DEMOGRAPHIC, SOCIO-ECONOMIC, AND ENVIRONMENTAL FACTORS ASSOCIATED WITH DIARRHOEA MORBIDITY IN CHILDREN UNDER- FIVE IN RURAL ODISHA:

A Study of Rayagada District-INDIA

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A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Public Health Program in Public Health
College of Public Health Sciences
Chulalongkorn University
Academic Year 2012

ปัจจัยทางเศรษฐกิจสังคม , สิ่งแวดล้อม และ ปัจจัยพื้นฐาน ที่เกี่ยวข้องกับอัตราการป่วยด้วยโรคท้องร่วงในเด็กอายุต่ำกว่า 5 ขวบในพื้นที่ชนบทของโอดิสสา : การศึกษาในอำเภอรายากาดา - อินเดีย

นาย เดบาจโยติ โมหาพาตรา

วิทยานิพนธ์ฉบับนี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาสาธารณสุขศาสตรมหาบัณฑิต

สาขาวิชาสาธารณสุขศาสตร์

วิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์มหาวิทยาลัย

ปีการศึกษา 2555

Thesis Title	DEMOGRAPHIC, SOCIO-ECONOMIC, AND ENVIRONMENTAL FACTORS ASSOCIATED WITH DIARRHOEA MORBIDITY IN CHILDREN UNDER FIVE IN RURAL ODISHA: A STUDY OF RAYAGADA DISTRICT-INDIA
By	Mr. Debajyoti Mohapatra
Field of Study	Public Health
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Accepted by the College of Public Health Sciences, Chulalongkorn University, in Partial Fulfillment of the Requirements for the Master's Degree

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##5578806353: MAJOR PUBLIC HEALTH

KEYWORDS: DEMOGRAPHIC FACTORS/ SOCIO-ECONOMIC FACTOTS/ENVIRONMENTAL FACTORS /UNDER FIVE CHILDREN/DIARRHOEA/RAYAGADA

DEBAJYOTI MOHAPATRA: DEMOGRAPHIC, SOCIO-ECONOMIC, AND ENVIRONMENTAL FACTORS ASSOCIATED WITH DIARRHOEA MORBIDITY IN CHILDREN UNDER- FIVE IN RURAL ODISHA: A Study of Rayagada District-INDIA. ADVISOR: ALESSIO PANZA, M.D., M.Com.H., DTM&H, 95pp.

Background: According to the UNICEF report, pneumonia and diarrhoea, the two biggest killers of children, killed about 2,197,000 children less than five years of age in 2010, making up 29 per cent of all child deaths under age five worldwide. And with 609,000 deaths India topped the list of the 75 countries with the highest mortality burden attributed to the two diseases The main purpose of this study was to determine the association of demographic, socio-economic, and environmental with diarrhoea morbidity in children under five in rural odisha, India.

Methods: A cross-sectional study was carried out in the severely Diarrhoea affected blocks of the Rayagada District to find out the association between socio-economic, environmental and demographic factors with Diarrhoea among under five children. The study was be based on the primary information obtained from the mothers of the under five children. Quantitative research methodology was applied for this study. Data Analysis was done using binary logistic regression with statistical significance of each analysis against the p value of 0.2.

Results: it was observed that out of the 630 children studies 42% had diarrhoea within last two months of the study. Factors like mother's education, age of the child, child's immunization status, Breast feeding status, source of drinking water, its treatment and cooking place has association in diarrhoea outcome of a under five child. After Binary logistic regression it was found that factors like age of the child and source of drinking water and separate room for cooking were highly associated with diarrhoea in under-five children of the study area.

Conclusions: considering the high prevalence of the diarrhoea Continued efforts to promote hygienic practices in child care, special attention in the care of children within the age group 7-12 months, treatment of both water source and awareness about treatment of water before consumption and availability of anti-diarrhoeal medicines at the village level round the year, prolonged breast feeding and promotion of Health Education are recommended

Field of study	Public Health	Student's Signature	
Academic Year	2012	Advisor's Signature	

คำสำคัญ: ปัจจัยทางด้านประชากร ปัจจัยทางด้านสังคม เศรษฐกิจปัจจัยทางด้านสิ่งแวดล้อม /ในเด็กอายุต่ำกว่า 5 ปี/โรคท้องร่วง/RAYAGADA/ประเทศอินเดีย

นาย เดบาจโยติ โมหาพาตรา : ปัจจัยทางด้านประชากร ปัจจัยทางเศรษฐกิจ สังคมและสิ่งแวดล้อมมีความสัมพันธ์กับการเป็นโรคอุจจาระร่วงในเด็กอายุต่ำกว่า5 ปีในชนบทของโอริสสา กรณีศึกษาในจังหวัดรายากาดา ประเทศอินเดีย อาจารย์ที่ปรึกษา: ALESSIO PANZA, M.D., M.Com.H., DTM&H, 95 หน้า.

จากรายงานขององค์การยูนิเซฟเกี่ยวกับโรคปอดบวมและโรคท้องร่วงซึ่งเป็นปัญหาใหญ่ที่สุดของเด็กมีจำนวนเด็กเสียชีวิตราว 2,197,000ในเด็กอายุต่ำกว่า5 ปีในปี2010ส่งผลให้จำนวนเด็กที่เสียชีวิตเพิ่มขึ้น19 เปอร์เซ็นต์ของทั้งหมดเสียชีวิตในเด็กอายุต่ำกว่า5ปีทั่วโลก และด้วยจำนวนผู้เสียชีวิต609,000ในประเทศอินเดียทำให้ประเทศอินเดียติดอันดับสูงสุดเมื่อเทียบเทียบกับ25ประเทศที่มีอัตราการเสียชีวิตที่สูงที่สุดเกี่ยวกับโรคปอดบวมและโรคท้องร่วง วัตถุประสงค์หลักของการศึกษาครั้งนี้เพื่อศึกษานี้วิเคราะห์ความสัมพันธ์ของประชากรเศรษฐกิจสังคมและสิ่งแวดล้อมที่สัมพันธ์กับโรคปอดบวมและโรคท้องร่วงในเด็กอายุต่ำกว่า5ปีในชนบทโอริสสา,ประเทศอินเดีย

วิธีการวิจัย: การศึกษาในครั้งนี้เป็นการวิจัยภาคตัดขวางในช่วงเวลาที่จังหวัดรายากาดา ได้รับผลกระทบอย่างรุนแรงเกี่ยวกับโรคท้องร่วงโดยต้องการศึกษาความสัมพันธ์ระหว่างปัจจัยทางเศรษฐกิจสังคมและสิ่งแวดล้อมที่ส่งผลต่อโรคท้องร่วงในเด็กอายุต่ำกว่า ปีการศึกษานี้ใช้ข้อมูลปฐมภูมิซึ่งเป็นฐานข้อมูลหลักที่ได้รับจากมารดาของเด็กอายุต่ำกว่า5ปีการศึกษาในครั้งนี้เป็นวิจัยเชิงปริมาณร่วมกับการวิเคราะห์ข้อมูลโดยใช้การวิเคราะห์ถดถอยโลจิสติกที่มีนัยสำคัญทางสถิติที่0.02

ผลการวิจัยพบว่าจากการศึกษาจำนวนเด็ก680มีจำนวนเด็ก42% มีอาการท้องเสียภายในสองเดือนสุดท้ายของภาคการศึกษา ปัจจัยที่ส่งผลคือ การศึกษาของมารดา ภูมิคุ้มกันของเด็ก การเลี้ยงลูกด้วยนมแม่ แหล่งที่มาของน้ำดื่มการรักษาและสถานที่ประกอบอาหารมีความสัมพันธ์ส่งผลทำให้เกิดภาวะท้องร่วงในเด็กอายุต่ำกว่า5ปีการวิเคราะห์ข้อมูลโดยใช้การวิเคราะห์ถดถอยโลจิสติกในพื้นที่ศึกษา พบว่าปัจจัยของเด็กแหล่งที่มาของน้ำดื่มและห้องที่แยกสำหรับการประกอบอาหารมีความสัมพันธ์กันอย่างมากกับโรคท้องร่วงในเด็กอายุต่ำกว่า5ปี

สรุปจากการวิจัยนี้พบว่า อัตราความชุกสูงของโรคท้องร่วงเป็นที่ต้องตระหนักอย่างต่อเนื่องเพื่อที่จะส่งเสริมการปฏิบัติที่ถูกสุขอนามัยในการดูแลเด็ก โดยเฉพาะควรให้ความสนใจเป็นพิเศษในการดูแลเด็กที่อยู่ในกลุ่มอายุ6-12เดือน ข้อเสนอแนะจากการศึกษานี้คือการรักษาแหล่งน้ำดื่ม น้ำใช้ การตระหนักเกี่ยวกับการบำบัดน้ำก่อนการใช้การให้นมบุตรนานขึ้นและการให้การศึกษาด้านการดูแลสุขภาพเป็นสิ่งสำคัญและยังเป็นยาต้านโรคอุจจาระร่วงที่สำคัญสำหรับหมู่บ้าน

สาขาวิชา	สาธารณสุขศาสตร์	ลายมือชื่อนิสิต	
ปีการศึกษา	2555	ลายมือชื่อ อ.ที่ปรึกษาวิทยานิพนธ์	

ACKNOWLEDGEMENTS

I would like to express my utmost gratitude to Dr. Alessio Panza, my thesis advisor for his invaluable advice and unfailing support to shape up my Thesis. This study could not be completed on time without his guidance and time to time encouragements.

I would also want to express my sincere gratitude to Dr. Robert Chapman for his invaluable help in data analysis despite his busy schedule.

At the same time I would also like to appreciate the untiring effort put by my research team during data collection.

I am grateful to all those people who participated in this study. My gratefulness also goes to Research and Ethics Committee, Department of Health and Family Welfare, Government of Odisha suggestions and ethical approval.

I am also grateful towards my teachers at College of Public Health Science, Chulalongkorn University for their inputs and moral support during my stay at College of Public Health Science, Chulalongkorn University. I would also extend my special thanks to our administrative staff for being accommodating to my inquiries. My Sincere thanks also goes to my friends at College of Public Health Science for their unconditional friendship, who guide me in several situations and help me to successfully complete my one year stay at Bangkok. I will cherish this memory throughout my life.

My special thanks to Neha Rajput, who stood beside me all the way for not only completing the thesis but also to complete the course

I am obliged to my friends Subhara Rajat Balabant Ray, Hanh nguyen my, Pratyush Bishi and Biswa Ranjan Rout who helped me to complete my thesis.

Lastly, I would like to thank my beloved parents and god for guiding and helping me via various means.

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LIST OF ABBREVIATIONS

ARI	Acute Respiratory Infections
AIDS	Acquired immune Deficiency Syndrome
AWC	Anganwadi Centre
AWW	Anganwadi Worker
BCC	Behavioural Change Communication
BF	Breast Feeding
BPL	Below Poverty Line
CDC	Centres for Disease Control and Prevention
CHC	Community Health Centre
CI	Confidence interval
DALYs	Disability Adjusted Life Years lost
DHS	Demographic and Health Survey
DLHS	District Level House Hold Survey
HDI	Human Development Index
HIV	Human immunodeficiency virus
HW(F/M)	Health Worker Male/Female
ICDS	Integrated Child development Services
IEC	Information Education Communication
LHV	Lady Health Visitor
MDG	Millennium Development Goal
NFHS	National Family Health Survey
NIC	National Information Council
NRHM	National Rural health Mission
NSSO	National Sample survey Organization
OR	Odds Ratio
OBC	Other Backward Class
OPD	Out Patient Department
PHC	Primary Health Centre
PPS	Probability Proportion to Size
SC	Schedule Caste

SDH	Sub-Divisional Hospitals
ST	Schedule Tribe
SD	Standard Deviation
UNDP	United Nation’s Development Project
UNICEF	United Nations Children's Fund
Vit-A	Vitamin A
WB	World Bank
WHO	World Health Organization

CHAPTER I

INTRODUCTION

1.1 Background

One of the major targets of the Millennium Development Goal (MDG) is to reduce the child mortality by two thirds between 1990 and 2015. As the targeted year is approaching a review of literature says though progress has been made to address the issue still there lies a huge gap with much more still to be done. According to the report of World Health Organization (WHO) every year around Nine million under five children die across the globe. The analysis of causes of such huge no deaths reveals that out of all factors only Pneumonia and Diarrhoea contributes to 29% of all deaths worldwide. According to the United Nation's Children Fund (UNICEF) report, pneumonia and diarrhoea, the two biggest killers of children, killed about 2,197,000 children less than five years of age in 2010, making up 29 per cent of all child deaths under age five worldwide. The report also noted that about half the world's deaths due to pneumonia and diarrhoea occur in just five mostly poor and populous countries such as India, Nigeria, Democratic Republic of the Congo, Pakistan and Ethiopia. And with 609,000 deaths India topped the list of the 75 countries with the highest mortality burden attributed to the two diseases (1).

Diarrhoea is more prevalent in the Developing countries which create a proper ground for severity of this disease with lack of access to safe drinking water, poor sanitation and hygiene and even poorer overall health and nutritional status of the community. According to the figures at present around 2.5 billion people lack improved sanitation facility and 1 billion people lack access to safe drinking water(1). Such situation leads to worsen the overall basic sanitation and hygiene condition for the community and subsequently it leads to allowing diarrhoea causing pathogens to spread more easily.

Mortality form diarrhoea has decreased over the last two decades which has also effective in lessening the under five mortality for the same during these decade still diarrhoea remains the 2nd biggest cause of death among under five, next to pneumonia the leading killer of young children. Around 1 in five child deaths is due

to diarrhoea counting a death toll of 1.5 million each year. The toll is greater than the joint toll due to AIDS, Malaria and Measles (1).

Africa and South East Asia are the major contributors to child death due to diarrhoea with around 80% of total death due to diarrhoea among under five taking place in this region. Three quarter of all the deaths due to diarrhoea among under-five is shared by just fifteen countries (1).

According to Water supply and Sanitation collaborative report (WSSC) 2.5 billion people, including almost one billion children, live without even basic sanitation. Poor sanitation leads to, a child death in every 20 seconds. If it will be transformed in to numbers then it will be around 1.5 million preventable deaths every year (2). According to the report of UNICEF unsafe drinking water, inadequate sanitation, and poor hygiene combining contributes to 88% of deaths due to diarrhoea. The simplest solutions which can reduce incidence of Diarrhoeal disease by 40% are access to clean water and good hygiene practises (1). Although reports reveal that access to drinking water has improved, the World Bank report brings out the fact that t 21% of communicable diseases in India are related to unsafe water although the report also tells that the access to safe drinking water has increased over the last few decades (3).

Use of Latrine by the people residing in rural areas is still quite low; only 14% of the rural population has access to a latrine (1). Hand washing practise is also very low, increasing the risk of spread of disease. In order to decrease the mortality and morbidity due to the above said disease a consistent effort is needed to improve the quality and access to drinking-water, latrine usage and hygiene simultaneously. Despite consistent investments in water and sanitation infrastructure, many low-income communities in India continue to have the problem of access to safe drinking water. Even though the initial water quality will be neglected the other contributing factors like widespread unhygienic practices during water collection and storage, poor hand washing and limited access to sanitation facilities increases the probability of transmission of diarrhoea-causing germs through the faecal-oral route.

Various factors play vital role in overall health status of a child. As per the report of WHO, the factors like water, sanitation and hygiene, adequate nutrition,

Immunization, Breast feeding, Micro-nutrient supplement play a vital role in the overall diarrhoeal status of a child(1).At the same time studies have shown importance of socio-economic, demographic and environmental factor in relation to diarrhoea in a child. The family's socio-economic status and surrounding environmental condition affects the child health(4).Socio-economic factors don't directly affect the risk of diarrhoea: rather they are more influential on the general behaviour of the family which affect the child's exposure towards diarrhoea spreading pathogens and susceptibility to infection (5).

Although all the above mentioned factors are potential risk factors for diarrhoea their mechanism of affecting a child is different. Some has direct influence of the heath status of the child where as some factor though vital don't affect the health status directly.

1.2 Rationale

Though a lot of studies have been conducted to assess the various determinants of diarrhoea no specific study has been done in one of the most backward district like Rayagada to assess the association between socio-economic, environmental and demographic factors with occurrence of diarrhoea among under-five children.

Rayagada has a history of Diarrhoeal epidemic. Though lot of steps have been taken by district administration to combat the cases every year still during the rainy season some part of the district face high diarrhoea outbreaks. Though every year the situation is not like epidemic but still in two or three years the epidemic reoccurs and the deaths tolls due to diarrhoea remains to be biggest health problem for the Health Department and for the whole district and state administration. It is obvious that the district administration has invested a lot in increasing the access of drinking water amongst the community residing in the hilly and terrain areas of the district still the unsafe drinking water and contaminated water sources were found to be predominant reasons for the cause of diarrhoea epidemic in 2010 which resulted in 41 lives loss.

There is a general consensus across the globe that the cause of child mortality and morbidity in developing countries cannot be attributed to a single factor. There

are multiple factors whose interplay affects the ultimate outcome of the health of the child. The child's survival depends on the interaction of socio-economic. Biological, environmental and behavioural factors (10, 11).Hence to formulate a robust public health intervention it's of primary importance to analyse the association between all these factors and to see how they affect the community.

According to the latest report of NSSO (National Sample Survey Organization) Rayagada is ranked as the district with least Human development index amongst all the district of India. (37). So study on one of the major health issue like diarrhoea can help the public health policy makers to formulate robust health policies to address such issues in not only Rayagada but also in the districts with similar Socio-economic and Cultural background.

