International Journal of Science Academic Research
Vol. 06, Issue 08, pp.10463-10472, August 2025
Available online at http://www.scienceijsar.com

ISSN: 2582-6425

Research Article

UNDERSTANDING WATERBORNE DISEASE VULNERABILITY OF DAY LABOURERS: A QUALITATIVE EXPLORATION IN RAJSHAHI CITY, BANGLADESH

[1, *]Golam Sarwar, [2]Ashadul Haque, M., [3]Arif Eftakhar, S. M., [4]Fozla Rabbi, M.

[1]Lecturer, Department of Development Studies, University of Chittagong, Chittagong-4331, Bangladesh
[2]Assistant Professor, Department of Anthropology, University of Chittagong, Chittagong-4331, Bangladesh
[3]Assistant Professor, Department of Anthropology, Jagannath University, Dhaka-1100, Bangladesh
[4]Research Officer, icddr,b, Dhaka-1212, Bangladesh

Received 12th June 2025; **Accepted** 15th July 2025; **Published online** 22nd August 2025

Abstract

In 2022, worldwide, at least 1.7 billion people use an unsafe drinking water source contaminated with faeces, though Sustainable Development Goal target 6.1 has asked for the universal and equitable access to safe and affordable drinking water. This contaminated water can transmit waterborne diseases like diarrhoea, cholera, dysentery, typhoid, jaundis and various skin diseases. It is estimated that approximately 505000 diarrhoeal deaths has occurred each year. This study aimed to understand the vulnerability of waterborne diseases of the day labourers in Rajshahi city, Bangladesh. Here, 60 respondents were enrolled by using purposive and convenience sampling. Data were collected through casual observation, in-depth interview and Focused Group Discussions (FGD), and were analyzed thematically. Findings shows that traditional social beliefs, lower educational status and lower economic condition are the main determinants towards the lay perception of water-borne diseases and their causation. It is important to mention that the geo-ecological condition and water management system are also responsible to create scarcity of safe drinking water. Besides these, day labourers have not enough solvency to take proper coping strategies. It's clear that these factors make the day labourers more vulnerable to waterborne diseases in this urban area which shows the emergence to develop safe drinking water management system and urban sanitation policy for the betterment of the urban informal working poor in Rajshahi City, Bangladesh.

Keywords: Lay perception, Causation, socio-economic factors, Safe drinking water, Waterborne disease and vulnerability.

INTRODUCTION

Waterborne diseases pose a significant global public health challenge with the highest burden observed in developing countries such as Bangladesh and less-developed countries [1, 2]. In this earth, only 3% is fresh water and only 0.06% is easily accessible of that [3], unfortunately this small portion of accessible fresh water sources are getting contaminated day by day with various contaminants, like coliform, toxic metals, pesticides and many emerging contaminants [4-7]. These pathogens transmitted while using infected water for drinking, food preparation, and washing clothes, among others [8] that often resulting from inadequate sanitation and poor hygiene[9].But safe drinking water and sanitation is recognized as human rights at first in UN General Assembly of 2010 [10] and Sustainable Development Goal target 6.1 has aimed to ensure the universal and equitable access everyone to safe and affordable drinking water [11-13]. Report shows that at least 1.7 billion people used a drinking water source contaminated with only faeces in 2022 globally[14].The contaminated drinking water results in life threatening waterborne diseases like diarrhoea, cholera, dysentery, typhoid or any other waterborne diseases like hepatitis (usually subtype E), amoebiasis, gastroenteritis, shigellosis, and other viral and parasitic infections [15]. Among these, diarrheal diseases alone account for approximately 505,000 deaths annually [14, 16] while cholera cases range between 1.3 to 4.0 million per year, with up to 143,000 fatalities globally [17]. Bangladesh has long struggled with waterborne diseases due to persistent water safety and sanitation challenges [18, 19].

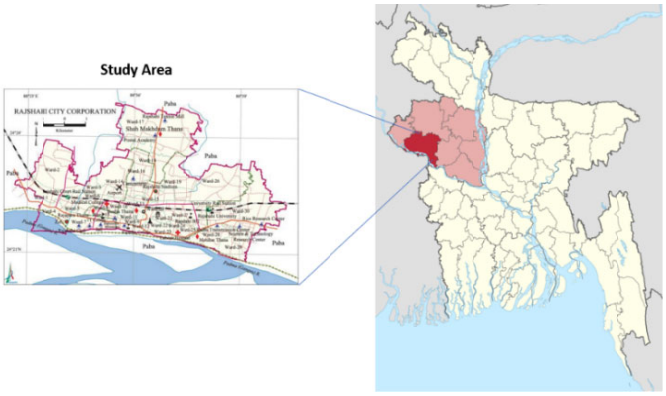
Corresponding Author:** ***Golam Sarwar,
Lecturer, Department of Development Studies, University of Chittagong, Chittagong-4331, Bangladesh

In 2020, over 35,000 people in the country died from diarrheal disease [20]. The Institute of Epidemiology, Disease Control & Research (IEDCR) estimates that Bangladesh experiences approximately 450,000 hospitalized cholera cases annually, with 4,500 resulting in death [21]. Rapid urbanization has exacerbated these issues, as water treatment and waste management infrastructure have not kept pace with population growth. Consequently, access to clean drinking water remains unequal and improper sanitation continues to fuel the spread of waterborne infections [4, 22-24]. Also, it has been observed environmental and infrastructural factors, socio-economic determinants such as education, health awareness, and risk perception play a crucial role in shaping communities' vulnerability to waterborne diseases [25, 26]. In Rajshahi City, a rapidly faces considerable challenges which are related to water quality and public health. The Rajshahi Water Supply & Sewerage Authority (RWASA) is the primary water provider in the city, and approximately 60% of the population drinks this water directly. However, the concerns persist regarding its safety. It also showed that among 40 households in Rajshahi found that 55% of residents suffered from waterborne diseases, with diarrhea and cholera being the most prevalent [27]. In particular, the situation is concerning for marginalized groups, such as day labourers, who form a substantial portion of the urban workforce [28, 29]. So, engaged in informal, often hazardous work environments, these labourers have limited access to safe drinking water, sanitation, and healthcare services, heightening their vulnerability to waterborne illnesses [28, 30, 31]. This research seeks to explore the risk and vulnerability that expose day labourers in this city to waterborne diseases, with a particular focus on their socio-economic conditions, environmental challenges, and public health determinants. By analyzing these factors, the study aims

to contribute to a deeper understanding of the vulnerability to waterborne diseases within this specific population.

METHODOLOGY

This study follows a qualitative research design to explore the perceptions, experiences, social conditions, and challenges that enhance the risk and vulnerability of waterborne diseases among day laborers.



