

CHAPTER 1: INTRODUCTION

1.1 Background of the Study

Globally 663 million people currently do not have access to clean water, whereas 2.4 billion people do not have access to improved sanitation; a facility that separates human waste from human contact. Similarly, it is quoted that 7 out of 10 people are without access to improved sanitation and 946 million people defecate in the open; whereby 9 out of 10 of those people, live in rural areas (UNICEF, 2016). An estimated \$260 billion annually is lost globally, from time spent and income not earned and averted health-related costs, due to a lack of basic water and sanitation (Hutton , 2012).

Water, Sanitation and Hygiene (WASH) is a collective term for three core issues which are interdependent in nature. Aggregated they represent a vital sector of development. As an example, without toilets, water sources can become contaminated; without clean water, basic hygiene practices are not possible. Inadequate WASH facilities cause a range of issues, from illness to lost income, although diarrheal disease is widely recognised as the main result of inadequate WASH provision. 1.8 million people die every year from diarrheal disease (Sanctuary & Tropp, 2005) with around 6,200 children under five dying in Nepal in 2008 (Sanitation and Water for All, 2012).

The advantages of having access to an improved drinking water source are heightened when there is also access to improved sanitation and adherence to good hygiene practices. Benefits of WASH have profound wider socio-economic impacts, particularly for females. As water has public good characteristics, arguably institutions rather than the market should be responsible for its provision (World Bank, 2004). Beyond reducing water-related illnesses, other benefits of WASH projects range from quantifiable (e.g. time saved, costs avoided) to the more intangible benefits which are difficult to measure (e.g. well-being, education etc.). The economic impact of improving water, sanitation and water resources management allows individuals to explore new

livelihood opportunities (Sanctuary & Tropp, 2005). Water resource management extends to minimising floods and droughts also; both of which involve significant economic losses.

Improving household water and sanitation access impacts households and eventually the macro economy. Empirical evidence demonstrates the significance of water and sanitation mismanagement on health and education to individuals and households and also economic welfare and growth (Sachs, 2001). Universal access to basic water and sanitation would result in approximately \$23.5 billion in economic benefits globally each year from avoided deaths alone (Hutton, 2012).

A country's overall development strategy and macroeconomic policies, including fiscal, monetary and trade policies, directly and indirectly affect demand and investment in water related activities. For example, macro policies affecting trade and agriculture affect production and cropping patterns which help dictate water resource use and allocation. However, the limited awareness of water's contribution to economic development is confirmed by its limited visibility in the Poverty Reduction Strategy Papers and other development strategies (Sanctuary & Tropp, 2005).

The UN's Millennium Development Goals (MDGs) were not completely achieved hence massive inequalities between those with access to clean water and basic toilets, and those without the amenities still exist. The successor to these goals, the current Sustainable Development Goals (SDGs), established in 2015, aim to achieve a fairer and more sustainable future for all. SDG 6 is a specific goal to "ensure the availability and sustainable management of water and sanitation for all" which is to be achieved by 2030. To achieve this goal, different organizations have their own approaches and targets. However, exclusion, discrimination, power asymmetries, poverty and material inequalities are key obstacles to fulfilling this (WWAP, 2019). Access to safe water and sanitation are human rights, as recognized in 2010 by the United Nations General Assembly. The global fulfilment of these rights will require the right systems, policies, distributed resources and capable institutions delivering services and changing behaviours in resilient and appropriate ways (United Nations, 2019).

As per the 2015 constitution of Nepal, access to safe drinking water and improved sanitation is a human right. A basic domestic water requirement is estimated to be on average 50 liters per person per day (Gleick, 1996). Nepal's household water provision is very complex; whilst the Himalayas contain vast water resources which input into rivers at the northern part of the South Indian continent, the geological and ecological conditions make it difficult to put water to economic use. In practice, many parts of Nepal face water scarcity. In the densely populated areas with growing industry, the demand for water for different purposes has led to intense inter-sectoral competition over water; ranging from irrigation, industrial use to drinking water (Benda-Beckmann, Spiertz, & Benda-Beckmann, 1997). Diarrheal diseases remain a challenge in Nepal because of inadequate safe water supply and sanitation; a minimum of 30,000 deaths per year and morbidity of 3.3 episodes per child was estimated due to diarrhea (Pokhrel & Viraraghavan, 2004).

According to UNICEF, in Nepal, 10.8 million people do not have access to improved sanitation and 3.5 million people do not have access to basic water services. To improve public health and to achieve the objectives of national poverty reduction, access to safe drinking water supply and improved sanitation services is fundamental. Lack of access to these essential services contributes to disease that shortens and impairs the lives of many people. People in both rural and urban areas are affected by water-related diseases due to the use of unsafe water, poor hygiene practices and inadequate sanitation facilities. Hence people face several problems and can lose opportunities to income sources. For women this is even worse due to the inadequate local availability of water, so they often spend several hours a day fetching water from far away sources for household purposes, rather than finding income sources. Given women are disproportionately affected by inadequate WASH provision, their involvement in such projects should not be underestimated. (Upadhyay, 2005)

Over the last few decades, Nepal has made significant progress in expanding access to water and sanitation despite tremendous challenges such as poverty, inequality, political instability and difficult terrain including earthquakes and conflicts. Compared to 46% in 1990, 95% of households now have access to improved water sources and 62% of households are using an improved sanitation facility, up from 6% in 1990. The Ministry of Water Supply and Sanitation

(MoWSS), instituted in December 2015 is the lead Ministry for the WASH sector with the Department of Water Supply and Sewerage (DWSS). DWSS has divisions/subdivisions in all 75 districts and regional monitoring and supervision offices in the five development regions. A study report published in 2016 (Nationwide Coverage and Functionality Status of Water Supply and Sanitation in Nepal, NMIP/DWSS) indicates that the national water supply coverage has slightly increased and has reached 87% whereas the sanitation coverage is 87.3%.

To achieve SDG 6, the Government of Nepal is working closely with different development partners, such as Non-Governmental Organizations (NGOs) and International Non-Governmental Organizations (INGOs) for WASH projects. These development partners are working at various levels and districts as per the Memorandum of Understanding (MOU) with the Government and as part of the Government program either with MoWSS or the Ministry of Federal Affairs and Local Development (MoFALD). Based on the agreement with the Social Welfare Council, some of the NGOs are working directly in different districts. Even though different agencies are engaged in implementing WASH projects, the reality is that most of the agencies are not able to achieve the maximum targets they aim to achieve.

1.2 Statement of the Problem

Access to water, sanitation and hygiene is a basic need for everyone. If access to water, sanitation and hygiene were available to all, then people will have higher productivity, higher income, improved health and higher life expectancy. In Nepal there are different interventions that have been conducted in urban and rural areas from different NGOs and Community-Based Organizations (CBOs) particularly throughout the past decade. In some ways these organizations which have been involved in WASH projects have been able to achieve significant progress in different districts and have created lasting change. But not all who have intervened have achieved the same impact. In Nepal the progress of WASH projects and their impact is not always optimal. There are still questions around whether these interventions really impact the community and what approaches can improve results. This study is designed to evaluate the effectiveness of an integrated WASH project carried out in villages in the Makwanpur district.

Simaltar and Ikchung are economically poor and socially backward communities, within the Makwanpur district. These communities had water scarcity after the 2015 earthquake as their water sources were damaged. Villagers had to spend hours in long queues to get enough water for their household purposes. The water was supplied via public shared community taps in the villages for only a few hours twice a day, which was not enough to meet local demand. Consequently, households have to spend time each day collecting water, whereby the opportunity cost of that time could amount to improved income if time was used for education, agriculture or economic purposes, rather than water collection. When time is spent collecting water multiple times a day, productivity levels can decrease, as individuals focus on water collection rather than economic activities. These communities did not have any external intervention related to WASH previously. Some of the households did not have any sanitation facilities. Awareness regarding good sanitation and hygiene practices was minimal among the villagers which caused them to spend a lot of money in health care centre and hospitals due to poor health of household members. The functionality of their water users' committee was not very effective in the community. The major focus of the program was recovery, rehabilitation and reconstruction maintaining the balance of both hardware and software activities.

This thesis studies the effectiveness of an integrated WASH project in the Makwanpur district. Thus, the study answers the following research questions:

- i. What is the WASH situation before and after the WASH intervention in the study area?
- ii. What is the effectiveness of the WASH project in the study area with reference to time saving and economic benefit?

1.3 Objective of the Study

The general objective of this study is to find out the effectiveness of an integrated WASH project. The specific objectives of this study are as follows:

- i. To assess the WASH situation before and after the project intervention in the study area and

- ii. To find out the effectiveness of the WASH project of the study area with reference to time saving and economic benefit

1.4 Significance of the Study

This thesis focuses on the integrated effectiveness of a WASH project that has been conducted in the study area. As a case study, two rural communities in the Makwanpur district have been used to measure the impact and effectiveness of a WASH project. This research compares the status of the villages before and after, in the context of the effectiveness of the project. The WASH project uses an integrated approach which involved a range of stakeholders ranging from local young people to community leaders, national and international volunteers and engaging and having the support of a local NGO and a CBO in order to utilize local knowledge and resources effectively.

This study shows the importance of different parties being involved to enable the successful completion of a WASH project. This study reflects the effect made by the intervention over a short period of time which can be a useful example for other organizations.

1.5 Limitations of the Study

This study has been conducted in Simaltar and Ikchung villages so this study may not necessarily represent the problems of the entire Makwanpur district or the overall country. While conducting this research there are a range of limitations such as:

- i. Out of 131 households, baseline and end line surveys were carried out among 77 households only.
- ii. Data was collected from only two villages (Simaltar and Ikchung). Therefore, the results are applicable for the study area only.
- iii. To analyze the data, simple statistical methods such as the paired t-test was used.
- iv. Restricted time and resources to conduct surveys

1.6 Organization of the Study

The chapters are divided into five topics in this report. The first chapter is an introduction which consists of a background and introduction to the study area, statement of the problem and objectives, significance, limitations and organization of the study. The second chapter includes the review of the literature from relevant published materials. Chapter three contains the research methodology including research design, source of data, method of data collection, data collection tools, sample size, population and data analysis. Chapter four covers data analysis and presentation consisting of socio-economic characteristics, the WASH situation in the study area and the effectiveness of the program. The final chapter five includes the findings, conclusion and recommendation for the project.

CHAPTER 2: LITERATURE REVIEW

This chapter reviews national and international literature available for WASH interventions that have been tested and implemented in various projects. This chapter covers the empirical review and research gap that exists.

