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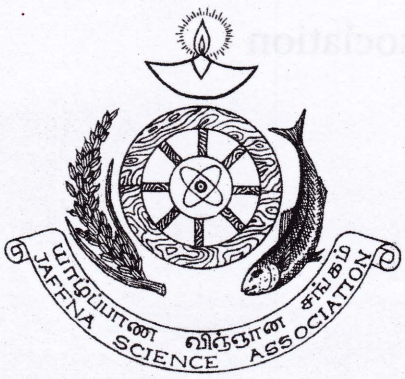
Proceedings of Jaffna Science Association

Presidential Address
Chief Guest's Address
Sectional Chairpersons' Addresses
Popular Lectures
Theme Seminar Presentations

Volume: 22 No: 02

Twenty-Second Annual Sessions
05 - 07 May 2015
Jaffna, Sri Lanka

ISSN 1800-1300



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Editors Note

The Jaffna Science Association (JSA) has been functioning with the aim of disseminating scientific knowledge to the masses in the region. Since its foundation in 1991 by late Professor Alagiah Thurairajah, it has been carrying out various knowledge-sharing activities to inform the latest advancements in Science to the people in this region. Many of the activities carried out by the JSA are targeted at school students and university undergraduate students, and it encourages them to actively participate in many different knowledge-sharing activities such as essay competitions, oratorical competitions, quizzes programs, science exhibition, school gardening competition and display their talents. JSA also conducts popular lectures, journal clubs, seminars and workshops to different audience groups to well inform them with the latest technical advancements in Science.

The annual sessions of the JSA are conducted with the objective of disseminating latest scientific research results and advancements in science to the people in the region and to encourage young scientific researchers to actively participate in innovative research.

A specific topic, which addresses a most crucial issue to the region or to the people in the region, is selected as the theme of the year and more focused activities are carried out by the JSA to identify the causes of the issues and to propose appropriate scientific solutions to these issues. Seminars, review lectures and popular talks are organized according to the identified themes, during the annual sessions. Then the presentations made at the annual sessions are recorded and published as proceedings.

This Proceeding (Volume 22, No. 2) contains the Presidential address, Chief guest's address, Chairpersons' addresses, Popular lectures and Theme seminar presentations delivered at the 22nd JSA annual sessions. The sessions were held on 5 - 7 May 2015 on the theme "Sustainable Natural Water Resource Development and Management" at the Faculty of Science, University of Jaffna.

I wish to thank the distinguished speakers for their contributions to this volume. I also wish to extend my sincere gratitude to Mr. Veerasingam Visithan, Programmer cum Systems Analyst, Department of Computer Science, University of Jaffna for his timely help in the editing process, and all the members of the Executive committee of JSA, for their valuable support in this endeavour.

Dr. (Mrs). T. Thileepan,
Chief Editor,
Jaffna Science Association,
May 2016.

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Theme Seminar Presentations

E-Waste: Its Impact and Future Trends

Kathiravelu Thabotharan
Department of Computer Science, University of Jaffna, Sri Lanka

Abstract: E-waste is one of the biggest challenges for authorities in developing as well as developed nations to tackle with. As the life span of the modern electronic equipment and other gadgets have reduced to two years or less, the amount of e-waste produced annually grows rapidly. Managing E-waste is a serious issue in developing countries due to the lack of proper law enforcement mechanisms and therefore, proper management of e-waste and action needs to be taken ensure that the e-waste is properly discarded. This article addresses problems of e-waste and how e-waste could be properly managed by following methods that can reduce the release of hazardous material to the environment to a great amount.

Introduction:

E-waste has been defined as the waste of electronics or electrical goods that have reached their useful life span and are dumped by the consumers. E-waste often comes from consumer electronic products such as Computers, Televisions, Washing machines, Stereo devices, Mobile phones, Electronic toys, Wireless equipment, Cables, Circuit boards and other products that are produced as byproducts of manufacturing processes.

E-waste often contains hazardous and toxic materials and therefore proper care should be taken when they are discarded. The main reason for this is that the materials that are used in the production of these consumer electronic products can release toxic substances to the environment and can create serious health and environment related problem. In addition, the materials that are used in the electronic goods are of high value in the local market and can be easily reused with little effort.

Due to the harmful effects that the e-waste can pose to human and the animal life, and to the nature, many international regulations have been created. International directives namely "Waste from Electrical and Electronic Equipment" and "Reduction of Hazardous Substances", are in force to regulate the use of and recycling of harmful material in the production of consumer electronics. In order to reduce the amount of e-waste that is produced, Reduction, Reuse and Recycle is a common term that is widely used by the enthusiasts to educate the consumers and producers to reduce the amount of harmful substances used in the production, reuse the maximum possible amounts of substances from the discarded products, and to recycle the components and substances in to reduce the amount of components and substances that are newly used.

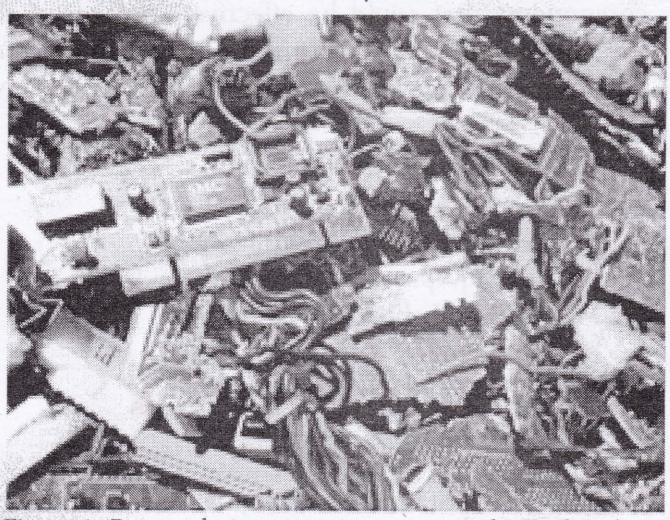

Figure 1. Removed circuit components just dumped withour proper care is considered as part of the e-waste. These circuit boards contain many components that can be recycled and metals that can be reused.

Many innovative and protective measures are now being used in developed countries to reduce the amounts of hazardous material that is leaked to the environment when the consumer products are discarded. In developing countries e-waste wait in storage areas for a long time before it is being disposed, before sent to landfill, before it is incinerated or before it is sent to recycling facilities. It is the developing countries where the law enforcement agencies do not take stringent actions to reduce the disposal of harmful substances in to the environment.

Sources of E-waste:

The increasing use of consumer electronic products and the habit of consumers to go for newer modern gadgets just by discarding the still usable devices contribute to the ever-increasing amount of e-waste. In addition, industries, hospitals and laboratories all dispose substances, components and gadgets that have reached the end of their useful life span. The amount of e-waste that is disposed annually is higher in the developed nations compared to the developing nations.

It is estimated that due to the pervading reach of information technology in trade and commerce, education, transport, medicine, and other domestic uses, computer waste is the most significant of all e-waste, along with televisions and cellular mobile phones. Many developed countries replace their fleet

of equipment when a newer equipment with a better technology reaches the consumer market irrespective of weather the existing equipment are still in usable condition or not. In domestic uses also, consumers have a habit of switching to a gadgets with newer technology just by dumping their existing gadgets. When these waste are not properly discarded and components that could be effectively not recycled, the waste can release harmful substances to the environment. Categories of e-waste are:

- Domestic appliances
- It and Telecommunication equipment
- Consumer electronic equipment
- Lighting equipment
- Medical and Laboratory equipment
- Electronic toys
- Monitoring and Control equipment
- Transportation equipment

Most of the exported e-waste end up in the recycling facilities in developing countries in Asia and Africa, for recycling and reuse of precious materials. These countries and their economy heavily depend on scarce material that can be extracted from the discarded electronic goods. In these facilities traditional naïve

Figure 2: Women and children at a recycling facility.

methods such as heating to melt metals and bonds, burning in the open air, are applied to extract the material with bare hands, where women and children can easily get exposed to harmful components of the e-waste.

Constituents of E-waste:

E-waste constitutes of mercury, cadmium, lead, paints, barium and other heavy metals, plastics, wire cables etc., which are used in the production of the electric and electronic equipment. It is estimated that e-waste

Figure 3: Discarded computer monitors in Ghana near to water resources. Such illegal disposal can cause great harm to local children who scavenge the dumps. Photograph: Sipa Press/Rex Features.

constitutes of more than 1000 different substances many of which are toxic, creating significant health risks and serious pollution problems associated with disposal. Chromium, tin, and other heavy metals permeate the soil.

Figure 4: A child is being exposed to the reuse facility in China. Early exposure to heavy metals can produce a disproportionate rate of infant mortality and unusually low IQs among children. Photo courtesy: VQR, Volume 92/2, Spring 2016.

Health Risks of E-waste:

When not properly disposed, E-waste, which contains several different substances and chemicals, many of which are toxic and are likely to create adverse impact on the health of the living organisms and to the nature. In developing countries imported e-waste and the industrial by products which are often just dumped in bare lands and other open areas, and as time progresses these waste can release toxic metal and liquids that can easily leach in to the natural water resources and farmlands. This can seriously contaminate the water resources and ultimately the drinking water.

The metals leaching into the ground water and the release of toxic material into the drinking water can cause illnesses such as Anemia, Renal Toxicity,

Insomnia Muscle tumors, Mental retardation, Cerebral palsy, risk in developing heart problems, Obesity, Damage to the liver, nervous and reproductive systems etc.

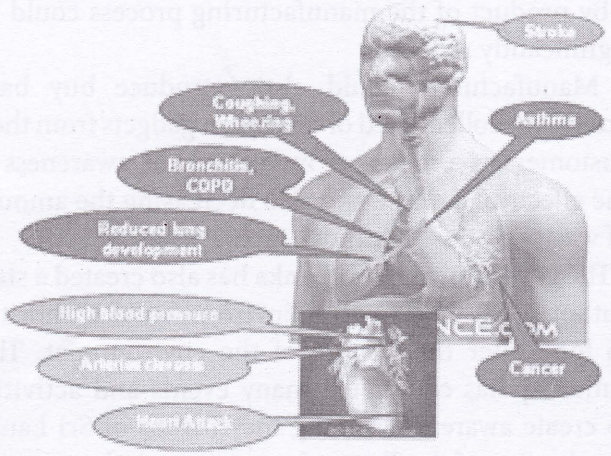

Figure 5: Health issues of e-waste.

Some of the health effects not only affect a person, but also can be in the system for many generations and can lead to further complications. Many medical studies have found that the chemical substances that are leached in to the nature can easily mingle into the food chain and can cause numerous health issues.

Challenges of E-waste

In addition to the risks created by e-waste to humans and to the nature, there are additional challenges posed b e-waste. The accurate figures of e-waste dumped by manufacturers and consumers is not available to authorities and the amount of e-waste is rapidly increasing every year. This is the first and the top most challenge faced by environmentalists in reducing the effect of e-waste.

The manufacturers and consumers have little awareness about the consequences of improper disposal of e-waste. In addition to this majority of the disposed e-waste ends up in the developing world and processed by informal sector that involves women and children applying rudimentary recovery methods. Due to lower of awareness and the lack of proper law enforcement these challenges continue to exist and the governments in developed and developing nations should take proper action to alleviate the problems of e-waste.

E-waste Management

The management of e-waste could be considered as composed of two activities:

- Collecting, sorting and transporting of e-waste,
- Recycling of e-waste

Collecting, sorting and transporting e-waste from the collection locations and then to the facilities involve greater amounts of work and the process needs to be thoroughly designed. Larger amount of financial investment is also needed to organize all these activities. In order to reduce the amount of e-waste in the manufacturing process, industries adopt a series of waste management policies which involve a series of actions such as inventory management of e-waste, modification of the production process therefore it can reduce the amount of waste and also the amount of substances used in the manufacturing process, reducing the volume of gadgets produced and activities to recover hazardous waste material from consumers by way of collecting them and then to reuse them in the production line.

E-waste Disposal

Disposing e-waste is a challenging task since it needs to be done with much care. Disposing e-waste along with other wastes by means of landfill can allow heavy metals to leach into ground water. Burning waste in the open air can make the hazardous material airborne. Acid baths are also used as one method to extract metals other materials from their bonds can lead to the contaminations of the ground water and other natural resources. When e-waste is exported to developing countries the disposal of hazardous material goes unattended and employees who are not trained properly or educated handle these wastes.