Study area

The research was conducted in Rajshahi city, situated on the banks of the Padma River. A city corporation that is known for its tropical climate, this city is not heavily industrialized but has a significant labor force engaged in physically demanding jobs like rickshaw pullers, van drivers, construction workers, masons, hotel staff, and goods carriers, whose economic struggles and resilience shape the urban workforce.

Sampling Strategy

A purposive sampling technique was used to carefully choose participants who could share valuable insights based on their experiences. Since the research focused on daily-wage laborers, the sample included people from different backgrounds to get a variety of opinions based on their type of work, age, availability, and social and economic conditions. Along with purposive sampling, convenience sampling was used to select participants who were easy to contact and willing to take part, considering the busy schedules of daily-wage workers.

The sample included:

- 44 in-depth interviewees, selected from different labor-intensive jobs, and
- 16 participants, selected for two focus group discussions (FGDs) (each FGDs with eight participants).

Fieldwork and Data Collection

The study was explorative and to some extent descriptive in nature that enforces to adopt a qualitative approach. To make a broader and intensive understanding on the subject matter, a wide range of secondary literature also consulted which included various books, journal articles, webpages, reports, news, periodicals and a lot of other relevant documents. The primary data collection was conducted by researchers who were trained and experienced in qualitative research methods. Primary data collection was started with simple casual observation. Both casual and direct observation were principal and important techniques in acquiring data during the whole study. Besides, the researcher was responsible for carrying out the in-depth interviews, facilitating the focus group discussions, and ensuring the ethical standards of the research was maintained throughout the data collection process. Total 44 in-depth interviews and two focus group discussions (which contained 16 people) were conducted with an open-ended questionnaire and a guideline respectively. Written consent paper was read out to the participants and signed in that ensured the volunteer participation. Though the day labourers were found very busy with their assigned tasks, the interviews and focus group discussions were conducted at their leisure time and also had to visit their residents in the case of six interviews. Note taking and keeping audio record have widely influenced the overall data collection procedures. A period of one and half month for fieldwork schedule has been followed from August to middle of September 2023.

Data Collection Methods	Number of Sessions	Number of Participants
In-depth interview	44	44
FGDs	2	16
Total Participants		60

Data Analysis

The data collected from the study was analyzed using a method called qualitative thematic analysis. The process followed several steps to make sure the analysis was accurate and thorough. The first step was to transcribe all the audio recordings from the interviews and focus group discussions. Every word was written down exactly as it was said to make sure no information was missed. Field notes and observations were also collected to give extra context and understanding of the labourers' environment. Next, a coding framework was created to organize the information. This was done by looking at the data and giving labels to meaningful parts of the text, a process called open coding. These labels were then grouped into larger categories. After the categories were created, the researcher looked at the data again to refine these codes and turn them into main themes. Once the themes were confirmed, these were compared with existing research and literature. The researcher looked at reports, books, and articles to see if the findings matched other studies. This helped to understand the laborers' situation towards waterborne diseases in a wider context. To make sure the findings were reliable, triangulation method was used to check the results by comparing information from different sources, like interviews, focused group interviews, and observations. Secondary literature, like research articles and reports, was used to support the findings. By using different data sources and perspectives, the study provided a well-rounded and accurate analysis of the vulnerability of informal labor force towards waterborne diseases in Rajshahi.

FINDINGS

Socio-economic Status of the participants

Rajshahi is a divisional city and also a city corporation area of Bangladesh. When every division of Bangladesh is characterized by various types of informal labours like rickshaw puller, van puller, auto-rickshaw driver, truck driver, bus driver, bus contractor, bus/truck helper, road constructionist, building constructionist, hotel boy, some contractual workers, hawkers and maid (Amin, 2016).

Table 1. Age, Educational status and residential status of the participants

Occupation	Age (Years)					Education						Residential Status			
	18-25	26-35	36-45	46 +	Total	No Edu	Class 1-5	Class 6-10	SSC	HSC & Above	Total	Pmt	Mgrt	Con. Mgrt	Total
Mason	2	7	6	3	18	2	4	10	1	1	18	4	11	3	18
Auto-rickshaw driver	1	2	4	5	12	-	2	8	1	1	12	10	2	-	12
Rickshaw puller	-	2	6	4	12	1	6	4	1	-	12	2	8	2	12
Van puller	2	5	3	2	12	1	7	4	-	-	12	1	7	4	12
Hotel Boy	2	1	1	-	04	-	1	2	1	-	04	-	2	2	04
Street Hawker	-	-	1	1	02	1	-	1	-	-	02	-	1	1	02
Total	07	17	21	15	60	05	20	29	04	02	60	17	31	12	60

No edu= No education or illiterate, Pmt= permanent, Con. Mgrt= Migrant, Con. Mgrt=Contemporary Migrant.

Table 2. Occupation, Family Type and Monthly Income of the participants

Occupation	Type of Family				Monthly Income (Taka in Thousands)					
	Single	Joint	Extended	Total	10-15	15-20	20-25	25-30	30 +	Total
Mason	17	-	1	18	3	4	5	4	2	18
Auto-rickshaw driver	7	3	2	12	2	5	3	1	1	12
Rickshaw puller	10	2	-	12	8	3	1	-	-	12
Van puller	9	3	-	12	6	4	2	-	-	12
Hotel Boy	4	-	-	04	-	3	1	-	-	04
Street Hawker	2	-	-	02	1	1	-	-	-	02
Total	49	08	03	60	20	20	12	05	03	60

By using the non-probability purposive sampling, snowball sampling and convenience sampling, we selected a sample size of 60 people who are generally worked as Mason, Auto rickshaw driver, rickshaw puller, van puller, hotel by and street hawker in Rajshahi City.

Lay Meaning of Waterborne Diseases and their Causes among the Day Laboure's

Findings showed that in Rajshahi City, the lay meaning of waterborne diseases among the day labourers are related to their traditional knowledge and beliefs, and differs according to types of diseases and vary one to another labourers. In the study, when the participants are asked what the common waterborne diseases in their community are, all of them replied that abdominal problems such as stomachache, flatulence, vomiting, and various skin diseases, like itch, scab, pox are waterborne diseases. They don't know another types of waterborne diseases. When researchers wanted to know their perception of dysentery, diarrhoea, cholera, jaundis and typhoid 51 participants mentioned that dysentery, diarrhoea, cholera are caused by food poisoning. If people intake rotten or stale food, these will cause these typess of diseases. One rickshaw puller stated his experience-

"Around three months ago, I took my lunch in a small hotel at Talaimaryin a sunny day. Usually, I take my food from these types of restaurants because of the cheapness of food. That day I suspected the Dal (Lentil soup) was staled. After taking my meal, from that evening I had been suffering from diarrhoea for around five days though I took medicine."

Where only nine people argued that these kinds of diseases also might be occurred from dirty or polluted water.