2.1 Empirical Review

Sanctuary & Tropp (2005) looked at the role of water within economic development and investigated the economic benefits of improved water resources and management. Their five key conclusions affirm that an improved water supply and sanitation boosts countries' economic growth and contributes greatly to poverty eradication. The economic benefits of an improved water supply and sanitation were also found to outweigh the investment costs, typically due to gains in health as well as agricultural and industrial sectors. When water storage capacity was improved, national economies were more resilient to rainfall variability and economic growth was boosted. The consequential increase to production and productivity within economic sectors after water and sanitation interventions was also found. They also recognise that to improve water supply and sanitation, investment needs to come from both public and private sources.

Cost-benefit studies globally have shown that WASH services provide favourable economic returns; with a global average benefit-cost ratio of 2.0 for improved drinking water and 5.5 for improved sanitation (WWAP, 2019). In Nepal specifically, the benefit-cost ratios are found to be 1.6 and 3.0 for water and sanitation investments respectively (Sanitation and Water for All, 2012)

Aside from economic studies, there are a range of intangible impacts to WASH projects. These include improved comfort, dignity, privacy, security and social acceptance. When WASH is improved at schools, this can improve school attendance and completion, and at the workplace can increase female participation. Hence water and sanitation promote social equality and economic growth. (Sanitation and Water for All, 2012)

The UN's 2019 WWDR found evidence suggesting the return on investment in water supply and sanitation services can be high, especially when broader macroeconomic benefits are taken into account. 75% of people globally living in extreme poverty live in rural areas, whereby the vast majority are smallholder family farmers. Equitable access to water for agricultural production even if only for supplemental crop watering, can determine whether farming is for survival or a source of livelihood, emphasising the role of water within economic development. As poor groups are not homogenous, policies regarding water supply and sanitation need to be bespoke and suitable for the underlying population. They also acknowledged that whilst the support of international donors will remain critical in developing countries, it will remain incumbent upon national governments to dramatically increase investments. (WWAP, 2019)

The role of water within socio-economic development was researched by Goswami and Bisht (2017) who found that water is vital to maintain health, grow food, manage the environment and create jobs hence is at the heart of economic development. Water requires optimal management to control scarcity and competition for use (e.g. agricultural, industrial, recreational and environmental) due to increasing demand, population growth, climate change and declining water supplies. The most fundamental role of water in socio-economic development is for domestic purposes. Using their case study of India, water resources development, multipurpose hydraulic infrastructure and irrigation were found to contribute significantly to their economic growth. They also found that water resource project construction may generate significant economic activity through both direct and indirect effects. (Goswami & Bisht, 2017)

A number of case studies indicate that corruption is a mounting problem within the water sector, costing millions of dollars each year. However aggregated empirical evidence is still insufficient to make generalisations on the magnitude or the extent to which it is an impediment to water development efforts. (Sanctuary & Tropp, 2005)

Udmale, Ishidaira, Thapa, & Shakya (2016) researched the water demand within Kathmandu, Nepal and noted the 2015 earthquake caused losses to the water and sanitation sector estimated at NPR11,379 million (c.\$106million). They also surmised that there is a supply deficit of 102million liters per day which the Melamchi Water Supply Project is hoping to resolve. The Government of Nepal's 2010 capital investment and asset management program aims to provide

135 liters per capita per day of domestic water to the residents of the valley by 2025. Water demand varies with the socio-economic status of households, whether they are rural or urban, and existing infrastructure. However, in most cases, relevant data is not available to local administrative divisions. To achieve SDG 6 in Nepal, investment into water supply and sewage system infrastructure needs to be considered against the backdrop of an increasing population, lifestyle changes and available water resources. Hutton & Chase (2016) summarized a range of global research on WASH. The paper covered evidence showing progress in drinking water, sanitation, and hygiene coverage, impacts of poor WASH practices, covering health, social, environmental and economic aspects, evidence on the effectiveness of WASH interventions, and the costs and socio-economic returns related to improved WASH. The authors reviewed the thematic area of WASH from different geographical regions based on the evidence mainly sourced from published reviews such as a systematic review, meta-analyses and literature review. The authors have evaluated and compared the MDGs and SDGs for WASH targets, how they differ, and what are the improvements made to the SDGs to achieve WASH targets. The review shows the evidence of improved policies and programmes needed in designing and implementing WASH. They concluded that the global overview of evidence is useful, but the evidence needed to be reviewed from a specific context such as rural or urban areas, or at country or regional level to achieve WASH targets.

Shrestha (2014) studied the impact of health education on the knowledge and practice regarding personal hygiene among primary school children. The objective of this study was to assess the change of knowledge and practice regarding personal hygiene among primary school children after educational interventions. Pre and post test study design was conducted at Government Urdu primary school. Baseline and end line surveys were carried out in the school. A pilot tested questionnaire was used to collect the data. To see the association between pre and post test variables, a paired t-test and McNemar test were used. Data was entered and analyzed using the Statistical Package for The Social Sciences (SPSS) software where the mean, proportions and percentages were also calculated. The analysis showed that the knowledge and practice on personal hygiene increased after health education intervention. The increase in knowledge and practice was statistically significant.

An economic study has shown that the result of poor sanitation and hygiene costs the economy of Nepal a range of 1.6-4.1% of annual GDP (Sanitation and Water for All, 2012). Across Nepal, the annual government spend on WASH is around 3% of the national budget, with a funding gap of NPR 30 billion rupees (c.\$280million) to meet current needs (Karki, 2015). That said, government led initiatives are making an impact. The Rural Water Supply and Sanitation Fund Development Board implemented a demand-led community based rural water supply and sanitation programs in 49 districts in Nepal with two phases (RWSSP- I 1996-2003 & II 2004 – 2009) with a participatory approach to bring about fundamental changes in the conventional supply. The aim of the project was to raise the living standard of rural people by improving sector institutional performance, mainstreaming the Fund Development Board approach, and by supporting communities to form inclusive local water supply and sanitation user groups. These groups plan, implement and operate drinking water and sanitation infrastructure to benefit rural households. The Fund Development Board is implementing its program with an “integrated approach” through the public private partnership (PPP) model. Apart from the construction of a water supply system, which is an “entry point” activity, the major program components included health hygiene and sanitation, school sanitation, skill-based training, micro irrigation, environmental management and community organization and mobilization. Non-formal education and a women’s technical support service were linked to income generation activities. The Fund Development Board successfully implemented the program in different districts which helped to define an effective demand-driven approach to service delivery through an inclusive, participatory process in which communities were empowered to make informed decisions, including water supply schemes. (Rural Water Supply and Sanitation Fund Development Board, 2009).

Sah, Baral, Ghimire, & Pokharel (2013) presented a study on water practices and sanitation in the Chandragadhi VDC of Jhapa district. The objective of the study was to understand the knowledge and practice about the water and sanitation related diseases and to know the pattern of water-related diseases in that area. The methodology involved a convenient purposive sampling technique, semi-structured questionnaire and the chi-square test was applied. The finding of the study showed the majority of people with knowledge of safe water and sanitation also used soap and water for handwashing before meals and after defecation. People drinking

untreated water showed significant correlation with water-related diseases i.e. diarrhea followed by dysentery.

Shrestha, Manandhar, & Joshi (2018) conducted a study on the knowledge and practices of water, sanitation and hygiene among secondary school students in both rural and urban areas. The study focused on WASH; inadequate and poor WASH being the leading cause of mortality and morbidity among children. The objective was to assess the school children's knowledge and their practices on WASH. A comparative descriptive cross-sectional study was conducted in both a rural and urban school in Sindhupalchowk and Bhaktapur in January-February 2018. The calculated sample size was 216, taking prevalence of 52% with a confidence interval of 95% and margin of error of 0.07. A convenient sampling method was applied. Two schools were randomly selected, and data collection utilized questionnaires, personal observation and a checklist. Data was entered into SPSS where the statistical test, mean and percentages were calculated. The study showed that the knowledge and practice of WASH among secondary school students was still poor, albeit better in urban areas compared to the rural areas on the basis of their knowledge score.

Budhathoki (2018) published a report on an end line study of a WASH management project in Bajhang. The project was implemented by the Nepal Red Cross Society where the end line objectives were to find analytical information about achievements of impact, outcomes, sustainability and effectiveness of the Sanitation, Hygiene and Water management (SHWM) project in the intervention areas. The methodology used was both qualitative and quantitative. Pre and post programme evaluation design were used to assess overall progress in this study. Outcomes of the project were assessed by comparing baseline and end line data. It was concluded that the project activities were highly relevant to the target communities as interventions fulfilled their urgent sanitation, hygiene and water supply needs. The project activities were implemented as per the action plan and framework aligned with the national as well as local sanitation and hygiene strategies through a collaborative, demand driven and participatory approach.

Kafle (2018) studied the situation of WASH and diarrheal diseases after the Open Defecation Free Declaration in Makwanpur. The objective was to understand the situation and impact to the

district after the declaration. The methodology used in this study was cross sectional among a random sample of 178 households using interviews and observations. The WASH situation was assessed in terms of related facilities, knowledge and practices of mothers. The results showed that of the total households, 92% had toilets and 90% had access to an improved water source. However, 79% mothers had high knowledge of safe water, sanitation and hygiene and 43% practiced handwashing with soap at critical times. Proper disposal of solid and liquid waste was found at 32% and 46% of households respectively. Diarrheal disease of children under five was found to be declining after the Open Defecation Free Declaration.

2.2 RESEARCH GAP

After reviewing the literature from national and international sources there have been ample studies and research conducted on the WASH sector. The literature review shows all the projects which have been conducted were of significant budget and the interventions have been over a long period of time. National studies that have been conducted on WASH projects show that there is no robust research carried out after project intervention to analyse the impact or there is no consistent data available from before the intervention in the project area. Most of the WASH research analysed school areas or focused on children's health and sanitation.

This study tries to analyse the effectiveness of a WASH project that has been conducted with limited budget and over a short period of time. It also analyses the economical effectiveness of the project in the study area. No prior research has been carried out where the WASH project duration was short, which used an integrated approach involving multiple stakeholders, whereby the project was completed in the specified time and which also focused on the economical effectiveness on the intervention area. The goal of this study is to analyze the economical effectiveness of a WASH project before and after the intervention conducted in two villages Simaltar and Ikchung of the Makwanpur district, particularly understanding whether time saving has been achieved and whether there has been increased economic benefit to the community. Paired t-test analysis will be used to compare before and after data obtained through baseline and end line surveys. This study would help to reflect and evaluate the program which has been

conducted in the Makwanpur district by a NGO. Recommendations can also be provided to improve WASH projects for future similar programs run in different villages.

CHAPTER 3: RESEARCH METHODOLOGY

This chapter describes the research design, source of data, method of data collection, data collection tools, sample size & population and data analysis.

3.1 Research Design

Descriptive research design has been adopted for this study. The research has been conducted in the Simaltar and Ikchung villages of the Makwanpur District. The study aims to emphasize the effectiveness of an integrated WASH project by comparing baseline and end line survey data. This study will reflect on the situation and the effectiveness of the WASH project. The data interpretation has been supported by charts and tabular analysis followed by their explanations and conclusions drawn.

