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Gender Contribution in Household Management of Water and its Impact on Residents of Dholak Basti (Slum) in Haldwani City of India

Yashi Gupta

Center for Ecology Development and Research, yashigupta852@gmail.com

Riyan Habeeb

Center for Ecology Development and Research, cedar.riyan@gmail.com

Manya Singh

Center for Ecology Development and Research, msmanyasingh@hotmail.com


Anvita Pandey

Centre for Ecology Development and Research, anvitapandey90@gmail.com

Vishal Singh

Center for Ecology Development and Research, vishal.the.1st@gmail.com

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Abstract

The paper explores water and gender sensitivity in one of the slum areas of Haldwani City, one of the fastest growing and least studied cities of Uttarakhand. The study is intended to contextualise the analysis of household water management and role of gender with respect to water management in the city. First, a city-wide ward wise analysis was conducted to identify wards with low socio-economic profile and high illiteracy based on Census of India, 2011 data and analysed spatially in Geographical Information System (GIS). The spatial analysis was followed by primary surveys in one of the identified wards and statistical data analysis. The results point out that lower social strata are not sufficiently covered by municipal water supply systems and women play a major role in household water management. Children are the worst affected by water-borne diseases in comparison to adults; this is in contrast to earlier studies where adult males were found more prone to water related diseases in comparison to females. Strategic interventions were worked out to find possible solutions related to health concerns and equitable water accessibility.

Keywords

gender sensitivity, Haldwani city, geographical information system, household water management, gendered water collection

Cover Page Footnote

Current study is part of the research was carried by CEDAR under 'Climate Adaptive Equitable Water Management Practices & Strategies', (CAMPS) Project, Funded by IDRC, Canada, In partnership with SIAS-Nepal, University of South Wales & University of Sydney, Australia. Authors gratefully acknowledge their support and motivation throughout the research.

Authors

Yashi Gupta, Riyan Habeeb, Manya Singh, Anvita Pandey, Vishal Singh, and Elizabeth Barker

Gender Contribution in Household Management of Water and its Impact on Residents of Dholak Basti (Slum) in Haldwani City of India

Yashi Gupta¹, Riyan Habeeb¹, Manya Singh¹, Anvita Pandey¹, Vishal Singh¹, Elizabeth Barker²

¹Center for Ecology Development and Research, Dehradun, Uttarakhand

²University of Cambridge, United Kingdom

KEY WORDS

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CORRESPONDING AUTHOR

Yashi Gupta; yashigupta852@gmail.com

ABSTRACT

The paper explores water and gender sensitivity in one of the slum areas of Haldwani City, one of the fastest growing and least studied cities of Uttarakhand. The study is intended to contextualise the analysis of household water management and role of gender with respect to water management in the city. First, a city-wide ward wise analysis was conducted to identify wards with low socio-economic profile and high illiteracy based on Census of India, 2011 data and analysed spatially in Geographical Information System (GIS). The spatial analysis was followed by primary surveys in one of the identified wards and statistical data analysis. The results point out that lower social strata are not sufficiently covered by municipal water supply systems and women play a major role in household water management. Children are the worst affected by water-borne diseases in comparison to adults; this is in contrast to earlier studies where adult males were found more prone to water related diseases in comparison to females. Strategic interventions were worked out to find possible solutions related to health concerns and equitable water accessibility.

1 INTRODUCTION

In this fast developing world, gender continues to be a concern regarding equity and opportunity. Gender identity within a society often determines the individual's roles, responsibilities, and behaviours. Gender discrimination can explain the distinct distribution of power and resources within society (Khanduri, 2018). For judicious use of natural resources, it is beneficial to demarcate who uses what and where. An ethical gender approach to freshwater-related issues means that all decisions regarding the design, localization, management, and use of freshwater resources must consider the needs of both men and women and allow them to influence, participate in, and benefit from water development (Hannan-Anderson, 1995). Women and water are intrinsical-

ly linked. Both are thought to be the wellspring of life, and domestic water management is feminized in many societies, including India (Kher et al., 2015; UNDESA, 2004). Women have considerable knowledge of water resources, including quality, natural variations of water availability and accessibility. This knowledge is gained through personal experience and interpersonal and intergenerational female knowledge sharing (SIDA, 1994). However, women's relation with and knowledge about water is frequently not considered by decision-makers, for example, engineers and policymakers are usually men (Baden, 1993). However, the UN Commission on the status of women asserts that women are gaining recognition as crucial intermediaries between ecosystem services and social issues, hence, are essential actors in conservation and safeguarding of natural resources.

A feminist political ecology approach urges researchers to move beyond the scale of the household to individuals' social differences when examining the socio-cultural dimensions of resource use (Rocheleau et al., 2008). For example, gender and age are two social differences which influence the impact of water stress. The UNDP report (2001) mentioned that women and children experience water insecurity most acutely through increased instances of waterborne diseases, insufficient drinking water, and physical violence induced by water stress. Women and children's high vulnerability to water stress is in part caused because they have less access to substitutes when water sources become degraded (Mayers, 2009).

Furthermore, the exclusion of women from the design and planning of water supply and sanitation projects in developing countries is a significant obstacle to development (World Bank, 1989). It is known that there are gender differences in the social determinants of waterborne diseases because there are different household roles borne by each gender which influence the risk of infection (Rathgobertal, 1993). Gender also has an impact and influence on health policies and their effects on both men and women (Vlassoffetal, 2005). Therefore, gender must be considered all through the research process from the identification of problems to the framing of solutions.

