeeper), occupation (service personnel), occupation (migrant worker), and occupation (other). Next, we set occupation (farmer) as the dummy base-level occupation.

3.3.5. Unhealthy Group

Gender ($P < 0.10$) and income ($P < 0.05$) showed negative impacts in the unhealthy group. The coefficient of dissemination was positive ($P < 0.05$). For the factor of occupation, service personnel and other had negative coefficients ($P < 0.05$). Pollution and air pollution had a positive impact ($P < 0.10$).

4. Discussion

Table 3 shows the results of each group. Some of the results from the split groups were similar to those of the total group. To be succinct, we mainly discussed the factors that had a different impact on the total group in the discussion of split groups.

4.1. Total Group

Demographically, females always show more interest than males in terms of natural resources [37], eco-friendly technology [38], and environmental policy [39]. In the total group, females also showed more WTP than males. Part of the reason for this result is because females are more inclined toward eco-friendly actions [37–39]. Furthermore, in the study areas, females performed most of the housework and upgrading toilets can be more convenient than the current toilets and make housework easier. These advantages probably motivate females to pay. This factor is also significant in the with-children and unhealthy groups. Thus, attention must be paid to the efforts of females in upgrading toilets.

In addition to gender, other important factors require attention include dissemination, which showed a positive impact in all groups. Other researchers have also observed a positive impact of dissemination and acquiring related knowledge to the WTP of the respondents [40–43]. This result is probably because the dissemination of toilet knowledge educates villagers and increases their awareness regarding the importance of toilets. A study on air pollution observed the positive impact of relevant experience on willingness [44]. Therefore, the dissemination of toilet knowledge may also arouse the villagers' WTP. The previous result provides strong evidence that dissemination is necessary for upgrading toilets.

Occupation is a factor that has been shown to affect the inhabitants' willingness in many studies [44,45]. In this study, shopkeepers, service personnel, and other showed less WTP than farmers in the total group. After a return visit, we observed that shopkeepers and service personnel always resided inside their shops. Additionally, a shortage of public toilets in the villages was observed. Some villagers asked to use the toilets of shopkeepers or service personnel; thus, the uncomfortableness of unsanitary toilets can reduce the number of villagers asking to use their toilets. Some shopkeepers and service personnel were worried that if the toilets were upgraded, there would be too many requests to use their toilets; then, refusals of these requests would negatively affect their businesses and interpersonal relationships with other villagers. If the shopkeepers and service personnel agreed to the requests, too much energy and time would have to be exerted. Based on the opinions of the shopkeepers and service personnel, upgrading toilets would entail extra work and demand more energy than owning unsanitary toilets. Thus, in this situation, the shopkeepers and service personnel showed less interest.

In this study, 35.754% of villagers who belonged to the occupation (other) group were aged older than 55 years. These villagers were too old to work; thus, most did not have a job and were supported by their children or pension. Therefore, they usually had a low income. Furthermore, they did not usually enjoy the benefits of hygienic toilets. These factors amount to a conservative attitude regarding paying for upgrading toilets.

Some researchers have observed that respondents who had resided for a longer duration in their study areas had a greater WTP [43,46]. However, this phenomenon was not repeated in this study. Moreover, living time showed a negative impact on the total group, without-children group, and healthy group. Part of the reason for this result was because the less time villagers spent in the village, the

greater the chance they may go to the city and use hygienic toilets. Additionally, the experience of hygienic toilets may motivate them to upgrade their toilets. However, villagers who live in the village year-round are used to unsanitary toilets and have less opportunity to use hygienic toilets. Therefore, these villagers did not have a strong motivation to pay.

Studies have suggested that higher income may have a positive impact on willingness [39,42,44,47,48]. Different concerns were voiced by villagers in this study because the negative impact of income was stable in every group. This result means that the more the villagers earned, the less they were willing to pay. Part of the reason for this result is because the toilets were built by the villagers. The villagers who earned a higher income usually spent more money building toilets and owned better toilets than the residents in lower income groups; however, these toilets may still be unsanitary. For villagers who earned a higher income, upgrading toilets would result in fewer benefits for them compared with the other income groups and could result in them having to dismantle their "good toilets." In their opinion, upgrading toilets was a huge waste. Therefore, the villagers with higher incomes showed an unwillingness to pay.

