**A study on WASH practices and under five (U5)
morbidity pattern using remote sensing and geographical
information system in Udupi Taluk.**

**A dissertation submitted in Fulfillment of the Requirement for
the Award of**

Master of Public Health (MPH) Degree

Submitted by

Dr Yogish C B

**DEPARTMENT OF PUBLIC HEALTH
MANIPAL UNIVERSITY, MANIPAL, INDIA
JULY 2015**

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Award of**

Master of Public Health (MPH) Degree

By

Dr Yogish C B

**Under the guidance of
Dr. Varalakshmi Chandra Sekaran
Lecture
Department of Public Health
Manipal University**

Co-guides

Dr. Sanjay M Pattanshetty
Associate professor
Dept of Public Health
Manipal University
Manipal-576104

Dr.Jagadeesha Pai B
Associate professor
Dept of Civil Engineering
Manipal University
Manipal-576104

Dr. Shreemathi S Mayya
Associate professor
Dept of Bio- statistics
Manipal University
Manipal-576104

DECLARATION

I hereby declare that the project entitled a study on “**A study on WASH practices and under five (U5) morbidity pattern using remote sensing and geographical information system in Udupi Taluk**” has been submitted during the year 2014 – 2015 under the valuable guidance and supervision of **Dr. Varalakshmi Chandra Sekaran**, Lecturer, Department of Public Health, in fulfilment of the requirement of the Master of Public Health (MPH) degree of Manipal University. Further, I extend my declaration that this report is my original work and has previously not formed the basis for the award of any degree or diploma.

Place: Manipal

Dr Yogish C B

Date:

Certificate

This is to certify that the Research Project entitled “**A study on WASH practices and under five (U5) morbidity pattern using remote sensing and geographical information system in Udupi Taluk**” prepared by Dr Yogish C B under my supervision in fulfilment of the requirement for Master of Public Health, Manipal University, has not previously formed the basis for the award of any degree or diploma by this or any other University and that this work is a record of the candidate’s personal work.

Date:

Place:

Dr. Sanjay M Pattanshetty

Associate professor

Department of Public Health,
Manipal University.

Certificate

This is to certify that the dissertation entitled, “**A study on WASH practices and under five (U5) morbidity pattern using remote sensing and geographical information system in Udupi Taluk**” is a bona fide work done by **Dr Yogish C B** in the Department of Public Health, Manipal University, under our direct supervision and guidance.

Guide

Dr. Varalakshmi Chandra Sekaran
Lecturer
Department of Public Health
Manipal University

Co-Guides:

Co-guide Name

Dr. Sanjay M Pattanshetty
Associate professor
Dept of Public Health
Manipal University
Manipal-576104
Date:

Co-guide Name

Dr. Jagadeesha Pai B
Associate professor
Dept of Civil Engineering
Manipal University,
Manipal-576104
Date:

Co-guide Name

Dr. Shreemathi S Mayya
Associate professor
Dept of Bio- statistics
Manipal University,
Manipal-576104
Date:

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Abbreviations and acronyms

MDG- Millennium Developmental goals

U5- Under five

WASH- water, sanitation and hygiene

WHO- World Health Organization

WB- World Bank

HIV- Human immunodeficiency virus

UNICEF- United Nations Childers's Fund

DALY- Disability adjusted life year

NFHS- National Family Health Survey

NRHM- National Rural Health Mission

DLHS-District Level Household & Facility survey

GIS- Geographic information system

RS- Remote sensing

PHC- Primary health Centre

CHC- Community Health Centre

UHC- Urban Health Centre

FPAI- Family Planning Association of India

MO- Medical Officer

MHW- Male Health worker

ARI- Acute respiratory tract infection

LRTI- Lower respiratory tract infection

SD- Standard deviation

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Executive Summary

Millennium development goals seven (MDG-7) emphasizes about environmental sustainability. Globally one in five habitually defecates in open and globally, about 13% of world population collects water from unprotected sources; most of the Asian cities fail to meet national water quality standards. MDG Goal-4 targets reducing child mortality. Under the age group of five years diarrhoea is the second biggest cause of death cause by poor water, sanitation and hygiene (WASH) practices. Worldwide unsafe water, inadequate sanitation or insufficient hygiene leads to 80% of diarrhoea.

India accounts to 60% of world's open defecation, only 31% of population use improved sanitation, in rural areas it's about 21%. In India diarrhoea kills one child per minute. Diarrhoea and respiratory infection are the leading cause of deaths in India. Over 40% of the diarrhoea and 30% of the respiratory infection among children can be reduced, particularly by practicing hand wash with soap after contacted with excreta. An adequate water supply and basic sanitation are important elements of primary health care. This study is an attempt to fill the gap in understanding WASH practices and morbidity pattern among under five children in Udupi taluk.

The objective of the study was to assess the morbidity pattern and factors associated with it among U5 children, to identify water, sanitation and hygiene practices in the community and to map morbidity patterns of U5 children in relation to water sources. A cross sectional study was conducted in between February 2015 to June 2015 across Udupi taluk among 258 children between the age group of three to 59 months, mixed method study design approach was used.

Of the 258 children, 55.4% participants were female. Majority of the participants lived in nuclear families (64.7%). The current illness of ARI was 7.5% followed by pneumonia (4.7%) and diarrhoea (2.8%). Prevalence of ARI over a period of three months was 76.4% followed by fever 56.2% and diarrhoea (22.1%). Most of the parents preferred private setting for treatment of their children. On assessing weight for age 16.5% children were underweight and 8.8% were thin on assessing weight for length. Boys were thinner compare to female. Most of the households used improved sources of drinking water (95.3%) and adequate sanitary facilities (89.5%). Among them 58.1% drew water from protected dug wells. For drinking purpose, 24% of participants travelled outside the premises to fetch water from improved source, and at household level 61.6% used adequate water treatment methods. A minimal number of participants practiced open defecation of about 5%. Almost the participants washed their hands before feeding the child (98.8%) and 56.1% used water and soap. Logistic regression showed children less than 2 year

were 4.26 times more likely to suffer from diarrhoea compared to the age group of 2 to 5 years. Association of fever and cough showed statistical significance. Qualitative data showed cause of diarrhoea was mainly due to food poisoning, unhygienic food; eating food from outside food and the main organism was viral followed by bacteria. Fever and cough were due to cross infection.

Introduction

In 1923 Mahatma Gandhi quoted

“Sanitation is more important than political Independence”⁽¹⁾.

“If we do not keep our backyards clean our swaraj will have a foul stench”⁽²⁾.

During the millennium summit of 2000 of the United Nations, all the United Nations member states committed to achieve the Millennium development goals (MDG) by 2015 MDG goal- 7 emphasizes about environmental sustainability. According to World health organization (WHO) “Sanitation generally refers to the provision of facilities and services for the safe disposal of human urine and faeces”⁽³⁾. One in five habitually defecates in open globally and India accounts to 60% of world’s open defecation⁽⁴⁾. In India Only 31% of population use improved sanitation, in rural areas about 21% use improved sanitation. Over 50%, i.e. an estimated 594 million population defecates in the open. Only 6% of rural children under the age of five uses a toilet, while only 11% of families dispose the children stool safely. There is a high risk of microbial contamination with water and food. Globally about 13% of world population collects water from unprotected sources. Most of the Asian cities fail to meet national water quality standards^(5,6). Data from World Bank, 2012 report shows that in India about 93% population has access to drinking water from an improved source⁽⁷⁾, 67% of households do not treat their drinking water even though it could be with chemically or bacterially contaminated. A Public health Association study shows only 30% wash their hand with soap before preparing food, 38% before eating and 53% after defecation⁽⁶⁾.

MDG Goal-4 targets reducing child mortality. Human immunodeficiency virus (HIV), tuberculosis and malaria are the three diseases gaining more attention but Diarrhoea alone kills young children each year than all three combined⁽⁶⁾. Under the age group of five years diarrhoea is the second biggest cause of death cause by poor water sanitation and hygiene (WASH) practices. Worldwide unsafe water, inadequate sanitation or insufficient hygiene leads to 80% of diarrhoea, while 50% of the underweight or malnutrition is associated with repeated diarrhoea or intestinal nematode infections. Under the age of five, Diarrhoea alone takes away the life of 1.4 million children preventable death per year. United Nations Children’s Fund (UNICEF) and WHO issued a report on 2009 highlighting another common cause of death among children were pneumonia (*The forgotten Killer of children*), with the same intent focus on diarrhoeal diseases, as central to improve child survival⁽⁸⁾. Diarrhoea and respiratory infection are the leading cause of deaths in India. “In India diarrhoea kills one child per minute”⁽⁴⁾. Over 40% of the diarrhoea and 30% of the respiratory infection among

children can be reduced, particularly by practicing hand wash with soap after contacted with excreta ⁽⁹⁾. Good hand wash practices also shows reduction in almost 50% of diarrhoea, pneumonia, trachoma, scabies, skin and eye infection ⁽¹⁰⁾. Hygiene promotion was the most cost effective intervention in the control of all the major diseases at US \$-5 per Disability Adjusted Life Year (DALY) averted. Increased use of safety water and hygiene helps in the reduction of morbidity malnutrition and intestinal helminthic infection leads to stunting, late entry to school and impaired cognitive function ⁽⁵⁾. According to National Family Health Survey (NFHS-3) almost half the children U5 are stunt (48%), 43% are underweight ⁽¹¹⁾.

Adequate sanitation, hygiene and safe drinking water are the fundamental to the good health, by improving one or more of three components; reduction in the rates of morbidity and severity of various diseases particularly in children ⁽¹²⁾. If everyone practices appropriate hygiene, safe drinking water and reliable sanitation, globally 2.4 million deaths (4.2% of all deaths) can be preventable and 6.8% of DALY lost ^(5,6).

