Public Awareness of Drinking Water Safety and Contamination Issues in Selangor: A Case Study Among Non-university Malaysians

Kumar Krishnan [1*] iD , Chee Kong Yap [2*] iD , Tze Yik Austin Hew [3] iD , Jia Ming Chew [4] iD ,

Yoshifumi Horie [5] iD , Meng Chuan Ong [6] iD , Ahmad Dwi Setyawan [7] iD , Wan Hee Cheng [8] iD

[1*] Associate Professor, Faculty of Health and Life Sciences, INTI International University, Persiaran Perdana BBN, Negeri Sembilan, Malaysia. E-mail: kumar.krishnan@newinti.edu.my

[2*] Professor, Faculty of Science, Department of Biology, University Putra Malaysia, Selangor, Malaysia. E-mail: yapchee@upm.edu.my

[3] Faculty of Science, Department of Biology, University Putra Malaysia, Selangor, Malaysia. E-mail: 205533@student.upm.edu.my

[4] Faculty of Science, Department of Biology, University Putra Malaysia, Selangor, Malaysia. E-mail: gs65172@student.upm.edu.my

[5] Associate Professor, Faculty of Maritime Science, Graduate School of Maritime Sciences, Kobe University, Japan.
E-mail: horie@people.kobe-u.ac.jp

[6] Associate Professor, Faculty of Science and Marine Environment, University Malaysia Terengganu, Terengganu, Malaysia; Ocean Pollution and Ecotoxicology (OPEC) Research Group, University Malaysia Terengganu, Terengganu, Malaysia. E-mail: ong@umt.edu.my

[7] Professor, Department of Environmental Science, Faculty of Mathematics and Natural Sciences, Universitas Sebelas Maret. Jl. Ir. Central Java, Indonesia; Biodiversity Research Group, Universitas Sebelas Maret. Jl. Ir. Central Java, Indonesia. E-mail: ahmad@staff.uns.ac.id

*Corresponding Author: Kumar Krishnan; Chee Kong Yap, E-mail: kumar.krishnan@newinti.edu.my; yapchee@upm.edu.my

[8] Faculty of Health and Life Sciences, INTI International University, Persiaran Perdana BBN, Negeri Sembilan, Malaysia. E-mail: wanhee.cheng@newinti.edu.my

Abstract

This case study aims to assess public awareness of drinking water safety and water contamination incidents in Selangor among non-student individuals at Universiti Putra Malaysia (UPM), with a total of 247 respondents. From 247 respondents, the majority of the respondents' age is around 20 until 34 years old and mostly female which is 63.2% compared to males which are only 36.8%. Most of the respondents are bachelor's degree holders which are 62.8%. The respondents with a science background are 51.8%. The majority of the respondents' income is below RM 3000 which is 38.9%. The number of Malay respondents is the highest compared to another ethnicity which is 86.2%. We evaluated public satisfaction with the quality of drinking water, their level of trust in its safety, and their awareness of water-related problems and potential alternatives. The study revealed that 31.2% of participants expressed strong confidence in the safety of their drinking water. A significant majority (80.2%) prioritized concerns about water quality and contamination events, focusing on risks to human health, the scale of impact, and underlying causes of such incidents. Notably, 30.4% of respondents addressed water quality issues independently, with only a small fraction escalating complaints to health authorities or local helplines. While age and gender showed no substantial link to public awareness of water pollution, rural residents reported greater satisfaction with their drinking water and heightened awareness of contamination risks compared to non-rural populations. Additionally, individuals with higher educational attainment tended to prioritize water quality concerns and pollution incidents more than those with less formal education.

Keywords:

Article history:

Introduction

The availability of safe and good-quality drinking water has a substantial impact on the general population's health (Ismai & Al-Kellabi, 2025). Unfortunately, in many developing countries, the quality of drinking water is unsafe and unsatisfactory, resulting in a range of water-contaminated infections (Li & Wu, 2019; Latif et al., 2024). Malaysia experiences water crises and water quality issues despite various water sources, frequent rainfall, and government efforts (Aini et al., 2007). According to (de França Doria et al., 2009), government efforts alone are not sufficient; the general population must also play an important part in successful water management. This study hypothesizes that higher public awareness and knowledge about drinking water safety will positively influence satisfaction with water quality and trust in water safety measures (Dziurakh et al., 2024). The World Health Organization (WHO) has included public acceptability of drinking water in their drinking water quality guidelines (WHO, 2011). As a result, the level of awareness and understanding that the public has of the safety of drinking water and water contamination incidents is important in water management (Mahler et al., 2015). To involve the public in environmental concerns, appropriate public

knowledge and comprehension must be created (Hoedjes,2014; de França Doria, 2010). A study from the European Economic Agency (2016) has shown that raising public knowledge and comprehension of environmental issues is critical to the effectiveness of pollution control (Kulkarni et al., 2024). The public's understanding of drinking water safety would also contribute to increased water treatments in households, the selection of water sources, and the avoidance of contaminated water incidents (Wright et al., 2012; (Zafarmand, 2016).

Several studies on drinking water quality in Malaysia have been conducted; for example, a case study by Aini et al. (2007) evaluated Malaysian households' drinking water practices and found that a majority of respondents gave low ratings for the quality of water that was supplied to their houses, with 70% of the respondents rating the water quality as poor and 16% rating it very poor (Radhakrishnan Satish et al., 2024). A study by Praveena et al. (2018) in Seri Kembangan evaluated the public health concerns of drinking water from vending machines. In this study by Praveena et al. (2018), E. coli contamination was found in the water samples that the public was not aware of, and in relation to the lack of awareness of drinking water quality, 53.7% of the public had a good perception of their drinking water from the vending machines. In Pasir Mas, Kelantan, Ab Razak et al. (2016) conducted a study to evaluate the drinking water quality along with the public's knowledge, attitude, and practice towards it. Ab Razak et al. (2016) observed that public awareness, attitude, and practice in the population were nearly comparable, with 80% of the population having excellent knowledge and practice and 93% of the population agreeing with a less favourable attitude towards their drinking water sources. All three studies found that perception of quality, satisfaction with services, and selection of water sources were crucial in assessing public knowledge of drinking water quality and contaminated water accidents (Basu et al., 2024). A better understanding of the influences of public awareness regarding drinking water safety helps improve water management and systems, as well as the treatment of water contamination accidents. Doria (2009) suggested that a complex combination of various elements, such as water taste, odour, clarity, socioeconomic variables, demographic factors, water treatment, the geographical region in the supply system, and local media representation, influence awareness of water quality and related public health concerns. Current research on public knowledge of drinking water safety focuses mostly on bottled water, municipal water, and recycled water consumption. As a result, minimal studies on the relationship between public knowledge and a reduction in drinking water accidents have been conducted. (Rhodes Pump Services Inc., 2019)

The case study in Selangor, Malaysia, offers a fascinating insight into the dynamic relationship between urbanisation, water resources, and climate (Zafarmand et al., 2016; Abdullah et al., 2020). Selangor, located in the western part of Peninsular Malaysia, is one of the most populous and economically vibrant states in the country (Vinusha et al., 2024). Its water supply heavily relies on several key sources, including the Selangor River, the Klang River, and groundwater reservoirs. However, this region faces significant challenges related to water scarcity, especially during the dry season when rainfall is scarce. The growing population, rapid urbanisation, and changing climate patterns have put immense pressure on Selangor's water

resources, necessitating innovative water management strategies and conservation efforts to ensure a sustainable and resilient future for its residents. The purpose of this study was to analyse the public, consisting of non-students of UPM, in terms of their awareness, knowledge, and attitudes towards the safety of their drinking water and the occurrence of water contamination accidents in Selangor. The outcomes of this study will help reduce contamination in drinking water and improve water management, particularly in terms of public participation.