This paper is an investigation into the gendered water insecurity and poor health impacts due to sub-standard quality of consumptive water taking a case from Haldwani city which is a mid-sized city lying in the foot hills of the Himalayan state - Uttarakhand (India). An assessment into gender and household water resource management was undertaken in one of the slums known as 'Dholak Basti' (basti being the Indian term for slum), which is a vulnerable socio-economic group in the city.

2 METHODS

2.1 Study Area

Haldwani is located at 29.21'83° N and 79.51'30° E in Nainital district of Uttarakhand State, in Indian Himalayan Region. It is situated on the bank of Gaula River covering an area of 44.11 km². According to the 2011 census report, the population of Haldwani was 156,078 and has grown significantly over the past two decades witnessing a high in-migration rate from the upper reaches of Uttarakhand for various prospects (Mamgain & Reddy, 2015). This has led to a huge surge in informal population across the city. Administratively, Haldwani is divided into 25 municipal wards or sub municipal boundaries with as many as 22 slums distributed mostly in the southern wards.

2.2 Methodology

This study involved a mix of methods including quantitative and qualitative data spatial and statistical methods. Under the quantitative research method, the population of Haldwani city was taken as per Census of India 2011 for GIS-based spatial

analysis. The study area was selected based on a spatial analysis of all 25 wards in Haldwani with respect to ward-wise literacy and percentage sex ratio as per census data. This led to identification of Ward-22 which had a very low literacy rate and low sex ratio. Following the identification, a survey was carried out at three different locations in the slum area of Dholak Basti : Eastern Subdivision-1 from Jain Temple side, Central Subdivision-2 is the Middle portion of the slum and Western Subdivision-3 is from the Railway Station side. These areas are differentiated based on their dependency on different types of water supply systems in their locality – Subdivision-1 has Community Pipeline Connections, Subdivision-2 is dependent upon community tube-wells and Subdivision-3 uses public taps for their daily water requirements. Approximately 150 out of 300 households in Dholak Basti were surveyed using the stratified random survey technique through a structured questionnaire with 50 households surveyed in each of the three subdivisions. Stratified random sampling is a method that involves division of a population into similar sub-groups known as strata and randomly selecting the respondents from the strata. In our research we have divided the population into three subdivisions on the basis of their dependency on different types of water supply systems in their locality. Under the qualitative research method, personal/household interviews were done as well as key informant interviews. Out of the 150 respondents, 87 respondents were female, and 63 respondents were male, each representing their household. The respondents, both men and women fell under three age classifications i.e., below age 18, ages 18 to 60 and above age 60 categorized as minor, adult and old respectively in this case study. Five respondents (one boy and four girls) were minors, 142 respondents (59 men and 83 women) were adults, and three respondents (all women were old). A fully structured questionnaire was used for the survey which mainly focused on the background information of the respondent, water accessibility, its demand and supply, quality and quantity, sanitation facility, household water management and previous history of water related diseases in the family with respect to each family member (refer to Supplementary Information for detailed questionnaire) The survey was then collated in a statistical format to derive inferences from the data collected.

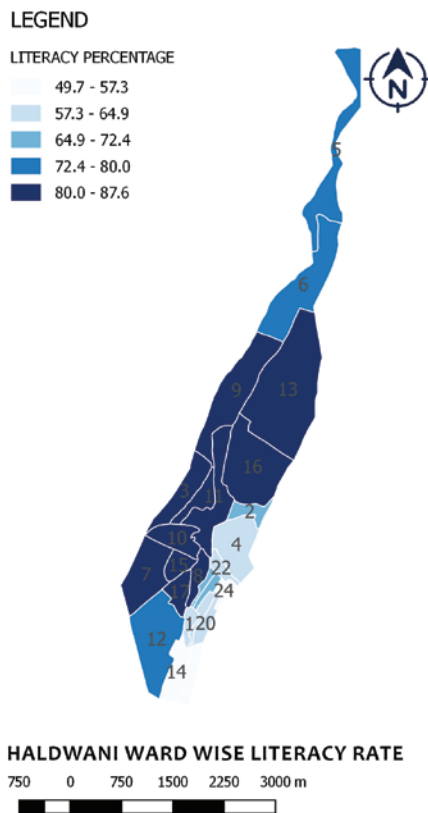
3 RESULTS

3.1 Ward Wise Literacy

Figure 2 shows the Ward Wise Literacy Map. Haldwani has an overall average literacy ratio of 70.2%. A lower literacy rate of 84.48% is observed in southeast wards in comparison to average literacy of 87.6% in the city. Wards 24 (49.7%), 14 (51.8%), 21 (53.5%) and 22 (57.9%) show the lowest literacy rates in Haldwani. Literacy rate has a positive correlation with socio-economic status (UNDP, 2006). Therefore, these Wards have lower than average socioeconomic status relative to other wards which have higher literacy rates. These same wards show relatively low female literacy, wards 24