Under National Rural Health Mission (NRHM) Village health, sanitation and Nutrition committee is the key element, this committee take collective action related to village level health and social determinants ⁽¹³⁾. It involves the panchayati raj Institutions in the management of health system (VHSC 2014), it Provides water supply to each households, maintains sanitary level in the village and give subsidy to construct toilet facility ⁽¹³⁾.

Rationale

An adequate water supply and basic sanitation are important elements of primary health care. A study was conducted on 2006 by World Bank on water and sanitation program estimated that “lack of sanitation coverage cost the country the equivalent of 6.4% of its 2006 gross domestic product” ⁽⁴⁾ and the report from the ministry of drinking water and sanitation shows, India spent over \$3 billion on constructing toilets across the country since 1986, In spite of such massive amounts invested India’s sanitation campaign yield less results ⁽¹⁴⁾. Diarrhoea, pneumonia and malnutrition are the leading causes of mortality and morbidity among children under age five worldwide; it is highly influenced by poor environment, socio economic condition of the family. Each year, an estimated 2.5 billion cases of diarrhoea occur among children under five years of age, and estimates suggest that overall incidence has remained relatively stable over the past two decades ⁽⁸⁾.

Though the indicator of Udupi taluk is fairly good; morbidity among under five remains challenging. Report of District Level Household & Facility survey (DLHS) three from 2006-2007 shows that the population using piped drinking water was 27%, 76.9% had toilet facility and 54% population fall below poverty line ⁽¹⁵⁾. Jalan J et al, conducted a study in 2003 shows prevalence of diarrhoea can be reduced by providing households with piped water ⁽¹⁶⁾. Mothers and primary care givers are directly linked with the children's health.

Accurate information on WASH practices is not available to the stakeholders, national leaders, decision makers. Evidence based information can be used in various ways like assessment of progress towards MDG, promoted increase investment in the sector, focus attention on needy areas ⁽¹⁷⁾. By current progress rate in sanitation it is of the most inaccessible target ⁽⁴⁾. This study is an attempt to fill the gap in understanding WASH practices and morbidity pattern among under five children in Udupi taluk. This study assessed morbidity pattern and WASH practices using Geographic information system (GIS) and Remote sensing(RS) as GIS is an extraction of statistical analyses that join epidemiological, sociological, clinical and economic data with reference to space, it helps in understanding the human interact with their environment, disparities in the health outcomes with in a community ⁽¹⁸⁾

Aim and Objectives

Aim

To study the patterns of under five (U5) morbidity in relation with WASH practices using remote sensing and GIS in Udupi taluk

Objectives

1. To identify the morbidity pattern among U5 children
2. To identify water, sanitation and hygiene practices in the community
3. To find factors associated with morbidity among under five children
4. To map morbidity patterns of U5 children in relation to water sources

Review of Literature

International

Bhandari T U et al 2013 ⁽¹⁹⁾

A cross sectional study was conducted in Kapilvastu District of Nepal, to assess the nutritional status of under five children. Children's weight for age shows 25% were below -3 standard deviation (SD), 30.8% were below -2 SD and study shows stunting and underweight was seen in both the genders. Children's are more likely to suffer from diarrhoea, which had severed to moderate malnutrition in their childhood. Study result showed for better immunological status nutrition plays an important role.

Agustina R et al 2013 ⁽²⁰⁾

A cross sectional study was conducted among low socioeconomic urban areas of east Jakarta. Seven days of prevalence of diarrhoea was assessed, food hygiene practices, food preparation, water source and safe drinking water, child's bottle feeding hygiene and housing & environmental condition were collected from the mother and care givers. Children's living less dirty sewage had low prevalence diarrhoea and mother food hygiene practices not affected on occurrence of diarrhoea.

Tarique M D et al 2012 ⁽²¹⁾

It is an interventional study (SHEWA-B) was conducted in the Bangladesh targeted 68 sub district in 19 district. Aim to improve sanitation; hygiene and water supply and to assess SHEWA-B project effectiveness on changing behaviour and bringing down the diarrhoea and respiratory disease among under five children. The intervention results were found to be, improve child health many available, affordable and effective interventions are linked due to difficulties in scaling up it not reach the children. Difficulty in scaling up include weakness in the delivery system, inappropriate delivery strategies, limited resources, short time frame for planning, difficulties in estimating resources.

Goswami N D et al 2012 ⁽²²⁾

A prospective cross sectional study was done in United States to determine case detection and feasibility community Tuberculosis screenin. GIS helps in better understand transmission

dynamics of syphilis, HIV, And TB. The Yield of a GIS based approach to TB screening was higher compared to traditional screening methods

Bartram, J, et al 2010⁽²³⁾

This is the introductory article on water and sanitation from the Plos Medicine series. Globally 4.2% of death can be preventable by following appropriate, hygiene, reliable sanitation and drinking water. In developing countries diarrhoea, malnutrition and other diseases attributable to malnutrition, by practicing good WASH practices we can also endemic diarrhoea, intestinal helminthiasis, giardiasis, schistosomiasis, trachoma, typhoid, cholera, and cryptosporidiosis. 13% of the population lives where the water is collected from the far and unprotected source. By increase use of hygiene example from hand wash with soap we can prevent neonatal morbidity.

Pruss- ustun, A. et al (2002)⁽⁶⁾

On 2008 WHO Geneva has published safe water, better health. By ensuring personal, Domestic and community Hygiene will improve the quality of millions of individuals. Vector born diseases can be reduced by better managing water resources. It has an extensive direct and indirect economic benefit from micro level of house hold to the macro- perspective of national economics. By clear understanding the burden of diseases and clear understanding of alternative approaches to reduce the burden by providing the basic development strategy.

Hoque B A et al (1996)⁽²⁴⁾

An intervention study was run by International Centre for Diarrhoeal Disease Research, Bangladesh for the period of 5 years (1983-87) about education on water supply, sanitation, hygiene (wsh). After follow up of five years 82% of pumps were still working, 64% of latrine were in working condition. An about 84% adults were continuously using sanitary facility and knowledge about transmission of diseases were poor.

Indian studies

Sumeet, R. et al (2014) ⁽²⁵⁾

Study was conducted in Madhya Pradesh, to measure the effect the total sanitation campaign (TSC) which is supported by the World Bank. They used cluster randomised control sampling technique in 80 rural villages. The intervention shows that improved sanitation facilities as defined by the WHO/ UNICEF, But it fails to show improved improve child health measures in terms of multiple health out comes

Myles Elledge, et al (2013) ⁽⁴⁾

The united nation millennium development goals seven tells about environmental sustainability but it is most in accessible to achieve 75% of improved sanitation coverage by 2015. Globally 1.5 million children die from diarrheal disease and in India diarrhoea takes away one child per minute. World 60% of defecation happens only in India. World Bank study shows that India's lack of sanitation coverage cost the country the equivalent of 6.4% of its 2006 gross domestic product.

Singh N K et al (2013) ⁽²⁶⁾

A cross sectional study was done on Manipura to assess the morbidity among U5. Study shows commonly seen illness was respiratory infection with an episode of 2.6% per month followed by diarrhoea, an about 92.3% children suffered from ill in last 3 months.79.8% children showed normal nutritional status.

Clasen T et al (2012) ⁽²⁷⁾

A cluster randomized trial with villages as the unit of randomization was done on Puri, Orissa. Outcome measurement was done on diarrhoea among U5 children, helminth infections, water quality, no of insect vectors, faecal pathogens in environment and cost and cost effective analysis also done. Delays in intervention roll-out caused logistical problems for planning of health outcome follow-up surveys.

Ramachandra P et al (2009) ⁽²⁸⁾

A study was done by the Ramavhandra and Gopalan from the NFHS-3 database, to know the association of risk of under nutrition among preschool childrens. The study shows risk of morbidity was seen more among children's with lower BMI and wasting compared to stunting and underweight. Children are suffering from stunting and wasting has high risk of morbidity.

Ansari, M A et al (2008) ⁽²⁹⁾

A study was done to know the demographic profile and distribution pattern of diseases among under five in rural areas of Aligarh, the result shows that diarrhoea and acute respiratory tract infection seems to be more common among children. Skin infection and worm infection were more seen in 4 to 5 years of children.

Jalan J et al (2003) ⁽¹⁶⁾

A study was done by using the house hold data from India's National Council of Applied Economic Research in 1993–94. Prospective score matching was done to assess the casual effect of child health on piped water in a cross sectional sample without replacement was used. The prevalence of diarrhoea was low in who had piped water than observationally identical households without it. This study pi pass education of mothers, poor families.

Methodology

This chapter describes the methodology used to study the research problem i.e. Patterns of under five (U5) morbidity in relation with water, sanitation and hygiene (WASH) and possible associated factors for it in Udupi taluk.

The chapter will provide insight into the design of the study, study setting, study population, sampling technique, data collection procedures and ethical considerations. Furthermore, the analytical methods used to analyze the data will be discussed.

Study design

A cross sectional study was conducted using mixed method with quantitative and qualitative components of exploratory and explanatory design.

Study Setting

Udupi district is positioned in the southwest part of Karnataka. It consists of three taluks, Udupi, Karkala and Kundapura. Data from the 2011 census shows Udupi district has the population of 1,177,361 of which males were 562,131 and females were 615,230, with the density of 329 people per sq km. In 2011 average literacy rate of Udupi was 86.24% ⁽³⁰⁾.