Materials and Methods

Development of Questionnaires

A previously developed questionnaire from Wang et al. (2018) was updated and expanded to meet the above-mentioned study aims. The survey was distributed randomly using social media platforms (Instagram, Facebook, and Twitter) to reach as many participants as possible. Additionally, in-person distribution was conducted in selected locations in Selangor, including Cheras, Hulu Langat, Kajang, Shah Alam, Cyberjaya, Kuala Selangor, Gombak, and Klang. The questionnaire was open to the public and distributed from November 9, 2021, to November 29, 2021. The questions were aimed at eliciting data on the public's attitudes, knowledge, and behaviours about water contamination events and drinking water safety in Selangor from non-Universiti Putra Malaysia (UPM) students. Multiple-choice questions and Likert scale questions ranged from 1 = "very satisfied" to 4 = "dissatisfied" and 5 = "no answer." The researchers divided the questionnaire into three sections: social demographics (six questions), awareness about drinking water safety (six questions covering various aspects such as the type of primary source of drinking water, attention to water quality, satisfaction with water quality, degree of confidence in drinkable water safety, the problem of tap water quality and its solution, and general understanding about public water quality), and awareness about water quality. This questionnaire has a total of 12 questions. The appendix contains the primary questions.

The six questions elicited replies on respondents' sociodemographic characteristics and inquired about their age group, gender, education level, education background, family income, and ethnicity (section A, questions 1 to 6). One type of Likert-scale question about awareness of the public quality of drinking water, ranging from 1 = "special attention" to 4 = "not concern" and range 5 = "no answer," was provided to add variation to the respondent answer (section B, question 2). There is one type of Likert-scale question about satisfaction with drinking water quality, ranging from 1 = "very satisfied" to 4 = "dissatisfied" and 5 = "no answer" (section B, question 3). Additionally, there are three additional Likert-scale questions concerning one's level of faith in drinking water safety, concerns about drinking water quality, and awareness of water contamination occurrences (section B, questions 4, 5, and 8). The multiple-choice question asked respondents about the type of main source of drinking water (section B, question 1), the problem about drinking water and the solution (section B, question 6), factors affecting drinking water quality (section B, question 7), awareness of water pollution and the information source (section B, questions 9 and 10), the emergency response to solve the water pollution accidents, and the steps to prevent the accidents (section B, questions 11 and 12).

Data collection

Researchers conducted an online survey among Selangor citizens. To gauge awareness of water safety and pollution concerns, the questionnaire was distributed through randomized outreach on social media (Instagram, Facebook, and Twitter), prioritizing Selangor's population for wider citizen engagement. Secondly, distribution was done by meeting in person among the citizens in selected places in Selangor, including Cheras, Hulu Langat, Kajang, Shah Alam, Cyberjaya, Kuala Selangor, Gombak, and Klang, as shown in Figure 1.
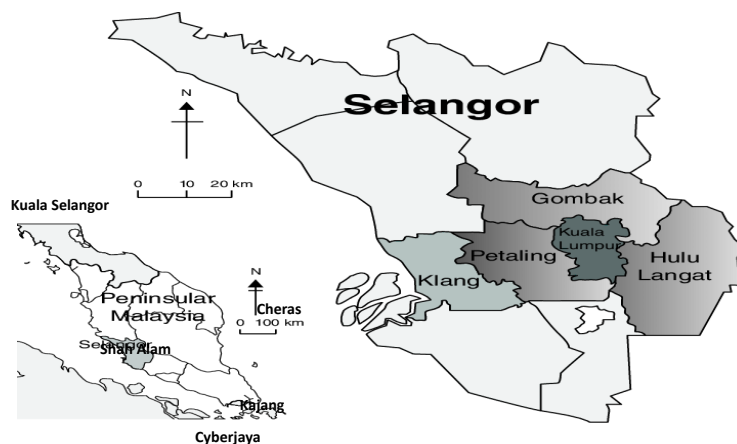

Figure 1. Survey locations at selangor, malaysia

This questionnaire consists of 12 questions covering the source of drinking water, quality satisfaction, problems with tap water, problems with drinking water, and water pollution (Table 1.). This questionnaire only needs to be filled out by people in the age range of 18 to 60. Universiti Putra Malaysia students were excluded from the data collection to justify the target group's decision to exclude UPM students. The questionnaire was open to the public and distributed to respondents from November 9, 2021, to November 29, 2021. Descriptive statistics were used to analyze the data, including frequencies and percentages for demographic variables and public awareness measures. The Likert scale responses were analyzed to determine levels of satisfaction, trust, and awareness. The sample size of 247 respondents may limit the generalizability of the findings to the larger population. Future studies should consider a larger and more diverse sample to enhance the representativeness of the results.

Results and Discussion

We distributed the online survey to approximately 300 residents of Selangor (non-UPM students) and obtained 247 responses. Table 1 shows the demographic composition of all respondents. The demographic profile of the study sample is characterised by a predominant age group of 20–34 years (81.8%), with a smaller percentage of individuals aged 35–50 (7.7%) and those under 20 (8.9%). The majority of respondents were female (63.2%), Malay (86.2%), aged 20-34 years (81.8%), and held a bachelor's degree (62.8%). These

demographic factors may influence the respondents' awareness and perception of water safety. The majority of participants have attained a bachelor's degree (62.8%), while a smaller proportion hold a master's degree (7.3%), and only a minimal percentage have a PhD (0.4%). A significant portion falls into the "other" category for education level (29.6%). When it comes to the type of education, science-related fields are more prevalent (51.8%) than non-science disciplines (33.6%), with a minority belonging to other categories (14.6%). Family income levels are diverse, with the largest group earning less than RM3000 (38.9%), followed by RM3000-RM6000 (28.3%), RM6000-RM9000 (11.7%), RM9000-RM12000 (11.3%), and over RM12000 (9.7%). In terms of ethnicity, the majority identify as Malay (86.2%), followed by Chinese (10.1%), Indians (1.2%), and others (2.4%).

Table 1. Demographic composition of respondents.