(47.9%), 14 (48.0%), 21 (49.4%) and 22 (55.7%). This observation correlates with socio-economic status, the higher the socio-economic status the higher the literacy ratio and thus the lower the inequality in literacy between men and women (Omelandjuk, 2005). One possible explanation is that women from low socio-economic status perform both domestic and wage work. This often means that rather than attending school, girls participate in household tasks, hence the literacy ratio is lower in these wards. This is in part caused by cultural norms which place greater emphasis on the education of boys over girls (Abbas, 2003). This trend may be exacerbated by poor water access because girls and women are predominantly the water collectors, as established during the household surveys where 100 percent of households had women and girls fetch water whereas only 34 percent of households had men involved in water collection. Therefore, where the literacy ratio is low, this may indicate wards where water access is poor, meaning girls and women must spend more time collecting water and missing out on education. Households which have low socio-economic status and less accessible water supplies are far more vulnerable to water insecurity as they are unable to purchase water privately and the shared water sources are under more pressure.

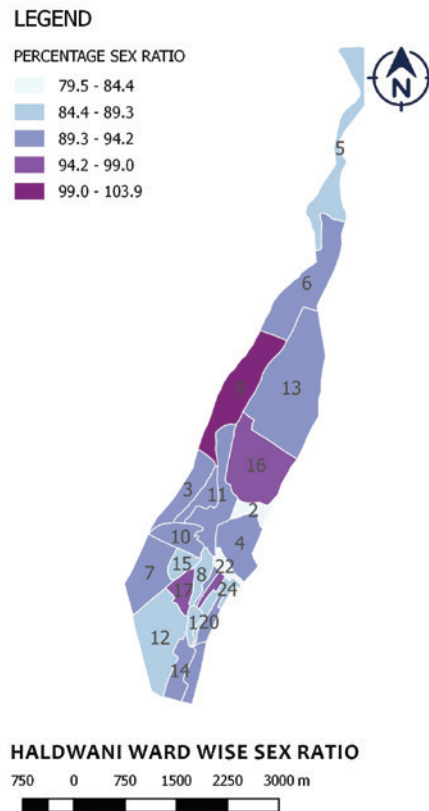
Figure 1: Ward Wise Percentage Literacy Rate



The range of literacy percentage, from 49.7%-87.6%, has been split into 5 equal categories (with the exception of category 3 (64.9-72.4) whose difference is 7.5% rather than 7.6%). The categories correspond to a blue colour gradient. The lightest blue colour corresponds to the lowest total percentage literacy of 48.7-57.3. For

example, Ward 14 with 51.8%. The darkest blue corresponds to wards with the highest percentage literacy between 80.0-87.6%. For example, Ward 15 with 84.1%.

Figure 2: Ward Wise Sex Ratio



This shows the number of females per 1000 males, as a percentage, for each ward. The percentage sex ratio ranges from 79.5-103.9%. This range has been split into five equal categories. These categories correspond to a colour gradient; light blue to dark purple. The lightest blue indicates the lowest percentage sex ratio of 79.5-84.4%. For example, Ward 22. The darkest purple shows the highest percentage sex ratio category of 99.0-103.9%. For example, Ward 9.

Source: author's analysis based on Census of India, 2011 data

3.2 Ward Wise Sex Ratio

Figure 2, shows the Ward Wise Sex Ratio Map. There is a potential spatial pattern with each end of this linear settlement, containing Wards 5 and 12, in the lowest category of 84.4-89.3% and the central portion of the city displaying a high percentage sex ratio Wards 9 and 16. This may suggest that peripheral wards are more prone to lower sex ratio.

Wards 2 (79.5%), 22 (83.9%), 1 (86.5%) and 12 (88.02%) have the lowest sex ratio in comparison to the other wards in the city (90.44%). Considering literacy rate, Ward 22 again was one with lowest sex ratio implying that men significantly outnumber women in this Ward. This is a concern because a low sex ratio often correlates with low socio-economic status (Hesketh and Wei Xing 2006).

Ward 22 has an anomalously low percentage sex ratio of 83.9%. This may be explained by the presence of a slum, in Ward 22 which has a high level of poverty (UNDP, 2006). The relationship between poverty and a low sex ratio is complex and based on many potential explanatory factors. One possible reason to link urban poverty and gender might be gendered mortality. Gendered mortality is the term used to describe a gender imbalance in mortality rates. In areas where women are more likely to die, a low sex ratio may be present. The reasons for an increased female mortality rate are many and complex. Often a high rate of female mortality will correlate with low socioeconomic status. This correlation may be caused by poorer access to healthcare, water and food which frequently disproportionately impacts women (WHO, 2009). In addition, death through childbirth may be a contributing factor because women with a low socio-economic status are more likely to die in childbirth due to less access to healthcare and poor nutrition, amongst other things (Filippi et al., 2006). Therefore, a high female mortality rate could be, in part, responsible for the low sex ratio found in Ward 22. However, further research would be required to assess the specific causes of the low sex ratio present in Ward 22, and those discussed above may or may not be responsible.

3.3 Water Sources

Dholak Basti slum, falling under Ward 22 was chosen and primary survey was conducted dividing the area into 3 Subdivisions based on their location and dependencies on water.

Table-1 Shows that residents in Subdivision-1 have access to community pipeline connections in their households. Residents in Subdivision-2 can access water from community tube wells. In Subdivision-3 the survey found that residents did not have access to any water connection or supply source near their homes. Instead they must fetch water from public taps which are located outside the community boundary.

