IMPACT OF WATER, SANITATION AND HYGIENE EDUCATIONAL INTERVENTIONS ON UNDER-FIVE DIARRHEAL DISEASE IN JIGJIGA RURAL AREAS, EASTERN ETHIOPIA: A CLUSTER RANDOMIZED TRIAL

BY

ABDIWAHAB HASHI

ABSTRACT

Diarrheal diseases are still the major cause of morbidity and mortality among children in many developing countries, including Ethiopia. There is a general agreement that the cause of child mortality and morbidity in developing countries is multi-factorial. Interaction of socioeconomic, biological, behavioural and environmental factors influences the survival of children. Though the relationships between these factors and the occurrence of diarrhea in children and the impact of WASH interventions on diarrheal diseases have been documented elsewhere, there are limited studies in Ethiopia in general and in Fafan Zone, Somali region particularly. The present study assessed the socio-economic, environmental and behavioural factors associated with the occurrence of diarrheal disease among under-five children and the impact of WASH interventions on diarrheal diseases among under-five children in Fafan Zone. The main objective of this study is to assess, describe and evaluate the factors associated with under-five diarrheal diseases, the water quality and water and sanitation hygien interventions and their impact on under-five diarrheal diseases in Jigjiga Woreda, Fafan Zone, Somali region, Eastern Ethiopia from June 2014 to December 2014. For the first objective, community based cross-sectional study will be used, with quantitative data collection method. One thousand, Four hundred and Seventy four mothers/care takers of index under-five children living in the households will be selected randomly from all Kebele of Jigjiga Woreda in Fafan Zone will constitute the study population. Data will be collected using structured and pre-tested questionnaire will be entered into a computer, edited and analyzed using SPSS for windows version 16. For the second objective qualitative study using in depth interview and focus group discussion will be conducted. For the third objective, bacteriological laboratory assessment of drinking household water quality will be done for the selected randomized intervention and control community households before and after the intervention trial. For the fourth objective, Community cluster randomized trail study will be done to study the impact of water and sanitation hygiene interventions on under five diarrheal diseases in the rural kebeles of Jigjiga Woreda. A total of 23 clusters was calculated to estimate diarrhea incidence in the control group, at the 5% significance level (2-tailed) with a power of 80%, 10% drop out and design effect of three from clustering. The intervention of this study will be an educational intervention of water and sanitation hygiene. The fifth objective is to review systematically published articles to evaluate the effectiveness of WASH interventions in Ethiopia.

SPATIO-TEMPORAL ANALYSIS OF MALARIA AND ITS RISK FACTORS: A STUDY COUPLING THE MAGNITUDE AND DETERMINANTS OF MALARIA IN AN EPIDEMIC PRONE AREA OF SOUTHERN ETHIOPIA

BY

ADMASU TASSEW TSEGAYE

ABSTRACT

In Ethiopia about 75% of the land mass is malarious putting above two-third (68%) of the country’s population at risk. Major epidemics have occurred at approximately 5-8 years intervals. Certain environmental, human related and entomological factors are indicated as determinants of malaria in the country, but the studies mainly emphasized on altitude, rainfall and temperature relations and lowland settings are much omitted. The current research aims to thoroughly analyze spatial-temporal
The dynamics of malaria with its environmental, human and vector related risk factors. The research will be conducted in Mirab Abaya District, Southern Ethiopia between January 2014 and June 2015. Repeated cross-sectional survey in community based prospective approach will be conducted for the parasitological data. The sample size will be estimated by single proportion estimate. Anopheline mosquito larva will be collected along with habitat and physico-chemical characterization of the breeding sites. Weather data will be collected from national meteorological agency (NMA). Pyrethrum space spray and light traps will be used to collect adult vectors. Microscopic identification aided with appropriate keys will be employed and polymerase chain reaction (PCR) will be used to identify sibling species which cannot be identified by morphology. Blood fed vectors of the sample will be investigated for the blood meal source by enzyme linked immunosorbent assay (ELISA). Stata software (Stata corp, 2009, Chicago) Stata/SE for windows version 11 will be used for the data analysis. The association between independent variables and the respective outcomes will be determined by Pearson correlation. Principal component analysis will be implemented to calculate wealth index of households. All important predictor variables will be fitted to logistic regression model to determine the relative contribution of each to the outcome of interest (malaria prevalence). Relative risk will be calculated to compare the risk of malaria among individuals, household, and villages characterized by varying risk factors. This research work is expected to clearly indicate the magnitude and major risk factors of malaria in the study area so as to complement missing gaps in the implementation of control measures within the scope the study.