	Total	
	Number	%
Age		
>50	4	1.6%
35-50	19	7.7%
20-34	202	81.8%
<20	22	8.9%
Gender		
Male	91	36.8%
Female	156	63.2%
Education level		
Bachelor	155	62.8%
Master	18	7.3%
PhD	1	0.4%
Other	73	29.6%
Type of Education		
Science	128	51.8%
Non-science	83	33.6%
Others	36	14.6%
Family Income		
<RM3000	96	38.9%
RM3000-RM6000	70	28.3%
RM6000-RM9000	29	11.7%
RM9000-RM12000	28	11.3%
>RM12000	24	9.7%
Ethnicity		
Malay	213	86.2%
Chinese	25	10.1%
Indian	3	1.2%
Others	6	2.4%

The majority of those who responded were female (63.2%), came from Malay ethnicity, with age groups of 20–34 years old, and had a science background (51.8%) holding a bachelor degree. The respondents

predominantly come from families with incomes of less than RM3,000 per month. In a study by Smith (2008), women are more likely to take part in an online survey when compared to men because they have high empathy or emotional closeness, which makes answering the surveys easier. Furthermore, women tend to answer the surveys because women naturally love to take part in communication and information exchange, while men are more likely to participate in an activity of information seeking. The comparison of demographic composition between the present study and Hainan's study is also presented in Table 2. The study yielded intriguing insights into the demographic distribution of its respondents. The data revealed a noteworthy gender discrepancy, with a substantial 63.2% of the participants identifying as female. This finding underscores the significance of gender representation in the context of the study's focus. Furthermore, the research delved into specific geographic regions, providing a case study in Selangor that demonstrated a 59.3% participation rate and another case study in Hainan Province. These regional variations suggest the potential influence of local factors on respondent engagement and highlight the importance of considering diverse geographical contexts in the interpretation of the study's results.

Table 2. Results of HM and HM for masking effect

	Percentage	
	A case study in Selangor	A case study in Hainan Province
Age		
>50	1.6%	17.6%
35-50	7.7%	39.8%
20-34	81.8%	39.5%
<20	8.9%	3.2%
Gender		
Male	36.8%	40.7%
Female	63.2%	59.3%
Education level		
Bachelor	62.8%	-
Master	7.3%	-
PhD	0.4%	-
Other	29.6%	-
Bachelor and above	-	18.0%
College	-	27.3%
High school	-	38.0%
Middle school	-	13.9%
Primary school	-	2.7%

Table 3. shows the public awareness of 247 respondents who have responded to the question asked in the questionnaire given to them. It showed that 65.6% of respondents use filtered tap water, while 15.8%

use regular tap water. Public attention to water quality is high, with 40.5% paying special attention and 39.7% paying comparatively high attention. However, 16.6% pay little attention, indicating a need for increased awareness campaigns and education about the significance of water quality. Fortunately, only a small 2.4% claim not to be concerned at all, and just 0.8% chose not to provide an answer, suggesting that the majority of the population acknowledges the importance of preserving and maintaining water quality for both human health and the environment.

The level of public satisfaction with drinking water quality reveals a mixed sentiment among the population. A noteworthy 23.1% of individuals express being very satisfied with the quality of their drinking water, indicating a high level of contentment and confidence in their local water supply. Additionally, a substantial 58.3% of respondents are relatively satisfied with their drinking water quality, while 31.2% are confident in the safety of their drinking water. However, 18.6% are somewhat worried, and 1.6% are extremely worried, highlighting areas for improvement in water safety measures. However, it is essential to address the 14.2% who are less satisfied, signalling room for improvement in certain areas to meet their expectations. Fortunately, the percentage of dissatisfied people is relatively low, with only 3.2% expressing dissatisfaction with their drinking water quality. A small fraction of 1.2% chose not to provide an answer, suggesting that the majority of the population has some level of opinion about the quality of their drinking water. These findings underscore the importance of ongoing efforts to maintain and enhance water quality to meet the diverse needs and expectations of the public.

The level of public trust in their drinking water's safety reveals a generally positive outlook. A notable 31.2% of respondents expressed confidence in the safety of their drinking water, indicating a high degree of trust in their local water supply systems. Furthermore, 47.8% report feeling relatively confident, suggesting a significant proportion of the population holds a positive perception regarding water safety. While 18.6% admit to being somewhat worried, this percentage is relatively modest, indicating that the majority of respondents have a favourable perception of their drinking water's safety. Only a small 1.6% are extremely worried, and 0.8% chose not to provide an answer, underscoring the overall trust in the safety measures in place to ensure clean and reliable drinking water for the community.

The level of awareness about tap water-related problems varied across participants. A significant portion, 31.2%, claim to have never encountered any issues with their tap water, indicating a relatively trouble-free experience. In contrast, a majority of 51.8% report having occasional problems that occur once or twice a year, suggesting that intermittent water issues affect a substantial portion of the population. However, a smaller 10.9% mention facing frequent problems, highlighting the need for improved water infrastructure and maintenance in certain areas. A mere 4.9% state they always have problems with their tap water, signifying a more persistent concern. Finally, 1.2% chose not to provide an answer, emphasising the importance of addressing and resolving these issues to ensure access to safe and reliable tap water for all.

When problems arise with drinking water, the responses of individuals vary, showcasing a range of approaches. A significant portion, at 30.4%, choose to address and resolve these issues independently, demonstrating self-reliance in handling water-related concerns. An equal 30.4% seek assistance from their local water utility, indicating a reliance on professional help to rectify drinking water problems. Additionally, 19.8% turn to their residential property maintenance staff for support, while 8.9% opt to report issues to the local department of health, emphasising the importance of regulatory oversight in ensuring water quality. A smaller yet notable 10.5% utilise the local government telephone hotline to seek help, underscoring the accessibility of municipal resources for addressing drinking water concerns. These diverse approaches reflect the multifaceted nature of problem-solving when it comes to ensuring safe and clean drinking water for communities.

Public knowledge about the factors contributing to water pollution varies, with 36% recognising river pollution as a significant factor. Additionally, 44.9% attribute water pollution to maintenance problems, indicating a concern about infrastructure and upkeep. Only 4% identify rainfall as a contributing factor, and 8.9% identify high chlorine levels as a potential issue. There is also a segment of 6.1% who admit they do not know the key factors involved in water pollution. Raising awareness and education about these factors is essential to effectively addressing and mitigating water pollution.

Public awareness of water pollution events reported by the media shows varying degrees of attention, with 31.2% paying high attention and a significant 40.5% showing considerable interest in these events. However, 24.7% of the population pays little attention to such reports, and 2% remain completely unaware of them. It's worth noting that 1.6% chose not to provide an answer. Among the types of water pollution events that capture public attention, river pollution leads with 53.4%, followed by water supply pollution at 36.4%. Coastal pollution and lake pollution garner comparatively lower levels of attention at 4.9% and 2.8%, respectively. Public awareness of water pollution accidents recognizes the causes at 56.7%, the location at 21.5%, and those responsible at 19.4%. At 1.6%, economic loss is a lesser concern, with 0.8% admitting they do not know. In response to drinking water contamination accidents, various authorities play a role, with the Selangor water department (40.1%) and environmental pollution department (29.1%) being prominent. The health department (12.6%), the department of irrigation and drainage (13.4%), and the Ministry of Housing and Local Government (4.9%) also contribute to emergency response efforts. To prevent water pollution accidents, strengthening laws and regulations is seen as the primary measure by 44.9%, followed by resource management at 27.9% and enhancing public awareness at 24.7%, while 2.4% expressed uncertainty about preventive measures. These findings highlight the importance of both public awareness and regulatory actions in addressing water pollution concerns.

