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Knowledge, Attitudes, and Willingness to Pay For Sewerage and Sanitation Services: A Contingent Valuation Survey in Metro Manila, Philippines

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ABSTRACT

This study uses contingent valuation to elicit Metro Manila households' willingness to pay (WTP) for improved sewerage and sanitation services that can bring about a reduction in the incidence of waterborne diseases and in the pollution load in Metro Manila waterways. The study yields a mean WTP of PhP 7.13-11.98 (US$0.17-0.29) m^{-3} of water use, just about a third of the average water price. The limited knowledge and appreciation of households on the contribution of their wastewater to the pollution of waterways and on the appropriate wastewater treatment facilities may have resulted in this low WTP. Thus, an extensive information campaign may be necessary to raise awareness and gain support for wastewater treatment programs.

Key words: *domestic wastewater, sewerage and sanitation, willingness to pay, contingent valuation, water pollution, waterborne diseases*

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INTRODUCTION

Used water or wastewater from family dwellings, commercial and industrial establishments eventually winds up into creeks, rivers and the aquifer. If not adequately treated, wastewater will pollute these water bodies which provide water supply, livelihood and recreation for the people. Further, untreated wastewater causes diseases such as diarrhea, cholera, typhoid, dysentery, and hepatitis (*WHO/ UNICEF 2000* and *2012*; *Petri et al 2000*; *Thielman and Guerrant 1996*; *Bern et al 1992*). Recently, lack of sanitary sewerage system has also been asssociated with gastric cancer and peptic ulcer disease (*Travis et al 2010*).

More than a third of the world's population do not have access to adequate sewerage facilities. Of these unserved population, 80% are in the fast growing Asian economies. Even in large Asian cities, less than half of the households are connected to sewerage systems (*Cairncross 2003*). Metropolitan Manila (MM), the study site for this paper, is the national capital region of the Philippines. MM is the political, economic, social and cultural center of the country. It is one of the more modern metropolises in Southeast Asia and is the world's 11th most populous. Covering an area of only 638 km^2, MM is the smallest of the 17 regions but it is the most populous (11.9 M in 2010, 13% of the entire Philippine population) and the most densely populated (18,113 km^{-2}) according to the Philippine Census of Population and Housing (*National Statistics Office 2010*). In MM, only about 12% are connected to sewer lines. The majority of the households build their own septic tanks; many of which, however, are sub-standard and not desludged on a regular basis.

The waterways in MM consist of Pasig River, the 27 km long river that stretches from Manila Bay in the west to Laguna de Bay in the east, its four major tributaries (San Juan River, Marikina River, Napindan River and Pateros-Taguig River), and 43 minor tributaries. These waterways drain into Manila Bay and six sub-basins, namely, Napindan-Taguig River Basin, Marikina River Basin, upstream portion of Pasig River, downstream portion of Pasig River, San Juan River Basin and Laguna de Bay. Water quality monitoring at different stations in this waterways system in 2008 yielded highly alarming pollution levels, with total coliform and biochemical oxygen demand (BOD) far exceeding acceptable levels. In 2009, additional water quality parameters, namely, total suspended solids, nitrate-nitrogen, phosphate, and oil and grease were also gathered and all failed to meet standards for Class C waters- primarily intended for fishery, recreation and supply for manufacturing proceses (*Gorme et al 2010*).

There is a high incidence of water-borne diseases in the Philippines. In 2002, diarrhea was the second leading cause of morbidity in the whole country with 914 cases per 100,000 population, and the third in MM with 758 cases per 100,000 population (*National Epidemiology Center 2002*). *Black et al.* (*2010*) estimated that in 2008, diarrhea was the second leading cause of deaths in children younger than 5 years worlwide as well as in the Philippines. In terms of the number of under-5 children, mortality cases due to diarrhea, the Philippines ranked third with 4,852 cases, next only to Indonesia and Myanmar, among Southeast Asian countries. Most recent data indicate that in 2010, there were 345,684 morbidy cases due to diarrhea among children below 5 years in the Philippines, 11% of whom (37,022 cases) were in MM (*National Epidemiology Center 2010*).

