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Notes

Willingness to pay to improve water quality in Zapopan

Disposición a pagar para mejorar la calidad del agua en Zapopan

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Abstract

The objective of this article is to explore the factors that are associated with the willingness to pay (WTP) to improve water quality in the Mexican city of Zapopan, Jalisco. A survey of four hundred households is carried out. It shows that the respondents drink bottled water (99 %); consider that the supplied water smells bad (53 %) and that it is contaminated (69 %); they fear for their health or that of their family members from drinking from the tap (74 %), but would to drink water from it if the quality improved (77 %). However, more than half would not be willing to pay for an improvement in water quality or pay up to a limit of 40 pesos (31 and 22 %, respectively). Through an orderly logit model, it is found that there is a significant and positive relationship between the willingness to pay for improving water quality and being open to drinking tap water if it happens, perceiving the authorities responsible for water sector do the right actions; a belief of water scarcity in the colony; having people with health problems at home, and the income level. On the other hand, more willingness to pay relates negatively and significantly with the perception that water smells bad, the level of trust in others, and age.

Keywords: Willingness to pay, safe drinking water, water service, water quality, water supply, pricing water.

Resumen

El objetivo que se persigue con el presente artículo es explorar los factores que están asociados con la disposición a pagar para mejorar la calidad del agua en la ciudad mexicana de Zapopan, Jalisco. Se lleva a cabo una encuesta a 400 hogares, la cual arroja que los consultados toman agua embotellada (99 %); consideran que el agua suministrada huele mal (53 %) y que está contaminada (69 %); temen por su salud o la de sus familiares por beber del grifo (74 %), pero estarían dispuestos a tomar agua del mismo si la calidad mejorara (77 %). Sin embargo, más de la mitad no estaría dispuesta a pagar más por mejorar la calidad del agua o pagaría no más de 40 pesos (31 y 22 %, respectivamente). A través de un modelo *logit* ordenado se encuentra que existe una relación significativa y positiva entre la disposición a pagar por mejorar la calidad del agua y estar abierto a tomar agua del grifo si esto sucede; a percibir que las autoridades encargadas del sector agua hacen lo correcto; a una creencia de escasez de agua en la colonia; a tener personas con problemas de salud en casa, y al nivel de ingresos. Por otro lado, mayor disposición de pago se relaciona negativa y significativamente con la percepción de que el agua huela mal, el nivel de confianza en los otros y la edad.

Palabras clave: disposición a pagar, agua de calidad, servicio de agua, suministro de agua, tarifa de agua.

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Introduction

Although water utilities in Mexico are determined to ensure that the quality of the water that reaches the homes is suitable for human consumption, the reality is that many homes choose to drink bottled liquid. However, the use of plastics to generate water bottles and jugs is not friendly to the environment and solutions to purify and treat water at home are not economically convenient (Friedler & Hadari, 2006). In addition, bottled water is much more expensive than tap water. The most expensive tariff per cubic meter for a consumption of 30 cubic meters per month in 2015, corresponding to the city of Querétaro, was 20.8 pesos; although there are cities like Zapopan in which the tariff was 11.3 and like Tlaxcala, where it was 5.6 (Conagua, 2016). A liter bottle of water, depending on where it is purchased and the brand, can exceed 10 pesos.

As in many other cities in Mexico, the current municipal water supply system in Zapopan faces a number of challenges. These include the lack of sufficient economic resources to keep the drinking water distribution network in good technical condition and reaching the

population at the lowest possible costs with adequate levels of quality (Briseño & Sánchez, 2018). Furthermore, the water supply in Mexico's cities is often polluted and unfit for drinking (Vásquez, Mozumder, Hernández-Arce, & Berrens, 2009).

Although there are different tariff schemes in Mexico, few studies have looked at citizens' willingness to pay to improve the quality of the water supplied by the operating agencies.

The objective of this work is to know the factors associated with the willingness to pay to improve water quality in the Mexican municipality of Zapopan, Jalisco. The article is organized as follows. First, it reviews previous studies on willingness to pay to improve water quality. Next, the study is contextualized in the municipality of Zapopan. Then, the methodology is described and descriptive statistics of the data are presented. We carried out an econometric model to know the impact factors on the willingness to pay and we offer some conclusions.

Literature review

Virtually all studies exploring the factors associated with willingness to pay to improve water quality use the contingent valuation method (CVM), which will be described later. This section reviews the main findings found in the literature.