1.3. Research question:

What are the demographic, socio-economic and environmental factors associated with diarrhoea morbidity in children under five in diarrhoea affected blocks of Rayagada District?

1.4. Study Hypothesis

1. There is high prevalence of diarrhoea in Rayagada District among under-five children during the study period (even if it is not the peak season for diarrhoea)
2. There is no association between demographic factors with diarrhoea among under-five children in diarrhoea affected blocks of Rayagada District?
3. There is no association between socio-economic factors with diarrhoea among under-five children in diarrhoea affected blocks of Rayagada District?
4. There is no association between environmental and factors with diarrhoea among under five children in diarrhoea affected blocks of Rayagada District?

1.5. Research Objective

1.5.1 General Objective:

To find out the factors which are significantly associated with diarrhoea among under -five children in diarrhoea affected blocks of Rayagada District.

1.5.2 Specific Objectives:

1. To find out the prevalence of diarrhoea among children aged less than five years Rayagada district.
2. To explore the relation between existing sanitation, hygiene and water handling practices and diarrhoea among children aged less than five years in Rayagada district
3. To explore the relation between maternal socio-demographic factors and diarrhoea among children aged less than five years in Rayagada district.
4. To explore the relation between child's socio-demographic factors and diarrhoea among children aged less than five years in Rayagada district

1.6 Conceptual Framework:

After analyzing number of literatures and conceptual frameworks on Diarrhoea and various risk factors associated with the Diarrhoea as well as its complication, the conceptual framework given below is proposed for the current study:

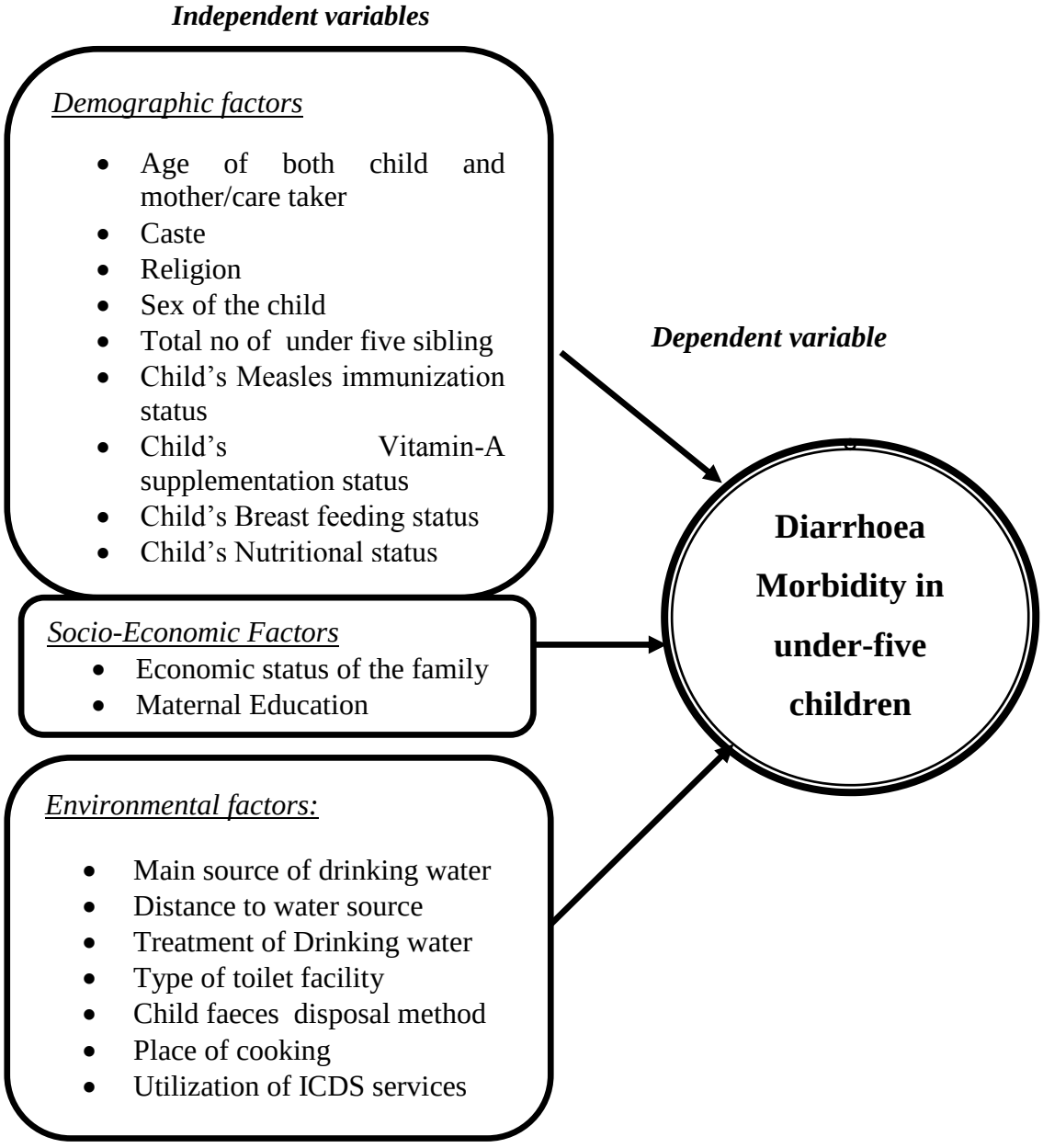

Figure 1: Conceptual frame Work

6.1 Operational Definitions

Independent variables

Demographic factors

- **Age of child:** defined as the age of the child in completed months at the time of survey
- **Age of mother/caretaker:** defined as the completed years of the mother before the date of interview
- **Caste**: it's the social classification of the study community. In the study it was divided in to Schedule cast(SC), Schedule Tribe(ST),Other Back ward Class(OBC) or None of them(general)
- **Religion**: defined as the religion of the mother at the time of interview. It was classified into Hindu, Muslim, Christian and others.
- **Sex of the child:** referred to either being male or female
- **Total no of under-five Siblings:** defined as total no. of children below five years of age in the household alive during the time of interview
- **Child's Measles immunization status:** referred to the status of the 9 month or older child against measles vaccination. In India the recommended practise of measles vaccinations for children is at 9 month of age.
- **Child's Vitamin-A supplementation status:** referred to the status of the 9 months or older child against vitamin-A supplementation. In India the recommended practice of Vit-A for a child is at 9 months of age and then bi-annually till 5 years.
- **Child's Breast Feeding status:** it referred to the breast feeding received by the child as reported by the mother.
- **Child's Nutritional status:** referred to the nutritional status of the child in the following category under weight (wt. for age below 2SD), stunted (ht. per age below 2 SD) and wasted (wt. for ht. below 2SD).it wa decided on the basis of the anthropometric measurement done during the time of interview.

Socio-Economic Factors

- **Economic status of the family:** it was classified in to two categories Below Poverty Line (BPL) and Non BPL as per the certification given by the government of India. Below Poverty Line is an economic benchmark and poverty threshold used by the government of India to indicate economic disadvantage and to identify individuals and households in need of government assistance and aid.

- **Maternal Education:** referred to the highest education standard enrolled by the mother during the time of interview. It was divided into following categories:

Figure 2: Education Standard

Standard	**Class**	**Age (years)**
Primary	1-3	6-8
Upper Primary	4-7	9-11
High-school	8-10	12-15
Intermediate	11-12	16-17
Graduate	12+	17+

Environmental factors

- **Main source of drinking water:** this was classified into the following categories

– PUBLIC PIPED WATER: it included water piped into dwelling or yard/plot/ public tap. Under this method first the ground water is put in a tank through water pump and then made portable through treatment and then supplied by above said methods.

– Bore well: Referred as a well constructed by boring a vertical hole (often subsequently fitted with a casing) for the purpose of extracting ground water from the safest available under ground water source

– Hand pump: referred as the pump worked by hand used to extract ground water from the safest available under ground water source

- DUG WELL: referred as the well dug manually for the purpose of saving water in it. it included protected well/ un-protected well
- WATER FROM SPRING: it included Protected spring and un protected spring
- SURFACE WATER: it included water from river/ dam/ lake/ pond/ stream/ canal/ irrigation channel
- Other source: it included Rain water/Tanker truck/cart with small tank

- **Distance to water source:** it referred to the tentative distance (in minutes) of the main water source from the household
- **Treatment of water:** it referred to the methods followed by the community to treat water before drinking. its further divided in to the following categories**:** boil, use alum, add bleach/chlorine tablets, strain through a cloth, use water filter (ceramic/ sand/composite/etc.),use electronic purifier, let it stand and settle ,other
- **Type of toilet facility:** was classified in to improved or unimproved sanitation facility. Improved facilities included flush/pour toilets connected to a sewage system, septic tanks or pit latrines; and pit latrines with slabs. Unimproved facilities included use of flush or pour flush to rivers or canals, pit latrines without slabs or no facilities (using bush or field)
- **Child faeces disposal method:** referred to what was done to dispose of stool the last time a child passed it. This was classified as disposed or un-disposed method. Disposal methods included having the child use a toilet, putting or rinsing faeces into a flush/pour toilet connected to a piped sewer system or into a latrine or pit latrine with slabs, putting faeces in garbage or burying it. Un-disposed refers to leaving it in the open.
- **Place for Cooking:** referred to the place used for cooking for the household.
- **Utilization of services of ICDS**: it referred to the services availed by the child and mother from the local ICDS centre during the last 12 months related to food supplementation, growth monitoring, weight counselling or any other.

Dependent variable: Diarrhoea Morbidity in under-five children: Diarrhoea Morbidity, referred as presence or absence of diarrhoea in children within two months of the date of the interview. Diarrhoea was the passage of 3 or more loose or liquid stools per day, or more frequently than is normal for the individual (as per WHO) within two month of the date of the interview**.**

CHAPTER II
LITERATURE REVIEW

2.1. What is the cause of Diarrhoea?

Diarrhoea is a common symptom of gastrointestinal infection caused by a wide range of pathogens including bacteria, viruses and protozoa (agent factors) that come to infect a person in association with socio-demographic (host factors) and environmental factors and. Most acute cases of diarrhoea is caused by just a handful of agent organisms. Around 40% of all hospital admission related to diarrhoea among children under-five is attributed to Rotavirus, the leading cause of acute diarrhoea. Other major bacterial pathogens which are responsible for diarrhoea include *E.coli., Sheigella , Campylobacter and Salmonella . Crypto spredium* has been the most frequently isolated protozoan pathogen seen among the children at the health facilities and is frequently found among HIV patients. Though cholera is often regarded as the major cause of death among the diarrhoeal children its more found in adults and young children (1).

"From the stool of one person to the mouth of another" is the most common and similar route through which the pathogens that crate diarrhoea transmit which is commonly known as Fecal-Oral transmission. According to WHO the major roots for transmission of these pathogens includes: ingestion of focally contaminated water or food, person to person contact or direct contact with fecal matters. Domestic domain transmission due to in house contamination and public domain transmission that corresponds to pollution directly at the water source are the two major mode of transmission pattern of diarrhoea causing pathogens (12, 13).

2.2 Main forms of Acute Childhood Diarrhoea (1):

Though there are many forms of child hood diarrhoea the major mortality and morbidity of child hood diarrhoea may be attributed to the following three forms of acute diarrhoea. All the three forms are high risk of life and require different method of treatment.

2.2.1 Acute Watery Diarrhoea:

Significant fluid loss and dehydration along with cholera are the major effects of this type of diarrhoea. The duration of the disease may vary from hours to few days. *V.cholerai* and the *E.coli* bacteria as well as rotavirus are the major pathogens that cause acute watery diarrhoea.

2.2.2 Bloody Diarrhoea:

Intestinal damage and nutrient loss in an affected individual are the two major outcomes associated with bloody diarrhoea. It's often referred as dysentery and marked by visible blood in the stools. *Shigella* is the most common cause of bloody diarrhoea which is also regarded as the common cause for all the severe cases.

2.2.3 Persistent Diarrhoea

It is termed as an episode of diarrhoea with or without blood that lasts for 14 days. Children with nutritional issues and other illnesses are more susceptible to develop such diarrhoea and the consequences of diarrhoea worsen their health condition even more.

2.3 Why the Children's are more susceptible?

According to WHO children who are more exposed to unhealthy environment, poor sanitation, along with poor nutritional status and low over all health status are more susceptible to diarrhoea infection as compared to the healthy children. Poor water sanitation and hygiene, poor nutritional status, Immunization status, breast feeding, micronutrient supplements are the major factors which play key role in the overall exposure status of a child towards diarrhoea. Malnutrition in children under five has been associated with more diarrhoea prevalence (14, 15, 16) though at times it's difficult to establish the cause and effect relationship between the two. It is not clear to infer which leads to another (17, 18). Studies have shown than children with HIV aids are more prone to diarrhoea incidence, mortality and duration as compared to the other children. (17).studies have shown that children who are exposed to measles has higher chances to get affected by diarrhoea as compared to those who are not exposed highlighting that measles has been associated with diarrhoea in 20 percent of the cases. So in nutshell it can be said that the above mentioned risk factors make a child more vulnerable to diarrhoea. Considering the above studies children within the age group of 0-5 were considered to be studied through this survey.

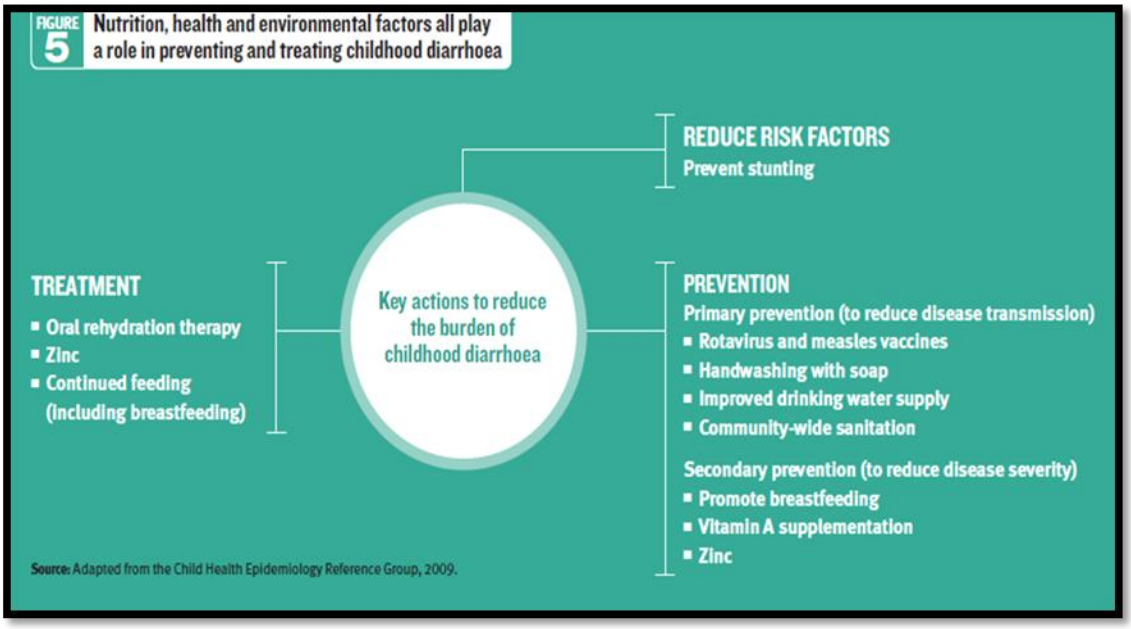

Figure 3: Key factors to prevent and treat childhood Diarrhoea

2.4. Potential Risk Factors for Childhood Diarrhoea

2.4.1 Demographic factors

There are many demographic factors which like child's age, sex, birth weight which play vital role in the outcome of diarrhoea. A study in Saudi Arabia has revealed a high prevalence of diarrhoea in children beyond 6 months of age who had no vaccination or follow up cards (6).

A study in Egypt revealed that children residing in rural areas have the higher risk of diarrhoea as compared to the children residing in urban areas. Similar observations were found in a study conducted in Philippines, the rural children had the higher risk of Diarrhoea and ARI as compared to the urban children (31).

A cohort study from Brazil revealed that the children from young mother's has a higher incidence of diarrhoea (8).Maternal education status has also found to be associated with diarrhoea in a study done in Gunnia Bisau (35). Studies in Latin America and Philippines also found association between mother's education and occurrence of diarrhoea in child (36).

The **Scheduled Castes** (SCs) **and Scheduled Tribes** (STs) are two groups of historically-disadvantaged people recognized in the Constitution of India. During the period of British rule in Indian, they were known as the Depressed Classes. The Scheduled Castes and Scheduled Tribes comprise about 15 percent and 7.5 percent, respectively, of India's population (or about 24 percent altogether, according to the 2001 census) (55). The proportion of Scheduled Castes and Scheduled Tribes in the country's population has steadily risen since independence in 1947.as far as the statistics of Department of SC & ST Orissa combining these two castes constitutes 38% population of the whole state. Studies across India has found that these two communities are more susceptible to any infectious disease due to their marginalization and social exclusion (56).Diarrhoea related studies also found that as comparison to other general caste people these two castes are more prone to diarrhoea due to their poor behavioral aspects.

Another important demographic factor which found to be associated with diarrhoea is the size of the families. Due to overcrowding and the competition to get mother’s time, attention and other resources makes a child more likely to acquire diarrhoea (27).Studies revealed that in the household which has more than five children has reported more no of childhood diarrhoea (29). Another study measured that the probability of getting diarrhoea was 60 percent higher in those households which had six or more children as compared to the households with three children (27).