ASSESSMENT OF THE EFFECT OF WATER, SANITATION AND HYGIENE INTERVENTIONS ON ACTIVE TRACHOMA ELIMINATION IN EAST GOJJAM ZONE, AMHARA NATIONAL REGIONAL STATE, ETHIOPIA

BY

BESELAM TADESSE

ABSTRACT

Trachoma is a contagious infection of the eye, caused by the bacteria Chlamydia trachomatis. This preventable disease can lead to blindness if left untreated. Water, sanitation and hygiene (WASH) are a crucial but all too often underplayed part of the prevention and control of Neglected Tropical Diseases (NTDs). Improving the sanitation, hygiene, and access to clean water within a community will lower the prevalence of active trachoma in a sustainable manner. Unless if only surgery and antibiotic therapy are provided, with little effort to make sustainable changes in hygiene and sanitation, only the symptoms of the disease, not the causes, will be addressed. The African region is the most trachoma affected area in the world with in the region Ethiopia is estimated to have the highest burden of disease. Therefore to tackle the burden of trachoma the WHO endorsed SAFE strategy has been implemented throughout all districts of the Amhara National Regional State since 2007. The goal of this PhD thesis is to evaluate the effect of Water, Sanitation and Hygiene interventions on trachoma control in East Gojjam Zone, Amhara National Regional State, Ethiopia. Specifically to determine whether the implementation of SAFE strategy has significantly reduced the prevalence of trachoma, to assess the attitude and knowledge of East Gojjam zone communities towards the role of hygiene practices and latrine utilization on trachoma control, to assess the continuity of water supply and sanitation services and to qualitatively investigate the challenges of household and community level WASH accesses and practices in East Gojjam zone. This study will be carried out in one of the largest Zone of Amhara National Regional State, East Gojjam zone. The study have both quantitative and
qualitative components. For the study that involves quantitative data comparative cross sectional and single population based cross sectional study designs utilizing multistage cluster sampling will be used to see the effects of SAFE strategy on trachoma elimination and to measure the community attitude towards the role of hygiene practices and latrine utilization as well as to assess the continuity of water supply and sanitation services respectively. Pretested and structured household questionnaires will be administered to the sampled household heads. Twelve ophthalmic nurses or ophthalmic medical assistants and three health extension workers will be recruited for data collection and supervision respectively. A separate team will carry out 24 FGDs involving 120 men and 120 women. Thirty six in-depth interviews will be conducted with administrators, health extension workers and household heads by data collectors. Besides, secondary data will be collected from the selected gott respective health and Water Resources Development offices.

DETERMINING THE LEVEL OF LATRINE ADOPTION, USAGE AND THE ASSOCIATED BEHAVIORAL AND SOCIO-CULTURAL FACTORS: LONGITUDINAL STUDY AMONG RURAL HOUSEHOLDS IN OROMIYA REGION OF ETHIOPIA

BY
FIKRALEM MEZGEBU

ABSTRACT
Sanitation continues to be the challenge for developing countries creating a great impact in under-five child mortality. Evidences indicate open defecation is very prevalent in Ethiopia as a result of low latrine adoption and low latrine use behavior(1-5). Despite this fact, efforts have been made to improve the situations. Many programs on latrine adoption and use invested a lot of resources without bringing significant improvements. Moreover, contradictory evidences on the level of latrine adoption, and use in Ethiopia are creating confusions on program planners as well as policy makers(6, 7). The objective of this study is to determine the level of latrine adoption, latrine use, and behavioral and socio-cultural determinants. This study aimed to determine the current latrine adoption (ownership), latrine use behavior, risk factors and the changes in latrine adoption, latrine use, risk factors in one year duration. Hence, the pattern of changes will be associations will be determined, and it will examine which factors changes when latrine adoption and latrine use behaviors changes The research design is longitudinal study by employing community survey using structured questioner to collect data at two points of the baseline, and after one year. one thousand and sixteen household heads in Oromiya region rural community of siraro will be interviewed. Association will be made on the positive or negative changes in latrine adoption, latrine use behavior, and risk factors. Qualitative method using FGD and Key informant interview will be used to explore and describe the values, beliefs and socio-cultural practices on latrine adoption and use.