In the case of jaundis, 52 participants believe when people continuously work hard for several days in over heat and sunny weather, it may cause jaundis. Another two participants don't know how peopleare attacked byjaundis. As well as, 47 people claimed that typhoid is occurred when people suffer from fever for several days, it may happen after 15 to 20 days. At that time, body temperature does not feel so high, but people feel sick. If they take medicine, they will feel better for one or two days and then they feel sick again. After suffering from this type of fever for the said period of time, typhoid may be identified in their body. None of the participants know the water related causes of typhoid. To narrate the causation regards waterborne diseases, most of them claim that drinking dirty water causes internal waterborne diseases and contacting with dirty water or using dirty water to washing leads to various kinds of water related skin diseases. 52 participants of in-depth interview and FGD inform that waterborne diseases are caused by dirty water. According to their opinion, dirty water means which contains dust or waste, or human or animal faeces andis not visually fresh or clean like the pond's and river's water. They argue that the supply water from the city corporation is not dirty and safe. Though they tie attribute waterborne diseases to dirty water, none of the participants mention any pathogens like bacteria or virus for any of the waterborne diseases that is recognized by modern medical science. Besides the concept of dirty water, eight participants in interview mention supernatural causes behind any types of illnesses or diseases. They believe that all types of diseases come from God. According to their opinion, when people disobey their creator or violate God's order in a regular manner, it causes sin to God and he punishes human beings with illnesses or diseases. One participant states that-

"When we are becoming habituated in telling lies, cheating people, doing illegal work, or doing any other worst things with our family members, relatives or other people, we are sinning. As a result, Allah punishes us in this world giving the illness or disease.''

In question of severity of these types of diseases, 47 participants opine that the abdominal problems like stomachache, flatulence, vomiting, dysentery, diarrhoea, and the skin diseases are not so dangerous for health. These may occur at any time and may be cured automatically or by taking with minimal treatment. Another 13 participants said that diarrhoea and skin diseases should not be ignored. Because diarrhoea make a man very weak within few hours as well as it may cause death especially to the young child. Besides,

various skin diseases may lead to serious infections, even skin cancer after a long period.For example, one mason informed that-

"I had been suffering from foot ulcers for around one and a half years. Initially, I was not concerned about this matter. After two or three months when I began having problems walking or doing my work in wet areas which is our typical workplace, I went to a known pharmacy and consulted with pharmacist. He advised me an ointment and some medicine. After taking these, I did not at recover rather the problem increased. After around one year he told me that it was not a good sign, it may turn into skin cancer, so I should take advice from a specialist doctor. I went to Rajshahi Medical College Hospital (RMCH) and visited a physician. After visiting him three times and taking medicine, the problem was cured.''

But, according to the participants' views, cholera is the most infectious and most harmful disease. All of them give the same opinion. They claim that, about 1 or 2 decades ago, people thought that cholera was caused by spiritual things and that it would kill all of the people who came into contact with any affected person. For this reason, in their society, everybody used to avoid a- cholera patients. They believed that if cholera would attack a village, it could cause many deaths. In response to the question about current trends, 42 persons inform that now they do not fear cholera-like in the past decades. According to their opinion, now the hospital provides treatment by which cholera is cured. But 18 people claim it's high risk, which may cause death at any time.

However, another 27 participants claim that some diseases are spread by flies' mosquitoes or other similar beings can spread some diseases like diarrhoea, cholera, dysentery, pox, other skin diseases. But none of them knows what types of germs the insects carry. One auto-rickshaw puller stated that-

"Flies and mosquitoes *carry many germs from* sewage *drains or other dirty places outside or inside of house. If these come into contact with our food or meal, we might be affected by diarrhoea, cholera and dysentery."*

But the participants are not so afraid of diarrhoea like cholera. 49 of them argue that it is only severe for children, but though adults suffer from diarrhoea it cannot cause death. The adult people, who suffering from diarrhoea, lose their physical energy considerably and become significantly weakened. Only 11 participants report that diarrhoea is a serious disease and it is a major common disease by which people suffer severely and it also causes death especially to the young children.

On the other hand, findings show that jaundice is a common experience for all of the participants, they mostly do not think that it's an infectious disease or serious disease. 36 of them think that it is a simple disease, which is occurred from over overexposure to sunlight or over-exploiting our body through physical labour. But 17 said that it is not a disease it's a symptom of other internal diseases. When one's internal organ is affected by some harmful diseases, jaundice reflects the primary symptoms. However, seven participants inform that they know that jaundice is a serious infectious disease, which may cause death easily. Two of them state that they have experienced with sorrowful death of their two close relatives suffered from jaundis. One states-

"It's around seven years ago, he passed away. He was one of my cousins, who used to work as a rickshaw puller like me in this city. Daily he travelled from our village, situated 60 kilometers from this city by local bus or any vehicle. When he suffered from jaundice, initially we tried to treat him with a traditional healer (known as Kabiraj). But, the days gone, he could not improve rather he became sicker. Then we visited our village doctors, but it did not work. When we went to RMCH, the doctor told us that we were very late. Finally, we could not save him. After being admitted to the hospital for three weeks, he had died."

Besides these, to explain the severity of typhoid, 55 participants claim that it's very harmful for health. Severe typhoid causes side effect in health condition. It may cause the loss of hair, may make blindness, or may defeat working capability of any organ of human body. Five participants also argue the harmfulness, but could not mention any of them. On the other hand, all of the participants inform that some skin diseases, like itch, scab and pox are contagious, but not very harmful to health. They state that these are simple health problems, which will be cured by some simple popular or folk treatment but these may and infect other people easily by contacting with other or by carrying the germ by mosquito or flies.

Treatment Seeking Behaviors

Like other urban areas, Rajshahi City also contains the characteristics of medical pluralism. Within the city area, there are many groups or individuals, each offering the patient their particular way of explanation, diagnosis and treatment systems. When the researchers wanted to know about participants' treatment-seeking behaviours, it is found that most of the participants state that initially they seek care from the traditional popular sector for any type of waterborne diseases and food borne diseases. 48 participants inform that they primarily visit traditional popular sector like nearer pharmacy or folk medicine practitioner, and ask medicine in case of their abdominal problems like stomachache, flatulence, vomiting, and various skin diseases, like itch, scab, pox are waterborne diseases.

About dysentery or diarrhoea of any family members, 52 participants inform that they visit their nearer pharmacy and take medicine and oral saline (if needed). But, six participants report that after having diarrhoea, they initially use homemade beverage or saline and try to solve it by intaking flattened rice water, and raw banana and steamed rice to their main food. If the situation getting worse, they also visit to nearer pharmacy. In that case, all of the participants inform if the pharmacist or village doctor fails, they go to visit a government hospital. One rickshaw puller shares a case-

"Around two years ago I suffered from diarrhoea. It started in the early morning about 4 am or 4.30 am, when the other family members were asleep. I went to the toilet about 10-12 times within three hours. My wife gave me flattened rice and homemade saline. I took these several times throughout the whole day. The condition was becoming worse and my wife visited a nearby pharmacy and obtained medicine. After taking medicine and saline 6 times within three days, I was cured, but became very weak."