Recycling of E-waste

Recycling of e-waste involves the following activities:

- Disassembly/Dismantling – where the components, parts or a set of parts are removed from the waste by way of disassembly and then are sent to facilities for reuse or to the remanufacturing.
- Upgrading – where materials are separated using mechanical or physical and/or metallurgical processing.
- Materials Recovery – where plastic, glass and metals are recovered in the recycling facility. By doing so these items are prevented from mixing with the regular waste.

E-waste Recycling Process

The recycling process of e-waste includes a series of well coordinated activities that separates potential reusable components from the e-waste and then send it back to the remanufacturing process. First of all waste is segregated for glass and other reusable

material. Once this process is done, then from the waste material plastics, aluminum, iron and other non-ferrous material are shredded off and then are sorted in to categorically. Plastics are then categorized into either recyclable or non-recyclable plastics. Non-recyclable plastics are then incinerated using various methods where as recyclable plastics are sent to facilities for recycling and reuse. Aluminum and iron from the waste are directly sent to the facilities for reuse in the manufacturing process where as non-ferrous metals undergo through the metallurgical process to recover the precious metals from the waste.

Advantages of Recycling

Recycling includes many benefits to the manufacturers and other since it allows the recovery of assets with methodical effort. It reduces the amount of hazardous material that goes in to landfilling therefore preventing the harmful toxic material reaching natural sources. Recycling also reduces the unwanted generation of junk material and clutters, which will become a serious threat to the environment as a pollutant. Recycling also creates new jobs for unemployed youth in recovering the precious metals and other components from e-waste.

What can We Do?

The impact of e-waste has been well identified by the governments and authorities and there have been many initiatives by the states to reduce the harmful effects of e-waste to humans and the nature. As responsible citizen, we too have responsibilities in many folds:

- The first and foremost thing that we as good citizens could do is to not to dispose the harmful waste along with other degradable domestic waste. This could greatly reduce the amount of waste disposed as e-waste.
- When modern gadgets are purchased customers could opt for upgrading to the latest versions rather than purchasing a new one. This could also greatly reduce the amount newer items produced and the amount of harmful materials used in the manufacturing process.
- Consumers could also opt for gadgets that are made of less harmful or toxic material, recycled components, or elements that are reused in the manufacturing process.
- Creating awareness among the citizens that each discarded item could create an adverse effect to the nature and therefore to reduce the amount of waste being created.
- Manufacturers of modern electronic and electrical gadgets could opt for reusing recyclable material from waste. They could also modernize their design process therefore the amount of waste produced as a by product of the manufacturing process could be significantly reduced.
- Manufacturers could also introduce buy back policies to collect used or discarded gadgets from their customers as a means of increasing the awareness of the effects of e-waste and also decreasing the amount of wastes disposed without care.
- The government of Sri Lanka has also created a state authority entitled "Central Environmental Authority", to look after the welfare of the environment. This authority has conducted many events and activities to create awareness among the citizens of Sri Lanka on the harmful effects of e-waste and the ways in protecting the environment.

Conclusion

The global impact that e-waste can create is well understood by the authorities and states. The amount of e-waste produces grows rapidly and swift action by the parties involved is urgently needed. Awareness among the public and educating manufacturers to follow environmental friendly approaches for the production of gadgets and then to follow well organized approaches to collect, recycle and reuse e-waste should be implemented.

Intestinal Worms and the Human Condition: A Sri Lankan Perspective

(Professor Kandiah Balasubramaniam Gold Medal Lecture-2015)

Nilanthi de Silva
Senior Professor of Parasitology and Dean, Faculty of Medicine, University of Kelaniya

President of the Jaffna Science Association, Prof S Kuganathan, Vice-Chancellor of the University of Jaffna, Prof Vasanthy Arasaratnam, members of the Jaffna Science Association, distinguished invitees, ladies and gentlemen, good morning. I must start by thanking the President for that very kind introduction, and the Council of the Jaffna Science Association for inviting me to deliver this lecture. It is truly a great pleasure to be back in Jaffna again, and to have so many known faces in the audience.

Prof K Balasubramaniam

It is a tremendous honour to deliver this lecture in the name of one of our most eminent academics, Prof Kandiah Balasubramaniam. Prof Balasubramaniam was born in 1932 and educated at St Henry's College, Illawalai. He was registered as a medical practitioner in 1952 but then went on to obtain a BSc Special degree from the University of Ceylon in 1960. He was awarded the Smith Mundt Fulbright Scholarship to Indiana University in the USA in 1960, and obtained his PhD in Biochemistry from that university in 1965. He was appointed as a lecturer in the Faculty of Medicine, University of Peradeniya on his return to Sri Lanka, but in 1968, he moved to the Dept of Biochemistry in the Faculty of Medicine, University of Colombo. He rose to the rank of Professor and Head of Dept in Colombo, and then in 1984, he moved to Jaffna as the Professor of Biochemistry in the Faculty of Medicine. He served two terms as Dean of the Faculty of Medicine, from 1988 to 1994.

Prof Balasubramaniam had a very distinguished academic record: he was a research associate with Nobel laureate Prof Louis Leloir in 1972; he was awarded a research fellowship in the international science programme at Uppsala University Sweden in 1980; and the Gold Medal from the Institute of Chemistry, Ceylon, for Scientist of the Year in 1984. He was elected a Fellow of the National Academy of Sciences of Sri Lanka in 1986, and conferred an honorary Doctor of Science degree by the University of Jaffna in 1998. In 2000, the Sri Lankan Chambers of Commerce and Industry recognized him with an 'Entrepreneur of the Year' award.

During his multi-facetted career, Prof Balasubramaniam won many national and international research grants, awards, scholarships and fellowships. He has held many professional posts and also served as Chairman and Director of Biotech Orient (Pvt) Ltd. He had a wide range of research interests which resulted in more than 100 publications in reputed national and international journals.

It is indeed a great privilege to deliver this lecture which is named after such a distinguished university academic.

Intestinal worms and their biology

I have chosen to speak today on "Intestinal Worms and the Human Condition: a Sri Lankan Perspective". A brief outline of my presentation first: I will introduce you to the soil-transmitted helminths (STH) and then present to you a personal narrative of some of the studies that I have carried out on STH, together with a review of the history of the epidemiology and control of STH infections in Sri Lanka. I will then briefly touch upon the current Sri Lankan health policy towards control of STH infections, and leave you with the question: can we eliminate STH infections from Sri Lanka?

Let me first introduce the main actors – and while I do so, I ask for a little patience from those who remember these details from their medical school days. The term 'soil-transmitted helminths' encompasses five species of worms that parasitize the human gut, but in Sri Lanka, as in the rest of the world, only three of them pose major public health problems: the common roundworm, the whipworm and one of the hookworm species. Roundworms are large – growing up to about 30 cm in length – and are often passed out by infected children. So when people talk about children and worms, this is the one they often refer to. However, hookworm, which is much smaller, sucks blood from the intestinal wall, and causes anaemia in infected persons, and so is a lot more problematic.

I will touch on a few basic salient points in the biology of the soil-transmitted helminths before I move on to talk about our research. The adult worms of all five species live in our gut. The female worms produce microscopic eggs that are passed out in faeces, and require a period of development in the soil in order to develop to the next stage – hence the term soil-transmitted helminths. People acquire new infections

by either ingesting infective eggs with food or water or soil, or in the case of hookworms, when the larval stages in the soil come into contact with bare skin. Each egg that is swallowed or each larva that enters the body, will grow into an adult worm, which lives out its given life span – about a year in the case of roundworms, and 3 – 5 years in the other two species. The adult worms cannot multiply and increase their numbers inside the human host, unlike in other infections where viruses or bacteria multiply inside us. The question of how many worms someone has at a given point in time is important, because that is generally what determines if the person will suffer ill effects from the worm infection or not. Another important point to note is that roundworm and whipworm eggs can remain viable in the soil for many years, if the environmental conditions are suitable (like in most of our country), and re-infection is very common among those whose behavior puts them at risk of infection. At the same time, it should be noted that animal reservoirs of infection are not common, and these infections are largely confined to their human hosts.

Research interest

I stumbled into working on these infections when I was young probationary lecturer in the University of Peradeniya. For my MD research project, I chose to look at intestinal parasitic infections among pre-school children living in line rooms within the Kandy Municipal Council limits next to the Mahaiyyawa Cemetary. I thought we would find a lot of amoebiasis and giardiasis (protozoan infections), but we didn't – their prevalence was <1%. Instead, we found that about 25% of the children had worm infections (1). And even within that underprivileged community, where most people were very poor, and not very educated, we found that the children of mothers who had a little bit more education, were much less likely to have worm infections (2).

And so, my interest in STH infections was aroused and when I looked for a place for my post-MD training overseas, I counted myself fortunate to get an opportunity to work with Don Bundy, a world-renowned expert on STH infections at the University of Oxford. From a global perspective, STH infections don't really make the headlines. Most infected children have only a few worms and they don't have any obvious symptoms. However, the few children who do have heavy infections with large numbers of worms, can suffer from very serious complications like intestinal obstruction in the case of roundworm infections. This is a photograph of a section of the small intestine removed post-mortem from a child who has died of intestinal obstruction and perforation due to this tangled mass of roundworms.

Studies from a global perspective

While I was in Oxford, my research focused largely on the relationship between the clinical features of ascariasis and the worm burden. I collated data from many different studies that described the occurrence of Ascaris-induced intestinal obstruction in specific regions of endemic countries, and studies on the community prevalence of ascariasis in the same regions. As you can see from Figure 1, I was able to show that the incidence of Ascaris-induced intestinal obstruction clearly increases as community prevalence of infection increases, but that this is not a linear relationship (3). Similarly, by collation of data from many sources in the published literature, I was also able to show that patients with acute intestinal obstruction due to ascariasis usually have >60 worms; that fatal cases usually had a 10-fold higher worm burden; and that children under the age of 5 years develop obstruction with much smaller worm burdens, as shown in Figure 2 (4).

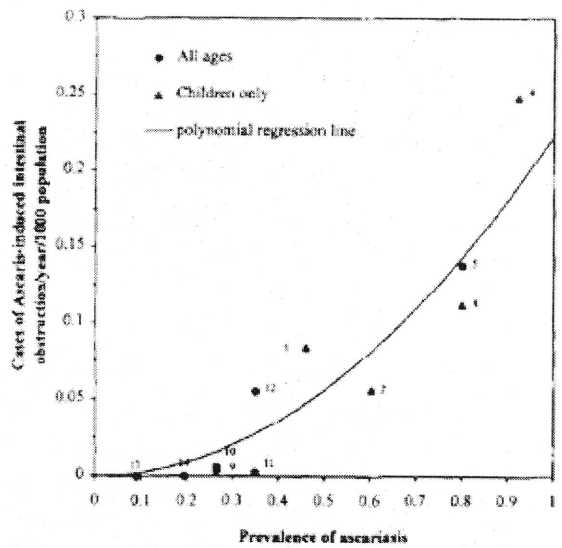

Figure 1. The relationship between community prevalence of ascariasis and incidence of Ascaris-induced intestinal obstruction (from reference 3)

Adapting modeling techniques that had been previously developed by my colleagues in Oxford, and their extensive collection of paper on community-based prevalence studies from around the world, I also went on to re-estimate the global morbidity and mortality due to ascariasis. We categorized morbidity caused by Ascaris infections into acute illness (like intestinal obstruction and other complications) and chronic deficits like growth retardation. Using

a mathematical model, we estimated that in 1990, there was a global total of about 1,274 million Ascaris infections, while 59 million individuals (mostly children) were at risk of suffering some deficit from this infection including 12 million cases of acute illness and about 10,000 deaths (5).

Figure 1 Comparison of worm burden in fatal ($n=9$) and non-fatal ($n=15$) cases, and in under-fives ($n=13$) and older patients ($n=11$). Vertical line indicates range, box indicates 25th and 75th percentiles. , Median; ▼, mean.

Figure 2. Worm burden in cases of ascaris-induced intestinal obstruction (from reference 4)

After returning to Sri Lanka, I continued this work and used similar techniques to update estimates of infections for all three major STH infections by WHO region and age groups (for the year 2000), based on updated survey data. At this point, we estimated that there were 1221 million Ascaris infections; 795 million Trichuris infections; and 740 million hookworm infections globally (6). Figure 3 shows an example of what these figures looked like for hookworm infections in endemic countries. These findings underscored the fact that although STH infections are not killers like malaria or TB or AIDS, they affect huge numbers of individuals in developing countries. I think this particular paper helped to put STH infections on the global health agenda. It was published in 2003, and as of 3 May 2015, it has been cited 678 times according to Google Scholar.