Male children have higher incidence of diarrhoea as compared to their female counter parts (35).

Studies have found that in 20 percent of the cases measles has been associated with diarrhoea, and studies in Guinea-Bissau have shown that children that were exposed to measles had more diarrhoea mortality than their counterparts that were not exposed to measles (40).

Some researchers have been carried out to find the mechanism of vitamin A on diarrhoea prevention. Vitamin A supplementation can reduce diarrhoea and respiratory infection maybe because of the effect of immune response regulation (41). Studies have shown that there is an interrelationship between the immune system and some micronutrients (vitamins A, E, B folic acid, Fe, Zn and Se).Immune competence

improves with optimization of micronutrient supply (42). Those vitamin and minerals have role in supporting the body's natural defense system and restoring resistance to infections by enhancing the three levels of immunity: epithelial barriers immune cells and antibody. It's proven that the immune system works against pathogens and cancer cells and protects the body against infections and diseases. Low levels of vitamins minerals and trace elements may result in suppressing immunity, predisposing individuals to infections, which in turn worsen the nutritional status, leading to a vicious cycle. Supplying the deficient micronutrients with the diet can re-establish immune function (43). According to the report of NFHS-3, 71% of children of Orissa who were more than 9 months of age had received at least one dose Vitamin-A.

According to WHO child feeding practices has been divided into three categories: Exclusive breastfeeding; supplementary feeding and replacement feeding.

- Exclusive breastfeeding refers to breastfeeding while giving no other food or liquid, not even water, with the exception of drops or syrups consisting of vitamins, mineral supplements or medicines.
- Complementary feeding refers to the process of giving an infant food in addition to breast milk or infant formula, when either becomes insufficient to satisfy the infant's nutritional requirements while replacement feeding refers to the process of feeding a child who is not receiving any breast milk with a diet that provides all the nutrients the child needs until the child is fully fed on family foods (WHO, 2003).

Inappropriate feeding practices and their consequences has emerged as one of the major obstacles to sustainable socioeconomic development and in long run poverty reduction. Breast milk is considered as the ideal food for healthy growth and development of infants and young children. Both the WHO and UNICEF recommend exclusive breastfeeding of infants for the first 6 months of the life. This is important in achieving optimal growth, development and health. From 6 months onwards the infant should receive nutritionally adequate and safe complementary foods while breastfeeding should continues for up to 2 years of age or beyond. Exclusive breastfeeding from birth is the recommended practice except for a few medical conditions (WHO/UNICEF, 2003). It is worth noting that the duration of exclusive

breastfeeding recommended by WHO and UNICEF was born out of an expert consultation which recommended exclusive breast feeding for six months, emphasizing that this recommendation applies to populations while recognizing that some mothers will be unable to, or choose not to, follow it (WHO, 2002) . Infants are particularly vulnerable during the transition period when complementary feeding begins. To ensure that the nutritional need of the child to be addressed the complementary foods should have the following properties (51):

a) Timeliness: Foods should only be introduced at that time when the need for energy and nutrients is not adequate by exclusive and frequent breastfeeding

b) Adequacy: Foods should contain requisite amount of energy, protein and micronutrients to meet a growing child's nutritional needs

c) Safety: Foods should be hygienically prepared and stored, and fed with clean hands using clean utensils and not bottles and teats

d) Properly fed: Foods should be given in consistent with a child's signals of appetite and satiety.

Despite this recommendation and the efforts put into promoting breastfeeding, only about 38% of infants in the developing world are exclusively breastfed during the first six months of life. Complementary feeding frequently begins too early, and foods are often nutritionally inadequate and unsafe (50).

Breastfeeding status again is determinant factor for diarrhoea occurrence in the children under-five years of age. Studies in Dhaka slums-Senegal and Metro-Philippines showed a more than 4-fold higher risk of deaths attributable to diarrhoea in the children that were partially or not breastfed when compared to those that were exclusively breastfed (52.53).

According to the reports under nutrition continues to be a primary cause of ill-health and premature mortality among children in developing countries. Under nutrition has been identified as an underlying cause of an estimated 53% of the 10.6 million annual deaths among children under-five years of age**.** According to a study the estimated proportions of deaths in which under nutrition is an underlying cause are roughly similar for diarrhoea (61%), and pneumonia (52%) (44).

Underweight or stunting has long been recognized as some of the important risk factor for high prevalence and severity of infection and high mortality rates

among children. (45). In a prospective study of Bedouin among children aged less than 5 years in Israel, researchers found that under nutrition and diarrhoea were risk factors for community acquired alveolar pneumonia (46). A study in Brazil has shown that previous pneumonia and malnutrition were associated factors for suffering diarrheal episodes (8). Malnutrition and diarrhoea interact in a vicious cycle. There is a close relationship between diarrhoea and indicators of malnutrition (47).

On the contrary some researchers opined that, diarrhoea is a risk factor for malnutrition (48). The probable reason might be due to nutrient depletion and reduced food intake during diarrhoea. In a recent study of multiple-country analysis of the effects of diarrhoea on childhood stunting conducted for nine countries and covering a 20 year period, the effect of diarrhoea on stunting was found to be similar across all studies (48).

Measurement of Under-Nutrition

Under nutrition in a population can be gauged by comparing children to a reference population. There are three types of under nutrition states based on deviation of anthropometric measurements expressed in standard deviations or Z-scores from the median of the reference population: wasting, stunting and underweight. Wasting refers to insufficient weight for height also known as acute under nutrition; stunting refers to insufficient height for age known as chronic under nutrition; and underweight refers to insufficient weight for age which could be a consequence of either or both acute and chronic under nutrition. The Z-score system is suitable to be used in population based survey. Besides the Z-score system of anthropometry, there is the percentile system which refers to the position of an individual on a given reference distribution. Percentiles are commonly used in clinical setting because their interpretation is straight forward. It is however inappropriate to compute summary statistics with percentiles. In general abnormal anthropometry is statistically defined as an anthropometric value of below -2 standard deviations (less than -2.rd percentile) or above +2 standard deviations (more than 97.7th percentile) relative to a reference median or mean (WHO, 1995). However for population based survey Z is the most reliable one as the only with the use of height, weight, age and sex of the child the nutritional status can be measured with

the help of WHO anthropometric software.

2.4.2 Socio-economic Factors

In a developing country there are so many factors which influence the health of a child. However there is a general consensus that the socio-economic status of the child's parent which creates the environment surrounding a child has greater role to play in the childhood mortality and morbidity irrespective of the cause of the disease (9). According to social scientist social economic status of a household basically relies on two components: the class and the position. Socio economic class refers to the social group that evolve from the interdependent economic, social and legal relationship among a group of people. Socio-economic position is a resource based concept that refers to the holding of certain assets, the income that these assets yield and the consumption that such income permits (19).

According to some of the studies socio-economic factors plays a vital role as far as diarrhoeal mortality and morbidity is concerned. An uneducated mother might not be able to protect her child from the risk of exposure which is beyond her capacity to control like unhealthy surrounding environment, inadequate water supply and improper sanitation. However her knowledge and wealth may allow her to use the available health care services more effectively as compared to the uneducated ones (20).

Many studies have tried to explore the association between educational level of the parents and income of the of the household with occurrence of childhood diarrhoea and these studies have found out that there is significant relationship among the above mentioned factors and diarrhoeal morbidity among children (21).

Several studies which analyze the determinants of child health have revealed that in a developing country mother's education is the most important socio-economic factors playing a crucial role in the survival of the child (22, 23, 24).This is because the approach of an educated woman varies significantly to that of an uneducated woman in relation to antenatal period, during delivery, postnatal period and during utilization of health services for her child (22, 24).

A study was conducted in a slum at Anjanappa Garden, Bangalore, which is the field practice area of M.S. Ramaiah Medical College. A sample size of 225 mothers

(at 5% level of significance at 20% relative error) was estimated based on reports which showed that 30% of children with Diarrhoeal episodes received increased fluid and continued feeding. The study revealed that frequency of breastfeeding during diarrhoea improved significantly ($p < 0.001$) after the educational intervention. Modification of food preparation during diarrhoea also improved significantly ($p < 0.001$) after the educational intervention. The educational intervention empowered the mothers to give extra food after the cessation of diarrhoea in the children (1.2% to 16.7%; $p < 0.001$). Out of the 20.2% of the mothers who administered extra food, a significant number of them ($p < 0.001$) administered extra food for at least two weeks after cessation of diarrhoea. However, practices such as administering foods other than breast milk during diarrhoea, relative quantity of food and frequency of feeding during diarrhoeal episodes did not improve significantly ($p > 0.05$) even after the educational intervention.

Some studies also tried to explore the relationship between wealth and income of the family along with childhood diarrhea (25, 26). A study on determinants of diarrhoea among under five children have revealed that the probability of having diarrhoea was 33-38% lower in the children from medium and high socio-economic groups as compared to the low socio-economic groups (27).

2.4.3 Environmental factors

The relationship of occurrence of diarrhoea along with the environmental factors surrounding a child has been highlighted by so many studies. Quality and quantity of water, access to improved water source, housing condition, food handling practices, over all sanitation and hygiene are the important environmental factors which affect the Diarrhoeal outcome in a child. Studies have revealed that most environmental factors are associated with the socio-economic status of the household and the place of residence of the family. (22,28). Though undoubtedly the environmental factors play an important role in the health outcome of a child but the magnitude of the effect varies depending on the other socio-economic and behavioral factors (4). So it is quite evident that both environmental and behavioral factors go hand in hand while affecting the ultimate health status of a child in regards to diarrhoea. For example the effect of sanitation and water facility may vary from child

to child depending upon the education of his parents and their behaviors towards such factors.

The quality as well as quantity of water along with the probability of getting contaminated before consumption is considered as important factors for diarrhoea morbidity among children. A study in the Republic of Congo which assessed the environmental determinants of childhood diarrhoea revealed that the children whose household collect water from the unprotected sources are more likely to get diarrhoea disease as compared to those child whose household collect water from the protected sources (29, 30). A study from Zimbabwe revealed that the children in the household who use river water as their main source of drink water had 33 percent more diarrhoeal episodes as compared to the households using borehole water (20).

According to the report of WHO/UNICEF improving the basic sanitation can contribute towards immediate reduction of diarrhoea incidence by 36 percent. Various studies have also revealed that simple interventions like hand washing by soap can result in reduction of diarrhoeal disease by 40 percent. Studies have revealed that interventions to improve the quality of water at source coupled with treatment at household and safe storage facility has resulted in decreasing the diarrhoea incidence by 47 percent (1).

Diarrhoea related mortality and duration in under-five children can be reduced significantly if the mother/care taker administers to the child fluids and electrolytes (ORS) and continuation of feeding timely and sufficiently. However early ORS treatment while is very important for prevention of mortality and severity of diarrhoea is has no impact in the prevalence of diarrhoea infections and will not be investigated in this research about .Due to growing awareness about diarrhoea management many mothers across the globe are now aware about the management of diarrhoea in their children. According to DLHS 3, 78 percent of mothers are aware about diarrhoea management and what to do when a child has diarrhoea. Fifty percent of women are aware about ORS and 58 percent have knowledge regarding salt and sugar solution. Only 10 percent of women stated that they continue normal feeding even when a child had diarrhoea (39).

2.5 Structural Design of Morbidity and prevalence of Diarrhoea

As with almost all measures of morbidity, a major problem with Diarrhoea Morbidity indicator is data availability and quality. Routine reporting of diarrhoeal diseases tends to be patchy, largely because many cases may not be referred to hospital but may be treated either in the home or by primary health services. Diarrhoeal diseases also take many different forms and can occur in association with a wide array of other illnesses, so differences in diagnosis can occur, affecting the reported disease rates. For these reasons, also, design of the indicator should take account of the context and purpose of application, as well as the completeness and reliability of the available data. According to WHO, ***Incidence of diarrhoea morbidity*** means total number of episodes of diarrhoea during a 1-year period amongst all the children surveyed. For calculation of this indicator the diarrhoeal episode of all the diarrhoea affected under five children is needed. As the present study is a cross-sectional study so instead of diarrhoeal morbidity the present study focused on the prevalence of diarrhoea in under five children. As per WHO the 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 (WHO).

2.6 Magnitude of Diarrhoea in India

Though over the past few decades India has immerged as a strong economy still the condition of the under five children in the country gives the contradictory picture to its economic growth. Some of the facts related to maternal and child health are as follows:

1. According to the report of UNICEF INDIA 2006 India contributed to 2.1 million under five deaths accounting 21 per cent of the global burden of child deaths (32).
2. In 2005-06 in India only 39 percent of children suffering from diarrhoea received ORT (Oral Rehydration Therapy).

3. In India, one child dies every 17 seconds due to easily preventable causes. On the scale of ‘best place to be a mother’, India ranks 75 out of 79 developing countries.
4. According to the report of WHO in India four million children die in 2009 due to diarrhoea.
5. In hospitals one third of all paediatric admissions are due to diarrhoeal disease and 17% of all deaths among indoor paediatric cases are attributed to diarrhoea.

So the above facts gives a picture of how the diarrhoea has its high burden on the under five children and still persist as one of the biggest cause for child mortality. The under-five mortality rate (U5MR) for India in 2006 has been estimated as 76. Although India has made progress in the reduction of child mortality, the average annual rate of reduction in U5 mortality between 1990 and 2006 has been 2.6 per cent. If India is to reach the MDG Goal of 38 by 2015, the average annual rate of reduction in the next nine years has to be about 7.6 per cent (UNICEF).

India recorded 98,621 rotavirus-inducted diarrhoea deaths in 2008, which is about 22% of global toll from the infection. Nigeria - the second worst-hit country - recorded about 41,000 deaths, or less than 50% of fatalities as compared to India. Five countries - Democratic Republic of Congo, Ethiopia, India, Nigeria, and Pakistan - accounted for more than half of all rotavirus-infection induced deaths (WHO).

India has moved up a notch on the UNDP’s Human Development Index — it is 126 out of 177 countries, compared to 127 a year ago. The HDI is a composite index based on income, health and education indicators. But the simultaneous progress in the field of overall improvement of infant and maternal mortality is way behind as targeted in MDG.

2.7 Integrated Child Development Services (India)

Integrated Child Development Services (ICDS) Government of India sponsored program, is India's primary social welfare scheme to tackle malnutrition and health problems in children below 6 years of age and their mothers. The main beneficiaries of the program were aimed to be the girl child up to her adolescence, all

children below 6 years of age, pregnant and lactating mothers. The gender promotion of the girl child by trying to bring her at par with the male child is a key component of the scheme (37)**.** The following services are sponsored under ICDS to help achieve its objectives:

1. Immunization
2. Supplementary nutrition
3. Health check up
4. Referral services
5. Pre-school non formal education
6. Nutrition and Health information

For nutritional purposes ICDS provides 300 calories (with 8-10 grams of protein) every day to every child below 6 years of age. For adolescent girls it is up to 500 calories with up to 25 grams of protein every day.

Delivery of services under ICDS scheme is managed in an integrated manner through Anganwadi centers, its workers and helpers. The services of Immunization, Health Check-up and Referral Services delivered through Public Health Infrastructure under the Ministry of Health and Family Welfare UNICEF has provided essential supplies for the ICDS scheme since 1975. World Bank has also assisted with the financial and technical support for the program. The cost of ICDS program averages $10–$22 per child a year. The scheme is centrally sponsored with the state governments contributing up to ₹1.00 (US$0.02) per day per child.

Furthermore, in 2008, the GOI adopted the World Health Organization (WHO) standards for measuring and monitoring the child growth and development, both for the ICDS and the National Rural Health Mission (NHRM). These standards were developed by WHO through an intensive study of six developing countries since 1997. They are known as New WHO Child Growth Standard and measure of physical growth, nutritional status and motor development of children from birth to 5 years age.

2.8 District Profile

Rayagada is one of the southern districts of Odisha. It is a district of meadows, forests, waterfalls and terraced valleys, peopled by many primitive tribal groups. The scenic beauty and heritage on the land is an unexplored paradise. The pattern of people living in the district shows unity in diversity of races, languages, and culture. The Scheduled Tribes living in the district possess dissimilar economics ranging from food gathering to settled cultivation and their languages/dialects, societies and culture show inter-societal and -cultural variations because of the ethnic mosaic.