Only two participants have experience to visit a government hospital directly to seek care for diarrhoea. They state their experience of getting admit their child in Rajshahi Medical College Hospital suffered in severe diarrhoea for three days in-spite-of continuing treatment from nearer pharmacy. From that time, they directly come to hospital. However, all of the participants also claim that currently cholera is not commonly in seen their areas. But they argue that firstly they are used to visit pharmacy or medicine shop for any types of disease. But, all of them opine that they should visit hospital directly in the case of cholera as it's a life killing disease. According to their opinion, besides seeking treatment all of the participants traditionally practice to intake flattened rice water, and raw banana and steamed rice to their main food in suffering of diarrhoea or cholera. But in those cases, traditionally they avoid fish, meat, egg and milk when they are suffering from dysentery, diarrhoea or cholera. Findings show that traditionally food restriction is involved at a high level to the case of jaundice. All of the participants claim that in their society, they allow only fresh rice with potato or raw banana, and also use to drink beverage or sugarcane juice. Otherwise, any types of meats, fishes, eggs, milk, cooked vegetables and all of the cooked foods are not allowed to a jaundice patient.
Besides the food restriction, the jaundis patient generally use to take rest to cure the jaundice. For healing, they use the folk healthcare sector. 42 participants report that they seek advice from a folk healer, who is a well-known practitioner *(Kabiraj)* in their nearer village or in Rajshahi city. According to one's experience-

"Around three years ago he went to visit a folk practitioner nearer to Rajshahi. The patient had to go physically and he prescribed three leaves of an unknown tree. He advised to taking the juice of these leaves with one cup water after every three days. By drinking this leaf juice, he got recovered within 15 days".

Another 13 of them reported that they get treatment from government hospital like Rajshahi Medical College Hospital (RMCH). The rest of the participants claim that they visit their nearby pharmacy for treatment of diarrhoea, while 2 of them go to consult homeopathic doctors. But in the case of typhoid, 12 participants have visited Rajshahi Medical College Hospital in case of typhoid of themselves or family members. But two participants have got treatment from a pharmacy man. He pushed injection for 7 days (not exact, based on their recalling), they have come round. Rest of the participants have not experience to get treatment of typhoid. To the cases of vomiting and any kind of skin diseases, they reported that these are not serious diseases. Only 14 people suffered from vomiting problems within the past six months. To cure skin diseases, 19 participants reported that they used advice from a pharmacist or village doctor, which is available in their local area. Only six people have consulted with a professional doctor when they have suffered for three or four months from itching. The rest of the participants do not get advice from any healthcare sector. They inform that if they get treatment for such kind of generous illness, how they will maintain their large family with their small income. They think such kinds of diseases occur automatically and are cured automatically.

One mason say that-

"I had to maintain a family with 6 members and to bear the education cost of my two children. I have limited ability to bear the health treatment cost for all family members that's why I have to ignore my simple skin disease like itching or ringworm."

Another findings show that the participants usually use the popular and folk sector for their health care. 53 of the participants show that they first use the popular sector to treat their waterborne diseases as well as the other diseases. To answer the question of why they do not go to a professional doctor, they informed me that every doctor has a minimum charge to visit a patient of 500 to 1000 takas or more in their chamber or in a clinic, which is a large amount for a day labourer like them. 42 participants informed that the doctors did not give equal treatment in government hospitals and private clinics or personal chambers. In government hospitals, doctors are not so careful to the patients and the private treatment is very costly. For these reasons, they prefer the popular and folk healthcare sector, which is less expensive and curable, they believe.

Geo-ecological aspects and water management system of waterborne diseases

The participants of the present study argue a different pattern of the season, though they know about the six seasons. Most of them (44 participants) argue that although six seasons in Bangladesh, only three seasons are dominant. These are summer, rainy season and cold. In their view, the other three seasons are about to missing in Rajshahi City. They also say that here the sharpness of summer and winter is very high. One participant explains,

"Brother, what can be said? In summer, the daylight is so high and the weather is so hot that the skin is about to burn. On the other side, in winter, the weather is so cold that not only the muscles or body, the borne also vibrates. It is difficult as to do work in both seasons."

Only 16 participants said that they can identify when seasons are changing and what season is coming. According to their opinion, they can understand it by observing their cropping system, flowers blooming, sky colour, rain flow and birds chirping. But they also confess that the summer winter and rainy seasons play the dominant role.

Though, all of the participants live in far from the Padma river bank, they have to depend on tube-well, ponds, and supply water. 27 participants inform that to their family purpose, mainly to cloth washing, they use the pond's water, rest of the participants use the supply water. Among the permanent residents, 14 participants inform that they take their bath in ponds traditionally. One participant states that-

"We were used to utilize the ponds water for taking bath, and washing cloth, cooking pots and pans, dishes and plates. My parents' generation and our generation have these experiences. But around last 15 years, the intensive use of supply water decreases this tendency. The water quality of the ponds also degraded, that's resulted negative impact on using the ponds water."

Other participants say that there is no pond near their household. But none of the migrated participants usually use to taking bath in ponds.

The participants inform that in the dry season (in summer-mainly January to June), the ground water level is going down and tubewell water is not easily accessible. As well as, the participants describe that the tubewell water of Rajshahi city contains a large number of irons, which is generally not good for drinking, washing or cooking. According to the participants, mainly this situation leads the people to use supply water for drinking. 26 of them also inform that their family also use the tubewell water, when it is available. However, according to the participants' perspective, the supply water management is not enoughgood. RWASA cannot provide the facility to supply water for 24 hours and maintains a time schedule of supplying. Generally, supply water shuts for one or two hours once or twice daily. For which, they are to storage the supply water. For this purpose, they use containers or drum for a long time; mostly it's being broken or unusable. Besides, 39 participants mention that sometimes the water quality falls down that seems unclear and contains odour, dirt or dust. Additionally, 11 participants claim that the supply pipe lines are leaked by various causes, which contaminates the supply water by mixing the sewerage, drain dirt and also the faces, etc. According to their statement, it generally occurs in the winter season, when the water flows over the drain and water pressure is high. But rest of the participants argue that they never see that case.

Socio-cultural and economic aspects of risk construction of waterborne diseases

Above findings show that educational level has a great impact on the perception, beliefs and values about waterborne diseases and this educational status is largely determined by the economic status. All of the participants say that they have come from a poor family. 48 participants inform that their parents wanted to make them more educated. They claim that they went to government primary schools where the schooling system was not so good and they could not be attentive in their lesson. Their parents had not the ability to expend much money to teach them from a private school or private tutor. Others informed that they were not interested in education in their childhood.