Figure 1: Udupi taluk map

Study Duration

This study was conducted between February 2015 to July 2015 after obtaining permission from the Institutional Ethical Committee of Manipal University. (IEC 41/2015)

Ethical consideration

Ethical approval for the study was obtained by the Institutional Ethics Committee of Kasturaba Medical College, Manipal (IEC 41/2015). Participants were provided with written information and oral Information on the study objectives, purpose of the study, risks & benefits involved in the study, their rights to enter and cancel their participation at any time, during the study. Informed consent both for participation and for recording of the sessions was obtained from all participants. The informed consent was prepared according to the WHO guidelines for a parental consent in case of children below the age of 18 years. For convenience of the participants/ respondents the informed consent was mentioned in the local language of the area (Kannada). The study was only proceeded with once the respondent understood the study and gave written or oral consent. Every interview was given a unique code and the use of participant name or other identification details was discouraged to ensure the confidentiality.

Operational definitions

Diarrhoea: Diarrhoea is defined as the passage of three or more loose or liquid stools per day (or more frequent passage than is normal for the individual). Frequent passing of formed stools is not diarrhoea, nor is the passing of loose, "pasty" stools by breastfed babies⁽¹⁷⁾

Improved sanitation facilities/ Adequate Sanitation facility: Hygienically separates human excreta from human contact⁽¹⁷⁾.

It includes a flush/pour-flush toilet or latrine that flushes to a sewer, septic tank or pit. A ventilated improved pit (VIP) latrine, pit latrines with the pit well covered by a slab, or composting toilets are also considered improved⁽¹⁷⁾..

Types of sanitation facilities that are not likely to meet the criterion are: flush/pour flush elsewhere; pit latrine without a slab/open pit; bucket; and a hanging toilet⁽¹⁷⁾..

Improved water source: A piped water supply into the dwelling; piped water to a yard/plot; a public tap/standpipe; a tube well/borehole; a protected dug well; a protected spring; and rainwater⁽¹⁷⁾..

Unimproved water source: An unprotected dug well; an unprotected spring; a cart with a small tank/drum; a water tanker-truck; and surface water⁽¹⁷⁾

Quantitative component

Study population

- Mother or care givers and under five (U5) children (3 months to 59 months)

Inclusion and exclusion criteria

Inclusion criteria:

- Mother or primary caregivers of under five children registered in the government health sector and in Anganwadi centers.

Exclusion criteria:

- Parents of children who are not willing to take part in the study.
- Severely ill child

Sampling technique

- Proportionate Stratified random sampling

Sample size estimation

$$N = \frac{(Z)^2 * P (1 - P)}{(d)^2}$$

Where Z= Value at specified confidential interval

P= 18%~20% from previous studies

D=0.05 margin of error/ absolute precision

With confidential interval of 95%

$$N = \frac{(1.96)^2 * 0.20 * 0.80}{(0.05)^2}$$

$$N = 246$$

Therefore sample is 246

By adding 10% non response rate the total sample size comes 273 ~ 280

Study tools

1. Semi structured questionnaire which was piloted and validated by the experts. The questionnaire was in English and then it translated to local language Kannada. Information was collected from the mothers/ primary caregivers on socio-demographic details, water sanitation and hygiene practice, morbidity history of the child in past three months, sanitation and hygiene practices, treatment seeking behavior.
2. Physical examination was done on the sampled children to identify current illness, by conducting general physical examination.
3. Mapping was done with the help of GIS.

Data collection method

Primary data was collected by principal investigator.

From the Udupi taluk health office, list of the health centers were obtained. The polio surveillance report of January 2015 was used to identify children under each Primary Health

Center (PHC)/ Community Health Center (CHC) and Urban health Center (UHC)/ Family Planning Association of India (FPAI).

Selection of Children:

The health sector was stratified into PHC and CHC and into UHC/FPAI. This was further proportionately sampled and simple random sampling was done to sample children from subcenters and anganwadi centers

Anthropometry

Anthropometric measurements namely weight and heights of the children were recorded. Height was measured using tape with 0.1 cm precision. It was recorded by making the child stand next to a wall without shoes and then marked the corresponding measurement on the tape to the wall; this marked measurement was taken as the height of the child. For child below 1 year of age or child unable to stand, length was recorded in the place of height, by making the baby lying on the floor line was drawn perpendicular to head and to tip of the leg and length in between the lines was measured. Weight (in kg) of the children was recorded using digital weighing scale, which was validated before the commencement of the study. Weight of the children of less than one year who were unable to stand was recorded as per WHO criteria. For these children weight of the mother was first recorded with the child and then without the child. Difference in between the two weights was taken as the weight of the child.

Qualitative component:

Thirteen in-depth interviews were conducted with mother or primary care givers of U5 children (3 months to 59 months) and stake holders including community leaders, PHC medical officer, private practitioners, grass root health workers and social worker. Most interviews lasted approximately 15 minutes. Interviews were held at the participant's house or at the participant's work place. All the interviews were performed by the principal investigator. In all, seven interviews were audio recorded using a voice recorder and notes were taken for six interviews.

Study tool

A qualitative in-depth interview guide was developed with the result findings of qualitative and GIS data. Reason for the findings and community WASH practices were asked.

Positionality:

Positionality was maintained by wearing simple local traditional dress and by maintaining good rapport with the participant. While collecting the data, position level was maintained according to the situation.

Data Entry and transcription

To maintain better quality of data, quantitative data was coded and entered and qualitative data has been transcribed on the same or following day from the data collection date. Qualitative data was first transcribed in to local language and later it has been translated to English by the Principal investigator.

Data analysis

Data was analyzed using statistical software SPSS version 15, Epi info version 7, WHO Anthro, remote sensing software ERDAS image 8.5, GIS software Q GIS version 2.6. Descriptive statistics, frequency and proportion were reported. Chi square and logistic regression was used to test the significance of association factors and qualitative data was analysed manually.

Figure 2: Water sanitation and hygiene system map

The Union Government of India lies atop the system map. They work in collaboration with the State Government of Karnataka to provide healthcare services to the population. The State Government of Karnataka can be further divided into the State Ministry of Health and State Ministry of Home Affairs, which are responsible for the provision of healthcare to the population of Karnataka.

The Karnataka State Ministry of Health is responsible for implementing the Program through District Health Society and Integrated Disease Surveillance Project, which is a horizontal program. The District Health Society is subdivided into the Community Health Center, the Taluk, and the Primary Health Center (PHC). At the PHC, the Medical Officer (MO) is the main coordinator who monitors and evaluates the development and implementation of healthcare programs. Under the MO, there are numerous stakeholders including: Junior Health Assistant, Lab Technician, Male Health Workers (MHWs), and Accredited Social Health Activists (ASHA). These implementers work very closely with one another in the completion of their respective roles, therefore they overlap within the system map. Out of these employees, the Junior Health Assistant, MHWs, and ASHAs are the grass root level implementers of the WASH program.

On the right side of the system map, the Karnataka State Ministry of Home Affairs leads into the Zilla Panchayat, which is responsible for Panchayat and Municipality systems. Under Zilla Panchayat there is a Taluk Panchayat, which is followed by Grama Panchayat. The Zilla Panchayat also controls numerous municipalities, which include: Municipal Corporation, Municipality Council, and Nagar Panchayat. Members are elected to work into the Grama Panchayat and Wards. The Government Officers implement and evaluate the effectiveness of WASH programs. Under WASH programs communities and stakeholders (e.g. NGOs and Schools) are directly involved. It is of note that within our system map it was difficult to illustrate the strengths of each relationship. This is due to the fact that we interviewed various stakeholders within different communities, all with their own distinct relationships to one another. Please refer to Annex A for a complete visual representation of the systems map.

Results and Discussion

The result and discussion section illustrates the research results after following statistical analysis. Tables, figures and comparison of the previous study findings are presented.

In the study, a total of 258 participants including children between three month to 59 months and mothers/ primary care givers were included to gather information on morbidity pattern and water sanitation and hygiene practice, factors associated with WASH and U5 morbidity and to map those finding using RS & GIS. Information was obtained from mothers/ caregivers with the help of a semi structured about socio-demographic details, water sanitation and hygiene practice, morbidity history of the child in past 3 months, behavioral habits, treatment seeking behavior of children. The results have been presented according to the socio-demographic profile of the study population, morbidity pattern and cross tabulation of selected factors with morbidity condition. Chi square test to assess the association of selected factors with morbidity conditions and mapping the morbidity, Water source were done.

Table 1: Socio- demographic profile of respondent (n= 258)

Variable	Category	n=258 (%)
Age of the children	< 2 years	121 (46.9%)
	= > 2 Years	137 (53.1%)
Gender of the children	Male	115 (46.6%)
	Female	143 (55.4%)
Religion of the mother/ primary caregiver	Hindu	217 (84.1%)
	Muslim	27 (10.5%)
	Christian	14 (5.4%)
Education of the mother/ primary care giver	Never gone to school	14 (5.4%)
	Up to Primary	27 (10.5%)
	Middle School	20 (7.8%)
	High School	103 (39.9%)
	Pre-University	48 (18.6%)
	Degree	46 (17.8%)

Table 1 shows the distribution of socio demographic details of the respondent.

The range of the age group of children was from three months to 59 months. Median age was 28 months with IQR (12, 42). Gender distribution showed that 55.4% of children were female. The majority were belongs to Hindu religion (84.1%) followed by Muslim (10.5%) and Christian (5.4%). Literacy rate of mother was 94.6% out of whom 39.9% had high school education while middle school was at (7.8%).

Table 2: Distribution of environmental factors and living condition of participants

Variables	Category	n=258 (%)
Type of family	Nuclear	167 (64.7%)
	Single	87 (33.7%)
	Joint	4 (1.6%)
Type of living house	Pucca	253 (98.1%)
	Kutcha	5 (1.9%)
Ownership of the house	Own	216 (83.7%)
	Rented	36 (14%)
	lease	3 (1.2%)
	Free	3 (1.2%)
Own Pets / Livestock / cattle's	Yes	131 (50.8%)
	No	127 (49.2%)

Table 2 shows the environmental factor and living condition of the participants.