Polyzou, Jones, Evangelinos and Halvadakis (2011) carried out a survey in the Greek city of Mytilene, and found a significant and positive relationship between the willingness to pay more for water quality and indicators related to social capital, as well as income.

Tanellari, Bosch, Boyle and Mykerezi (2015), in their study on the willingness to pay to improve water quality and infrastructure in northern Virginia and the Washington suburbs, find as their main contribution that there is a significant negative relationship between the willingness to pay and the cost of the alternatives proposed to improve water quality.

The source of the water supply is also a relevant aspect. Tussupova, Berndtsson, Bramryd and Beisenova (2015), in their study on willingness to pay to improve water supply in Kazakhstan, show evidence that those whose supply comes from underground sources are willing to pay less because they perceive that it is good quality.

The only study that was detected for Mexico was in the city of Parral, Chihuahua. Vásquez, Mozumder, Hernández-Arce and Berrens (2009) carried out a survey whose results, analyzed with an econometric model, concluded that there was a significant positive relationship between the willingness to pay to improve water quality and the variables education,

income, confidence that the improved system would provide quality water and the perception of the likelihood of the improvement project being carried out. Likewise, they found a significant negative relationship with age, perceived quality, and the presence of someone listening while the survey was conducted.

Perhaps the most relevant study in recent years is the one carried out in the city of Jacksonville, Florida. Chatterjee, Triplett, Johnson and Ahmed (2017) applied a survey and, through an ordered logit model, they find that the willingness to pay to improve water quality had a significant positive relationship with concern about getting sick, the presence of children at home, and the level of education. They found a significant negative association with the belief that water does not smell bad, knowing that the government is aware of the poor quality of tap water, mistrust of authorities, and age.

Table 1 shows a synthesis of the factors associated with the willingness to pay for water quality found in the literature review.

Table 1. Factors willingness to pay for water quality. Source: Author.

Positively related	**Negatively related**

Income Education Social capital Trust in authority Open air source (Perception of poor quality) Concern about getting sick Presence of children	Solution cost Subsoil source (Perception of good quality) Age Quality perception Perception that the water does not smell bad Perception that the government is aware of poor water quality. Mistrust of authority

Context of the city of Zapopan

The city of Zapopan is the second most important in the Guadalajara Metropolitan Area (ZMG), with an estimated population of 1,332,272 people, according to information from the INEGI intercensal survey in

2015. Zapopan is the largest municipality in extension of the ZMG and has an interesting socio-cultural composition, with homes in the highest economic sector that contrast with populations in situations of poverty or vulnerability. According to the Institute of Statistical and Geographical Information (INEGI) (2015), the poor or vulnerable population in the municipality of Zapopan reached 28.1 and 33.6 %, respectively.

In Mexico, the main body and authority of the public water service is the National Water Commission (Conagua), which is responsible for allocating the resource for different uses, including urban consumers.

The Inter-municipal System of Drinking Water and Sewerage Services (SIAPA) is a decentralized public body of the Jalisco state administration. It is in charge of supplying the liquid to the city of Zapopan, in addition to the cities of Guadalajara, Tlaquepaque and Tonalá (other municipalities that make up the ZMG).

The water supply to the ZMG occurs through three main sources: Lake Chapala through an aqueduct (61 %), underground wells (27 %) and the Calderón dam (12 %) (CEA, 2014). However, one of the great problems that the ZMG faces in the management, administration and distribution of water is contamination and scarcity of the resource, which does not guarantee that the supply sources are sustainable (Torres-Rodríguez, 2013). The contamination levels of the hydrographic basins of the ZMG have remained constant for a long time and are the result of agricultural, industrial and urban discharges (Ramírez, 2018).

Furthermore, the city's water treatment is insufficient and does not cover all the pollutants generated in the city (Camps, 2017).

During 2015 in Zapopan, the average water tariff for urban use per cubic meter, for a consumption of 30 cubic meters was 11.3 (Conagua, 2016). According to Conagua (2016), this tariff was made up of 1.3 pesos of fixed charge and 10 pesos of the water quota minus the fixed charge (Conagua, 2016). However, given the existence of a cross subsidy, the commercial and industrial tariffs stood at 19.3 and 20 pesos respectively (Conagua, 2016).

