Jurnal Teknologi

Full Paper

PENANG USER'S PERCEPTION OF DOMESTIC WATER QUALITY, HEALTH RISK CONCERN AND WILLINGNESS TO PAY: A PILOT STUDY

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Article history
Received
24 April 2015
Received in revised form
4 May 2015
Accepted
9 May 2015

Abstract

The state of Penang has been known to be offering the lowest water tariff rate for its users in Malaysia. The most recent water services reform exercise in Malaysia saw a suggestion made for the abolishment of water subsidies from the federal government and for full cost recovery (FCR) approach to be applied. This means that the operating cost will be transferred to consumers instead. This study reports a descriptive pilot study results that explored Penang user's responses to various issues pertaining to their perception of water quality, health risk concern and willingness to pay (WTP) for increased water tariff. The findings show that users were not that happy with water quality only in terms of taste, suspended solids that should not have come out of the tap, but sometimes they do, and chlorine content; however, not for its odor or color. As for health risk concern, although a majority believes that their tap water adhered to the drinking standard set by World Health Organization (WHO), still many perceived that their tap water is associated with health risk and unsafe for drinking, which saw many opted to buy bottled water for their drinking consumption. As for willingness to pay, the majority thinks that the tariff should not be increased at all, particularly at the current water quality provided to users. Gender and monthly income as part of demographic factor play important roles in enhancing the study's outcome. The findings provide preliminary insight to how water users may act towards a possible water tariff increase in the state.

Keywords: Willingness to pay (WTP), domestic water quality, health concern, Penang, perception

Abstract

Negeri Pulau Pinang telah terkenal menawarkan kadar tarif air yang paling rendah bagi pengguna-penggunanya di Malaysia. Perkhidmatan air reformasi yang paling baru dijalankan di Malaysia telah melihat cadangan yang dibuat untuk pemansuhan subsidi air oleh kerajaan persekutuan dan pemerolehan semula kos sepenuhnya pendekatan (FCR) yang akan digunakan. Ini bermakna kos operasi akan dipindahkan kepada pengguna sebaliknya. Kajian ini melaporkan hasil kajian deskriptif awal yang diterokai berdasarkan maklum balas pengguna Pulau Pinang kepada pelbagai isu yang berkaitan terhadap persepsi mereka terhadap kualiti air, kebimbangan risiko kesihatan dan kesanggupan untuk membayar (WTP) tarif air yang meningkat. Hasil kajian menunjukkan bahawa pengguna tidak begitu gembira dengan kualiti air dari segi rasa, pepejal terampai yang tidak sepatutnya keluar dari paip tetapi kadang-kadang mereka keluar, dan kandungan klorin; walau bagaimanapun, bukan untuk bau atau warnanya. Bagi kebimbangan risiko kesihatan, walaupun majoriti percaya bahawa air paip mereka dipatuhi standard minum yang ditetapkan oleh Pertubuhan Kesihatan Sedunia (WHO), masih ramai melihat bahawa air paip mereka dikaitkan dengan risiko kesihatan dan tidak selamat untuk diminum, yang menyaksikan ramai memilih untuk membeli air botol untuk kegunaan minuman mereka. Bagi kesediaan untuk membayar, majoriti berfikir bahawa tarif tidak perlu ditambah pada semua, terutama pada kualiti air semasa yang diberikan kepada pengguna. Jantina dan pendapatan bulanan sebagai sebahagian daripada faktor demografi memainkan peranan penting dalam meningkatkan hasil kajian itu. Hasil kajian memberi gambaran awal bagaimana pengguna air boleh bertindak terhadap kemungkinan kenaikan tarif air di negeri ini

Kata kunci: Kesanggupan untuk membayar (WTP), kualiti air domestik, kebimbangan kesihatan, Penang, persepsi

1.0 INTRODUCTION

Two important Acts i.e. Suruhanjaya Perkhidmatan Air Negara Act (Act 654)[1] and Water Services Industry Act (WSIA/Act 655)[2] were the results of the Malaysian government's latest water services restructuring exercise. The Acts provides SPAN the authority to perform various missions regarding water supply and sewerage services in the country particularly in ensuring effective services are made available for the public including water quality [3]. To curb water providers' inefficient water management which has caused a gap between the cost and water tariff for maintaining water services and supply, SPAN has suggested for the abolishment of water subsidies by the federal government and for a full cost recovery (FCR) to be applied instead when water is provided for the public [4]. In short, this means that the operating cost will be transferred to consumers instead. This also means that water will be treated as an economic good in this country instead of a social good. This view may seem logical given that water is a scarce resource that resulted for some countries (e.g. Singapore) depend on their neighbors or countries that have water possession (e.g. Malaysia) to supply them with clean water at a negotiated price [5].

As having to pay for increased water tariff is a politically sensitive issue, the researchers have carried out a pilot study that explores this issue further in a descriptive manner. Using Penang users as respondents, the study investigates whether they are willing to pay for domestic water consumption in the current water quality and services provided as well as in a hypothetical situation whereby they will be offered with better water services and quality. This is in addition to what they think of other variables like water quality and health risk concern. Although it is a pilot study, the findings are believed to provide in particular Perbadanan Bekalan Air Pulau Pinang (PBAPP), the water service provider in the state of Penang with initial insight as to what the public thinks of the water tariff increase issue, as well as for other water services providers in other states of the country.

2.0 LITERATURE REVIEW

From the perspective of water resource management, one effective way to solve the scarcity of water is treating the water as an economic good. For example, it is argued that by treating it as an economic good, water is considered a valuable and scarce resource that should be properly valued to sustain efficient utilization and preventing wastage[6].

2.1 Willingness to Pay (WTP)

Although water consumption issues have been investigated by previous researchers, they are lacking in numbers particularly in the local scene. Many of the local studies found were either descriptively described or conceptual, positioning or commentary rather than empirically researched [3-7-8-910-11]

As Penang state is observed to be offering the lowest water tariff with RM 0.22/m3 (for 0-20 m3) and RM 0.42/ m3 (for >20-40 m3)10-12, and that it has been a while for the Perak state to review its water tariff, [12] these becomes the main reason for why both states were chosen and empirically studied by researchers to find out factors that influenced paid water user's WTP [10, 13].

In one study that investigate the relationships amongst water quality, health risk concern, demographics, perceived water value and WTP of the Perak and Penang states' households, customer's willingness to pay is found to be influenced by water taste, continuous water supply, income, and perceived water processing value factors. In addition, the study also found that perceived water processing value is influenced by water quality factor, and that it plays the role of a mediator between water quality and WTP.10 In another study that tested eight proposed consumer's willingness to pay determinants, only four, i.e. taste, uninterrupted water supply, water contamination and income were found to be significant determinants [13].

2.2 Water Quality and WTP

In general, many of the WTP's studies define WTP as the highest price that an individual is willing to accept to pay for certain services or goods [14].

There have been quite a number of cases found on this WTP topic. Examples from the global perspective on WTP include a study focusing on households in Fuzhou, China whereby the households in that area are found to be willing to pay 10% extra of their water tariff in exchange of unpolluted water source [15] in comparison to another study that focused on households in Rethymno whose WTP is 17.67% higher than the current water tariff in exchange of a continuous water supply and better water service for better water quality [16].

Similar findings were found in other studies too as in general, individual's WTP is high if it is for an improved water quality such as taste or health concerns and services particularly if the services provided are affordable and appropriate [17] Taste as part of organoleptic or sensorial information plays a major role in how water quality is perceived by the public [11]. Examples on organoleptic or sensorial information studies include one study in Shebedino district of Southern Ethiopia that found resident's WTP is 1.5 times more than from the present water tariff paid18 as well as another study in Minnesota where resident's WTP is 16% to 21% from their current water bill with condition that the concentration of sulfate and iron in the water provided to their homes can be reduced [19]. Interestingly, WTP is less for individuals who complain about water chlorine smell and are unsatisfied with their water quality as they believe that water chlorine smell will not be improved,[16] or that

in the case whereby respondents perceive that their drinking water is already of good quality [19].

2.3 Health Risk Concern and WTP

The literature also identifies poor water quality as the cause of 80% of diseases in developing country, 5.7% total disease burden (in DALYs) globally and 4% worldwide deaths[20]. Some examples of these waterborne diseases are diarrhea, typhoid fever, and Arsenicosis.

It is important to note that the World Health Organization (WHO) has published Guidelines for Drinking-Water Quality (4th. Eds.) to ensure safe drinking water quality for global public health on which the framework is comprised of heath-based targets, proper infrastructure, monitoring and effective planning and management [21]. The guidelines for example describe reasonable requirement in microbial aspects, chemical aspects, radiological aspects and acceptability aspects (taste, odor, appearance) as the supporting information to the safe drinking water framework and used by nations like Malaysia to develop and implement their national standard of drinking water quality.

In Canada, a study related to sources of drinking water was conducted over 27 years and on how two-thirds of the water-borne illnesses were related to either semi-private or private drinking water supplies [22]. Water-borne pathogen for example causes vomiting and diarrhea, and that chemical contamination (by nitrate and pesticides) is a challenge to source of potable water as contamination often occur near to agricultural area.

