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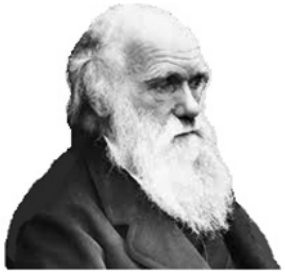

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Water-Borne Diseases and Their Challenges in the Coastal of Ampara District in Sri Lanka

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ABSTRACT

Water satisfies human needs in many ways. Without water, life is not possible on this planet. According to the estimation of the WHO, 4,000 children die every day from water-borne diseases and this condition is worst in developing and under-developed countries. Water-borne diseases are caused by the consumption of contaminated water. Indeed, it is the main agent of transference of the pathogens causing these diseases. The main objective of this paper is 'to identify the water-borne diseases and their challenges and to suggest remedial measures to overcome the challenges in the study area'. Both primary and secondary data were used to conduct this study and the analysis of this study is tabulated clearly in the data analysis part. The coastal areas of Ampara District (Sainthamaruthu, Karaitivu, Maligaikadu Mawadipalli, Akkaraipattu, Irakkamam, Varipathanchenai, Addalaichenai, Palamunai, Oluvil and Nintavur) face a lot of challenges induced by water-borne diseases. Viruses, bacteria, parasites and protozoa are the main pathogens. Bacillary dysentery (shigellosis), cholera, other diarrheal diseases, hepatitis A and E and typhoid fever were identified as the most common diseases in these areas. The causes for the diseases are the contamination of water by improper drainage management, effluent contamination of water sources, over population and the lack of awareness among residents about water-borne diseases. According to the result of this study, controlling water contamination, constructing water purification systems, mending existing drainage systems, following instructions when constructing latrines, examining and remediating contaminated wells and providing awareness among residents are ways to attain the objectives.

***Keywords*:** water-borne diseases, pathogens, consumption, coastal area, contamination

1. INTRODUCTION

Water is a prime necessity of the human life. Without water it is impossible to live in this world. The potential of the drinking water to transport microbial pathogens to great numbers of people, causing subsequent illness, is well documented in countries at all levels of economic development. Several researches have attempted to estimate the total burden of water-borne diseases globally. Water-borne diseases are the most serious threats to child health especially when there is limited access to safe water. Today the health and life of thousands of women and children are enhancing by giving them access to safe water (UNICEF). Human being get infected by water-borne diseases when consuming the contaminated water. The pathogens, namely virus, bacteria, and protozoa are the major triggers to cause water-borne diseases.

According to the World Health Organization, approximately 1.8 percent people die annually from diarrheal diseases including cholera, of which, almost 90 percent are children under five years old. Up to 88 percent of water-borne diseases arise form unsafe water supplies, inadequate sanitation and hygiene. Sri Lanka, is not except to this situation, the seriousness of water –borne diseases is very high. Annually, water-borne and mosquito-borne diseases have been infected in great amount. According to the 2014 national census, pipe-borne water coverage in Sri Lanka is around 44.6%, with the rest of the population depending on local sources such as wells, hand pump tube wells, small scale rural water supply schemes, rain water harvesting tanks and surface water bodies: irrigation tanks, canals, streams and springs. Although the National Water Supply and Drainage Board (NWS & DB) have been established to manage and deliver water resources to the public, it is evidently not functioning effectively in the majority of the country as yet.