Majority of the families lived in nuclear families (64.7%). About 98.1% respondent living in a pucca housing. Out of 258 participants 83.7% spouse or they themselves own their homes. Half of the households (50.8%) owned pets/ livestock/ cattle's.

Table 3: Distribution of children by age and gender

Age (Months)	Male n (%)	Female n (%)	Total n (%)
3-24 Months	54 (47%)	67 (46.9%)	121 (46.9%)
24-59 Months	61 (53%)	76 (53.1%)	137 (53.1%)
Total	115 (100%)	143 (100%)	258 (100%)

The above table describes age and gender distribution with more than half 53.1% belongs to 24 to 59 months comprising of 61 (53%) male and 76 (53.1%) female.

Table 4: Distribution of children with current illness

Variable	Incidence n=254 (%)
Diarrhoea	7 (2.8%)
Pneumonia	12 (4.7%)
Fever	2 (0.8%)
Acute respiratory tract infection (ARI)	19 (7.5%)
Worm infestation	11 (4.3%)
other	8 (3.15)

Table 4 explains about distribution of children's current illness. About 76.4% of children were healthy, ARI was found in 7.6% children followed by pneumonia (4.7%) (This has been cross verified with medical prescription by the doctor). Other disease (3.15%) includes cardiac disease, injuries and measles.

Table 5: Distribution of morbidity conditions among (U5) children (n=258)

Variable	Prevalence n=258 (%) over three months	Frequency of disease For 3 months
Diarrhoea	57 (22.1%)	One episode: 48 (84.2%)
		Two episodes: 8 (14.0%)
		Three episodes: 1 (1.8%)
Fever	145 (56.2%)	One episode: 108 (74.5%)
		Two episodes: 27 (18.6%)
		Three episodes: 8 (5.5%)
		Four episodes: 2 (1.4%)
Cough/ difficulty in breathing	147 (57.0%)	One episode: 110 (74.8%)
		Two episodes: 32 (21.8%)
		Three episodes: 4 (2.7%)
		Four episodes: (0.7%)
Acute respiratory tract infection (ARI)	197 (76.4%)	
Lower respiratory tract infection	32 (12.4%)	
Intestinal Worm (Mother Observation) (n= 258)	30 (11.6%)	

Table 5 represents the morbidity pattern and conditions seen among children over a period of three months. Most commonly seen morbidity was ARI 76.4%, followed by Fever 56.2%. Diarrhoea prevalence was 22.1%; similar finding about prevalence of diarrhoea was seen in the study done in Kashmir, India ⁽³¹⁾ and WHO report on Ghana, Neonatal and child Health profile ⁽³²⁾.

The children had most frequently experienced one episode of most condition; however, most frequently recurring episodes were due to cough. There were fewer episodes of recurrent diarrhoea (14%).

Table 6: Treatment seeking behaviour and practice of mothers towards children health.

Variable	Category	Frequency (%)
Preference of health centre diarrhoea treatment (n=57)	Private clinic/ Hospital	43 (75.4%)
	Government hospital	10 (17.5%)
	Home remedies/ Not shown to health facility	4 (7.01%)
Preference of health centres for fever/ cough/ARI/ LRTI treatment (n=197)	Private clinic/ Hospital	162 (82.2%)
	Government hospital	13 (5%)
	Home remedies	1 (.5%)
	Self medication	21 (10.7%)
Administered de-worming tablet (n= 205)	Yes	141(68.8%)
	No	64 (31.2%)
Zinc supplement during Diarrhoea (n= 57)	Yes	16 (28.1%)
	No	33 (57.9%)
	Don't know	8 (14%)
	Government health care (n=10)	8 (80%)
	Private health care (n= 41)	6 (14.6%)
Water supplementation during illness (n = 248)	Less than usual to drink	44 (17.7%)
	About the same amount	178 (71.8%)
	More than usual to drink	26 (10.5%)

The above table describes about the treatment seeking behaviour and practice of mothers/ primary caregivers during illness of children.

Most participants preferred private clinics for treatment of diarrhoea (75.4%) and for fever/ cough/ARI/LRTI treatment (82.2%). In government hospital only 17.5% and 5% were shown for diarrhoea and fever/ cough/ARI/ LRTI respectively.

Table 7: Nutritional status of participant children.

Variable \ Age		(3-60) Months (n=249)	(3-5) Months (n=13)	(6-11) Months (n=37)	(12-23) Months (n=61)	(24-35) Months (n=48)	(36-47) Months (n=49)	(48-60) Months (n=41)
Weight for Age %	% < -3SD	2	0	2.7	0	0	4.1	4.9
	% < -2SD	16.5	15.4	10.8	13.1	20.8	22.4	14.6
	Mean Z Score	-0.8	-0.58	-0.47	-0.5	-0.94	-1.1	-1.08
	SD	1.2	1.29	1.02	1.24	1.1	1.22	1.22
Length/height -for-age %	% < -3SD	7.6	15.4	2.6	8.2	6.3	12.2	4.9
	% < -2SD	20.8	30.8	10.5	23	22.9	20.4	22
	Mean Z Score	-0.88	-1.38	-0.35	-0.71	-1.01	-1.09	-1.09
	SD	1.45	1.46	1.43	1.6	1.26	1.48	1.3
Weight for length/height%	% < -3SD	3.2	7.1	8.1	3.3	0	2	2.4
	% < -2SD	8.8	7.1	8.1	6.6	6.3	12.2	12.2
	% < +2SD	4.8	14.3	5.4	4.9	4.2	4.1	2.4
	% < +3SD	1.6	14.3	2.7	0	2.1	0	0
	Mean Z Score	-0.41	0.61	-0.23	-0.21	-0.58	-0.69	-0.68
	SD	1.36	1.74	1.48	1.35	1.18	1.23	1.32

Table 7 explains about nutritional status of participant children among three to 60 months old children, it shows assessing for weight for age in percentage 2% of them were below three standard deviation (SD) i.e. severely underweight with 4.9% of them belonging to 48-60 months of age.

Among Height/ Length for age 7.6% of children shows sever shortness (< -3SD) and Shortness (< -2 SD) shows 20.8%. Sever shortness prevalence has more seen among the age group of three to five months. Among children Weight for length 7.6% children shows sever thinness (< -3SD) and thinness (<-2SD) of 8.8% and 1.6% children shows over weight (< +3 SD). Prevalence level of low height for age tends to be substantially greater than those of weight- for- height. Similar findings were observed on WHO Global Database magnitude of protein- energy malnutrition (de Onis M et al)⁽³³⁾

Figure 3: Weight for age

Figure 3: Weight –for –age. By assessing the health status of children on the basis of weight-for-age; 16.5 % children were below the -2 SD (Z- score) and 2 % children were -3SD.

Figure 4: Length/ Height for age

Figure 4: Weight –for-height. Regarding the weight-for-height, 20.8% children were below the -2 SD (Z- score) and 7.6 % children were below the -3 SD.

Figure 5: Weight for length

Figure 5: Weight –for-height. Regarding the weight-for-height, 8.8% children were below the -2 SD (Z- score) and 3.2% children were below the -3 SD.

Table 8: Difference in nutritional status based on gender of the children

Variable \ Age		Male (3-60) Months (n=112)	Female (3-60) Months (n=137)
Weight for Age %	% < -3SD	1.8	2.2
	% < -2SD	15.2	17.5
	Mean Z Score	-0.76	-0.83
	SD	1.22	1.18
Length/height -for-age %	% < -3SD	9.8	5.8
	% < -2SD	19.6	21.7
	Mean Z Score	-1.01	-0.77
	SD	1.4	1.48
Weight for length/height %	% < -3SD	1.8	4.3
	% < -2SD	9.8	8
	% < +2SD	8	2.2
	% < +3SD	1.8	1.4
	Mean Z Score	-0.28	-0.51
	SD	1.47	1.27

Table 8 explains about Gender nutritional status differences. In compare to boys, female children were found to weigh less for age ($< -3SD = 2.2$, $< -2SD = 17.5$). Male children were found shorter for length for age in comparison to females ($< -2SD = 19.6$). On assessing for thinness females were sever thinness, 9.8% male, were this in comparison with 8% of female.

Table 9: Knowledge about causes of diarrhoea and ORS solution.

Variable	Category	Frequency (%)
Knowledge of reasons for diarrhoea (n= 258)	Unclean water	70 (27.1%)
	Unclean food	172 (66.7%)
	Weather Change	43 (16.7%)
	Unclean Hands	35 (13.6%)
	Changing feeding Habits	63 (24.4%)
	Beliefs	13 (5.0%)
Oral rehydration solution Knowledge (n=258)	Yes	191 (74 %)
	No	67 (26%)
Knowledge of ORS preparation (n= 191)	Yes	136 (71.2%)
	No	55 (28.8%)
Correct knowledge of sachet ORS preparation (n= 136)	Yes	78 (57.4 %)
	No	58 (42.6%)
Correct knowledge of ORS preparation at Home (n= 136)	Yes	27 (19.9%)
	No	109 (80.1%)

Table 9: Describes about knowledge about ORS and reason of diarrhoea.

Above stated that diarrhoea was due to unclean food was 66.7%, while 27.1% stated it was due to unclean water and about 5% gave the following reasons about beliefs like superstitious. Out of 258 participants, 74.1% participants are aware or heard about the ORS out of which 71.2% knows about preparation. Out of 71.4%, about 57.4% knows correct ORS preparation from the sachet and 19.9% knows home preparation in the absence of sachet. Similar findings were seen from the DLHS-3 survey about women know what to do when a child gets diarrhoea⁽²⁶⁾

Table 10: Knowledge of ORS among mother/ caregiver of children with diarrhoea

Variable	Category	Diarrhoea		Chi-square
		Yes (n= 57)	No (n= 201)	P-value
Knowledge of ORS (n= 258)	Yes	50 (87.7%)	141 (70.1%)	0.008
	No	7 (12.3%)	60 (29.9%)	
Knowledge of Preparation (n= 191)	Yes	36 (72 %)	100(70.9%)	0.885
	No	14 (28 %)	41 (29.1%)	

Table 10: Brief about knowledge of ORS among diarrhoea case.