Table 1: Water source, time spent and amount of water fetched daily

Study Sites	Water Source	Time Spend in Fetching Water per 5 ltr (minutes)	Amount of water Fetching Daily (Liters)
Subdivision-1	Community Pipeline Connections	5-6	10-15
Subdivision-2	Community Tube wells	2-3	10-12
Subdivision-3	Public Taps	2-3	15-20

All families in Dholak Basti slum fetch water from community water sources by taking a number of small (around 5 litres) containers with them. After filling one container the community member is required to give way for other residents to fill their containers and wait for their turn again to fill their next container. Thus in order to get the daily requirement of water, each resident carries 4 to 5 small containers and waits for their turn to fill all their containers, one container at a time. Also, due to poor water discharge speed in the pipelines/taps, the process is slow and takes a long time before each resident is able to completely fetch the minimum amount of water required for their daily needs. The data for time spent fetching water (Table 1) shows that in Subdivision-1, one pipeline connection is there which is further subdivided into several connections and due to this subdivision of the main connection, the speed of water discharge gets very slow. From each sub-connection, 4-5 families fill their water containers, thus after filling one container of 5 liters they give others a chance to fill their container and wait for their turn to come again. Thus filling 10-15 liters of water takes 50-60 minutes. Residents spend about 5-6 minutes when fetching 5 liters of water. Thus, in fetching 10-15 liters of water they spend 50-60 minutes daily. The same condition exists at Subdivision 2, where residents fetch

Figure 3: Different Water Collection Sources in Dholak Basti Slum



water from tube wells and after filling their one container, they have to give others a chance, thus at Subdivision-2 the time spent by the residents when fetching 5 liters of water is about 2-3 minutes. Thus, in fetching 10-12 liters daily, the residents spend about 20-30 minutes. At Subdivision-3 the time spent in collecting 5 liters of water is about 2-3 minutes, therefore, when fetching 15-20 liters of water they spend about 2-3 hours daily, including filling time and the time it takes to walk to the public taps as the public taps are at some distance from the community.

3.4 Gendered Water Collection

Figure 4: Gender contribution in fetching water from all studies Subdivisions

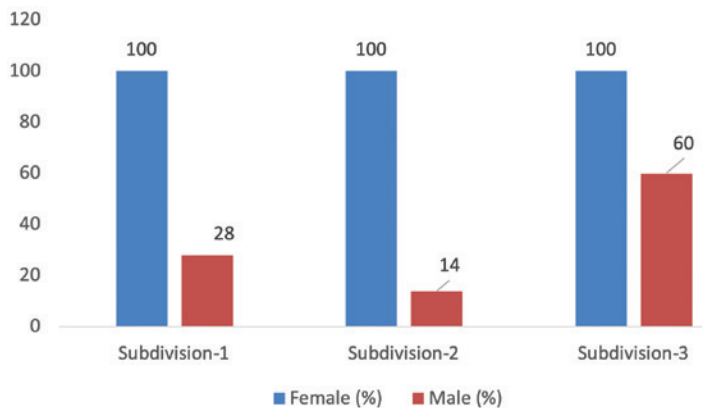


Figure 4 shows the gender contribution to fetching water. In all the three study Subdivisions 100% of the women surveyed were involved in fetching water for domestic use. However, the male contribution varied at each Subdivision. At Subdivision-1, 28% of men were involved in fetching domestic water. In Subdivision-2, 14% of men contributed to water collection. This was the lowest contribution out of the three Subdivisions. Subdivision-3 presented the highest percentage contribution of 60%.

3.5 Water Quality

Figure 5: Water quality and the percentage of population affected by waterborne diseases

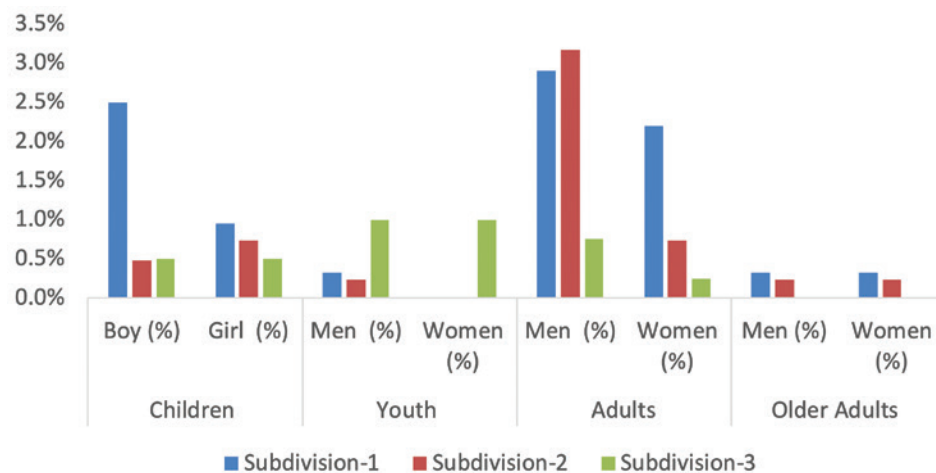
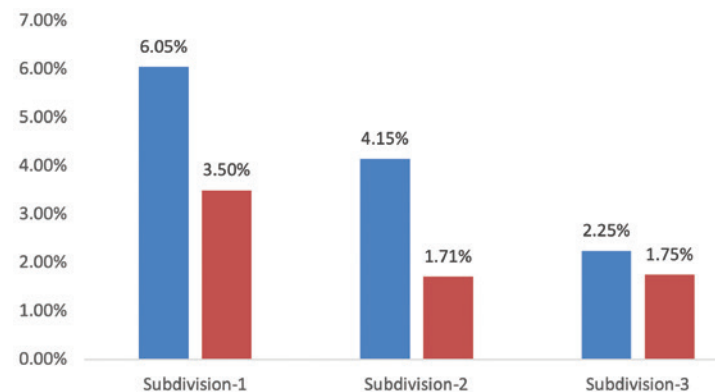