3.2 Source of data

This study is based on primary data. Primary data was collected from two villages (Simaltar and Ikchung) using questionnaire interviews with the head of each individual household. All the information was collected, collated and analyzed for this research.

3.3 Method of data collection

WASH project data was collected using a baseline survey before the project intervention and after the project intervention end line surveys were carried out. These surveys were conducted using interviews with a pre-designed questionnaire (in the Appendix) and all the interviews were conducted with the head of each sample household as far as possible. Interviews avoided the need for respondents to be able to read the questionnaire. After the collection of all the data and information, the data was thoroughly checked, compiled and tabulated to form a data set suitable for analysis.

3.4 Data Collection tools

The data collection tool used was a structured questionnaire completed by interview. The questionnaire is divided into six sections i.e. household, water, sanitation, health and hygiene, WASH management and additional information. The questionnaire includes questions regarding socio-economic condition, water availability & usages, sanitation practices, health and hygiene condition, WASH management system and any additional information provided by the respondent. The questionnaire was developed so that it obtains all the relevant information related to WASH project. The same questionnaire was used for both baseline and end line surveys for comparison. The full detailed questionnaire can be obtained from the Appendix.

3.5 Sample Size and Population

The villages Simaltar and Ikchung were selected purposively for two reasons. First, the project was carried out after the earthquake in an area that had been severely adversely affected. Second, no external interventions relating to WASH projects had previously been done in these villages.

3.5.1 Population

The population for the study is the total number of households in the study area. There were 131 households in total, consisting 684 individuals. The baseline and end line surveys were conducted among 77 households in the villages.

3.5.2 Sample Size

Baseline surveys were conducted at the beginning of the project across the villages and the same sample households were used for the end line survey after the completion of the project for comparison purposes. It was not possible to select every household so instead the households were selected, ensuring that more than 50% of the households were covered in each village. 77 households (59% of total households) were selected as a sample as not all households had individuals present at the time of interview and due to the researcher's limited time and resources. The end line survey was conducted after the completion of the project to assess the effectiveness and impact of the project comparing information gathered from the baseline

survey. Project intervention and baseline surveys were completed in 2016 and end line surveys were conducted in 2017.

3.6 Data Analysis

Data analysis used Microsoft Excel where all the data was aggregated, compiled and analyzed using pivot tables for both before and after survey data. Later, all the related variables were analyzed using Stata statistical software. The statistical technique used to analyze this research was a paired t-test.

Shier (2004) states that a paired t-test is used to compare two population mean where you have two samples in which observations in one sample can be paired with observations in the other sample. Examples of where this might occur are:

- Before and after observations on the same subjects (e.g. student's diagnostic test results before and after a particular module)
- A comparison of two different methods of measurement where the measurements are applied to the same subjects (e.g. blood pressure measurements using a stethoscope and a dynamap)

A paired t-test is used to determine whether the mean difference between two groups is statistically significantly different to zero. Given the prominence in the literature review of diarrheal disease being widely recognised as a principal result of inadequate WASH provision, their level of incidents and other variables will be tested using the paired t-test after WASH intervention.

CHAPTER 4: DATA ANALYSIS AND PRESENTATION

This chapter describes the study area chosen and the demographic and socio-economic composition. The analysis and effectiveness of the WASH intervention is considered. Using comparative analysis and the paired-t test, the economic effectiveness and impact of the project is presented, particularly with reference to time saving achieved, changes in water availability and economic impact.

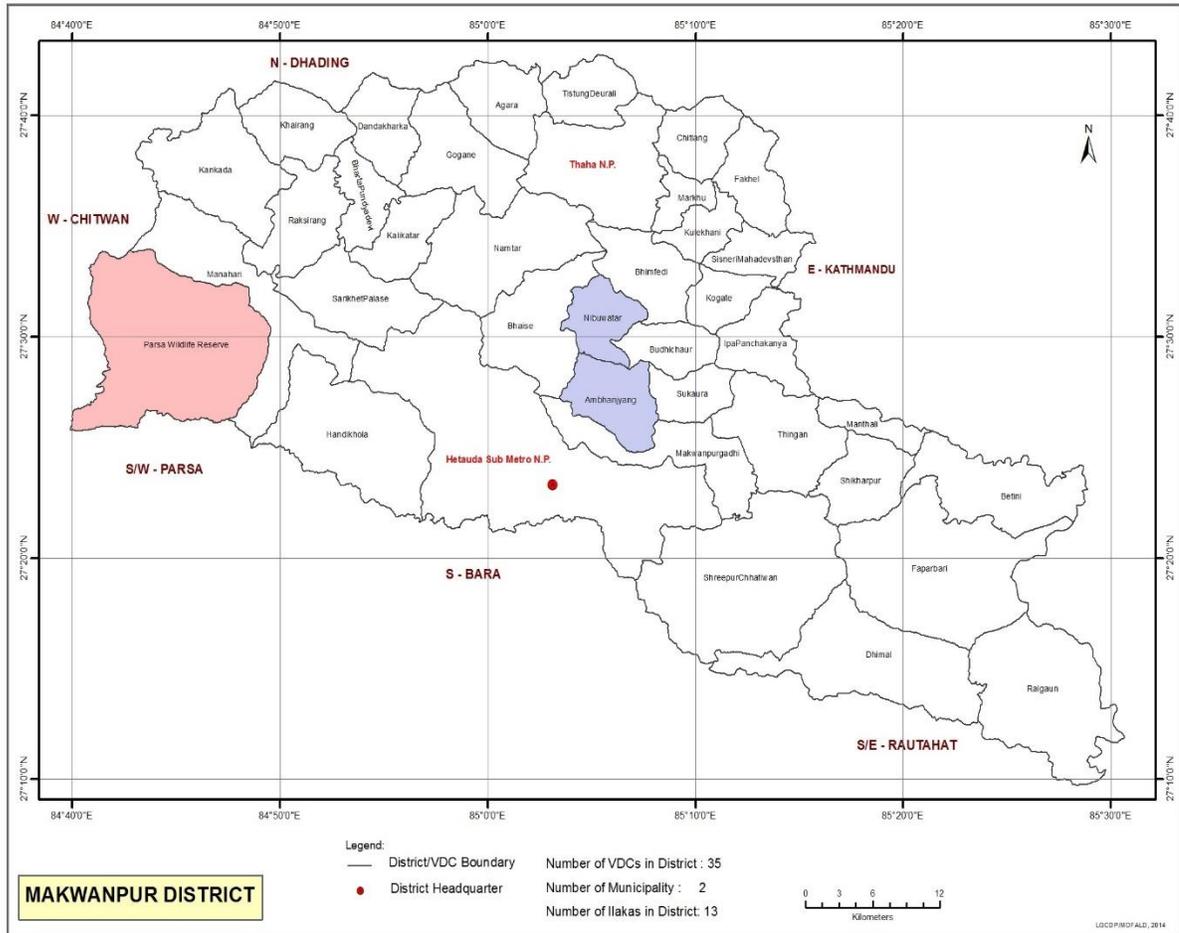
4.1 Introduction of the Study Area

Makwanpur lies in the central region of Nepal with a population of 420,477 people (206,684 males and 213,793 females) and a water supply coverage of 87.9% and sanitation coverage of 77.5%. Makwanpur district was declared Open Defecation Free in 2013 as the movement started in Nepal (since 2003) to address the high burden of diarrheal disease amongst children under five. This study has been conducted in two villages, Simaltar and Ikchung, within the Makwanpur District to evaluate the WASH project conducted through an integrated approach. To evaluate the project, both baseline and end line surveys have been conducted and compared. The selection of these villages used a community and needs based assessment, which included considering a range of factors; the areas affected by the 2015 earthquake, adequate local demand for the project, water source or tank damage, low flow of water level, zero previous interventions by an organization related to WASH, and/or a lack of awareness regarding basic hygiene and sanitation practices.

The short-term intervention period of the project was 6 months in a village using an integrated approach by mobilizing local youth, local community members, engagement with national and international volunteers, and in collaboration with a local NGO and CBO. The range of activities carried out during the project period included construction/rehabilitation of two safe water schemes in the two villages, installation of hand washing stations, constructing/rehabilitating sanitation facilities (toilets), raising awareness of the health benefits of sanitation, promotion of good hygiene practices, awareness raising on menstrual hygiene, educating about the 7 steps of handwashing with soap, water purification methods, and water quality testing. WASH related orientation was also conducted for youth groups in the community and training/capacity building

sessions for the local water users' committees, in addition to focus group discussions and key informant interviews.

Figure 4.1: Study Location



Source: Ministry of Federal Affairs and General Administration (MoFAGA)

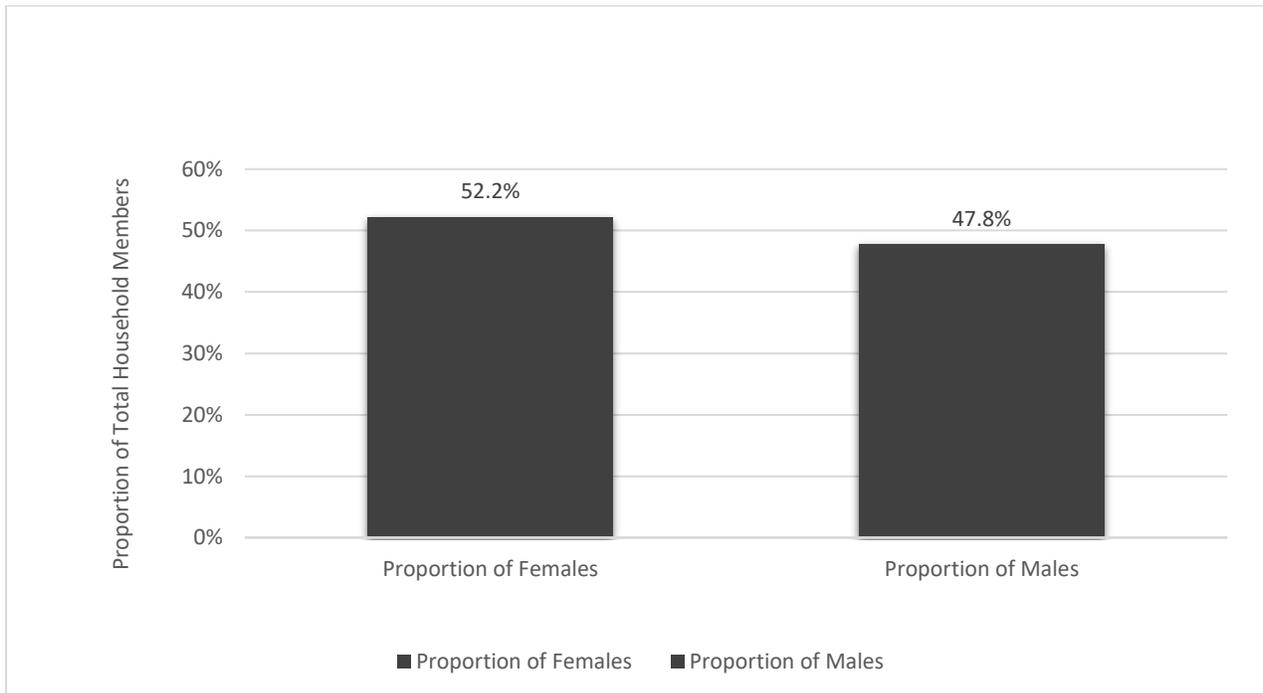
4.2 Socio-Economic Characteristics

This chapter shows the demographic and socio-economic characteristics of the study area after the intervention including gender, age group, education status, caste/ethnicity and settlement quality. Since the socio-economic composition does not vary within a short span of time, the end line information is used to describe the socio-economic characteristics of the sampled households.