Knowledge about ORS in mother/ primary care givers among child suffered from diarrhoea was 87.7%. This relationship was found to be statistical significance ($p < 0.05$). Out of whom 72% knew about ORS preparation though it was not statistically significant.

Table 11: Sources of water and water treatment practise

Variable	Category	Frequency (%)
Main source of Drinking Water (n=258)	Improved source	246 (95.3%)
	Unimproved source	12 (4.7%)
Main source of water used for House hold's purpose (n=258)	Improved source	248 (96.1%)
	Unimproved source	10 (3.9%)
Time to collect water (n=258)	Water on premises	196 (76.0%)
	Water outside the premises	62 (24.0%)
Number of minutes to collect the water (n=61)	Mean=7.51 SD = $\pm$ 3.19 minimum=2 minutes maximum = 15 minutes	
Individuals collecting water from out source (n=62)	Adult women	49 (79.03%)
	Adult man	12 (19.35%)
	Not respond	1 (0.016%)
Adequate water treatment method at house hold (n=258)	Yes	159 (61.6%)
	No	99 (38.4%)
Methods used for water treatment (n= 159)	Boil	135 (52.3%)
	Add bleach/ chlorine	4 (1.6%)
	Used Water filter	17 (6.6%)
	Other	3 (1.9%)
Well water test for potable (n=151)	Yes	9 (6%)
	No	142 (94%)
Disinfection of well Water. (n=151)	Yes	13(8.6%)
	No	137(90.7%)
	don't know	1 (.07%)
Hand contact with drinking water (n=258)	Yes	67 (26%)
	No	162 (62.8%)
	Not responded	29 (11.2%)

Table 11 Brief about source of water and their handling practice.

The majority i.e. 95.3% used improved source of drinking water for members of households, out of which 58.1% drew water from protected dug well followed by piped water into ward (9.7%) and dwelling (9.3%), about 8.9% participants uses public well and 1.9% uses tanker-truck water. The majority i.e., 96.1 % used protected water for their house hold purpose. Findings are similar to World Bank report of 2012, improve source of water ⁽³⁴⁾. About 76% house hold had water on premises and 24% had to travel outside to collect water for drinking purpose/basic house-hold purpose. The mean total minutes to fetch water from the water collection point to dwelling were 7.15 ± 3.19 minutes. Mostly women i.e., 79.03% of adult women went to fetch the water from the dwelling followed by adult men 12%. More than half i.e., 61.6% households used adequate water treatment methods; among them 52.3% used boiling method to disinfect water, followed by water filter (6.6%) and bleaching powder (1.6%).only 6% house-hold wells has been checked for quality of water for potable purpose and 8.6% disinfect there well. During handling water, 26% had hand contact with drinking water.

Figure 6: distribution of drinking water according to source

Figure 7: Types of drinking water sources.

Table 12: Distribution of sanitary facility and practices

Variable	Category	Frequency (%)
Sanitation facility used by adults in the household (n= 258)	Adequate	231 (89.5%)
	Inadequate	27 (10.4%)
Shared sanitation facility (n=253)	Yes	12 (4.7%)
	No	241 (95.3%)
Number of households share that toilets (n= 12)	Two house holds	4 (40%)
	Three house holds	3 (30%)
	Four house holds	2 (20%)
	Six house holds	1 (10%)
Open Defecation: (n= 258)	5 (1.9%)	
Disposal of childrens faeces (less than 3years) (n= 197)	Safe disposal	114 (63.6)
	Unsafe disposal	83 (36.4)
	Child used toilet/ latrine	57 (31.8%)
	Put/ rinsed into toilet or latrine	57 (31.8%)
	Put/ rinsed into drain or ditch	5 (2.8%)
	Thrown in to garbage	5 (2.8%)
	Buried	3 (1.7%)
	Left in the open	11 (6.1%)
	Other	41 (22.9%)
Disposal of childrens faeces (More than 3years) (n= 79)	Child used toilet/ latrine	67 (84.3%)
	Put/ rinsed into toilet or latrine	2 (2.5%)
	Put/ rinsed into drain or ditch	3 (3.8%)
	Thrown in to garbage	2 (2.5%)
	Buried	1 (1.3%)
	Left in the open	3 (3.8%)
	Other	1 (1.3%)

Table 12 Describes about the sanitary facility and practices.

Most respondent i.e. 89.5% used improved sanitary faculty by adult in the house hold. Out of this, 87.2% used flush/pour to pit latrine followed by 4.7% of flush/ pour flush to sewage system. Only 1.2% household practices open defecation. Findings are similar to DLHS -4.⁽³⁴⁾ About 4.7% share their sanitary facility with other households. Among less than 3 years of age, 63.6 % disposed their children's faeces safely, out of which 31.8% children used toilet and 31.8% children's stools were dropped into latrine/ toilets.

Table 13: Hygiene practices.

Variable	Category	Frequency (%)
Mother/ care giver hand washing practice after defecation (n= 258)	Yes	253 (98.1%)
	No	3 (1.2%)
	Some times	2 (0.8%)
Washing children/ hand washing after defecation (n= 258)	Yes	253 (98.1%)
	No	3 (1.2%)
	Some times	2 (0.8%)
Hand washing before preparing food (n= 258)	Yes	210 (81.4%)
	No	40 (15.5%)
	Some times	8 (3.1%)
Hand washing before eating (Mother/ caregiver) (n= 258)	Yes	255 (98.8%)
	No	3 (1.2%)
Washing hand before feeding the children (n= 258)	Yes	255 (98.8%)
	No	3 (1.2%)
Child hand washing before eating (n=224)	Yes	217 (84.1%)
	No	5 (1.9%)
	Some times	2 (0.8%)
Hand washing and feet washing after returning school/ going out (n= 205)	Yes	61 (29.8%)
	No	111 (54.1%)
	Some times	33 (16.1%)

Table 14: Materials used for washing their hands

Variable	Material used	Frequency (%)
Mother/ care giver Hand washing practice after defecation (n= 258)	Water only	83 (32.5%)
	With soap and water	169 (66.3%)
	other	3 (1.2%)
Washing children/ Hands after defecation (n= 258)	Water only	89 (34.9%)
	With soap and water	162 (63.5%)
	other	4 (1.6%)
Before preparing food (n= 221)	Water only	165 (74.7%)
	With soap and water	54 (24.4%)
	other	2 (0.9%)
Before eating (Mother/ caregiver) (n= 255)	Water only	151 (59%)
	With soap and water	99 (38.7%)
	other	5 (2.3%)
Washing hand before feeding the children (n= 255)	Water only	108 (42.4%)
	With soap and water	143 (56.1%)
	other	4 (1.6%)
Child washing hand before eating (n= 219)	Water only	101 (46.1%)
	With soap and water	114 (52.1%)
	other	4 (1.8%)
Washing hand and foot after returning school/ going out (n= 97)	Water only	47 (48.5%)
	With soap and water	46 (47.4%)
	**other	4 (4.1%)

**Other materials include hand wash, sanitizer, mud, ash

Table 13 and 14 speaks about the hygiene practices of the respondent.

Almost every one i.e., 98.1% mothers/caregiver wash their hands after defecation, among them 66.3% used water with soap followed by 32.5% with water only. 98.1% mothers/ caregivers wash their kids after defecation, among them 63.5% used water with soap followed by 34.9% with water only. Most (81.1%) participants wash their hands before preparing the food. Out of this, 74.1% used only water for the same. Almost all i.e., 98.8% participants

wash their hands before feeding the child, 56.1% used water and soap followed 42.1% with water. Almost mothers i.e., 84.1% mother/ caregiver washed their child hands before eating and among them 52.1% used water and soap.

Table 15: Feeding habits and practices.

Weaning initiated	Mean : 5.41 months SD= ± 1.21 Minimum =2 month Maximum= 8 month	
**Bottle cleaning method before feeding the child (n=34)	With water	3 (8.8%)
	With water and soap	5 (14.7%)
	Boiling the bottle with water	26 (76.5%)

** This question has been asked to children less than 24 months of age

Table 15 shows feeding habits and practices of the children less than 24 months of age.

The mean age of initiating weaning practice 5.41 ± 1.21 .with minimum and maximum of 2 and 8 months respectively. More than half i.e., 76.5% use sterilization technique for cleaning the feeding bottle, followed by soap with water

Table 16: Association of diarrhoea with WASH practices

Variable	Category	Diarrhoea		Chi-square P-value
		Yes (n= 57)	No (n= 201)	
Age (n= 258)	Less than 2 Years	39 (68.4%)	82 (40.8%)	0.0001
	More than 2 Years	18 (31.6%)	119 (59.2%)	
Education of Mother	Up to Middle school	19 (33.3%)	42 (20.9%)	0.041
	Above middle school	38 (66.7%)	159 (79.1%)	
Source of drinking water (n= 258)	Improved	52 (91.2%)	194 (96.5%)	0.94
	Unimproved	5 (8.8%)	7 (3.5%)	
Adequate water treatment method at house hold (n= 258)	Treated (Yes)	33 (57.9%)	126 (62.7%)	0.51
	Not treated (No)	24 (42.1%)	75 (37.3%)	
Dispose of children stool (n= 258)	Safe dispose	48 (84.2%)	117 (88.1%)	0.442
	Unsafe dispose	9 (15.8%)	24 (11.9%)	
Shared toilet facility (n= 253)	Yes	6 (10.7%)	6 (3%)	0.017
	No	50 (89.3%)	191(97%)	
	Above middle school	38 (66.7%)	159 (79.1%)	

Table 16: Explains about the association between diarrhoea and the WASH practices in the community. Significant association was seen by doing Chi-Square test.