Another study in USA found respondent's common concerns of water quality of private water supplies to be related to bacteria and chemicals which negatively affect their perceptions on health risk[23]. Water Quality Association (1999) found that 60% of respondents in a U.S. survey of municipal water quality said that the quality of drinking water affects their health and 50% of them were concerned about possible health-related contaminants in the water supply [23]. One study found that 30.3% respondents in Goro-Gutu District of Eastern Ethiopia reported that at least one of their family members experienced waterborne disease in 2009. [32]

2.4 Demographics and WTP

WTP studies that are associated with demographics show various results. One study found that WTP decreases with age and women are found to have lower WTP than male [17]. In other studies, women's WTP is higher since they are more directly involved in the day-to-day needs of the household chores [6-16]. Studies show that respondents with higher levels of education have greater awareness on health benefits of improved water supply and water quality [6-24-25-26]. Households' income also significantly impact on the WTP as households with higher income tend to have higher WTP [6-15-16-19-26]. Studies show that age is negatively related with WTP, with younger people more willing to pay for improved water service than the elderly people, who have traditionally used to experiencing low cost water supply and shorter planning horizon [6-26-27].

3.0 METHOD

This pilot study is descriptive in nature and uses a simple structured questionnaire to survey respondent's views on WTP issue that is related to perceived water quality, health risk concern and demographic factors. The main intention of this pilot is to find out whether the variables investigated are indeed perceived by the respondents and that if they are so, then they can be used for further investigation in the actual study to be conducted by the researchers later.

As the study is intended to be exploratory, the study needs only few number of respondents to participate [28]. The literature has acknowledged suggestions on the number of samples need to be used for a pilot study; some have suggested for the pilot sample to be between 10 to 40 samples only [29-30] while another study recommended for a minimum of 12 sample [31]. In short, the consensus in the literature acknowledged that pilot study samples are few in number; no matter it is for quantitative or qualitative purposes.

As earlier explained, Penang state offers the lowest water tariff rate in Malaysia compared to other states. Noting this fact, it is the intention of this pilot study to explore the state's water users' views on various issues related to their willingness. As the scope is limited to only Penang state water users, the researchers proceeded to design the prerequisite criteria that limits on who from the water users' population can be invited to participate in the study. Following the criteria, in this study, only those who live in Penang and paid water users were to be targeted for their participation.

In line with the literature support, twenty eight willing respondents were approached. They however were required to answer two qualifying questions i.e. on whether the respondent is from Penang or not (to qualify as Penang water user), and on whether they acted as their household's representative in paying the water bill (to qualify as paid water user).

As a result of this qualifying exercise, eight respondents had to be turned away as two of them were not from Penang while the other six did not pay the household's water bill. The eight respondents were politely thanked for their short participation in the exploratory survey. The rest of the respondents (20 of them) were then requested to proceed to answer the questionnaire.

The questionnaire for the pilot study has been divided into four sections. The first section focused on respondent's information background or demographics while the second to the last sections of the questionnaire emphasized on variables investigated in this study; namely, perceived water quality (measured by 11 statements), health risk

concern (measured by 9 statements) and willingness to pay (measured by 6 statements).

Respondent's level of agreement and disagreement to statements or questions investigate in the questionnaire was measured using a 5 point Likert-type scale: (1) "Strongly disagreed", (2) "Slightly Disagreed", (3) "Neutral", (4) "Slightly Agreed" and (5) "Strongly Agreed". Such scale is widely acknowledged and used by researchers in their studies.

For purpose of analysis, the researchers have opted for descriptive type of analysis, hence in this study, simple frequency and cross-tab analyses have been chosen to help interpret the study's findings.

4.0 RESULTS AND DISCUSSION

4.1 Respondent's Profile

Results of the respondent's profile are presented in Table 1. The results show that gender distribution is almost equal with 45% male and 55% female. The majority of the respondents was found to age between 24 to 35 years old (80%), have Bachelor degrees (50%), monthly income between RM3000 to RM6000 (40%), household's size between two to four persons (55%), and pay household's water bill at RM6 or below (30%). It is important to note however that in Malaysia, water bill is paid once every two months, and in this case, it means that the majority of respondents pay only RM3 and below per month for their domestic water consumption.

Table 1 Respondent's profile

Demographic	Profile	Freq.	Percentage (%)
Gender	Male	9	45%
	Female	11	55%
Age	Below 24 years	0	0%
	24 to 35 years	16	**80%**
	36 to 45 years	3	15%
	46 to 55 years	1	5%
	Above 55 years	0	0%
Highest Education Level	Secondary School	0	0%
	Certificate/Diploma	2	10%
	Bachelor Degree	10	**50%**
	Master Degree	7	35%
	PhD/Doctorate	1	5%
Monthly Income	<RM1500	2	10%
	RM1500-RM2999	6	30%
	RM3000-RM5999	8	**40%**
	>RM6000-RM8999	3	15%
	>RM9000	1	5%
Water bill	RM6 or below	6	**30%**
	RM7-RM14	2	10%
	RM15-RM24	3	15%
	RM25-RM34	3	15%
	RM35-RM44	2	10%
	RM45-RM54	2	10%
	>RM55	2	10%
Water consumption	<10m3	2	10%
	10m3-20m3	4	20%
	21m3-39m3	2	10%
	40m3-59m3	3	15%
	60m3-79m3	0	0%
	80m3 and above	2	10%
	I am not sure	7	**35%**
Household Size	Only 1 person	0	0%
	2 to 4 persons	11	**55%**
	5 to 7 persons	8	40%
	8 to 10 persons	1	5%
	>10 persons	0	0%

4.2 Perceived Water Quality

Table 2 presents the study's findings from the simple frequency analyses. In terms of perceived water quality issues, the study found that overall, majority of Penang users was happy with domestic water quality that is provided to them (55% agreed and strongly agreed). Majority believed that the water provided to their homes adheres to the standard set by both the World Health Organization (WHO) and Malaysia's Ministry of Health (50% agreed and strongly agreed). Although this is so, the study found that the respondents were still not happy with some aspects of the tap water; namely the water quality organoleptic characters like taste, suspended solids that can be physically seen sometimes flowing out from the tap (35% agreed and strongly agreed for present of unpleasant taste and 45% agreed and strongly agreed for suspended solids), and perceived high chlorine content (60% agreed and strongly agreed).

Water odor and color seemed not to be perceived as problematic for the respondents (60% disagreed or strongly disagreed that their tap water has unpleasant smell while 55% disagreed that their tap water has unusual color). While these findings are positive, the study found many of the respondents admitted to installing water filters at their home for reasons like attempts to reduce the perceived unpleasant taste of the tap water they are experiencing (60% agreed and strongly agreed), to filter suspended solids believed flown out of the tap water (60% agreed and strongly agreed), and to reduce the unusual color of the tap water (55% agreed and strongly agreed). Interestingly, the effort was not due to rid of the odor (40% disagreed and strongly disagreed).

Table 2 Overall descriptive analysis results for penang user's perceived water quality

Item statement	Likert scale	Freq.	Percentage%
1. Overall, my perception on water quality provided in my home is good.	1:SD	1	5.0%
	2:D	3	15.0%
	3:N	5	25.0%
	4:A	10	**50.0%**
	5:SA	1	**5.0%**
2. I believe that tap water delivered to my home follows WHO standard and/or	1:SD	3	15.0%
	2:D	4	20.0%
	3:N	3	15.0%
	4:A	7	**35.0%**
	5:SA	3	**15.0%**

Malaysia's Ministry of Health standard			
3. Tap water at home has unpleasant taste	1:SD	2	10.0%
	2:D	7	35.0%
	3:N	4	20.0%
	4:A	6	**30.0%**
	5:SA	1	**5.0%**
4. Tap water at home consists of suspended solids	1:SD	3	15.0%
	2:D	6	30.0%
	3:N	2	10.0%
	4:A	5	**25.0%**
	5:SA	4	**20.0%**
5. I believe the tap water has too much chlorine sometimes	1:SD	0	0.0%
	2:D	4	20.0%
	3:N	4	20.0%
	4:A	5	**25.0%**
	5:SA	7	**35.0%**
6. Tap water at home has unpleasant smell/odor	1:SD	2	**10.0%**
	2:D	10	**50.0%**
	3:N	2	10.0%
	4:A	5	25.0%
	5:SA	1	5.0%
7. Tap water at home has unusual color	1:SD	0	0.0%
	2:D	11	**55.0%**
	3:N	3	15.0%
	4:A	3	15.0%
	5:SA	3	15.0%
8. Water filter is installed at home to reduce the unpleasant taste of the tap water	1:SD	1	5.0%
	2:D	4	20.0%
	3:N	3	15.0%
	4:A	7	**35.0%**
	5:SA	5	**25.0%**
9. Water filter is installed at home to filter the suspended solid found flowing from the tap water	1:SD	1	5.0%
	2:D	6	30.0%
	3:N	1	5.0%
	4:A	6	**30.0%**
	5:SA	6	**30.0%**
10. Water filter is installed at home to reduce the unusual color of the tap water	1:SD	1	5.0%
	2:D	5	25.0%
	3:N	3	15.0%
	4:A	7	**35.0%**
	5:SA	4	**20.0%**
11. Water filter is installed at home to reduce the unpleasant odor of the tap water	1:SD	4	**20.0%**
	2:D	4	**20.0%**
	3:N	5	25.0%
	4:A	5	25.0%
	5:SA	2	10.0%

Note: 1: SD = strongly disagreed; 2: D = disagreed; 3: N = neither agreed or disagreed; 4. A = Agreed; 5: SA = strongly agreed

It is important to note on other responses that have been given by the respondents on the statements explored in the study. For example, although 55% of respondents were found to be happy with their overall tap water quality (refer statement no. 1), the data in Table 2 shows that at least there are 20% of the respondents who are either strongly disagreed or disagreed with the statement. On top of that, there is another 25% respondents who chose to be neutral. While these 20% bravely gave their negative view on water quality provided at their homes, the other 25% refused to make the judgment by choosing to keep silent instead. If by being silent means that they believe the water quality is good, then the outcome is fine. However, if this means otherwise, then, the state's water service is in trouble because if the 20% and 25% are added together, these in total, gives a response of 45% which is quite high and thus should be a major concern to PBA, the state's water service provider.