Another findings show that participants' health experiences are very much related to human social and cultural life, which also creates risk and vulnerability. 54 of participants firstly blame the socio-economic system, which makes them the household head position and gives the social and economic responsibility of all members. One participant describes,

"Brother, for being the household head. I am responsible for all duties of my family. For that I have to work and earn the money to maintain the household expenditure".

This needy situation of earning money forces them to work. They also inform that they have face a lot of difficulties to maintain their family with their small income. They could not dream for luxury living in this urban area, could not give their children in private educational institution, also face difficulties to maintain the health cost of their family members. All of the participants argue that in the workplace, they are used to taking their food and water here and there, and from any type of restaurant. They have no option to choose a suitable working place or hygienic food or water. The participants informed that they take food from the low prized restaurants, or at times they eat Kalai roti (one kind of bread made of flour and pulse) from footpath food shop, those use the supply water to wash, cook and drink. For example, one rickshaw puller describes-

"Brother, we are the poor, we can't take our breakfast, tea or lunch from a luxurious restaurant. We use the low-rated restaurant, situated on footpath. Poor should not be cared for clean or unclean, safe or unsafe. They eat only to live, not for good health."

Findings show that flies and mosquitoes are the carriers those can spread of some diseases like diarrhoea, cholera and dysentery. As a preventive measure, all of the participants say that they always try to cover their food in home, but have no control in workplace or restaurants, and they are not concern about the hygiene in restaurant. One participant states-

"The foods are mostly open in the footpath hotel. If we think about hygiene, none should take any kind of food or water from outside of their house. It's a matter of belief, keep the belief heartily, there nothing will happen wrong".

Another finding known as sharing culture is common among the participants. They inform that all day labourers use common glass or drinking pot generally in their workplace or in restaurant. To show the causation of such kind of behaviour, one participant says...

"We do it traditionally. All of us do it, so I also do."

Another participant shows the religious causation. According to his opinion, sharing culture is a normal religious practice. He says...

"One Muslim naturally can share another Muslim's glass, plate, bowl, clothes another usable thing. This behaviour is not guilty."

All of the participants are habituated to these types of sharing behaviour. They say that they learn it from family practices and also from society. They are used to in their daily life without any kind of hesitation. But the glasses are not always washed carefully. One participant states that the hotel boys wash the glasses with soap or powder only once time when they start to work in the morning. The whole day they never use soap or detergent to wash the glasses, they wash the glasses only with water.

Another cause regards the sharing culture it's found that sometime the poor people are bound to share glasses, especially when they drink beverage, juice or sugarcane juice from a street seller. Participants claim that the street seller use two or three glasses whole day for all people and wash these glasses in a bowl for long time because of the scarcity of nearer water source or the shortage of time or it's their ignorance.

The findings show that mostly they have to depend on supply water for drinking, but supply water is not always safe. When researcher inform that manufactured water is safer. The participants raise a single voice-

"With the poor income, we are struggling to maintain our family expenses. If I buy drinking water, my family should have strived".

The participants also never drink the boiled water. They know that boiled water is safe, but they cannot boil water always. The participants believe that being poor, God always stays with them. They need not to boil the water or need not to be so careful. Another reason, they state that they could not afford the fuel cost to boil water. Using sanitation is another big problem in outside of home. The two hotel boys use latrine and wash their hands with soap or detergent powder. But the others participants urinate in open places or by road sides, and use latrine for defecation in rickshaw garage or bus/truck terminal where they don't get soap or any other hand washing elements. None of the participants use public toilet by paying money for defecation where the hand washing facility is available.

DISCUSSION

The findings from this study illuminate the complex interplay of socio-cultural beliefs, economic constraints, and environmental realities shaping the perceptions, treatment-seeking behaviours, and coping strategies of day labourers in Rajshahi City regarding waterborne diseases. These insights reveal both the resilience and vulnerability of this population, offering valuable implications for public health interventions tailored to low-income urban workers in Bangladesh.

The perception towards waterborne diseases, causes and harmfulness is mostly related to the day labourers' lack of knowledge which has been shaped by their traditional beliefs and values. According to the findings, day labourers indicate the abdominal problems such as stomachache, flatulence, vomiting, and various skin diseases, like itch, scab, pox as waterborne diseases. But, most of the participants don't know that dysentery, diarrhoea, cholera, jaundis and typhoid are the waterborne diseases. Some of them perceive jaundis as the over exploiting their body by hard working under over heated sunlight. However, another people perceive a disease as a supernatural cause where it depends on God's willingness or as a punishment for human's ill activity. As well as, the severity of waterborne diseases is not so high which also remarks the lack of proper knowledge on waterborne disease. Our study show that day labourers' belief systems is not an independent variable. These are dependent on some socio-economic factors, such as economic status, educational status, and nature of workplace. Conceptually these perceptions can be described by Helman's (1990) idea, where it's mentioned-

"in general, lay theories of illness place the etiology off ill-health in one of the following sites-within the individual patient, in the Natural world, in the social world and in the super natural world[32]"

Additionally, Swami *et al*, (2009*)* have showed that a series of bivariate correlations were performed in order to investigate the relationship between lay perceptions and demographic variables (sex, age, education, global health, and religiosity). But he mostly focused on the religious perspective [33]. In another systematic review that assessed the socioeconomic inequality based on virus-contaminated water usage in developing countries shows that the socioeconomic factors like poverty, standard of living, age, gender, education and access to health care facilities attributed to the various waterborne diseases[34], that are similar to our present findings. Besides these issues, the supernatural and socio-cultural beliefs regard diseases are also found around the world. A study on exploring beliefs and perception of ill-health causation shows supernatural, natural and societal causes behind the belief system of Ethiopia [35]. These findings are consistent with similar studies that have examined the lay perceptions of health in the West [36]. On the other hand, the participants think that dirty or polluted water is one of the most vital causes behind water borne diseases. They have the knowledge of dirty water as containing dust, wastage, and human, animal or birds' faeces, but they could not mention any bacteria or virus as a causation of polluted water. This finding also shows the illiteracy and ignorance of the day labourers. But a study shows that the great majority of evident water-related health problems are the result of microbial (bacterial, viral, protozoan or other biological) contamination [37]. The following are commonly used as indicators of fecal contamination in water: total coliforms, *Escherichia coli*, fecal coliforms, fecal streptococci/enterococci, coliphage, and *Clostridium perfringens* [37-39].