Child less than 2 years were more likely to suffer from diarrhoea and chi-square shows an association between age and diarrhoea with statistical significance ($p < 0.05$). With the prevalence of 68.4% among less than two years of age. Most cases of diarrhoea were found in homes with improved source of drinking water, adequate treatment of water and those who disposed of children's stool safely. None of these findings were statistically significant and could be due to underlying confounders. While 50% of those shared toilets facilities had diarrhoea cases this was significantly associated. As the education advances occurrence of the disease is likely to less. Educational status of the mother shows a significant association ($p < 0.05$) with prevalence of diarrhoea.

Logistic regression shows children's less than 2 years of age has **4.26** (2.10 8.637) odd times more likely to get diarrhoea with 95% confidential interval, compare to children age group of

2 to 5 years. This has been adjusted to shared toilet facility, education of mother and ownership of the property.

Table 17: Association between ownership and diarrhoea of the property.

Variable	Category	Property ownership		Chi-square P-value
		Own (n= 216)	Rented/Lease/Free (n= 42)	
Diarrhoea	Yes	42 (19.4%)	15 (35.7%)	0.020
	No	174 (80.6%)	27 (64.3%)	

Table 17 shows regarding the association between ownership of the house and diarrhoea, Children's living in rented/lease/free house are more likely to suffer from diarrhoea, comparing to children living in their own homes. It is statistically significant ($p < 0.05$). This could be related to the socioeconomic status.

Table 18: Association between WASH and cough

Variable	Category	Cough		Chi-square P-value
		Yes (n= 147)	No (n= 111)	
Main source of drinking water	Improved	138 (93.9%)	108 (97.3%)	0.197
	Unimproved	9 (6.1%)	3 (2.7%)	
Type of Family	Nuclear	97 (66%)	70 (63.1%)	0.413
	Single	49 (33.3%)	38 (34.2%)	
	Joint	1 (0.7%)	3 (2.7%)	
Child Washing Hand's before eating	Yes	128 (96.2%)	89 (97.8%)	0.501
	No	3 (2.3%)	2 (2.2%)	
	Some times	2 (1.5%)	0 (0%)	

Table 18 explains about relation between cough and WASH

Majority of i.e., 93.9% of children suffered from cough lived in households, who are using improved source of drinking water. There was no much difference between occurrence of cough with type of family and child washing hand before eating.

Table 19: Association of fever with co-morbidities

Variable	Category	Fever		Chi-square p-value
		Yes (n= 145)	No (n= 113)	
Suffering from cough	Yes	105 (72.4%)	42 (37.2%)	0.0001
	No	40 (27.6%)	71 (62.8%)	
Running nose	Yes	108 (74.5%)	68 (60.2%)	0.014
	No	37 (25.5%)	45 (39.8%)	
Diarrhoea	Yes	33 (22.8%)	24 (21.2%)	0.445
	No	112 (77.2%)	89 (78.8%)	

Table 19 shows association of co-morbidities diseases with fever.

Almost 72.4% children who suffered from cough, had fever. Association shows statistical significance ($p < 0.05$), with chi-square value ($\chi^2 = 32.18$), while 74.5% children suffered from cough and fever, this association shows statistical significance ($p < 0.05$), with chi-square value ($\chi^2 = 5.995$).

Figure 8: Map showing distribution of diarrhoea cases in Udupi taluk

(Source Q GIS version 2.6)

Figure 8 shows distribution of diarrhoea cases according to PHC. Proportion shows distribution of cases in colours yellow< orange< red (0 to 0.31). Prevalence was found to be 22.1% cases. Malpe, Avarse, Saibrakatte, Karje has show high proportion of diarrhoea cases.

Figure 9: Map showing distribution of Case cluster diarrhoea cases

(Source Epi- info 7

The above figure shows case cluster distribution of diarrhoea cases in udupi taluk. Each blue dot represents the cases and the number in the dot shows number of density cases around the area. Towards Malpe area diarrhoea cases were more.

Figure 10: Map showing distribution of unimproved drinking water source in Udupi taluk

(Source Q GIS version 2.6)

Figure 10 shows distribution of un improved source of drinking water, unimproved water source were found in averse, kokarne, saiberkate, petri, udupi, malpe and kapu areas

Figure 11: Map showing distribution of fever cases in Udupi taluk

(Source Q GIS version 2.6)

Figure 11 shows distribution of fever cases according to PHC. Proportion shows distribution of cases in colours yellow< orange< red (0 to 0.81). Prevalence was found to be 56.2%. towards west, prevalence of disease was more compare to north east. Kodibengre showed high prevalence.

Figure 12: Map showing distribution of cough cases in Udupi taluk.

(Source Q GIS version 2.6)

Figure 12 shows distribution of cases with cough according to PHC. Proportion shows distribution of cases in colours yellow< orange< red (0 to 0.83). Towards North West of kota, sasthanana, barkur and in Udupi, Shirva prevalence of cough was high.

Figure 13 : Map showing distribution of lower respiratory tract infection in Udupi taluk

(Source Q GIS version 2.6)

Figure 13 shows distribution of prevalence of LRTI cases. Towards Mudarangadi and towards middle of the udupi taluk around udupi, manipura, barkur, kota and kolalgiri cases were found.

Remote sensing findings for distribution of diarrhoea cases

Distribution of sample is more in the regions of coastal area, Udupi town, along the sides of NH-17. Crowd of house were seen in Udupi, Malpe, Saligrama, Kapu and in rest places spacing between the houses were more. Towards Avarse, kokkarne, Karje, Hiriyadka, Perampalli most of the houses are in deep geographic vegetation. Finding shows most of the villages not located too close to river, except in Malpe, kodibengre and sasthana

Figure 14: Distribution of diarrhoea cases with geographical structure of Udupi taluk

Figure 14 explains about the distribution of diarrhoea cases with relation to geographic structure of Udupi taluk.

Figure 15: Distribution of diarrhoea case with satellite image in Malpe Beach

Figure 15: shows distribution diarrhoea cases (red dot) with satellite image. It shows the distribution of vegetation, water body (Arabian sea), distribution of houses with access to road.

Qualitative component

The qualitative component was focused on identifying factors related to morbidity pattern and WASH practices among community.

Main stake holders includes: General practitioners, paediatricians, neonatologist, medical officer, auxiliary mid wife, male health worker, social worker, community leaders, Community members.

Geographic Nature

Udupi taluk share a peculiar geographic distribution with sea, plain and hilly area, socio demography with high to low socio economic status. In rural area home are spread apart compare to urban area and they were built in their own farmland (except government provided lands) and most of them have their own well.

“Everyone has their own well... so they keep there well clean” [Affluent area, medical officer]

Water

The common source of drinking water is well water, even in the presence of pipe water at their home premises. In the absence of well water in their premises they collect the water from public well or from other households.

“Panchayathi niru kempuge eruthe adhuke navu baav...neere kudiyothu”

“Panchayth water is red in colour so use well water for drinking” [Affluent area, mother participant]

Reason for using unimproved source of drinking water:

In the northern part of Udupi taluk, during summer wells enter into a dry stage. Panchayath's took the responsibility of distribution of water and they supplying once in 3-4 days in tanker.

“Eevaga bavili nneru kami yathu.. adhuke panchayathi tank neerua balushthivi”

“Now water level is reduced in well..so we are using panchayathi water” [Affluent area, mother participant]

In the region of Udupi and Malpe unprotected dug wells were used for daily house-hold purpose, these wells were not maintained by owner/ public service provider. Here migrants were the more vulnerable group as they lived close to the river and Udupi drainage system.

Sanitation and Hygiene

The weathers, geography of Udupi helps the community in maintaining sanitation and hygiene in their environment. Drainage system here has not been replaced with modern

techniques. block in drainage leads to an overflow or expel of the drainage content. As the river bed system of Udupi is good, drainage content mixes with river and with underground water.

“Even some small sanitary pad block the drainage system” [Affluent area, Social worker]

Diarrhoea

Reasons found for occurrence diarrhoea including: feeding the children with unhygienic food from outside, Unhygienic food, food poisoning from the ceremony/ temple/ festival, rotten chicken and egg, bakery items, fried items, non-veg items like fish and chicken in early period . Prevalence was high in pre monsoon and inearly monsoon season. Among pre-school/ anganwadi children un-hygienic hands before eating were said to contribute.

Age: Commonly seen in the age group of 7th month to 3 years. Was attributed mainly due to the behaviour of the children like mouthing and scrolling over the ground and in mud and introduction of complimentary feeding after 6 months.

“No one looks after the quality of outside food, they are the main culprit” [Affluent area, paediatrician]

In most of the cases doctor's follow symptomatic treatment. In low resource setting, paediatrician not able to identify organism, by clinical findings they predict the organism. In most of the cases they found it's due to viral, rarely they find amoebic or bacillary organisms. Simultaneously in high resource setting (Private) they found mixed organisms (50:50= bacteria: viral). Rota virus is the main cause of viral diarrhoea. By experience they found viral diarrhoea is more common in early and pre monsoon seasons.

Reasons for diarrhoea in high prevalence areas, in the Malpe region may be due to contamination of water from the sewage, high density of population and low socio economic status. In Sairbrekatte, Averse, Karje and Kukkehalli it's due to unimproved source of drinking water, low socio economic status, low education among mothers, tribed communities were living here and most of the population living in remote areas.

“Adhu edhu thindhu bedi yahith....u mostly ice cream erbeku”

“Eat different things that why diarrhoea happen mostly...due to ice cream” [Affluent area, mother participant]

Reasons of low prevalence of diarrhoea.