Similar caution has to be taken with other responses shown on each of the other 10 statements made on water quality, particularly with those that have high neutral percentage responses (e.g. statements no. 2, 3, 5, 7, 8, 10 and 11).

Table 3a provides a cross tab analysis of the 11 item statements made according to gender. This is to find our whether demographic variables like gender can show any further in-depth results on issues investigated in the study. It is interesting to note on the similarity of responses given by both male and female gender, either when they agreed or disagreed with many of the statements. For example, statement 1 that asked respondent's view on how they perceive overall water quality provided to their home found that majority from both gender groups agreed (Likert scale - 4) that the water quality is good (20% male and 30% female respectively). Or in another statement (statement 7) that asked for their opinion on whether they think that the water provided to their home is of unusual color, again, it is found that majority from each gender group (20% male and 35% female respectively) responded with Likert scale – 2 (disagreed) which means that majority of them disagreed that domestic tap water provided is of unusual color. However, it is observed that there are slight perception differences between the gender groups. For example, statement 5 that asked respondent's view on whether they perceive tap water at their home has too much chlorine, it is interesting to note that while majority of the female gender strongly agreed with the statement (25% strongly agreed; Likert scale - 5), the study found that majority of the male gender responded neutrally instead (15% neutral; Likert scale - 3).

In another example concerning statement 6 that explores respondent's view on the smell/odor of the tap water provided at their households, the cross tab analysis found a perception difference whereby majority of males agreed (20% agreed; Likert scale – 4) that the tap water carries unpleasant smell/odor compared to the females who disagreed with the statement (35% disagreed; Likert scale – 2).

The study also notes on the slight perception differences that are found within each gender group itself on certain statements. An example of this perception difference is shown from the responses given to statement 4 when respondents were asked on whether they perceive tap water provided to their home consists of suspended solids. Here, the study found that within each segment of male and female gender, each of the 5-point Likert scale that measures the respondent's level of dis/agreement with survey statements have been filled.

Table 3a Cross tab analysis results for Penang user's perceived water quality according to demographics (gender)

Item statement	Likert scale	Male		Female	
	1-2-3-4-5	Freq.	%	Freq.	%
1. Overall, my perception on water quality provided in my home is good.	1:SD	0	0.0%	1	5.0%
	2:D	2	10.0%	1	5.0%
	3:N	2	10.0%	3	15.0%
	4:A	4	20.0%	6	30.0%
	5:SA	1	5.0%	0	0.0%
2.I believe that tap water delivered to my home follows WHO standard and/or Malaysia's Ministry of Health standard	1:SD	3	15.0%	0	0.0%
	2:D	1	5.0%	3	15.0%
	3:N	1	5.0%	2	10.0%
	4:A	4	20.0%	3	15.0%
	5:SA	0	0.0%	3	15.0%
3. Tap water at home has unpleasant taste	1:SD	1	5.0%	1	5.0%
	2:D	3	15.0%	4	20.0%
	3:N	2	10.0%	2	10.0%
	4:A	2	10.0%	4	20.0%
	5:SA	1	5.0%	0	0.0%
4. Tap water at home consists of suspended solids	1:SD	1	5.0%	2	10.0%
	2:D	3	15.0%	3	15.0%
	3:N	1	5.0%	1	5.0%
	4:A	3	15.0%	2	10.0%
	5:SA	1	5.0%	3	15.0%
5. I believe the tap water has too much chlorine sometimes	1:SD	0	0.0%	0	0.0%
	2:D	2	10.0%	2	10.0%
	3:N	3	15.0%	5	5.0%
	4:A	2	10.0%	3	15.0%
	5:SA	2	10.0%	5	25.0%
6. Tap water at home has unpleasant smell/odor	1:SD	1	5.0%	1	5.0%
	2:D	3	15.0%	7	35.0%
	3:N	1	5.0%	1	5.0%
	4:A	4	20.0%	1	5.0%
	5:SA	0	0.0%	1	5.0%
7. Tap water at home has unusual color	1:SD	0	0.0%	0	0.0%
	2:D	4	20.0%	7	35.0%
	3:N	2	10.0%	1	5.0%
	4:A	2	10.0%	1	5.0%
	5:SA	1	5.0%	2	10.0%
8. Water filter is installed at home to reduce the unpleasant taste of the tap water	1:SD	1	5.0%	0	0.0%
	2:D	0	0.0%	4	20.0%
	3:N	2	10.0%	1	5.0%
	4:A	4	20.0%	3	15.0%
	5:SA	2	10.0%	3	15.0%
9. Water filter is installed at home to filter the suspended solid found flowing from the tap water	1:SD	1	5.0%	0	0.0%
	2:D	3	15.0%	3	15.0%
	3:N	1	5.0%	0	0.0%
	4:A	3	15.0%	3	15.0%
	5:SA	1	5.0%	5	25.0%
10. Water filter is installed at home to reduce the unusual color of the tap water	1:SD	1	5.0%	0	0.0%
	2:D	3	15.0%	2	10.0%
	3:N	1	5.0%	2	10.0%
	4:A	3	15.0%	4	20.0%
	5:SA	1	5.0%	3	15.0%
11. Water filter is installed at home to reduce the unpleasant odor of the tap water	1:SD	2	10.0%	2	10.0%
	2:D	2	10.0%	2	10.0%
	3:N	2	10.0%	3	15.0%
	4:A	2	10.0%	3	15.0%
	5:SA	1	5.0%	1	5.0%

Note: 1: SD = strongly disagreed; 2: D = disagreed; 3: N = neither agreed or disagreed; 4. A = Agreed; 5: SA = strongly agreed

In this example for instance, there are 5% males and 10% females that strongly disagreed with the statement (Likert scale - 1), 15% males and 15% females that disagreed with the statement (Likert scale - 2), 5% from both the male and female groups that chose to be neutral to the statement (Likert scale - 3), 15% males and 10% females that agreed with the statement (Likert scale - 4), whereas another 5% male and 15% female strongly agreed with the statement (Likert scale - 5). Results on responses from statement 11 also show similar pattern whereby responses were found to be distributed across all five levels of agreement scale within each gender group.

Another cross-tab analysis has been carried out to examine the impact of perceived water quality according to respondents' monthly income. It is important to note that in this study, the majority of samples (40%) are found to be within the RM3000-RM6000 income category, followed by samples in the RM1500-RM3000 income category (30%) while the others are scattered in other categories; namely; 15% in the RM6000-RM9000, 10% in the below RM1500 and another 5% in the above RM9000 income per month. Thus, the results on issues investigated in this study (i.e. perceived water quality, perceived health risk, willingness to pay) should be analyzed and interpreted with caution. Table 3b shows the full results of perceived water quality. From the results, clear majority responses from the overall monthly income group can be observed for three statements (statements 1, 6 and 7). In statement 1 that asked respondent's view on how they perceive the overall water quality provided to their home for example, majority of the respondents (50%) agreed (Likert scale - 4) that the water quality they receive is of good quality. This majority consists of 15% of respondents with monthly income between RM1500 to RM3000, 25% between RM3000 to RM6000, and another 10% with monthly income between RM6000 to RM9000. For statement 6 that explored respondent's view on whether they perceive tap water at their home unpleasant smell/odor, 50% (5% from below RM1500, 10% from RM1500-RM3000, and 30% from RM3000-RM6000 income groups) disagreed (Likert scale – 2) while for statement 7 that investigated on whether the tap water provided has unusual color found that 55% (10% from below RM1500, 15% from RM1500-RM3000, 20% from RM3000-RM6000, and 10% from RM6000-RM9000 income groups) disagreed (Likert scale – 2).

The results however also show conflicting opinions amongst and within each income category. An example of this situation can be seen the cross tab analysis results on statement 5 that asked respondent's view on whether they perceive tap water provided to their home has too much chlorine. Here, the study found conflicting responses as the majority for each income category differs from one another. In specific, for those earning below RM1500, the results were split between disagreed (5%, Likert scale – 2) and strongly agreed (5%, Likert scale – 5). For those earning between RM1500-RM3000, the views expanded from neutral (5%, Likert scale – 3), agree (10%, Likert scale - 4) and strongly agree (15%, Likert scale – 5). Similar results are observed for those earning between RM3000-RM6000. The feedback varies from disagreed (15%, Likert scale – 2), neutral (5%, Likert scale – 3), agreed (10%, Likert scale – 4) and strongly agreed (10%, Likert scale – 5). For those earning between RM6000-RM9000, the feedback were split between neutral (10%, Likert scale – 3) and strongly agreed (5%, Likert scale – 5) while the respondent with an income of above RM9000, s/he agreed (5%; Likert scale – 4) with the statement.