Table 1: District Profile Source: Rayagada District NIC (National Information Council)

DEMOGRAPHIC PROFILE		
INDICATORS	**RAYGADA**	**ORISSA**
AREA	7,584 Sq. Kms.	155707 Sqr Kms
POPULATION		
Population (2001-Census)	8,31,109	36804660
Male	4.06 lakh	18660570
Female	4.17 lakh female	18144090
Rural Population (2001-Census)	745303	31287422
SC Population	115665	
ST Population	463418	
Total Literacy Rate (2001-Census)	36.15%	63.08%
Male Literacy Rate	48.2	75.35%
Female Literacy Rate	24.6	50.51%

Table 2: Administrative Profile of Rayagada District (Source : Rayagada District NIC)

ADMINISTRATIVE PROFILE		
Indicators	**Raygada**	**Orissa**
No. of Blocks	**11**	**314**
No. of Gram Panchayats	**171**	**6234**
No. Of villages Inhabited	**2445**	**50972**

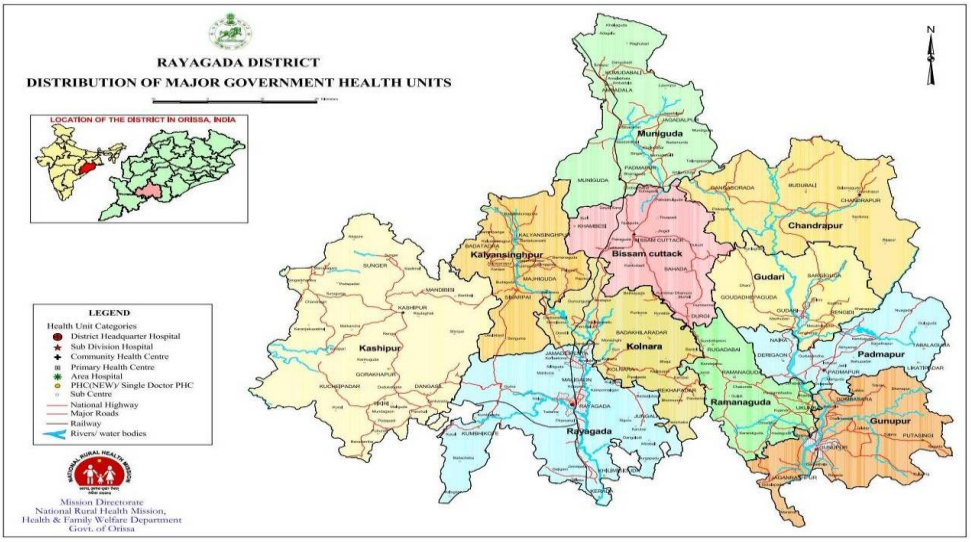

Figure 4:HEALTH PROFILE Map indicating Health Institutions

Source: Mission Directorate NRHM, Odisha

Table:3 ***Health Institutions in District (Source: District Health Information System*****)**

HEALTH INSTITUTIONS	
No. of District Head Quarter Hospital (DHH)	1
No. of Sub-Divisional Hospitals (SDH)	2
No. of Community Health Centres (CHC)	4
No. of Primary Health Centre (PHC)	7
No. of Primary Health Centre New (PHC-N)	34
No. of other hospital	3
No. of Mobile Health Unit	17
No. of Sub Centres	235
No. of Sectors	45
No. of AWC	1397

2.9 Literature Review related to National Family Health Survey (34)

The National Family Health Survey (NFHS-3) is the third in a series of national surveys carried out in 2005-06; earlier NFHS surveys were carried out in 1992-93 (NFHS-1) and 1998-99 (NFHS-2). All three surveys were conducted under the stewardship of the Ministry of Health and Family Welfare, Government of India, with the International Institute for Population Sciences, Mumbai, serving as the nodal agency. ORC Macro, Calverton, Maryland, USA, provided technical assistance for all three NFHS surveys. NFHS-1 and NFHS-2 were funded by the United States Agency for International Development, with supplemental funding from UNICEF. NFHS-3 funding was provided by the United States Agency for International Development, the Department for International Development (United Kingdom), the Bill and Melinda Gates Foundation, UNICEF, the United Nations Population Fund, and the Government of India. Assistance for the HIV component of the NFHS-3 survey was provided by the National AIDS Control Organization and the National AIDS Research Institute.

In NFHS-3, 18 research organizations conducted interviews with more than 230,000 women age 15-49 and men age 15-54 throughout India. NFHS-3 also tested more than 100,000 women and men for HIV and more than 200,000 adults and young children for anemia. Fieldwork for NFHS-3 was conducted from December 2005 to August 2006.

NFHS-3 was a household survey which provided estimates of indicators of population, health, and nutrition by background characteristics at the national and state levels. In NFHS-3, information is collected about households, and individual interviews are conducted with women age 15-49 and men age 15-54. NFHS-3 also includes height and weight measurement and blood tests for HIV and anemia.

Three different questionnaires are used for collecting household data and interviewing eligible women and men.

- Village Questionnaire
- House Hold Questionnaire
- Women Questionnaire

2.10 Literature Review related to Sampling Technique

The term, cluster sampling, was coined originally to refer to sample designs in which all members of a group were sampled (33). In recent years, however, cluster sampling has been broadly used to refer more generally to surveys in which there is a penultimate stage of sampling that selects (and defines) the clusters, such as villages, census enumeration areas or city blocks. Then, the final stage of sampling consists of a sub-sample of the households within each selected cluster (as opposed to surveying all of them). In household surveys the sample design will invariably utilize some form of cluster sampling, of necessity, in order to ensure that the survey costs are contained. Clustering of the sample, unfortunately, decreases the reliability of the sample due the likelihood that people living in the same cluster tend to be homogeneous or to have more or less similar characteristics. This so-called clustering effect has to be compensated in the sample design by increasing the sample size commensurately. The clustering effect of a sample is partially measured by the design effect, *deff*. Therefore, *deff* indicates, primarily, how much clustering is there in the sample.

Probability proportional to size (PPS) is a sampling technique for use with surveys or mini-surveys in which the probability of selecting a sampling unit (e.g., village, zone, district, and health center) is proportional to the size of its population. It gives a probability (i.e., random, representative) sample. It is most useful when the sampling units vary considerably in size because it assures that those in larger sites have the same probability of getting into the sample as those in smaller sites, and vice verse. This method also facilitates planning for field work because a pre-determined number of respondents are interviewed in each unit selected, and staff can be allocated accordingly (33).

CHAPTER III

RESEARCH METHODOLOGY

3.1 Research Design:

A cross-sectional (descriptive and analytical) study was carried out in the severely Diarrhoea affected blocks of the Rayagada District (as per the distinction made by the district vulnerability assessment report) to find out the association between socio-economic, environmental and demographic factors with Diarrhoea among under five children. Quantitative research methodology will be applied for this study. The study was based on the primary information obtained from the mothers of the under five children by questionnaire. In addition to the use of a questionnaire, data were collected by two other methods

- Measurement of height and weight of the children
- Verifying the register of the Local Health worker and local ICDS center

3.2 Study Area:

By using district vulnerability map for 2010 Diarrhoea affected blocks, five blocks were selected out of the 11 blocks of the districts which were severely affected during the Diarrhoea epidemic. The blocks were B.cuttack, Kashipur, K.singhpur ,J.pentha and Gudari blocks of Rayagada District. The 30 study sites were selected by Probability Proportion to Size (PPS) sampling technique. As per PPS sampling the cluster distribution resulted in the following allocation of clusters to the study blocks:

1) Bissumcuttack-6 clusters
2) Gudari-3 clusters
3) Kalyansinghpur-4 clusters
4) Kashipur-10 clusters
5) Jemadei pentha-7 clusters

3.3 Study Period:

The study was carried out in the month of February and March, 2013

3.4 Study Population:

The population in this study were the pair of under five children and his/her mother or care taker of Bissumcuttack , Kashipur, K.alyansinghpur, Jemadeipentha and Gudari Block of the District . The total population of these 5 blocks is 429,995.

DISTRICT NAME : RAYAGADA

Present Rural Population As On 01/04/2009

(Based on Census 2001 Growth Rates)

Table 4: Population scenario Source Ministry of drinking water and Sanitation – NIC

S. No.	Block Name	Total
1	BISSAM CUTTACK	89535
2	GUDARI	40774
3	KALYANSINGHPUR	60147
4	KASHIPUR	134339
5	RAYAGADA	105190
	Total:	**429995**

3.5 Inclusion and Exclusion Criteria:

The inclusion and exclusion criteria for the study was as follows

3.5.1. Inclusion:

- All the children those were less than five years of the age living in the study area were eligible for the study
- Out of all the under five children only the present youngest child with mother/caretaker were recruited for the purpose of the study.
- Mother or care taker must be able and willing to participate in the study.

3.5.2. Exclusion

- Children having any other chronic disease during the time of interview
- Children whom mothers/care takers were not present during the time of interview

3.6 Sample size

The sample size was calculated by using the UN statistical handbook for household survey. The formula is

$n_h = (z^2) (r) (1-r) (f) (k)/ (p) (n) (e^2)$, where

n_h is the parameter to be calculated and is the sample size in terms of number of Households to be selected;

Z is the statistic that defines the level of confidence desired;

R is an estimate of a key indicator to be measured by the survey;

F is the sample design effect, deff. assumed to be 2.0 (default value);

K is a multiplier to account for the anticipated rate of non-response;

P is the proportion of the total population accounted for by the target population and upon which the parameter, r, is based;

N is the average household size (number of persons per household);

E is the margin of error to be attained.

The z-statistic to use should be 1.96 for the 95-percent level of confidence. The former is generally regarded as the standard for assigning the degree of confidence desired in assessing the margin of error in household surveys. The default value of f, the sample design effect, should be set at 2.0 unless there is supporting empirical data from previous or related surveys that suggest a different value. The non-response multiplier, k, should be chosen to reflect the country's own experience with non-response – typically under 10 percent in developing countries. A value of 1.1 for k, therefore, would be a conservative choice. The parameter, p, can usually be taken from the most recent census, although a reasonable rule of thumb is to use 0.03 for each year of age that the target population represents. The parameter, n, is often about 6.0 in most developing countries. For the margin of error, e, it is recommended to set the level of precision at 10 percent of r; thus e =0.10r. A smaller sample size can be gotten with a less stringent margin of error, e = 0.15r, but the survey results would be much less reliable of course. For this study as no empirical evidence is not available about the prevalence of diarrhoea among the under five children among the study population, the data from recent National Level Family Survey may be utilized for the purpose of calculation of r. As per the NFHS 3 the prevalence of diarrhoea among under-five children in India is around 39% so by assuming the same

prevalence for the study area the r was considered to be 40%.

So using the formula the sample size was

$n_h = (1.96)^2 (.4) (.6) (2) (1.1) / (5*.03) (6) (.15*.4)^2$

$= (3.84) (.4) (.6) (2) (1.1) / (.15) (6) (.0036)$

$=625$

So the total sample size for the study was 625.

3.7 Sampling Technique

3.7.1 Selection of Village:

The list of all the villages of the five study blocks along with their population was obtained from the District Programme Management Unit (DPMU) Rayagada. Then from the list of villages, 30 villages (clusters) were selected by using Probability proportion to Size (PPS) method.

3.7.2 Selection of Subjects

As the total sample size is 625, a total of 21 respondents were selected from each cluster. So the total respondents were 630 for the study. In each village cluster the selection of the first household was done randomly. The map of the village was obtained from the Anganwadi Centre and after obtaining the list the first household was decided by spinning the pencil on the map. After selecting the household it was enquired whether any under five children was available in that household, if such child was found then relevant data were obtained from that household or else the interviewer moved to the next house hold. Similarly adjoining households in the same direction were enquired till the interviewer got 21 such households. If the mother/caretaker of the eligible child was not at home at the time of the interview, the researcher returned to the selected household at different time at least twice. If the caretaker was not found even after two trials the next household in the same direction was selected instead.

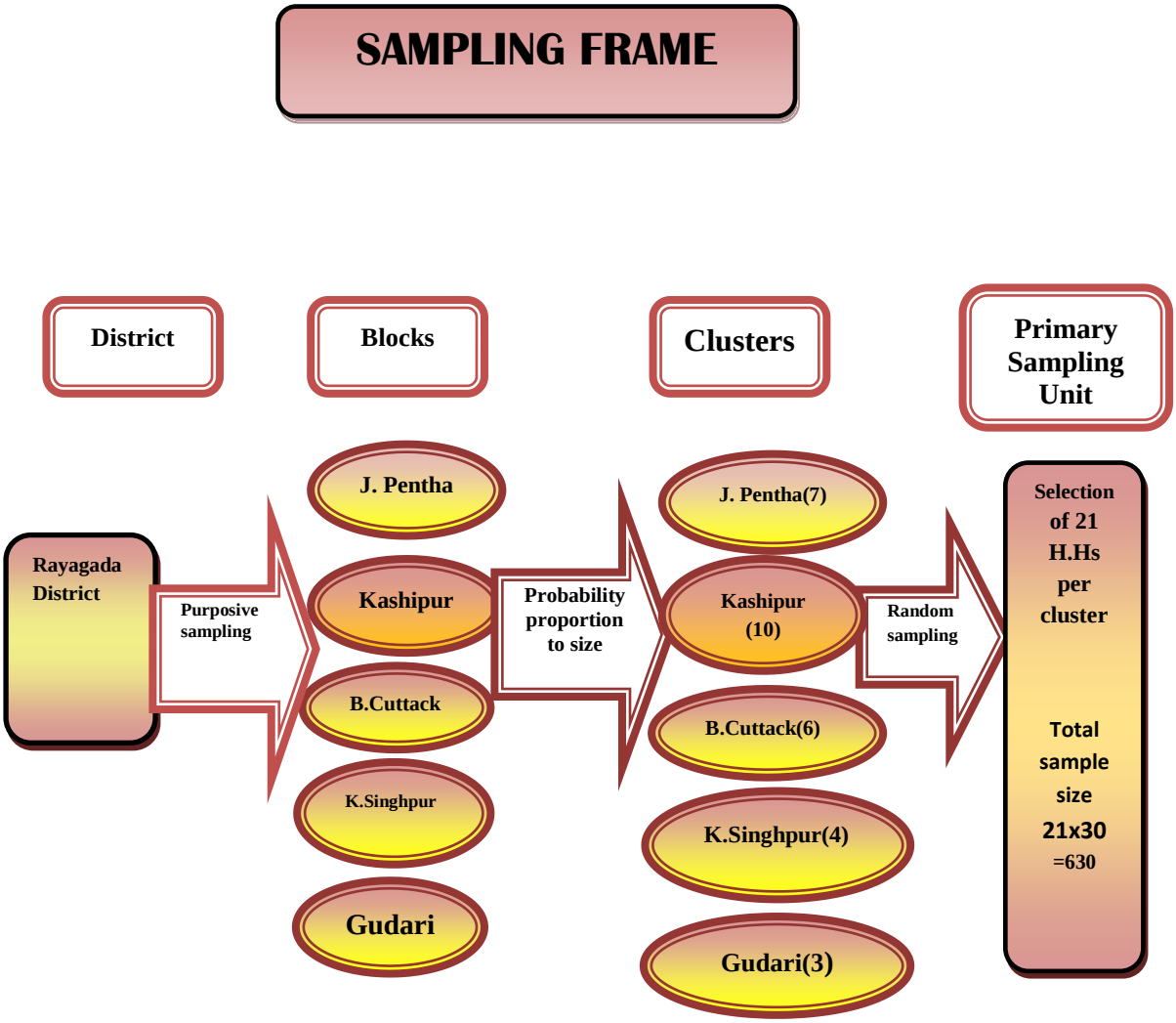

Figure 5: Sampling Frame

3.8 Measurement Tool:

A structured questionnaire was developed to be used as the main measurement tool for the survey. The questionnaire was prepared by extracting relevant questions from the National Family Health survey-3 (NFHS3) for the purpose of the survey. The questionnaire was used to collect data related to socio-economic, environmental and demographic factors associated with diarrhoea in under-five children. For example:

I. Questions related to demographics factors were extracted from the household questionnaire and women's questionnaire.
II. Questions related to child and childhood diarrhoea were extracted from the women's questionnaire
III. Questions in the immunization and breastfeeding section were taken from the women's questionnaire
IV. Questions related to utilization of ICDS services were extracted from the women's questionnaire
V. Questions related to drinking water and place of cooking were extracted from the household questionnaire.

The study questionnaire mainly had 5 sections:

- Section related to basic demographic information
- Section related to Child and childhood Diarrhoea
- Section related to Immunization and breast feeding
- Section related to Utilization of services of ICDS
- Section related to Drinking water, sanitation and Food Hygiene

During the interview the measurement of height and weight of the under five child was measured by using the height scale and weighing scale of the village Anganwadi centre. The weight was measured in Kilogram where as the height was measured in centimeter. The local Anganwadi staffs were requested to assist the research assistant for taking the measures. After the completion of the visit the visit to local ICDS centre was made to cross check the answers given by the mothers related to utilization of ICDS services.

3.9 Validity

As all the questions for the survey were extracted from the previously validated questionnaire the questionnaire were not validated further (34).

3.10 Data collection

3.10.1 Training of Research Assistant

Ten research assistants currently working as Multi Purpose Health Worker (MPHW) two from each study block were recruited for conducting the household survey. They were oriented about the research through 1day training at the DPMU office. The primary objective of the orientation programme was to make the research assistants clear about the objective of the study, filling up the questionnaire and how to maintain the confidentiality .The orientation training was given by the principle researcher. As the training venue is located inside the district headquarters Hospital, the senior Lady Health Visitor (LHV) was requested to train the participants about how to measure the weight and height of under-five children properly. The training methodology included class room lectures by the principal researcher, demonstrations, class room practice sessions and practice with mothers of under-five coming to attend OPD of the DHH on the training day.

3.10.2 Pretesting of the Questionnaire

Prior to the actual study the pretesting of the questionnaire was done among 10 mothers of under five children in a village whose characteristics is similar to that of the study site and which will not fall under the study site. The main objective of this pretesting was to ensure that relevant information was obtained by the questionnaire. Based on the observations during the pretesting necessary adjustments was done in the questionnaire.

3.11 Data Analysis

3.11.1Descriptive statistics

All the independent variables which were under nominal and ordinal scale were presented through frequency and percentage.

3.11.2Analytic statistics

Bivariate analysis using logistic regression was done to find out the association between each of the independent variables and the dependant variable.