DOMESTIC RAINWATER HARVESTING: RELIABILITY, QUALITY AND POINT-OF-USE TREATMENT SYSTEMS IN THE SEMI-ARID CITY OF MEKELLE, ETHIOPIA

BY
GETACHEW REDAE

ABSTRACT
Based on United Nations proxy indicators, 87% of the global population have access to improved water sources. Still, 884 million people are still lacking access to safe water, most of them from developing countries. In Ethiopia, some 30 million people have no access to improved sources to date. It is also identified as a water deficit country starting from the year 2000 and will be one of the water scarce countries by the year 2025 In response to the increasing water scarcity challenge many...
developed countries have grown and adapted many alternative water supply mechanisms, recording remarkable advances in best practices to increase their water access and play a role in mitigating the looming water crisis. Nonetheless, developing countries such as Ethiopia have not yet considered alternative supplementary water supply sources to date. The main objective of this research is thus to determine domestic rainwater harvesting: reliability, quality, and point-of-use treatment using the semi-arid urban city of Mekelle, Ethiopia, as a case study. Longitudinal study design will be used to determine reliability of rainwater harvesting and investigate the spatiotemporal rainwater quality trend. Field experiment and laboratory based experiments will be used to assess the suitability of roof top materials for rainwater harvesting and explore treatment options respectively. This study will also adopt a mass balance approach to determine rainwater harvesting storage reliability. Physicochemical, bacteriological and heavy metal quality of rain water samples will be analyzed following standard methods for generating data. Prior to analysis of the data using statistical tools, univariate quantitative analysis will be used to summarize the frequency distribution and determine the central tendency. We will also use suitable multivariate statistical tools to test our research hypothesis. From the family of multivariate analysis, principal component analysis and analysis of variance will be applied to the complete data set to identify factors affecting rainwater composition for the second and third objectives.

**BIOACCUMULATION OF PERSISTENT ORGANIC POLLUTANTS (POPS) AND MERCURY: IN REFERENCE TO LAKE TANA, ETHIOPIA**

**BY**

**HABIBA GASHAW**

Contamination of surface waters with even low environmental concentrations of toxic chemicals is problematic for several reasons. Many toxic chemicals are relatively resistant to natural degradation or breakdown in the environment and are, therefore, extremely persistent. Methylmercury in the water bodies is absorbed by phytoplankton, ingested by zooplankton and fish. Fishes absorb methylmercury from water as it passes over their gills and as they feed on aquatic organisms. The inorganic salts of mercury are corrosive to the skin, eyes and gastrointestinal tract, and may induce kidney toxicity if ingested. According to Hailu, 2012, Felegehiwot hospital and Bahir Dar Prison discharge their effluents into Lake Tana. Pollution from agricultural (Chere chera) dam silt load and turbidity are increasing. Hailu, (2012) has recommended a more comprehensive systematic study on the impact of waste water that is generated in the town into Lake Tana. And that is why this survey study is proposed to be done on Lake Tana. Sampling sites will be chosen based on human impact on it: littoral vegetation availability; agricultural/industrial runoff and proximity to expected anthropogenic emission sources. Water, fish, sediment and human hair sampling will be conducted between February and January 2015. Then fish, sediment and hair samples will be analyzed for mercury and POPs accumulation. Physicochemical measurement will be done on water samples. Statistical analysis of results will be done using Stata 11 software.
Water is mandatory for all life including harmful microorganisms. Globally, unsafe drinking water, coupled with insanitation condition kills at least 1.6 million children under the age of five. The most common and widespread health risk associated with drinking water is contamination. Globally, the greatest risk to public health from microbes in water is associated with consumption of drinking-water that is contaminated with human and animal excreta. One of the most important human diseases is diarrheal illness which is associated with many health risks and it is a major public health problem. Acute diarrheal disease accounts for more than 1.8 million deaths annually, particularly in children <5 years of age, and more than 40% of those deaths occur in Africa. Globally, diarrhea is the third largest cause of morbidity and the sixth largest cause of mortality among population of all ages. In Ethiopia, diarrhea is the major killer of children and thus is a serious public health problem. Among the nine regions of Ethiopia, Amhara has a population of 19 million and 90 000 children under 5 years of age die annually from diseases related to water and sanitation. The objective of this study is an assessment of water collection and storage practice; household microbial water contamination and diarrheal related potential health risks in Wegera Woreda, North Gondar, Ethiopia. In this study, descriptive cross sectional and case control study design will be applied to evaluate household’s water use practice, microbial quality of drinking water and diarrhea related potential health risks. The outcome of the current study will reveal that household’s drinking water deterioration condition in the study area. Hence, this would help the regional government to intervene on point of use drinking water quality in the region.