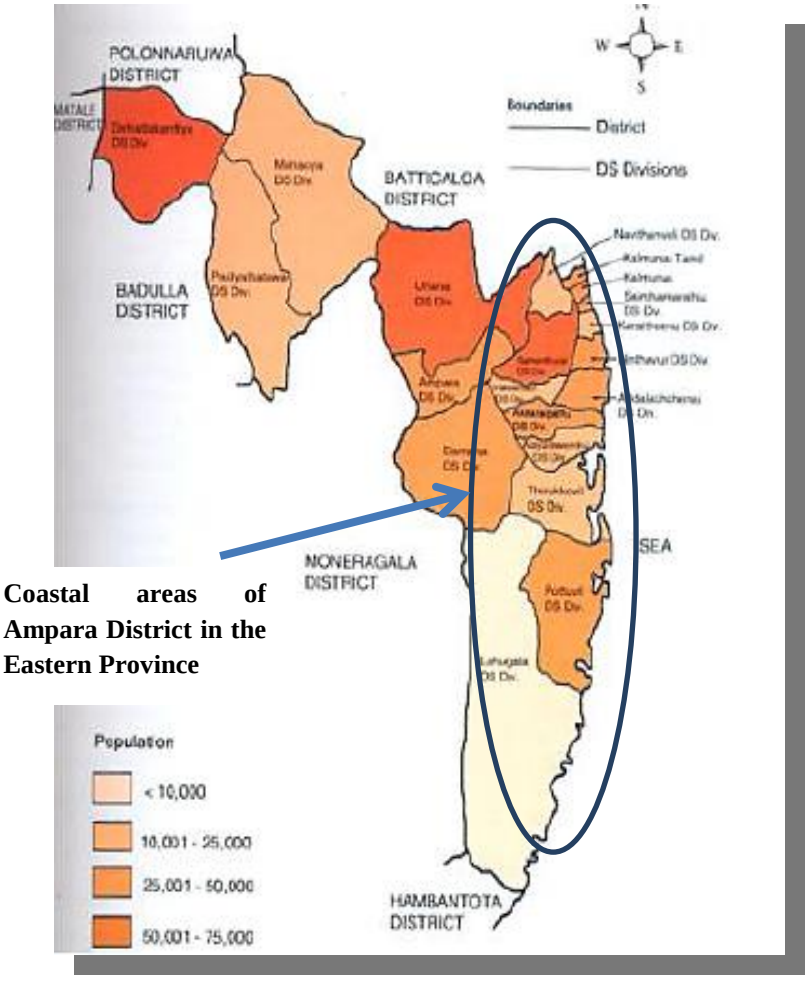
The coastal areas of Ampara District easily affected by the water-borne diseases mainly due to the consumption of water from unsafe sources and lack of awareness. All sources of water empty into the sea through the coastal areas. This is also a driving force to cause the contaminations. Water is a necessary need for human being. Therefore, to sustain the life of human, water should be consumed in a hygienic manner. The coastal areas of Ampara District are suffering from water-contamination due to the natural disasters namely tsunami, flooding and drought. The increased population growth caused the compact settlement in the study area. People like to live in the urban area without considering the environment. A close nearness from well to latrines in the urban areas have not been considered due to the coast of lands. This study is to identify the exact situation of the water-borne diseases which is a major challenge in the study area.

Water borne diseases are contagious and prevention of water-borne diseases requires high standards of hygiene and sanitation. In order to be acquainted with the ways to avoid water borne diseases, it is essential to first know how infection takes place.

2. STUDY AREA

Coastal area of Ampara District is situated in the eastern part of the Ampara district in the north latitude 6°3’ to 7°44’ and the east longitude 80°47’ to 81°51’. The boundaries of the study area are: in North Batticaloa District, in West Uhana, Ampara and Thamana area, in South, Hambantota District, and in the East Indian Ocean. The total extend of the area is

1250.77 km^2 and it is 28.23 percent in total area of land. It has 13 divisional secretariats. Coastal plains and dispersed hills are available in the area. The mean sea level (MSL) is 30 m and the annual average temperature is 30-33 °C and the annual average rainfall is 1250 mm – 2500 mm. Main water source is ground water and the pipe-borne water supply also accessible in some places in the study area (**Fig. 1**).



Coastal areas of Ampara District in the Eastern Province

Figure 1. Study area
(Source: Post-war Development in the Eastern Province, Ampara District)

3. OBJECTIVES

Primary Objective

- To identify the water-borne diseases and their challenges in the study area.

Secondary Objective

- Suggesting remedial measures to overcome the challenges.

- Providing water-borne disease's control and prevention methods to the inhabitants through awareness programs.

4. RESEARCH METHODOLOGY

Primary data

Questionnaire survey and purposed group discussion were made to collect primary data. 100 questionnaires were distributed among the people in the area considering the closed proximity of contaminated water sources. All the questionnaires were distributed using the purposive sampling. And the public health inspectors (PHIs), Doctors and officers from the health department and District health officers were discussed in this regard. The aim was to identify the contaminated wells due to the seeping of the latrines in to the water.

Secondary data

As secondary data, books, magazines, reports from department of health, report from Regional Director of Health Service (RDHS) Kalmunai, newspapers, reports of WHO and UNICEF, reports from National Water Supply and Drainage Board (NWS & DB) of Sri Lanka and reports from Divisional Secretariats, were used.