The main reason was attributed to geographical structure and living style, most of the houses have their own wells and sanitary facility. Open defecation was not acceptable, if any one practice they consider them uncivilized people.

“Diarrhoea does not often occur occurrence once in a year is also difficult” [Affluent area, medical officer]

Researcher observation: Diarrhoea cases were seen in populations living in un hygienic environment, low socio economic status, applying cow dung around the house among migrant population.

Fever and Cough

Fever and cough are causing mainly due to cross infection from elder people, mothers, siblings, courtyard children's. It's mainly due to urbanization, early entry to pre- school and low immune power.

Among north Indian migrants malaria cases were more common compared to north karnataka [Affluent area, paediatrician]
migrants and sporadic vaccine failure measles were found.

“Padubidri kids joining to bramavara pre-school, infection may travel all the way from padubidri to brahmavar! It's all most more than 20 km !!!....” [Affluent area, paediatrician]

“We get the cases of measles vaccination failure of sporadic cases” [Affluent area, paediatrician]

Lower respiratory tract infection

Around the region of Mudarangadi and Padubidri acute respiratory infections were common attributed to presence of thermal power plant.

Summary

- ✓ A total of 258 mothers/ primary care givers were interviewed with semi-structured, pretested questionnaire..
- ✓ About 46.6% of respondents were female and 53.1% of children sampled belonged to age of more than 2 years.
- ✓ Socio- demographic details showed 39.9% mother/ primary care giver had high school education, 64.7% family lived in nuclear families and 83.7% owned their homes.
- ✓ Pattern of morbidity were assessed for the last three months: Most commonly seen morbidities included cold/ running nose 68.2%, followed by cough 57%, fever 56.2%, diarrhoea 22.1%, lower respiratory tract infection, worm infestation 11.6% and 16.5% child shows under weight.
- ✓ Treatment seeking behaviour was commonly at private clinic/ hospital compared to government hospitals.
- ✓ Awareness about ORS was present among of mothers/ caregivers was 74.1% and participants knowledge on reasons for diarrhoea diseases includes water 27.1%, unclean food 66.7%, changing food habits 24.4 and 13.6% unclean hands
- ✓ Main source of drinking water in Households from improved source was seen in 95.3% and 76% had water on premises. Before drinking, 61.6% of households used adequate water treatment methods at their household.
- ✓ Most (89.55%) adult's used adequate sanitary facilities, 63.6% disposed their child faeces safely. On assess for hygiene practice, 98.1% mother/ primary care-givers washed their hands after defecation, among them 66.3% used water and soap and 98.8% washed their hands before feeding the child.
- ✓ Chi- square and p- value were used to assess an association between diarrhoea and age of the children, property ownership and education of mother.
- ✓ Fever and cough showed association with statistical significance.
- ✓ Qualitative data reveals main reason for diarrhoea as due to un hygienic, food poisoning, unimproved source of drinking water, Less than 2 years of age was seen to emerge as the high risk group.
- ✓ Distribution of diseases is different according to geographic structure, urbanization and socio economic status.

Conclusion

Udupi taluk shares different demographic details along the lines of geographic area. With good indicators of health, Udupi shares the highest position in Karnataka state. High economic status population generally live towards the coastal area and towards north east. Towards east of Udupi most of the population living in the interior rural area with lack of facility and their standard of living is low compared to people living towards coastal area and along the route of National Highway-66.

This Socio- demographic and geographic distribution showed different morbidity and WASH practices. Highlights distribution of diarrhoea cases were seen towards north east, its due low socio economic status and unimproved water source. Distribution of fever and cough cases were more prevalent towards the coastal area, its due to the suppressed immune power among under five children compare to previous generation, urbanization, cross infection, over crowded of population and early entry of kids to pre- school.

Treatment seeking behaviour at diarrhoea in government hospital is high at 17.5% for diarrhoea compare to fever/ cough/ LRTI. Prevalence of diarrhoea is high in Averse, Siaberkatte, Karje and Kokarne where treatment seeking behaviour towards government setting was higher compared to other centres.

The present study found association factors for diarrhoea included, food, un-hygienic practices no association between water and diarrhoea was seen.

Limitations

- ✓ Morbidity in different seasons has not been recorded as study duration was limited
- ✓ It was self reported by mother/ primary care giver and there is a possibility of recall bias.
- ✓ Small sample size in some PHC (Kodibengre, Averse, Kokkarne and Karje)

Recommendations

- ✓ Supplementation of soap and cross ventilation facility in anganwadi and pre- schools.
- ✓ Decentralization of the current centralized policy on distribution of ORS and zinc supplementation.
- ✓ Training can be provided to private doctors about rehydration and zinc supplementation therapy.
- ✓ Policy to test the private well water for potable
- ✓ Policy to test the out source/ festival/ locally prepared food.
- ✓ Educate the mother to provide hygienic food to children's

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Annexures

Annexures 1: Subject information sheet

Introduction of self:

Hi my name is Dr. Yogish C B , am studying 2nd year Master of Public Health in Manipal University, Manipal.

Please read this form carefully, if you do not understand the language or any information in this document, Please discuss with the principal investigator (Yogish). If you decided to volunteer to take part in this study you must sign at the end.

Introduction about the study

Mahatma Gandhi quoted in 1923 that “Sanitation is important than political Independence”. Millennium development goals seven and four speak about ensuring environmental sustainability and reduce child mortality. Globally one in five defecates in open, India accounts 60% of it. Adequate sanitation, hygiene and water are the basic fundamental to health. By follow above this we can prevent 6.8% of DALY lost. Indisposed Hygiene and sanitation services are likely to occurrence of Diarrhoea, Intestinal helminthiasis, Cholera, typhoid, respiratory infection, vector born diseases, giardiasis, trachoma, skin and eye infection. GIS provides epidemiological, sociological, clinical and economic data with reference to space.

Back ground of the study

Worldwide unsafe water, inadequate sanitation or insufficient hygiene lead to 80% of the diarrhoea. 50% of the underweight or malnutrition is associated with repeated diarrhoea or intestinal nematode infections as a result of unsafe water, underweight contributing 35% of all deaths. Under the age of five, diarrhoea alone takes away the life of 1.4 million children preventable death per year, Underweight children are more vulnerable to all infectious diseases, 1.2 million people die every year out of which 90% of whom children are under 5 years. In India Over 50% of the population defecating in the open, Only 6% of rural children under the age of five use toilet, 80% of the children stool thrown to the garbage or left in the open, 44% mother disposing their children's faces in open, only 11% of families dispose the children stool safely. There is a high risk of microbial contamination with water and food. . Under the five years diarrhoea is the second biggest cause of death cause by poor Water sanitation and hygiene. Over 40% of the diarrhoea and 30% of the respiratory infection among children can be reduced particularly by practicing hand wash with soap after contacted with excreta. Morbidity among under five remains challenging. Mothers and care givers are directly linked with the children's health. Importance of sanitation, Hygiene and pure drinking water receives less attention in the community.

Who can take part?

Under- five children, mothers/ caretakers and stake holders like community leaders, grass root health workers.

Information about the study

- A total of 280 Mothers/ care givers and children are expected to participate
- A set of semi structured questionnaire on WASH practices and Morbidity pattern of the child will be asked, it will take around 30 to 40 min to complete.
- None of the questions are sensitive or embarrassing
- Anthropometric measurement of under five children will be measured like Height and weight, and general examination will be done.

Your role and responsibility

You are invited for participation to provide information on WASH practices and Morbidity of U5 children.

What are the risks?

There is no potential risk in the study except for participants losing their information. The information provided by the participants will be treated as confidential. This proposal has been reviewed and approved by the Institutional review committee, Manipal University which is a committee whose task it is to make sure that participants are protected from harm.

What are the potential benefits of participating in the study.

This study may prove beneficial for the students and community by generating evidence on WASH practices and under five (U5) morbidity Pattern using geographic information system in Udupi Taluk.

Confidentiality of information.

The information provided will be treated as confidential, and no one else except me and my guide will have access to the information documented during your interview.

Voluntary participation.

- Whether or not you take part is your choice. If you do not wish to participate, you do not have to give a reason.
- You have the right to access information collected as part of the study

Contact details in case of any questions

Name: Dr.Arthi roa

Address: Department of public health, Manipal University

Email: arthimph@gmail.com

Phone: 9008418848

Annexure 2: Informed consent form

Project title: A study on WASH practices and under five (U5) morbidity pattern using remote sensing and geographical information system in Udupi Taluk.

Name of the Research Subject:

Age of the Research Subject:

I have read the Participant Information Sheet and its contents were explained. I had the opportunity to ask questions and received satisfactory answers.

I understand that my participation in the study is voluntary and that I have the right to withdraw at any time without giving any reason, without my medical care or legal rights being affected.

I agree to take part in the above study. I confirm that I have received a copy of the Participant Information Sheet along with this signed and dated informed consent form.

Name and Signature of the subject

Date

Signature & the name of the witness

Date

Name & Signature of the person explaining the consent

Date

INFORMED CONSENT FORM(Pediatric group)

Project title: A study on WASH practices and under five (U5) morbidity pattern using remote sensing and geographical information system in Udupi Taluk.

Name of the Research Subject:

Age of the Research Subject:

I have read the Participant Information Sheet and its contents were explained. I had the opportunity to ask questions and received satisfactory answers.

I understand that my child's participation in the study is voluntary and that my child has the right to withdraw at any time without giving any reason, without my child's medical care or legal rights being affected.

I agree to my child taking part in the above study. I confirm that I have received a copy of the Participant Information Sheet along with this signed and dated informed consent form.