Although according to what is stipulated in the state of Jalisco, SIAPA performs analyses that allow monitoring the quality of water in water treatment plants in accordance with the Official Mexican Standard NOM-127-SSA1-1994, confidence in the quality of tap water has been culturally discouraged by the use of bottled water. However, to date, no study has been conducted to understand citizens' attitudes towards water quality and their willingness to pay for this service. According to the Household and Environment Module (MOHOMA), Mexican households in 2017 spent an average of 52 pesos a week on the purchase of bottled water. However, the representativeness of this module is only at the national level.

In this work, a survey is carried out on the inhabitants of the city of Zapopan with the purpose of knowing their perceptions of the water

supply in the municipality and their willingness to pay to improve the quality of the liquid.

Survey, methodology and descriptive statistics

The contingent valuation method (CVM) is used in this study to design a survey and estimate users' willingness to pay to improve the quality of water that is supplied to households. Surveys are used in the CVM method to collect information on preferences about the provision of public goods and services in developing countries ((Whittington, Briscoe, Xinming, & Barron, 1990).

Some studies provide examples of the application of CVM surveys in developing countries, such as those of Genius and Tsagarakis (2006) in Greece; Pattanayak, Yang, Whittington and Bal-Kumar (2005) in Nepal; Rosado, Cunha-E-Sá, Ducla-Soares and Nunes (2006) in urban areas of Brazil, and Vásquez *et al*. (2009), in Chihuahua, Mexico.

In the CVM method, people are asked about their willingness to pay to receive a good or service. This methodology emphasizes respondents' stated preferences in contrast to those approaches that use revealed

preferences (Chatterjee *et al.*, 2017). However, obtaining respondents' preferences using this method requires careful questionnaire design, choice of survey mode, and sample selection (Bateman *et al*., 2002; Whittington, 2002).

In this study, closed-ended questions were asked using a face-to-face survey to estimate willingness to pay to improve water quality in the city of Zapopan, Jalisco. Closed-ended questions have been shown to be incentive-compatible and have become the standard approach to simulate willingness to pay (Cameron & James, 1987); Chatterjee *et al*., 2017; Smith, 2006). In this type of questioning, the respondents answer if he or she could pay more to receive a certain benefit and to what extent.

In this investigation, a questionnaire was applied to 400 representative households of Zapopan in a face-to-face modality during October 2018. The municipality of Zapopan has a total of 277,657 households according to information from the State Institute of Statistical and Geographical Information from Jalisco, with a margin of error of 5 % and a confidence level of 95 %. The significant sample size is at least 384 households. Therefore, 400 households is considered an adequate sample. The questionnaire was applied to 20 neighborhoods in the municipality of Zapopan that cover different socioeconomic levels. Of the 400 households surveyed, 120 (30 %) correspond to the ABC+ strata (upper and upper middle class), 140 (35 %) to stratum C (middle class) and 140 (35 %) to stratum D+ (lower middle class). The interviewer

determined these strata according to the scale of the Mexican Association of Market Intelligence and Opinion Agencies (AMAI).

The survey has 20 items associated with the objective of this work. The first five are about preferences regarding water consumption. The following seven address the perception of water quality and quantity, as well as its administration. Then, eight questions are about the characteristics of the house and the interviewee.

The definition and descriptive statistics of the main variables used in the analysis are presented in Table 2. These variables are: willingness to pay (WILLPAY), bottled water (BOTTLED), propensity to drink tap water if quality improves (TAPIMPROVE)), tap water smells bad (BADODOR), contaminated water (CONTAMINATED), concern about illness from drinking tap water (GETSICK), the authorities of the water sector do the right thing (AUTGOOD), perception of scarcity (SHORTAGE) , trust in others (TRUST), people in poor health (SICK), number of people in the home (INHABITANTS), homeowner (OWNHOME), level of education (EDU), average monthly income (INCOME) and age of the respondent (AGE). As mentioned at the foot of Table 2, the conversion of scale of some variables was necessary since at certain levels there were very few answers (see Table 2 footnotes).

Table 2. Variables and descriptive statistics. Source: Author.