5. RESULT AND DISCUSSION

THE IDENTIFIED WATER-BORNE DISEASES IN THE STUDY AREA

According to the RDHS and (PHI) report, the following water-borne diseases are very common in the coastal areas of Ampara District (**Table 1**).

Table 1. Registered cases of water-borne diseases in the study areas in 2015

Water-borne diseases	No.of cases in 2015
Cholera	-
Typoid	973
Shigellogis	805
Amoebisis	450
Food poisoning	139
Diarrhea	2908
Other infectious diseases	2405
Leptospirosis	89
Hepatitis A	432
Helminthiasis	731

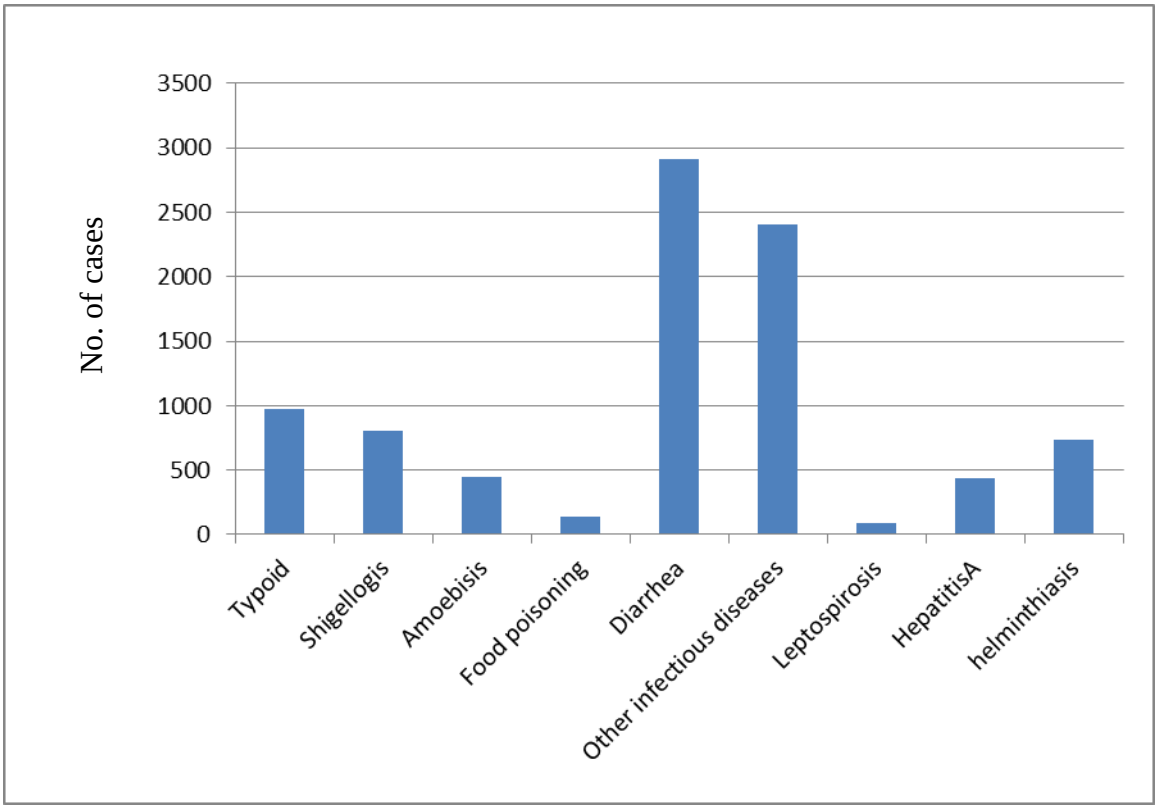


Figure 2. The trend of water-borne diseases in the study area - 2015
(Source: RDHS, Kalmunai, 2015)

Figure 2 shows the incidence water-borne diseases in the study area. Diarrhea and the other infectious diseases are very high level. These diseases are very common among the people who live in the nearby places in lagoon and contaminated water sources. The main factor for the spreading of disease is mixing the contaminated water with groundwater, the connection of the effluent form the sewerage and the indiscriminated consumption of the groundwater which is much closed to the latrines. 70 percent water-borne diseases are caused due to the well water which has very close proximity of latrines.