4.2.1 Gender distribution of the study area

The gender distribution of the study area during end line surveys showed females at 52.2% whereas males were 47.8% of the sample. Given there was proportionately more women in the sample than males, it shows that women have benefited slightly more from the WASH project in this study area.

Figure 4.2: Gender distribution of the study area



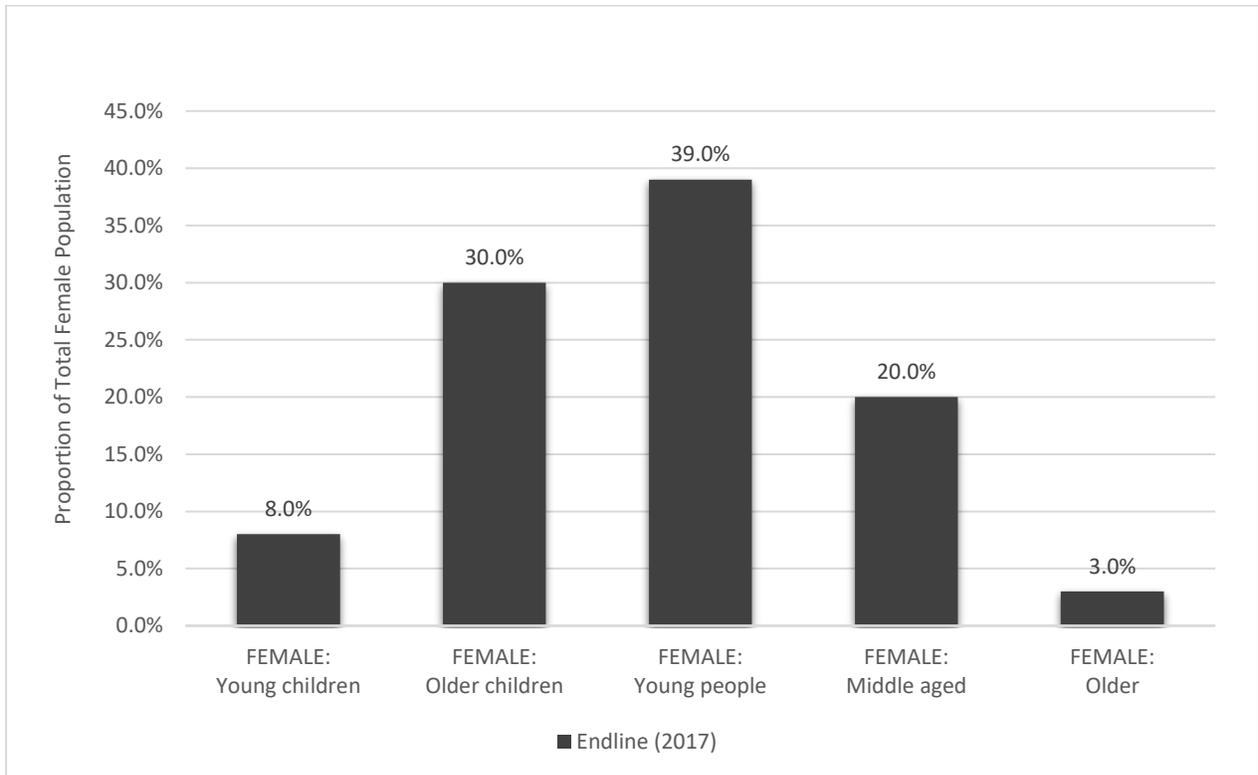
Source: Field Survey, 2017

4.2.2 Age Group of population in surveyed families

a) Female age group of household members

The age group distribution below uses different categories; young children were aged 1-10years, older children 11-19 years, young people 20-35 years, middle aged 36-69 years and older were classed as being above 70 years of age. This chart shows the female age group distribution during the end line survey. It reflects that female older children and young people have the highest distribution of population in those villages.

Figure 4.3: Female age group distribution



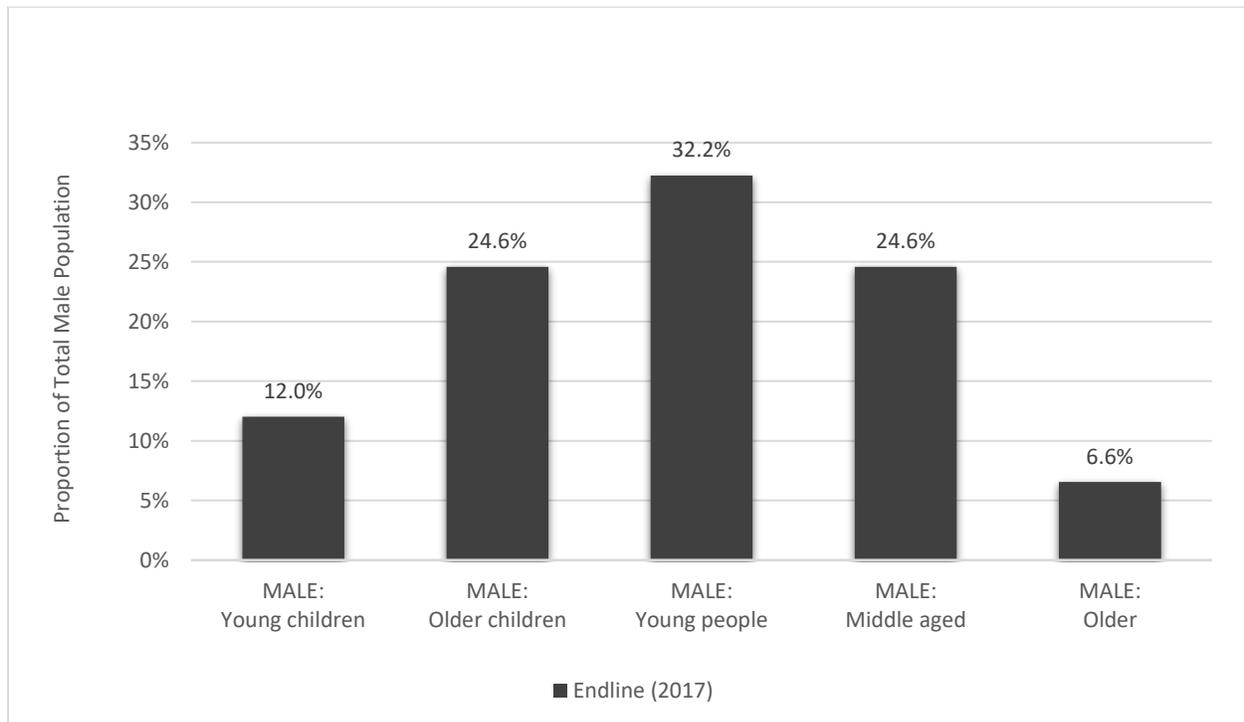
Source: Field Survey, 2017

b) Male age group of household members

This age group distribution uses the same categories as the females above; young children were aged 1-10years, older children 11-19 years, young people 20-35 years, middle aged 36-69 years and older were classed as being above 70 years of age. It reflects that in end line surveys, older children, young people and middle-aged male populations have the highest

distribution of population in those villages, in line with the female demographic trends above.

Figure 4.4: Male age group distribution

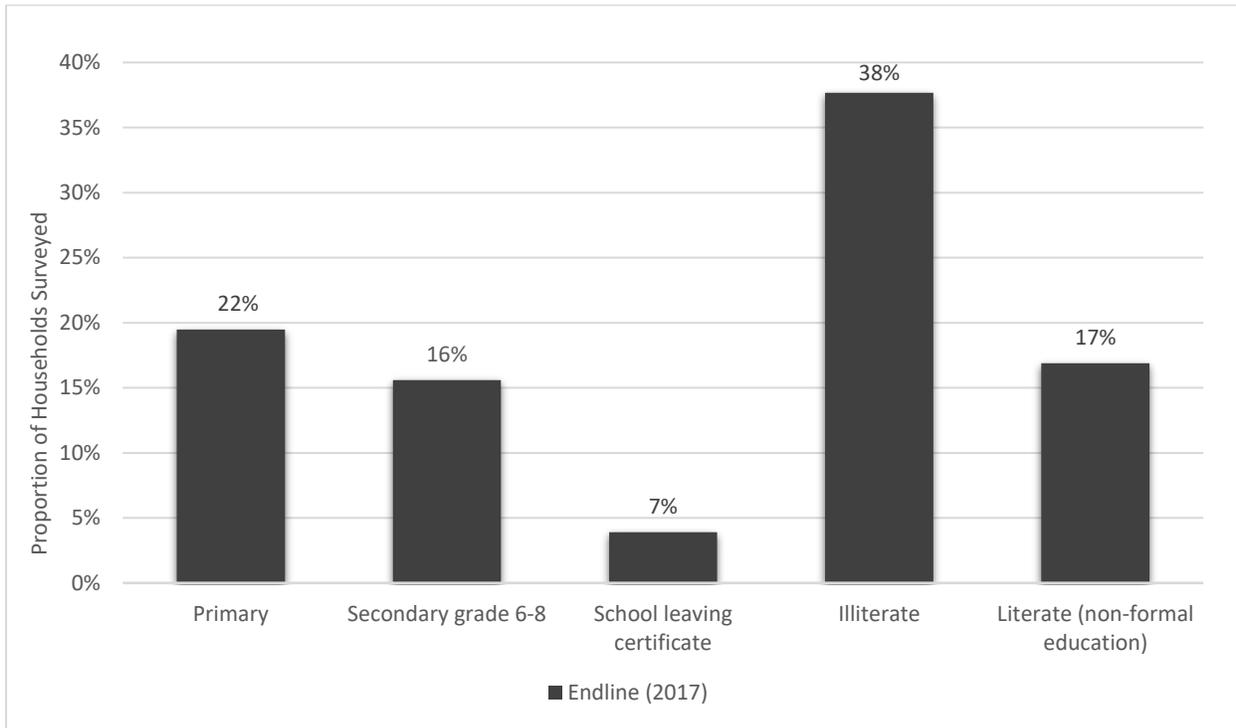


Source: Field Survey, 2017

4.2.3 Education Status of household head of respondents

The education level of the head of the household has been categorized into different levels. Broadly the level of education is quite low in the sample villages with the level of illiteracy being 38% during the end line surveys. Whereas the primary level 22%, secondary grade 17%, school leaving certificate 7% and literate stands at 17%. This finding reflects a general rural Nepalese trend as educated household heads are leaving villages to pursue employment in cities or abroad, seek opportunities and migrate from the original area which has resulted in the household head being replaced, possibly by illiterate individuals. Primary education has been the second highest which shows that household heads are sending their children to school early on.