Variable	Description	Obs.	Average	St.Dev.	Min.	Max.
WILLPAY	How much increase in your monthly water bill (in Mexican pesos) would you be willing to pay to improve water quality to the extent that you can drink it from the tap? (1. $ 0; 2. Up to $ 40; 3. From $ 41 to $ 60; 4. From $ 61 to $ 100; 5. $ 101 to $ 200; 6. From $ 201 to $ 299; 7. $ 300 or more)	400	2.69	1.63	1	7
BOTTLED	1 if you drink bottled water; 0 otherwise	400	0.99	0.07	0	1
TAPIMPROVE	If the quality of the tap water were improved, would you be willing to drink from it? (1. Yes; 0. No)	399	0.77	0.42	0	1
BADODOR*	How much do you agree that the tap	400	2.13	0.95	1	3

	water smells bad? (1. Disagree; 2. Neither agree nor disagree; 3. Agree)					
CONTAMINATED *	How much do you agree that the tap water is contaminated? (1. Disagree; 2. Neither agree nor disagree; 3. Agree)	400	2.44	0.86	1	3
GETSICK *	Using a scale of 1 to 3 where 1 means "I am not worried" and 3 "I am very worried", what How worried are you or a member of your family of getting sick from drinking tap water?	400	2.56	0.76	1	3
AUTGOOD **	The authorities responsible for water supply and quality do the right thing: (1. Never; 2. Sometimes; 3. Most	400	1.95	0.68	1	3

	of the time or always)					
SHORTAGE *	Do you agree that there is a problem of water shortage in your neighborhood? (1. Disagree; 2. Neither agree nor disagree; 3. Agree)	400	1.75	0.94	1	3
TRUST ***	3 being "you can totally trust" and 1 "you must not trust" How much can people trust in the others?	400	1.99	1.00	1	3
SICK	Including yourself, how many people living in your home are in poor health? (1, 2, 3, 4, 5 or more)	400	0.29	0.62	0	4
INHABITANTS	Including yourself, how many people live in your home? (1; 2; 3; 4; 5 or more)	400	3.66	1.18	1	5

OWNHOME	What type of accommodation do you live in? (1. Own home, 0. Other)	400	0.78	0.41	0	1
EDU	What is the highest level of schooling that you completed? (1. Basic education; 2. High school; 3. Bachelor's degree; 4. Full degree; 5. Postgraduate)	400	2.60	1.27	0	5
INCOME	What is your household's monthly income? (1. $ 2,650 to $ 13,254; 2. $ 13,254 to $ 26,508; 3. $ 26,508 to $ 39,662; 4. Over 39,662)	381	1.89	0.79	1	4
AGE	Exact age	400	45.51	19.09	18	57

* These questions were originally designed on 5 levels, but were re-scaled to 3 because there were few answers on some levels. "Fully agree" and "slightly agree", were merged, as were "strongly disagree" with "slightly disagree". "Neither agree nor disagree" was left as originally answered.

** This question was re-scaled from 4 levels to 3 because at level 4 there were very few answers. "Always" and "most of the time", were merged; both indicate that the authorities responsible for water do the right thing.

*** The highest levels (3 and 4 in 3) and the lowest levels (1 and 2 in 1) were merged.

Of those surveyed, 31 % were unwilling to pay more for water quality, 22 % would pay up to 40 pesos more, 16 % up to 60, 19 % up to 100, and the remaining 12 % more than 100 pesos. Regarding the characteristics regarding water consumption, 99 % drink bottled water and 77 % would be willing to drink tap water if the quality improved.

On the perception of the water supply, 39 % consider that it does not have a bad smell, while 8 % are indifferent and the vast majority (53 %) perceive that the water smells bad. 25 % of the respondents disagree that the water is contaminated, 7 % are indifferent and 69 % think that it is contaminated. The majority (59 %) do not perceive that there is a shortage in their neighborhood, 5 % are indifferent and 35 % think that there is a shortage problem. Almost three-quarters (74 %) are concerned about getting sick from drinking tap water. Only 21 % perceive that the authorities in charge of water management do the right thing, while 54 % are indifferent and 26 % disagree.

With respect to the characteristics of the home and the interviewees, in 31 % of the dwellings there are more than five people, in 27 % four, in 22 % three, in 16 % two and in 4 % only one. In 79 % of

the surveyed households, there are no people with health problems, in 16 % there is one sick person and in the remaining 7 % more than one. 78 % of the cases responded living in their own home and the average age was 46 years old. 1 % of those surveyed did not study, 25 % had basic education only, 28 % high school diploma, 10 % unfinished bachelor's degree, 1 % associate degree, 33 % completed a bachelor's degree, and only 3 % have a postgraduate degree. On the income level, 39 % earn less than $ 13,254 pesos, 40 % between the previous level and $ 26,508, 19 % between $ 26,508 and $ 39,662 and only 2 % earn more than $ 39,662.

