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Enhancing Youth Capacities on Climate Change Adaptation and Drinking Water Management

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ABSTRACT

This was a small study to improve knowledge and build capacity among the youths of the selected four secondary schools on the impacts of climate change and its adaptation and mitigation in drinking water management, as well as its use perspectives inside the Chitra-Nabaganga Area Water Partnership at Narail District in Bangladesh. The study was implemented by the Environment and Population Research Centre, Bangladesh, in financial collaboration with Bangladesh Water Partnership and the Global Applied Research Network - South Asia. The study included classroom training focusing on climate change and its impacts, water safety and its management, and knowledge about water disinfection methods during floods. This study found that knowledge about water disinfection methods during floods, such as "boiling arsenic-free water" and "using chlorine solution," improved significantly p <.01) in the end-line from the baseline survey. The level of knowledge about flood preparedness, causes and potential consequences of climate change also increased significantly p <.01). According to the findings of this study, training can increase the skills of young students and turn them into active learners who are interested in gaining more knowledge about contemporary issues.

Keywords: Arsenic, Climate change, Education, Flood, Safe water, Training, and Water safety plan.

INTRODUCTION:

The term "climate change" describes changes in temperature and weather systems that occur gradually over long periods of time. There is a possibility that these shifts are the consequence of natural processes; but, since the 1800s, human activity has been the dominant influence in climate change. The combustion of fossil fuels, which causes the emission of greenhouse gases, is primarily responsible for this phenomenon. The impacts of climate change on water sources as well as other components of the environment are significant and growing. In addition to this, its effects are becoming more severe with each passing day, which may result in a diminished supply of potable water (IPCC, 2014; Olmstead, 2014; Xia, 2017; Ali, 2021; Siddik *et al.,* 2021; Siddik *et al.*, 2022). The detrimental consequences that climate change and its repercussions have been displaying on the availability of clean water, including a reduction in the amount of clean water as well as damage to sources of clean water that are caused by natural disasters (Siddik *et al.,* 2014; Abedin *et al.*, 2019). Bangladesh is among the nations with the greatest susceptibility to the effects of climate change (CDMP, 2008). The coastline of Bangladesh, which accounts for around 32 percent of the country, is very susceptible to the consequences of climate change,

including sea level rise, storm surge, flooding, river-bank erosion, and others (WARPO, 2006; Miah, 2010; Siddik *et al.,* 2017; Siddik *et al.,* 2018).

There were 126,615 primary schools in Bangladesh in 2016, with 18,602,988 students and 548,201 teachers. There were 20449 high schools in Bangladesh in 2016, with 10,184,364 students and 243,553 teachers (MED, 2017; BANBEIS, 2019). An evaluation conducted by UNICEF found that around 53 percent of the safe water tube-wells located in primary schools was operational. Concerns have also been raised over the safety of the drinking water and the methods used for maintaining hygiene at a number of Bangladeshi schools (Hoque *et al.*, 2011; WaterAid, 2016). This was the result of contamination brought on by a wide variety of substances, including arsenic, salt, bacteria, and a few others. Every citizen should have the fundamental right to access safe drinking water, which is essential for promoting better health (Hall *et al.,* 2014). The government of Bangladesh came up with the Sustainable Development Goals (SDGs) in order to ensure that these rights are respected (SDGs). Target 6.1 of the Sustainable Development Goals (SDG) says that by 2030, everyone should be able to get clean water at a price they can afford.

The ability to successfully adapt to and mitigate the effects of climate change requires the proper information, skills, and behavioral change, all of which can be provided via education. It is a well-known fact that learning opportunities provided by schools may give young people the tools they need to build a prosperous future (Goodman *et al.,* 2011; Anderson, 2010; Anderson, 2012; HEART, 2013). In particular, education has the potential to make it possible for individuals and communities to take actions that will lead to climate-resilient and sustainable development (Anderson, 2010; Anderson, 2012). The aim of the study was to enhance the capacity of school youths (both boys and girls) from the selected four secondary schools through classroom training focusing on climate change adaptation towards sustainable water management inside the Chitra-Nabaganga Area Water Partnership (CN-AWP) at Narail District in Bangladesh. Narail is a large coastal area with high arsenic contamination of ground water and salinity, making it vulnerable to the effects of climate change. Moreover, its impacts are increasing day by day, which leads to a scarcity of safe water availability (Sarker and Ahmed, 2015; Hoque *et al.*, 2015).

METHODOLOGY:

Study Area

This study was carried out in 2016 at four schools in the Narail Sadar sub-district of Narail District, Bangladesh (**Fig. 1**).