From the result of the bivariate analysis multivariate model was constructed and multivariate analysis was done. The multivariate model included all the variables whose P value ≤0.2 in bivariate analysis and the variables whose P value is <0.2 but they are found to be associated with diarrhoea in under five children in other pool of studies. Chi-square test was done to find out the association between the dependent variable and the independent variables. All the analysis was done with statistical significance set at ≤0.05. All the data would be analyzed by using SPSS 17 for Windows.

3.12 Ethical consideration

The questionnaire does not elicit any sensitive information. Prior to the interview, all the interviewees were explained about the research including purposes and questionnaires. Written consent was obtained from each and every respondent. Their names were not recorded for the confidentiality and the data was coded. The respondents were requested to feel free to answer the questions, they were told that they may remain silent to the questions or may leave the research at any point of time according to their own will. They were explained that the data will be used for the purpose of research work only for the partial fulfillment of the MPH degree at the college of Public Health Sciences, Chulalongkorn University. All the data was kept confidential except for the further health education or implementation for the people of the study site.

Ethical clearance was given by the Research and Ethics Committee, Department of Health and Family Welfare, Government of Odisha vide letter no: 6348 dated 23rd February 2013(Appendix-E). After the completion of the study a copy of the thesis will be submitted to the Ethical Committee.

3.13 Benefit of the study:

The study was conducted in Rayagada district which was found to be the least in development index as per the latest survey of NSSO. As the study is basically about the diarrhoea disease which one of the persistent public health threat to the district, the study highlighted the factors associated with such recurrence and hence can provided a sustainable solution to the problem. The study focuses on the economic, socio-demographic and environmental factors associated with childhood diarrhoea. So an analysis of such factors can contribute in formulation of public health interventions which may help in reduction in diarrhoeal morbidity and mortality among children. This study also emphasized on the overall behavioral aspects of the community related to sanitation, hygiene and practices related to drinking water .So with analysis of above factors, the study might help the policy makers to formulate plans to avoid diarrhoea epidemic. The study may suggest reasons associated with diarrhoeal morbidity among under five children. Moreover the study also put some light on why even after investing a lot in development of infrastructure related to safe drinking water still diarrhoea is a major health issue. The results of the study may help in formulation of plans related to following aspects

- Factors which are significantly associated with diarrhoea in children can be emphasised for prevention plan
- Education to grass root health providers related to practice followed by the community and how to address them
- Emergency preparedness plan during diarrhoea epidemic

CHAPTER IV
RESULTS

This chapter includes results of descriptive and analytical statistics based on data collected by quantitative study method from the mothers of under five children of Rayagada District, Orissa, India in the month of February and March, 2013 via Questionnaire.

Data analysis began with descriptive statistics such as frequency and percentage for all independent variables. The descriptive statistics was further divided into the following categories.

1) Socio-demographic characteristics of mothers
2) Socio-demographic characteristics of children
3) Measles Immunization and Vitamin-A syrup supplementation
4) Breast Feeding
5) Height and weight of children
6) Utilization of services of ICDS (integrated child development services.
7) Drinking water
8) Sanitation
9) Cooking
10) Status of Diarrhoea in under-five children

Analytical statistics was done to see the association and to measure strength of association between dependent and independent variables. Bivariate analysis was done using logistic regression to see association between dependent and independent variables. Strength of association between dependent and independent variables was seen using Chi-square and Fisher exact test*. Multivariable analysis was also done using logistic regression for all those variables whose p-value ≤ 0.2 in bivariate analysis and those variables whose p value is > 0.2 but has been significantly associated with under-five Diarrhoeal morbidity in several other previous studies. From the analysis it was observed that all the caretakers were mothers so the interpretations were made from the point of view of mother's characteristics. From now onwards the word 'mothers' only is used in the result presentation.

4.1 Descriptive Analysis

Mothers within the age group of 20-25 were the highest participants in the study. Out of the total study participants this group represented 33% of the study population. Out of all the mothers participated 27% have attended school. Amongst the educated mothers the larger section, 44% has completed Primary education only. The religion of most of the participants was Hindu with 97.3% and the mother with Schedule Tribe cast were around 50%.Out of all the participants 70% families had the Below Poverty Line (BPL)card which is a symbolic of their socio-economic status.

Table 5: **Socio Demographic characteristics of Mothers (n=630**)

Variables	**Frequency**	**Percentage**
Age group of the mother* in months		
16-19	20	3.2
20-25	208	33
26-30	162	25.7
31-35	82	13
36-40	20	3.2
41-50	7	1.1
Don’t know year	131	20.8
Attendance of school by mother		
No	466	74
Yes	164	26
Level of mother’s Education (n=164)		
Primary	73	44.5
Upper Primary	50	30.5
High School	34	20.7
Intermediate	7	4.3
University	0	0
Religion		
Hindu	613	97.3
Muslim	6	1.0
Christian	11	1.7
Caste		
Schedule Tribe (ST)	314	49.8
Schedule Cast (SC)	217	34.4
Other Backward Class (OBC)	91	14.4
General	8	1.3
Below Poverty Line(BPL) card status		
Yes	441	70.0
No	180	28.6
Don’t know	9	1.4

Out of the 630 household surveyed it was observed that there were 61% of households with only one under five children in the family. Out of all the children surveyed 53.5 % were male and 46.5% were female. Almost 65% of children were less than two years of age during the time of survey.

Table 6: **Socio-demographic characteristics of under five children** (**n = 630**)

VARIABLES	**Frequency**	**Percentage**
No. Of under-five children in the household		
1	389	61.7
2	208	33.0
3	26	4.1
4	3	.5
5	4	.6
Sex of the child		
Male	337	53.5
Female	293	46.5
Age of the child in months		
1-9	165	26.2
10-12	63	10.0
13-24	188	29.8
25-36	117	18.6
37-48	57	9.0
49-60	40	6.3

During the study it was observed that around 10% of the mothers didn't have the immunization card of their children with them. After cross-checking from the register of the local female health worker it was observed that there were 12% and 13% children in the study area who were not given measles or Vitamin- A supplementation respectively, as a part of routine immunization program. It was also observed that there were around 4% and 3% missed opportunity cases measles and Vit-A supplementation where a child either received Measles or Vit-A but not both**.**

Table 7: Immunization and Vitamin-A Syrup Supplementation (n=630)

Variables	Frequency	Percentage
Availability of immunization card during interview		
Yes	568	90.2
No	62	9.8
Measles vaccination(crosschecked from register of Female Health worker)		
Due date not reached	137	21.7
Measles given	414	65.7
Measles not given	79	12.6
Vitamin-A supplementation(crosschecked from register of Female Health worker)		
Due date not reached	137	21.7
Vit-A given	410	65.2
Vit-A not given	83	13.1
Missed opportunity		
Measles given but Vit-a not given**(n=414)**	18	4.34
Vit-A given measles not given**(n=410)**	14	3.41

During the study it was found that 99% of mothers have breastfed their child. Out of all the study participants 69.9 % of mothers were doing breastfeeding during the time of study. Out of the 194 mothers who were not breast feeding during the study time it was observed that 36% of mothers breastfed their child for more than 1 year.

Table 8: History of Breast feeding (n=630)

Variables	Frequency	Percentage
Breastfeeding		
Yes	626	99.4
No	4	6
Still breast feeding(n=626)		
Yes	432	68.6
No	194	31.4
Breast feeding in months for children not currently Breast fed (n=194)		
Up to 6 months	31	16.0
Up to 7-12 months	92	47.4
More than 12 months	71	36.6

On the basis of the anthropometric measurement taken during the study and on the basis of the WHO growth chart all the children under the study were categorized in to wasting, stunting and underweight. It was observed that stunting was more prevalent in the study population with 62% of under five children are stunted out of the total study population.

Table 9: Height and weight of children (n=630)

Variables	Frequency	Percentage
Wasting		
Non-wasting	484	76.7
Wasting	146	23.1
Stunting		
Non-stunting	236	37.4
Stunting	394	62.4
Underweight		
Normal	350	55.5
Underweight	280	44.4

It was observed from the study that 95% of households have availed any service from ICDS. Out of all the study participants 81% reported to receive daily supplementation from the ICDS for their child, where as food supplements were given to total 18% of mothers who were in lactating phase. According to the service delivery mechanism of ICDS the weight of children below 3 years of age is to be done every month and for more than 3 years children it should be done once in a month. Accordingly it was observed from the register of the AWC that for 80% of the children the weight measurement was done once in a month and for 19% children it was done quarterly. It was also observed that after weight measurement 77% of mothers were given counseling about the weight management of their child.

Table 10: Utilization of services of integrated child Development Services (ICDS) (n=630)

Variable	Frequency	Percentage
ICDS service utilization		
Yes	604	95.9
No	26	4.1
Receipt of food from ICDS(cross checked from the register of the local Anganwadi Worker)		
Almost daily	514	81.5
Food given to the lactating mothers	116	18.5
Measurement of weight in ICDS centre		
Once a month	507	80.5
Quarterly	123	19.5
Counselling after weight measurement		
Yes	487	77.3
No	65	10.3
Don’t know	78	12.4

During the study it was observed that the main source of drinking water for the study population was Bore well and hand Pump with around 77% of the study population were dependant on these two sources. There were 75% households for whom the distance of water source was within 10 minutes of their house. Around 67.8% households don't do anything to treat the water before using it for the purpose of drinking. Out of the 144 households those who treat water before drinking 79% boil the water before drinking.

Table 11: Drinking water (n=630)

Variables	Frequency	Percentage
Main source of drinking water		
Piped into dwelling	1	.2
Piped to yard	2	.3
Public tap	84	13.3
Hand Pump	89	14.1
Bore well	396	62.9
Surface water (river/dam/lake/pond)	33	5.2
Others	25	4.0
Location of Water source		
Own dwelling	3	.5
Own yard	2	.3
Elsewhere	625	99.2
Distance of the water source		
Less than 1 minute	5	.8
1-10 minutes	471	74.8
11-20 minutes	130	20.6
21-30 minutes	24	3.8
Treatment of water		
Don't know	55	8.6
No	431	68.6
Yes	144	22.9
Methods of treatment (n=144)		
Boil	114	79.2
Use bleach	2	1.4
Strain through a cloth	18	12.5
Use water filter	1	.7
Use electronic water purifier	4	2.8
Let it stand and settle	5	3.5

It was found from the study that open defecation is the most common practice amongst the study population with only 1% of the households using latrine. Out of 630 households only 22% of households follow proper method to dispose their child's feces.

Table 12: Defecation and its disposal (n=630)

Variables	Frequency	Percentage
Kind of toilet facility		
Flush to safetic tank	2	.4
Twin pit/composing toilet	3	.5
No facility/uses open space or field	625	99.1
Methods to dispose Feces of the child		
Child used toilet or latrine	2	.3
Disposed into toilet or latrine	3	.5
Disposed into drain or ditch	93	14.8
Thrown into garbage	36	5.7
Buried	6	1.0
Left in the open	490	77.8

It was found from the study that 78 % of the households do their cooking in the house and 18% of the families do it outside their house. Out of the totals households who cook in their house 52 % had separate room for cooking.

Table 13: Place of Cooking (n=630)

Variables	Frequency	Percentage
Cooking		
In a separate building	10	1.6
Outdoors	118	18.7
Others	6	1.0
In the house	496	78.7
Separate room for cooking in the house (n=496)		
Yes	295	52
No	201	48

It was found that out of all the children participated in the study 42% had Diarrhoea within last two months of the study. Out of all the children who had Diarrhoea within last two months 53% were male and 46% were female.

Table 14: Status of Diarrhoea in under-five children (n=630)

VARIABLES	Frequency	Percentage
Diarrhoea in last two months(n-630)		
Yes	269	42.7
No	361	57.3
Sex wise distribution of Diarrhoea (n=269)		
Male	143	53.2
Female	126	46.8

4.2 Analytical Statistics:

Bivariate and multivariate analysis was done to find out the association between socio-economic, demographic and environmental factors and Diarrhoea morbidity in under-five children. In the analysis presence of Diarrhoea within two months of the date of the interview was treated as dependant variable and the association with other factors was assessed in comparison to presence or absence of Diarrhoea. Chi-square test was done to find out the association among the independent variables and diarrhoea among under-five children. For the homogeneous variables like History of BF, location of water source, Kind of toilet facility for the household the fisher exact test was done to find out the association.

From table below it was observed that there is no association between mother's socio-demographic characteristics and Diarrhoea among under-five children. From the uni-variate analysis the "don't know year" category under mother's age variable was excluded in the bivariate analysis, as it could not be merged in any other group.. So that 131 observations were considered as missing data in the bivariate analysis. No significant association was found among mother's age and diarrhoea in under-five children. For bivariate analysis the standard of mother's education has been merged and divided in to three categories, Primary, Upper Primary and illiterate. Similarly as most of the participants were Hindu, the independent variable religion was also merged and divided into two categories, Hindu and Non-Hindu. It was

observed children whose mothers have attended school had higher rate of diarrhoea (47%) as compared to the children whose mothers are illiterate (41%).Amongst different castes it was found that ST children had higher Diarrhoea rate as compared to the other castes.

Table 15: Association between Socio-demographic characteristics of mothers and Diarrhoea in children under five

Factors	Diarrhoea in past two months		X^2	P value
	Yes	No		
	N (%)	N (%)		
Age group of Mothers				
16-19	6(30%)	14(70%)		
20-25	82(39%)	126(61%)		
26-30	73(45%)	89(55%)	4.400	.355
31-35	35(42%)	47(58%)		
>35	15(55%)	12(45%)		
Attendance of school by mother				
Yes	78(47.6%)	86(52.4%)	2.143	**.143**
No	191(41.0%)	275(59%)		
Level of mother's Education				
Primary	30(41.1%)	43(58.9%)	4.310	**.111**
Upper Primary	48(52.7%)	43(47.3%)		
Illiterate	191(41%)	275(59%)		
Religion				
Hindu	260(42.4%)	353(57.6%)	.749	.387
Non-Hindus	9(52.9%)	9(47.1%)		
Caste				
Schedule Tribe (ST)	136(43.7%)	178(56.7%)		
Schedule Cast (SC)	84(38.7%)	133(61.3%)	3.329	**.189**
Others	49(42.7%)	50(53.7%)		
Below Poverty Line(BPL) card status				
Yes	184(41.7%)	257(58.3%)	.571	.450
No	85(45%)	104(55%)		

It was observed that factors like no of under-five children in the house-hold and sex of the child had no association Diarrhoea. But age of the child is found to be statistically significant**(p<.002).**For Bivariate analysis the children among various age group has been merged in to three groups, up to six months,7 months to 1 year and more than one year. It was found that children in the age group of 7 months to 1 year had more diarrhoea morbidity 54% as compared to the other two age groups.

Table 16: Association between Socio-demographic characteristics of children and Diarrhoea in children under five

Factors	Diarrhoea in past two months		X^2	P value
	Yes	No		
	N (%)	N (%)		
No. Of under-five children in the household	164(42.2%)	225(57.3%)	.393	.822
1	92(44.2%)	116(55.8%)		
2	13(39.4%)	20(60.6%)		
>2				
Sex of the child				
Male	143(42.4%)	194(57.6%)	.021	.885
Female	126(43.0%)	167(57.0%)		
Age of the child in months				
Up to 6 months	34(31.2%)	75(68.8%)	12.84.	**.002**
7 months-1 yr	65(54.6%)	54(45.4%)		
More than 1 yr	170(42.3%)	232(57.7%)		

For bivariate analysis the children within the age group 0 to 9 months were excluded from the analysis as the due date for both Vitamin-A and Measles is after 9 months of birth. Bivariate analysis was done only for 493 children who were beyond 9 months of age and eligible to get both Vitamin A supplementation and Measles vaccination. Though availability of immunization card and Measles vaccination were not found to be associated with Diarrhoea, Vitamin-A supplementation was found to be marginally associated with **p<.055**.

Table 17: Association between Measles Immunization and Vitamin-A syrup supplementation and Diarrhoea in children under five

Factors	Diarrhoea in past two months		X^2	P value
	yes	No		
	N (%)	N (%)		
Availability of immunization card during interview				
Yes	244(43.0%)	324(57.0%)	.159	.690
No	25(40.3%)	37(59.7%)		
Measles Vaccination *(crosschecked from register of Female Health worker) n=493*				
Measles given	181(43.7%)	233(56.3%)	1.861	.173
Measles not given	28(35.4%)	51(64.6%)		
Vitamin-A *(crosschecked from register of Female Health worker) n=493*				
Vit-A given	182(44.4%)	228(55.6%)	3.675	**.055**
Vit-A not given	27(32.9%)	55(67.1%)		

For bivariate analysis the BF months for the children was merged and divided in to three categories like Breast feeding up to six months, up to 7 months to one year, more than one year and still feeding. None of the factors related to Breast feeding was found to be associated with Diarrhoea.

Table 18: Association between Breast Feeding and Diarrhoea in children under five

Factors	Diarrhoea in past two months		X^2	P value
	Yes	No		
	N (%)	N (%)		
History of BF				
Yes	266(42.5%)	360(57.5%)		**.**190 *
No	3(75%)	1(25%)		
Currently breast feeding				
Yes	198(45.8%)	234(54.2%)	5.521	**.019**
No	68(35.9%)	126(64.1%)		
Bf in months for those who are not feeding currently				
Bf for 6 months	11(35.5%)	20(64.5%)	1.184	.119
Bf up to 1 year	30(32.6%)	62(67.4%)		
BF > 1 year	29(40.8%)	42(59.2%)		
still feeding	196(45.4%)	236(55.6%)		

(*) Fisher exact test

There was no association between children nutritional status and Diarrhoea. It was observed that Diarrhoea rate was high (44%) among the children who were wasted as compared to who were not wasted (42%).