Data on the sources of pollution in MM waterways are

scarce. A study conducted by the Department of Environment and Natural Resources (DENR) in 1989-1990 established baseline data for pollution levels in Pasig River by source. Total BOD of 323 t d^{-1} came from domestic wastewater (148 t d^{-1} or 46% of total), industrtial wastewater (145 t d^{-1}, 45%) and solid waste (30 t d^{-1}, 9%). The Pasig River Rehabilitation Commission (PRRC) 1998 Final Report revealed a reduction in pollution load from industrial wastewater and solid waste in 1996 to 115 t d^{-1} and 11 t d^{-1}, respectively. This improvement, however, was just offset by an increase in pollution originating from domestic wastewater to 200 t d^{-1}. Hence, total pollution load remained at the same high level. PRRC as well as recent studies report current pollution shares of domestic, industrial and solid waste sources at the 60%-35%-5% ratio. The reductions in the shares of both industrial wastewater and solid waste can be attributed to policies and programs spearheaded by government and civic organizations. Since the 1990s, the Laguna Lake Development Authority has intensified efforts to monitor wastewater treatment facilities and wastewater disposal of commercial and industrial establishments. PRRC and local governments have implemented bold programs to clean up rivers and creeks of solid wastes. On the other hand, nothing significant has been done about municipal sewerage and sanitation infrastructure in MM due to financial and physical constraints.

Before the 1997 privatization of the government-owned and operated Manila Waterworks and Sewerage Services (MWSS), the water utility mandated to supply water and provide municipal wastewater treatment facilities in MM, only about 7% of the service areas of MWSS were connected to sewer lines. This means that only 7% of domestic wastewater were completely treated before disposal to water bodies. Much of MM's wastewater either flowed into septic tanks for primary treatment or flowed directly into drainage/ flood canals without treatment. People living in slum areas relied on rudimentary latrines without drainage facilities. The bulk of wastewater that was not completely or not at all treated drained through flood canals where the water supply pipes are laid. With water pipes not properly maintained and replaced, leakages proliferated which resulted in water contamination and high incidence of water-borne diseases.

The privatization of MWSS operations in 1997 brought about some remarkable improvements in water supply coverage and service performance but unfortunately this was not matched by improvements in sewerage coverage. The sewerage facilities of MWSS remain to be confined to a few areas in the major cities of Manila, Makati and Quezon City, comprising only about 12% of the MWSS service areas, an increase in sewerage coverage of only 5% points. The necessary sewerage and sanitation infrastructure expansion projects have not pushed through as scheduled. A major constraint in the expansion of sewer and sanitation services is the financing requirement. *Kimura* (*2007*) notes that sewerage is one area of public works that is farthest away from being self-supporting. In Japan, interest and principal payments on loans for sewerage projects are more than twice the annual revenues from sewerage user charges. *Whittington et al.* (*2012*) stresses the need for more evidence-based planning of public health and development intervention.

The benefits involved in the sewerage and sanitation projects in MM must be carefully assessed. Reduced water pollution and improved health conditions, two major benefits that can be derived from municipal wastewater treatment facilities, are intangible and non-marketable. The objective of this paper is to monetize these non-market benefits through the use of contingent valuation method (CVM) so it may be properly considered in the development and implementation of a sewerage and sanitation program for MM. The study also looks into the factors- demographic, socio-economic, and water and health-related awareness and attitudes- that affect household's willingness to pay (WTP) for domestic wastewater services.

METHODOLOGY

Contingent Valuation Method

The study employs the contingent valuation method (CVM), a survey-based methodology for eliciting monetary values people place on goods, services, and amenities for which there are no markets (for a thorough discussion of this approach, please refer to *Bateman et al 2002 and Boyle 2003*). There is a growing recognition of the need to incorporate estimates of non-markets benefits in public policies and programs assessments. Water and wastewater treatment programs, in particular, offer intangible health and environmental benefits to society at large that can be measured with CVM (see, for example, *Alcon et al. 2013*; *Almanza and Martinz-Paz 2011*; *Perni et al. 2013*; *Birol et al. 2010*).

The monetary valuation respondents make in a CVM survey is referred to as willingness to pay (WTP). The WTP question may be in the form of an open-ended question (What maximum amount are you willing to pay?) or a dichotomous choice (DC) question (Are you willing to pay $x?). The open-ended format has been progressively abandoned by CVM researchers due to large non-response rates and generally unreliable responses (*Mitchell and Carson 1989*). The DC format, on the other hand, simplifies the cognitive task of respondents as market transactions in which they participate in daily life usually involve deciding whether or not to buy goods at given prices, rather than stating maximum WTP (*Bateman et al. 2002*). Hence, the DC format was used for this study.