Figure 5 is a breakup of the percentage of persons affected by water-borne disease at Subdivision 1, 2 and 3. The columns show the Child (0-8 years), Youth (9-17 years), Adults (18-60 years) and Old (61 years and above).

At Subdivision 1, a total of 50 surveys were conducted in which 20 adult men, 28 adult women and 2 young women were surveyed. In the survey male adults and male children show a higher percentage, 2.9% and 2.5%, of water-borne diseases. Male children are more affected as compared to female children (0.95%). In Adults, the percentage of affected men and women is very close at 2.9% and 2.2% respectively. 0.32% of Young Male, Old Male and Old Female are affected. In the case of young women, the percentage of affected is 0%.

At Subdivision 2, 50 surveys were conducted where 19 adult men, 29 adult women, and 2 young women were surveyed. The trend is similar only in the case of adult men affected by water borne disease at 3.17% which is followed by 0.73% for girls and adult women each, 0.24% for young male and older adult men and women, each. Then 0.48% of boys are affected by a similar trend of 0% in the case of female children.

Figure 6: Percentage of Water Borne Disease (Male and Female)



At Subdivision 3, again 50 surveys were conducted in which 22 adult men, 27 adult women, and 1 young man were surveyed and the results show a different trend where young boys and girls are highly affected by the water-borne diseases at 1% each. Male and female adults are affected at 0.75% and 0.25% respectively. Male and female children are equally affected at 0.50% each. At this Subdivision, none of the older males and females are affected with any of the diseases.

Figure 6 shows the disease-stricken percentage of people in Dholak Basti slum at Subdivision 1, 2 and 3. The waterborne diseases- Jaundice, Typhoid and Diarrhea, are identified in men and women. All three study Subdivisions demonstrated that men were more inclined to waterborne illness in contrast

to women. Subdivision 1 shows more percentage of illness (4.77%) as compared to Subdivision 2 and three which is 2.93% and 2% respectively.

One likely reason for the skew towards men in Ward 22 can be explained by meaning the number of men suffering from waterborne diseases is higher than the number of women. Out of the total 62 men and 88 women surveyed in all the three sites, 45 men (72.5%) and 25 women (28.4%) in all age categories were affected with water borne diseases such as Jaundice, Diarrhea and Typhoid. However, it is unlikely this can account for the whole difference between the number of females and males suffering from the waterborne disease.

Another possible explanation for the higher number of men suffering from water borne diseases is supported by the workforce data which shows that out of the total workforce population 86.2% are men and only 13.8% women. The nature of the work also suggests the vulnerability of particular gender to severe illness.

In Dholak Basti slum case, the main occupation of men pertains to making dholaks (musical instruments) and selling them outstation which demands greater mobility than women. They travel to bordering countries as well as intra-state cities to sell their products wherein they consume the available water from various natural or municipal sources. Whereas in the case of women, they are engaged in day labour jobs such as rag-picking and scavenging other than taking care of the household/fetching potable water. The vulnerability to illness exists in the case of women too because of the non-conductive work environment. Studies by authors (Shrivasta et al 2015; Udoh, 1987; Adeyemi, 2004; Dixit and Shanker, 2009) have established that dirty water is the only carrier of water borne disease like Jaundice, Diarrhea and Typhoid, thus this may be the reason for the increased number of illnesses in men in comparison to women in the community. From the interviews conducted, our qualitative results reflect that the women generally do not consume water/food outside their household. This may be another explanation of why women are less prone to water-borne diseases. Other factors might include gender differences in sanitation habits and occupations which could hinder individual immune systems, though these are some of the possible explanations and might not account for the total difference between the number of females and males suffering from waterborne diseases. Owing to different occupations, it is quite likely that there are other factors which merits further investigation.

4 DISCUSSIONS

Ward 22 has an exceptionally low sex ratio of 83.9% (Census 2011). This is below the national average of 99.1%, the urban average of 95.6% and below the city average. This low sex ratio may indicate an average low socio-economic status. Further research would be required to investigate the reasons for the low sex ratio in Ward 22. This is important because by understanding the causes of the problem, policymakers can work on solutions. For example, if there is higher average

mortality in girls and women in Ward 22 policymakers could launch a public health campaign focussed on women and girl's health.

The total literacy percentage of Ward 22 is (57.9%), the fourth lowest total literacy percentage in Haldwani. This is well below the National and State average and therefore significant concern is required. A low literacy rate can be an indication of high unemployment or low economic status which forces children to miss out on education. Furthermore, women in Ward 22 show a lower literacy rate (25.40%) as compared to men (32.54%); this could be an indication of poor water access. As women and girls are the most frequent collectors of water, where access to water is poor, they may miss out on more education relative to their male counterparts. One key aspect of improving literacy levels may be improving access to water. By decreasing the time taken to collect water, policymakers may free more time for education.