Table 19: Association between Nutritional status and Diarrhoea in children under five

Factors	Diarrhoea in past two months		X^2	P value
	Yes	No		
	N (%)	N (%)		
Wasting				
Non-wasting	204(42.1%)	280(57.9%)	.258	.612
Wasting	65(44.5%)	81(55.5%)		
Stunting				
Non-stunting	100(42.4%)	136(57.6%)	.016	.898
Stunting	169(42.9%)	225(57.1%)		
Under-weight				
Non-underweight	157(44.9%)	193(55.1%)	1.500	.221
Underweight	112(40.0%)	168(60.0%)		

As far as the service utilization of ICDS was concerned no association was found amongst service utilization and Diarrhoea in under-five children.

Table 20: Association between ICDS service utilization and Diarrhoea in children under five

Factors	Diarrhoea in past two months		X^2	P value
	Yes	No		
	N (%)	N (%)		
ICDS service utilization				
Yes	259(42.9%)	345(57.1%)	1.809	.405
No	9(36%)	16(64%)		
Counseling after weight measurement				
Yes	217(44.6%)	270(55.4%)	3.034	**.082**
No	52(36.4%)	91(63.6%)		

For the bivariate analysis, it was observed that the source of drinking water was highly associated with Diarrhoea in under five children with p<.000.it was found that children whose household use public system as their main source of drinking water had more rate of Diarrhoea (60%) as compared to the other water sources. It was also observed that for the household where the distance to the water source was less than 10 minutes had more Diarrhoea among children as compared to those whose water source was beyond 10 minutes from their house. As it was found those who treat water mostly follow boiling, the methods of treatment of water was merged and divided in to the categories of boiling, other and don't treat. Cross tabulation also done to find out the association between distance of water source and treatment of water but no association was found among the two (p=.068).[Results not shown]

Table 21: Association between Drinking water and Diarrhoea in children

Factors	Diarrhoea in past two months		X^2	P value
	Yes	No		
	N (%)	N (%)		
Main source of drinking water				
Public Piped system	53(60.9%)	34(39.1%)		
Hand pump	27(30.3%)	62(69.7%)	18.37	**.000**
Bore well	168(42.4%)	228(57.6%)		
Other sources[@]	21(36.2%)	37(63.8%)		
location of water source*				
Inside home	2(40%)	3(60%)		.903*
Outside home	267(42.7%)	358(57.3%)		
Distance of the water source				
Less than 10 minutes	216(45.4%)	260(54.6%)	5.715	**.017**
More than 10 minutes	53(34.4%)	101(65.6%)		
Treatment of water				
yes	72(50%)	72(50%)	4.067	**.044**
No	197(40.5%)	289(57.3%)		
Methods of treatment				
Boil	58(51.3%)	56(49.1%)	4.240	.120
Others[#]	14(46.7%)	16(53.3%)		
Don't Treat	197(59.5%)	289(40.5%)		

(*) Fisher exact test
Others[@] includes surface water source and other water sources
Others[#] includes use of bleach/strain through cloth/water filter/electronic purifier/left to stand and settle

For the bivariate analysis the child feces disposal methods was merged and divided in to two categories like disposed properly and left open. It was observed that children whose feces were left open had more Diarrhoea (44%) as compared to them whose feces were disposed properly(35%).

Table 22: Association between Toilet facility and Diarrhoea in children under five

Factors	Diarrhoea in past two months		X^2	P value
	Yes	No		
	N (%)	N (%)		
Kind of toilet facility for the household				
Personal toilet	3(60%)	2(40%)		.432*
Open defecation	266(42.6%)	359(57.3%)		
child feces disposal method				
Disposed by any method	49(35%)	91(65%)	4.360	**.037**
Left in the open	220(44.9%)	270(55.1%)		

(*) Fisher Exact test

From the bivariate analysis it was observed that the availability of separate room for cooking is highly associated with Diarrhoea in under five children with p<.001. Those who have separate room for cooking had more Diarrhoea (50%) as compared to them who doesn't have a separate room (37%)

Table 23: Association between place of cooking and Diarrhoea in children

Factors	Diarrhoea in past two months		X^2	P value
	Yes	No		
	N (%)	N (%)		
Place of cooking				
In the house	220(44.4%)	276(55.6%)		
outside the house	49(36.6%)	85(63.4%)	2.615	**.106**
Separate room for cooking				
yes	121(50.8%)	117(49.2%)	10.364	**.001**
No	148(37.8%)	244(62.2%)		

4.3: Multivariate Analysis:

Results obtained from bivariate analysis were used to construct multivariable model for multivariable analysis. This multivariable model, included variables for which p-value was less than or equal to 0.20 in bivariate analysis and Wasting* whose p value was not found to be <.05 in this study but it was found to be associated with Diarrhoea in under five children in previous pool of studies. So the following variables were put in the logistic regression model.

- Attendance of school by mother
- Standard of mother's Education
- Caste of the household
- Age of the child
- Measles vaccination status
- Vitamin-A supplementation status
- Breast feeding status of the child
- Feeding months for the child for those who are not Breast fed currently
- Counselling about weight measurement at the ICDS centre
- Source of drinking water
- Distance of the water source from the household
- Treatment of the drinking water
- Methods of treatment of drinking water
- Child feces disposal method
- Cooking facility
- Separate room for cooking
- Wasting status of the child*

Two logistic regression models were formulated to analyze the data in a systematic manner. In the first model all the independent variables were included except measles and Vitamin-A, because there were 137 children who were not eligible to get measles or Vitamin-A as they were below 9 months of age during the time of interview. So in the first logistics model the analysis was done for all the 630 people by not putting Measles and Vitamin-A in the model. In the second model the variables Measles and

immunization were included analysis was done for 493 people by excluding 137 children whose due date has not reached for measles and Vitamin-A the following table illustrates the two different logistic regression model. The observations “never breast fed” (4 cases) which cannot be merged in any group were treated as missing data and analysis was done excluding them from the model.

The below multivariate table illustrates that at 95% CI out of all the independent variables put in the logistic regression model only age of the child and source of drinking water are statistically significant with Diarrhoea in children under five. The following major observations were seen on the above table

- Children within the age group of 7-12 months are 2.8 more likely to develop diarrhoea as compared to the children in the age group of 0-6 months
- Children in the household who use hand pump or bore well are .3 and .6 less likely to develop diarrhoea as compared to children whose household use public piped system.

Table 24: Multivariate Analysis for Diarrhoea (excluding Measles and Vitamin-A)

Variables	B	Sig.	Adjusted OR	95% CI	
				Lower	Upper
Attendance of school by Mother [a)]	-.062	.821	.940	.549	1.610
Level of mother's Education [b)]					
Primary[(R)]		.185			
Upper Primary	.452	.185	1.571	.805	3.066
Illiterate	.093	.356	1.097	.901	1.337
Caste [c)]					
ST [(R)]		.552			
SC	-.206	.300	.814	.551	1.202
Others	-.002	.994	.998	.599	1.663
Age of the child [d)]					
0-6 months [(R)]		**.001**			
7 months-12 months	1.064	.000	2.899	1.650	5.096
More than 1 year	.835	.001	2.304	1.390	3.819
Breast feeding [e)]	-.469	.274	..626	.270	1.450.
Breast feeding months for those who are not feeding currently [f)]	- .006	.976	.994	.659	1.489
Weight counseling [g)]	-.031	.891	.969	.619	1.518
Drinking water Source [h)]					
Public Piped System [(R)]		**.045**			
Hand pump	-.994	.007	.370	.180	.762
Bore well	-.469	.082	.625	.368	1.062
Others	-.724	.057	.485	.230	1.022
Distance to water source [i)]	-.276	.198	.759	.499	1.155
Treatment of water [j)]	.328	.574	1.388	.442	4.359
Method of water treatment [k)]	-.043	.923	.958	.400	2.296
Child faeces disposal [l)]	.019	.933	1.019	.651	1.596
Cooking place [m)]	-.217	.371	.805	.500	1.295
Separate room for cooking [n)]	.393	.058	1.481	.987	2.223
Wasting [o)]	.325	.124	1.384	.915	2.094

R: Reference group
a:comparision between never attended school to attended school
b :compare to primary to upper primary to illiterate with primary as the reference group
c :compare ST(reference group) to SC and Others
d :compare 0-6 months (reference group) of the child to 7-12 months and > 1 yr
e:compare ever breastfed to never breast fed

f: compare between Bf up to 6 months (reference group) to 7-months-1 year and > 1 year
g: compare between counseling given after weight measurement to not given
h: compare between public Piped system to hand pump bore well and others
i:compare between less than 10 minutes to more than 10 minutes
j: compare between treatment of water and non-treatment of water
k:compare between boiling (reference group) to others and don't treat
l:compare between disposal of child feces by any method to left open
m:compare between cooking inside home to outside home
n:compare between separate room for cooking to no separate room for cooking
o:comparision between wasting to non-wasting

The below multivariate table illustrates that at 95% CI out of all the independent variables put in the logistic regression model including Measles Vaccination and Vitamin A supplementation, only separate room for cooking is statistically significant with Diarrhoea in children under five. The major observation from the above table is

- Children of the household who has separate room for cooking are 1.7 more likely to develop diarrhoea as compared to the children whose household doesn't have separate room for cooking.

Table 25: Multivariate analysis for diarrhoea (including Measles and Vitamin-A)

Variables	B	Sig.	Adjusted OR	95% CI	
				Lower	Upper
Attendance of school by Mother [a)]	-.136	.674	.873	.462	1.647
Level of mother's Education [b)]					
Primary(R)		.337			
Upper Primary	.382	.337	1.465	.672	3.193
Illiterate	.017	.284	1.071	.986	1.048
Caste [c)]					
ST (R)		.299			
SC	-.357	.120	.700	.446	1.098
Others	-.145	.635	.865	.475	1.575
Age of the child [d)]					
0-6 months		.938			
7 months-12 months	-.100	.878	.905	.254	3.229
More than 1 year	.002	.998	1.002	.294	3.410
Breast feeding [e)]	-.515	.237	.597	.254	1.403
Breast feeding months for those who are not feeding currently [f)]	-.037	.863	.964	.693	1.461
Weight counseling [g)]	.214	.427	1.238	.731	2.099
Drinking water Source [h)]					
Public Piped System (R)		.195			
Hand pump	-.925	.032	.397	.170	.923
Bore well	-.395	.228	.673	.354	1.280
Others	-.374	.398	.688	.289	1.638
Distance to water source i)	-.359	.136	.698	.435	1.120
Treatment of water [j)]	-.036	.958	.964	.245	3.790
Method of water treatment [k)]	.417	.443	1.518	.522	4.409
Child feces disposal [l)]	.010	.971	1.010	.608	1.676
Cooking place [m)]	-.015	.955	.985	.580	1.672
Separate room for cooking [n)]	**.569**	**.021**	**1.767**	**1.091**	**2.862**
Wasting [o)]	.314	.189	1.369	.856	2.189
Measles [p)]	.281	.507	1.325	.578	3.038
Vitamin-A [q)]	-.468	.260	.626	.278	1.412

R: Reference group

a:comparision between never attended school to attended school

b :compare to primary to upper primary to illiterate with primary as the reference group

c :compare ST(reference group) to SC and Others
d :compare 0-6 months (reference group) of the child to 7-12 months and > 1 yr
e:compare ever breastfed to never breast fed
f: compare between Bf up to 6 months (reference group) to 7-12 months and > 1 year
g: compare between counseling given after weight measurement to not given
h: compare between public Piped system to hand pump bore well and others
i:compare between less than 10 minutes to more than 10 minutes
j: compare between treatment of water and non-treatment of water
k:compare between boiling (reference group) to others and don't treat
l:compare between disposal of child feces by any method to left open
m:compare between cooking inside home to outside home
n:compare between separate room for cooking to no separate room for cooking
o:comparision between wasting to non-wasting
p:comapriosion between measles given to not given
q:comparision between Vit-A given to not given

CHAPTER V

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1. Discussion

This study examined factors associated with Diarrhoea among children aged less than 5 years in Rayagada district of Orissa through a cross-sectional survey conducted between February - March 2013.

The results of this study will be discussed under the following parts

5.1.1. Prevalence of Diarrhoea in children

5.1.2. Association between demographic factors and Diarrhoea

5.1.3. Association between Socio-economic factors and Diarrhoea

5.1.4. Association between Environmental Factors and Diarrhoea

5.1.1: Prevalence of Diarrhoea in children

The two month prevalence of Diarrhoea in the study population was found to be 42% (269 out of 630). The observed prevalence of Diarrhoea in the current study was found to be unusually higher as compared to previous studies. According the findings of NFHS-3, 9% of all under-five children were found to be suffering from diarrhoea in last2 weeks prior to the study (39). The corresponding figures for NFHS-2 andNFHS-1 were 19.2% and 10%, respectively (39).These figures are not truly comparable as the information related to diarrhoea was obtained from mothers of children with different age groups. In NFHS-1 it was collected from the mothers of children< 4 yrs where as in NHFS-2 and 3 it was collected from the mothers whose children were < 3 yrs and < 5 yrs respectively.

A recent study from UNICEF which was conducted in 10-districts of India with high infant and child mortality report that 19.8% children (2-59 months) suffered from diarrhoea in the two weeks preceding the survey (56). Similarly a Countrywide UNICEF coverage evaluation survey reported 14.3% of children (< 2 yrs) to be suffering from diarrhoea in the two weeks preceding the survey (56).

Considering the present study was not conducted in the rainy season the prevalence of Diarrhoea reported in the study is alarmingly high. Almost all the studies on diarrhoea have been conducted in the dry season which makes it difficult to

make meaningful and reasonable comparison of the prevalence. However, although slightly higher, the prevalence in the current study is not far removed from the findings of some other studies which had considered either one month or more preceding the study period as the time period of evaluation. A similar study conducted in Malawi found that the prevalence of Diarrhoea one moth prior to the study was 41% (57). Similarly in another study done in Kashmir, India found that an overall period (last 15 days) and the point (24 hrs) prevalence rates of Diarrhoeal diseases among children under age of 5 years were 25.2% and 9.3% respectively.(58) According to the same study both period and point prevalence rates of diarrhoea decreased significantly with increased age. These rates were highest in the age group of 6–11 months (49.1%) and were lowest among children aged 48–59 months (15.7%). The high prevalence of Diarrhoea in the present study may be attributed to four factors.

Firstly the present study considered two months prior to the study as the evaluation period which might have contributed to high number of cases. There might be increased number of cases reported by the mother as the recall period was little high as compared to other studies that mostly use 2 weeks recall period.

Secondly the findings (from the study) show that overall poor sanitation/rubbish action disposal, water and food hygiene- related practices was not satisfactory in the study area and this could have enhanced prevalence of diarrhoea even during the non peak period as demonstrated by some other studies(1,80)

Thirdly, the fact that most studies about diarrhoea focus only on peak periods (rainy season) underling the notion that the main cause of diarrhoea is because of contamination of water sources due to poor sanitation. This could be a wrong assumption: Studies in USA, in Guatemala and in Lesotho remarked fecal-oral transmission of diarrhoea was not caused by drinking contaminated water exclusively, vast majority of transmission episodes may occur via other routes which are not water-borne (59).

Fourthly the measurement of prevalence by cross-sectional survey is more likely to report valid data (83) of diarrhoea prevalence during the dry season because previous measurement of prevalence were based on the routine reporting of

the lady health workers, who are not alerted to report diarrhoea all year round but only during the rainy season .

The current study, also emphasized on the overall poor sanitation and hygiene practice followed by the community throughout the year and not only during the rainy season which is in consonant with the above arguments. Another fact to be considered over here is that this study found high prevalence of diarrhoea during the dry season too and not only in the rainy season as so far reported by most studies has only focused on the peak.

5.1.2. Association between demographic factors and Diarrhoea

Socio-demographic factors play an important role in Diarrhoeal outcome of a child. Though various socio demographic factors like age of the mother, age of the child ,sex of the child, no. of under-five children in the household, caste and religion of the household, measles immunization status, Vitamin-A supplementation status, breast feeding status and child's nutritional status in relation to Diarrhoeal outcome was analyzed in the study it was only age of the child ,breast feeding and Vitamin-A supplementation which were found to be statistically significant in the bivariate analysis. Further more in the multivariate analysis it was only the age of the child which found to be significantly associated with diarrhoea in children.

This study defers from the association between age of the mother and Diarrhoea in under-five under five children which was previously documented by many other studies (60.61).The previous studies emphasize that the lower the age of the mother the higher was the risk of diarrhoea. But in the current study it was observed that the risk of diarrhoea was more among the children whose mother's age was more than 35 years. The reason might be the awareness related to diarrhoea was lacking in older mothers as compared to the young mothers. After recent epidemics in the study area lot of interventions have been initiated to combat diarrhoea but might be due to old behavioral practices the older mothers are not able to adopt the good practices related to sanitation and hygiene and as a result of which their children are more susceptible towards diarrhoea. Some other studies in some of the similar set ups also showed the same result where the age of the mother was not found to be associated with diarrhoea in children.(62) similarly a study done in India showed

significant associations between maternal age and infant and child diarrhoea, malnutrition, low birth weight, and mortality in bivariate analysis where as only stunting and underweight remained significant in adjusted analyses (63).