Survey Instrument

The questionnaire used in the study resulted from a series of interviews and focus group discussions with officials of the national and local government units and of relevant government agencies (e.g.: DENR, Department of Health, National Water Resources Board, MWSS Regulatory Board and Laguna Lake Development Authority), officers of the two MWSS concessionaires, and representative segments of the target population.

The questionnaire consisted of 5 sections. Section A included awareness and attitudinal questions on the environment, water sources, domestic wastewater and its effects on people's health and livelihood. Section B elicited information on the household's supply of water and on the current wastewater treatment facilities availed of by the household. Section C contained the CVM scenario and WTP question. Section D presented choice sets for the choice modeling component of the study. Finally, section E asked socio-economic questions about the respondent and his/her household. Only the results of the CVM section (C) and summary socio-econonomic, water and wastewater, and knowledge and attitudinal variables in sections A, B and E that are relevant to the CVM-based WTP estimate are reported in this study.

The CVM scenario began with giving the respondent information and data on pollution levels in MM water bodies, the baseline incidence of waterborne diseases, and how these diseases can be caused by untreated domestic wastewater. This was followed by an explanation of the proposed wastewater treatment facilities, and how these can bring about reductions in water pollution levels and incidence of waterborne diseases. As the wastewater treatment program is a public program and the resulting health and environmental benefits a public good, the WTP scenario was framed as a hypothetical referendum question as follows:

In this survey, we would like to know if your household will be willing to contribute to the effort to treat our wastewater and hence, clean up the final repository of our wastewater (rivers in Metro Manila, Manila Bay and Laguna Lake) that will lead to a stable and safe supply of water for everyone, as well as prevent waterborne diseases.

Putting up the wastewater treatment facilities requires a huge amount of capital investments and maintenance costs. We are undertaking this survey to determine if people are capable and willing to pay for this project so as to assess the financial viability of the project. The plan is to include a wastewater charge in your water bill. In other countries, the common practice is to collect a sewer charge per cubic meter of water used. The assumption is that what comes out of the water pipes more or less goes back into the sewer.

Let us suppose that before the project is implemented, there would first be a referendum. The purpose of the referendum is to determine how many people in Metro Manila would support the project through an additional sewer charge on their water bill. Should majority of the voters vote to support the project, the local government will push through with the project.

The survey you are participating in today is only to find out your opinion about this matter. It is not an actual referendum. But we are interested in finding how you would vote if an actual referendum is to take place. So please consider that voting yes and paying if the project is implemented would leave you less money available for your household needs and other things such as contribution to other issues/projects. In other words, we request you to answer exactly as you would vote if you were really going to face the consequences of your vote.

Would you vote in favor of the implementation of the wastewater treatment project and be willing to pay an additional PhP_____ per cubic meter of your water consumption as sewer charge?

The four bid levels (PhP m^{-3} of water), namely, PhP 5.00, PhP 7.00, PhP 10.00 and PhP 15.00, used in the final survey were arrived at after a series of pre-tests with representative segments of the target population, that is, households belonging to different income classes in Metro Manila. Different minimum and maximum bid levels were used in the pre-tests. About ten pre-tests were done for each candidate minimum and maximum bid level. Some pre-tests were conducted during focus group discussions and others were done with households in Quezon City.

The WTP question was immediately followed by questions on the respondent's degree of certainty as well as the reasons for either a 'yes' or 'no' response (referred to in the CVM literature as debriefing questions).

Sampling and Survey Implementation

A total sample of 406 respondents was generated from 13 cities and municipalities in Metro Manila, namely, Quezon City, Manila, Caloocan, Mandaluyong, Pasig, Taguig, Makati, San Juan, Las Pinas, Paranaque, Navotas, Rizal and Marikina. For each city, a residential barangay, with residents belonging to all social classes, was selected. Respondents in each barangay were chosen using systematic sampling. Permission and assistance to conduct the survey were secured from the barangay captain's office. With maps provided by the barangay office, starting points were identified and enumerators were instructed to approach the 50th house from the starting point. In case of refusal to participate, the next house would

be approached. Every succeeding respondent approached had to be the 50th house from the last responding household.