Table 3b Cross tab analysis results for Penang user's perceived water quality according to demographics (monthly income)

Item statement	Likert scale		Monthly Income				
	1-2-3-4-5		Below RM 1500	RM 1500 to RM	RM 3000 to RM	RM 6000 to RM	above RM 9000
1. Overall, my perception on water quality provided in my home is good.	1:SD	Freq.	0	0	1	0	0
		%	0%	0%	5%	0%	0%
	2:D	Freq.	1	1	1	0	0
		%	5%	5%	5%	0%	0%
	3:N	Freq.	1	2	1	1	0
		%	5%	10%	5%	5%	0%
	4:A	Freq.	0	**3**	**5**	**2**	0
		%	0%	**15%**	**25%**	**10%**	0%
	5:SA	Freq.	0	0	0	0	1
		%	0%	0%	0%	0%	5%
2.I believe that tap water delivered to my home follows WHO standard and/or Malaysia's Ministry of Health standard	1:SD	Freq.	1	1	0	1	0
		%	5%	5%	0%	5%	0%
	2:D	Freq.	0	2	1	1	0
		%	0%	10%	5%	5%	0%
	3:N	Freq.	0	1	2	0	0
		%	0%	5%	10%	0%	0%
	4:A	Freq.	1	1	3	1	1
		%	5%	5%	15%	5%	5%
	5:SA	Freq.	0	1	2	0	0
		%	0%	5%	10%	0%	0%
3. Tap water at home has unpleasant taste	1:SD	Freq.	0	0	1	0	1
		%	0%	0%	5%	0%	5%
	2:D	Freq.	1	1	3	2	0
		%	5%	5%	15%	10%	0%
	3:N	Freq.	1	1	2	0	0
		%	5%	5%	10%	0%	0%
	4:A	Freq.	0	3	2	1	0
		%	0%	15%	10%	5%	0%
	5:SA	Freq.	0	1	0	0	0
		%	0%	5%	0%	0%	0%
4. Tap water at home consists of suspended solids	1:SD	Freq.	0	2	1	0	0
		%	0%	10%	5%	0%	0%
	2:D	Freq.	0	0	3	3	0
		%	0%	0%	15%	15%	0%
	3:N	Freq.	1	1	0	0	0
		%	5%	5%	0%	0%	0%
	4:A	Freq.	0	3	1	0	1
		%	0%	15%	5%	0%	5%
	5:SA	Freq.	1	0	3	0	0
		%	5%	0%	15%	0%	0%
5. I believe the tap water has too much chlorine sometimes	1:SD	Freq.	0	0	0	0	0
		%	0%	0%	0%	0%	0%
	2:D	Freq.	**1**	0	**3**	0	0
		%	**5%**	0%	**15%**	0%	0%
	3:N	Freq.	0	**1**	**1**	**2**	0
		%	0%	**5%**	**5%**	**10%**	0%
	4:A	Freq.	0	**2**	**2**	0	**1**
		%	0%	**10%**	**10%**	0%	**5%**
	5:SA	Freq.	**1**	**3**	**2**	**1**	0
		%	**5%**	**15%**	**10%**	**5%**	0%
6. Tap water at home has unpleasant smell/odor	1:SD	Freq.	1	0	1	0	0
		%	5%	0%	5%	0%	0%
	2:D	Freq.	**1**	**2**	**6**	**1**	0
		%	**5%**	**10%**	**30%**	**5%**	0%
	3:N	Freq.	0	1	0	1	0
		%	0%	5%	0%	5%	0%
	4:A	Freq.	0	3	0	1	1
		%	0%	15%	0%	5%	5%
	5:SA	Freq.	0	0	1	0	0
		%	0%	0%	5%	0%	0%
7. Tap water at home has unusual color	1:SD	Freq.	0	0	0	0	0
		%	0%	0%	0%	0%	0%
	2:D	Freq.	**2**	**3**	**4**	**2**	0
		%	**10 %**	**15%**	**20%**	**10%**	0%
	3:N	Freq.	0	1	2	0	0
		%	0%	5%	10%	0%	0%
	4:A	Freq.	0	1	0	1	1
		%	0%	5%	0%	5%	5%
	5:SA	Freq.	0	1	2	0	0
		%	0%	5%	10%	0%	0%
8. Water filter is installed at home to reduce the unpleasant taste of the tap water	1:SD	Freq.	0	1	0	0	0
		%	0%	5%	0%	0%	0%
	2:D	Freq.	0	1	2	1	0
		%	0%	5%	10%	5%	0%
	3:N	Freq.	1	1	0	1	0
		%	5%	5%	0%	5%	0%
	4:A	Freq.	1	2	4	0	0
		%	5%	10%	20%	0%	0%
	5:SA	Freq.	0	1	2	1	1
		%	0%	5 %	10%	5%	5%
9. Water filter is installed at home to filter the suspended solid found flowing from the tap water	1:SD	Freq.	0	1	0	0	0
		%	0%	5%	0%	0%	0%
	2:D	Freq.	1	1	3	1	0
		%	5%	5%	15%	5%	0%
	3:N	Freq.	0	0	1	0	0
		%	0%	0%	5%	0%	0%
	4:A	Freq.	0	3	0	2	1
		%	0%	15%	0%	10%	5%
	5:SA	Freq.	1	1	4	0	0
		%	5%	5%	20%	0%	0%
	1:SD	Freq.	0	1	0	0	0

10. Water filter is installed at home to reduce the unusual color of the tap water		%	0%	5%	0%	0%	0%
	2:D	Freq.	2	0	3	0	0
		%	10 %	0%	15%	0%	0%
	3:N	Freq.	0	2	1	0	0
		%	0%	10%	5%	0%	0%
	4:A	Freq.	0	2	2	2	1
		%	0%	10%	10%	10%	5%
	5:SA	Freq.	0	1	2	1	0
		%	0%	5%	10%	5%	0%
11. Water filter is installed at home to reduce the unpleasant odor of the tap water	1:SD	Freq.	1	1	2	0	0
		%	5%	5%	10%	0%	0%
	2:D	Freq.	0	0	3	1	0
		%	0%	0%	15%	5%	0%
	3:N	Freq.	1	2	1	1	0
		%	5%	10%	5%	5%	0%
	4:A	Freq.	0	2	2	0	1
		%	0%	10%	10%	0%	5%
	5:SA	Freq.	0	1	0	1	0
		%	0%	5%	0%	5%	0%

Note: 1: SD = strongly disagreed; 2: D = disagreed; 3: N = neither agreed or disagreed; 4. A = Agreed; 5: SA = strongly agreed

From the cross-tab analyses results shown in this study, water services providers like PBA should take caution to the importance of demographic factors like gender and monthly income. It seems that although the paid water users (male and female gender; and those within different monthly income categories) may share similar perception on some water quality issues, they can also differ in opinion on other issues; the differences can be seen even within their own gender or income group.

From what have been presented here, the results seem to support some previous local studies' findings. For example, they are in line with few local studies [10, 13] which show tap water taste as a significant factor in respondent's perception on water quality, while water odor or color were not perceived to be problematic though. However, as the studies did not do any cross tab analysis on gender or income factors, it is unfortunate that this study's results cannot be compared to the other local studies.

4.3 Perceived Health Risk

Table 4 shows simple frequency analysis results for perceived health risk issues. The study found that majority of respondents believed that water should be free of health risk problems (90% agreed and strongly agreed with statement no. 12); indicating the seriousness of the domestic or tap water safety issue to users.

It is interesting to note that although majority believes that their tap water adhered to drinking water standard set by World Health Organization (WHO) and Ministry of Health as per earlier reported, still, many of them perceived that tap water is associated with health risk and believed that it is unsafe for drinking (85% and 70% agreed and strongly agreed respectively). As a result, many opted to buy bottled water for drinking consumption (50% agreed and strongly agreed consuming bottled water for drinking most of the time). It is more interesting to observe that the respondents' admission to be quite divided on whether their households use tap water for drinking purposes most of the time (refer statement 16 and its results that show 50% of respondents strongly disagreed and agreed and another 50% agreed and strongly agreed with the statement; no neutral response given). Similar mixed and spread out responses are found in other statements (refer statements 17 and 18). For statement 17 that explores Penang water users' view on whether they think their tap water is contaminated with dangerous contaminates like lead or arsenic, the study found responses to be mixed and spread out all over the 5-point Likert scale agreement. Although majority of the respondents (45%) were found to respond neutrally to the statement, 30% more responded with either disagreement or strong disagreement; while the rest (25%) either agreed or strongly agreed. In this particular case, it is important to consider the neutral responses as this percentage indicates that there are 45% of respondents who neither agreed nor disagreed with the statement. This neutral response can be disastrous particularly when the respondents' decision to keep quiet means that they believe their tap water does contain dangerous contaminants like lead or arsenic. The result will be more disastrous if this 45% response is added to the 25% respondents who agreed with the statement since the total summation is 70% agreement. With such a high Penang water user's perception percentage on the statement, PBA will surely feel its impact particularly as it affects PBA's water service delivery operation, its water safety image and history water services record.