This study found a strong association between child's age and Diarrhoea. It was observed that the higher risk of diarrhoea was among children aged more than 6 months (with the highest risk being among children aged 7-12 months). Similar relationships between age and child morbidity was also observed in a study in the Philippines (31). A possible explanation for this is that children within the age group of 0-6 moths are taken special care by the parents and they are less exposed to the external environment as compared to the children of other age groups. They might also get the benefit from the protective effect of breast milk (if breastfed). Studies have also shown that the Protective effects of breast milk drops dramatically after 6 months of a child's age (64). With increased awareness about breast feeding it may be believed that the mothers follow exclusive breast feeding till 6 months and From 6 months, children are introduced to a variety of foods. Moreover the child becomes more mobile and getting exposed to the external environment and thereby increasing their chances of contamination and infection (especially for diarrhoea), as their immune system is still under developed. But with growing age, their adaptive immune system becomes strengthened resulting into fewer infection rates. This study also concurs with a study in which Turkey found higher diarrhoea incidences in children aged 6-11 months (65). Similarly the findings are similar to that of a study conducted in India(66) where Children in the age group 7-12 months had the highest prevalence of diarrhoea to the extent of 40.7% followed by the age group 13-24 months and 0-6 months.

Prevalence of diarrhoea was not different in relation to the sex of the child. The female had slightly more prevalence (43%) as compared to their male counterpart (42%). In another research conducted in India also found that the prevalence of diarrhoea was marginally high among the female children as compared to the male children (67). In another population based study conducted in south of India it was found that the prevalence of acute diarrhoea among males and females were 21.4% and 23.8% respectively. So similar to the sited study there is no significant association between sex of the child and diarrhoea. The reason might be there are not marked

differences between exposure of male and female child to diarrhoea susceptibility within 5 years of age.

There was no association between number of under-five children in the household and diarrhoea. From the uni-variate analysis it was observed that around 60% of the population in the study area has only one under five children in the household. In bivariate analysis no association was found among the no of under-five children in the household and diarrhoea. However some studies have revealed that there was association between these factors. The probability of having Diarrhoea was 30 % and 60% higher if there are 3-5 or more than 6 children in the household respectively. (68).The reason for no association in the study might be the percentage of families with more than two under five children in the household was less than 10 %.

The study district has a predominant tribal population of 57.52%. All the 11 blocks (including five study blocks) of the district have been covered under tribal sub-plan for the pre-literate indigenous tribal communities. The present study found that the around 50% of the participants belong to Schedule tribe community and 35% participants belong to schedule cast community which are considered to be the most deprived and backward community in the whole state. Though no association was found among the cast and diarrhoea still from the study it was observed that the ST children had more prevalence of diarrhoea (43%) as compared to other communities. So the study also reflects that the marginalization due to backward caste still has effect in the prevalence of diarrhoea. This finding is in consistent with a review done on social exclusion. Caste and health which also emphasizes that ST and SC communities in India being socially disadvantaged were more prone to poor health status (55).

From the study it was observed that 97% of the participants in the study population belong to “Hindu” religion and that might be the reason why no association was found among the religion and diarrhoea in under-five children. A study done in Uttar Pradesh, India to find the association between recurrent flood and prevalence of diarrhoea in under-five children also found that there was no significant association between religion of the household and prevalence of diarrhoea in under five children (69).

Children more than 9 months of age who are eligible to receive Vita-A and received it were found to be 71% in NFHS-3 where as in the present study it was found to be 65%.No association was found between Vitamin-A supplementation and diarrhoea among under five children. This is similar to a masked controlled field trial in India which gave low dose of Vitamin-A supplementation for 52 weeks.(70) and a study conducted among pre-school children in 34 villages in Indonesia in 1990 (71).

According to NFHS-3 the children 12-23 months who have received measles vaccine was 81.1%. In the present study it was found that the measles vaccination rate was 65% among the 9 month and older child .No association was found among measles vaccination and diarrhoea among children. This may be explained from the point of view that the protective effect of measles immunization on Diarrhoeal morbidity is limited to "with measles diarrhoea" (1 week-pre rash-onset and 4 weeks-post rash-onset) and post measles diarrhoea (4-26 weeks post rash-onset) (59), where as the present study considered all the children within the age group of 5 and also irrespective of the measles outbreak or epidemic. Similar observations were found in one of the study done in India where there was no significant difference in diarrhoea attack rates in immunized children (1.6 attacks/children/year) in comparison to non-immunized children(1.5 attacks/children/year). The mean duration of diarrhoea in both the groups was 2.6 days. The prevalence of diarrhoea was also not significantly different in both the groups (72).

It was also observed in the study that the missed opportunity rate for both measles and vitamin-A was around 4% and 3% respectively. Though the figures are not alarmingly high still service delivery mechanism can be improved to include these children to enhance the coverage.

According the present study breast feeding was found to be a common practice in the study area. Almost all the children (99%) were breast fed ever. It was also observed that around 70% of mothers were breastfeeding during the time of study. In the bivariate analysis it was found that only the current Breast feeding status was associated with diarrhoea where as in multivariate model it loses association. The reason might be Rotavirus gastroenteritis is the leading cause of diarrhoea among children (73). And the impact of breast feeding on decreasing the effect of rotavirus exits till the child is breast fed. Studies also reveal that no long lasting effect of breast

feeding was found against severe diarrhoea caused due to rotavirus. This finding is in consistent with another study done in Lalitpur district of Nepal where no significance difference in diarrhoea occurrence was found among the children who are exclusively breast fed and among 37-48 months children who are not breast fed (74). A study in Congo also shows that breast feeding status was not significantly associated with diarrhoea out come in under-five children. However there are studies who suggest that Breast feeding helps in protecting the Vita-A deficiency and protects the child till 3 years. One of the major lacunas of the study was that no information was obtained about the duration of breast feeding for the children otherwise a concrete analysis could have made about the association of breast feeding and diarrhoea in the sample population.

Nutritional status of the child has been considered as one of the risk factor for diarrhoea and ARI in several cohort studies (75). However this study failed to show an association between any of the three nutritional statuses of the children finalized via anthropometric measurement during the study (weight for age, weight for height and height for age). Though wasting which is the form of acute malnutrition was as high as 23% in the study area it failed to show any association with diarrhoea in bivariate analysis. Even though the associations was too weak to allow for inclusion in multivariate analyses still considering the previous literatures it was included in the multivariate model but still it failed to show any significance. Findings of this study agree with findings from a cohort study done in Guinea Bissau (35). This cited study suggests that in Thailand diarrhoea in children were associated with factors other than the nutritional status of a child, similar observations were made by the study done by calistus which also showed that there was no significant association between nutritional status and diarrhoea in the under five children in the secondary analysis of MICs Thailand survey(76). So it seems more studies should be done to clarify this unanticipated observation.

5.1.3. Association between socioeconomic factors and Diarrhoea

In relation to the association between educational level of the mother and diarrhoea this study did not find any significant association. The findings are in contrary to studies in other countries which have shown that mother's education is associated with diarrhoea in children (35). It is expected that educated mothers/caretakers are more aware about the importance of hygiene, better childcare and feeding practices, and are more protective towards disease causation factors and preventive measures. However a study done in Philippines reflects that the protective effects of mother's education on outcome of diarrhoea in child vary in relation to the socio-economic environment where the mother lives. Mother's education acts as a protecting factor in socially and economically advantaged community but not in the disadvantaged community (77). This may be analyzed that though the mother has adequate knowledge about the risk factors related to diarrhoea due to poor sanitation and surroundings which was beyond her control failed to show any impact of mother's education and diarrhoea in under-five children. But to substantiate the hypothesis further studies should be done. Another hypothesis for this unexpected result between high education and high prevalence could be that in spite of high education the mothers did not have specific health education on hygienic practices and the oral-fecal transmission of diarrhoea but to substantiate the hypothesis further studies should be done.

In the present study the BPL status which is the symbolic of the socio-economic status of the household was not found to be associated with diarrhoea in under-five children. This finding is contrary to with several studies which have found significant association between household economic status and diarrhoea in children (36,78).Generally it was believed that children living in poor households have higher diarrhoea rates than their wealthier counterparts, probably due to unsanitary environments in the home and poor child hygiene and inadequate access to sanitary facilities, however some studies also found that there is no significant association between wealth index of the household and diarrhoea outcome in the under five children (79). A study done in Brazil also shows that diarrheal disease among the children in the different socio-economic group from the same urban

community in a developing country shows different epidemiology and etiology. The reason for no association in the study may be though BPL certification is the symbolic of poor socio-economic status; it does not bring much difference in the behavioral aspects and the surrounding environment of the household which make the child more susceptible towards risk of diarrhoea.

5.1.4. Association between Environmental factors and Diarrhoea

This present study found that there is significant association between sources of drinking water and Diarrhoea in under than five children. This finding is consistent with other studies who also emphasized the importance of drinking water in relation to Diarrhoea morbidity in under-five children. (28,29,30). The present study found that the prevalence of diarrhoea was more in the household who use public piped water as compared to the households who use hand pump and bore well. This reason might be after the diarrheal epidemic the government has ensured the availability of safe drinking water through hand pump and bore well as these can be constructed quickly and need less infrastructural investment at the same time no investment was done to ensure the safety of existing public piped system as a result of which it has become an unsafe source of drinking water. Another reason which may be attributed to this is the unsafe water handling practice by the community. This concurs with one of the study done by WHO in India which reflects that adverse impact of unsafe drinking water despite of increased access to safe drinking water and regardless of the quality of water at source and how lack of hygienic practices and limited access to sanitation facilities worsen the condition more.

Location of the water source was not found to be statistically significant in the present study. The reason might be only 1% of the households in the study population had the water source inside their premises where as rest 99% had it outside their house.

Distance to the water source from the household was found to be associated with Diarrhoea in under-five children. The bivariate analysis shows that the households for whom the distance to water source was less than 10 minutes had higher prevalence of diarrhoea in children as comparison to them for whom the water source was beyond 10 minutes of distance. The possible reason might be due to

proximity and convenience of the water source the households use the water source irrespective taking adequate safety measures to treat and store it properly.

Treatment and main source and of drinking water was found to be associated with diarrhoea children in the bivariate analysis where as it lost its significance in the multivariate model. It was observed that 90% of households in the study population had the access to safe drinking water whereas only 67% of household treat water to make it safe for drinking. Further analysis found that the method of treatment had no association with diarrhoea in children from the above two findings it may be inferred that though people treat water before drinking might be they are not aware about the right method of treating it as a result of which the drinking water they were consuming was not safe actually. A case control study done in Tanzania showed no association between different water sources and diarrhoea in children (81).

This study did not show an association between kind of toilet facility used by the household and diarrhoea in children. Open defecation which was found to be most common (99%) in the study population is related to poor hygienic practices which can result into food and water contamination leading to infections in children. The high rate of open defecation is also attached to the behavioral aspects of the community. Though after lot of interventions the community is now aware about the bad impacts of open defecation but due to poor behavioral practices they are still following open defecation

This study found that there is association between child feces disposal method and diarrhoea in children. The study shows that children whose feces are left in open had higher prevalence of diarrhoea as compared to those whose feces are disposed properly. This observation was similar to a study done in Srilanka where the children from the such families were less likely to develop diarrhoea where their excreta was disposed to the latrine in comparison to those families who dispose excreta of their children improperly (80).

The study found no significant association between place of cooking inside the house and outside the house and diarrhoea in under-five children. However the bivariate analysis shows that the prevalence of diarrhoea was more for those households who cook inside the home as compared to those who cook outside the home. As discussed earlier in this paper a possible reason might be due to poor

sanitation and hygiene practices in inside the house more contaminated as compared to the environment outside the house. As the present study has not explored more about the cooking practice followed by the community which might be a probable reason for high prevalence of Diarrhoea even after having separate kitchen, further studies need to be done to explore the hypothesis. The hypothesis needs to be supported by Evaluation of Fecal Contamination (Escherichia coli *in the water, as well as* Enterococcus faecalis*)* in the kitchen and other cooking places (82). In Contradiction with few other studies (reference) the present study found significant association between separate room for cooking and Diarrhoea in under-five children. An analysis of NFHS-3 Madhya Pradesh (India) shows that there was no significant association between room for cooking and diarrhoea in under-five children (34).

This study found no association between ICDS service utilization and diarrhoea among under-five children. However the study has shown that the availability and accessibility of ICDS services was quite high in the study area. All the 30 sites had the functional ICDS centers available in the village with a high enrolment of both children and mother. This finding is similar to the report published by World Bank which shows in Orissa the enrolment of undernourished children in ICDS was as high as 95% as compared to other states of India (37). According to the report studies estimated the association between having an ICDS centre in a village and the likelihood that a child is underweight, and find little or no association between the presence of an ICDS centre and child nutritional status. Using both the 1992/93 and the 1998/99 NFHS data, the report analyze that the program appears to have a significant and positive effect on nutritional outcomes. In multivariate model of cross-sectional data collected in Kerala, Rajasthan and Uttar Pradesh between 2000 and 2002, researcher found that children who live in villages with ICDS centers are not significantly less likely to be underweight or ill than other children. There might be two reasons which attributed to no association between diarrhoea and ICDS service utilization. First though the coverage of ICDS services has increased there is no mechanism at present to ensure the quality of services provided at the ICDS centre. Although communication for behavior change through the ICDS is a crucial weapon against poor health and malnutrition, it appears that any information that the AWW is conveying to mothers is not being communicated effectively enough to impact

positively on mothers' behavior. Secondly due to low literacy and poor behavioral practices people failed to accept the recommendations given by the ICDS worker. According to the WB report the ICDS III baseline/ICDS II end line survey reveals a very large discrepancy between the child's measured weight and the mother's subjective assessment of her child's growth status: in Kerala, all mothers think that their children are experiencing normal growth, and in Uttar Pradesh where underweight prevalence in the ICDS III baseline/ICDS II end line sample is 46%, 94% of women describe their children's nutritional status as "normal" (24).

5.2: Conclusion

The main objective of the study was to assess the association between demographic, socio-economic, behavioral and environmental factors with under-five Diarrheal prevalence and it has found a much higher prevalence in dry season (42%) than ever reported so far by other measurements methods like NFHS or DLHS . In other words it can be said that it's a study of prevalence or frequencies of the different practices and reasons among the mothers or care takers in the area in relation to diarrhoea outcome in their children

The study provides the information about the factors which are significantly associated with diarrhoea in under-five children. The study highlights the fact that there was higher rate of prevalence of diarrhoea even in non-peak periods (rainy season) and the prevalence was highly concentrated in the children with the age group of 7-12 months in both the bivariate and multi-variate analysis. There was no gender difference as far as diarrhoea outcome is concerned other socioeconomic-demographic factors like age of the mother, educational level of the mother, religion and cast of the household was not found to have association with diarrhoea in children.

It was also found that the current status of breast feeding and Vitamin-A supplementation though had significance in the bivariate analysis but it lost it association in the multivariate while other factors are controlled found that the source of drinking water was highly associated with diarrhoea in under five children.

Other factors associated with child like measles vaccination, ICDS service delivery and nutritional status of the child were not found to be significantly associated with diarrhoea in under-five children.

Diarrhoea is water borne disease. The environmental factors which are found to be associated with diarrhoea in bivariate analysis were main source of drinking water, distance to the water source, treatment of water, child's feces disposal method and separate room for cooking where as only source of drinking water and separate room for coking maintained their significance in the multivariate model.

5.3: Limitation of the study

- ❖ As the study was conducted in one of the remote districts of the state which had previous history of diarrhoea epidemic due to poor sanitation, hygiene and unavailability of water the result of the study cannot be generalized to the population of Odisha who has better status than the study population.
- ❖ Recall period for diarrhoea was two months in the present study which might have contributed to recall bias
- ❖ The study did not include important health practices related variables like period for breast feeding and other behavioural aspects like hand washing which were considered important in many other diarrhoea related studies.
- ❖ The high rate of illiteracy among the rural tribal women might have contributed to information distortion.
- ❖ As no standardised and objective tool was used to measure the distance of the water source, the judgment of the research assistant was considered the measurement of distance which might have lead to inter-researcher bias.
- ❖ As the study is a cross sectional survey it doesn't establish the causation among other determinants of diarrhoea.
- ❖ Though the study discussed about various source of drinking water it did not investigate about the quality of drinking water which is considered as the most important factor as far as diarrhoea in children is concerned.

❖ Due to limitation of laboratory resources, funding and time the study could not investigate the agent's microorganisms that are the cause of diarrhoea in under-five children in the study area.

5.4: Recommendations

Considering the high prevalence of diarrhoea in the study population and with the past history of diarrhoea epidemic still lot of interventions are needed at the policy level to combat this threat of diarrhoea. Only with sustainable long term interventions the diarrhoea epidemic can be avoided in the coming future.

5.4.1 Recommendations for the policy and implementation level:

- As children those aged 7-12 months have higher risk of getting diarrhoea they should receive special attention in prevention efforts.
- Considering the contamination of public piped system special focus should be given for maintenance of the system.
- Awareness about right water treatment methods should be emphasized.
- Special intervention plans should be made to address the high rate of malnutrition in the community.
- Emphasis should be given on imparting Health Education to mothers and care takers about diarrhoea in children.
- Considering the high prevalence of diarrhoea IEC (Information Education communication) campaign in local language should be conducted on regular basis
- Service delivery mechanism of ICDS should be more focused on providing qualitative services to the needy rather than just enhancing the coverage.

5.4.2 Recommendations for the Local health Workers

- The local health workers, Anganwadi worker, ASHA worker should work in one unit to promote health education and anti-Diarrhoeal medicines should be readily available with them all year round and not during rainy season only to avoid any epidemic situation.
- Considering the high burden of diarrhoea on the age group of 7-12 months mothers should be made aware about prolonged breast feeding.