Parasitic infections, caused by intestinal helminthes and protozoan parasites, are among the most prevalent infections in humans in developing countries. In Ethiopia intestinal parasitic prevalence is high in different region with different magnitude and the health problems in children are communicable diseases arising from the environment and particularly related to water and sanitation, most of which being associated with microbial contamination of drinking water. This study will determine water quality, under nutrition and other risk factors that have association with intestinal parasitic infection and helminthes re infection. The objectives of this study are to determine the magnitude of intestinal parasitic infection, to determine and compare the microbiological water quality among water sources and risks associated with intestinal parasitic infection, to examine the association of intestinal parasitic infection and malnutrition and to find out helminthic infection before and after treatment. A community based cross sectional study will be combined with cohort studies. For the first and fourth specific objectives cross-sectional study design will be used. For the second specific objective comparative cross-sectional design will be used. While for the third and fifth specific objective cohort study design will be conducted. The outcome of this study will help to understand the current magnitude of intestinal parasitic infection and its association with water quality and malnutrition. Also the outcome of this study will provide information on helmithic re
infection rate and risks associated with re infection. Also it will help the health sector planners to conduct cost benefit analysis and choose intervention where to be implemented.

ASSESSING EFFECTS OF SEASONAL VARIABILITY ON BACTERIOLOGICAL WATER QUALITY AND GASTROINTESTINAL ILLNESS, AND ITS ASSOCIATED FACTORS AMONG CHILDREN IN WEST GOJAM, ETHIOPIA

BY
MESKEREM GIRMA

ABSTRACT
Thus all sources of water that are intended for human consumption must be free from pollution. Polluted water increases the risk of disease transmission to consumers. The most common and widespread health risk associated with water is microbial contamination (2). According to World Health Organization statistics, diarrheal diseases accounted for 17% of all deaths worldwide in children younger than 5 years of age, resulting in approximately 1.8 million deaths annually. Moreover, children six consumption of contaminate water has been associated with diarrhea in every continent worldwide; examples are the World Health Organization estimates that improved water quality would reduce the global burden of GI by 31% (3). The prevalence of GI is determined by the socioeconomic and health conditions, education and beliefs, contamination of water and food, age is also an associated factor related to the individual’s immunologic status and behavioral patterns contributing to the high prevalence of GI in children than in adults. This contamination might explain increased rates of GI (9,12) and waterborne disease outbreaks (13, 14) especially during rainy season. Similarly, in temperate regions, periods of heavy rainfall can increase the risk or incidence of waterborne disease. The objective of study assess effects of seasonal variability on bacteriological quality of water sources and gastrointestinal illness, and its associated factors among children in West Gojam, Amhara Regional state. A combination of cross sectional and longitudinal study designs will be used. Both quantitative and qualitative data collection techniques will be used in the study. The water source will be all protected water sources, and source of population will be all under five children with mother or care givers

ASSESSING SPATIAL AND TEMPORAL PATTERNS, DETERMINANTS AND FORECASTING INCIDENCE OF DIARRHEAL DISEASES IN NORTHWESTERN PARTS OF AMHARA REGION, ETHIOPIA

BY
MULUKEN AZAGE

ABSTRACT
Diarrhea has remained a major public health problem that causes high level of morbidity and mortality in Ethiopia. Research findings on diarrhea diseases in Ethiopia so far have focused solely on prevalence and common determinants (socio-demographic, behavioral and environmental sanitation variables) of diarrhea which are insufficient and fail to capture other important disease determinants, climatic factors. Spatial and temporal patterns of diarrhea and diarrhea predication model using climate variability and routine surveillance data in Ethiopian have not yet conducted. Thus, data on identification of hot spot areas of diarrhea and its trend and early recognition of infectious disease using models are significantly important for public health planners and decision makers in disease prevention and control. The main aim of the study is to investigate the spatial and temporal patterns, and identify determinants of diarrhea and to develop a model for diarrheal disease
prediction in north-western parts of Amhara region, Ethiopia. Retrospective spatio temporal, cross sectional and case control studies will be employed to address the purpose of the study. Monthly data of diarrhea from the routine surveillance system of health centers will be collected for spatial and temporal pattern, and time series analysis. Cases of diarrhea will be Geo-coded at district level to investigate the spatial patterns and hot spots of diarrhea. Monthly data of diarrhea will be mapped to observe the seasonal patterns of diarrhea diseases. Primary data from cases (diarrhea) and control (none diarrhea) of mothers or caregiver of under-five children will be collected to identify determinants of diarrhea diseases. Data entry and cleaning will be done using EPI INFO 3.5.3. SPSS 16 will be used to do regression and time series analysis. ArcGIS 10.2 will be used for spatial analysis. Spatial statistic will be used will be used to identify clusters of diarrhea. Different time series models will be compared and best fitted model will be used to develop a model for diarrhea prediction. Identification districts with hotspot of diarrhea and its temporal patterns, determinates of diarrhea diseases and developing a model for diarrhea diseases prediction in the study area will be the output of this study.