As for statement 18, the study found that while 40% respondents responded neutrally to the statement: 'I believe the tap water has too much lime scale (white foam)', the samples were found to be quite divided as to whether they agreed or disagreed with the statement (note: 30% were found to either agreed or strongly agreed with the statement while another 30% were either disagreed or strongly disagreed). This finding indicates that water users in Penang may either be really knowledgeable or have no knowledge at all about their tap water quality and safety's condition. On whether tap water has been perceived to be the cause of their household's water borne diseases, 50% of them gave neutral response while another 35% either disagreed or strongly disagreed. Response for 'I think the tap water at home is contaminated with water borne bacteria like E-Coli or other bacteria' (statement 20) provide further support with half of the respondents had either disagreed or strongly disagreed; indicating that respondents perceived that water provided is safe for domestic consumption.

Table 4 Descriptive analysis for perceived health risk

Item statement	Likert scale	Freq.	Percentage%
12. Tap water should be free of health risk problem	1:SD	0	0.0%
	2:D	1	5.0%
	3:N	1	5.0%
	4:A	4	**20.0%**
	5:SA	14	**70.0%**
13. I believe the tap water is associated with health risks	1:SD	0	0.0%
	2:D	2	10.0%
	3:N	1	5.0%
	4:A	10	**50.0%**
	5:SA	7	**35.0%**
14. I believe the tap water at home is unsafe for drinking	1:SD	1	5.0%
	2:D	1	5.0%
	3:N	2	10.0%
	4:A	12	**60.0%**
	5:SA	4	**20.0%**
15. My household consumes bottled water for drinking water most of the time	1:SD	4	20.0%
	2:D	4	20.0%
	3:N	2	10.0%
	4:A	6	**30.0%**
	5:SA	4	**20.0%**
16. My household uses tap water for drinking water purpose most of the time	1:SD	5	25.0%
	2:D	5	25.0%
	3:N	0	0.0%
	4:A	6	**30.0%**
	5:SA	4	**20.0%**
17. I think the tap water is contaminated with dangerous contaminants like lead or arsenic	1:SD	4	20.0%
	2:D	2	10.0%
	3:N	9	**45.0%**
	4:A	4	20.0%
	5:SA	1	5.0%
18. I believe the tap water has too much lime scale (white foam)	1:SD	2	10.0%
	2:D	4	20.0%
	3:N	8	**40.0%**
	4:A	4	20.0%
	5:SA	2	10.0%
19.Tap water has caused water borne illness to me or to someone in my family previously	1:SD	3	15.0%
	2:D	4	20.0%
	3:N	10	**50.0%**
	4:A	1	5.0%
	5:SA	2	10.0%
20. I think the tap water at home is contaminated with water borne bacteria such as E Coli	1:SD	2	**10.0%**
	2:D	8	**40.0%**
	3:N	3	15.0%
	4:A	6	30.0%
	5:SA	1	5.0%

Note: 1: SD = strongly disagreed; 2: D = disagreed; 3: N = neither agreed or disagreed; 4. A = Agreed; 5: SA = strongly agreed

Table 5a displays cross tab analyses results for the 9 item statements as per view of gender groups on perceived health risk. Similar to perceived water quality results, it is observed that there are responses' similarities by both male and female groups, either when they agreed or disagreed with many of the statements explored. Statements no. 12 and 14 provide good examples on agreement similarity between the two groups. In statement no. 12 for instance, respondents were asked on whether they think tap water should be free of health risk problem. The study found that majority from both gender groups strongly agreed (Likert scale - 5) with the statement (25% males and 45% females respectively). As for statement 14, again the results show similarity in the gender response as majority of the male and female groups agreed that tap water provided at their home is unsafe for drinking (30% males and 30% females respectively responded to a Likert scale of 4 (agreed)).

Table 5a Cross tab analysis results for Penang user's perceived health risk according to demographics (gender)

Item statement	Likert scale	Male		Female	
	1-2-3-4-5	Freq.	%	Freq.	%
12. Tap water should be free of health risk problem	1:SD	0	0.0%	0	0.0%
	2:D	1	5.0%	0	0.0%
	3:N	1	5.0%	0	0.0%
	4:A	2	10.0%	2	10.0%
	5:SA	5	**25.0%**	9	**45.0%**
13. I believe the tap water is associated with health risks	1:SD	0	0.0%	0	0.0%
	2:D	1	5.0%	1	5.0%
	3:N	0	0.0%	1	5.0%
	4:A	6	30.0%	4	20.0%
	5:SA	2	10.0%	5	25.0%
14. I believe the tap water at home is unsafe for drinking	1:SD	0	0.0%	1	5.0%
	2:D	1	5.0%	0	0.0%
	3:N	1	5.0%	1	5.0%
	4:A	6	**30.0%**	6	**30.0%**
	5:SA	1	5.0%	3	15.0%
15. My household consumes bottled water for drinking water most of the time	1:SD	0	0.0%	4	**20.0%**
	2:D	2	10.0%	2	10.0%
	3:N	2	10.0%	0	0.0%
	4:A	4	**20.0%**	2	10.0%
	5:SA	2	5.0%	3	15.0%
16. My household uses tap water for drinking water purpose most of the time	1:SD	0	10.0%	3	15.0%
	2:D	3	15.0%	2	10.0%
	3:N	0	0.0%	0	0.0%
	4:A	4	20.0%	2	10.0%
	5:SA	0	0.0%	4	20.0%
17. I think the tap water is contaminated with dangerous contaminants like lead or arsenic	1:SD	2	10.0%	2	10.0%
	2:D	0	0.0%	2	10.0%
	3:N	5	25.0%	4	20.0%
	4:A	2	10.0%	2	10.0%
	5:SA	0	0.0%	1	5.0%
18. I believe the tap water has too much lime scale (white foam)	1:SD	0	0.0%	2	10.0%
	2:D	1	5.0%	3	15.0%
	3:N	5	25.0%	3	15.0%
	4:A	2	10.0%	2	10.0%
	5:SA	1	5.0%	1	5.0%
19. Tap water has caused water borne illness to me or to someone in my family previously	1:SD	2	10.0%	1	5.0%
	2:D	1	5.0%	3	15.0%
	3:N	5	25.0%	5	25.0%
	4:A	0	0.0%	1	5.0%
	5:SA	1	5.0%	1	5.0%
20. I think the tap water at	1:SD	0	0.0%	2	10.0%
	2:D	4	20.0%	4	20.0%

home is contaminated with water borne bacteria e.g.E Coli	3:N	2	10.0%	1	5.0%
	4:A	3	15.0%	3	15.0%
	5:SA	0	0.0%	1	5.0%

Note: 1: SD = strongly disagreed; 2: D = disagreed; 3: N = neither agreed or disagreed; 4. A = Agreed; 5: SA = strongly agreed

Perception differences between the gender groups can be found in some of the responses given to statements explored like for statement 15 that asked if respondents' households consume bottled water for drinking. Perception difference between the groups can be seen as the majority of the female gender strongly disagreed with the statement (20% strongly disagreed; Likert scale - 5) compared to the majority of the male gender who agreed with it instead (20% agreed; Likert scale - 4).

Another cross-tab analysis has been carried out to examine the impact of perceived health risk according to respondents' monthly income. Table 5b shows the results.

In statement no. 12 for instance, respondents were asked on whether they think tap water should be free of health risk problem. The study found that majority of respondents (70%) strongly agreed (Likert scale - 5) with the statement which is clearly represented by all income groups (5% from below RM1500, 25% from RM1500-RM3000, 30% from RM3000-RM6000, and 10% from the RM6000 to RM9000 income groups).

In addition, statement no. 14 asked on whether respondents believe the tap water at home is unsafe for drinking. The results showed that majority (60%) of them agreed with this statement (Likert scale – 4; represented by 5% income below RM1500, 15% between RM1500 to RM3000, 20% between RM3000 to RM6000, 15% between RM6000 to RM9000 and 5% monthly income above RM9000).

Perception differences between the respondents with different monthly income can be found in some of the responses given to statements explored like for statement 15 that asked if respondents' households consume bottled water for drinking. Perception difference between the groups can be seen as 5% of respondents with monthly income below RM1500 disagreed with the statement (Likert scale – 2) while 30% of them (represented by 15% of respondents with monthly income between RM1500 to RM3000, 10% of respondents with monthly income between RM6000 to RM9000 and 5% of respondents with monthly income above RM9000) actually agreed (Likert scale – 4) with this statement.

Overall, the finding that acknowledges the importance of water contamination issue as found in this study seemed to be in line with few local studies [10, 13] findings. In addition, the findings indicate respondents' negative perception about the level of safety for tap water as shown in their responses for statement 14 which must be noted by the water authority. This pilot study has helped to add more data to the local literature by providing data on demographics (gender and income) which the local studies lack for perceived health risk.

These findings indicate that demographic factors like gender and income groups are important for PBA and any other water services providers in the country to take note of as they can provide them with initial insight on water services related issues that the groups consider vital for their satisfaction on tap water provided to their homes.