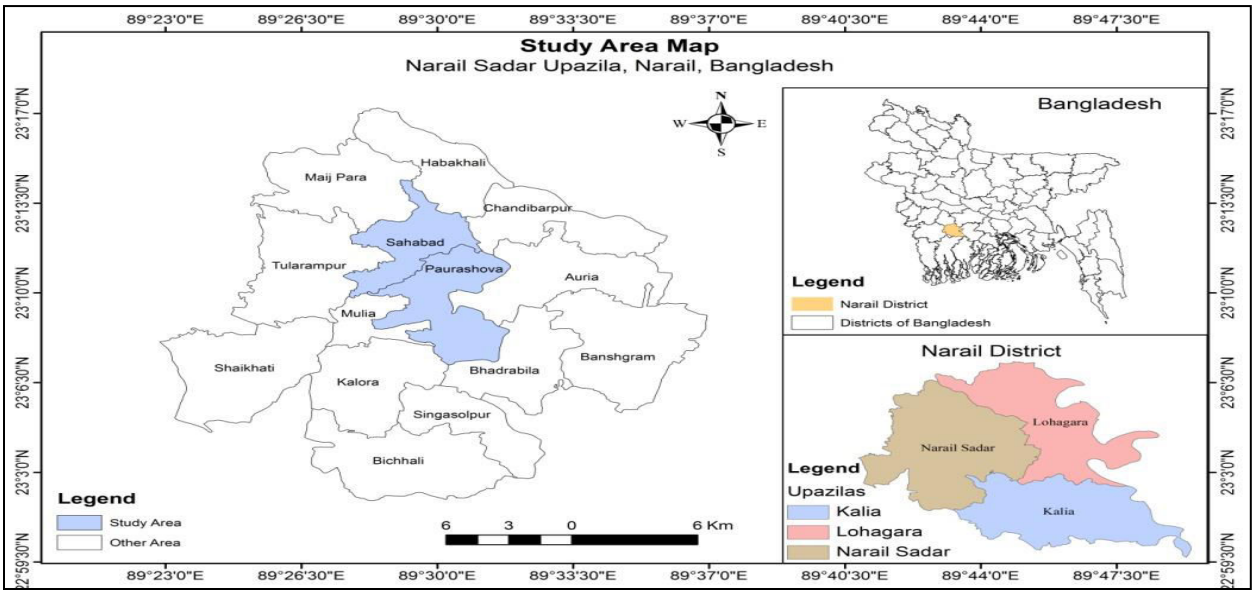

Fig. 1: Location of the study areas including Sahabad Union and Paurashova of the Narail Sadar sub-district of Narail, Bangladesh.

The social and environmental conditions of the selected sub-district are reportedly vulnerable. The study was done with the financial support of the Bangladesh Water Partnership (BWP), a country chapter of the Global Water Partnership-South Asia (GWP-SAS). GWP SAS represents six countries, i.e., Bangladesh, Bhutan, India, Nepal, Pakistan, and Sri Lanka, as Country Water Partnerships (CWPs). These CWPS are distinct and independent organizations that collaborate to support integrated water resource management in the areas.

School Selection

After consulting with the district's education officer and the sub-district secondary education officer, four secondary schools were selected inside the Chitra-Nabaganga Area Water Partnership in Narail Sadar sub-district under Narail District. The schools were situated in arsenic, salinity, and flood-prone areas. The headmasters of the schools were contacted about their interest before finalizing the schools. Selected schools were -

1) Paura Secondary School.
2) Rupganj Secondary Girls School.
3) B.R.D Adarsha Secondary School.
4) Shahabad Secondary School.

The total number of students at the schools was about 1095, including 32% boys and 68% girls. There were 53 teachers, including 30 male teachers and 23 female teachers.

Educational Intervention

The educational intervention mainly included lectures and demonstrations among students at the schools through classroom training. The class groups were six to ten in each school. A total of 480 secondary school students, including 200 boys and 280 girls, and 18 teachers of the schools, participated in the training. The training session included discussions on climate change, its impacts and adaptation, water safety and its management, and methods of water disinfection during floods.

Monitoring and data collection

Every school received a baseline and end line (end-of-year) survey. Baseline and end-line surveys were done among 100 students (25 from each school). The information was collected on the basis of multi-disciplinary variables such as knowledge on the causes and impacts of climate change, water disinfection methods, and preparedness for getting safe water during floods. The surveys were conducted among the students of class six to class ten. Randomly, five students were chosen for the surveys from each class. Advanced statistical software (Statistical Package for the Social Sciences, version 17.0) and Microsoft Excel were used for data processing and analysis. ArcGIS was used to prepare the study area map.

RESULTS AND DISCUSSION:

Characteristics of the Selected Schools

All four schools were secondary non-government high schools with MPO registration. In total there were about 1095 students (32% boys and 68% girls) and 53 teachers (**Table 1**). The selected sub-district and schools are exposed to the risks of arsenic contamination and salinity in ground water as well as flooding. Indeed, all schools located inside the Chitra-Nabaganga Area Water Partnership (CN-AWP) in Narail.

Table 1: Number of Students in the Selected Schools.