Figure 4.5: Educational level of household head

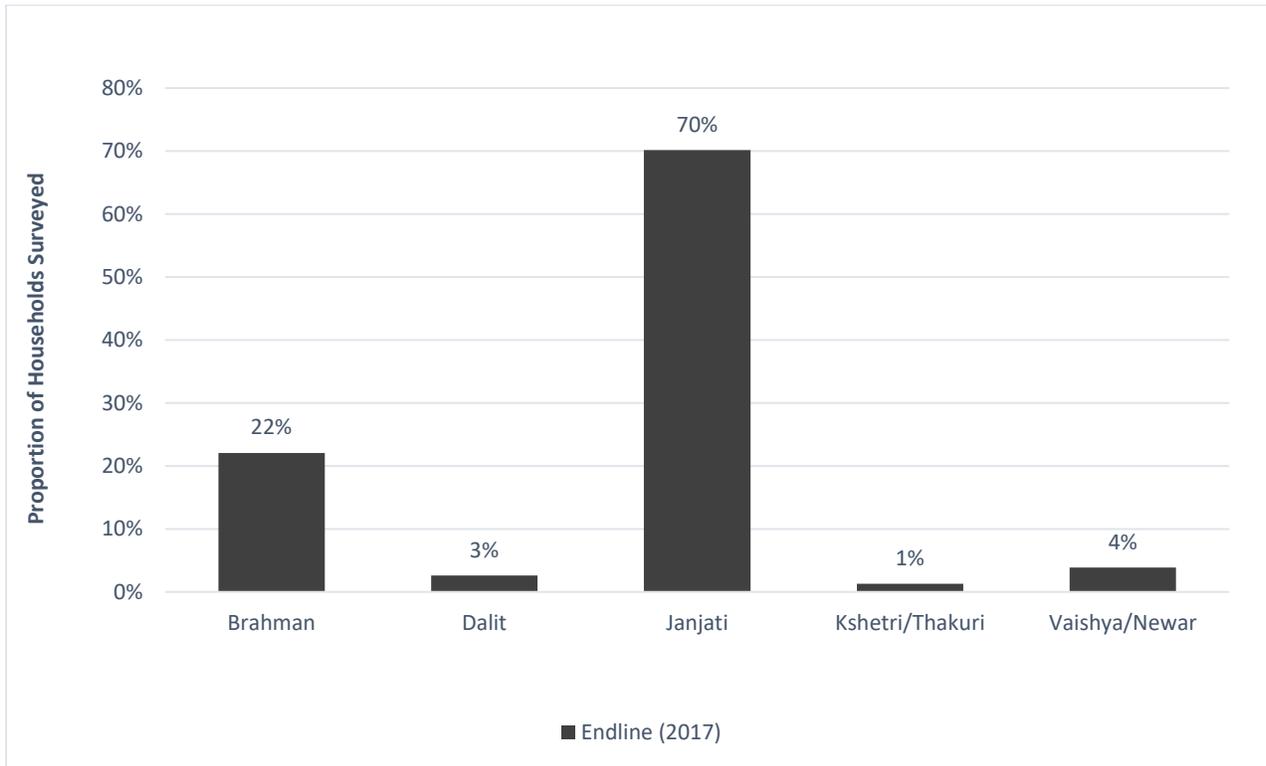


Source: Field Survey, 2017

4.2.4 Caste/Ethnicity of household head respondents

The caste/ethnicity of the household head has been presented in this chart. In the study area the caste/ethnicity is divided among Brahman, Dalit, Janjati, Kshetri/Thakuri and Vaishya/Newar. The intervention villages have a mixed caste/ethnicity. The highest proportion caste/ethnicity during end line survey shows Janjati 70%, followed by Brahman 22% then Vaishya/Newar 4%, Dalit 3% and Kshetri/Thakuri 1%. Figure 4.6 shows that the WASH project has focused on Janjati caste/ethnicity who are a marginalized community in Nepalese society, which should improve their economic status.

Figure 4.6: Caste/Ethnicity

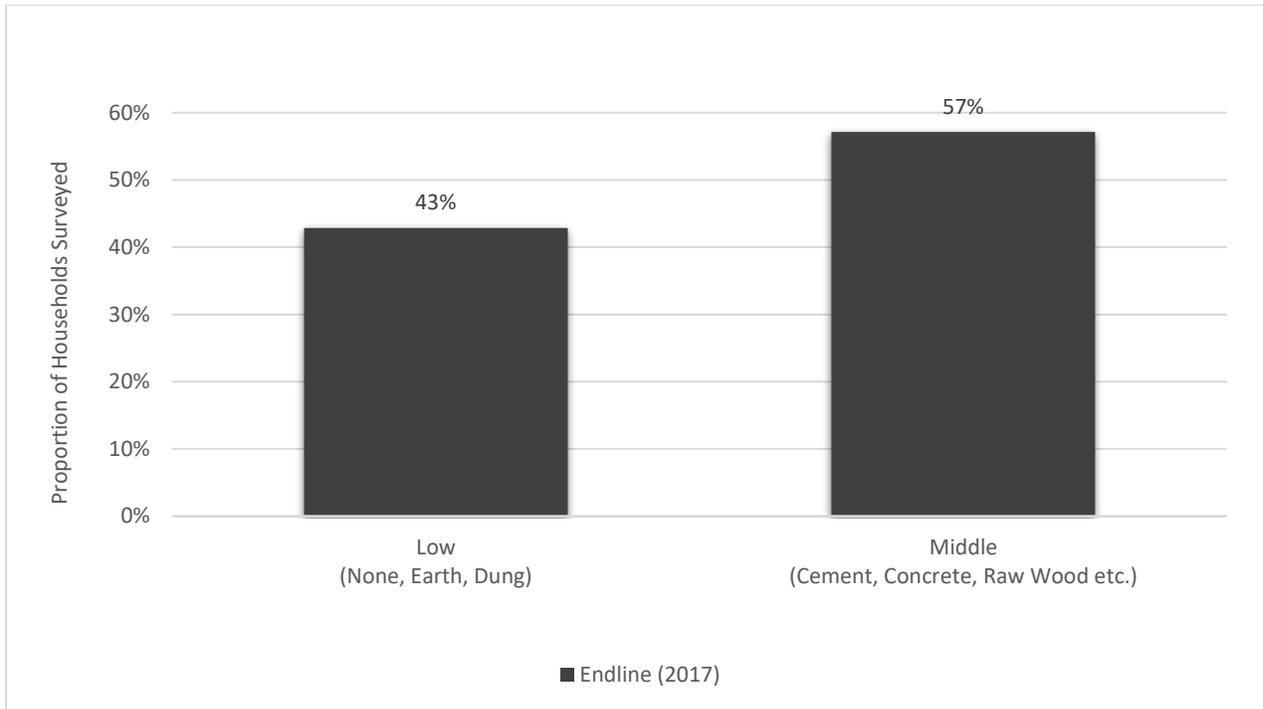


Source: Field Survey, 2017

4.2.5 Settlement Quality of households

The household settlement quality differs by village to village depending upon the economic status of the household. According to end line data, 43% stayed in low quality earth/dung type settlements whereas 57% stayed in middle quality settlements created using cement, concrete or raw wood. The type of settlement quality of the household reflects the economic status of a household and also plays a vital role in the health condition of household members.

Figure 4.7: Settlement quality



Source: Field Survey, 2017

4.3 WASH situation in the study area

This sub section discusses the WASH situation in the study area before and after intervention and also highlights the economical effectiveness, specifically analyzing the effects on drinking water, the sanitation status, health & hygiene and WASH management.

4.3.1 Effects on Drinking Water of respondents

a) Ease of getting access to drinking water

Access to drinking water is vital for everyone. Improved water supply and sanitation contributes to the economic growth of the country. Easy access means piped water is available for drinking easily by households in terms of having access to a tap and there being enough water available in line with demand. Before the WASH intervention, the community members had to wait in long queues, limited water was available, sources dried up due to the impact on infrastructure caused by the earthquake and water supply was only available for limited times, twice a day.

The WASH project facilitated changing to a new water source so that the community will have access to more water even during the dry season, with the supply of water available for a longer period compared to before the intervention. From Table 1 below, if baseline and end line surveys are compared, 39% of respondents said yes, which increased to 65%. This information is based on the respondent's perception about how easily water is available. The 26% increase indicates they subjectively have easier access to drinking water after the project intervention. With the increase in water access, the most benefited caste/ethnic group is Janjati. However, this did not extend to all respondents and the water supply still used communal tap stands rather than individual house installations. Whilst this shows there could be further improvement to water access, there is still a meaningful positive impact after project implementation.

Table 1: Ease of getting access to drinking water

Survey Period	Yes Respondent	Total	Percentage
Baseline	30	77	39%
End line	50	77	65%
Grand Total	80	154	

Change in %	26% ↑
-------------	-------

Source: Field Survey, 2017

b) Number of liters of water being used by households per day

Table 2 demonstrates during baseline surveys, on average, a household uses 76.65 liters of water per day whereas during end line surveys, on average, a household uses 92.55 liters of water per day, which is an increase of 15.9 liters per household.

With the change in mean and standard deviation as 15.9 and 86.08 respectively, we can see that the p -value is greater than 0.05 (i.e., $p > 0.05$), hence it can be concluded that there is no statistical significance between our two variable scores (end line and baseline). The difference in the means of the two variables (end line and baseline) may be due to chance and sampling error. Therefore, there is no significant difference between average liter of water used by households per day during baseline and end line.

Table 2: Liters of water being used by households per day

Survey Period	Average liter available per day (Mean)	Standard Deviation
Baseline	76.65	48.25
End line	92.55	134.33
Change	15.90	86.08
Paired t-test (p value)		0.2930

Source: Field Survey, 2017

Table 3 shows most household heads were found to be male (74%) which reflects that male household heads have benefited most from the WASH intervention and that the surveyed heads of households did not change over the 6 month period. The study area shows that the household head is dominated by the male gender which reflects the nature of Nepalese society.