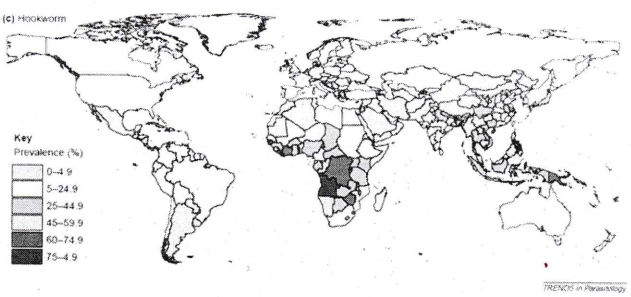

Figure 3. Estimated prevalence of hookworm infection in endemic countries (from reference 6)

Sri Lankan studies

After passing my MD exam in 1994, I went to talk to Prof Mahroof Ismail, then Professor of Parasitology and Dean of the Faculty of Medicine in Colombo. He had recently attended a WHO meeting on hookworm infection and anaemia in girls and women. He suggested that a study to establish the safety of mebendazole use for deworming in pregnancy would be very timely, because Sri Lanka seemed to be the only country that was doing routine antenatal deworming at that time. I had moved from Peradeniya to Kelaniya University by then, and the medical faculty at Ragama was in its infancy. A small team of us, which included a physician, an obstetrician, and a paediatrician, got together and designed a study which compared birth outcomes in 5,275 women who had received routine mebendazole while pregnant, with 1,737 women who had not. In total, we examined the babies of about 7000 mothers who delivered in Ragama and Peradeniya hospitals over a 6-month period. We found that stillbirths and perinatal deaths were significantly less and birth weight was significantly higher in babies of women treated with mebendazole and so we concluded that mebendazole use in pregnancy was safe (7).

The paper that described this study was published in the Lancet in 1999, and it was one of the pieces of evidence that led to the WHO recommendation that all women in hookworm endemic regions should be offered routine antenatal anthelmintic treatment after completion of the 1st trimester of pregnancy.

A few years later, I had a MSc student who was very keen to look at the impact of hookworm infections on the lives of women working in plantations. We assessed 304 women for anthropometry, haemoglobin levels, hookworm infection status, and dietary intake, along with the weight of tea leaves that they plucked over a month (8). The severity of anaemia was linked to the intensity of hookworm infection, and as you can see from Figure 4, there was a very clear, statistically significant relationship between haemoglobin levels (which were indicative of the severity of anaemia) and their labour productivity, as measured in the weight of tea leaves plucked per month.

A few years later, I had the privilege of being part of a large, inter-sectoral team that conducted a national study of the health status of primary school children. In 2003, the survey team examined about 2,528 nine-ten year old children in 144 schools located in all nine provinces of Sri Lanka. The survey methods included

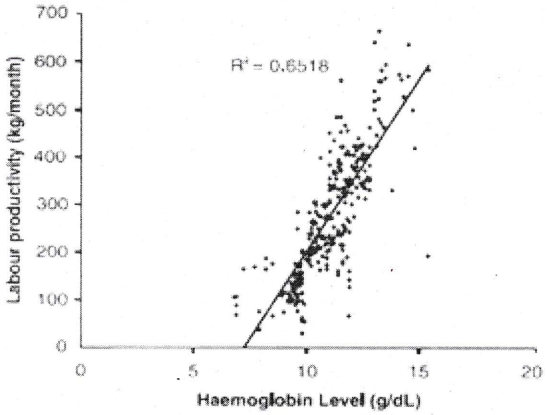

Figure 2 Scatter plot showing relationship between haemoglobin level and monthly productivity

Figure 4. Relationship between haemoglobin levels of tea pluckers and their monthly labour productivity (from reference 8)

examination of a stool sample for STH infections. We found that only 6.9% of children harboured one or more species of STH. The prevalence was highest (between 10 and 15%) in the conflict-affected Eastern and Northern Provinces, as well as in the Western Province, because of the urban slum areas (9).

Although we found that at a national level the prevalence of STH infections was low, we know that infection is closely associated with poverty and lack of sanitation. And so a few years later, a team of us from Ragama designed and carried out a survey that looked more closely at the situation in the plantation sector. We examined 1,890 children from 114 estate sector schools in five districts that had extensive tea or rubber plantations: Ratnapura, Kegalle, Kandy, Nuwara Eliya and Badulla. There we found that the overall combined prevalence was nearly 30% (10). The commonest infection was roundworm. Interestingly, we found no hookworm infections in Nuwara Eliya and Badulla districts, probably because the high altitudes make it too cold for the hookworm larvae to survive.

The map shown in Figure 5 was drawn by my colleague Prof Kithsiri Gunawardena. It shows the predicted prevalence of STH infection in the five districts that we studied. The area in red, in Kegalle district, had a predicted prevalence of over 50%, whereas the area in blue, which covers most of Kandy and Badulla districts, predicts prevalence of less than 20%. The photograph on the side shows part of the reason why STH infections are still common in these communities – even if people have latrines, they do not understand the value of using them for disposal of faeces. They are perceived to be of greater utility for storing firewood, or even tethering livestock.

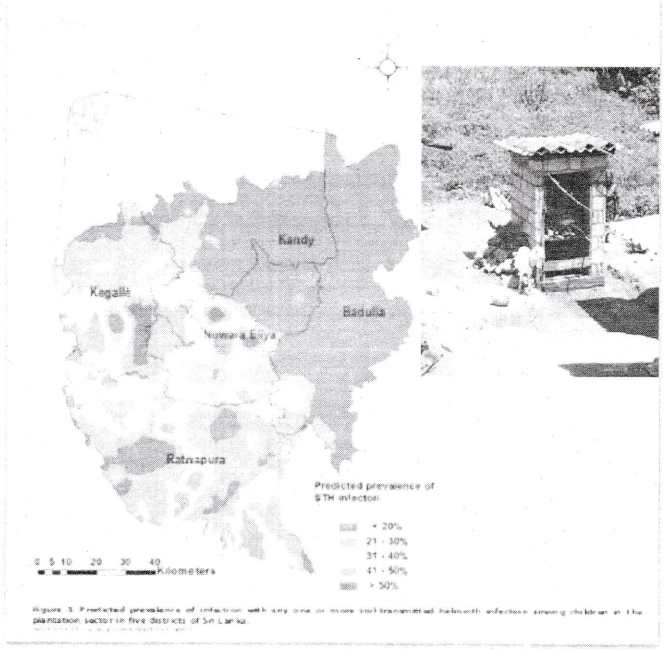

Figure 5. The predicted prevalence of STH infection among children in the plantation sector

This study in the estate sector combined assessment of prevalence rates with a cluster randomized study of the impact of deworming and iron supplements on the cognitive abilities of school children. We randomized schools to treatment or control: treatment consisted of a single dose of mebendazole and weekly iron supplements for 24 weeks, while the control group received placebos. Children were assessed for STH infection, Hb levels and in tests of concentration ability, at baseline and follow up after 6 months. At the 6-month follow up we found that there was a significant reduction in the prevalence and intensity of roundworm and whipworm infections in the treated group, but we could not demonstrate any impact on Hb levels or cognitive abilities (11).

STH control in Sri Lanka

STH eggs are relatively large, and easily identified through microscopic examination of a simple saline smear of a faecal sample. So the first surveys in Sri Lanka were carried out nearly a hundred years ago, soon after the parasites were described by scientists in Europe. Those surveys showed that virtually everyone had intestinal worms. For example, 90% of 32,000 individuals examined in an island-wide survey conducted in 1924/'25 were found to have hookworm. Heavy infections and complications such as severe hookworm anaemia and intestinal obstruction due to roundworms, were also very common. Mass deworming was introduced in the 1930s and although the drugs which were used then were not very effective, with time, the general population accepted that regular deworming is

desirable. Deworming also became part of the annual school medical inspections several decades ago, as did routine antenatal deworming with mebendazole, to combat maternal anaemia.

So over the course of the 20th century, there was a slow decline in prevalence of STH infections, until about the 1980s, and then there was a much sharper drop. There are several factors that probably contributed to the accelerated decline. Improved living conditions with better sanitation and hygiene definitely has been one factor - the infections cannot be transmitted from one person to another if water-sealed latrines are used for disposal of faeces. The discovery of mebendazole and albendazole was another, because they are both very effective in getting rid of STH infections; and once the patent on the branded variety expired, our local State Pharmaceuticals Manufacturing Corporation started producing a good quality, low cost, generic preparation of mebendazole. Somewhere along the way, the belief that good parents regularly deworm their children became part of our national psyche.
Spurred on by the recommendations that have been issued by the WHO's Dept for Control of Neglected Tropical Diseases, and based on data from several of the studies that I just described, the Family Health Bureau of the Ministry of Health has stepped up efforts to control STH infections. A circular with fresh guidelines for community-based deworming was issued in 2013 (12). It categorized provinces in High Risk (Uva, Sabaragamuwa and Central Provinces) and Moderate Risk (all other provinces). The guidelines recommended that pre-school aged children and school children in high risk areas are dewormed twice a year, and all others once a year; while ante-natal mothers should be given a single dose of mebendazole in the 2nd trimester of pregnancy. The policy is to be reviewed after two years of implementation, in 2016.

Elimination of STH infections from Sri Lanka

Which brings me to the question that I raised at the beginning - can we eliminate STH infections from Sri Lanka?

The World Health Organization has identified 17 Neglected Tropical Diseases. Of these, the WHO aims at 'eradication' of guinea worm; 'elimination' of lymphatic filariasis, leprosy, blinding trachoma and sleeping sickness, as public health problems; and 'control' of the remaining diseases, including STH infections.

Let me digress a little and explain the terms 'eradication', 'elimination' and 'control' a little more. The definitions, as agreed upon by the WHO's Dept of Control of NTDs, are as follows (13). 'Control' means the reduction of disease incidence, prevalence, morbidity and/or mortality to a locally acceptable level as a result of deliberate efforts; continued intervention measures are required to maintain the reduction. The term 'elimination as a public health problem' is used in relation to the achievement of measurable targets set by the WHO in relation to a specific disease. 'Elimination with interruption of transmission' means reduction to zero of the incidence of infection caused by a specific pathogen in a defined geographic area, as a result of deliberate efforts; continued actions to prevent re-establishment of transmission may be required. 'Eradication' means permanent reduction to zero of the worldwide incidence of infection caused by a specific pathogen, as a result of deliberate efforts, with no more risk of re-introduction'.

It is likely that without strong active intervention, the elimination with interruption of transmission of STH infections in Sri Lanka (i.e., reduction of incidence to zero), will take a long while, because we have a climate that is very conducive to continued transmission. Elimination as a public health problem, on the other hand, is certainly possible within the next five years, if there is a concerted effort on the part of relevant stakeholders. It will require improvements in water supply and sanitation in all communities, including the poorest and most underprivileged; it will also require a deworming programme with high coverage in all these vulnerable communities; and it will require powerful health education messages which are delivered together with the deworming programme.
It may sound challenging, but I am convinced that it can be done, and that Sri Lanka should rise to that challenge.

Acknowledgements
There are many people that I have to thank and acknowledge because without their contributions I could not have done any of the work that I have just presented to you. My gurus in Parasitology, Prof Kamini Mendis, Prof Manel Wijesundera and Prof Mahroof Ismail, who have inspired me with a vision of what parasitologists can do for our country. All the colleagues that I have had the privilege and the good fortune to work with, in Peradeniya University, in Oxford University and later at Imperial College London, in Jaffna, and at the WHO Headquarters in

Geneva – they are too numerous to mention by name, but I acknowledge them with gratitude and affection. The wonderful team of people that I work with on a daily basis, at Ragama – I have no words with which to thank them for their unwavering support and dedication. The numerous communities that I have worked with in Sri Lanka, the school children and their teachers – none of this would have been possible without their whole-hearted cooperation. And finally, my family, who has put up with my passion for worms with much patience and tolerance!

References

1. de Silva NR, de Silva, HJ, Jayapani, VPP. Intestinal parasitoses in the Kandy area, Sri Lanka. Southeast Asian Journal of Tropical Medicine and Public Health 1994; 25, 469-473.