The survey was conducted through interviews during the months of May-October 2012. Enumerators, recruited from a pool of applicants who were at least university students, were given a two-day training course prior to the pre-tests. The first day of training gave an overview of the objectives of the study and the CVM approach; and familiarized the enumerators with concepts and systems of water supply and wastewater treatment. On the second day, enumerators were trained on the survey instrument, with the meaning and the reasons for each question and statement discussed. Enumerators were instructed to strictly follow the wordings in the questionnaire. The training included role-playing exercises.

Data Analysis

The yes-no response to the dichotomous choice CVM question was analyzed using the framework developed by *Hanemann* (*1984*) based on the random utility model. Indirect utility, u, depends on h (which takes on the value 1 if the respondent is voting for the domestic wastewater program, 0 if otherwise), household income y, a vector of respondent and his/her household's characteristics m, and a component of preferences that are known only to the respondent and not to the researcher εh.. This utility function is specified as additively separable in deterministic (v) and stochastic preferences (ε):

$$u(h, y, m, \varepsilon_h) = v(h, y, m) + \varepsilon_h \quad (1)$$

As the random part of preference is unknown, only probability statements about yes and no responses can be made. The probability that a bid price *B* for the wastewater treatment program is accepted can be expressed as:

$$\begin{aligned} Pr\ (yes) &= Pr\ [v(1, y\text{-}B, m) + \varepsilon_1 \geq v(0, y, m) + \varepsilon_0] \\ &= Pr\ [v(1, y\text{-}B, m) - v(0, y, m) \geq \varepsilon_0 - \varepsilon_1\ ] \\ &= F\varepsilon\ (\Delta v) \end{aligned} \quad (2)$$

$F\varepsilon\ (\Delta v)$, the probability that the random variable ε will be less than Δv, represents the cumulative density function of the respondent's true maximum willingness to pay.

The stochastic terms ε are assumed to be independently and identically distributed following a normal distribution with mean of *0* and standard deviation of σ, and the indirect utility function is specified to be a linear function such that the probit regression procedure can be used to evaluate (2). The parameter estimates from the binary probit model are used to calculate mean willingness to pay *E(B)* according to

$$E(B) = -\ (\beta/\sigma)X/(\beta_B/\sigma) = -\ \beta X/\beta_B \quad (3)$$

β is a vector of estimated coefficients of all explanatory variables except bid price (vector X) and βB is the estimate for the bid price coefficient.

Non-paramteric mean willingness to pay for households' sewerage and sanitation program is calculated using the lower bound Turnbull formula (*Haab and McConnell 2002*):

$$E_{LB}(B) = \sum_{j=0}^{M} B_j\ (F_{j+1} - F_j) \quad (4)$$

M is the number of bids, *Bj* is the bid level, *Fj* is the proportion of no responses to bid price *Bj*, $F0=0$ and $F_{M+1}=1$.

RESULTS AND DISCUSSION

Survey Results

Some variables gathered in the survey which provide relevant background information for this study, albeit not used in the regression, are just mentioned in the text.

The average age of respondents is 46 years. More than two-thirds of the respondents are female. In the Philippines as in some other Asian countries, even the non-income-earning housewives are entrusted with making budget decisions for the household, and thus qualify for the household head definition in the survey. Average monthly household income is PhP 47,457.00 (US$ 842.00). This is more than twice the average monthly income of the respondent, which implies multiple income earners in the average household, a situation that has become more common due to increasing costs of living (**Table 1**).

Water Supply and Sewerage

Ninety-one percent of the responding households get their water from either of the two MWSS concessionaires. The few who are not connected to MWSS get their water from private subdivision deep well (2%), public or community deep wells in informal settling areas (2%), or buy from neighbors (3%) or water tankers (1%). Average monthly volume of water consumed per household is 33 m^3 valued at about PhP 970.00 (US$24.00), an effective price of PhP 29.21 (US$0.71) m^{-3} of water. Variable 4 (Drinking Water) indicates that 56% of responding households buy bottled water and/or buy water from water refilling stations for their drinking water (**Table 1**). These households incur an additional monthly water cost of about PhP 404.00 (US$10.00), nearly half of what they pay to the main water supplier. Thus, about half of the respondents are paying 50% more to ensure safe drinking water.

Most (95%) of responding households have their own

Table 1. Descriptive statistics.