Table 3: Demographics of household heads

Survey Period	Male Headed Household	Percent of Male Headed Household	Female Headed Household	Percent of Female Headed Household	Total Survey
Baseline	57	74%	20	26%	77
End line	57	74%	20	26%	77
Paired t-test (p value)					1

Source: Field Survey, 2017

c) Water treatment to make it safer to drink

Safe drinking water is essential for the body to remain healthy. If drinking water is not safe, one will be unhealthy which will impact their ability to perform economic activities. Table 4 below shows the water treatment used by households for their drinking water. During baseline surveys, water treatment was used by only 39% of households whereas after the intervention, this had increased to 65% of households that treated their water to make it safer to drink. The result shows a 26% increase in treatment. As the *p*-value is less than 0.05 (i.e., $p < .05$), it can be concluded that there is a statistically significant difference between our two variable scores (end line and baseline). This improvement is due to an increased awareness around the benefits of water treatment. By using water treatment, household members are likely to avoid water-related illnesses and hence have a higher efficiency in day to day activity, are able to be more engaged in income generating activity and have an improved attendance in school/employment. In order to improve further and increase water treatment to 100%, more awareness raising and education is needed about water treatment amongst household members.

Table 4: Water treatment to make it safer to drink

Survey Period	Treatment Yes	Percentage	Treatment No	Percentage	Total Survey
Baseline	30	39%	47	61%	77
End line	50	65%	27	35%	77

Change		26% ↑		26% ↓	
Paired t-test (p value) 0.0012					

d) Frequency of water collection per day

The frequency of water collections per day, per household, is shown below in Table 5. During the baseline surveys, households collected water 2.53 times on average per day compared to the end line survey result of 2.3 times per day which indicates 0.23 times saving for each household. The standard deviation of the baseline and end line are 1.26 and 0.69 respectively with the change of 0.57, but there is no significant difference between the frequency of water collection per day before and after intervention due to p-value being greater than 0.05 (i.e., $p > 0.05$). It can be concluded then, that there is no statistical significance between the two variable scores (end line and baseline). This minimal change may reflect that containers used to transport water are unchanged (due to weight and physical size limitations) so households still need to go to the communal taps, on average, the same amount per day.

Table 5: Frequency of water collection per day

Survey Period	Average time per day (Mean)	Standard Deviation
Baseline	2.53	1.26
End line	2.30	0.69
Change	0.23↓	0.57
Paired t-test (p value) 0.2345		

e) Time taken to collect and return with water

Table 6 shows the time taken to collect and return with water for a household, per day. The table shows a significant reduction in time taken due to the increased access in water supply, after the installation of more communal taps located close to households and greater water availability due to improved infrastructure. This suggests one impact of the project has been that household members no longer have to wait in queues to collect water and are physically closer to a communal tap, benefiting households and also those who collect the water. The average time

taken during the baseline survey was 29.74 minutes for a household which has been significantly reduced to 3.55 minutes during the end line survey, reflecting the impact of the project. The 26.19 minute time saving for each water collection trip shows a significant difference between the collection time before and after intervention. This result is backed up by a p-value being less than 0.05 (i.e., $p < 0.05$) which concludes that there is a statistically significant difference between the two variable scores. This time saving per day is instead used for small income generating activities, agriculture purposes, animal farming, education, or paid employment which had a direct economic benefit due to the WASH intervention. Given the demographics of the sample; the high proportion of females within households and also the high proportion of Janjati caste/ethnic group, it is likely they have gained the most, proportionately, from the project intervention.

Table 6: Time taken to collect and return with water

Survey Period	Average minutes per day (Mean)	Standard Deviation
Baseline	29.74	87.37
End line	3.55	3.16
Change	26.19↓	84.21
Paired t-test (p value)		0.0103

4.3.2 Status of Sanitation and awareness of sanitation options of respondents

a) Disposal trends of household waste

Table 7 shows the disposal method of household waste which the community members used after the intervention of WASH project. The community members used a range of methods including burning, river, garbage pit/bury, thrown anywhere, landfill, public disposal area and composting. Due to awareness raising schemes and education programmes there has been a change of disposal behaviours in the community. The disposal trend shows burning as the highest used option with 66% of respondents preferring this option, followed by throwing litter anywhere (11%) and then public disposal area, landfill/to fill low ground, garbage pit, composting and river as 9.1%, 6.5%, 3.9%, 2.6% and 1.3% respectively. The trend shows that head of households, majority male, prefer to burn waste as they are the key decision makers.

Likewise, many respondents from the Janjati community also prefer to burn household waste as it is perceived to be the easiest option. Hence the data suggests more awareness is needed to improve disposal trends so that households better understand appropriate and sustainable management of household waste.

Table 7: Disposal trends of household waste

Disposal Trend End line	Respondent	Total Survey	Percentage
Burn	51	77	66%
Thrown anywhere	8	77	10.6%
Public disposal area	7	77	9.1%
Landfill/ to fill low ground	5	77	6.5%
Garbage pit/bury	3	77	3.9%
Composting	2	77	2.6%
River	1	77	1.3%
Total	77		100%

4.3.3 Status of Health & Hygiene of respondents

a. Episode of diarrhea in a household

Diarrhea incidents are unfortunately common in rural communities and are often correlated with inadequate sanitation. One of the survey questions asked how long had it been since a household member had diarrhea, and data was collected (Table 8) for the timing of diarrheal incidents, relative to the time of questioning. The number of diarrheal incidents that occurred in the most recent 6 months had reduced by 30%, or 23 fewer incidents, between surveys. Similarly, the number of incidents that had occurred at least 6 months ago or longer ago had increased, from 44 incidents to 67 incidents, suggesting that there were significant improvements and fewer diarrheal incidents were occurring since the WASH intervention.

Table 8: Episode of diarrhea in a household

Survey Period	Diarrhoea Incident \leq 6 month	Percentage	Diarrhoea Incident \geq 6 months	Percentage	Total
Baseline	33	43%	44	57%	77
End line	10	13%	67	87%	77
Change	23 ↓	30% ↓	23↑	30%↑	

The descriptive statistics for the two surveys, including the mean, standard deviation, and the paired t-test results in Table 9, show that the end line survey had a lower mean compared to the baseline survey data. There is a mean difference between the two surveys is a reduction of 0.30 with the change in standard deviation being 0.16. As the *p*-value is less than 0.05 (i.e., $p < 0.05$), it can be concluded that there is a statistically significant difference between the two variable scores (end line and baseline). In other words, the difference between the two-diarrhea incidents is not equal to zero. This shows the significant impact of the WASH project in the study area; with this intervention the community members' health has been improved and expenditure for health has likely been decreased as well. Children will benefit most from sanitation and health improvements; due to the awareness program, household heads are taking the right step to prevent diarrhea through water treatment practice and easier access to safe drinking water.

Table 9: Paired t-test Episode of diarrhea in a household

Survey Period	Average	Standard Deviation
Baseline	0.43	0.50
End line	0.13	0.34
Change	0.30	0.16
Paired t-test (p value)		0.000082

4.3.4 Awareness of WASH Management of respondents

a. Awareness of community groups involved with managing WASH

The awareness of community groups involved with managing WASH can be seen in Table 10 below. There has only been a marginal improvement in the proportion of community groups that are more aware about managing WASH. According to data collected, 40% of respondents are aware about community group managing WASH during the baseline survey, whereas there was only an 11% improvement in awareness after intervention, up to 51% of respondents. With the initiation from the water user's committee, community members have an awareness raising program regarding sanitation and hygiene practices, which disproportionately benefits female participants.

Table 10: Awareness of community groups involved with managing WASH

Survey Period	Yes Respondent	Total	Percentage
Baseline	31	77	40%
End line	39	77	51%
Grand Total	70	154	
Change in % 11% ↑			

4.4 Economic benefits from improved water access and sanitation

Improved water access and sanitation contributes significantly to economic growth, better health and eradication of poverty. Overall Table 1 shows a 26% subjective increase in access to water in surveyed households; with improved water access, the household members can benefit in their day to day life. The economic benefit of the project can be reflected in the household members getting involved in small income generating activities such as animal farming and agriculture. The ethnic group of Janjati are mostly impacted due to their higher population in the study area. Closer access to facilities has facilitated higher productivity and higher school attendance in primary level in the surveyed households. Now the households can be involved in economic activities rather than wasting their effort in accessing drinking water. As the majority of the underlying population is female, they disproportionately benefit and do not have to limit themselves to only household activities but can instead spend some time being involved in other economic activities as well.

4.4.1 Improved water access and time saving

Time savings were also significant (26 minutes) due to an increased number of communal taps being installed and water availability improvements (Table 6). The minimum wage rate of Nepal is Rs 69 per hour, so using this as an estimate, the time saved can be transformed into a monetary value equivalent and can be an approximate direct benefit from the WASH intervention.

Table 11: Minimum wage rate in Nepal

Minimum Wage other than Tea Estate				
S. N	Minimum wage	Basic Wage (Rs.)	Allowance (Rs)	Total (Rs)
1	Monthly	Rs 8,455/-	Rs 4,995/-	Rs 13,450/-
2	Daily	Rs 325/-	Rs 192/-	Rs 517/-
3	Hourly	Rs 43/-	Rs 26/-	Rs 69/-

Source: Minimum Wage rate (The Himalayan Times, 2018)

Average time saving = 26.19 minutes per day per household

Minimum wage per minute = Rs 69/ 60 mins = Rs 1.15 per minute

Total monetary value from time saving per household = Rs 1.15 * 26.19 = Rs 30.12

From the above calculation, we can estimate a monetary saving of Rs 30.12 per day per household that can be earned from the time saved from water collection. Hence across the 77 households sampled, this amounts to an economic benefit of Rs 2319.24 to the study area, every day, due to the WASH intervention. This reflects the direct positive impact of the WASH intervention in the study area resulting in economic growth of the villages.

4.5 Economic benefits from improved health

According to WHO data (2015) Nepal's total expenditure on health stands at 6.1% of Gross Domestic Product (GDP). As it states, 'Health is Wealth'. Health is essential for any individual, household and the nation as it promotes economic growth. It links to economic growth through higher labour productivity and educational attainment. The WASH project resulted in a statistically significant improvement in diarrheal incidents after the intervention, with a 30% decrease in diarrheal incident within a 6-month period (Tables 8 and 9). Likewise, with the awareness in the study area after the intervention, a 26% increase in households are treating the water to make it safer for drinking purpose (Table 4). These interventions will result in improved health, which benefits the economic ability of the household and community. With better health, household members are more productive and spend less time away from their work. Children attend school regularly without missing days relating to preventable illness. Household expenditure relating to health care is minimized and those expenses could instead turn into savings for the household.

CHAPTER 5: SUMMARY, CONCLUSION AND RECOMMENDATION

This chapter comprises of a summary, conclusion and recommendation of the overall WASH project intervention in the sampled communities within the Makwanpur district.