In the case of water sources and time spent fetching water, there were three different types of sources used for collecting water. In Subdivision-1 the pipeline was the source used for managing water. However, because the residents attached many pipes to the first significant pipeline to run the water to their homes, the discharge rate of the water has dropped. This results in residents having to spend more time fetching water. In Subdivision-2 the water source was tube wells which were managed by the community members. Residents did not have to spend much time carrying the water because it is pulled from groundwater. However, in the summer season, the time spent fetching water increased as the water table was depleted. In Subdivision-3 there is no water source inside the community so the residents must fetch water from public taps located in the market area. The market is a considerable distance from Subdivision-3, and therefore the residents must spend time walking to fetch water. This is problematic because carrying water over a distance is very hard physical work and can impact the health of those fetching the water. It can be particularly detrimental to the health of pregnant women and children who are developing (UNDESA, 2004).

Where gender is involved in fetching water, all three study Subdivisions showed that there was complete involvement of females in the activity of fetching water and that female contribution was significantly higher than male contribution. This suggests that in the slums, domestic water management is considered as a female role within household labour division. This is a phenomenon recognized across India and in many other developing societies (Kher et al., 2015). The involvement of males in water collection in Subdivision-1 and 2 was far less than their contribution in Subdivision-3. One possible explanation is that the water sources are nearer to the household. However, for Subdivision-3 the distance of the water source results in male members of the household needing to contribute to water fetching so that the household can meet their daily water needs. It is likely that the women carry empty containers with them to the public taps in the market, fill them and then male members of their household

help them to carry the full containers back to their home. The domination of women involved in fetching water in the locality means that women are disproportionately impacted by water stress. If water insecurity increases, female residents may have to spend more time collecting water. Where gender is more affected by waterborne disease, all three study Subdivisions showed that the male gender, including the age classes adult, young and child, is more prone to waterborne disease mainly from jaundice and diarrhea as compared to the female gender. This is significant because much of the literature suggests that female adults and children are most vulnerable to waterborne diseases because they have the most contact with water and less access to unpolluted alternatives (WDR, 2012) Therefore, the results from Dholak Basti contradict the trend of female-dominated sufferers from waterborne diseases reported widely in the literature which can have probable explanation such as low sex ratio and then exposure of men to non-conducive environment in their respective occupation.

In most research papers and articles, it is observed that women are more prone to water-borne diseases than males, but in our research, the findings showed that males are more prone than females. One key reason may be the high sex ratio found in Ward 22 which means there are more men and thus, the number of men who suffer from waterborne diseases is likely to be higher. However, this factor alone might not be solely accountable for the total gender difference. Another reason may be because of the natural mobility in the occupations males might have where they drank unsafe water from different places other than the slum itself, while women are more engaged in household work and have the basic sense of knowledge related to the purity and quality of water there. Another reason may be alcoholism, as men doing hard work (daily wage labour, drivers, vendors) may drink alcohol at night, which adversely effects their health and makes their immune system weak to fight against the disease. Chronic and even acute moderate alcohol use can increase host susceptibility to infection caused by bacterial and virus pathogens (Szabo, 1999). Chronic alcoholics are more prone to infections with a variety of pathogens and have decreased ability to fight with diseases (Roselle et al 1993). Another reason for this could be that given equal living standards, women are supposed to be hardier and have a better immune system than men. Research says if men and women receive similar nutritional and medical attention and general health care, women tend to live noticeably longer than men. Women seem to be, on the whole, more resistant to disease and in general hardier than men, an advantage they enjoy not only after they are forty years old but also at the beginning of life, especially during the months immediately following birth, and even in the womb. When given the same care as males, females tend to have better survival rates than males (Sen 1990). Other factors could include gender differences in sanitation and occupation. However, further research is required to investigate the potential causal factors of this gender difference.

The research carried out in the studied area concluded that the time invested in water collection and carrying heavy

loads from far distances is a grueling everyday ritual, particularly in Subdivision-3. Through our research, it is evident that there is an acute water shortage in the area. The numbers of households affected with water-borne diseases can be most evidently because of the poor water quality or contamination. Though further analysis of local water samples is required to prove this inference, however, as per authors (Halder and Islam, 2015, (Shrivasta et al 2015; Udoh, 1987; Adeyemi, 2004; Dixit and Shanker, 2009) poor water quality is one of the major reasons for water-borne diseases. The Dholak Basti area falls under category-three slum criteria (as laid by Uttarakhand Slum Act, 2016) where the government cannot take the responsibility of water provisioning as the population is not recognized officially by the Urban Local Body which grants land tenure rights. This doesn't devoid slum residents of their fundamental human rights. Through this research project as well as the findings from the qualitative and quantitative methods, issues with water quantity and quality were found. To address these issues and overcome these problems installation and use of a filtration systems at the community level can be explored. Water can be treated by chlorination, boiling or by using filtration system. In this regard, bio-sand filters might be a feasible option since they are very cheap to construct, and their maintenance cost is low. Also, the installation of filters at the community level in the slum will reduce the time involved in fetching water and female drudgery because residents can take water directly from the filters according to their daily drinking requirements. This could allow girls to improve their education and women to have more time for other domestic duties or wage employment.