- Special attention should be given to minimize the missed opportunity cases in immunization.

5.4.2: Recommendation for future Research:

- To reduce recall bias, it is recommended to use one month recall period instead of two month for studies on diarrhoea conducted during low prevalence (as dry seasons).
- Other important factors like hand washing and period of exclusive breast feeding should be included in cross-sectional studies to have more realistic results.
- It would be more useful if studies about the quality of drinking water can be done during the survey. It's very simple test which can be done on site with ease.
- It is recommended to study the hypothesis that the relationship between the high level of general education and not reduced prevalence of diarrhoea is due to poor knowledge of hygienic norms in oral-fecal transmission of diarrhoea.
- It is recommended to include the health seeking practice of the community in such studies to have a holistic idea about community's approach towards diarrhoea.
- Further research, in the form of longitudinal studies, is needed to understand the complete dynamics of diarrhoea in children and associated factors.

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APPENDIX-A

Questionnaire on demographic, socio-economic, and environmental factors associated with diarrhoea morbidity in children under five

—— —— —— —— —— —— —— —— —— —— —— —— —— —

Interviewer Code: ..... Village code: ...../..... Respondent code: .....

Section 1: Basic Information

1.1 In what month and year were you born?

Month .....

Don't know month .....

1.2 How old were you at your last birthday?

Year .....

Don't know year .....

Age in completed years: .....

1.3 Have you ever attended school? (if no skip to 1.5)

Yes ☐ No ☐

1.4 What is the highest standard you enrolled?

Standard: .....

1.5 **What is your religion**?

Hindu ☐

Muslim ☐

Christian ☐

Other ☐

1.6 Do you belong to a scheduled caste, a scheduled tribe, other backward class, or none of these?

Scheduled caste .....

Scheduled tribe .....

OBC .....

None of them .....

1.7 Does this household have a BPL card?

Yes ☐ No ☐ Don't Know ☐

Section 2:Child and childhood Diarrhoea

2.1 How many under five children do you have in your household?

Total: .....

Male : .....

Female : .....

Sl No.	Name	Age(completed in months)	Sex
1	(Name of the youngest child)		
2			
3			
4			
5			

2.2 Has (NAME) had diarrhoea in the last two month?

Yes .....

No .....

Don't Know .....

2.3 The last time (NAME OF YOUNGEST CHILD) passed Stools, what was done to dispose of the stools?

Child used toilet or latrine ☐

Put/rinsed into toilet or latrine ☐

Put/rinsed into drain or ditch ☐

Thrown into garbage ☐

Buried ☐

Left in the open ☐

Other (specify)..... ☐

Don't know ☐

Section 3: Immunization and breast feeding

3.1 Do you have a card for (name) where vaccinations can be seen?

Yes ☐ No ☐

If yes can I see that?

Vaccination	Day	Month	Year
MEASLES			
VITAMIN A (LAST DOSE)			
VITAMIN A (NEXT-TO-LAST DOSE			

3.2 If No then (name) ever had a vaccination?

Yes ☐ No ☐

3.3 Did you ever breastfeed (NAME)? (if no skip 3.4 and 3.5)

Yes ☐ No ☐

3.4 Are you still breastfeeding (name)?(if yes skip 3.5)

Yes ☐ No ☐

3.5. (if No for Q 3.4)For how many months did you breast feed (name)?

Months:

Measure the height and weight of the child and Record.

Height: -----CM

Weight: -----KGs

Section 4: Utilization of services of ICDS (integrated child development Scheme)

4.1 Did during last 12 months (name) has got any benefit in the form of supplementary food, growth monitoring, health checkups or health education from the anganwadi/ICDS centre? **(if no skip to 4.3)**

Yes ☐ No ☐ Not at all ☐

Crosscheck From the local ICDS register:

4.2. In last 12 months how often has (name) has received food from the anganwadi/ICDS centre?

All most daily ☐ At least once in a week ☐ At least once in a month ☐

Less often ☐ Don't know ☐

Crosscheck From the local ICDS register:

4.3. In the last 12 months how often (name) weight has been measured at the Anganwadi/ICDS centre?(if no skip to next section)

Not at all ☐ At least once in a month ☐ At least once in 3 month ☐

Less often ☐ Don't know ☐

Crosscheck From the local ICDS register:

4.4 After (name) was weighed did you ever received counselling from the Anganwadi/ICDS centre?

Yes ☐ No ☐ Don't Know ☐

Section 5: Drinking water and Sanitation and Hygiene

5.1 What is the main source of drinking water for members of your household?

PIPED WATER

PIPED INTO DWELLING ☐ PIPED TO YARD/PLOT ☐

PUBLIC TAP/STANDPIPE ☐ TUBE WELL /BOREHOLE ☐

DUG WELL

PROTECTED WELL ☐ UNPROTECTED WELL ☐

WATER FROM SPRING

PROTECTED SPRING ☐ UNPROTECTED SPRING ☐

RAINWATER ☐ TANKER TRUCK ☐

CART WITH SMALL TANK ☐

SURFACE WATER (RIVER/DAM/ LAKE/POND/STREAM/CANAL/ IRRIGATION CHANNEL ☐

BOTTLED WATER ☐

OTHER (specify) .....

5.2 What is the main source of water used by your household for other purposes suc cooking and hand washing?

PIPED WATER

PIPED INTO DWELLING ☐ PIPED TO YARD/PLOT ☐

PUBLIC TAP/STANDPIPE ☐ TUBE WELL /BOREHOLE ☐

DUG WELL

PROTECTED WELL ☐ UNPROTECTED WELL ☐

WATER FROM SPRING

PROTECTED SPRING ☐ UNPROTECTED SPRING ☐

RAINWATER ☐ TANKER TRUCK ☐

CART WITH SMALL TANK ☐

SURFACE WATER (RIVER/DAM/ LAKE/POND/STREAM/CANAL/ IRRIGATION CHANNEL ☐

OTHER (specify) .....

5.3. Where is the water source located?

IN OWN DWELLING ☐ IN OWN YARD/PLOT ☐ ELSEWHERE ☐

5.4. How long does it take to go there, get water, and come back in one trip?

MINUTES ☐ ON THE PREMISES ☐ DON'T KNOW ☐

5.5 Do you treat your water in any way to make it safer to drink?(if no skip to 5.7)

Yes ☐ No ☐ Don't Know ☐

5.6 What do you usually do to the water to make it safer to drink?

BOIL ☐ USE ALUM ☐ ADD BLEACH/CHLORINE TABLETS ☐

STRAIN THROUGH A CLOTH ☐

USE WATER FILTER (CERAMIC/ SAND/COMPOSITE/ETC.) ☐

USE ELECTRONIC PURIFIER ☐ LET IT STAND AND SETTLE ☐

OTHER ☐ DON'T KNOW ☐

5.7 What kind of toilet facility do members of your household usually use?

FLUSH OR POUR FLUSH TOILET

FLUSH TO PIPED SEWER SYSTEM ☐

FLUSH TO SEPTIC TANK ☐

FLUSH TO PIT LATRINE ☐

FLUSH TO SOMEWHERE ELSE ☐

FLUSH, DON'T KNOW WHERE ☐

PIT LATRINE

VENTILATED IMPROVED PIT (VIP)/BIOGAS LATRINE ☐

PIT LATRINE WITH SLAB ☐

PIT LATRINE WITHOUT SLAB/open pit ☐

TWIN PIT/COMPOSTING TOILET ☐

DRY TOILET ☐

NO FACILITY/USES OPEN SPACE OR FIELD ☐

OTHER ☐

5.8 Is the cooking usually done in the house, in a separate building, or outdoors?

IN THE HOUSE ☐ IN A SEPARATE BUILDING ☐

OUTDOORS ☐ OTHER ☐

5.9 (if 5.10 is "IN THE HOUSE") **Do you have a separate room which is used as a kitchen**?

Yes ☐ No ☐

Appendix-B
Informed Consent Form

Dear Participants,

Please consider this information carefully before deciding whether to participate in this research.

Objective of the research: To find out the factors which are significantly associated with diarrhoea among under five children in diarrhoea affected blocks of Rayagada District.

Study Population: The population in this study will be the pair of under five children and his/her mother of Bissumcuttack ,Kashipur,K.alyansinghpur, Jemadeipentha and Gudari Block of the District. A total of 630 such pairs will participate in this study.

Role of participant in this research: You will be requested to respond to a questionnaire regarding socio-economic, environmental and demographic factors associated with diarrhoea morbidity in children under five. During the interview the height and weight of your child will be measured with the help of anganwadi didi to check the nutritional status.

Time required: Participation will take approximately 15-20 minutes to complete.

Benefits/Risk: There is no risk in participating in this study as no intervention will be administered to your child.

Confidentiality: Your participation in this study is anonymous and will remain confidential. There will be no link between your responses and your identity. Data will be presented in an aggregated way and there is no way to link the result with your identity.

Participation and withdrawal: Your participation in this study is completely voluntary, and you may withdraw at any time without penalty (no questions asked).

Agreement:

The nature and purpose of this research have been sufficiently explained and I agree to participate in this study. I understand that I am free to withdraw at any time without incurring any penalty.

Participant's Signature:_____ Date: _____

Witness Signature:_____ Date: _____

Appendix C: Budget

No	Activities	Unit Price (THB)	Quantity	Total (THB)
1.	**Pretesting** Print + Photocopy Quest + Informed consent form	10	30 sets	300
	Stationary	150	1 set	150
2.	**Data collection** Photocopy Quest + Informed consent form	10	700 sets	7000
	Stationary	150	5 set	750
	Interviewers per diem	200	10pers x 5days	10000
	Miscellaneous			5000
	Transportation cost during study	12000	1 trip	12000
	Training for questionnaire use (stationary + photocopy quest + perdiem)	300	5 persons	1500
	Hiring place for training	500	1 day	1300
3.	**Document printing** Paper + printing			1000
	Photocopy (exam + final submit)	0.5	12 x 400 pages	2400
	Stationary	500	1 set	500
	Binding Paper (exam)	150	7 set	1050
	Binding paper (submit)	150	7 set	1050
4.	Air fare of the researcher to the study area			10000
	Total			**54,000**

APPENDIX D Time schedule

DURATION: 1 YEAR												
No.	**Research process/ activities**	**2012 (months)**						**2013 (months)**				
		7	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**	**5**
1.	Research question formulation and literature review											
2.	Proposal writing											
3.	Ethical approval											
4.	Field work: ask for corporation and recruit samples, Pre-test											
5.	Field work: data collection											
6.	Data analysis											
7.	Report writing and presentation											

Appendix E: Ethical Approval

Government of Odisha
Health & Family Welfare Department

No. 6438 /H., Dt: 23.2.13
Scheme-I-Med-81/13

From

Shri Sibabrata Dash, IAS,
Addl. Secretary to Government.

To

The Team Leader,
SHRMU,Odisha,Bhubaneswar.

Sub: Approved minutes of the Ethical Committee meeting held on 20.02.13 under the Chairmanship of Principal Secretary to Govt. Health & Family Welfare Department.

Sir,

I am desired to enclose herewith the approved minutes of the Ethical Committee meeting held on 20.02.13 under the Chairmanship of Principal Secretary to Govt. Health & Family Welfare Department for necessary action at your end.

Yours faithfully,

23/2/2013
Additional Secretary to Government

Memo No. 72 / Dated. 23/02/2013.

Copy along with the enclosures forwarded to Ms. Anna Custers, Research Manager, J-PAL South Asia / Mr. Debajyoti Mohapatra, MPH Student of Chulalongkorn University, Thailand / Dr. S.M Kadam, Asst. Prof, IIPH, Bhubaneswar / Dr. Bikash Patnaik, Jt. DHS (TB), Odisha / Dr. Prameela Baral, Deputy Director (IDSP) for information & necessary action.

23/02/13
Team Leader, SHRMU cum
Member Convenor, Ethical Committee

Memo No. 73 / Dated. 23/02/2013

Copy along with the enclosures forwarded to DHS, Odisha / DPH, Odisha / DFW, Odisha / Asso. Prof., RHTC, Jagatsinghpur / Deputy Director (Training) / Dr. Anna Kerketta, Scientist-D for information & necessary action.

23/02/13
Team Leader, SHRMU cum
Member Convenor, Ethical Committee

Minutes of the Ethical Committee meeting held on 20.02.13 under the chairmanship of Principal Secretary to Govt. Health & Family Welfare Deptt.

Venue: Conference Hall, Health & FW Deptt. Time : 10.30 AM

At the outset, Jt. DHS SHRMU welcomed the members present and briefly outlines the research proposals submitted for approval by the committee. Then researchers presented their research objective, methodology, expected outcome and Budgetary requirements.

The members present in the meeting is placed at Annexure-1

Details of the proposal and decisions taken in the meeting is given below

Project	Proposal Submitted By / Investigator	Total Budget / Source of fund / Duration	Decision
Requested to postpone distribution of IFA tablet supplementation under Anaemia Control Programme	• J-PAL South Asia • Ms. Anna Custers, Research Manager	• Nandi Foundation has signed a MOU with Govt. Of Odisha, School & Mass Education and recently started distributing iron fortified meals at 226 schools and non-fortified meals at 151 schools, totalling 377 schools in 5 blocks of Keonjhar Districts. • She requested that the Govt. may be kind enough to postpone the IFA Tablet distribution in those schools till Jan 2014.	**Approved** It is decided to post pone the IFA distribution in 377 schools till January 2014. The concept note and research paper of the organization need to share with the Health & FW Deptt.
Demographic Socioeconomic & environmental factors associated with diarrhoea Morbidity in children under 5 in rural Odisha: A study of Rayagada District, India	• MPH Student of Chulalongkorn University, Thailand • Mr. Debajyoti Mohapatra,	• Own Source	**Approved** He is instructed to share the study results to the Deptt. and Concerned University. Confidentiality is to be maintained.
Assessment of Utilization of AYUSH doctors services in Odisha	• IIPH Bhubaneswar • Dr. S. M. Kadam, Associate Professor	• Rs. 11,43,065/- • OHSP fund at SHMRU, O/O DHS, Odisha • March– August 2013	**Approved** It is decided to include AYUSH Doctors engaged under MHU in the study. No public is involved hence

Project	Proposal Submitted By / Investigator	Total Budget / Source of fund / Duration	Decision
			ethical committee approved
Estimation of burden of Tuberculosis in the district of Jagatsinghpur, Odisha- A cross sectional Overview	• State TB Cell • Dr. Bikash Patnaik, Jt DHS,TB	• Rs. 15 .30 Lakh • OHSP fund at SHMRU, O/O DHS, Odisha • 6 months (March to August 2013)	**Approved** The Committee instructed to re-examine the budget in consultation with DHS, Odisha and limit the budget within 10-12 lakhs and get approval of the budget separately. This study is aimed at public welfare in present public health scenario.
Study of Risk Factors for Acute Diarrhoeal Disease Outbreaks in Vulnerable Districts like Nabarangpur, Angul, Ganjam, Kalahandi of Odisha	• State Surveillance Unit, IDSP • Dr. Prameela Baral, Deputy DHS,IDSP	• Rs. 2. 47 lakh • OHSP fund at SHMRU, O/O DHS, Odisha • 3 months (March to May 2013)	The committee instructed to include Papadahandi block of Nabarangapur district in the study. The study identifies only risk factor, no personal data, hence **Approved**.
Practicing Hand Hygiene among primary school children of tribal residential schools will improve the overall hygienic practices of the community – An Intervention Study	• State Surveillance Unit, IDSP • Dr. Prameela Baral, Deputy DHS,IDSP	• Rs. 1. 75 lakh • OHSP fund at SHMRU, O/O DHS, Odisha • 3 months (March to May 2013)	**Approved.** Health promotion effort.
Role of Laboratory Surveillance in Detection of V. Cholera in Vulnerable Tribal Districts to Forecast early Outbreak in Odisha, 2013	• State Surveillance Unit, IDSP • Dr. Prameela Baral, Deputy DHS,IDSP	• Rs. 1. 84 lakh • OHSP fund at SHMRU, O/O DHS, Odisha • 3 months (March to May 2013)	**Approved.** The confidentiality of the persons to be kept by the investigator.

The meeting was ended with vote of thanks to the chair.

Principal Secretary to Govt.
Cum Chairperson, Ethical Committee

VITAE

A. Personal details

Name: Mr Debajyoti Mohapatra

Address: Plot No: 184, Co-operative Housing Colony Bhubaneswar Orissa
Pin: 751024

Phone No: 0850573703

E-mail: debajyoti.mohapatra@gmail.com

Date of Birth: 12/04/1985

Nationality: Indian

Sex: Male

B. Educational Qualification

- Post Graduate Diploma in Hospital and Health Management with specialization in Health Management (65%) from Indian Institute of Health Management & Research (IIHMR), Jaipur, Rajasthan. (2006-2008)
- Bachelor of Arts with Economics Honors (62% with distinction) from Utkal University, Bhubaneswar, Odisha. (2003-2005)

C. Work Experience

- State consultant Hospital Administration and Quality Assurance under National Rural Health Mission, Department of Health & Family Welfare, Government of Odisha Since May 2011 to May 2012**.**
- Worked as District Program Manager (D.PM) in Rayagada district of Orissa under National Rural Health Mission from February 2009 to April 2011.
- Worked as District Program Coordinator (D.P.C) in Sabarkantha district of Gujarat under National Rural Health Mission from December 2007 to January 2009.