Treatment seeking behaviour is also showing the same characteristics. Though they have not enough knowledge regards waterborne disease, causation and severity and living with poor socio-economic condition, they could not understand the importance of getting treatment. The poor people generally use to visit the folk or popular sector (like pharmacy or medicine shop) for their primary health care service regards waterborne disease. They claim poverty as the major cause, and the high treatment cost of private doctor are the other causes. Some of them visit nearer pharmacy man, asking medicine for their diseases. If they fail after trying two or more times, they turn to visit government hospital. Only a few persons visit government hospital directly. As well as, findings show that they have a cultural trend to take some specific foods for some special waterborne disease and have some taboo on some definite foods in case of different waterborne diseases. According to a systematic review, among the water and health literature (n = 187 publications) 69% of studies provided evidence that health behaviour is influenced by (risk) perception[40]. Swami *et al*, (2009*)* presented a series of correlations in order to investigate the relationship between lay perceptions and demographic variables like sex, age, education, global health, and religiosity [33]. Evidence shows that treatment choice involves to several factors related to illness type and severity, pre-existing lay beliefs about illness causation, the range and accessibility of therapeutic options available, and their perceived efficacy [41-43]. The findings of our present study show the consistency of the determinants like lay beliefs and socio-economic perspectives in choosing the treatment care seeking source.

In our research, it's found that geo-ecological characteristics have a vital role of determining the risk and vulnerability of the poor people. The geological location of Rajshahi city, dominance of dry season and the high rate of iron in groundwater, decreasing groundwater level and polluting ponds water are the causes to force the poor people to be dependent on supply water in outside of their household. But in the participant's opinion, the water management of supply water in Rajshahi is not so rich, which creates the risk of waterborne diseases. Most of the participants claim that RWASA interrupts supply water for 1-2 hours once or twice daily. Sometimes the water quality falls down that contains odour, dust and seems unclear. Besides this issue, a significant portion of our participants inform that supply pipe lines are leaked by various causes (generally occurs in the winter season), which contaminates the supply water by mixing the

sewerage, drain's dirt and also the faeces, etc. Water management and risk construction is also described in some works. For example, Paul Coussens. C. (2007) shows that in developing countries, the problem of water distribution is more complex and severe, with many large outbreaks occurring as a result of distribution problems [44]. The WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply, Sanitation and Hygiene reported that, in 2020, globally two billion people still did not use safely managed drinking water [45]. In Bangladesh, E-coli contamination risk level in urban area is 46.3% in piped water into dwelling [46]. In Rajshahi, RWASA stablished on 1st August, 2010 is the main water supply authority providing the service to 84% of the total projected population, where it's serving 46,127 households with 712.5 kilometers supply lines for about 12 hours a day from 6.30 AM in the morning [47].On the other hand, a study finding shows that the condition of water supply system by WASA is not good and it's frequently interrupted for 1-2 hours at the day time. As well as, at morning public receive worse quality of water. The common problems like blackish water, odour and iron problems are respectively 70%, 95%, and 90% in the supply water [27]. Other study shows that supplied water may also pollute during transfer, treatment, distribution or storage [48, 49]. But in the most cases, there is no significant evidence of the geo-ecological aspects of vulnerability towards waterborne diseases in Bangladesh.

Besides these above issues, our findings show that it is usually shown that socio-economic condition like poverty, educational status, lack of knowledge, traditional beliefs and practices, housing, nature of work and workplace are the key factors behind the creating vulnerability of waterborne diseases among the day labourers in Rajshahi city. The economic status of the participants is not so high and most of them could not complete the secondary level education. Above findings shows that these factors have played a vital role to determine the perception and influence the treatment seeking behaviour. This study also shows that the poor economic condition is another barriers of taking proper strategies to face the risky and vulnerable situation. The participants cannot think to drink the manufacturing mineral water, though they are more vulnerable in their working place. They also inform that they do not drink the boiled water for not having the ability to boil water. As a result, they have to depend on supply water for drinking that is also influenced by the geo-ecological factors. As well as, they have a traditional practice of sharing culture, specially sharing the glass of water or juice. On the other hand, they have a devastating situation of sanitation and hygiene practices at outside of household. A study '*Drinking Water Treatment at Home: a Trial in Dhaka, Bangladesh'* by N. A. Molla et al (2009) found through the pre-trial field survey of the local water supply and sanitation, as well as the socioeconomic status in the Lalbagh area, that household heads, engaged in informal work activities with low income, are known to be more likely to get sick [50]'. A systematic review assessed the socioeconomic inequality based on virus-contaminated water usage in developing countries shows that the socioeconomic factors like poverty, standard of living, age, gender, education and access to health care facilities attributed to the various waterborne diseases [34]. Another study assessing the relation between poverty and health care seeking behaviour in developing countries shows that people in poor countries and the poor within these countries have less access to health services [51], where in Bangladesh, the cost of a severe diarrhoea episode is almost equivalent to 4.35 days of household's income of a low-income urban poor [52]. Evidence on the poor migrants of Rajshahi city shows that although poor migrants have played vital role in the economic growth and earned more wages, they remain socially and economically excluded from the wider benefits of economic growth such as access to food, shelter, education, sanitation and freedom [53]. These said factors are also similar to our present study, but we have not previous clear evidence to describe the vulnerability of the informal poor day labourers in urban area of Bangladesh like Rajshahi city, that are clearly seen in our present study. However, as reported by WHO in the Global Health Observatory, 1.4 million annual deaths could be prevented with safe WASH [54]. But our present study shows a crying need to develop safe drinking water management system and urban sanitation policy of Rajshahi city to especially for the urban informal working poor.

Conclusion

Along with many other problems, now the developing countries are facing a great problem of scarcity of safe drinking water, for which they are suffering from many kinds of waterborne diseases. In the present study, our principal objective was to understand the vulnerability of waterborne diseases among the day labourers in Rajshahi city, Bangladesh. The data analysis and conceptualization among the day labourers significantly is very much related to their traditional belief system like natural or supernatural matter and human activities. As well as, the treatment care seeking behaviour is linked to their traditional practice, norms and values. It's very significant that both of the issues are shaped by their socio-cultural and economic condition. Besides, the water level depletion and poor water supply management system are also responsible for being scarcity of safe drinking water in Rajshahi City that creates force on the people in generating dependency on supply water. As well as, their poor economic condition is the main cause of their low education rate, informal occupation, low income, poor residents, unequal access to safe drinking water sources, insufficient sanitation and treatment system which are the hinders to ensure safe drinking water. That ultimate situation of the informal day laboures make them vulnerable towards many common waterborne diseases. From the above discussion, it's clear that the day laberours of Rajshahi city are at a riskier and more vulnerable situation due to their low socio-economic condition and poor educational status.