CYANOBACTERIA AND THEIR TOXINS IN SOME ETHIOPIAN LAKES: SPATIO-TEMPORAL VARIATIONS AND THEIR PUBLIC HEALTH IMPORTANCE

By

SAMSON TILAHUN

ABSTRACT

The occurrence of harmful algal blooms in Lakes and other surface waters is becoming a global concern. Although not well understood and conflicting reports appear, climate change, introduction of nutrients like nitrogen and phosphorus due to rapid population growth, urbanization and increased agricultural development practices and industrial operations are considered to be the triggering factors for the occurrence of potentially toxic algal blooms. In fresh water systems, such harmful algal blooms are largely caused by cyanobacteria of the genera, Anabaena, Aphanizomenon, Cylindrospermopsis, Microcystis, and Planktothrix (Oscillatoria). They are known to produce a variety of toxins that cause acute and possibly chronic public health problems and fatal poisoning in aquatic and domestic animals. The recurrent development of such ecologically damaging blooms is becoming increasingly common in the Ethiopian Rift Valley Lakes area as well, where water bodies are used as sources of income, food and drinking water supply. The protection of public health, wild and domestic animals through appropriate measures requires generation of dependable data on algal toxins of surface waters as well as investigation of risk factors dictating the occurrence of the blooms and production of the toxins. Although there are some few reports here and there, a comprehensive study in this regard is scanty in the country. The proposed research work will, therefore, update and complement the existing data on the occurrences of harmful algal blooms, type and level of algal toxins. Furthermore, the project aims to investigate the temporal and spatial variations in Microcystis populations with a view to identify the physico-chemical drivers of bloom development and productions of associated toxins. The data generated through the proposed research work will hopefully provide scientific information usable in the development of strategies geared towards the protection of public health and sustainable use of aquatic resources.
Evidence suggests that improved handwashing can have a major impact on public health and significantly reduce the two leading causes of childhood morbidity and mortality, diarrheal disease and acute respiratory infection. Moreover handwashing with soap can prevent the transmission of a variety of pathogens; it may be more effective than any single vaccine. However, handwashing rates are considerably low in Ethiopia, with only around 17% of primary caregivers washing their hands with soap after defecation, and with the majority washing their hands with only water before eating. Hence, this dissertation is designed to assess the effect of hand washing practice on diarrheal diseases and identify factors affecting handwashing habits. The aim of this study is to investigate the effect of hand hygiene practice on diarrheal diseases among under five children: “A Community Randomized Field Trial” in the Kilte-Awlaelo Health and Demographic Surveillance Site (KA-DHSS), Tigray, Ethiopia. Cross-sectional quantitative and qualitative study will be carried out from randomly selected 1758 households of mothers/caregivers and their under-five children: to assess effect of hand washing practice on diarrheal diseases in under-five children and identify factors affecting mothers hand washing habit. Cluster randomized trial: clusters will be assigned randomly to the intervention and control arms; and from these clusters a total of 512 households (256 in each arm) with mothers of under-five children will be selected randomly. Households under the intervention will be received soap and weekly hand washing education but the counterpart households will continue their usual trained. The data entry and data analysis will be performed using EPI Info Version 6.04 and SPSS Version 16 statistical packages respectively. Descriptive measurements and the strength of association between variables will be determined using odds ratio, with 95% confidence interval and P-values of 0.05 or lower. Intention-to-treat analysis will be used to compare the incidence of diarrhea among children. Generalized estimation equation (GEE) with log link Poisson distribution family will be used to consider the repeated and clustered nature of the data. Magnitude of diarrheal diseases among under-five children; identification of factors that affect mothers/caregivers’ hand washing habit and their hand washing compliance at each critical junction.