Table 3. Public awareness of respondents

	Number	Percent (%)
Main source of drinking water		
Regular tap water	39	15.8
Filtered tap water	162	65.6
Barreled or bottled water	32	13
Well water	3	1.2
Spring water	4	1.6
Others	7	2.8
Public attention of water quality		
Special attention	100	40.5
Comparatively high attention	98	39.7
Little attention	41	16.6
Not concerned	6	2.4
No answer	2	0.8
The degree of public satisfaction with drinking water quality		
Very satisfied	57	23.1
Relatively satisfied	144	58.3
Less satisfied	35	14.2
Dissatisfied	8	3.2
No answer	3	1.2
The degree of public trust in the safety of drinking water		
Confident	77	31.2
Relatively confident	118	47.8
Somewhat worried	46	18.6
Extremely worried	4	1.6
No answer	2	0.8
Public awareness of problems with their tap water		
Never had problems	77	31.2
Had problems once or twice a year	128	51.8
Had problems frequently	27	10.9
Always had problems	12	4.9
No answer	3	1.2
The measures taken to solve problems that arise with drinking water		
Solve problems by themselves	75	30.4
Help by local water utility	75	30.4
Complain to the local department of health	22	8.9
Help by the residential property maintenance staff	49	19.8
Call the local government telephone hotline for help	26	10.5
Public knowledge about factors of water pollution		
River pollution	89	36
Rainfall factor	10	4
Maintenance problem	111	44.9
High chlorine level	22	8.9

Do not know	15	6.1
Public awareness of water pollution events reported by media		
High attention	77	31.2
Considerable attention	100	40.5
Little attention	61	24.7
No attention	5	2
No answer	4	1.6
Type of water pollution event that public pay attention to		
River pollution	132	53.4
Lake pollution	7	2.8
Coastal pollution	12	4.9
Water supply pollution	90	36.4
No answer	6	2.4
Public awareness of water pollution accidents		
Location	53	21.5
Causes	140	56.7
People responsible	48	19.4
Economic loss	4	1.6
Do not know	2	0.8
Emergency response provider during drinking water contamination accidents		
Health department	31	12.6
Environmental pollution department	72	29.1
Selangor water department	99	40.1
Ministry of Housing and Local Government	12	4.9
Department of Irrigation and Drainage	33	13.4
Main measures to prevent water pollution accident		
Resource management	69	27.9
Enhance public awareness	61	24.7
Strengthen laws and regulations	111	44.9
Do not know	6	2.4

Table 4. shows the comparison between two different cases that involved a case study among non-UPM students in Selangor, Malaysia, and a case study in Hainan Province, China, on public awareness of drinking water safety. In a comparative study between Selangor, Malaysia, and Hainan Province, China, regarding the main sources of drinking water, some intriguing differences emerge. While in Selangor, well water accounts for only 1.2%, with spring water and other sources also low, 65.6% rely on filtered tap water. In contrast, Hainan province sees a substantial 70.7% of its population using regular tap water, with 13% opting for barreled or bottled water. Interestingly, public attention to water quality is notably higher in China, where 56.1% express comparatively high attention compared to Selangor's 39.7%. Public satisfaction with drinking water quality, however, is fairly similar, with the majority in both regions expressing relative satisfaction. When it comes to trust in water safety, Hainan residents seem more concerned, with 42.2% somewhat worried or extremely worried, whereas Selangor has a higher percentage of relatively confident individuals at 47.8%. Regarding problems with tap water, Selangor's residents face them more frequently,

with 10.9% having problems frequently, compared to Hainan's 4.4%. The measures taken to address these issues also vary, with more Selangor residents solving problems by themselves (52.4%), while Hainan residents tend to call their local health department (42.2%). These findings reflect differences in water infrastructure, awareness, and public trust between the two regions.

Table 4. Comparison of statistical analysis on public awareness of drinking water safety between case study in Selangor, Malaysia among non-UPM students and case study in Hainan province, China.

	Case study in Selangor, Malaysia (Among non-UPM students)	Case study in Hainan province, China
	Percentage (%)	
Main source of drinking water		
Well water	1.2	22.8
Spring water	1.6	1.1
Others	2.8	0.2
Barreled or bottled water	13	5.2
Regular tap water	15.8	70.7
Filtered tap water	65.6	
Public attention of water quality		
No answer	0.8	4.9
Not concerned	2.4	16.3
Little attention	16.6	
Comparatively high attention	39.7	56.1
Special attention	40.5	22.7
The degree of public satisfaction with drinking water quality		
No answer	1.2	1.5
Dissatisfied	3.2	18.3
Less satisfied	14.2	
Relatively satisfied	58.3	59.8
Very satisfied	23.1	20.5
The degree of public trust in the safety of drinking water		
No answer	0.8	0.7
Extremely worried	1.6	42.2
Somewhat worried	18.6	34.9
Relatively confident	47.8	42.2
Confident	31.2	17.1
Public awareness of problems with their tap water		
No answer	1.2	6.8
Always had problems	4.9	
Had problems frequently	10.9	4.4
Had problems once or twice a year	51.8	25.9
Never had problems	31.2	62.9
The measures taken to solve problems that arise with drinking water		
Complain to the local department of health	8.9	42.2

Call the local government telephone hotline for help	10.5	1.8
Help by the residential property maintenance staff	19.8	17.3
Solve problems by themselves	30.4	52.4
Help by local water utility	30.4	21.9