Typhoid is caused by the Salmonella typhi bacteria. It can also be caused by Salmonella paratyphi, a related bacterium that usually causes a less severe illness. According to the RDHS report, in Nintavur, the infection of the typhoid is very commonplace. Approximately 30 percent of the cases have been identified in this area. The bacteria are deposited in water or food by a human carrier and are then spread to other people in the area. And the shigellosis is a potentially dangerous and extremely contagious bacterial infection of the colon. It is most prevalent in children between the ages of one and four. In Akkaraipattu area, the seriousness of the shigellosis is scaring the people. 21 percent people have been infected due to the shigellosis.

Amoebisis, food poisoning, leptospirosis, hepatitis and helminthiasis were approximately 13 percent, 5 percent, 3 percent, 14 percent, and 17 percent, respectively in 2015. Considering the water-borne diseases and the mosquito-borne diseases such as dengue, it appears to be a serious threat to people in the study area.

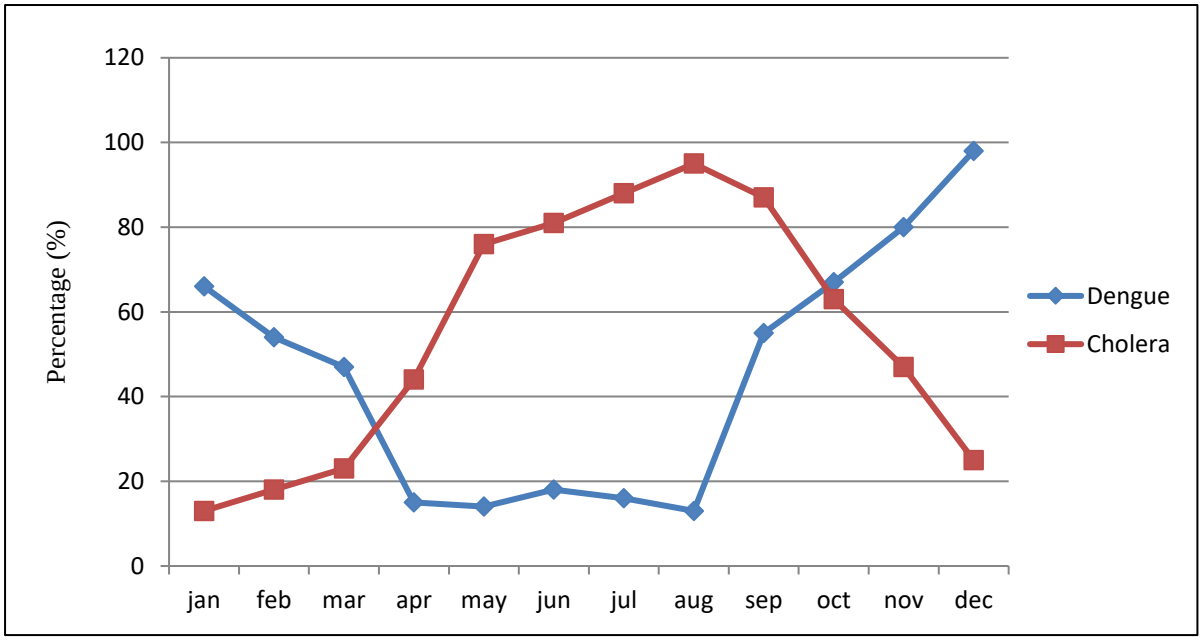


Figure 3. Dengue and cholera spread in coastal areas of Ampara District (2015)
(Source: RDHS, Kalmunai, 2015)

Figure 3 shows the occurrence of dengue and cholera. These are much challenged water-borne diseases in the study area. All the coastal area people have been infected by these diseases. The dengue disease has increasing curve in the starting and ending portion of the month. This is due to the rainfall and seasonal spread of this disease. During the drought, the effect of the cholera is very high. This is due to the water poverty during the dry season. People consume water for drinking purposes from the contaminated sources. During the field observation, the situation was observed and identified. Thus the seriousness of dengue in the study area is very scaring the people. Annually many people die due to the dengue infection because Sri Lanka is fighting to eradicate the dengue.

Therefore, the spreading of the cholera is serious up in the middle of the year. This is actually due to the drought and flooding. After flooding, the contaminated water adds with groundwater sources. This leads to the infection of the cholera. Continuous infection of cholera causes adversarial impact to the body and even the death.