They were asked a question about the level of trust in others and 50 % answered that people should not be trusted, 34 % that people can be partly trusted and only 16 % that people can be trusted.

Regarding the aforementioned statistics, we can highlight that there is a perception that you cannot drink tap water because either it has a bad smell, or it is contaminated and you are in danger of contracting a disease for this reason. Therefore, the people surveyed would be willing to drink from the tap if the quality of the water improved. In the following section, an econometric model is developed in order to find the factors that are associated with the willingness to pay for the improvement in water quality in Zapopan, Jalisco.

Econometric model

The implemented model is an ordered logit because it allows the possibility of observing if some characteristics of the users, as well as their perceptions, are associated with the level of willingness to pay to improve water quality. The dependent variable of the model is willingness to pay (WILLPAY), while the explanatory variables are INCOME, AGE, perception of bad odor (BADODOR) and water contamination (CONTAMINATED), concern about getting sick from drinking tap water (GETTINGSICK), thinking that the authorities responsible for water do the right thing (AUTGOOD), perception of water shortage in the neighborhood (SHORTAGE), trust in other people (TRUST), people living at home (INHABITANTS), people with poor health in the home (SICK), type of accommodation measured through the dichotomous variable OWNHOME, the exact age (AGE), the degree of education (EDU), and the level of monthly household income (INCOME).

The results of the ordered logit model are shown in Table 3. Model 1 is the base, 2 and 3 keep the most significant variables and 4 seeks to find a more parsimonious result. In general, the signs and significance of

the variables are consistent across all models. The square pseudo-R in all models is around 0.08. However, a more functional adjustment indicator for this type of model is the correctly predicted percentage of around 37 %. The above shows a good fit considering that there are seven levels of willingness to pay. If this is divided 100 % by seven, it gives us 14 %. In other words, the model is 23 % more correct than if the willingness to pay was chosen at random.

Table 3. Logit model ordered on willingness to pay to improve water quality in Zapopan.

	(Model 1)	(Model 2)	(Model 3)	(Model 4)
	WILLPAY	WILLPAY	WILLPAY	WILLPAY
BOTTLED	1.880 (1.318)	1.812 (1.329)		
TAPIMPROVE	1.789 *** (0.268)	1.778 *** (0.268)	1.742 *** (0.266)	1.723 *** (0.264)
BADODOR	−0.287 ** (0.115)	−0.314 *** (0.106)	−0.272 *** (0.105)	−0.271 *** (0.100)
CONTAMINATED	−0.080 (0.126)			
GETTINGSICK	0.142 (0.124)	0.129 (0.123)		
AUTBIEN	0.267 * (0.149)	0.278 * (0.147)	0.250 * (0.147)	
SHORTAGE	0.169 (0.103)	0.166 (0.103)	0.178 * (0.103)	
CONFIDENCE	−0.332 ** (0.132)	−0.318 ** (0.131)	−0.287 ** (0.130)	
INHABITANTS	0.062 (0.083)			
SICK	0.283 * (0.154)	0.286 * (0.153)		
OWNHOME	0.085 (0.229)			
AGE	−0.019 *** (0.005)	−0.020 *** (0.005)	−0.019 *** (0.005)	−0.019 *** (0.005)

EDU	0.009 (0.089)			
INCOME	0.379*** (0.145)	0.396*** (0.125)	0.375*** (0.124)	0.382*** (0.124)
Observations	380	380	380	380
Pseudo R square	0.08	0.08	0.08	0.07
PCP[1]	37.4 %	37.4 %	36.8 %	36.1 %

[1] Percentage correctly predicted.

Notes: Standard errors in parentheses; *, **, *** are significant at 10 %, 5 % and 1 % respectively.

Source: Author.

The TAP IMPROVE variable is statistically significant with a positive sign at 1 % in all models. This means that if the person is open to drinking tap water if quality permits, and they would be willing to pay more.

Regarding BADODOR, it is significant and negative in all models. In three of them at 1 % and in one at 5 %. Therefore, the perception of bad odor is associated with a lower willingness to pay in the respondents. This result is in contrast to studies from other countries, in which the bad smell is associated with a greater willingness to pay. Perhaps this has to do with the fact that in other countries people trust more in the authorities' ability to respond to citizen demands.