The main sources of drinking water identified in the present survey are presented in Figure 1. From the survey, results from Figure 2 showed that the main source of water among the respondents was filtered tap water (65.60%). The sources are then followed by regular tap water (15.80%) and barreled or bottled water (13%). The consumption of spring waters, well water, and others is relatively small, at 1.6%, 1.2%, and 2.8%, respectively. The majority of the respondents main sources of drinking water are filtered tap water (65.60%) that is purified by either reverse osmosis, distillation, or ion exchange, which is safe to drink (Smith, 2021). The most important sources of drinking water among the respondents were followed by regular tap water (15.60%) and bottled water (13%). Drinking water straight from tap water in Malaysia is not safe and not recommended, as tap water in Malaysia mostly has a bad smell and taste and has high chlorine added to water supplies to help lower the chance of bacteria spreading through the water supply. It is advisable to boil tap water before drinking (Annua et al., 2020). Barrelled or bottled water also has a high percentage among the students (13%) and is safe to drink, as all the manufacturers of bottled water have to ensure their bottled water is sanitary under the Food and Drug Administration (FDA) (Leonard J, 2020;Basu & Muthukrishnan, 2024).
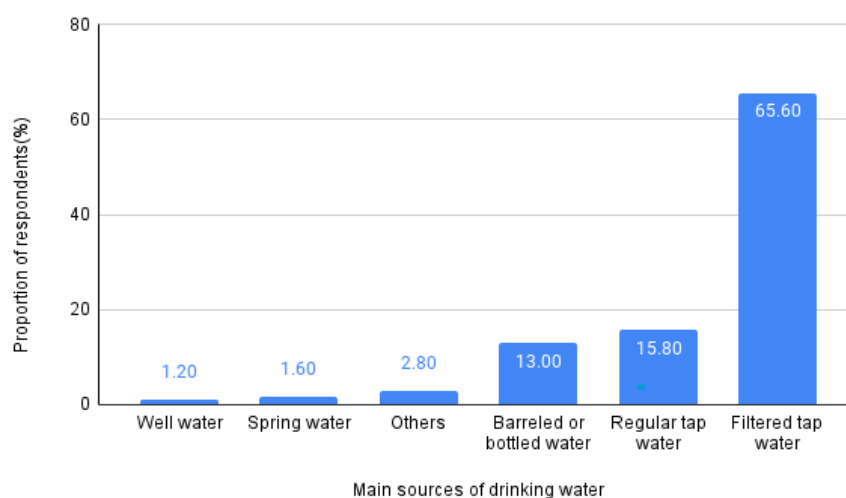

Figure 2. Main sources of drinking water

From Figure 3, results from surveys about respondents' attention to drinking water quality in the area showed that 40.5% of students give special consideration to the drinking quality of water, 39.7% give high attention, 16.6% give little attention, 2.4% are not concerned, and 0.8% are not answering the question. From the data, respondents were predominantly given that drinking water quality is a priority, as poor-quality water can have a negative effect on human health. Drinking water that is contaminated with polluted substances such as bacteria, viruses, or inorganic matter can cause major health problems that can be fatal. Examples of

diseases that are related to drinking water are hepatitis A and norovirus. Therefore, high attention to water quality is a must, and from this result, the majority of the respondents give attention to the water quality, which is good for illness prevention (Rhodes, 2019; (Basu & Muthukrishnan, 2024). Also, high attention to water quality is good, as it can help water users know that their water pipe network and their water sources are in good condition.
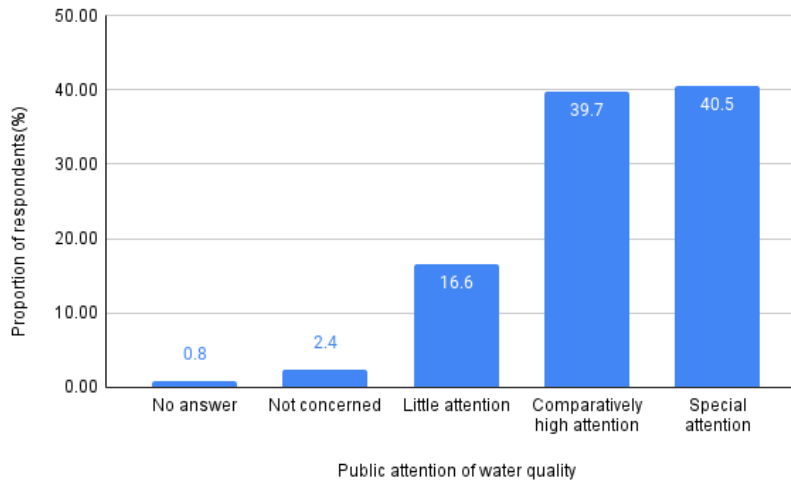

Figure 3. Public attention of water quality

The level of public satisfaction with drinking water quality is illustrated in Figure 4. A majority of respondents (58.3%) expressed moderate satisfaction, while 23.1% reported being highly satisfied. Conversely, 14.2% indicated lower satisfaction, and 3.2% were dissatisfied with the quality of their drinking water. Majority of the respondents were satisfied with their water quality. There are many factors regarding the satisfaction of water quality which are the odor of the water, taste and color. Filtered tap water usually used sediment and carbon blocks to help remove the taste and odor of water traveling through the piping system. The filters are able to block out debris or elements in the water and hence produce the tasteless, odorless clean water. While unfiltered tap water does not have the ability to filter out the debris or unwanted elements in the water. Hence, the old piping systems that deliver the water can make the water unpleasant to drink due to rusting and poor maintenance of the systems (Compeer, 2019). Drinking water from wells and spring water might also have a probability that the water has an odor and bad taste as it is an unfiltered source of water. Barreled/bottled water may not have any problem with the odor, taste and sediments since the manufacturers need to make sure their bottled water is safe to drink under standards of FDA. Hence, it is rare to have odor or contamination of foreign matter in water bottled/barreled (Leonard J, 2020).
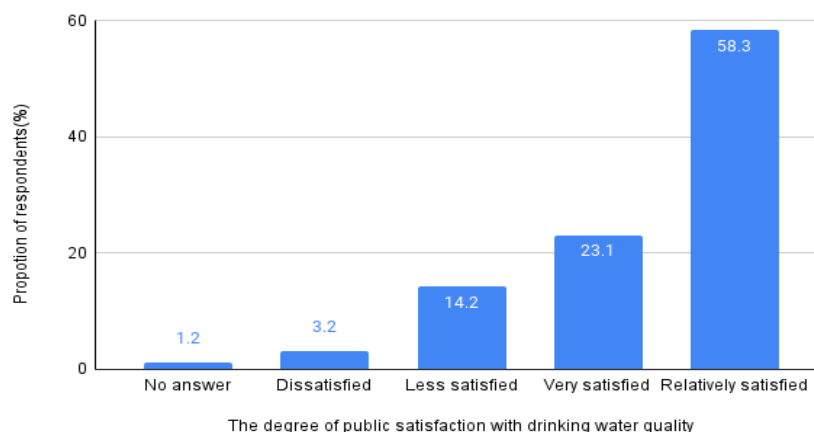
Figure 4. The public's satisfaction level concerning the quality of drinking water