5.1 Summary

The overall project was completed within 6 months with the support of an NGO who provided an estimated NPR 2,170,000 in funding, alongside the input from the two local communities. In this short period of time, the project has made a positive impact to the communities. As a result, the impacted communities have increased access (26% respondents acknowledged an increase in water access, with households needing to collect water less frequently, and spend less time collecting per day) and increased quantity of safe and reliable drinking water. Two safe water schemes were constructed, there is increased access to adequate sanitation facilities, improved hygiene practices in the communities and construction of handwashing stations and toilets. There were however inadequate improvements when it came to recognising public health and hygiene campaigns. Through the analysis of baseline and end line data, the most significant impact can be seen to be a reduction of diarrheal incidents by 30% of respondents during the intervention period and access to increased water level resulted in time savings (26.19 minutes per day) for each household allowing them to not wait in long queues to collect water and hopefully use their time more efficiently to their economic benefit (approximately Rs 30.12, per day, per household). All of this was achieved by using an integrated approach from local youth, local community members, engagement with national and international volunteers and collaboration with a local NGO and CBO. This study has also helped to understand the demographic and socio-economic situation of the project area, particularly benefiting the Janjati caste/ethnicity who are a marginalized community in Nepalese society, and understanding the effectiveness of the WASH project.

5.2 Conclusion

Whilst the study has shown a positive economic impact in the community, only short-term analysis has been used, over a short period of time and the long-term impact and sustainability of the project is not yet known. Usually the objective of water projects, years after the completion date, is that the water supply remains regular without significant additional human effort/intervention. However, after a few years, the schemes in reality are likely to need maintenance and repair. The water supply intake (source) and pipelines could be damaged by natural calamities like earthquakes, floods and landslides. Minor maintenance might be required at anytime, anywhere from source to ultimate tap stand. If maintenance is overlooked, the project will not have been sustainable and any positive impacts from such a project could be reversed. In previous NGO projects, long-term sustainability issues have typically been neglected. Instead of helping maintain existing schemes, users expected new schemes and service providers were interested in building new ones. This has been established as a precedent/culture with NGO projects. If users and communities themselves would facilitate the water and sanitation project management from the beginning, there would be less of a problem related to the functionality of schemes. Based on the WASH project conducted, community ownership is critical for any sustainable project. A detailed needs assessment of the project site needs to be done before program implementation/intervention starts so that communities with the greatest need can be prioritised.

If WASH projects were completed using an integrated approach from multiple parties, the impacts are more likely to be more sustainable. Evaluation of before and after data and analysis is vital for understanding the project impact as the differences must be studied so that the right methods and improvements can be taken for future projects. This should ultimately ensure a greater impact for future WASH development projects within Nepal.

5.3 Recommendation

The key areas of success of the project were that the community were fully engaged and participated in all stages of the project. A detailed needs assessment of the project site should be completed ahead of program implementation to ensure the most needy can economically benefit, regardless of caste. Basic water supply via community taps is an incremental improvement for water access, with individual taps being an even greater improvement. The increased number of taps is likely to be correlated with increased water usage. The water user's committee should take full responsibility of repair and maintenance after project completion to prevent the community being reliant on NGO/external interventions over time also.

REFERENCES

- Ahner-McHaffie, T., Guest, G., Petruney, T., Eterno, A., & Dooley, B. (2018). Evaluating the impact of integrated development: are we asking the right questions? A systematic review. *Gates Foundation Author Manuscripts*. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6034098/>
- Benda-Beckmann, k., Spiertz, & Benda-Beckmann, f. (1997). Disputing Water Rights: Scarcity of Water In Nepal Hill Irrigation.
- Budhathoki, C. (2018). *End Line Study of Sanitation, Hygiene and Water Management Project, Bajhang*. Nepal Red Cross Society.
- Chard, A., & Freeman, M. (2018, March 22). Design, Intervention Fidelity, and Behavioral Outcomes of a School-based Water, Sanitation and Hygiene Cluster- Randomized Trial in Laos. *Environmental and Public Health*, 1-2,4,7,12. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5923612/pdf/ijerph-15-00570.pdf>
- Dreibelbis, R., Winch, P., Leontsini, E., Hulland, K., Ram, P. K., Unicomb, L., & Luby, S. (2013). The Integrated Behavioural Model for Water, Sanitation, and Hygiene: a systematic review of behavioural models and a framework for designing and evaluating behaviour change interventions in infrastructure-restricted settings. *BMC Public Health*, 13(1). Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4231350/pdf/1471-2458-13-1015.pdf>

- Gleick, P. H. (1996). Basic Water Requirements for Human Activities: Meeting Basic Needs. *Water International*, 21, 83-92. doi:10.1080/02508069608686494
- Goswami, K., & Bisht, P. (2017). The Role of Water Resources in Socio-Economic Development. *International Journal for Research in Applied Science & Engineering Technology (IJRASET)*, 5.
- Hutton, G. (2012). *Global costs and benefits of drinking-water supply and sanitation interventions to reach the MDG target and universal coverage*. World Health Organization. Retrieved from https://www.who.int/water_sanitation_health/publications/2012/globalcosts.pdf
- Hutton, G., & Chase, C. (2016). The Knowledge Base for Achieving the Sustainable Development Goal Targets on Water Supply, Sanitation and Hygiene. *Internal Journal of Environmental Research and Public Health*, 2,26. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4923993/pdf/ijerph-13-00536.pdf>
- Kafle, S., & Pradhan, B. (2018). Situation of Water, Sanitation and Hygiene and. *J Nepal Health Res Counc (JNHRC)*, 160-4.
- Karki, K. (2015). *Water Sanitation and Hygiene National Sector Development Plan*. Sector Efficiency Improvement Unit Ministry of Water Supply and Sanitation Nepal. Retrieved from http://seiu.gov.np/images/SDP_Draft3_Dec_14_2015.pdf
- Pokhrel, D., & Viraraghavan, T. (2004). Diarrhoeal diseases in Nepal vis-a` -vis water supply and sanitation status. *Journal of Water and Health*, 71-81. Retrieved from https://watermark.silverchair.com/71.pdf?token=AQECAHi208BE49Ooan9khhW_Ercy7Dm3ZL_9Cf3qfKAc485ysgAAAc0wggHpBgkqhkiG9w0BBwagggHaMIIB1gIBADCC

Ac8GCSqGSib3DQEHATAeBglghkgBZQMEAS4wEQQM711W5K8cDWXk7EagAgE
QgIIBoCLAodafdTxBjKdTDGK-TYfUqorr8pg_M42A-Ugb5hxWhcsrrG3

Rural Water Supply and Sanitation Fund Development Board. (2009). A Successful Model for Community - Managed Program Implementation. *Hydro Nepal: Journal of Water, Energy and Environment*, 4,52-53. Retrieved from <https://doi.org/10.3126/hn.v4i0.1828>

Sachs, J. (2001). *Macroeconomics and health : investing in health for economic development : executive summary / report of the Commission on Macroeconomics and Health*. World Health Organization. Retrieved from <https://apps.who.int/iris/handle/10665/42463>

Sah, R., Baral, D., Ghimire, A., & Pokharel, P. (2013). Study on knowledge and practice of water and sanitation application in Chandragadhi VDC of Jhapa District. *Knowledge & practice of water & sanitation application Health Renaissance*, 241-245. Retrieved from <https://doi.org/10.3126/hren.v1i1i3.9639>

Sanctuary, M., & Tropp, H. (2005). *Making water a part of economic development : The economic benefits of improved water management and services*. World Health Organisation. Retrieved from https://www.who.int/water_sanitation_health/waterandmacroecon.pdf

Sanitation and Water for All. (2012). *Nepal Briefing : Economic impact of water and sanitation*. Retrieved from http://sanitationandwaterforall.org/wp-content/uploads/download-manager-files/Nepal%20-%20WASH%20Economic%20Briefing_EN.docx

Shier, R. (2004). Statistics: 1.1 Paired t-tests. *Mathematics learning support centre*.

Shrestha, A. (2014). Impact of Health Education on the Knowledge and Practice Regarding Personal Hygiene among Primary School Children in Urban Area of Karnataka, India. *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, Volume 13(4 Ver. VII.), 86-89. Retrieved from www.iosrjournals.org

Shrestha, M., Manandhar, N., & Joshi, S. (2018). Study on Knowledge and Practices of Water, Sanitation and Hygiene among Secondary School Students. *Journal of College of Medical Sciences-Nepal*, Vol-14, No 3, 160-165. Retrieved from <https://doi.org/10.3126/jcmsn.v14i3.21158>

The Himalayan Times. (2018, July 10). Retrieved from <https://thehimalayantimes.com/business/minimum-monthly-wage-for-workers-set-at-rs-13450/>

Udmale, P., Ishidaira, H., Thapa, B., & Shakya, N. (2016). The Status of Domestic Water Demand: Supply Deficit in the Kathmandu Valley, Nepal. *MDPI*. Retrieved from <https://www.mdpi.com/2073-4441/8/5/196/pdf>

UNICEF. (2016, April 10). Retrieved from https://www.unicef.org/wash/3942_3953.html

United Nations Development Programme. (2018). *undp.org*. Retrieved from <http://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-6-clean-water-and-sanitation/>

United Nations. (n.d.). *UN Water*. Retrieved from <http://www.unwater.org/water-facts/water-sanitation-and-hygiene/>

Upadhyay, B. (2005). Women and natural resource management: Illustrations from India and Nepal. *A United Nations Sustainable Development Journal*, 29(3), 224-232.

Water.org. (2019). *Water.org*. Retrieved from Water.org: <https://water.org/our-impact/water-crisis/economic-crisis/>

WHO. (2015). Retrieved from who.int.