2. de Silva NR, Jayapani VPP, de Silva HJ. Socioeconomic and behavioural factors affecting the prevalence of geohelminths in preschool children. Southeast Asian Journal of Tropical Medicine and Public Health 1996; 27: 36-42.

3. de Silva NR, Guyatt HL, Bundy DAP. Morbidity and mortality due to Ascaris-induced intestinal obstruction. Transactions of the Royal Society of Tropical Medicine and Hygiene 1997; 91 (1) 31-36.

4. de Silva NR, Guyatt HL, Bundy DAP. Worm burden in intestinal obstruction caused by Ascaris lumbricoides. Tropical Medicine and International Health 1997; 2 (2) 189-190.

5. de Silva NR, Chan MS, Bundy DAP. Morbidity and mortality due to ascariasis: re-estimation and sensitivity analysis of global numbers at risk. Tropical Medicine and International Health 1997; 2 (6) 519-528.

6. de Silva NR, Brooker S, Hotez PJ, Montresor A, Engels D, Savioli L. Soil-transmitted helminth infections : updating the global picture. Trends in Parasitology 2003 ; 19 (12) 547 – 551.

7. de Silva NR, Sirisena JLGJ, Gunasekera DPS, Ismail MM, de Silva HJ. Effect of mebendazole therapy during pregnancy on birth outcome. Lancet 1999; 353: 1145-49.

8. Selvaratnam RR, de Silva LDR, Pathmeswaran A, de Silva NR. Nutritional status and productivity of Sri Lankan tea pluckers Ceylon Medical Journal 2003; 48 (4) 114 - 8.

9. Pathmeswaran A, Jayatissa R, Samarasinghe S, Fernando A, de Silva RP, Thattil RO, de Silva NR. Health status of primary schoolchildren in Sri Lanka. Ceylon Medical Journal 2005; 50 (2) 46 – 50.

10. Gunawardena N, Kumarendran B, Ebenezer R, Gunasingha MS, Pathmeswaran A, de Silva NR. Soil-transmitted helminth infections among plantation-sector schoolchildren in Sri Lanka: prevalence after ten years of preventive chemotherapy. PLoS Neglected Tropical Diseases 2011; 5 (9) e1591.

11. Ebenezer R, Gunawardena K, Kumarendran B, Pathmeswaran A, Jukes MCH, Drake LJ, de Silva N. Cluster-randomised trial of the impact of school-based deworming and iron supplementation on the cognitive abilities of schoolchildren in Sri Lanka's plantation sector. Tropical Medicine & International Health 2013; 18 (8): 942 – 951.

12. Ministry of Health of Sri Lanka. Guidelines on de-worming children and pregnant women in community setting 2013 – 2016. General Circular Letter No 02-172 / 2012.

13. Sustaining the drive to overcome the global impact of neglected tropical diseases: second WHO report on neglected tropical diseases. Geneva, World Health Organization, 2013 (WHO/HTM/NTD/2013.1)

Microbial Safety of Drinking Water

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Introduction

Water is an abundant natural compound. It covers approximately 55 – 60 % of the body mass of adult human. The following properties of water are important for animal and plant biology:

- Water is an excellent solvent
- Movement of water molecules through biological membranes
- Takes part in many chemical reactions
- Can act as a lubricant / to reduce friction between moving surfaces
- It has cohesion, adhesion, surface tension, capillary action

Therefore directly or indirectly water affects all life of organisms. Water covers about 70% of the earth surface. Out of this ,97% of water is salted (sea, oceans) and 3% is fresh water. Out of this 3%, 2% is unavailable for plants and animals(polar regions), 0.6% is ground water, 0.14% is really available for human use, 0.001% is in air as vapour and clouds and rest of is in large water bodies. But the utility of water by human is very high and water is used for drinking, cooking, washing, agriculture, transportation, chemical uses , heat exchange, fire extinction, recreational activities, power generation, industrial uses, food processing etc. To determine the well-being of human, two factors such as quantity and quality of water are important.

Water Quality

Water fit or suitable for drinking is called potable water. Two major sources of getting potable water are surface water and ground water. Contamination of potable water supplies may occur at the source, during storage or during distribution. So the quality of drinking water is a powerful environmental determinant of health. Assurance of drinking water safety is mainly for

- Microbial safety (Prevention and Control of water borne diseases)
- Chemical safety(Chemical and Physical parameters/ characteristics)

Microbial safety

Drinking water should be tasteless, colourless, odourless, clear, free of pathogenic organisms, free of toxins, radioactive material, oils, gases, etc. Even water looks clear and pure, it may be sufficiently contaminated with pathogenic microorganisms (Bacteria, Viruses, Protozoans). One of the main tasks of water microbiology is the development of laboratory methods to detect microbial contamination in drinking water. Checking each of these agents would be difficult and time consuming job. Direct tests for pathogens involve selective cultivation to large numbers, time consuming, expensive and potentially dangerous to lab personnel. Molecular tests require testing for each pathogen, expensive and require expertise. So in practice indicator organisms are used to suggest the presence of pathogens.

Indicator Organisms

Characteristics of a useful indicator organism are

- Useful for all water types
- Always present when pathogens are present
- Not present in the absence of the pathogen
- Correlated with degree of pollution
- More easily detectable than a pathogen
- Survive longer than the pathogen
- Not dangerous to work with

There are three groups of indicator organisms

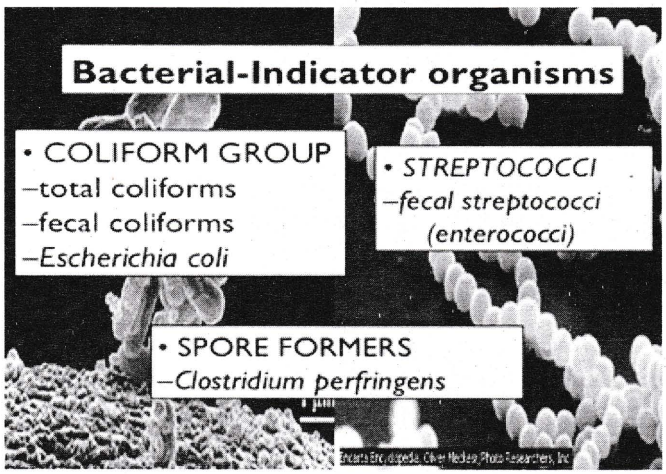
1. General indicators
   - Demonstrate the efficacy of a process.
   - Total heterotrophic bacteria/total coliforms for chlorine disinfection
2. Faecal indicator
   - indicates the presence of faecal contamination
   - Thermo tolerant coliforms / E.coli
   - They only infer that pathogens may be present
3. Index and model organisms
   - A group or species indicative of pathogen presence and behavior respectively

E.coli as an index for *Salmonella* : RNA coliphages as models of human enteric viruses

Types of indicator organisms:

1. Coliforms: Gram negative, non spore forming, oxidase negative, rod shaped, facultative anaerobic bacteria, ferment lactose to acid and gas within 24-48 hours at 37°C. Not specific indicators of faecal pollution
2. Thermotolerant coliforms / Faecal coliforms : Produce acid and gas from lactose at 44.5°C within 24 – 48 hours. They are the faecal indicators

3. Escherichia coli (E.coli): Thermophilic coliforms that produce indole from tryptophan. Most appropriate group to indicate faecal pollution from warm blooded animals.
4. Faecal Streptococci and Enterococci: Gram positive, catalase negative cocci grow on selective medium at 45oC. Faecal Streptococci are relatively high numbers in the excreta of human and other warm blooded animals, presence in waste waters and known polluted waters, absence from pure waters and environments having no contact with human and animals and persistence without multiplication in the environment. Enterococci are the preferred indicators of faecal pollution. Most of the faecal Streptococci don't survive for long time in water.
5. Sulphite- reducing Clostridia: Gram positive, spore forming, non-motile, strictly anaerobic rods that reduce sulphite to H_2S . *Clostridium perfringens* often associated with the faeces of warm blooded animals
6. Bacteriophages: Using of phages as a model for indicating the presence of pathogenic enteric bacteria. There is a direct correlation between the presence of phages and the intensity of faecal contamination. F-RNA coliphages are used as models of human enteric viruses.



The coliform group of organisms is preferably used as indicator organisms to determine the bacteriological safety of drinking water. Because they are common inhabitants of the intestinal tract of both human and warm blooded animals, generally present in large amount, when they excreted into the water environment coliform eventually die, rate of death of coliform is lower than compare to pathogen and both coliforms and pathogens behave similarly. Among coliforms , E.coli can be easily detected and used as an indicator for faecal contamination.

Methods used to determine the bacteriological safety of water:

- Most common recommended methods are Multiple tube fermentation / Most Probable Number method(MPN)
- Membrane filter method

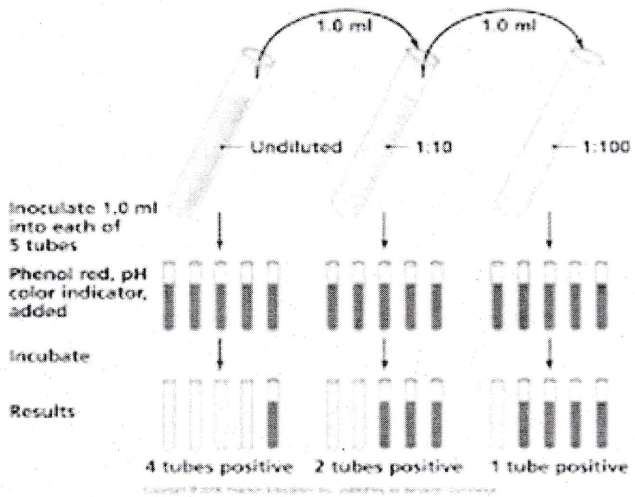
MPN method:

A series of tests is carried out in systematic order according to the results of each step. Three steps in this series are

- Presumptive test
- Confirmatory test
- Completed test

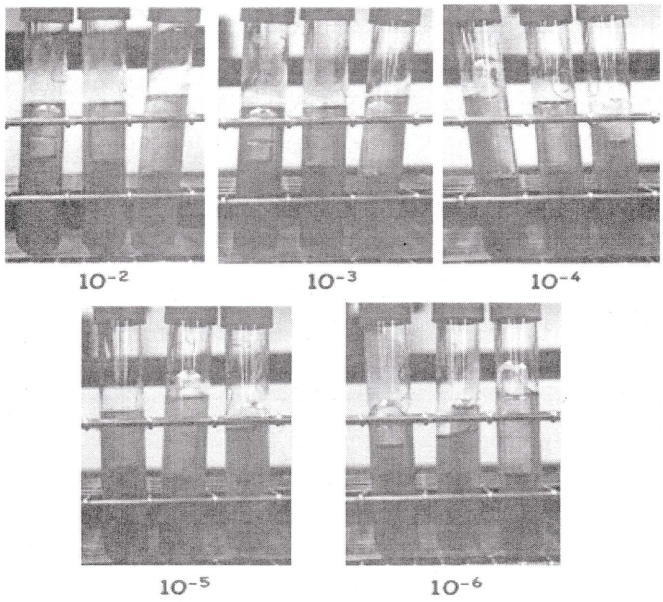
Presumptive test

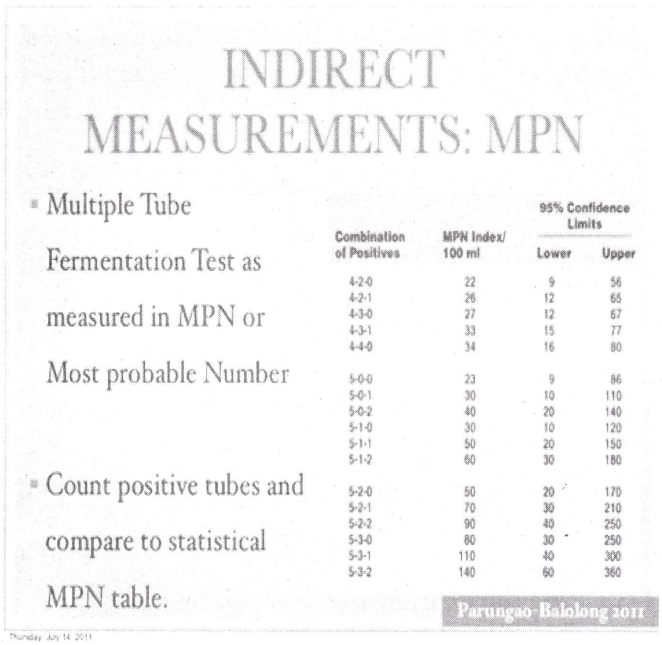
Any lactose fermenting medium can be used. Prepare a series of dilution tubes with inverted durham's tubes. Transfer water samples in to tubes. Incubate the tubes at 37°C for 24-48 hours. Observe the production of acid and gas. This may indicate the presence of coliforms. Most non-coliforms do not produce gas. Acid and gas formation may occasionally due to certain aerobic and anaerobic spore formers. Presence of coliforms can not be confirmed at this level.