Name & Signature of the mother / guardian
Of the research subject

Date

Signature & the name of the witness

Date

Name & Signature of the person explaining the consent

Date

Annexure -3: Questionnaire

1)	1a.Date of survey(DD/MM/2015):- 1b.Time of survey(HR/MM)
2)	Village name and PHC code
3)	Latitude and Longitude
4)	What is the age of the Child?
5)	Gender of the child 1. Male 2. Female
6)	Can you tell me which religion are you following? 1.Hindu 2.Muslim 3.Christian 998.Dont want to answer
7)	Highest education (of mother/ Guardian) Attained 1. Never gone to school 4.High school 7.No formal education (Can read and write) 2. Up to primary school 5.pre-university 3. Middle school 6.degree 998. Don't want to answer
8)	What type of family are you living at presently 1.Nuclear 3.Joint 2.single 4.Extended family
9)	Type of house 1.Pucca 2.Kutcha 3.Mixed
10)	Do/ Spouse you own this house? 1.Own 3.lease 998.Dont want to answer 2. Rented 4. Free
11)	Have you own Pet's/ Livestock/ cattle's? 1.Yes 2.No
12)	What is the main source of drinking water for members of your households? (<i>Open ended</i>) 1.Piped water into dwelling 8.Unprotected spring 14.Tube/borewell 2.Piped water to yard/plot 9.Rainwater collected 3.Public tap/Stand pipe 10.Bottled water 4.Protected dug well 11.cart with small tank/drum 5. Unprotected dug well 12. Tanker-truck 6.Protected spring 13. Public Well 7.Surface water(river, lake, dam, pond, canal, irrigation channels) (<i>Question 14,15,16 depended upon this variable</i>)
13)	What is the main source of water used by your house-hold for other purposes, such as cooking and hand washing? (<i>Open ended</i>) 1.Piped water into dwelling 8. Unprotected spring 14.Tube/borewell 2.Piped water to yard/plot 9.Rainwater collected 3.Public tap/Stand pipe 10.Bottled water 4.Protected dug well 11.cart with small tank/drum 5. Unprotected dug well 12. Tanker-truck 6.Protected spring 13. Public Well 7.Surface water(river, lake, dam, pond, canal, irrigation channels) (<i>If answer Inside the house skip to Q 20) (outside house answer Q14,15)</i>)
14)	How long does it take to go there, get water, and come back 1. Number of mints _____ 98. DK 2.Water on premises (<i>skip →16,20</i>)
15)	Who usually goes to this source to fetch the water for your household? 1.Adult women 4.Female child(under 15 years) 2.Adult Man 98.DK

		3. Male child(under 15Years)
	16)	Have you tested your well water? 1.Yes 2.No Whom tested _____
	17)	Have you treated your well water in last 3 month? 1.Yes 2.NO (NO→ Q19)
	18)	Who treated your well water? 1.Own 2.Government worker 3.Private agency
	19)	In last use do you treat your water in any way to make it safer to drink? 1. YES 2. No 98.DK (NO→ Q21)
	20)	What do you Usually do to the water to make it safer to drink? 1.Boil 5.let it stand and settle other 2.Add bleach/chlorine 6.Other (specify)_____ 3.used a water filter 98.Dk 4.solar disinfection
	21)	How do you take out water from the storage vessel? (<i>Open ended</i>) (<i>Demonstrate the process</i>) 1. Hand contact with water 3.Other specify_____ 2.No hand contact with water
	22)	When you started Weaning practices? _____ (<i>Above 2 years Skip → Q25</i>)
	23)	Before feeding the child are you washing your hands? 1. Yes 2. No
	24)	If your baby is feeding from bottle milk how do you clean the bottle? 1.with water 3.Other (specify)_____ 2.With water and soap
	25)	In past 3 months did your child experience diarrhoea? 1. Yes 2. No (<i>Skip Q →30</i>)
	26)	If yes, How many times he/she suffered? _____
	27)	Have you treated above condition, from where? 1. Home remedies 3. Private 5.Not took treatment. 2. Government 4. traditional
	28)	Have you given Zinc syrup to child during diarrhoea? 1. Yes 2. No
	29)	Have you heard of ORS? 1. Yes 2. No (<i>Skip Q →33</i>)
	30)	If yes, do you know how to prepare? 1. Yes 2. No
	31)	Can you explain for me 31a With ORS sachet 1. Correct 2.Incorrect 31b Home preparation
	32)	What do you think is the reason for diarrhoea? 32a. Unclean water 1.Yes 2.No 32b. Unclean food 1.Yes 2.No 32c. Weather change 1.Yes 2.No 32d. Unclean hands 1.Yes 2.No 32e. Changing feeding habits 1.Yes 2.No 32f. Beliefs 1.Yes 2.No 32g. Others _____ (98). don't know
	33)	Did your child suffer from any kind of fever in last 3 months 1. Yes 2.No (<i>Skip → 36</i>)
	34)	How many times had fever _____
	35)	35. a. Did your children had cough or difficulty in breathing at any time in the last 3 months?

		1. Yes 35 b. If yes how many times? _____ (Ask for treatment card to confirm) 35c. Did your child had running nose 1. Yes 2. No	2. No (Skip → 39)
	36)	When child had an illness with a cough or difficulty breathing, did he/she breathe faster than usual with short, rapid breaths or have difficulty breathing? 1. Yes 2.No	
	37)	Was the fast or difficult breathing due to a problem in the chest or to a blocked or runny nose? 1. Chest only 2. Nose only	3.Both (chest indrawn) 4. other _____
	38)	Did your child had fever with cough in the past 3 months? 1. Yes 2. No	
	39)	Now I would like to know how much to your child was given to drink (including breast milk) during the illness with a (fever/cough/ diarrhoea). Was (he/she) given 1. less than usual to drink 2. about the same amount IF LESS, PROBE: Was (he/she) given much less than usual to drink or somewhat less?	3. More than usual to drink?
	40)	Have you treated above condition, from where? 1. Home remedies 2. Government	3. Private 4. traditional 5. Not took treatment.
	41)	Have your child suffer from any symptoms in last 3 months? 41. a. Compliant about abdominal pain 41. b Compliant of nausea 41. c. Compliant of Itching in the anal region 41. d. Has your child lost his/her weight	1. Yes 2.No 1. Yes 2.No 1. Yes 2.No 1. Yes 2.No
	42)	Have you observed any worms in stools 1. Yes 2. No	
	43)	Have you administered any de worming in last 6 months 1. Yes 2. No	
	44)	Have you immunized the child against rota Virus? (Ask immunization card to confirm) 1. Yes 2. No	
	45)	Have you heard about village and health sanitation committee? 1. Yes 2.No	
	46)	If Yes can you explain me what kind of work they do? _____	
	47)	Socio economic status (Monthly income of the family) _____	
	48)	What kind of toilet facility do members of your house-holds usually use? 1.Flush/pour flush to 11.Piped sewer system 12.Septic Tank 13.Pit latrine 14.elesewhere 15.Unknown Place/Not sure/DK	2.Ventilated improved pit latrine 3.Pit latrine with Slab 4.Pit latrine without slab/open pit 5.composting toilet 6.Bucket 7.No Facility or bush or field 8. Other(specify) _____
	49)	Do you share this facility with other households 1. Yes 2. NO (Skip Q → 52)	
	50)	How many other households share this toilet? _____	
	51)	The last time Passed child stools, what was done to dispose of the stools? 1.Child used toilet/latrine 5.Buried	

		2.Put/rinsed into toilet or latrine 3.Put/rinsed into drain or ditch 4.Thrown into garbage	6.Left in the open 7.Other(specify)_____ 8.DK
	52)	How frequently your child pass the stools _____	
53)	Do you wash hands in following situations and what material do you use? (Last time)		
Situation		Yes	No
		Sometimes	If yes, what material do you use, with 1) water only 2) with soap and water 3) with ash/ soil and water, 4)others (specify)
53.a.After defecation			
53.b.Before preparing food			
53.c.Before eating			
53.d.Before feeding the children			

54) Does your child wash hands in the following situations and what material do they use?

Situation (Last time)	Yes	No	Some times	If yes, what material do you use, with 1) water only 2) with soap and water 3) with ash/ soil and water, 4)others (specify)
54.a.After defecation				
54.b.Before eating				
54.c.When they return from school/going out				

55) Physical examination of child

55a.Height/ Length:-

55b.Weight:-

55c.Mid arm circumference:-

55d.Physical examination for clinical features (current status):

Qualitative data: Why? How?

Annexure -4: Institutional Ethical Clearance Certificate

Kasturba Medical College, Manipal

Institutional Ethics Committee

Communication of the Decision of the Institutional Ethics Committee

KMC IEC 41/2015

Saturday, 17th January 2015

Protocol title	:	A study on WASH practices and under five (U5) morbidity pattern using remote sensing and geographical information system in Udupi taluk.
Principal Investigator	:	Dr. Yogish C B
Guide / Co Guide / Co Investigators	:	Dr. Varalakshmi Chandra Sekaran, Dr. Sanjay M Pattanshetty, Dr. Shreemathi S Mayya
Name & Address of Institution	:	Dept. of Public Health, Dept. of Statistics, MU, Manipal.
New review	:	New
Date of review (DD/MM/YYYY)	:	16.01.2015
Decision of the IEC	:	<ul style="list-style-type: none"> • Approved • Pending • Revision • Rejected
Remarks	:	Approved for the study period of 6 months as mentioned in protocol. The final report has to be submitted at the end of the study

Please Note*

- * Inform IEC in case of any amendments to the protocol, change of study procedure, site and Investigator and premature termination of study with reasons along with summary.
- * Study completion Report to be submitted to IEC.
- * Members of IEC have right to monitor the Study with prior intimation.
- * A copy of the consent document to be given to the study participant giving the consent.
- * Inform IEC immediately in case of any Adverse events and Serious adverse event.

**APPROVED
KMC IEC
MANIPAL**

Dr. Vikram Palimar
 Member Secretary KMC IEC