Fu observed that altruistic action aroused respondents' willingness [49]. In this study, concern showed a positive impact in the total group, with-children group, and healthy group. Compared with villagers who had a higher level of interest in the public affairs of the village, villagers with a lower level of interest were less likely to pay. This is probably because the more the villagers care about the public affairs of the village and participate in public events, the more belonging they feel for the village. Therefore, they would be more willing to do something good for the village such as upgrading the toilets to protect the village environment.

Unsatisfactory experience may also arouse the inhabitants' WTP, according to a study on Canary Island [50]. In this study, this phenomenon appeared in the without-children group and healthy group. The results showed that the less individuals were satisfied with their toilets, the more they were willing to pay. This result was because the unsatisfactory experience of unsanitary toilets may provide the motivation to pay for toilets.

4.2. Live with or without Children Group

Some researchers believe that children may have affected parents' WTP [51,52]. In a study in Canada, researchers observed that children could arouse their parents' WTP and female guardians with children were more willing to pay than males [53]. In this study, we also observed that female guardians showed more interest in upgrading toilets than male guardians in the with-children group and total group. However, this phenomenon was not repeated in the without-children group. The reason for this result is probably because female guardians pay more attention to children than male guardians; thus, female guardians are more likely to be influenced by children. Additionally, upgrading toilets improves the environment for children. As a result, the female guardians showed more interest in paying.

According to the results of the logit model, shopkeepers showed a stable negative impact in the total group,

with-children group, and healthy group, and the results were not significant in the without-children group. This result may be because for the shopkeepers who live with children, the villagers who use their toilets result in extra time and costs and are a threat to their children. For shopkeepers who live without children, they do not have these scruples. Therefore, in this manner, the negative impact is weakened.

In the with-children group, occupation (other) was not significant and had a stable negative impact in the total group, without-children group, and unhealthy group. This result may be because in this study, many villagers who belonged to the occupation (other) and lived with children were housewives or grandparents. For these villagers, the focus of their lives revolves around the children they live with. Unsanitary toilets threaten the growth and health of children [12]. This type of threat may affect these villagers' choices; therefore, the negative impact of occupation (other) was offset in the with-children group.

Similarly, living time was not significant in the with-children group and showed a stable negative impact in the total group, without-children group, and healthy group. This result is mainly because plenty of young villagers are migrant workers who remained in the village for a short time [28,33,36]. Many villagers who lived in the village year-round were old villagers who lived with their grandchildren. Due to the results of China's forced child family planning policy, these grandparents cherish their grandchildren greatly; thus, although these grandparents may never enjoy the benefits of hygienic toilets, they think that improved toilets would be much cleaner and better for their grandchildren. Furthermore, the willing parents may also persuade these grandparents to upgrade toilets for their children. Thus, the negative impact of this factor was offset in the with-children group.

In the without-children group, concern did not show a positive impact, and this factor had a stable positive impact in the total group, without-children group, and healthy group. During the interview with the villagers living without children, we observed that some of the villagers concerned about public affairs were willing to perform the labor to upgrade the toilets but were unwilling to pay. For the villagers concerned with the public affairs of the village, the impact of concern may have existed but was not sufficiently strong for the villagers to pay. Children enhanced the impact of the concern to arouse the willingness of the villagers; otherwise, this influence may be undercut.

The with-children group satisfaction did not show a negative impact, and this result is similar to the result in the total group, without-children group, and healthy group. This phenomenon is because although the guardian may ignore their feelings regarding toilets, they do not ignore the disadvantages of unsanitary toilets to their children or grandchildren. In some of the interviews, the guardians felt that their toilets were fine but not sufficient for their children; therefore, they wanted to upgrade their toilets. The concern for children may cover the feelings of the guardians and offset this factor in the with-children group.

Researchers have observed that pollution may arouse the WTP for eco-friendly products or acts [44,54] and that some of the respondents' willingness was affected by the types of pollution [55]. In the with-children group, guard-

ians suffering from pollution showed more interest in paying. This result is partly because pollution may threaten the health of children and an unsanitary environment exacerbates this threat. Therefore, the guardians wanted to upgrade toilets and improve environment for the children.