World Bank. (2004). *World Development Report 2004 : Making Services Work for Poor People*. World Bank. World Bank. Retrieved from <https://openknowledge.worldbank.org/handle/10986/5986> License: CC BY 3.0 IGO

WWAP. (2019). *UNESDOC*. Retrieved from <https://unesdoc.unesco.org/ark:/48223/pf0000367306>

APPENDIX

QUESTIONNAIRE

VDC _____ Ward no _____ Settlement name _____

1. Household

- 1.1 **Gender and age of respondent** M F - years
- 1.2 **Who is the head of household?** Respondent Respondent's spouse Other M Other F
- 1.3 **How many people live here on a permanent basis?** _____
- 1.4 **What ages and gender are household members?** [List gender and age all household members e.g. M47, F16, M3.]
1 _____ 2 _____ 3 _____ 4 _____ 5 _____ 6 _____ 7 _____ 8 _____ 9 _____ 10 _____ 11 _____ 12 _____
- 1.5 **What is the caste/ethnicity of the household head?** Dalit Janjati Tharu Muslim
 Kshetri/Thakuri Vaishya/Newar Brahman Other (specify) _____
- 1.6 **What is the highest completed level of education of the household head?** Preschool
 Primary Secondary grade 6-8 Secondary grade 9-10 School leaving certificate
Intermediate level/class 12 Bachelor level Masters level Professional degree
 Literate (non-formal education) Illiterate Don't know
- 1.7 **How many household members are currently at school?** Primary _____ Secondary _____
- 1.8 **Do any household members have mobility problems due to old age or disability?** No
 Yes
(specify) _____
- 1.9 **Does the household own or have the following:**
- | | | |
|----------------------------|------------------------------|-----------------------------|
| TV | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Refrigerator | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Phone | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Bike | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Car | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Cheap utensils (<\$50) | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Expensive utensil (>\$300) | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Electricity | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
- 1.10 [OBSERVATION: Assess quality of flooring inside the house]
 Finished floor with parquet, carpet, tiles, linoleum, ceramic etc (high quality)
 Cement, concrete, raw wood, etc (middle quality)
 None, earth, dung (low quality)

2. Water

2.1 **What are the main sources of water for members of your household for...**

		...drinking?...cooking?...laundry?...bathing?				
Piped water	Into dwelling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		To yard/plot	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		To neighbour	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Public tap/standpipe	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ground water	Tube well or borehole	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		Dug well – protected ¹	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Dug well – unprotected ¹	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Spring – protected ¹	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Spring – unprotected ¹	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other	Rainwater	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		Tanker truck	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Cart with small tank	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Surface water (river/dam/lake, etc)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Bottled water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Other (specify) _____				

2.2 **Is it always easy to get enough drinking water for your family?** Yes No
[If not always easy/Why is this? NA Long queues Limited water from source (all year)
 Source runs dry (seasonal) Tap/pump faulty Other (specify)

[If source runs dry seasonally] **During the last 12 months, for how many months was your household's main source of water sufficient to meet your household needs?** ____
 (specify which months)

2.3 **Has your household water supply been affected by the earthquake, for example was there structural damage and/or a reduction in water quantity or quality?** Yes No
[If yes] Can you describe how? _____

2.4 **How far is it to the furthest regular water source?**
 <200m 200m-500m 500m-1km 1km-3km >3km

2.5 **Who usually collects water for the household?** *[List gender/age of up to three household members, e.g. F15, F10, M14]* 1 ____ 2 ____ 3 ____

2.6 *[If there are children at school]* **How often do the school children collect water during term-time?** NA Rarely Sometimes Often

¹ Protected wells and springs have concrete or brick infrastructure to minimise contamination of the water source. Community members should know if their water source is protected or not.

- 2.7 **What container(s) do you usually use to collect water? Can you show me?**
[Assess cleanliness] Not observed Clean Unclean Mixture of clean/unclean
- 2.8 **How many times per day is water collected?** ____ times
- 2.9 **How long does it take to go, get water and come back?***[Excluding social time]* ____ mins
- 2.10 **How many liters of water does the household use per day?***[Estimate from size and number of containers collected per day]* ____ liters
- 2.11 **How do you store your drinking water? Can you show me?**
[Assess cleanliness] Not observed Clean Unclean Mixture of clean/unclean
[Check if container is covered] Not observed Covered Not covered
[Check if there's a tap or dedicated water scoop] Not observed Tap Water scoop
 Neither
- 2.12 *[If no tap]* **How do you usually get drinking water from the container?** NA
 Dip hand to fill cup/scoop Fill cup/scoop without dipping hand Tilt and pour
 Other (specify) _____
- 2.13 **How often do you treat your water to make it safer to drink?** Always Most times
 Sometimes Rarely/Never

<i>[If treat water]</i> What treatments do you use...	... sometimes <i>[tick all]</i>	...most often <i>[tick one]</i>
<input type="checkbox"/> NA		
Boil	<input type="checkbox"/>	<input type="checkbox"/>
Bleach/chlorine/water guard/aqutab	<input type="checkbox"/>	<input type="checkbox"/>
Strain through a cloth	<input type="checkbox"/>	<input type="checkbox"/>
Solar disinfection	<input type="checkbox"/>	<input type="checkbox"/>
Water filter (ceramic, sand, composite)	<input type="checkbox"/>	<input type="checkbox"/>
Let it stand and settle	<input type="checkbox"/>	<input type="checkbox"/>
Other (specify) _____	_____	_____

- [If don't treat water]* **Why not?** NA It is expensive Water is safe Used to untreated water
 Don't know how to treat Other (specify)

3. Sanitation

- 3.1 **Does your family own a latrine?** Yes No
- 3.2 *[If yes]* **Do all your family members use the household latrine?** Yes No

- 3.3 *[If no latrine]* **Where do family members usually go for defecation?** NA Neighbour's latrine
 Public latrine Dig a hole Bush/backyard/field Plastic bag River/waterway
 Other
 (specify) _____
- 3.4 *[If no latrine]* **What is the main reason you have not constructed a latrine?** NA Too expensive
 No space to build A lot of space for (open) defecation Defecation is not a problem
 Not a priority Other
 (specify) _____
- 3.5 **Do you think there are benefits to owning a latrine?** Yes No
[If yes] **What are they?** *[Tick all]* NA Health Personal safety Convenience/saving time
 Status in the community Don't know Other (specify)

- 3.6 **How important is it to have a private latrine for your household?** NA
 Not at all Fairly Very
- 3.7 **Do you think there are problems associated with owning a latrine?** Yes No
[If yes, tick all] **What are they?** NA Difficult to keep clean Expensive to maintain
 Other (specify)

- 3.8 **Can you show me your latrine?**
[Record distance from household] Within 50m >50m
[Asses structure, tick all] Not observed Adequate privacy Door Not full/blocked
[Record wall material] Brick/stone/concrete Wood Corrugated iron Bamboo
 Temporary local materials None Other (specify)

[Record roof material] Brick/stone/concrete Wood Corrugated iron Bamboo
 Temporary local materials None Other (specify)

[Assess cleanliness] Not observed Very clean A bit dirty/smelly Very dirty/smelly
- 3.9 **What type of latrine is it?** NA Flush/pour flush (safe disposal²) Flush/pour flush (unsafe disposal) VIP latrine Double pit latrine with slab Single pit latrine with slab
 Double pit latrine without slab Single pit latrine without slab Composting/ecosan
 Biogas latrine Hanging (draining to waterway)
 Other (specify) _____

² To be safe, disposal needs to be to a piped sewer system, septic tank or pit latrine.

3.10 **Do you re-cycle the latrine contents to use as fertiliser or soil conditioner?** No Yes
[If yes] How confident are you that this process is carried out safely, without exposing household members to diseases? Very confident Fairly confident Not very confident
 Don't know

3.11 *[If have latrine, or use a shared latrine]* **Is it easy for all household members to access and use the latrine?***[Including toddlers and those with mobility problems]* Yes No (specify)

3.12 *[If have latrine]* **Did the government or another organisation help you build the latrine?** NA
 No Local authority/government NGO Other (specify)

3.13 *[If have latrine]* **Do you share it with other households?** No Yes NA

3.14 **Where do family members usually throw away baby or infant faeces?** NA Latrine
 Bury Garbage pit Open ground Bush River/waterway
Other (specify) _____

3.15 **Where do you dispose of other household waste?** Garbage pit/bury Burn Public disposal area
 Landfill/to fill low ground Composting River Thrown anywhere
Other (specify) _____

4. Health and Hygiene

4.1 **Have any household members passed away due to diarrhea in the last 12 months?**
 No Yes *[If yes, skip to question 4.6]*

4.2 **How long ago did a household member have diarrhea/runny stool?***[Check this was actually diarrhea. The definition is the passing of a watery, bloody or mucoid stool three times or more in 24hrs]*
 ≤2 weeks ≤1 month ≤3 months ≤6 months >6 months Don't know

4.3 **What do you think are the main causes of diarrhea?**

[DO NOT READ THE LIST. Prompt for all known causes, ticking all mentioned.]

- | | | |
|--------------------------------------|--|---|
| <input type="checkbox"/> Don't know | <input type="checkbox"/> Open defecation | <input type="checkbox"/> Part of a child's growth |
| <input type="checkbox"/> Dirty hands | <input type="checkbox"/> Poor hygiene | <input type="checkbox"/> Rain |
| <input type="checkbox"/> Dirty food | <input type="checkbox"/> Germs | |
| <input type="checkbox"/> Dirty water | <input type="checkbox"/> Flies | |

Others (specify) _____

4.4 **At which times is it most important for people to wash their hands?**

[DO NOT READ THE LIST. Prompt for all known causes, ticking all mentioned.]

- | | |
|---|--|
| <input type="checkbox"/> After using toilet/defecation | <input type="checkbox"/> After touching animals/animal faeces |
| <input type="checkbox"/> Before preparing food | <input type="checkbox"/> After touching household refuse |
| <input type="checkbox"/> Before eating | <input type="checkbox"/> Before/after caring for a sick person |
| <input type="checkbox"/> After wiping baby's bottom/
changing baby's nappy | <input type="checkbox"/> After blowing nose/coughing/sneezing |
| Others (specify) _____ | <input type="checkbox"/> When hands look dirty <input type="checkbox"/> Don't know |
-

4.5 **For each household member, can you say whether you think they wash their hands at each of these times?**

4.6 **Have you heard any public campaign messages on hygiene in the last few months?** *[Tick all]*

- Yes No

[If yes] **What messages or instructions can you recall?** NA

- | | |
|--|---|
| <input type="checkbox"/> Use latrine/stop open defecation | <input type="checkbox"/> Wash hands with water and soap |
| <input type="checkbox"/> Dispose of baby faeces in the latrine | <input type="checkbox"/> Prepare food hygienically |
| <input type="checkbox"/> Bury faeces | <input type="checkbox"/> Cover food |
| <input type="checkbox"/> Cleanliness around water point | <input type="checkbox"/> Dispose of garbage properly |
| <input type="checkbox"/> Clean and cover water containers | <input type="checkbox"/> Bathe regularly |
| <input type="checkbox"/> Treat water | <input type="checkbox"/> None |
| <input type="checkbox"/> Others (specify) _____ | |
-

4.7 **Where do family members most often wash their hands? Can you show me?**

[Record facility location] Not observed (outside plot) Not observed (other reason)

Fixed (in dwelling/plot) Mobile

[Check water availability] Not observed Water available Water not available Not observed

[Check soap availability] Not observed Soap or detergent (bar, liquid, powder, paste)

Ash/mud/sand None

4.8 **Do family members use this handwashing facility after defecation?** Yes No

[If yes, record distance from latrine] _____m

[If no] **How far from the latrine is there a facility for washing hands?** _____m

5. WASH Management

5.1 **Are you aware of any community groups that are involved with managing water, sanitation and community hygiene?** Yes No

5.2 *[If yes]* **How effective do you think they are at managing these issues?** NA

- Very effective Fairly effective Only slightly effective Not at all effective Don't know

6. Additional Information

- 6.1 **Do you have any suggestions on how to improve hygiene, sanitation and water supply in your community?**