THE PROXIMITY ANALYSIS OF WELLS AND LATRINES

According the study, 90 percent of wells have the adversarial impacts due to the seeping of the latrines into the water. The proximity of the wells and latrines has a high influence to decide the water pollution (**Figure 4**).

According to the questionnaire survey, the people who live in the lower proximity area have experienced many diarrheal and cholera diseases. And some wells have been abandoned due to the contamination by the latrines. This was a major impact soon after the tsunami disaster. Therefore, the people who were affected mostly by the water-borne diseases, are living near and below the 15 m proximity. According to the questionnaire survey, the decrease of the proximity has caused the increasing of the water-borne disease and vice versa.

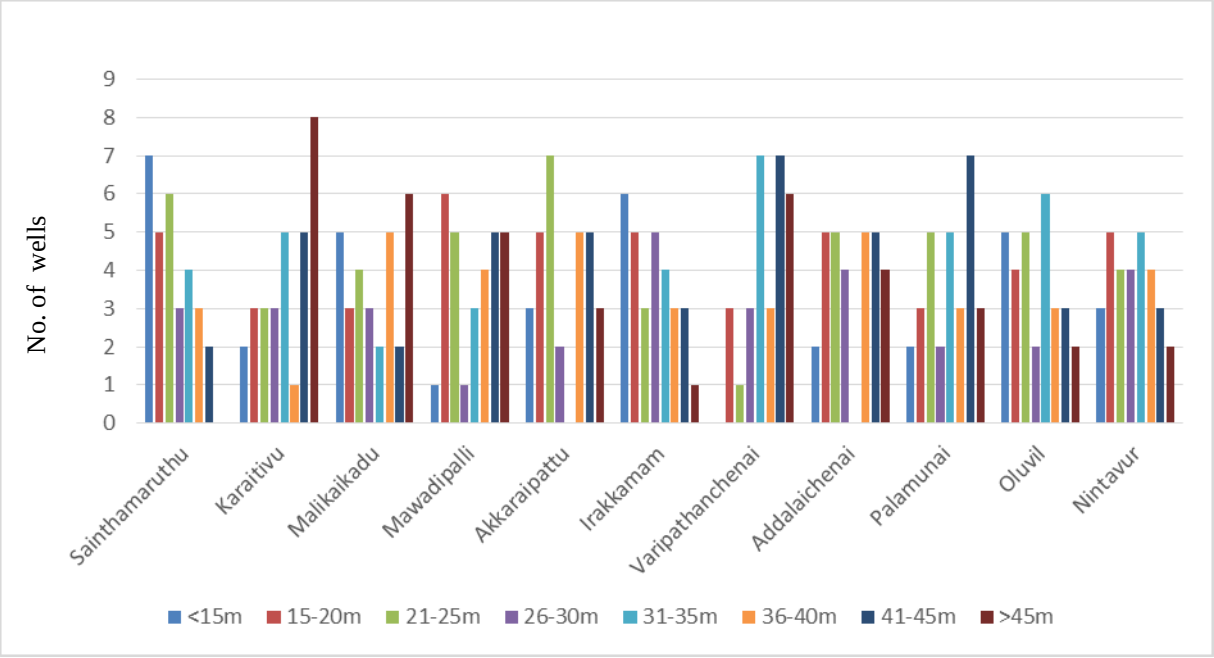


Figure 4. The proximity analysis between wells and latrines in the study area
(Source: field data collection, 2015)

FUTURE PREDICTION OF WATER-BORNE DISEASES (2005-2015)

Figure 5 and **Table 2** show the future prediction of water-borne diseases using 10-year average data from RDHS. The future prediction of the water-borne disease has been manipulated to identify the future trend of the water- borne diseases in the study area.