Figure 5. summarizes the findings regarding the degree of public trust in the safety of drinking water. Results of the public trust in the safety of drinking water quality survey show that most respondents reported that they are confident (31.2%) or relatively confident (47.8%) in the safety of their drinking water quality. However, the number of respondents who were slightly concerned about the safety of drinking water was rather lower (18.6%), and some residents are extremely worried (1.6%) about the safety of their drinking water. These results may be due to the demographic factors, in which most of the respondents consist of youngsters whoare aware of the water quality in Selangor.
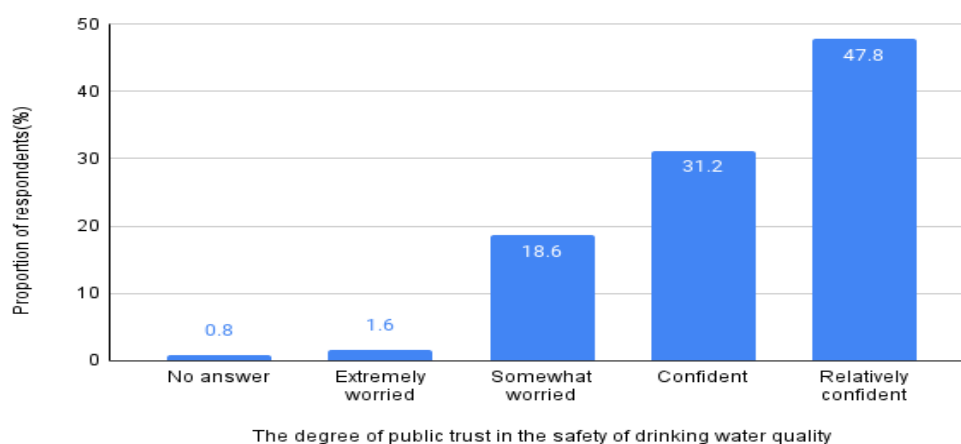
Figure 5. The degree of public reliance on the safety of drinking water quality

The present results also demonstrate that most residents in Selangor will face problems with their tap water once or twice a year (51.8%), and some face them frequently (10.9%). Only 31.2% of the respondents never had problems with their tap water, and a small proportion of them (4.9%) always face them (Figure 6). As shown in Graph 1, the main source of drinking water among the respondents is filtered tap water (65.60%), and they still encounter problems once or twice a year due to water shortages and water quality. According

to Rosen (1966), in assessing drinking water, the problem that typically arises is because of odours in the water. A previous study claimed that the consumption of filtered tap water is more related to sensory matters such as foul smell and taste (Levallois et al., 1999, Smith M, 2021). According to this study, most people purchase filtered tap water systems to remove lime from the water and to get rid of taste and smell.
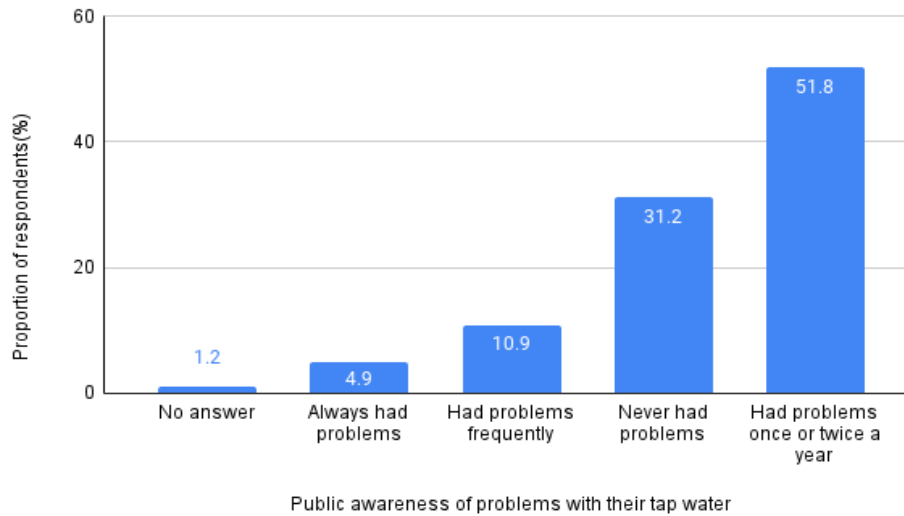

Figure 6. Public perception of tap water quality issues

From the survey of the measures taken to solve problems that arise with drinking water (Figure 7), the graph demonstrates that 30.4% of the residents solve problems with their drinking water by themselves, which is similar to the number of respondents that seek help from local water utilities. The remaining respondents solved their drinking water problem by getting help from residential property maintenance staff (19.8%), calling the local government hotline (10.5%), and complaining to the local department of health (8.9%).
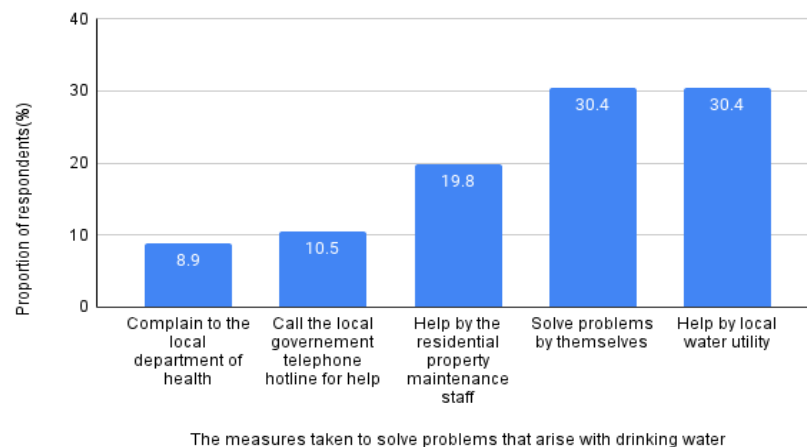

Figure 7. The measures adopted to fix issues with drinking water

Most respondents from Figure 8 agreed that maintenance problems (44.9%) and river pollution (36%) cause water pollution. A small number of residents agreed that water pollution is due to the high chlorine level (8.9%) and rainfall factors (4%).
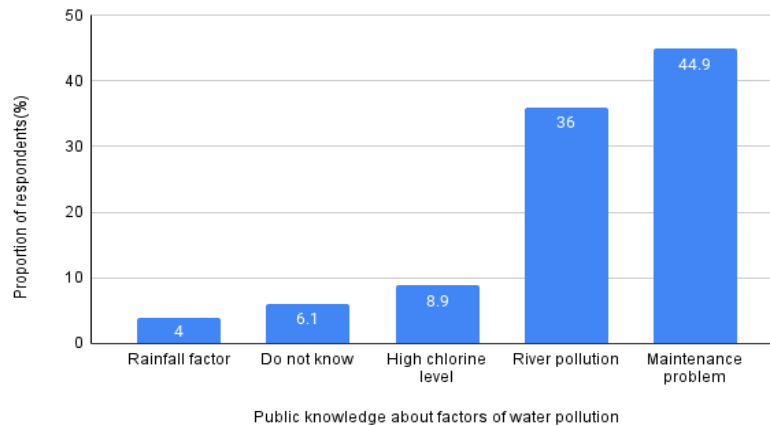