The AUTGOOD variable (perceiving that the water authorities are doing the right thing) is a positive 10 % in three of the models. This implies that if people trust the authorities responsible for water, they are more willing to pay to improve the quality of the supplied water resource.

The SHORTAGE variable is only significant at 10 % in one of the models. What it suggests to us is that, in the face of perceived water scarcity, people are willing to pay more to improve the quality of service.

Trusting other people (TRUST) is significantly negative at 5 % in three of the models. In general, more trusting people are less likely to be willing to pay more for water quality. Feeling safe and comfortable with their environment, they have less concern for improving the public services they receive.

The number of people with health problems (SICK) was positive at 10 % in two of the models. Having sick people at home positively impacts the willingness to pay for water quality. This is predictable given that there is concern that family members will be affected by contaminated water.

The variable AGE is significant and negative at 1 % in all models. Older people are less likely to pay more for water quality than younger people are. People with higher INCOME are willing to pay more. The variable was significantly positive at 1 %.

The odds ratios of the ordered logit models are shown in Table 4. Those coefficients with values greater than one indicate that when the variable increases, the willingness to pay for the quality of the water is more likely to increase. On the other hand, when they are less than one, if the variable increases, it is less likely that people are willing to spend more money to improve the quality of the water resource received. The

following paragraphs interpret the coefficients of the variables that were significant.

Table 4. Odds ratios of the ordered logit model.

Variable	(Model 1) WILLPAY	(Model 2) WILLPAY	(Model 3) WILLPAY	(Model 4) WILLPAY
BOTTLED	6.551 (8.635)	6.121 (8.132)		
TAPIMPROVE	5.981***(1.602)	5.920 ** * (1.584)	5.707 *** (1.518)	5.601 *** (1.450)
BADODOR	0.751 *** (0.086)	0.730 *** (0.078)	0.762 *** (0.080)	0.762 *** (0.076)
CONTAMINATED	0.923 (0.112)			
GETTINGSICK	1.152 (0.143)	1.137 (0.140)		
AUTGOOD	1.306 * (0.194)	1.321 * (0.195)	1.284 * (0.189)	
SHORTAGE	1.184 (0.122)	1.181 (0.121)	1.195 * (0.123)	
TRUST	0.717 ** (0.095)	0.728 * * (0.095)	0.750 ** (0.098)	
INHABITANTS	1.064 (0.088)			
SICK	1.328 * (0.205)	1.331 * (0.203)		
OWNHOME	1.089 (0.250)			
AGE	0.981 *** (0.005)	0.980 *** (0.005)	0.981 *** (0.005)	0.981 *** (0.005)
EDU	1.009 (0.089)			
INCOME	1.461 *** (0.212)	1.486 *** (0.185)	1.455 *** (0.181)	1.465 *** (0.181)
Observations	380	380	380	380

Pseudo R square	0.08	0.08	0.08	0.07
PCP[1]	37.4 %	37.4 %	36.8 %	36.1 %

[1] Percentage correctly predicted.

Notes: Standard errors in parentheses; *, **, *** are significance at 10 %, 5 % and 1 % respectively.

Source: Self made.

For an increase of one unit in the variable TAPIMPROVE, the odds of greater willingness to pay against the combination of medium and low willingness to pay increase between 5.6 and 5.9 times, leaving the other variables unchanged in the model.

If there is an increase of one unit in the variable BADODOR, the odds of greater willingness to pay versus the combination of medium and low willingness to pay are between 0.73 and 0.62 times less, leaving the other variables unchanged in the model.

Given an increase in the variable AUTGOOD, the amounts of greater willingness to pay against the combination of medium and low willingness to pay increase between 1.2 and 1.3 times, leaving the other variables unchanged in the model.

If there is an increase in the SHORTAGE variable, the odds of greater willingness to pay against the combination of medium and low willingness to pay increase 1.19 times, assuming no change in the other variables of the model.

For an increase of one unit in the variable TRUST, the odds of greater willingness to pay against the combination of medium and low willingness to pay are between 0.71 and 0.75 times less, leaving the other variables without change in the model.

Given an increase of one unit in the variable SICK, the odds of greater willingness to pay against the combination of medium and low willingness to pay increase 1.3 times, leaving the other variables unchanged in the model.