REFERENCES

1. Manetu, W.M. and Karanja, A.M. "Waterborne Disease Risk Factors and Intervention Practices: A Review", Open Access Library Journal, 8, 1-11. 2021. doi: 10.4236/ oalib.1107401.
2. Teymouri, P., and Dehghanzadeh, R., "Climate change and water-related diseases in developing countries of WesternAsia: a systematic literature review",Climate and Development. 14. 222-238. 2022. doi: 10.1080/17565529. 2021.1911773
3. Musie, W. and Gonfa, G., "Fresh water resource, scarcity, water salinity challenges and possible remedies: A review", Heliyon. 2023.doi: 9:10.1016/j.heliyon.2023.e18685
4. Hasan, M.K., Shahriar, A. and Jim, K.U., "Water pollution in Bangladesh and its impact on public health",Heliyon. 2019, doi: 5:10.1016/j.heliyon.2019.e02145

5. Schwarzenbach, R.P., Egli, T., Hofstetter, T.B., et al.: "Global water pollution and human health. Annual review of environment and resources", 35. 109-136. 2010. doi: 10.1146/annurev-environ-100809-125342
6. Proshad, R., Islam, S., Tusher, T.R., et al., "Appraisal of heavy metal toxicity in surface water with human health risk by a novel approach: a study on an urban river in vicinity to industrial areas of Bangladesh", Toxin reviews. 40. 803-819. 2021. doi: 10.1080/15569543.2020.1780615
7. Jayaswal, K., Sahu, V. and Gurjar, B., "Water pollution, human health and remediation", Water remediation. 11-27. 2018. doi: 10.1007/978-981-10-7551-3_2
8. Patel, H., and Pharm, M., "Water-borne diseases", News-Medical. Net. 2018.
9. Shayo, G.M., Elimbinzi, E., Shao, G.N., et al., "Severity of waterborne diseases in developing countries and the effectiveness of ceramic filters for improving water quality", Bulletin of the National Research Centre. 47(1). 113. 2023.
10. United Nations, "Resolution adopted by the General Assembly on 28 July 2010", (2010). https://digitallibrary.un.org/record/687002?ln=en&v=pdf.[Accessed: 03 October 2024].
11. World health statistics 2024: monitoring health for the SDGs, Sustainable Development Goals. (2024), https://iris.who.int/bitstream/handle/10665/376869/9789240094703-eng.pdf?Sequence=1, [Accessed: 03 October 2024].
12. UN-Water, "Summary Progress Update 2021: SDG 6 - water and sanitation for all", Geneva, Switzerland. 2021. https://www.unwater.org/publications/summary-progress-update-2021-sdg-6-water-and-sanitation-all, [Accessed: 03 October 2024]
13. Arora, N.K. and Mishra, I., "Sustainable development goal 6: Global water security. Environmental Sustainability". 5. 271-275. 2022. doi: 10.1007/s42398-022-00246-5.
14. World Health Organization, "Drinking-water", 2024. https://www.who.int/news-room/factsheets/detail/drinking-water, [Accessed: 03 October 2024]
15. Ali, S., Amir, S., Ali, S., et al., "Water pollution: Diseases and health impacts (1st Edition)", Apple Academic Press(ed): 1-23. 2021.
16. Aboah, M. and Miyittah, M.K., "Estimating global water, sanitation, and hygiene levels and related risks on human health, using global indicators data from 1990 to 2020. J Water Health. 20(7). 1091-1101. July 2022. doi: 10.2166/wh.2022.065. PMID: 35902991.
17. World Health Organization, "Cholera", [Newsletter]. 04 September 2024. https://www.who.int/news-room/fact-sheets/detail/cholera, [Accessed: 03 October 2024].
18. Islam, T., Peng, C., Ali, I., et al., "Assessment of heavy metals and organic pollutants of wastewater in different region of Bangladesh", Indian Journal of Geo Marine Sciences. 47(12). 2552-2556. December 2018. https://nopr.niscpr.res.in/bitstream/123456789/45424/1/IJMS%2047(12)%202552-2556.pdf, [Accessed: 03 October 2024]
19. Center for Environmental and Geographic Information Services, "Final Report Geospatial Technology based Water Quality Monitoring System for Bangladesh", Department of Environment, Bangladesh. 2017. https://doe.portal.gov.bd/sites/default/files/files/doe.portal.gov.bd/page/1f58f60a_51d9_46c0_9fa1_79b7b565db05/2024-08-27-08-03-39cbaaa5acccc2f894065f6b643696d2.pdf, [Accessed: 04 October 2024].
20. Government of Canada, "Saving lives in Bangladesh through diarrheal disease research", Published on 18 April 2023.https://www.international.gc.ca/world-monde/stories-histoires/2023/2023-04-disease_research_bangladesh-recherche_maladies_bangladesh.aspx?lang=eng, [Accessed: 04 October 2024].
21. Clemens, J. and Qadri, F., "Cholera in Bangladesh", Weekly epidemiological record/Health Section. World Health Organization. 90(40). 539-542. 2015: https://iris.who.int/handle/10665/350523, [Accessed: 04 October 2024].
22. Mostafa, M., S.H. Uddin, and Haque,A., "Assessment of hydro-geochemistry and groundwater quality of Rajshahi City in Bangladesh", Applied Water Science. 7. 4663-4671.2017.doi: 10.1007/s13201-017-0629-y
23. Patz, J.A., Vavrus, S.J., Uejio, C.K., et al., "Climate change and waterborne disease risk in the Great Lakes region of the US", American journal of preventive medicine. 35(5). 451-458. 2008. doi: 10.1016/j.amepre.2008.08.026.
24. Bilal, H., Li, X., Iqbal, M.S., et al., "Surface water quality, public health, and ecological risks in Bangladesh—a systematic review and meta-analysis over the last two decades", Environmental Science and Pollution Research. 30. 91710-91728. 2023: doi: 10.1007/s11356-023-28879-x
25. Anthonj, C., Rechenburg, A. and Kistemann, T., "Water, sanitation and hygiene in wetlands. A case study from the Ewaso Narok Swamp, Kenya", International Journal of Hygiene and Environmental Health. 219. 606- 616. 2016. doi: 10.1016/j.ijheh.2016.06.006
26. Bhuiyan, M.A.H., Islam, M.A., Dampare, S.B., et al., "Evaluation of hazardous metal pollution in irrigation and drinking water systems in the vicinity of a coal mine area of northwestern Bangladesh", Journal of hazardous materials. 179. 1065-1077. 2010. doi: 10.1016/j.jhazmat.2010.03.114
27. Akter, S., Ferdous, L. and Kafy, A., "Assessment of Water supply system and water quality of Rajshahi WASA in Rajshahi City Corporation (RCC) area, Bangladesh", in 1st National Conference on Water Resources Engineering (NCWRE)-2018, 2018.
28. Amin, A., "The Informal Sector and Urban Poor. Dhaka", Bangladesh Rural Advancement Committee (BRAC). 2016, Dhaka, Bangladesh..
29. Bangladesh Bureau of Statistics: Bangladesh: Labour Force Survey 2022. 2023.
30. Alam, M.Z., Rahman, M.A. and Firoz, M.A.A., "Water supply and sanitation facilities in urban slums: a case study of Rajshahi City corporation slums", American Journal of Civil Engineering and Architecture. 1. 1-6. 2013. doi: 10.12691/ajcea-1-1-1
31. Haque, A.K.M.M., Hossen, M.S., Haque, M.N., et al., "A comparative study of water supply, sanitation, and hygiene practices in Bangladeshi city corporation areas", Environment, Development and Sustainability. 1-17. 2023. doi: 10.1007/s10668-023-04211-y
32. Helman, C.G., "Culture, Health and Illness: An Introduction for health professionals", Linacre House, Jordan Hill, Oxford, London.: Butterworkh Heinemann; 1990.
33. Swami, V., Arteche, A., Chamorro-Premuzic, T., et al., "Lay perceptions of current and future health, the causes of illness, and the nature of recovery: explaining health and illness in Malaysia", British Journal of Health Psychology. 14. 519-540. 2009. doi: 10.1348/135910708x370781