Figure 8. The extent of public awareness regarding water pollution

The result of public awareness of water pollution is displayed in Figure 9. Public awareness of water pollution reported by the media is receiving considerable attention (40.5%), while high attention was reported (31.2%) by the respondents. These results show that the media is always reporting to the public about pollution that is happening in our country, and citizens are aware of it.
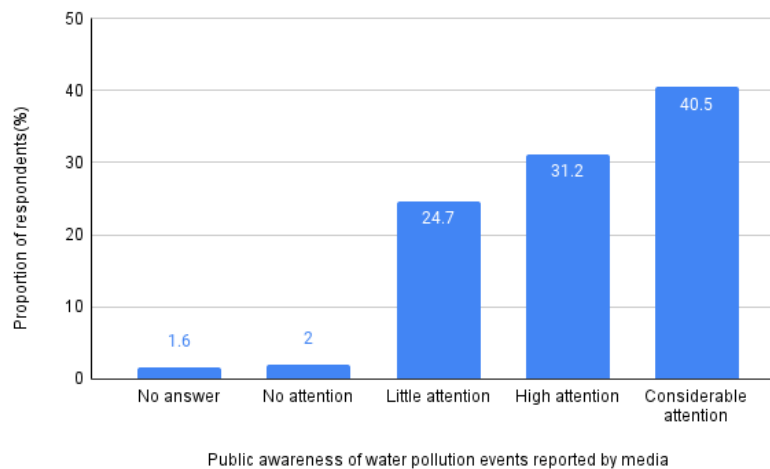

Figure 9. Public awareness of water pollution events reported by media

As shown in Figure 10, 56.7% of the respondents are aware of the causes of water pollution accidents during the incident. About 21.5% of respondents primarily pay attention to the location of water pollution accidents. 19.4% of the respondents were looking at those who were responsible for the water pollution

accident that happened. While another 1.6% of the respondents checked out the economic loss that affected the whole area where the water pollution accidents take place.
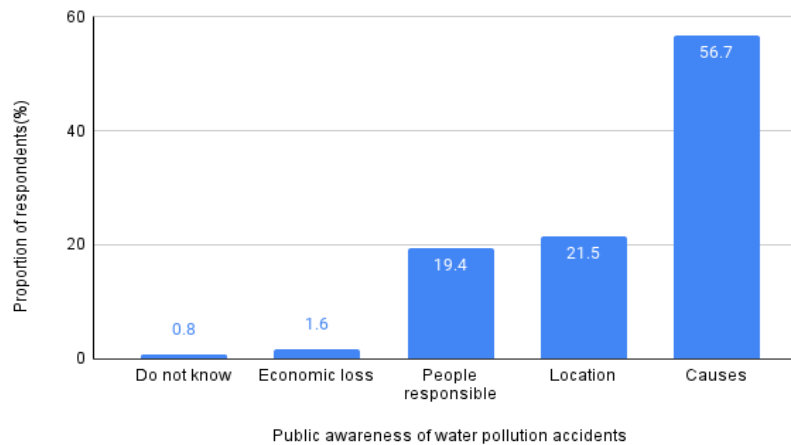

Figure 10. Public awareness of water pollution accidents

As depicted in Figure 11, survey participants identified key agencies responsible for emergency response during drinking water contamination incidents. The Selangor Water Department was perceived as the primary authority by 40.1% of respondents, followed by the Environmental Pollution Department (29.1%). Other noted agencies included the Department of Irrigation and Drainage, the Health Department, and the Ministry of Housing and Local Government.
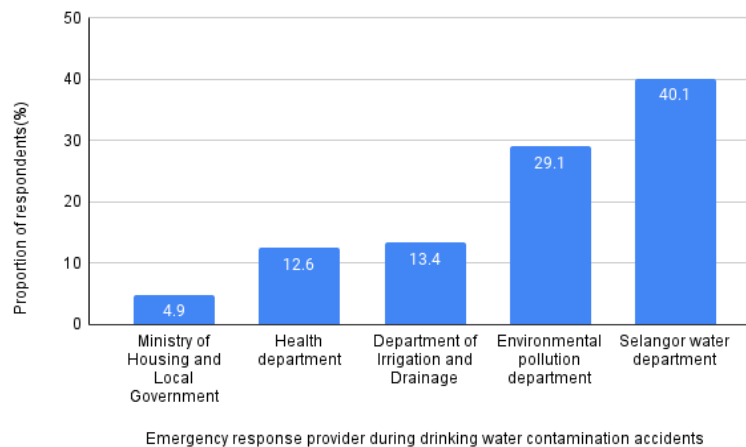

Figure 11. Emergency response provider for drinking water contamination incidents

Figure 12. shows that about 44.9% of respondents believe the most effective measure to prevent water pollution accidents during emergency response is reinforcing laws and regulations for those responsible, followed by resource management and improving public awareness. Water contamination always happens in

Selangor. This proves that laws and regulations are still loose because industry and factories are not afraid of laws and release their waste into the water.
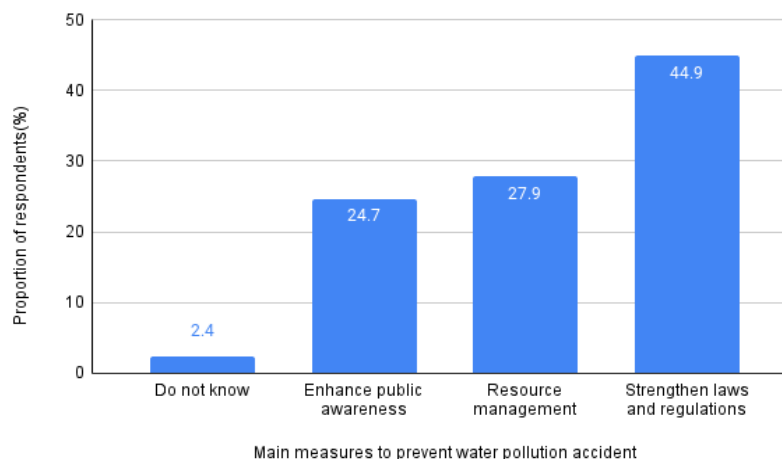

Figure 12. Key actions to prevent water pollution incidents

The findings suggest that public awareness campaigns should focus on educating the population about the importance of water quality and the risks of contamination. This could include media campaigns, community workshops, and school programs. Strengthening laws and regulations (44.9% of respondents) is seen as a key measure to prevent water pollution accidents. Additionally, resource management (27.9%) and enhancing public awareness (24.7%) are crucial for improving water safety. Future studies should explore the relationship between public awareness and actual behavioral changes, such as the adoption of water filtration systems or the avoidance of contaminated water sources.

Conclusion

This study investigated drinking water safety and contamination incidents among non-UPM students in Selangor, revealing critical insights into public perceptions and challenges. A significant proportion of the population expressed dissatisfaction with current water safety standards, reflecting widespread concerns over water quality and pollution. Proposed measures, such as increasing chlorine levels to reduce bacterial contamination, have not fully addressed the persistent water quality issues in Malaysia, which stem from multifaceted sources. The findings emphasize the necessity for collaborative efforts among government bodies, institutions, and the public to implement effective water management strategies. While a segment of the population reports satisfaction with water quality, disparities persist, particularly in rural and lower-income communities. Enhancing public awareness and fostering unified action are essential to ensuring a safer, more reliable water supply. This study underscores the urgency of addressing water contamination through coordinated interventions, aiming to achieve equitable access to clean drinking water for all citizens.