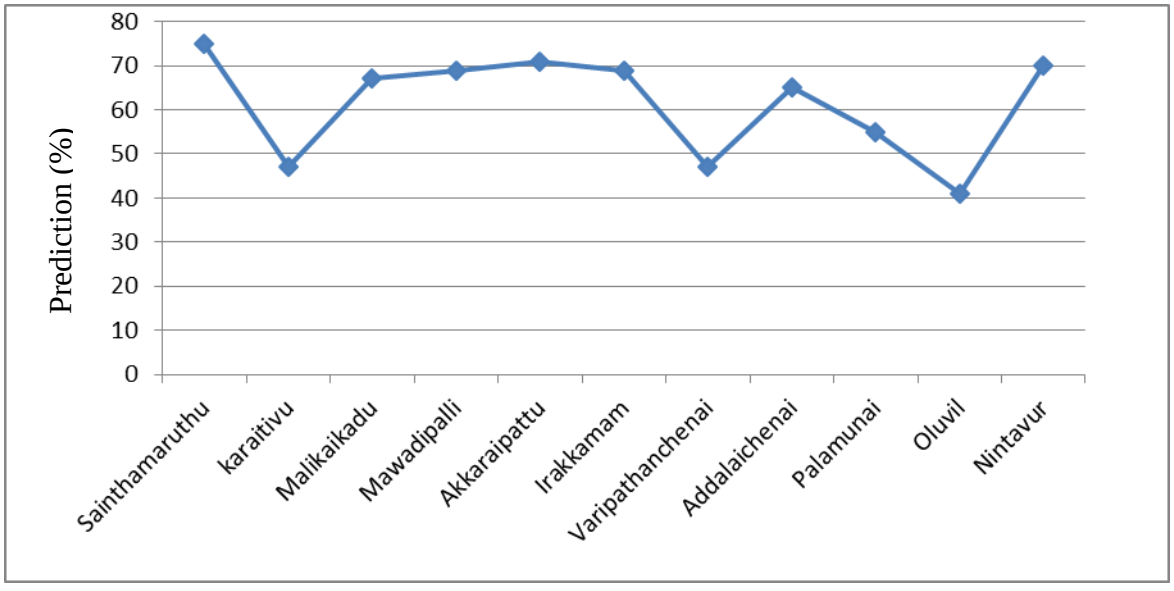


Figure 5. Future prediction trend using the data from 2005-2015
(Source: RDHS, 2015)

Table 2. Prediction using 10-year average data from RDHS - 2015

Places	Average (%)
Sainthamaruthu	75
Karaitivu	47
Malikaikadu	67
Mawadipalli	69
Akkaraipattu	71
Irakkamam	69
Varipathanchenai	47
Addalaichenai	65
Palamunai	55
Oluvil	41
Nintavur	70

This 10-year prediction was made using the data collected from RDHS Kalmunai to identify the future trend of the water-borne diseases and to protect and fight against water-borne diseases. Accordingly, this is because the dense population and water contamination by the lagoon which is running through the area in many places. Due to the dense population, people have made compact settlement. The proximity of the well and latrine has not been considered when constructing. It should be 15 m or more when considering the soil types.

Likewise, Akkaraipattu has 71-percent potential to the water-borne disease in future. Varipathanchanai and Karaithivu have the same average percentage of experiencing likelihood of water-borne diseases. This value is relatively lower than others. Even though, these places have population density with the proximity of settlement slightly far from others.

According to the questionnaire survey, the people who live much close to the contaminated water sources have experienced the water-borne diseases. Especially in Sainthamaruthu, 60 percent of people who live in much closer proximity with lagoon have experienced water-borne diseases frequently rather than the people who are living relatively far from the lagoon. People dump the wastages into the lagoon. This is the cause of the contamination of water and air pollution too. 26 percent of people have been infected due to the improper hand washing.

This prediction was made considering the development activities and natural phenomena, such as monsoons, and climate elements.

IDENTIFIED CHALLENGES BY THE WATER-BORNE DISEASES IN THE STUDY AREA

Deficiency of the drinking water facility

Even though there is a water supply facility to the people in the study area, mostly the people depending on the groundwater for their drinking and domestic purposes. According to the questionnaire survey, 70 percent of people do not like to drink the chlorinated water due to the smell (chlorinated-odor), because they do not adapt to the taste of the pipe-borne water supply. Thus, the frequent water supply cut also trigger the people to prefer the well water in the study area.

Improper drainage system

In the study area, the drainage system is in poor management. The storm water retains in the small ponds and this leads to the mosquito breeding. Mosquito-borne diseases, such as dengue, spread due to this activity. In very recent past, the spread and consequence of the dengue was very worst. Many deaths have been registered in the regional hospitals. According to the questionnaire survey and direct observation, many places in the coastal areas face dengue breeding problems without the proper drainage management. Some people do not have awareness about the seriousness of the places which are prone to mosquito breeding.