34. Adelodun, B., Ajibade, F.O., Ighalo, J.O., et al., "Assessment of socioeconomic inequality based on viruscontaminated water usage in developing countries: a review", Environmental Research. 192. 110-309. 2021. doi: 10.1016/j.envres.2020.110309
35. Kahissay, M.H., Fenta, T.G., and Boon, H., "Beliefs and perception of ill-health causation: a socio-cultural qualitative study in rural North-Eastern Ethiopia", BMC public health. 17. 1-10. 2017. doi: 10.1186/s12889-017-4052-y
36. Furnham, A. and Smith, C., "Choosing alternative medicine: a comparison of the beliefs of patients visiting a general practitioner and a homoeopath", Social science & medicine. 26. 685-689. 1988. doi: 10.1016/0277-9536(88)90060-3
37. Guidelines for drinking-water quality: incorporating the first and second addenda. (2022). https://www.who.int/publications/i/item/9789240045064,, [Accessed: 05 October 2024].
38. Inyinbor, A. A., Adebesin, B.O., Oluyori, A.P., et al., "Water pollution: effects, prevention, and climatic impact", Water challenges of an urbanizing world. 33. 33-47. 2018. doi: 10.5772/intechopen.72018
39. Chabalala, H. and Mamo, H., "Prevalence of water-borne diseases within the health facilities in Nakuru district", Applied Epidemiology University of Nairobi, Kenya. 34. 2001
40. Anthonj C, Setty KE, Giuliana F, et al., "Do health risk perceptions motivate water-and health-related behaviour? A systematic literature review", Science of the total environment. 2022.doi: 10.1016/j.scitotenv.2021.152902
41. Kleinman, A. and Gale, J.L., "Patients treated by physicians and folk healers: a comparative outcome study inTaiwan", Culture, medicine and psychiatry. 6. 405-423. 1982. doi: 10.1007/bf00118886
42. Zola, I.K., "Culture and symptoms--an analysis of patient's presenting complaints", American sociological review. 31. 615-630. 1966. doi: 10.2307/2091854
43. Ahmed, S.M., Tomson, G., Petzold, M., et al., "Socioeconomic status overrides age and gender in determining health-seeking behaviour in rural Bangladesh", Bulletin of the world health organization. 83. 109-117. 2005.https://pmc.ncbi.nlm.nih.gov/articles/PMC2623805/pdf/15744403.pdf, [Accessed: 05 October 2024]
44. Coussens, C., "Global Environmental health: research gaps and barriers for providing sustainable water, sanitation, and hygiene services: Workshop summary", National Academies Press, Washington DC. 2009. https://doi.org/10.17226/12597, [Accessed: 05 October 2024]
45. World Health Organization, "WHO global water, sanitation and hygiene: annual report 2022", Geneva: World Health Organization. 2023. https://books.google.com.bd/books?hl=en&lr=&id=A6MOEQAAQBAJ&oi=fnd&pg=PR5&dq=WHO.,+WHO+global+water,+sanitation+and+h...., [Accessed: 04 October 2024].
46. UNICEF, "Drinking Water Quality of Bangladesh: Meeting the SDG 6.1 for Safely Managed Drinking Water: Challenges, Evidence and Priority Recommendations", UNICEF Bangladesh. 2018. https://www.unicef.org/bangladesh/sites/unicef.org.bangladesh/files/2018-10/Drinking%20Water%20Quality%20in%20Bangladesh.pdf, [Accessed: 04 October 2024].
47. Bari, Q.S. and Bari, Q.H., "Water supply history of Rajshahi city", in AIP Conference Proceedings. AIP Publishing. 2023, doi: 10.1063/5.0129970
48. Fernández-Navarro, P., Villanueva, C.M., García-Pérez, J., et al., "Chemical quality of tap water in Madrid: Multicase control cancer study in Spain (MCC-Spain)", Environmental Science and Pollution Research. 24. 4755-4764. 2017. doi: 10.1007/s11356-016-8203-y
49. Chaitee, N., Alam, S., Momin, A.A., et al, "An Assessment on Availability of Water Supply System in the Rajshahi City Corporation Area", Proceedings of International Conference on Planning, Architecture and Civil Engineering, 12 - 14 October 2023, Rajshahi University of Engineering & Technology, Rajshahi, Bangladesh. 2023
50. Molla, N.A., Molla, K.A., Hossain, A. et al., "Drinking water treatment at home: a trial in Dhaka, Bangladesh", Bangladesh Journal of Scientific and Industrial Research. 44. 233-240. 2009. doi: 10.3329/bjsir.v44i2.3679
51. Peters, D.H., Garg, A., Bloom, G., et al., "Poverty and access to health care in developing countries", Annals of the New York Academy of Sciences. 161-171. 2008. doi: 10.1196/annals.1425.011
52. Sultana, R., Luby, S.P., Gurley, E.S., et al., "Cost of illness for severe and non-severe diarrhea borne by households in a low-income urban community of Bangladesh: a cross-sectional study",PLoS neglected tropical diseases. 15. 2021. doi: 10.1371/journal.pntd.0009439
53. Farhana, D.K.M., Rahman, S.A. and Rahman, M., "Factors of migration in urban Bangladesh: an empirical study of poor migrants in Rahshahi City", Bangladesh e-Journal of Sociology. 9(1). 105-117. 2012. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2517201,[Accessed: 04 October 2024],
54. WHO, "Burden of disease attributable to unsafe drinking-water, sanitation and hygiene, 2019 update.", Geneva: World Health Organization; 2023. Licence: CC BY-NC-SA 3.0 IGO. https://iris.who.int/bitstream/handle/10665/370026/9789240075610-eng.pdf?sequence=1, [Accessed: 04 October 2024]:

****