Variable	Description	Mean	Standard Deviation
(1) Household Income	Monthly in PhP	47,457	57,404
(2) Respondent Gender	1 if male, 0 if female	0.32	0.47
(3) Respondent Age	In years	45.56	13.04
(4) Drinking Water	1 if respondent's household buys bottled water or from refilling stations for drinking water, 0 otherwise)	0.56	0.50
(5) Water Pollution	1 if water pollution is cited by respondent to be one of top 3 environmental problems in the Philippines, 0 otherwise	0.41	0.49
(6) HHWastewater	1 if domestic wastewater is considered by respondent to be the primary cause of water pollution, 0 otherwise	0.12	0.32
(7) Knowledge	Number of correct answers out of 5 wastewater/pollution awareness questions	3.16	1.12
(8) OpinionA	1 if respondent thinks that water pollution is not a serious problem in Metro Manila, 0 otherwise	0.21	0.41
(9) OpinionB	1 if respondent thinks that government should be the one to finance programs to clean the water bodies in Metro Manila, 0 otherwise	0.81	0.40
(10) OpinionC	1 if respondent thinks that all households must contribute money for the clean up of the water bodies, 0 other wise	0.41	0.49
(11) Near Creek	1 if respondent's household resides near a creek/canal, 0 other wise	0.51	0.50

watersealed toilets, even if only about half have flush. The few with no watersealed toilets use public/communal toilets or open/closed pits or live near rivers, creeks or canals. The most common sewerage facility utilized by MM households is private septic tanks. While only 12% of the responding households are connected to a sewer line that transports wastewater to sewage treatment facilities, a substantial 85% have their own septic tanks. Some crowded, low income communities have communal/public septic tanks (about 2% of respondents) while low income or informal settling areas near canals and rivers have their wastewater flow straight to these water bodies. More than two-thirds of households connected to a sewer line or 8% of all responding households are serviced by the two MWSS concessionaires. The sample is fairly representative of the actual sewer coverage in MM.

Many private septic tanks in Metro Manila are suspected to be substandard. Not all septic tanks are fully cemented on all sides. Only 79% are cemented at the bottom. This means that a substantial 21% of responding households' sewage flow through the ground and can contaminate the aquifer. Of those septic tanks that are cemented at the bottom, only about half are desludged of septage on a regular basis. It is likely that much of the septage may just be overflowing to drainage canals, posing health risks to neighboring communities and pollution to rivers and lakes. That not all household heads are sufficiently aware of their household sewerage system is revealed by the inability of some 21% of responding household heads to point to the location of their septic tanks to the enumerator. This corroborates the earlier finding that about half of the septic tanks are not desludged on a regular basis or may not have been desludged even once at all.

Knowledge and Attidtudes

Only 41% of the respondents selected water pollution as one of the three biggest environmental problems from a list of nine problems that included air pollution, solid waste, endangered species, deforestation, traffic, floods, climate change and groundwater depletion (variable 5 in **Table 1**). Only 7% ranked water pollution first; 16% ranked it second; and 18%, third. What appear to be more important concerns for MM residents are solid waste and flooding which are included in the top 3 list by 92% and 59%, respectively, of respondents. At the tail of the list are groundwater depletion (included in the top 3 problems list by only 2% of respondents) and endangered species (1% of respondents). Endangered species is an understandably low concern for people in the metropolis. It is, however, alarming that groundwater depletion has become a non-issue for MM residents. Just a couple of years (5-10 years) earlier, the dwindling stock of good quality groundwater was a big concern for MM residents many of whom depended on deep-well based village water supply systems. With the expansion of the water supply service coverage of MWSS after its privatization in 1997, many groundwater supply systems have been replaced by MWSS systems which larlely utilize surface water from outside MM.

Almost all (98%) of respondents think that the rivers in Metro Manila are extremely polluted. However, the majority 64% of the respondents believe that the primary cause of the pollution is garbage and 23% think it is wastewater from industries. Variable 6 of **Table 1** refers to the remanining measly 12% of respondents who point to domestic wastewater as the main culprit. Thus, most of the respondents are not aware of the fact that water fowing from their toilets and kitchens are causing 60% of the pollution

load in the MM river system. This may be understandable as pollution from domestic wastewater is much less visible than pollution from solid wastes and factory wastewater.