5 CONCLUSION

From the above discussion it is evident that female gender plays a major role in household water management. Inability of the system to recognize slums in the mainframe of city services and amenities is a major challenge to the health and security of the lower income class and informal groups. Basic services like water and shelter are some of the major challenges to be met by the residents in these poor pocket communities and with increasing climate led extremes like urban flooding they will be the most vulnerable groups since both climate and urban phenomena shall exacerbate the water stress in Haldwani (Habeeb et al, 2019).

If these stresses are not assessed, residents may have to spend significantly more time collecting water which leaves less time for wage employment, education and leisure time. In all three studied Subdivisions the percentage of residents affected by water-borne diseases is also high. To overcome this problem it is requisite to look for those techniques which can not only help in purification of water but also aid in provision of sufficient water quantity to meet daily needs.

In the case of gender involved in fetching water, if water insecurity increases, female residents may have to spend more time collecting water. This is significant because it may result in women missing out on education and wage employment, a

common phenomenon reported by the (WHO, 2005) in water stressed areas. Therefore, due to socially constructed gender roles in the household, water stress in Haldwani may impact women more. Hence, these factors must be considered when forming new practices and strategies for water management.

SUPPLEMENTARY INFORMATION

Supplementary information related to this article can be found on page 59.

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Gender Contribution in Household Management of Water and its Impact on Residents of Dholak Basti in Haldwani City of India

Yashi Gupta¹, Riyan Habeeb¹, Manya Singh¹, Anvita Pandey¹, Vishal Singh¹, Elizabeth Barker²

¹Center for Ecology Development and Research, Dehradun, Uttarakhand

²University of Cambridge, United Kingdom

Southasia Institute of Advanced Studies (SIAS)

Climate Adaptive Water Management Practices for Cities in South Asia

Questionnaire for Household Survey

This survey is a part of Climate Adaptive Water Management Plans for Cities in South Asia, conducted by SIAS/CEDAR in collaboration with other partners.

The interviewer informs that s/he is conducting a household survey to understand the access and use of drinking water in and around the respondent's home, as well as environment which the respondent interacts with.

This survey is being conducted for research purpose and the information obtained will be treated strictly confidentially, and the name of respondent will not be printed or used in any documents. Your household has been chosen randomly within your municipality. All households will have a code number, which will be used for analysis.

The survey should take around 30 minutes.

Interviewer informs that participation is voluntary and information remains confidential.

Are you willing to participate? Yes No

If the respondent does not give INFORMED CONSENT, thank him/her and move on to the next household.

A. Background Information

1. Interview date	2. Respondent's name	
3. Municipality	4. Ward No.	5. GPS point
6. Age	7. Caste	
8. Education	9. Occupation	
10. Gender	11. Number of family members	
12. House type	13. Income range	

B. Water Access/Supply/Quantity /Quality and Sanitation

14. What is the main source of drinking water for members of your household?	a) Piped water into dwelling = 1 c) Public tap/standpipe = 3 e) Protected dug well = 5 g) Protected spring = 7 i) Rainwater collection = 9 k) Cart with small tank/drum = 11 m) Surface water (river, dam, lake, pond, stream, canal, irrigation channels) = 13	b) Piped water to yard = 2 d) Tubewell/borehole = 4 f) Unprotected dug well = 6 h) Unprotected spring = 8 j) Bottled water = 10 l) Tanker-truck = 12 o) Other (specify) = 14	
15. Is your water supply private or public or community?	a) Private = 1	b) Public = 2	c) Community = 3
16. What is the main source of water used by your household for other purposes (eg. for sanitation purpose)?	a) Piped water into dwelling = 1 c) Public tap/standpipe = 3 e) Protected dug well = 5 g) Protected spring = 7 i) Rainwater collection = 9 k) Cart with small tank/drum = 11 m) Others (Specify) = 13	b) Piped water to yard = 2 d) Tubewell/borehole = 4 f) Unprotected dug well = 6 h) Unprotected spring = 8 j) Tanker-truck = 10 l) Surface water (river, dam, lake, pond, stream, canal, irrigation channels) = 12	
17. Is this water supply private or public or community?	a) Private = 1	b) Public = 2	c) Community = 3
18. If you fetch water, how much time do you spend per trip?	a) Minutes	b. Water on premises	c. Don't know
19. How many people use water in your house/block?	a) Family members:	b) Tenants:	c. Other specify:
20. Does the household have land/ house ownership certificate?	a) Yes = 1	b) No = 2	c) No response = 3
21. How much water per day does your household need?	a) < 300 L/day = 1 c) 500 -1000 L/day = 3	b) 300 - 500 L/day = 2 d) > 1000 L/day = 4	
22. Who usually goes to the source to fetch water for your household?	a) Adult man = 1 d) Boy (<15) = 4	b) Adult woman = 2 e) All of above = 5	c) Girl (<15) = 3 f) Do not know = 6
23. How much time is spent in water management/collection each day? (for private connection)	a) < 10 minute = 1 c) 20 - 30 minute = 3	b) 10 - 20 minute = 2 d) Others specify = 4	