Table 5b Cross tab analysis results for Penang user's perceived health risk according to demographics (monthly income)

Item statement	Likert scale		Monthly Income				
	1-2-3-4-5		Below RM 1500	RM 1500 to RM	RM 3000 to RM	RM 6000 to RM	above RM 9000
12. Tap water should be free of health risk problem	1:SD	Freq.	0	0	0	0	0
		%	0%	0%	0%	0%	0%
	2:D	Freq.	0	0	0	0	1
		%	0%	0%	0%	0%	5%
	3:N	Freq.	1	0	0	0	0
		%	5%	0%	0%	0%	0%
	4:A	Freq.	0	1	2	1	0
		%	0%	5%	10%	5%	0%
	5:SA	Freq.	**1**	**5**	**6**	**2**	0
		%	**5%**	**25%**	**30%**	**10%**	0%
13. I believe the tap water is associated with health risks	1:SD	Freq.	0	0	0	0	0
		%	0%	0%	0%	0%	0%
	2:D	Freq.	1	0	1	0	0
		%	5%	0%	5%	0%	0%
	3:N	Freq.	0	1	0	0	0
		%	0%	5%	0%	0%	0%
	4:A	Freq.	0	3	3	3	1
		%	0%	15%	15%	15%	5%
	5:SA	Freq.	1	2	4	0	0
		%	5%	10%	20%	0%	0%
14. I believe the tap water at home is unsafe for drinking	1:SD	Freq.	0	0	1	0	0
		%	0%	0%	5%	0%	0%
	2:D	Freq.	1	0	0	0	0
		%	5%	0%	0%	0%	0%
	3:N	Freq.	0	1	1	0	0
		%	0%	5%	5%	0%	0%
	4:A	Freq.	**1**	**3**	**4**	**3**	**1**
		%	**5%**	**15%**	**20%**	**15%**	**5%**
	5:SA	Freq.	0	2	2	0	0
		%	0%	10%	10%	0%	0%
15. My household consumes bottled water for drinking water most of the time	1:SD	Freq.	0	1	2	1	0
		%	0%	5%	10%	5%	0%
	2:D	Freq.	**1**	1	2	0	0
		%	**5%**	5%	10%	0%	0%
	3:N	Freq.	1	0	1	0	0
		%	5%	0%	5%	0%	0%
	4:A	Freq.	0	**3**	0	**2**	**1**
		%	0%	**15%**	0%	**10%**	**5%**
	5:SA	Freq.	0	1	3	0	0
		%	0%	5%	15%	0%	0%
16. My household uses tap water for	1:SD	Freq.	0	2	3	0	0
		%	0%	10%	15%	0%	0%
	2:D	Freq.	1	1	1	2	0
		%	5%	5%	5%	10%	0%

drinking water purpose most of the time	3:N	Freq.	0	0	0	0	0
		%	0%	0%	0%	0%	0%
	4:A	Freq.	1	1	2	1	1
		%	5%	5%	10%	5%	5%
	5:SA	Freq.	0	2	2	0	0
		%	0%	10%	10%	0%	0%
17. I think the tap water is contaminated with dangerous contaminants like lead or arsenic	1:SD	Freq.	0	0	3	0	1
		%	0%	0%	15%	0%	5%
	2:D	Freq.	0	1	1	0	0
		%	0%	5%	5%	0%	0%
	3:N	Freq.	2	2	3	2	0
		%	10 %	10%	15%	10%	0%
	4:A	Freq.	0	3	0	1	0
		%	0%	15%	0%	5%	0%
	5:SA	Freq.	0	0	1	0	0
		%	0%	0%	5%	0%	0%
18. I believe the tap water has too much lime scale (white foam)	1:SD	Freq.	0	0	2	0	0
		%	0%	0%	10%	0%	0%
	2:D	Freq.	0	0	3	1	0
		%	0%	0%	15%	5%	0%
	3:N	Freq.	2	3	1	2	0
		%	10 %	15%	5%	10%	0%
	4:A	Freq.	0	2	1	0	1
		%	0%	10%	5%	0%	5%
	5:SA	Freq.	0	1	1	0	0
		%	0%	5%	5%	0%	0%
19. Tap water has caused water borne illness to me or to someone in my family previously	1:SD	Freq.	0	1	1	1	0
		%	0%	5%	5%	5%	0%
	2:D	Freq.	0	2	2	0	0
		%	0%	10%	10%	0%	0%
	3:N	Freq.	1	3	4	1	1
		%	5%	15%	20%	5%	5%
	4:A	Freq.	0	0	0	1	0
		%	0%	0%	0%	5%	0%
	5:SA	Freq.	1	0	1	0	0
		%	5%	0%	5%	0%	0%
20. I think the tap water at home is contaminated with water borne bacteria e.g.E Coli	1:SD	Freq.	0	0	2	0	0
		%	0%	0%	10%	0%	0%
	2:D	Freq.	1	2	3	1	1
		%	5%	10%	15%	5%	5%
	3:N	Freq.	1	0	2	0	0
		%	5%	0%	10%	0%	0%
	4:A	Freq.	0	4	0	2	0
		%	0%	20%	0%	10%	0%
	5:SA	Freq.	0	0	1	0	0
		%	0%	0%	5%	0%	0%

Note: 1: SD = strongly disagreed; 2: D = disagreed; 3: N = neither agreed or disagreed; 4. A = Agreed; 5: SA = strongly agreed

4.4 Willingness to Pay (WTP)

As for willingness to pay (Table 6), majority of the respondents thinks that the water tariff should remain at the current tariff charged and not be increased at all (75% agreed and strongly agreed), particularly at the current water quality provided to users (55% either disagreed or strongly disagreed that they are willing to pay more for the quality of water that they are provided with at home). They believed that increased tariff should be charged for water wasters instead (65% agreed and strongly agreed). However, they would be willing to pay more if the water quality is improved or if water provided is free from health risk related to water borne disease and contaminants (65% and 55% agreed and strongly agreed respectively).

Similar with perceived water quality and perceived health risk issues that have been analyzed and reported in sections 4.2 and 4.3 earlier, the researchers also analyze other responses that have been given by the respondents on WTP statements explored in this study. In particular to be noted is on results for statement no.22 that explored respondents' opinion on whether they would pay more at the current water quality that is provided to their households. Although only 10% of them chose to stay neutral (Likert scale - 3), in the case that they are forced to choose and in such situation they chose to either agreed or disagreed with the statement, then this would give a total of 65% from the 55% (strongly disagreed and disagreed) found earlier. In short, there will be 65% respondents who are not willing to pay more for their water tariff.

Table 6 Descriptive analysis for willingness to pay (WTP)

Item statement	Likert scale	Freq.	Percentage%
21. Water tariff should remain at the rate it is charged	1:SD	1	5.0%
	2:D	2	10.0%
	3:N	2	10.0%
	4:A	5	**30.0%**
	5:SA	9	**45.0%**
22. I am willing to pay more for water with the current water quality that is provided to my household	1:SD	7	**35.0%**
	2:D	4	**20.0%**
	3:N	2	10.0%
	4:A	4	20.0%
	5:SA	3	15.0%
23. Only water wasters should be charged more compared to other users	1:SD	3	15.0%
	2:D	0	0.0%
	3:N	4	20.0%
	4:A	6	**30.0%**
	5:SA	7	**35.0%**
24. I am willing to pay more for water charges if the current water quality that my household is provided with is improved	1:SD	3	15.0%
	2:D	2	10.0%
	3:N	2	10.0%
	4:A	7	**35.0%**
	5:SA	6	**30.0%**
25. I am willing to pay more for water charges if the water supply to my household is free from health risk	1:SD	2	10.0%
	2:D	3	15.0%
	3:N	4	20.0%
	4:A	5	**25.0%**
	5:SA	6	**30.0%**

Note: 1: SD = strongly disagreed; 2: D = disagreed; 3: N = neither agreed or disagreed; 4. A = Agreed; 5: SA = strongly agreed

Similar note should be given to statement 23 ("Only water wasters should be charged more compared to other users") as the 20% respondents with neutral opinion may give a big impact to the whole finding if their neutrality means that they agreed with the statement which means that 85% of the whole

respondents actually think that only water wasters should be punished rather than the whole water users in the state. Even if the neutral 20% is added to the 15% of those who strongly disagreed or disagreed, then the total of 35% that goes against this statement is still low in comparison to the majority 65% who strongly agreed and agreed with it. The same observation is also made for responses given for statement 25 in this study. Overall, it seems that the neutral opinion of respondents can provide quite a significant impact on the results of issues explored if their response can actually either be constructive or destructive for water provider's intention to increase water tariff.

Results of cross tab analysis on WTP are displayed in Table 7a. The study observed that there are similarities in responses provided by both male and female groups, particularly in their agreement with many of the statements explored. Examples include responses given for statements 21 ('Water tariff should remain at the current state it is charged') and 23 ('Only water wasters should be charged more compared to other users'). In these examples, majority from each gender either strongly agreed or agreed with the statements made (i.e. 40% and 35% for males and females respectively for statement 21; 25% and 40% for males and females respectively for statement 23). Similar observations are seen for statements 24 and 25 (refer results in the table).