School name	Number of students		
	Boys	Girls	Total
Paura Secondary School	159	165	324
Rupganj Secondary Girls School	0	287	287
B.R.D Adarsha Secondary School	92	130	222
Shahabad Secondary School	104	158	262
Total	355	740	1095

Level of Knowledge

Causes of Climate Change

During the baseline and end-line surveys, students from the selected schools were asked about the causes of climate change. It was found that almost half of the students were unaware of the reasons why the climate was changing or the factors that contribute to climate change. Before the educational intervention, just 14%

of students correctly recognized the rising levels of greenhouse gases as the primary driver of climate change. However, following the intervention, this number increased to 92%. There was a statistically significant difference between the end line and the baseline in terms of the improvement (*p*-value <0.00001). Additionally, the improvement was the same for deforestation, which is also a root cause of climate change (**Table 2**).

Table 2: Causes of climate change.

Variables	Baseline (%)	End-line (%)	Yates Correction	p-value
N	100	100		
Increase of greenhouse gases	14	92	119.01	<0.00001
Deforestation	22	94	103.47	<0.00001

Impacts of Climate Change

This study discovered that training has a positive impact on the education level of young students. After training, they identified and realized that the frequency and intensity of floods, cyclones, and drought have been increasing due to climate change and its associated impacts. They further explained that climate change creates negative impacts by increasing arsenic in ground water and saline water intrusion in Inland. Knowledge about the impacts of climate change, such as saline water intrusion, improved to about 29% in the end-line survey from only 1% in the baseline. After classroom training for students from the selected schools, the improvement is significant compared to the baseline (*p*-value <0.00001). The detailed information regarding the responses of the comparative study about the possible impacts of climate change in Bangladesh is presented in **Table 3**.

Table 3: Impacts of Climate Change.

Variables	Baseline (%)	End-line (%)	Yates Correction	p-value
N	100	100		
Increase flood frequency and intensity	4	84	126.64	<0.00001
Increase drought	14	91	115.81	<0.00001
Increase arsenic in ground water	1	44	50.58	<0.00001
Saline water intrusion	1	29	28.59	<0.00001
Increase cyclone frequency and intensity	21	27	0.69	0.408

Water Disinfection during Flood

Water makes up about 60% of our bodies; in fact, water makes up about 80% of infants' bodies, making it even more important that they have access to safe drinking water (Morelli, 2006). A total of 100 students from the selected schools were interviewed during the baseline and end-line surveys. Knowledge about water disinfection methods during floods, such as boiling arsenic-free water and using chlorine solution for water disinfection, improved by about 35 percentage points at the end of the survey from the baseline survey (**Table 4**). The improvement significantly differed on the end line from baseline (*p*-value <0.00001).

Table 4: Water disinfection during flood.

Variables	Baseline (%)	End-line (%)	Yates Correction	p-value
N	100	100		
Boiling arsenic free water	45	80	24.66	<0.00001
Using chlorine solution	14	49	26.79	<0.00001

Preparedness for getting Safe Water during Flood

Disease transmission from contaminated water occurs principally by ingesting water. Water disinfection is accomplished most effectively with a chlorine-containing chemical (Hrušková *et al.,* 2018). Thus, keeping

the chlorine solution is an important prepared-ness method for getting safe water during a flood.

Knowledge about the preparedness methods for getting safe water during a flood including keeping the chlorine solution in the house, keep plastic container in house, remove tube-well head and plugging mouth, raising tube-well pipe, and keep alum (fitkari)/ bleaching powder in house was improved significant at p <.01 (**Table 5**).

Table 5: Preparedness for safe water during flood (*Significant at p < .01).

Variables	Baseline (%)	End-line (%)	Yates Correction	p-value
N	100	100		
Keep chlorine solution in house	3	63	87.23	< 0.00001*
Keep plastic container in house	12	33	11.47	.0007*
Remove tube-well head and plugging mouth	7	42	31.25	<0.00001*
Raising tube-well pipe	10	28	9.39	.002*
Keep alum (fitkari)/bleaching powder in house	22	70	44.46	<0.00001*

CONCLUSION AND RECOMMENDATIONS:

About 1095 students directly and indirectly benefited from the educational intervention of the project. The basic sustainability of safe water management and climate change adaptation and their related functions were found to be poor before the intervention. The study confirmed that after a simple educational intervention, rates of knowledge, attitude, and practices (KAP) about climate change adaptation and sustainable safe water management, as well as related issues, can be significantly improved at p <.01.

This study recommends to the concerned departments of the government, non-government organizations, and international non-government organizations to undertake this kind of educational intervention in all parts of the country so that youth can create awareness inside the school catchment through the student cabinet and user groups. Teachers should also set up and keep an eye on safe water and technology management facilities at schools, and they should encourage students to maintain water safety plans.

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CONFLICTS OF INTEREST:

The authors declare that they have no conflict of interest.

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