Respondents were asked to agree or disagree with each of five statements on wastewater and sewerage. The respondents, on the average, correctly responded to 3 out of 5 items (variable 7 in **Table 1**). Although most (97%) of respondents are aware that the primary cause of diarrhea and typhoid is untreated water, many are unaware of what happens to domestic wastewater that flows to the septic tank. More than half (54%) wrongly think the wasteatwer remain in the septic tank. Almost half (46%) of the respondents were not aware that their wastewater ultimately flows into rivers and other water bodies. Even more (68%) are not aware of the need to desludge their septic tanks regularly. This can partly explain the earlier finding on the low percentage of households desludging their septic tank on a regular basis.

Only 79% of respondents think that pollution of water bodies in MM is a serious concern. More than 90% of responding household heads agree that companies disposing their wastewater and people disposing of their garbage to the water bodies must be obliged to pay for the damage they are causing (**Table 2**). A big proportion, albeit slightly less, of respondents also feel that government is financially responsible for the clean up. On the other hand, only 41% of the households feel they need to contribute as well. It appears that majority of the households do not want to assume the financial burden for the clean up. It is also possible that they do not think they are causing the pollution and hence are not responsible. As shown earlier, many of the households are not well informed about where their wastewater goes, how wastewater is adequately treated and disposed of, and up to what extent domestic wastewater contributes to pollution of rivers and lakes. The three 'opinion' variables, namely OpinionA, OpinionB and OpinionC, in **Table 1** refer to statements 1, 2 and 4, respectively, in **Table 2**.

WTP for Sewerage and Sanitation Services

Respondents were asked to indicate certainty of their "yes" response using a scale of 1 (not sure) to 5 (very sure). Respondents who answered 1 and 2 (11 respondents) were removed from the sample (**Figure 1**). Answers to the WTP question exhibit a fairly well-behaved bid function. The proportion of respondents who are willing to pay for the domestic wastewater program tends be smaller if the bid price is higher. The non-parametric mean WTP calculated using the Turnbull method is PhP 7.13 (US$ 0.17) m^{-3} of water use.

The sign of the coefficient of each explanatory variable indicates only the direction (not the magnitude) of the impact of the variable on the likelihood of the respondent voting for and being willing to pay for the public program (**Table 3**). The significant negative coefficient of the variable Bid, the program cost, implies that respondents are more likely to vote for the sewerage and sanitation program if the program cost is lower. The significant positive coefficient of Household Income, on the other hand, means that respondents with higher monthly incomes are more likely to vote for the program. These outcomes are consistent with the economic theory of demand. The regression results further reveal that male respondents are more likely to vote for the sewerage and sanitation program than female. Likewise statistically significant, a respondent whose household is using bottled water or water refilling station water for drinking and who thinks domestic wastewater is the primary cause of water pollution is more likely to vote for the program. Knowledge and opinion variables as well as age do not turn out to be

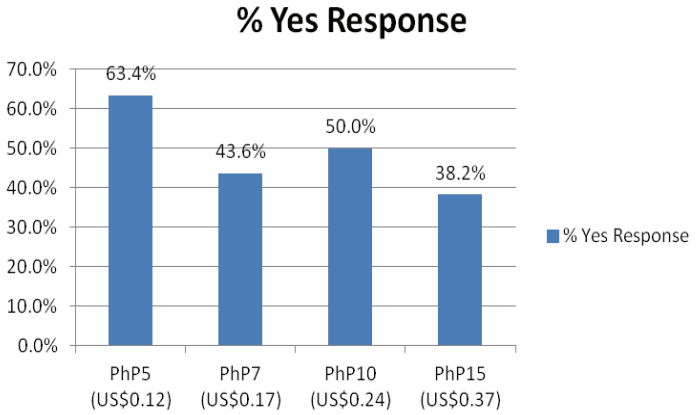

Figure 1. Proportion (%) of yes responses, by bid price.

Table 2. Attitude towards water pollution and the responsibility of addressing the problem.

Statement	% of respondents who agreed
1. Water pollution is not a serious problem in Metro Manila. There are other more serious and urgent problems than this.	21%
2. The government must be the one to finance programs to clean Manila Bay, Laguna Lake and Metro Manila rivers.	81%
3. Factories and companies that dispose of their dirty wastewater into rivers must pay for the clean up of these water bodies.	92%
4. Since domestic wastewater of all Metro Manila residents ultimately flow to rivers, Manila Bay and Laguna Lake, all households must contribute money for the clean up of these water bodies.	41%
5. Anyone caught disposing solid wastes to creeks, esteros, rivers, Manila Bay and Laguna Lake must be fined.	98%

Table 3. WTP for sewerage and sanitation services, Binary Probit Model.