For an increase of one unit in the variable AGE, the amounts of greater willingness to pay against the combination of medium and low willingness to pay are 0.98 times less, leaving the other variables unchanged in the model.

If there is an increase in the INCOME variable, the amounts of greater willingness to pay against the combination of medium and low willingness to pay increase 1.4 times, assuming no changes in the other variables of the model.

Discussion and conclusions

The survey of the 400 representative households in Zapopan found that the respondents drink bottled water (99 %), consider that the water supply smells bad (53 %) and that it is contaminated (69 %). They fear for their health or for that of their relatives by drinking from the tap (74 %) but would be willing to drink tap water if the quality improved (77 %). However, more than half would not be willing to pay more to improve water quality or would pay no more than 40 pesos (31 and 22 % respectively).

The models presented in this articles show that willingness to pay to increase water quality in Zapopan is significantly and positively associated with being open to drinking tap water if quality improves (TAP IMPROVE), to a perception that the authorities in charge of water act well (AUTGOOD), to a belief of water shortage in the neighborhood (SHORTAGE), to having people with health problems at home (SICK) and to the level of income. On the other hand, the willingness to pay is negatively and significantly related to the perception that water smells bad (BADODOR), the level of trust in others (TRUST) and age.

There are factors that are consistent with the literature, such as the negative relationship of willingness to pay with age (Vásquez *et al*., 2009; Chatterjee *et al*., 2017), and the positive relationship with income level if measured through the level of education (Chatterjee *et al*., 2017). Regarding the positive significance of the income variable with the willingness to pay, this study coincides with those carried out in the Greek

city of Mytilene (Polyzou *et al*., 2011) and in Parral, Chihuahua in Mexico (Vásquez *et al*., 2009). However, in other variables there is no consistency.

In the case of the Jacksonville study, which asks if there is concern about contracting diseases by drinking contaminated water, this variable turned out to be positively and significantly associated with the willingness to pay to improve water quality. In the case of Zapopan, the concern about contracting diseases was not significant, but the number of people with health problems at home was significant. Similarly, both studies reveal that the willingness to pay for health is relevant.

When it comes to water smelling bad, the Jacksonville research has a positive association between bad odor and willingness to pay. In Zapopan it turned out to be different. Faced with increases in the perception of bad smells, people are less willing to pay. These differences could be explained by the contexts of the cities, as the people of the American city could trust more in the ability of their governments to meet citizen demands than in the case of the Mexican municipality.

On the question of trust in the government, there were differences in the way of questioning. In the study of the American city, the greater the average distrust of the authorities, the less willingness to pay for the improvement in water quality. In the Zapopan investigation, it was asked if the authorities in charge of water acted correctly, this variable being positive. That is, although it was asked differently, the conclusion at this

point is similar. When there is confidence in authority or it is perceived as doing its job well, the willingness to pay increases.

In the research in Zapopan, the variable trust in others was added, which was significantly negative. This is an interesting finding because it reveals that when there is a high level of social trust, concerns about the increase in the quality of public services decrease. Perhaps these results would not be consistent if, instead of talking about increasing water quality, we were talking about service provision in cases where there were programmed cuts or lack of continuous service.

A question about the perception of water scarcity is also included in this study, being slightly significant in one of the models. It would be interesting to explore this variable in contexts where there are more serious problems of water shortages.

Given the aforementioned evidence, it is relevant to note that there is a willingness to pay more for tap water if there is a perception that the service improves; this is consistent with the refusal to pay more if the water smells bad. Likewise, those households with more income show a greater willingness to pay for better water quality. Given the above, it could be feasible for the authority to adjust tariffs for those high-income strata upward and thus be able to obtain resources to improve the quality of water in the city. As suggested by the models, it is very important that these resources focus on avoiding the bad smell of the liquid. And, once the service is improved, it is vitally important to inform the community to

change the perception in a positive sense. However, before demanding user tariff increases, the water operator must make a commitment to increase its operational and commercial efficiency, and to be transparent in the use of resources.

In conclusion, this study shows evidence that when it is perceived that the authority is doing a good job, people are willing to pay more to improve the quality of public services. Likewise, it shows that when the same question is asked in different contexts, the significance of the variables can be contrasting, as in the case of the perception of bad odor. As possible future studies, it would be interesting to explore the willingness to pay for the continuous supply of water in places where there are supply problems; and to continue exploring specific health concerns, as it is a variable that has generally been significant.

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