Additionally, in the with-children group, we observed that following the decrease in water pollution, the willingness of guardians also decreased. This result is mainly because of the close connection between water pollution and unsanitary toilets. If guardians suffer from water pollution, they would think that upgrading their toilets would reduce water pollution and the threat of water pollution to their children; if not, this type of motivation decreases. However, this phenomenon was not repeated with the other types of pollution investigated, and this result was partly because of the guardians could not connect unsanitary toilets with the pollution. Additionally, pollution and water pollution did not show a negative impact in any of the other groups, and all the other factors showed no difference with the total group.

4.3. Healthy and Unhealthy Group

Researchers have observed that being unhealthy may arouse the respondents' willingness for eco-friendly acts [42,44,56]. In this study, we observed that the attitudes of females in the unhealthy group were more positive compared with the males, and females in the healthy group showed no differences compared with the males. This result is mainly because a healthy individual is likely to be less affected by the inconvenience of unsanitary toilets and makes females ignore the necessity of upgrading toilets. However, for females who are unhealthy, illness is a reminder of the health threats of unsanitary toilets, such as being unhygienic and difficult to clear. Additionally, illness may debilitate females who are unhealthy and increase the physical fitness gap between healthy males and females who are unhealthy. Therefore, the inconvenience of unsanitary toilets results in more trouble to females who are unhealthy than to unhealthy males, which increases willingness.

In the healthy group, service personnel did not show less willingness than farmers. However, in the unhealthy group, this factor showed a negative impact. This result may be because 34.62% of service personnel in the healthy group were aged younger than 35 years, and this number decreased to 16.67% in the unhealthy group. This result may be because the younger and healthy service personnel have a sufficient amount of energy to manage the extra villagers who ask to use their toilets, which decreases their unwillingness to upgrade toilets. However, for the unhealthy respondents, the result was different.

Similarly, the category of other had a negative coefficient in the unhealthy group but was not significant in the healthy group. This result may be because of the high level of highly educated villagers in this group, that is, 23.13% villagers who worked other jobs in the healthy group had a college degree or above; in the unhealthy group, this number was 5.26%. Many researchers have observed that education level could arouse the respondents' WTP for eco-friendly products [48]. In this study, the number of highly educated villagers was too low to show an impact but was

sufficient to weaken the negative impact. Therefore, the negative impact of occupation (other) was offset in the healthy group.

Finally, in the unhealthy group, living time and satisfaction regarding toilets were not significant, and air pollution had a positive coefficient. The unhealthy group did not pass the likelihood-ratio test; thus, we only retained it for a comparison and did not discuss these results in isolation. All the other factors acted similarly in these groups and in the total group.

5. Conclusions

Upgrading toilets in rural areas is an attempt to solve a critical health and social problem in developed and developing countries. By using CVM and logit regression, we attempted to understand the relationship between the factors of willingness and influence. This attempt was in response to an urgent need for a mass upgrade of the toilets in Northwestern Chinese villages.

In this research, we observed that dissemination could arouse the villagers' willingness. Females were more interested in upgrading toilets than males. The villagers who spent a long time in the village may have had a negative attitude toward upgrading. Additionally, the greater the villagers' income, the less they were willing to pay. The villagers more concerned with the public affairs of the village may have been more interested in upgrading the toilets. The increased degree of toilet satisfaction was accompanied by a decrease in the willingness to upgrade. Finally, we observed that villagers who lived with children may be more sensitive to pollution and water pollution than the other respondents.

The results of this research show that the measures undertaken by the Chinese government to implement its toilet revolution, particularly in the study area, were insufficient to achieve its goals; thus, we suggest that the Chinese government should consider the factors that impacted the willingness of villagers, such as sufficient dissemination of toilet knowledge. This suggestion would highlight the connection between unsanitary toilets and pollution, especially different types of pollution, and provide additional public toilets in rural areas. Notably, the Chinese government decided to not upgrade toilets in the areas of China with the worst toilets. Females, villagers who are poor, and villagers who are more concerned with the public affairs of the village may play leading roles in this mission.

Based on the results of this research, we assert that the Chinese government could improve the implementation of its toilet revolution such that all villagers can enjoy the critical benefits of hygienic toilets and all children can grow up in a clean environment.

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