Table 7a Cross tab analysis results for Penang user's willingness to pay according to demographics (gender)

Item statement	Likert scale	Male		Female	
	1-2-3-4-5	Freq.	%	Freq.	%
21. Water tariff should remain at the rate it is charged	1:SD	0	0.0%	1	5.0%
	2:D	0	0.0%	2	10.0%
	3:N	1	5.0%	1	5.0%
	4:A	**4**	**20.0%**	**2**	**10.0%**
	5:SA	4	**20.0%**	5	**25.0%**
22. I am willing to pay more for water with the current water quality that is provided to my household	1:SD	4	20.0%	3	15.0%
	2:D	**2**	10.0%	**2**	10.0%
	3:N	1	5.0%	1	5.0%
	4:A	1	5.0%	**3**	15.0%
	5:SA	1	5.0%	2	10.0%
23. Only water wasters should be charged more compared to other users	1:SD	1	5.0%	2	10.0%
	2:D	0	0.0%	0	0.0%
	3:N	3	15.0%	1	5.0%
	4:A	**3**	**15.0%**	3	**15.0%**
	5:SA	2	**10.0%**	5	**25.0%**
24. I am willing to pay more for water charges if the current water quality that my household is provided with is improved	1:SD	1	5.0%	2	10.0%
	2:D	1	5.0%	1	5.0%
	3:N	0	0.0%	2	10.0%
	4:A	4	20.0%	3	15.0%
	5:SA	3	15.0%	3	15.0%
25. I am willing to pay more for water charges if the water supply to my household is free from health risk	1:SD	0	0.0%	2	10.0%
	2:D	3	15.0%	0	0.0%
	3:N	1	5.0%	3	15.0%
	4:A	3	15.0%	2	10.0%
	5:SA	2	10.0%	**4**	20.0%

Note: 1: SD = strongly disagreed; 2: D = disagreed; 3: N = neither agreed or disagreed; 4. A = Agreed; 5: SA = strongly agreed

Another cross-tab analysis has been carried out to examine the impact of willingness to pay according to respondents' monthly income. Table 7b shows the results.

As can be seen, cross-tab analyses results on statement 21 ('Water tariff should remain at the current state it is charged') found majority (45%) strongly agreed (Likert scale - 5) with it which is represented by 5% respondents with monthly income below RM1500, 20% between RM1500 to RM3000, 10% of between RM3000 to RM6000, 5% between RM6000 to RM9000 and 5% above RM9000). Similar observations can be seen for statement 23, 24 and 25.

Table 7b Cross tab analysis results for Penang user's willingness to pay according to demographics (monthly income)

Item statement	Likert scale		Monthly Income				
	1-2-3-4-5		Below RM 1500	RM 1500 to RM	RM 3000 to RM	RM 6000 to RM	above RM 9000
21. Water tariff should remain at the rate it is charged	1:SD	Freq.	0	0	1	0	0
		%	0%	0%	5%	0%	0%
	2:D	Freq.	0	0	1	1	0
		%	0%	0%	5%	5%	0%
	3:N	Freq.	1	1	0	0	0
		%	5%	5%	0%	0%	0%
	4:A	Freq.	0	1	4	1	0
		%	0%	5%	20%	5%	0%
	5:SA	Freq.	**1**	**4**	**2**	**1**	**1**
		%	**5%**	**20%**	**10%**	**5%**	**5%**
22. I am willing to pay more for water with the current water quality that is provided to my household	1:SD	Freq.	1	2	3	1	0
		%	5%	10%	15%	5%	0%
	2:D	Freq.	0	0	3	1	0
		%	0%	0%	15%	5%	0%
	3:N	Freq.	1	1	0	0	0
		%	5%	5%	0%	0%	0%
	4:A	Freq.	0	1	2	1	0
		%	0%	5%	10%	5%	0%
	5:SA	Freq.	0	2	0	0	1
		%	0%	10%	0%	0%	5%
23. Only water wasters should be charged more compared	1:SD	Freq.	1	0	2	0	0
		%	5%	0%	10%	0%	0%
	2:D	Freq.	0	0	0	0	0
		%	0%	0%	0%	0%	0%
	3:N	Freq.	1	0	2	1	0
		%	5%	0%	10%	5%	0%
	4:A	Freq.	0	3	2	1	0
		%	0%	15%	10%	5%	0%

to other users	5:SA	Freq.	0	3	2	1	1
		%	0%	15%	10%	5%	5%
24. I am willing to pay more for water charges if the current water quality that my household is provided with is improved	1:SD	Freq.	1	0	2	0	0
		%	5%	0%	10%	0%	0%
	2:D	Freq.	0	0	1	1	0
		%	0%	0%	5%	5%	0%
	3:N	Freq.	0	2	0	0	0
		%	0%	10%	0%	0%	0%
	4:A	Freq.	1	1	4	1	0
		%	5%	5%	20%	5%	0%
	5:SA	Freq.	0	3	1	1	1
		%	0%	15%	5%	5%	5%
25. I am willing to pay more for water charges if the water supply to my household is free from health risk	1:SD	Freq.	0	0	2	0	0
		%	0%	0%	10%	0%	0%
	2:D	Freq.	1	0	1	1	0
		%	5%	0%	5%	5%	0%
	3:N	Freq.	1	2	0	1	0
		%	5%	10%	0%	5%	0%
	4:A	Freq.	0	1	3	1	0
		%	0%	5%	15%	5%	0%
	5:SA	Freq.	0	3	2	0	1
		%	0%	15%	10%	0%	5%

Note: 1: SD = strongly disagreed; 2: D = disagreed; 3: N = neither agreed or disagreed; 4. A = Agreed; 5: SA = strongly agreed

One important question that is explored in the study concerns how much Penang water users are willing to make sacrifices and pay extra water charges on top of their current water bill (Table 8).

In question number 26, respondents were given a hypothetical situation where they were asked to think about WTP when water services improvements will be made to the current one that they are provided with holding their consumption constant (Q26: How much would you be willing to pay above your actual water bill statement charges to improve the quality of your tap water (additional price)?). As shown in Table 8, the study found that majority choose to pay less than RM5 followed by an increase of between RM5-RM10 (30% followed by 30% respectively). These descriptive findings provide preliminary insight to a possible water tariff increase in the state. The results seem to support previous local studies' findings.[10-13]

Table 8 Descriptive analysis for willingness to pay (WTP) for extra water charges on top of current water bill

Item statement	Likert scale	Freq.	Percentage%
26. How much would you be willing to pay above your actual water bill statement charges to improve the quality of your tap water (additional price)?	Nothing	4	20.0%
	Less than RM5	6	**30.0%**
	RM5 to RM10	6	**30.0%**
	RM11 to RM15	2	10.0%
	RM16 to RM20	1	5.0%
	above RM20	1	5.0%

A comparison made between gender group's responses found a difference in how much each group is willing to pay (Table 9a). Majority of the male group is found to be willing to pay between RM5-RM10 compared to the female group who offered to pay less than RM5. A close inspection on the WTP data also found that the male responses are dispersed within all the six categories listed compared to the female ones that are observed to be contracted within the first four categories. This finding show that male Penang water users to be more open to such tariff increase compared to females who can be seen to be tightfisted. Another comparison based on respondents' monthly income (Table 9b) shows interesting results. The majority of respondents who have monthly income below RM 1500 are willing to pay either nothing (5%) or less than RM5 (5%), while respondents who have monthly income between RM1500 to RM3000 are willing to pay less than RM5 (15%). Respondents who have monthly income between RM3000 to RM6000 are found to be willing to pay between RM5 to RM10 and finally respondents with monthly income above RM9000 are willingness to pay more than RM20 (5%).

Table 9a Cross tab analysis results for willingness to pay (WTP) for extra water charges on top of current water bill according to demographics (gender)

Item statement	Likert scale	Male		Female	
	1-2-3-4-5	Freq.	%	Freq.	%
26. How much would you be willing to pay above your actual water bill statement charges to improve the quality of your tap water (additional price)?	Nothing	2	10.0%	2	10.0%
	Less than RM 5	1	5.0%	**5**	**25.0%**
	RM5 to RM10	3	**15.0%**	3	15.0%
	RM11 to RM15	1	5.0%	1	5.0%
	RM16 to RM20	1	5.0%	0	0.0%
	above RM20	1	5.0%	0	0.0%

Table 9b Cross tab analysis results for willingness to pay (WTP) for extra water charges on top of current water bill according to demographics (monthly income)

Item statement	Likert scale		Monthly Income				
	1-2-3-4-5		Below RM 1500	RM 1500 to RM	RM 3000 to RM	RM 6000 to RM	above RM 9000
26. How much would you be willing to pay above your actual	Nothing	Freq.	1	0	3	0	0
		%	5%	0%	15%	0%	0%
	Less than RM 5	Freq.	1	3	1	1	0
		%	5%	15%	5%	5%	0%
		Freq.	0	2	3	1	0

water bill statement charges to improve the quality of your tap water (additional price)?	RM5 to RM10	%	0%	10 %	15 %	5 %	0%
	RM11 to RM15	Freq.	0	1	1	0	0
		%	0%	5%	5%	0%	0%
	RM16 to RM20	Freq.	0	0	1	0	0
		%	0%	0%	5%	0%	0%
	above RM20	Freq.	0	0	0	0	1
		%	0%	0%	0%	0%	5%

For PBA, these findings imply on the need to be more observant and understanding of their customers. For example, they need to be able to convince female water users in the state on why they should pay more water tariff as they seem to be quite unwilling to pay extra charges for their domestic consumption compared to the male segment. Similarly, they need to convince those earning below RM1500 to do the same. In short, the study findings have somehow shown the importance of demographic factors to help water service providers like PBA to understand their customers better. Any action to be taken in regards to increase of water tariff needs to be planned with much thought and care so that a backlash from the consumer segments will not be experienced.