Variable	Description	Coefficient
Constant		-0.4914
Bid	Program Cost	-0.0517***
Household Income	monthly in PhP	0.4247E-05**
Respondent Gender	1 if male, 0 if female	0.3146**
Respondent Age	in years	0.0005
DrinkingWater	1 if respondent's household buys bottled water or from refilling stations for drinking water, 0 otherwise)	0.4837***
Water Pollution	1 if water pollution is cited by respondent to be one of top 3 environmental problem in the Philippines, 0 otherwise	0.0018
HHWastewater	1 if domestic wastewater is considered by respondent to be the primary cause of water pollution, 0 otherwise	0.4586**
Knowledge	number of correct answers out of 5 wastewater/pollution awareness questions	0.1307
OpinionA	1 if respondent thinks that water pollution is not a serious problem in Metro Manila, 0 otherwise	-0.0428
OpinionB	1 if respondent thinks that government should be the one to finance programs to clean the water bodies in Metro Manila, 0 otherwise	-0.0031
OpinionC	1 if respondent thinks that all households must contribute money for the clean up of the water bodies, 0 other wise	0.7602
NearCreek	1 if respondent's household resides near a creek/canal, 0 other wise	-0.1375
Log-likelihood		-239.0015
No. of observations		406

Notes: * = significant at α=0.10; ** = significant at α=0.05; *** = significant at α=0.01.

significant factors. Parametric mean WTP using the binary probit coefficients is PhP 11.98 m^{-3} of water use.

CONCLUSIONS AND RECOMMENDATIONS

In MM, the foremost urban area in the Philippines, wastewater from residential dwellings accounts for about 60% of the pollution load in rivers and other water bodies (Manila Bay and Laguna Lake). This is due to inadequate domestic wastewater treatment facilities. Up to the present, only 12% of the households are connected to sewer lines. Majority make use of individually constructed septic tanks, many of which are substandard and are not properly maintained and regularly desludged of septage. Those in informal settler areas dispose of their wastewater directly to drainage canals or creeks/esteros.

This study looks into the preferences of MM households with regard to domestic wastewater treatment programs. By means of a CVM survey, it estimates households' WTP for a sewerage and sanitation program that can bring about a reduction in water pollution as well as a reduction in the incidence of water-borne diseases. Survey results reveal that even in highly urbanized MM, households still do not possess adequate understanding and appreciation of the issue of wastewater-caused pollution of water bodies and health problems. While all respondents think that Metro Manila rivers are extremely polluted, water pollution is not considered as one of the top three environmental problems by majority of the respondents. An overwhelming majority of respondents were not aware that water that flows from their toilets is the primary cause of water pollution in Metro Manila rivers. Presumably because of this lack of awareness, most Metro Manila households refuse to take responsibility for the clean-up of water bodies. Instead, they point to factories and entities that dispose of their liquid and solid wastes near water bodies as primarily liable. It may also be that households only do not want to assume the additional financial burden as most of them believe that government should assume the costs.

The over-all proportion of "yes" answers to the WTP question is only 49%, resulting in a very low mean WTP for improved sewerage and sanitation of PhP 7.13-11.98 (US$0.17-0.29) m^{-3} of water use, only about a third of the average water price. The market research for the proposed sewerage and sanitation services project of Manila Waters Company, Inc. (MWCI), the east zone concessionaire of MWSS conducted in November-December 2006 (*REECS 2007*) revealed comparatively low WTP for the project. Of the 300 randomly selected MWCI customers which were not yet connected to the sewerage system, less than three-fourths expressed some WTP for sewerage and sanitation services. The average WTP was estimated to range just between 18-20% of the water bill, short of the current sewer charge of 50%, and way below the 150% rate for sewerage connection and 75% for sanitation services stipulated in the MWSS concession agreement (*REECS 2007*).

The survey results underscored the need for information and education campaigns not only on the physical science of water and wastewater but also on the economics of water use and its preservation. *Tortajada and Joshi*

(*2013*) have shown that the additional costs of wastewater treatment programs may be made more acceptable with appropriate and effective education and communication strategies. A better understanding of the increasing scarcity of good quality water and of the externality costs, pollution and health effects, of their water use may help raise people's support for domestic wastewater treatment programs.

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