Acknowledgments

Conflict of Interest

The authors declare no conflict of interest.

Authorship Contribution

Conceptualization, Krishnan Kumar, Chee Kong Yap and Wan Hee Cheng; Writing—review and editing, Tze Yik Austin Hew, Jia Ming Chew, Yoshifumi Horie, Meng Chuan Ong, Ahmad Dwi Setyawan. All authors have read and agreed to the published version of the manuscript.

References

Ab Razak, N. H., Praveena, S. M., Aris, A. Z., & Hashim, Z. (2016). Quality of Kelantan drinking water and knowledge, attitude and practice among the population of Pasir Mas, Malaysia. *Public Health*, *131*, 103-111. https://doi.org/10.1016/j.puhe.2015.11.006

Abdullah, S., Mansor, A. A., Napi, N. N. L. M., Mansor, W. N. W., Ahmed, A. N., Ismail, M., & Ramly, Z. T. A. (2020). Air quality status during 2020 Malaysia Movement Control Order (MCO) due to 2019 novel coronavirus (2019-nCoV) pandemic. *Science of the Total Environment*, 729, 139022. https://doi.org/10.1016/j.scitotenv.2020.139022

Aini, M. S., Fakhrul-Razi, A., Mumtazah, O., & Chen, J. M. (2007). Malaysian households' drinking water practices: A case study. *The International Journal of Sustainable Development & World Ecology*, *14*(5), 503-510. https://doi.org/10.1080/13504500709469749

Annua, Z. F., Azmi, W. N. F. W., Ahmad, N. I., Sham, N. M., Mahiyuddin, W. R. W., Veloo, Y., & Abdullah, N. A. (2020). Drinking water quality in Malaysia: a review on its current status. *Int J Environ Sci Nat Resour*, *24*(2).

Basu, A., & Muthukrishnan, R. (2024). Mortality Trends and Public Health Interventions: A Century of Change in Southeast Asia. *Progression journal of Human Demography and Anthropology*, 1-4.

Compeer (2019), Is Tap Water Safe to Drink in Malaysia | Home Water Dispenser Supplier. https://www.compeer.my/is-tap-water-safe-to-drink/

de França Doria M., Pidgeon N & Hunter PR, Perceptions of drinking water quality and risk and its effect on behaviour, A cross-national study. *Science of the Total Environment, 407*(21), 5455-5464, 2009.

de França Doria, M. (2010). Factors influencing public perception of drinking water quality. *Water policy*, *12*(1), 1-19.

Dziurakh, Y., Kulyniak, I., Sarkisian, H., Zhygalo, I., Chepil, B., & Vaskovych, K. (2024). Intrusion Detection Systems for Smart Tourism Platforms: Safeguarding Food Safety and User Privacy. *Journal of Internet Services and Information Security*, *14*(4), 484-498.https://doi.org/10.58346/JISIS.2024.I4.030

European Environment Agency (2016). Public participation: Contributing to better water management. https://www.eea.europa.eu/publications/public-participation-contributing-to-better

Hoedjes, J. C. B. (2014). Public participation in environmental research. *Occasional Paper*, *22*(1).

Ismai, A. H., & Al-Kellabi, H. G. (2025). Assessment of Water Use Efficiency in Fields: Impact of Water Depletion Levels and Soil Textures on Zea Mays. *Natural and Engineering Sciences*, *10*(1), 31-40. https://doi.org/10.28978/nesciences.1606425

Kulkarni, S., & Nair, H. (2024). The Role of Medical Terminology in Public Health Surveillance and Pandemic Preparedness. *Global Journal of Medical Terminology Research and Informatics*, *2*(3), 5-7.

Latif, M., Nasir, N., Nawaz, R., Nasim, I., Sultan, K., Irshad, M. A., ... & Bourhia, M. (2024). Assessment of drinking water quality using Water Quality Index and synthetic pollution index in urban areas of mega city Lahore: a GIS-based approach. *Scientific Reports*, *14*(1), 13416. https://doi.org/10.1038/s41598-024-63296-1

Leonard J (2020), Which is better: Bottled water or tap water?, *Medical News Today.*

Li, P., & Wu, J. (2019). Drinking water quality and public health. *Exposure and Health*, *11*(2), 73-79.

Mahler, R. L., Barber, M. E., & Shafii, B. (2015). Urban public satisfaction with drinking water since 2002 in the Pacific Northwest, USA. *International Journal of Sustainable Development and Planning*, *10*(5), 620-634. https://doi.org/10.2495/SDP-V10-N5-620-634

Praveena, S. M., Huyok, N. F. K., & de Burbure, C. (2018). Public health risk assessment from drinking water from vending machines in Seri Kembangan (Malaysia). *Food Control*, *91*, 40-46. https://doi.org/10.1016/j.foodcont.2018.01.019

Radhakrishnan, S., Velanganni, R., & Paranthaman, P. (2024). Groundwater Management: Integrating Geological and hydrological data for effective decision making. *Archives for technical sciences*, *31*(2), 131-139. https://doi.org/10.70102/afts.2024.1631.131

Rhodes Pump Services Inc (2019). Water Quality and Why It's Important to Humans. *Rhodes Pumps.* https://rhodespump.com/water-quality/

Rosen, A. A. (1966). Recent developments in sensory testing. *Journal (American Water Works Association)*, *58*(6), 699-702.

Smith M (2021), Bottled Water vs. Filtered Water, Pros and Cons. *Your Source For All of Your Filter Needs.*

Smith, W. G. (2008). Does gender influence online survey participation? A record-linkage analysis of university faculty online survey response behavior. *Online submission*, https://files.eric.ed.gov/fulltext/ED501717.pdf

Vinusha, B., Gandhi, N., Vidya Sagar Reddy, G., & Vijaya, C. (2024). Advanced nanoparticle-based treatment of aquafarm and hatchery effluents: The role of chitosan and chitosan TPP in water purification. *International Journal of Aquatic Research and Environmental Studies*, 4(2), 117-143. http://doi.org/10.70102/IJARES/V4I2/8

Wang, L., Zhang, L., Lv, J., Zhang, Y., & Ye, B. (2018). Public awareness of drinking water safety and contamination accidents: A case study in Hainan Province, China. *Water*, *10*(4), 446. **https://doi.org/10.3390/w10040446**

World Health Organization (2011). Guidelines for drinking-water quality, *WHO Chronicle, 38*(4), 104-108.

Wright, J. A., Yang, H., Rivett, U., & Gundry, S. W. (2012). Public perception of drinking water safety in South Africa 2002–2009: a repeated cross-sectional study. *BMC public health, 12*(1), 556.

Zafarmand, O. (2016). The study of the relationship between entertainment and water sport through creating tourism attraction and development (sport tourism) in Bushehr coasts. *International Academic Journal of Innovative Research, 3*(1), 18–22.