24. Do you think the quantity of water has changed in the last 10 years?	a) Increased = 1 c) No change = 3	b) Decreased = 2 d) Don't know = 4		
25. Are you satisfied with the quantity of drinking water?	a) Highly dissatisfied = 1 d) Satisfied = 4	b) Dissatisfied = 2 e) Highly Satisfied = 5	c) Neutral = 3	
26. Do you think the quality of water has changed in the last 10 years?	a) Improved=1 c) Degrade =3	b) No change = 2 d) Don't know = 4		
27. Are you satisfied with the quality of drinking water?	a) Highly dissatisfied = 1 d) Satisfied = 4	b) Dissatisfied = 2 e) Highly Satisfied = 5	c) Neutral = 3	
28. How often have you experienced bad smell or foreign body or turbid in the water in the past 1 year?	a) Always = 1 d) Rarely = 4	b) Frequently = 2 e) Not at all = 5	c) Occasionally = 3	
29. Which month is bad for water supply in relation to Quantity?	a) Baishak = 1 e) Bhadra = 5 i) Poush = 9	b) Jestha = 2 f) Ashwin = 6 j) Magh = 10	c) Ashadh = 3 g) Kartik = 7 k) Falgun = 11	d) Sharwan = 4 h) Mangsir = 8 l) Chaitra = 12
30. Which month is bad for water supply in relation to Quality?	a) Baishak = 1 e) Bhadra = 5 i) Poush = 9	b) Jestha = 2 f) Ashwin = 6 j) Magh = 10	c) Ashadh = 3 g) Kartik = 7 k) Falgun = 11	d) Sharwan = 4 h) Mangsir = 8 l) Chaitra = 12
31. How do you treat your drinking water?	a) Chlorination = 1 d) Solar disinfection (SODIS) = 4 f) No treatment = 6	b) Boil = 2 e) Let it stand and settle = 5 g) Others specify = 7	c) Filtration = 3	
32. How do you manage water during the scarcity?	a) Bottle water=1 e) Rainwater harvest = 4	b) Tanker=2 f) Other specify = 5	c) Local springs=3 d) Neighbor = 6	
33. If water shortage, how much do you spend per month for coping mechanism?	NPR/INR:			
34. Do you pay for the water services?	a) Yes = 1	b) No = 2		
35. If yes, how much do you pay monthly?	NPR/INR:			
36. What kind of toilet facility do members of your household usually use? <i>If "flush" or "pour flush" Where does it flush to?</i>	a) Flush toilet = 1 to b) Pit latrine = 2 d) Composting toilet = 4 f) Open defecation = 6	(i) Piped sewer system (ii) Septic tank (iii) Don't Know c) Open pit (temporary) latrine = 3 e) Hanging toilet = 5 g) Other specify = 7		
37. Do you reuse water?	a) Yes = 1	b) No = 2		
38. If yes, do you use retreated water?	a) Yes = 1	b) No = 2		

45. Have you felt changes in max/min temperature since last 10 years?	a) Increased = 1 c) No change = 3	b) Decreased = 2 d) Don't know = 4
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C. Water Supply /Management / Institutions

46. Who manages the water supply system in your area?	a) Government = 1 d) Private sector (tanker, bottled water) = 4 e) Others specify = 5	b) Municipality = 2	c) Community = 3
47. Generally speaking, how do you find the current water supply and management situation in the town?	a) Very good = 5 d) Poor = 2	b) Good = 4 e) Bad = 1	c) Fair = 3
48. Do you think the current supply system is distributing water to each HH equally?	a) Yes = 1	b) No = 2	c) Do not know = 3
49. How often did you have conflicts over water in the past year?	a) No conflicts = 1 c) Most of the times = 3 e) Not me but heard other incidents = 5	b) Sometimes = 2 d) Almost everyday = 4	
50. What is the nature of conflicts?	a) Source related = 1 c) Price related = 3	b) Access related = 2 d) Others specify = 4	
51. Do you think that private sector should be engaged in water management?	a) Good = 5 d) Bad = 2	b) Okay = 4 e) Very bad = 1	c) Neutral = 3
52. Which institutions play key role in water management?	a) Municipality = 1 d) All of these = 4	b) Water Board/user group = 2 e) Other specify = 5	c) Water forum = 3w group = 2
53. Is increasing population affecting water availability in the town?	a) Yes = 1	b) No = 2	c) I don't know = 3
54. What change factors have affected water availability in your city?	a) Climate change = 1 c) Population growth = 3 e) Other specify = 5	b) Urbanization = 2 d) All of the these = 4	
55. How can water scarcity be addressed in your town?	a) Infrastructure = 1 d) Private sector = 4	b) Source conservation = 2 e) Other specify = 5	c) Equitable distribution = 3
56. How often do you participate in water management decision and planning?	a) Mostly = 5 d) Rarely = 2	b) Often = 4 e) Never = 1	c) Sometimes = 3
57. If participated, what role did you play?	a) Decision making = 1 c) Passive participation = 3 e) Other specify = 5	b) Meaningful participation = 2 d) Only listening = 4	

D. Water Borne Diseases

58. Does your family has a history of water borne diseases?	a) Yes =	b) No =
59. What are the water borne diseases? Name them		
60. Who are the people?	Child = Young = Adult = Old =	Gender = Gender = Gender = Gender = Number = Number = Number = Number =