Dearth of sanitation

In the coastal area, people use water mostly from the natural sources such as groundwater, and surface water. The pots and other utensils to carry water are not safe and some time it causes to transfer the pathogens from one place another. For the domestic purposes water is used from streams and rivers. The microbial pathogens cause the water-borne diseases spread by this activity. The wastage from human and animals also causes the fecal contamination in the water.

Poor access to health services

Lack of health care and lack of proper case management lead to an increased unhealthy life to the people in the area. During the disaster periods, people face health challenges. Tsunami and flood have caused many health challenges in the study area people. The remote area people do not consider about the water-borne diseases, so this state leads to the chronic condition and sometimes is the cause of deaths.

Lack of safe water, poor hygiene practices and poor sanitation

Crisis for the clean water is a major challenge to people in the disaster period, namely, tsunami, drought, and flood. Drought triggers the people to consume the water without considering the hygiene. During the flooding period, groundwater sources in the study area are affected heavily due to the fact that people get infected to the water-borne diseases. Cholera and diarrhea are very commonplace during the flooding time.

Lack of awareness among the people

Dearth of awareness among peoples is a greater challenge than other, because normally people consume water for drinking and domestic purposes from unsafe sources. The agents to cause the water-borne diseases, such as the wastages and sewerage water mix with drinking water sources. In many areas, people consume water only considering the appearance but not to the cleanness. Some people drink water from the streams in the paddy land, this is a major factor to cause the water-borne diseases.

Unsafe proximity between wells and latrines

Increased population growth demands the need of the land to occupy the people. But the people like to live in the urban and crowded area considering job and service facilities. This is a very serious problem for the people in the study area. The distance from the toilets to well should be considered when the construction is done, but it is ignored in the study area, therefore, the groundwater is contaminated. *E. coli* and feces are the main problem to cause the diorama and cholera diseases.

Due to the increased population growth, the number of latrines has been increased rapidly. This is the main factor affecting the groundwater quality. The distance from the well to latrines decides of the transportation of the pathogens from the latrines. The coastal areas, such as Kalmunai, Karaithivu, Nintavur, and Olvil, face these problems.

6. CONCLUSION AND RECOMMENDATION

Conclusion

Every year, the coastal areas of Ampara District lose people due to the infection of many kinds of diseases. According to the RDHS report, water-borne diseases are ones of the main factors to cause the human loss in the study area. There is not any previous research about this contemporary issue in the study area. Therefore, this research has been conducted in an analytical manner to attain the objectives of this study. Water-borne diseases have been identified using the data from the RDHS Kalmunai. The deficiency of the drinking water facility, improper drainage system, dearth of sanitation, poor access to health services, lack of safe water, poor hygiene practices and poor sanitation, lack of awareness among the people and unsafe proximity between wells and latrines are the challenges, identified by this study. The recommendations have been suggested to in the recommendation part to overcome and to minimize the challenges, faced by the residents from the study area. Accordingly, the primary and secondary objectives have been attained by this study.

Further, in the analysis section, the future prediction of the water-borne diseases have manipulated to identify the future trend of the water-borne diseases in the study area. Using 10-year data, the future prediction has been revealed. This will help to the respective officers, particularly PHIs and other health officers, to reduce and take necessary steps to free water-borne diseases in the study area. It will definitely be the alarm to the people to take precautions in the study area.

Recommendations

- Supply and instruct people to consume the pipe-borne water supply for their drinking purposes
- Drink having boiled the water. Pathogens causing diseases to the human being are destroyed by the extreme boiling of the water. This activity definitely is a mechanism to reduce and least the infection of the water-borne diseases
- Environmental management and controlling the mosquito breeding. The mosquito breeding areas cause to increase the spread of the diseases, such as dengue
- Constructing the latrines in a safe manner considering the distance from well to latrines
- Frequently check the wells to identify the water contamination
- Giving awareness among people about the water contamination and the agents for the water contamination and the seriousness of the water-borne diseases
- Conducting Shramadhana activities to eradicate the dengue breeding
- Chlorinating the wells in a 3-month interval to clear the pathogens
- Wash hands properly before eating
- Keeping fingernails short and clean to least the likelihood of the spread of the water-borne diseases
- Avoid consuming foods, fruit juices, and milkshakes from roadside vendors; some roadside vendors sell their products which were made with water from the unsafe water sources. This sometime causes the water-borne disease spreading
- Prevent the spreading of waterborne illnesses, people suffering from waterborne illness should be confined to themselves from work until symptoms have been subsided
- Making immediate medical assistance centers during the disaster periods to control the water-borne diseases
- Receiving assistance from the NGOs for the clean water supply
- Conducting dengue prevention programs to control the dengue breeding
- Proper drainage management.