Confirmatory test

Consider only the positive tubes from the presumptive test. Inoculate a loopful of sample from each positive tubes into duplicate tubes containing brilliant lactose bile broth(BGLB) with inverted durham's tubes. Keep one set at 37°C for 24 – 48 hours (total coliforms) and the other at 44.5°C for 24- 48 hours(Faecal coliforms). Positive result indicated by gas production. Find out the number of positive tubes in each series. Refer the MPN table and get the number of coliforms/faecal coliforms per volume of water sample.

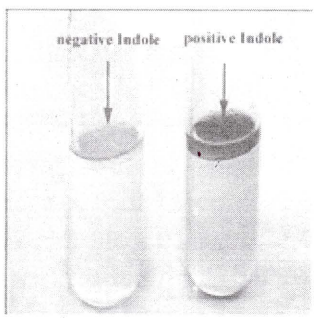




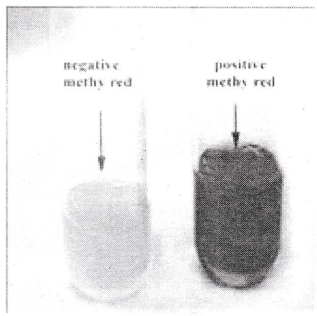
Completed test

At the second stage if typical or even suspicious colonies are observed, then there is a necessity to do completed test. This test involves isolation of each colony in pure form and performs a series of biochemical tests known as IMViC tests.

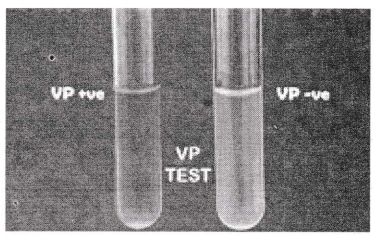
I – Indole test : This is performed on a culture grown in peptone medium rich in tryptophan is a test for the presence of enzyme tryptophanase. This enzyme splits tryptophan to indole, pyruvate and ammonia. Indole can be easily detected with kovac's reagent.



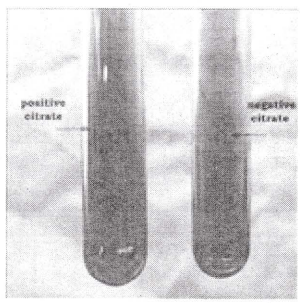
M – Methyl Red test: This is performed on a culture grown in glucose phosphate broth. This is used to detect the mixed acid fermentation pathway. Red colour development by the addition of methyl red indicator gives positive results.



V – Voges- Proskauer test : This is performed on a culture grown in glucose phosphate broth. This is used to detect the butanediol fermentation pathway. Intermediate product acetyl methyl carbinol is detected by the addition of 40% KOH and α-napthol.



C – Citrate test : It determines the ability of the organisms to grow in a synthetic medium containing citrate as the sole carbon source.



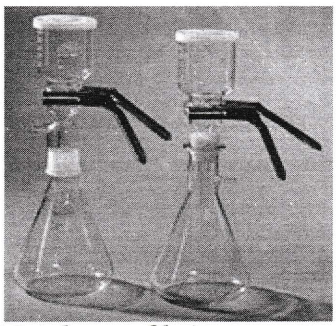
Organisms	Iodole	Methyl Red	Voges-Pros	Citrate
E.coli	+	+	-	-
Enterobacter aerogens I	-	-	+	+
Enterobacter aerogens II	+	-	+	+

Note: Other combinations of results are IMViC intermediates. Appearance of intermediates are not a good evidence of water being contaminated by faecal pollutants.

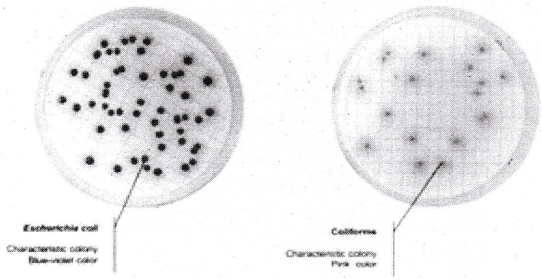
Membrane Filter method (MF)

Filter a known quantity of water sample through a membrane filter. Place the filter membrane inside

the petridish on an absorbent pad(soaked in endo broth). Incubate at 37°C for 24 – 48 hours. Examine the filter under the microscope. Coliforms appear as purple colonies with metallic sheen. For further identification, carry out completed test.



Membrane filter apparatus



Development of colonies

Advantages: It gives rapid results. False positives are avoided. Examine large volume of water. Single bacterium can be trapped. Counting can be done. Reuse of filter.

Disadvantage: This method cannot be used for turbid water.

Enumeration of faecal streptococci

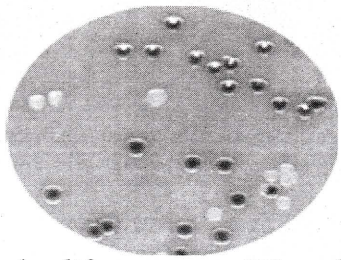
Carryout membrane filtration technique, culture medium: ME agar, Temperature: 35.5°C, Incubation period:48 hours, Red colour colonies are counted with fluorescent light as faecal streptococci.

Enumeration of Enterococci

Carryout membrane filtration technique, culture medium: ME agar , Temperature:41.5°C, incubation period: 48 hours, transfer the filter EIA medium, incubate at 41.5°C for 20 minutes, Pink to red colour colonies with black or reddish brown precipitate - Enterococci

Detection of Enteric Viruses

Earlier phages were used as indicators/ models(eg: coliphages – DNA T type, F-RNA). Later it was found that they are not absolute indicators. Aerobic spore forming *Clostridium perfringens* to be a suitable index for enteric viruses and parasitic protozoa. Spores can also be used as models for protozoan cysts/ oocysts removal.



Faecal coliforms on m-FC medium

Drinking water quality standards

It describes the quality parameters set for drinking water and are protective for public health. It also ensures the quality of water is acceptable to consumers. These standards usually cover microorganisms, chemicals, metals, the way water looks, how it tastes and other physical properties. Many countries specify their standards.

Eg; Sri Lanka standards Institution(SLS)
European drinking water directive(EU)
United States Environmental Protection Agency(USEPA)
World Health Organization(WHO)

Sri Lanka Standard 614 :1983
Specification for Potable Water
Part 1 : Physical and Chemical Requirements

Part 2: Bacteriological Requirements

2.1 Pipe borne public water supplies

2.1.1 Throughout any year, 95% of the samples shall not contain any coliform organisms in 100ml

2.1.2 None of the samples examined shall contain more than 10 coliform per 100 ml

2.1.3 Coliform organisms shall not be detectable in 100 ml of any two consecutive samples

2.1.4 None of the samples examined shall contain E.coli in 100ml

2.2 Individual or small community supplies

2.2.1 None of the samples examined shall contain more than 20 coliform organisms per 100 ml on repeated examination

2.2.2 No sample shall contain E.coli in 100 ml It was amended and approved on 07.06.1988

2.1.2 None of the samples examined shall contain more than 3 coliform per 100 ml

2.2.1 None of the samples examined shall contain more than 10 coliform organisms per 100 ml on repeated examination

The first revision : 2013

Treatment works and piped distribution system

2.1.1 *E.coli* or thermotolerant coliform shall not be detectable in any 100 ml sample

2.1.2 Total coliform bacteria shall not exceed 3 in any 100 ml sample. Total Coliform bacteria shall not be detectable in 100 ml of any two consecutive samples

2.1.3 In the case of large supplies, total coliform bacteria shall not be present in 95% of samples taken throughout any 12 month period. In the remaining 5% sample total coliform bacteria shall not exceed 10 per 100 ml

Microbiological parameters(US)

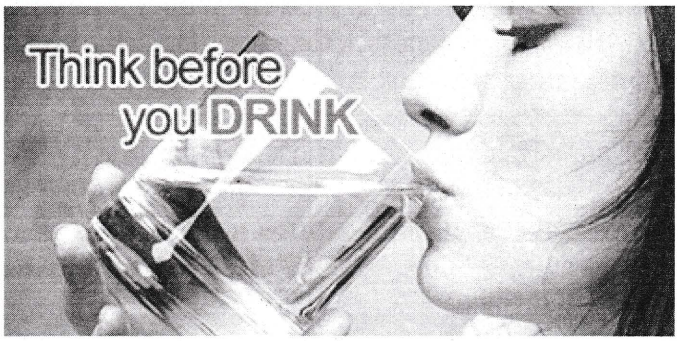
E.coli	0 in 250 ml of sample
Enterococci	0 in 250 ml of sample
Clostridium perfringens	0 in 100 ml of sample
Colony count at 22°C	100/ml
Colony count at 37°C	20/ml
Coliforms	0 in 100 ml of sample

Bottled drinking water(SLS)

Aerobic plate count	100 - 1x104 /ml
Coliforms	0 – 10 /100ml
E.coli	0 / 100ml

Water quality standards

Parameter	Type	WHO	EU	USEPA
Ammonia	Social	1.5 mg L -1	0.50 mg L -1	No GL
pH	Social	6 5-8	No guidelines	6 5-8.5
Chloride	Social	250 mg L -1	250 mg L -1	250 mg L -1
Iron	Social	0.3 mg L -1	0.2 mg L -1	0.3 mg L -1
Lead	Health	0.01 mg L -1	0.01 mg L -1	0.015 mg L -1
Arsenic	Health	0.01 mg L -1	0.01 mg L -1	0.01 mg L -1
Copper	Health	2.0 mg L -1	2.0 mg L -1	1.3 mg L -1
Fecal Coliform bacteria	Health	0 counts/100 mL	0 counts/100 mL	0 counts/100 mL



Nursing: Then and Now

Mrs. Deivy Thabotharan
Unit of Allied Health Sciences, Faculty of medicine

Introduction:

Nursing began to keep people healthy and, to provide comfort and assurance to the sick.. Although the general goals of nursing have remained relatively the same over the centuries, ever-advancing Science and the changing of society's needs have deeply influenced the practice of nursing. As such, it has gone through many stages and has been an integral part of social movements. Nursing has been involved in the existing culture, shaped by it and yet being developed by it.

Stages of Nursing:

Nursing from ancient times to the twenty first century has gone through many changes. The changes have been described under these headings:

Early Civilization (Before AD)
Nursing in the Early Christian Era - (1 – 500AD)
Nursing in Middle Ages - (500 – 1500AD)
Nineteenth century - Period during Nightingale

Period of Early Civilization:

The early civilization started in Egypt. In Egypt, they had medical laws as fixed codes. The law clearly mentioned what a doctor could do and could not do. During this period, traditional female roles of wife, mother, daughter, and sister are considered as nurturing and caring roles. Most nursing historians agree that nursing or the care of sick and injured has been performed by those who provide nurturing roles. It had been the females since the dawn of human life who provided such care to the human beings. Egyptian physicians are believed to have specialized in certain diseases. They also hired women, later known as midwives, to assist with childbirth. These women were the first records nurses.

In ancient India, women held a relatively high position in the society. Their main activities were management of the homes and during illness in the family, they took care of them. At that time in India, early hospitals were staffed by male nurses who were required to meet four qualifications: knowledge, cleverness, devotedness to the patient, and, purity of mind and body.

Sri Lanka also adopted India's methods. There were hospitals and well prepared physicians and nurses who attended the sick people. Mihintale and Anuradapura hospitals are very good images. Will Durant, a well known historian, mentioned in his book that the "world's best hospital was built in Sri Lanka". In 4th century B.C. King Bandugabhayan built that hospital and later it was demolished. In 956-972 A.D., the 4th Mahintale built one hospital in Mihintale, which contained outpatient, inpatient, surgical, pharmacy department and a beautiful garden. From these hospitals we came to know that about 2000 years ago they have practiced definite medicine and nursing. Kings built temples, monastery and palaces for their satisfaction. Hospitals were built for old disabled patients and the people in need.