4.0 CONCLUSION

This study has demonstrated the importance of understanding various factors that influence Penang water users' perceptions on domestic or tap water quality, perceived health risks and their willingness to pay. The analyses made via frequency and cross-tab exercises on data of the pilot study have helped the researchers to have insights on the issues explored. Several conclusions thus can be made from the descriptive results of the pilot study.

One, the users were not that happy with water quality only in terms of taste, suspended solids that should not have come out from the tap but sometimes they do, and chlorine content; however, not for its odor or color.

Two, as for health risk concern, although majority believe that their tap water adhered to the drinking standard set by World Health Organization (WHO), still many perceived that their tap water is associated with health risk and unsafe for drinking, which saw many opted to buy bottled water for their drinking consumption.

Three, in regards to water user's willingness to pay, majority thinks that the tariff should not be increased at all, particularly at the current water quality provided to users.

Four, water users that are segmented through gender provide insight as to the similarities and dissimilarities of their opinions in regards to perceived water quality, perceived health risk and WTP issues explored. The findings provide preliminary insights to scenario that deals with a possible water tariff increase in the state. It is important to note that customers are not willing to pay a hefty price for their water bill. The study has identified that any increment should not be more than RM5 from the current customer's water bill, and that female water users seems to be quite difficult to convince of the possible increase compared to male users.

Five, when water users were segmented through their monthly income, the study conclude that the increase of the monthly income of the respondents will lead to increase their pay Willingness to pay (WTP) for extra water charges on top of current water bill.

The findings and conclusions lead the researchers to make these recommendations to help Penang state strategizes on the willingness to pay issue. PBA in particular, should start planning on how to break the news to Penang's public if the increase is indeed happening. The public might give a better response if the tariff is perceived to be justified. Importantly, this study is only a pilot, hence the findings will not be able to be generalized to a larger population unless the actual study is carried out.

Acknowledgement

The authors acknowledge the research grant provided by the Ministry of Education Malaysia under the Long Term Research Grant Scheme (LRGS) 203/PKT/6726002 and those who have took part and provided us with information for this study.

References

[1] National Water Services Commission (SPAN): Laws of Malaysia,Suruhanjaya Perkhidmatan Air Negara (Act 654) [Online] Available at http://www.span.gov.my/pdf/law/bi/act654_bi_2006.pdf.

[2] National Water Services Commission (SPAN): Laws of Malaysia,Suruhanjaya Perkhidmatan Air Negara (WSIA/Act 655) [Online] Available at http://www.agc.gov.my/Akta/Vol.%2014/Act%20655.pdf.

[3] Abdul Wahid, N., Ahmad, Z. A., & Arshad, R. 2014. Malaysia Water Services Reform Legislative Issues. *Journal of Natural Resources and Development.* 4. doi: 10.5027/jnrd.v4i0.09.

[4] SPAN. 2008. SPAN Business Plan 2008-2010. SPAN. 1-21.

[5] Lee, P. O. 2003. The Water Issue Between Singapore and Malaysia : No Solution In Sight? *Economics and Finance.* 1: 1-40.

[6] Bogale, A., & Urgessa, B. 2012. Households' Willingness to Pay for Improved Rural Water Service Provision: Application of Contingent Valuation Method in Eastern Ethiopia. *Journal of Human Ecology.* 38(2): 145-154.

[7] Abdul Wahid, N., & Abustan, I. 1998. Water Crisis: A Question of Perceived Value?, Annual Bulletin 1998, institution of Engineers Malaysia Perak branch. 24-26.

[8] Abdul Wahid, N., Abustan, I., Abas, Z., & Arshad, R. 2013. Drinking Water for Public Consumption: The Call for a Socio Economic Cost Analysis. *AWER Procedia dvences in Applied Sciences.*

[9] Abdul Wahid, N., Ahmad, Z. A., Arshad, R., Cheong, Y. K., & Abustan, I. 2014. Water Services Reform Issues in Malaysia: A Review – The 1st national Conference on Non-Point Source 2014, Vivatel Hotel, Kuala Lumpur, organised by UTM-UNESCO IHP., April, 2014, Vivatel Hotel, Kuala Lumpur, Malaysia.

[10] Chew, K. H. 2014. Factors Influencing Households' Willingness To Pay For Water In Penang And Perak. Unpublished Master Dissertation. Universiti Sains Malaysia, Malaysia.
[11] Doria, M.F. 2010. Factors Influencing Public Perception of Drinking Water Quality. *Water Policy*. 12: 1-19.
[12] SPAN. 2012b. Water Rates 2012. Retrieved April 8, 2013, from http://www.span.gov.my/index.php?option=com_content &view=article&id=529&Itemid=424&lang=en.
[13] Abdul Wahid, N., & Chew, K. H. 2014. Factors Determining Household Consumer's Willingness to Pay for Water Consumption in Malaysia, *Asian Social Science*. 11(7): 2015 (in-print).
[14] Breidert, C. 2006. *Estimation of Willingness-to-Pay:Theory, Measurement, Application*. Germany: Gabler Edition Wissenschaft.
[15] Jiang, Y., Jin, L., & Lin, T. 2010. *Higher Water Tariffs for Less River Pollution—Evidence from Min River and Fuzhou City, People's Republic Of China.* Philippines.
[16] Genius, M., Hatzaki, E., Kouromichelaki, E., Kouvakis, G., Nikiforaki, S., & Tsagarakis, K. 2008. Evaluating Consumers' Willingness to Pay for Improved Potable Water Quality and Quantity. *Water Resources Management*. 22(12): 1825-1834.
[17] Beaumais, O., Briand, A., Millock, K., & Nauges, C. 2010. What are Households Willing to Pay for Better Tap Water Quality. A Cross-Country Valuation Study, Documents de Travail du Centre d'Economie de la Sorbonne.
[18] Behailu, S., Kume, A., & Desalegn, B. 2012. Household's Willingness to Pay for Improved Water Service: A Case Study in Shebedino District, Southern Ethiopia. *Water and Environment Journal*. 26(3): 429-434.
[19] Cho, Y., Easter, K. W., McCann, L. M. J., & Homans, F. 2005. Are Rural Residents Willing to Pay Enough to Improve Drinking Water Quality? *Journal of the American Water Resources Association*. 41(3): 729-740.
[20] Prüss, A., Kay, D., Fewtrell, L., & Bartram, J. 2002. Estimating the Burden of Disease from Water, Sanitation, and Hygiene at a Global Level. *Environmental Health Perspectives*. 110(5): 537-542.
[21] WHO. 2011. *Guidelines for Drinking-Water Quality*. Fourth Edition. Malta: Gutenberg.
[22] Charrois, J. W. 2010. Private Drinking Water Supplies: Challenges for Public Health. *Canadian Medical Association Journal*. 182(10): 1061-1064.
[23] Jones, A. Q., Dewey, C. E., Dore, K., Majowicz, S. E., McEwen, S. A., David, W. T. Henson, S. J. 2006. Public Perceptions of Drinking Water: A Postal Survey of Residents with Private Water Supplies. 6(94). www.biomedcentral.com/1471-2458/6/94.
[24] Dutta, V., & Verma, N. 2009. Water Pricing, Affordability and Public Choice: An Economic Assessment from a Large Indian Metropolis. *International Journal of Economics and Finance*. 1(2): P238.
[25] Khan, H., Iqbal, F., Saeed, I., & Khan, I. 2010. Estimating Willingness to Pay for Improvements in Drinking Water Quality: Evidence from Peshawar, Northern Pakistan. *J. Environ. Econ*. 1(2): 38-43.
[26] Wendimu, S., & Bekele, W. 2011. Determinants of Individual Willingness to Pay for Quality Water Supply: The Case of Wonji Shoa Sugar Estate, Ethiopia. *Journal of Ecology and the Natural Environment*. 3(15): 474-480.
[27] Olanrewaju, Cecilia, E., Omonona, & Titus, B. 2012. Determinants of Households' Willingness to Pay for Improved Water Supply Service in Kosofe Local Government Area of Lagos State. *Continental J. Sustainable Development*. 3(3): 20-31.
[28] Nunnally, J. C. 1978. *Psychometric Theory*. 2nd ed. New York: McGraw-Hill.
[29] Hertzog, M. A. 2008. Considerations in Determining Sample Size for Pilot Studies. *Research in Nursing and Health*. 31(2): 180-191.
[30] Julios, S. A. 2005. Sample Size of 12 Per Group Rule of Thumb for a Pilot Study. *Pharmaceutical Statistics*. 4(4): 287-291.
[31] Van Belle, G. 2002. *Statistical Rules of Thumb*. New York: Wiley.
[32] Lema, Z., & Beyene, F. 2012. Valuation. *Journal of Economics and Sustainable Development*. 3(14): 145-159.