References

[1] M.I.M. Kaleel. The Impact on Wetlands: A Study Based on Selected Areas in Ampara District of Sri Lanka**.** *World News of Natural Sciences* 7 (2017) 16-25.

[2] M.I.M. Kaleel. Pipe-borne water consumption and its wastage: A study based on Panandura Urban Area in Sri Lanka. *World Scientific News* 66 (2017) 250-262

[3] S.M.M. Ismail. Post-war Socio-economic Development in the Eastern Province: A Case Study of Ampara District. *KALAM International Journal of Faculty of Arts and Culture, South Eastern University of Sri Lanka*. Volume VIII(2) (2014) 176-182.

[4] S. Sharma, P. Sachdeva, J.S. Virdi. Emerging water-borne pathogens. *Applied Microbiology and Biotechnology*, June 2003, Volume 61, Issue 5–6, pp 424–428

[5] Bagchi K, Echeverria P, Arthur J.D., Sethabutr O., Serichantalergs O., Hoge C.W. (1993) Epidemic diarrhoea caused by *Vibrio cholerae* non-O1 that produced heat-stable toxin among Khmers in a camp in Thailand. *J Clin Microbiol* 31: 1315–1317

[6] Bert F., Maubec E., Bruneau B., Berry P., Lambert-Zechovsky N. (1998) Multi-resistant *Pseudomonas aeruginosa* outbreak associated with contaminated tap water in a neurosurgery intensive care unit. *J Hosp Infect* 39: 53–62

[7] Bik E.M., Bunschoten A.E., Gouw R.D., Mooi F.R. (1995) Genesis of the novel epidemic *Vibrio cholerae* O139 strain: evidence for horizontal transfer of genes involved in polysaccharide synthesis. *EMBO J* 14: 209–216

[8] Bilge S.S., Vary J.C. Jr., Dowell S.F., Tarr P.I. (1996) Role of *Escherichia coli* O157:H7 O-side chain in adherence and analysis of *rfb* locus. *Infect Immun* 64: 4795–4801

[9] Brewster D.H., Brown M.I., Robertson D., Houghton G.L., Bomson J., Sharp J.C.M. (1994) An outbreak of *Escherichia coli* O157:H7 associated with a children′s paddling pool. *Epidemiol Infect* 112: 441–447

[10] Chalmers R.M., Aird H., Bolton F.J. (2000) Waterborne *Escherichia coli* O157. *J Appl Microbiol* [Symp Suppl] 88: 124–132

[11] Dalsgaard A., Albert M.J., Taylor D.N., Shimada T., Meza R., Serichantalergs O., Echeverria P. (1995) Characterization of *Vibrio cholerae* non-O1 serogroup obtained from an outbreak of diarrhoea in Lima, Peru. *J Clin Microbiol* 33: 2715–2722

[12] Dutta S., Deb A., Chattopadhyay U.K., Tsukamoto T. (2000) Isolation of Shiga toxin-producing *Escherichia coli* including O157:H7 strains from dairy cattle and beef samples marketed in Calcutta, India. *J Med Microbiol* 49: 765–767

[13] Engberg J., Gerner-Smidt P., Scheutz F., Moller Nielsen E., On S.L., Molbak K. (1998) Water-borne *Campylobacter jejuni* infection in a Danish town—a 6-week continuous source outbreak. *Clin Microbiol Infect* 4: 648–656

[14] Falkinham J.O. III (1996) Epidemiology of infection by non-tuberculous mycobacteria. *Clin Microbiol Rev* 9: 177–215

[15] Furtado C., Adak G.K., Stuart J.M., Wall P.G., Evans H.S., Casemor D.P. (1998) Outbreaks of waterborne infectious intestinal disease in England and Wales, 1992–1995. *Epidemiol Infect* 121: 109–119

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