Nursing in early Christian Era:

At the beginning of Christianity, nursing began to have a formal and a more clearly defined role. Lead by the belief that love and caring for others was important, women made the first visits to sick people, male gave nursing care and buried the dead. Nursing became a respected vocation. There were three groups of Christian women known as apostolic orders. They were either unmarried or widows, who devoted themselves to the service of other women. They visited the homes of the poor and sick, provided food and money for the needy and prayed with them. They gave medicine and their services according to their ability and knowledge.

Nursing in Middle Ages - (500 – 1500AD)

More hospitals were built during early middle ages. Nurses delivered care and depended on physicians for direction. Nurse midwifery, as one of the oldest nursing roles, flourished. Much nursing care was provided by monks for male patents and by nuns for female patients. During the period of Fifteenth to early Nineteenth Century, due to the extensive population growth in cities, the lack of hygiene and sanitation, and the increasing poverty in urban centers resulted in serious health problems. Many monasteries and convents were closed, which lead to a tremendous shortage of people to care for the sick. Women who had committed crimes were recruited into nursing in lieu of serving sentences. "Wayward" women of low status became "nurses" instead of going to jail. The only acceptable nursing role was within a religious order, where services were provided as part of Christianity charity.

Nineteenth Century - Period of Nightingale

Florence Nightingale was born in 1820, in a wealthy family. She was determined to become a nurse since

she believed she was "called by God to help others and to improve the well-being of mankind". She visited Kaiserswerth and received nurse's training in 1850 for three months. The outbreak of the Crimean War (1854 – 1856) gave Nightingale an opportunity for achievement; When the Crimean War began (Between England, France & Russia), reports came back to England about the terrible conditions for wounded and sick soldiers. Florence Nightingale volunteered to go to Turkey (Britain & France). Thirty-eight women, including 18 Anglican and Roman Catholic sisters, accompanied Florence Nightingale to the warfront. She established more sanitary conditions and ordered supplies, beginning with clothing and bedding.

After the war, Nightingale established the Nightingale Training School for Nurses at St. Thomas' hospital in London (1960); the school served as a model for other training school; as the founder of modern nursing, Florence Nightingale established the first nursing philosophy based on health maintenance and restoration.

Milestones in Nursing:

There were certain milestones that took place in nursing as time goes:

1. The International Council of Nurses (ICN) was founded in 1899 and was the first international organization for health care professionals.
2. In 1900, American Journal of Nursing was introduced and scholarly articles have enhanced the notion of nursing education.
3. In 1946 the American Nurses Association was established. The mission was to enhance collaboration among practicing nurses and educators.
4. Training and Education - Development and Establishment of Nursing Schools all over the world.
5. Regulatory Agency/ Body - Existence of Regulating Body for Nurses that sets that the conduct of nurses and regulates safe nursing practice
6. Nursing has extended roles and has various participation in the community service and industry.
7. Involvement in Research and geared research outputs results towards Evidenced-Based Practice.

Career Opportunities

There was a time when professional nurses had very little choice of service because most nursing was centered in the hospital and bedside nursing. Most of the nurses served as staff nurses only a few of them got opportunities for promotion. But the working situation for nurses is very different today. Whether graduate of a certificate/ diploma or a degree programme, there are wide opportunities for service. Today the nurses play multiple roles in different fields. Hospital nursing service offers the broadest opportunities of service in practice and administrative positions. Community Health Nursing is encouraged by the Government. It focuses on preventive medicine. Professional nurses who are interested in teaching have a broad scope in Nursing. Other than this they can work as an Occupational Health Nurse in Industries, Military nurse in Military hospital, Geriatric nurse in old aged homes etc.

Nursing in Sri Lanka

The first nursing school was started in Manipay in 1890. After that the formal Nursing Education was established in the School of Nursing, Colombo, Sri Lanka in 1939. Then School of Nursing in Kandy, Galle, Ratnapura, Kurunegala, Jaffna, Anuradhapura, Batticaloa, Badulla, Kandana, Sri Jayawardhanapura and Ampara followed. Sri Lanka Nurses Association was established in 1943. It is the only professional organization which exists for nurses in Sri Lanka. In 1966, The School of Psychiatric Nursing, Mulleriyawa was commenced. In 1960 Post Basic School of Nursing (PBSN) was established. It provides diploma in Teaching and Supervision for Nursing Tutors and diploma in Ward Management and Supervision for Ward Sisters. Diploma in Public Health Nursing is provided by the National Institute of Health Sciences at Kalutara. In 1994, BSc nursing degree programme for the registered nurses was commenced at the Open University, Sri Lanka. Later in 2005, University of Sri Jayawardanapura commenced the B.Sc. Nursing Programme. Followed that University of Jaffna, Peradeniya, Eastern, Ruhunu and Kotelawela Defence University have commenced B.Sc. nursing degree programme. Recently, the Sri Lanka Nursing Council (SLNC) has been established. It is the registering body for the nurses in Sri Lanka.

The Future: Trends & Challenges for Nurses and Nursing

Trends in Nursing are related to changes in the society because nursing serves to meet the needs of the society. Any major change in the society will bring about a new trend in nursing. Among the major changes in recent years, the following have greatly influenced present trends in nursing:

1. Impact of chronic disease on health care.
2. Demand for nurses with a degree.
3. More job opportunities for nursing educators.
4. A more highly educated public.
5. Expanding Technology.
6. Preventative Care.

7. Nursing shortage and greying workforce as key issues in many countries.
8. Greater investment in research and development.
9. Rising skill requirements.
10. New areas of Nursing specialization.
11. Promotion of evidence based practice.
12. Multidisciplinary team approach.

Conclusion

Knowledge of reviewing history and time line of nursing has given an insight to acknowledge the hard work done by nursing leaders and has given a perspective to pursue the challenges of 21st century health care. We can infer now that how an occupation can change into a profession.

The World has Become Flat Through Globalization

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Introduction

Globalization is the process of the world becoming more connected through technology, trade, economics, politics, and increasingly, every other aspect of people's lives. Different societies, cultures, and regional economies integrate through a worldwide network of political ideas in transportation, communication, and trade. Generally, globalization affects many nations in various ways; economically, politically, and socially. It is a term that refers to the fast integration and interdependence of various nations, which shapes the world affairs on a global level. Globalization has an effect on the products, environment, culture, security, and idea exchange between different countries. There are many factors that lead to the speedy globalization trends. This acceleration in globalization can be attributed to an increase in free-trade activities, emerging technologies, or the worldwide acceptance of markets.

Financial and industrial globalization is increasing substantially and creating new opportunities for both industrialized and developing countries. The largest influence on developing countries is able to attract foreign investors and foreign capital. This leads to both positive and negative effects for those countries.

Definition of Globalization

Stephen Gill (1997) defines globalization as the reduction of transaction cost of transborder movements of capital and goods thus of factors of production and goods. Guy Brainbant states that the process of globalization not only includes opening up of world trade, development of advanced means of communication, internationalization of financial markets, growing importance of multinational corporations, population migrations and more generally increased mobility of persons, goods, capital, data and ideas but also infections, diseases and pollution (Goyal, 2006).

Flattening of the World

It means that we are now connecting all the knowledge centers of the world together into a single global network, which if politics and terrorism do not get in the way – could usher in an amazing era of prosperity and innovation.

Friedman (2005) describes his view that the world is flattening because of globalization, meaning that it is becoming increasingly possible for individuals to get ahead on their own. With the increase in and the spread in availability of technology, more individuals are able to connect to a greater amount of resources and other people from all over the world. Globalization is an unstoppable force that will continue to forge on and reshape the world.

Globalization can be incredibly empowering and incredibly coercive. It can democratize opportunity and democratize panic. It makes the whales bigger and the minnows stronger. While it is homogenizing cultures, it is also enabling people to share their unique individuality farther and wider (Friedman, 1999).

Globalization is not a phenomenon. It is not just some passing trend. Today it is an overarching international system shaping the domestic politics and foreign relations of virtually every country.

Globalization affects cultures and economies on matters dealing with environmental destruction and availability of limited resources. Globalization has diverse implications for environmental issues such as, pollution, deforestation, water resources climate change, and biodiversity loss. The rampant environmental problems have become the subject of international efforts because the effects are felt globally.

Impact of Globalization in Sri Lanka

Globalization vitally impacts on various macroeconomic variables in developing countries like Sri Lanka. In particular, it has a direct influence on economic growth, employment creation, price level, imports, exports, balance of payment, exchange rate, debt, government budget, economic and social infrastructure, income distribution and poverty, as well as on socio-political variables.

Globalization and International Trade in Sri Lanka

Historical evidence shows that Sri Lanka was a hub in the silk route in the early days which allowed it to benefit from international trade. The country was rich with spices, gems, and elephant which attracted the traders from Far East countries to have the relations and this made Sri Lanka a core in international trade centuries ago.

To facilitate international trade Sri Lanka became a member of the World Trade Organization (WTO) in 1995. Increased integration into global economy creates both positive and negative impacts in Sri Lankan industries.

- Impact of Globalization in Plantation Industry

Globalization creates both prospects and challenges for the plantation industry. It introduces new technologies which help to produce good quality products and increase productivity. Introduction of partial mechanization facilitates to save labour. Skilled worker out-migration creates a real challenge for the plantation industry.

- Impact of Globalization in Rubber Industry

Globalization has significant changes in the rubber industry. Rubber industry plays a vital role in manufacturing tire and medical insulation products. Rubber industry is governed by the International Natural Rubber Agreement (INRA) which helps to stabilize the price of rubber in world market.

- Impact of Globalization in Mining Industry

This mainly includes the gem mining industry. With the open economic policy in the 1977 this industry flourished. Globalization creates a place for Sri Lankan gems in the world market. Globalization introduces new technologies associated with gem mining in cutting, polishing and identification of gem stones.

Impact of globalization in Service industry

Globalization, privatization and more demand for intermediate and final consumer services lead the service sector to be the helping hand for the social and economic growth of a nation. Service sector is the largest and fastest growing sector, employing more people and contributing more to the global and national output.

Service sector of Sri Lanka witnesses a major boom and is the major contributor to employment and national income. Service industry includes health care and education, foreign employment, communication, IT industry, banking and tourism.

- Health care and Education

Key service industry is health care and education. A strong health care and education system helps to create a strong and diligent human capital, who will contribute productively to the country's growth. Today, globalization helps many patients to benefit from foreign medicines and to get consultation from foreign experts.

- Foreign Employment

Globalization and integration of regional economies add impetus to the growing mobility of workers across borders. Labor migration supports development of the country through remittances.

- Communication

Globalization allows Foreign Direct Investments (FDIs) in telecommunications sector. This endorses Sri Lanka to bring Technology and Management know-how at a decisive moment. Over 80% of investments are owned by regional telecommunication giants which help to the industry to be aligned with global trends.

- IT industry

The IT industry has achieved growth after the liberalization. The industry is performing well amidst tough competition. Virtusa, IFS and Millennium IT are some of the leading IT companies that have set their branches in Sri Lanka

- Banking Sector

Liberalization has lead to foreign banks getting access to local market and private investors to enter the banking domain. These banks are governed by the same rules and regulations that govern the domestic banks. HSBC, Standard Chartered Bank and Indian Overseas Bank are some of the foreign banks that are operating in Sri Lanka.

- Tourism

Tourism is one of the fastest growing big businesses in the global economy. Sri Lanka being a tropical island is one of the best tourist destinations in Asia and with the end of the ethnical war in the country it has attracted more tourists. Increase of tourist arrival creates new job opportunities and brings foreign exchange and investments to the country.

Impact of Globalization in Garment industry

Garment industry has an important role in Sri Lankan economy. Globalization allows Sri Lanka to increase the garment production to benefit from the wider market and supports to the garment industry with technological advancement which helps to reduce the production time and cost.

Conclusion

Globalization is a complex and controversial issue. It creates interdependence and competition between the economies of the world market. Today globalization has made domestic economy more dependent on both domestic and international policies and economic conditions. Therefore by the globalization process the world has become more flat.

References:

1. Friedman, T. (1999). The Lexus and the Olive Tree.
2. Gill, Stephen. (1997). Globalization, Democratization and Multilateralism. International Political Economy Series.
3. Goyal, K.A. (2006). Impact of Globalization on Developing Countries. International Research Journal of Finance and Economics.

Water Policy for Jaffna Peninsula

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Water is Life. More than 60-80% of the living material is made of water and is also part of the biochemistry and physiology of living organisms. There is no second to water. The next world war may be for 'water' and not for 'gold' as water is an essential good unlike the gold or petroleum and is getting scarce by the day and its demand increasing. Civilisations have risen in the river beds e.g Nile, Ganges and they have also been lost for lack of water. More than 20 million people have been displaced for lack of water over the past decade around the globe. Water is used forand in every aspect of human life as support medium, fishing, washing, cooking, agriculture, drinking, cleaning, cooling and as steam into a range of other uses while as ice it is used for a range of different uses. The frozen water in the polar regions is a main component which controls and or modify the global environment. As such it is essential that the water is conserved for the maintenance of life on earth. Jaffna is no different. It is perhaps the availability of fresh water that had caused the rise and sustenance of a Kingdom of Jaffna in history and it is essential that it is maintained for it to be a reality in future.

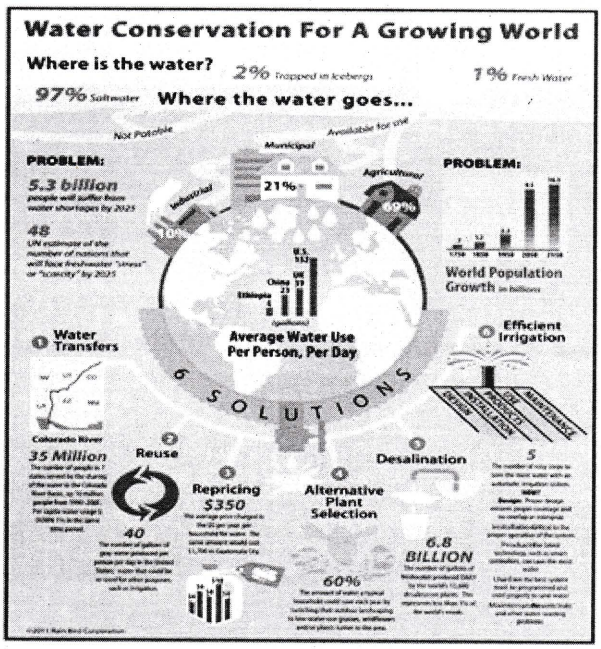

Figure 1: the distribution of water in the planet

Water is found in all three states, solid, liquid and gaseous forms in the globe under 'normal' temperatures as ice/snow, water/sea, and vapour. The different states and status of each change with the operation of the water cycle where water evaporates and precipitates as rain/snow/mist and also solidifies as ice/snow in colder climate. This cycle facilitates the continuous availability of water in the globe as the resource itself is limited and thus the operation of the cycle is essential for the continuity of the resource. It is this process that makes/made the water available for the existence of life over the centuries. However it must be understood that 97% of water is saline in the oceans of the world. Of the 3% remaining fresh water 2% percent is locked as frozen polar scapes and ice and only 1% makes the available fresh water as rivers and streams that flow and ground water.The water is really scarce. The increase in the temperature of the globe or global warming causes the melting of the polar ice and this makes the rise of the sea level and change of ocean patterns whose effects would be substantial.The continuous pollution of the oceans through the sediments and components from the rivers and streams that flow in them and from dumping of various wastes in oceans and also the oil and material that are emptied from the ships and boats add up to high levels that cause concern. Sewage makes 30%,farm run off makes 20, air pollution makes 20, industrial waste makes 10, maritime transport makes 10, off shore oil makes 5 and litter makes another 5 in a nutshell. Basically the oceans are being polluted daily and the effort to minimize is far from satisfactory. They affect the water cycle and thus the availability of water itself.

Of the available fresh water water 69% go for agriculture, 21% for Municipal/domestic and 10% for industry. It is estimated that by 2025, 48 countries would have severe shortage of water and 5.3 billion people will suffer from such shortages.

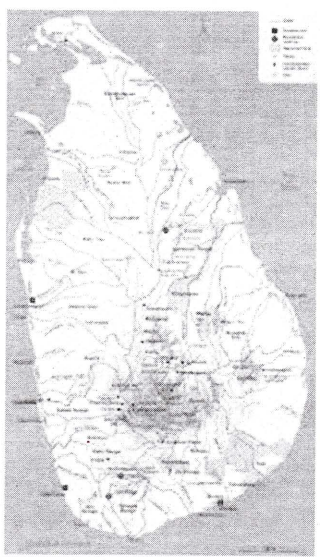

Figure 2 The rivers and their catchments in the country

Sri Lanka may be relatively better given its present climate and water sources. We have an average rainfall of about 1500 mm with only limited areas which have below 1000mm rainfall per year. The mean annual temperature is around 26° C. 103 rivers flow

across the country the major ones arising from the central highlands others arise as water sheds. Jaffna Peninsula in the North has no rivers. Sri Lanka has been a very prosperous country in the past with more than 80% forest cover at the beginning of the 20thcentury which had now dwindled to around 20%. Most of the rainfalls are from two monsoons i.e. South west and North east, the former being wetter than the latter. These create seasonality of wet and dry seasons. However with the reduction of forest cover, increasing use of water use, conversion of land for farming and building purposes and failure/changes in rainfall patterns had caused more flood and drought scenarios in the country over the past 10-15 years. The increase in population, global warming, climate change, increased pollution of water ways, increased use/waste of water and failure to manage water is causing a heavy dent in the water equation of the country. The electricity supply which is also dependant on the hydro electrical power also seems to be interrupted as a cause of water shortages. Sri Lanka too is no exception on the global trend of water scarcity, the success would be how we resolve it for the sustenance.

Water in Jaffna Peninsula

'It is very unlikely that JAFFNA KINGDOM could have been established or thrived if there was no water over history. It is perhaps the availability of water that made people colonise in the peninsula.'

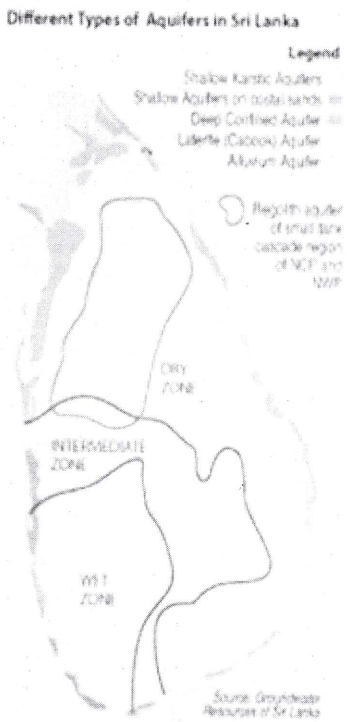

Figure 3 Distribution of aquifers in the country

Sri Lanka has limited aquifers mostly in the coast which are alluvial(Panabokke & Perera,2005). It is only in the north and north west there are more aquifers though there are no rivers in the Peninsula). There are 4 ground water aquifers in the Peninsula vizkayts, chunnakam, vadamaratchi and thenmaratchi (croos,2013). Jaffna is unique in having these and also the Miocene limestone layer as the geology beneath. It provides a structure where water is available in these limestone structures in pockets, linked nodules and some even linking to the sea water at places.

Jaffna has a rainfall of around 1250 mm with most of the rainfall limited to the North East monsoon from October to January each year. Temperature is high with mean around 28° C over the year and evaporation is high. There are no natural rivers or lakes in the peninsula making its water budget limited to incoming from rainfall and outgoing as evaporation and surface flow.

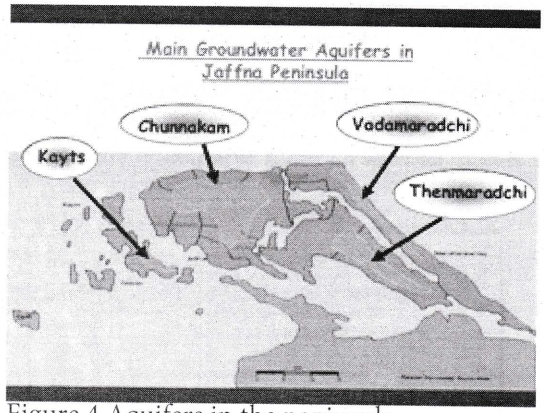

Figure 4 Aquifers in the peninsula

Soil is also characteristic from north of North West in the country to northern part of the peninsula which is red soil on top of the limestone layer whose depth varied from few centimeters to many meters depth. The limestone rock is seen where the soil depth is low. Collectively the soil and the aquifers made a winning combination making the soil a heaven for cultivation of crops making Jaffna a prime center in agriculture. However over time specially over the past 60 years increasing population and improved access to technology had caused over irrigation and mismanagement of watermaking the future of the water in the peninsula a question. The fresh water lens floats on the salt water lens as shown in the diagram and the excess abstraction may cause the shrinking of the fresh water lens. The intrusion of the salt water would be prevalent in places where inkages are seen with the sea as shown in the Kratzx aquifer structures shown in Fig

Let us look at the water economy of the peninsula. Jaffna receives an average annual rainfall of 1250 mm a year but 900 mm of it is received during the three months from October to December during the North East Monsoon. Evapotraspiration makes around 50%

of the annual rainfall. The monthly deficit of water is high except for the monsoon months and April where there had been convectional rains. Spatial variation of net ground water recharge has been observed to be in the range of 12-69% of the rainfall with an average of

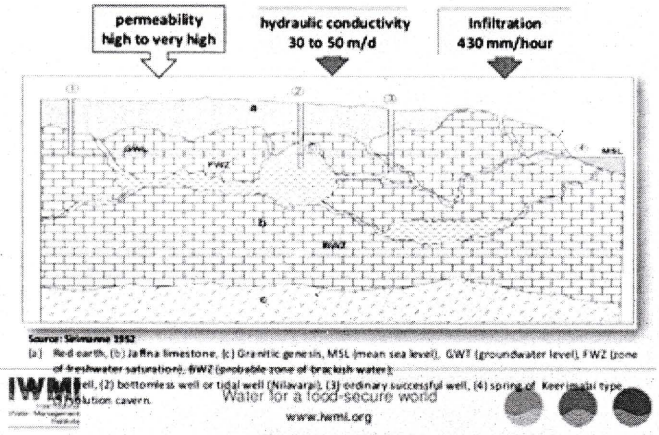

Figure 5 Geology and ground water condition in Jaffna

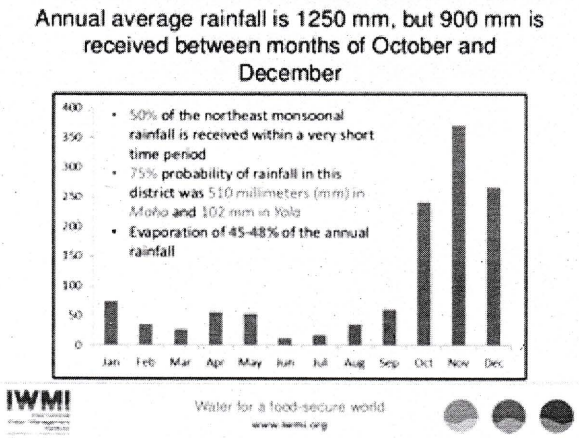

Figure 6 Monthly rainfall pattern in Jaffna

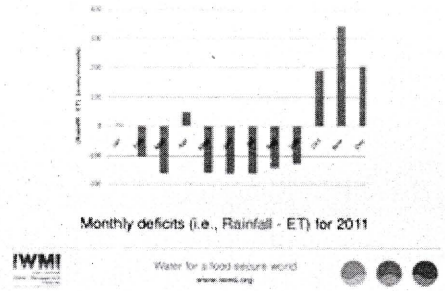

Figure 7

37% during the rainy season.

Significant volume of run off(43-60-%) is lost to the sea during the monsoon months. Abstraction for irrigation varied from 9.4-15.6 mm with an average of 11.5 mm per day. The Evapotraspiration varied from 3.4-5.6 mm per day with an annual average of 4.7 mm per day. It is considered that the peninsula needs around 600 mm a year distributed even throughout but unfortunately we have around 1250 mm with 60% run off during the monsoon months only causing around 540 mm loss (of the 900 mm) (IWMI-). Given these facts drought is imminent in the peninsula(Mikunthan et al, 2013).

The options for the future of Water in the peninsula may be considered along with various factors that may affect the water quality,quantity and distribution of water vizpopulation increase, global warming, sealevel rise, climate change, over extraction, pollution, wastage, agrochemical usage, living standards(conveniences and consumption) and attitude(free good concept).

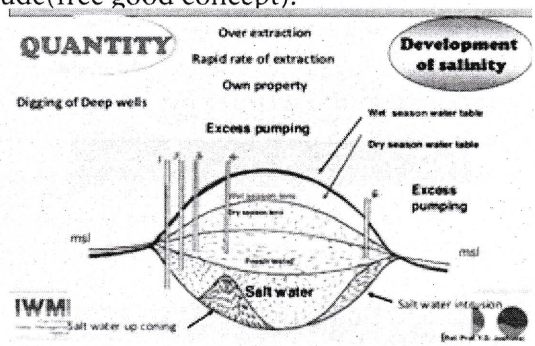

Figure 8 : scheme of Fresh water lens in the peninsula

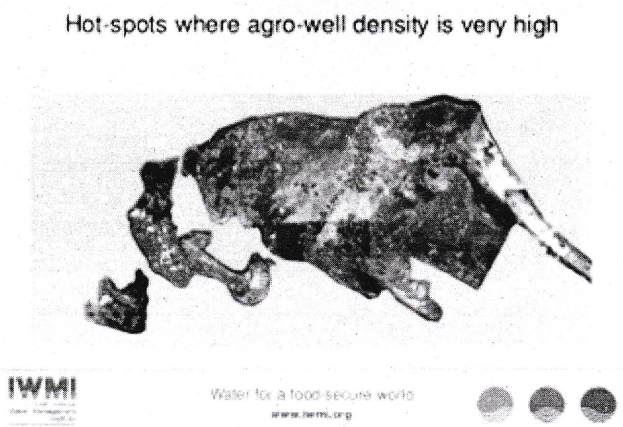

Figure 9 Agrowells in the Peninsula

The Jaffna water itself rest on a limestone substratum and the high level of minerals (specially Calcium) making most of the water as hard water is a fact. But thousands of years of civilization in the peninsula also suggests that there may be 'adaptation' of the local to the water itself by evolutionary mechanisms which is only a plausible suggestion. However the increased level of nitrogen in water (nitrates) has been recorded and vividly demonstrated in many parts of the peninsula. The use of high levels of agrochemicals including fertilizers is suggested as a cause to this problem and if this is not regulated the water may be there but not available to people. The increased number of agrowells in different parts of the peninsula is a direct evidence to the issue. The levels of E-coli in water have also been found to be excess of the accepted levels, which indicatesfaecal pollution in water. Given

the increased population and the frequency of wells for domestic use this does not come as a surprise. The Krast structure of the geology the linkage of the water lenses also facilitate this. Further the 30 year of armed conflict had seen many blasts in this area which perhaps would have destroyed/damaged the limestone layer forming cracks in the limestone may be at microlevel which would thus act as a conduit to move water and pollutants across the limestone layer facilitating spread of pollutants.It is essential that the waterquality is periodically monitored to ensure that the quality is within the accepted limits and usage of boiled water for drinking would ensure safety.

Salinity increase in the soils have also been recorded in the peninsula which is another significant issue for domestic use and for agriculture(JKWSSP). Both, the sea level rise as suggested and excess abstraction of ground water may cause the observed result. Speedy irrigation using motors unlike the traditional methods do not allow the time for ground water recharge; they empty the fresh water lens and draw the saline water

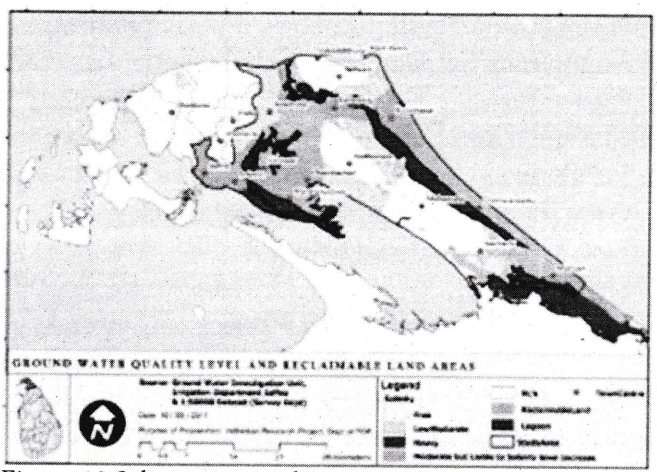

Figure 10 Salinisation in the peninsula(JKWSSP)

associated with it making saline irrigation which eventually degrades the soil too. Excess temperatures in the peninsula seen in the recent past also contribute to increased evapo transpiration making saline soils as a result. Conversion of the Jaffna lagoon into fresh water has been a project conceived many decades ago, utilizing the barrages that were built across the Thondamanar lagoon. However it does not seem to have been successful though reduction in periodic salinity has been reduced in the lagoon. Salt water bunds at Ariyalai, Arali and other places had limited the influx of sea water into the land considerably but the limited maintenance may have caused issues specially during the period of conflict. The River to Jaffna project which suggested to feed the lagoon from the water in the wanni which empties into the Elephant pass is yet in the pipeline with various dimension of discussion, technical and political. Whether that would ensure fresh water to the peninsula is still a question. Given the extreme heat over the past few years and droughts in many parts of the island, sustainability of such large projects raise a doubt in mind.

Desalinization has been suggested as a solution for the water problem in Jaffna. The expense involved is a question at the beginning and the maintenance of the plant over time is another issue. The disposal of the removed solutes also needs attention which may be of significance.

Rationality has to be used in the providing solution to the water problem in the peninsula. Thousands of shallow ponds have been constructed historically which are widely distributed across the peninsula. They had been used to store water from the monsoonal rains and utilized for domestic and livestock purposes. Given the limestone base deeper tanks had not been an option for the peninsula and thus the pond system is a solution, traditional and wise. It would be ideal and appropriate to renovate these ponds for the collection of water during the monsoon and preventing the runoff to the sea which in turn would increase the recharge potential of the ground water. Rainwater harvesting technologies would be ideal for remote places to ensure their water sustainability. Facilitation of reducing surface water flow to the sea during the monsoon would be anideal solution to increase the ground water levels pushing the salt water lens further deep. Slower means of extraction and consideration for limited irrigation per day providing for water recharge either by legislation or by practice is an essentialfeature that needs to be built into the society. There may be more advocacy necessary in this regard. This moves to water conservation or conservation of use of water. Water being a free good many think it is unlimited but the results here and the globe shows water has become very limited and scarce in many parts of the country and globe. Thus wise use of water needs to be practiced from now for sustainability and survival.

These include efficient water use for agriculture (sprinkler systems), alternate crops (water efficient crops), tree crops, change in cultivation modes, limits in chemical usage etc. That would be effective in sustaining better water balance in the peninsula. Recycling of waste water and reduction of pollution of water would be beneficial. Maintenance of wells

and effective solid waste management mechanisms would reduces the polluting of water thus increasing the availability for use also the operation of the water cycle.

Simple measures to direct the rainwater from roof to the well would facilitate recharge and also ensure better and deeper fresh water lens in the aquifer.

The Jaffna population has to make hard decisions over water. Given the present trend of increased temperature under global warming climate change, potential of sea level rise where parts of the peninsula may be lost including some aquifers, their land use policy and agriculture practices need to be revisited and appropriate measures taken for sustainability. There may be also need to be rational limitations of water usage for domestic purposes promoting reuse of water wherever possible by recycling methods.

Continuous mismanagement of water of excess abstraction with the increase in pollution and limitations by potential sea level rise and increased temperatures, the option of a FORCED MIGRATION AWAY FROM THE JAFFNA PENINSULA is imminently visible in the horizon. It is thus the responsibility of every person and institution to ensure that this is avoided by the rational utilizationand management of water effectively and efficiently. It is not a free good any more but the most precious good on earth.

References

- Abeysinghe, P.B,( ) Limestone Resopurces of Sri Lanka. Science education series No:23. NARESA, Colombo.
- Arumugam, S. (1966). Studies on Groundwater in Jaffna. Water Resources Board, Colombo.
- Croos, S (2013) Managing aquifers in Jaffna Peninsula and providing safe drinking water. In Proceedings of the National seminar on groundwater governance of Sri Lanka. IWMI. Srilanka.
- Hidayathulla,M.S.M., Karunaratne,G.P.R.(2013). In proc. 29th technical session of Geological society of Sri Lanka. 109-113
- (http://www.gsslweb.org).
- Jaffna Kilinochi water supply and sanitation project(JKWSSP) -ADB
- Kumara,I.G.C.I.,Rathnayake,S.S.K., Mayadunne,M.M.C.M.,Rajapakse, R.R.G.R.(2011). Journal of Geological society of Sri Lanka. 15,
- Mageswaran Rajeswary, mahalingam, S(1983) Nitrate Nitrogen content of well water and soil from selected areas in Jaffna peninsula. J natn. Sci.Coun.Sri Lanka 11(2) 265-275.
- Mahadeva, S. The Hydrology of Jaffna with particular reference to Jaffna water supply, Public works department , Ceylon
- Mikunthan, T.; Vithanage, M.; Pathmarajah, S.; Arasalingam, S.; Ariyaratne, R.; Manthrithilake, H. 2013. Hydrogeochemical characterization of Jaffna's aquifer systems in Sri Lanka. Colombo,
- Mikunthan,T., De Silva, C.S.(2008) Tropical Agricultural Agricultural Research Vol.20:303-312
- Panabokke, C.R., Perera, A.P.G.R.L (2005) Ground water resources of Sri Lanka. Water Resource Board, Colombo.
- Sirimanne,C.H.L.(1952) . Geology for water supply. Presidential address. Sec. D.CAAS: 87-118.
- Sri Lanka: International Water Management Institute (IWMI). 69p.

Tamil Tradition on Mental Health

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Healthis defined by the WHO as follow "state of complete physical, mental, and social wellbeing and not merely the absence of disease or infirmity". The Mind can be considered as the key for the body. Any mal function of the body can be exposed as mental problem and vice versa. The Tamil community has had a very bad experience of thirty years of war. It affected the social capital in various ways. The social capital is the key element in maintaining the mental health. The main driven force behind the social capital is the culture and the tradition. Any defect in the social capital leads mental trauma. The mental trauma is surfaced in various ways like lack of community cohesion,lack of leadership, lack of creativity and various health related problems like depression, drug and alcoholic addition, etc. So it is obvious that mental trauma not only affect the health but the economic,social, culturalnorms.This in turn ended up in low productive community which always depends on external support.

It is proud to say that our tradition is more than 3000 years ancient. It mainly teaches us the spiritual health. The spiritual health was considered as the supreme of whole. The spiritual health cannot be achieved with in overnight. It can only be possible by continuous practice of some rituals and norms. The accumulation of those rituals and norms can be considered as tradition or culture.

There is no debate about the social benefits of Tamil tradition and the culture. But unfortunately the active Tamil public involvement on it is a query. It can be rationalized by the influencing of western culture and the other issues related to globalization. The public has to be cleared about which side of the globalization is good and how much it should be involved to the tradition. The Tamil tradition is practiced by years and years among Tamil concentrated area. But it is true that traditional cultural trend should be tally with the current rapidly evolving world. The Jaffna university community should take the guidance role in this regards. The university community consist the experts from broad spectrum of principle at the same time the JSA include most of the principles related to the science stream.

It was realized the brain storming may be necessary to in initiate the above activity. The JSA annual scientific meeting is the best place for the brain storming discussion.

During the 45 minutes discussion it was briefed about the Tamil tradition through a literature review. Then the current health problems were expressed with clear evidence. Finally the Tamil tradition was showed as the solution for the current health burden mainly the mental health related health issues. A question was posted to the audient to think about how the revitalization of Tamil tradition is possible. . The thought of Prof Nandi and Prof DayaSomasuntharam were also shared. At the same time the obstacles of revitalization of the tradition were also analyzed in details and details. It was emphasis that importance of the research in this regards. The research should be multisectorial. The results from the research not only published among academic but to the public in laymen languate.

The oration by the Prof DayaSomasundaram was coated in various places. Athesudi and the Therukuralwere also highly appreciated in the presentation. It was advised to take those two ancient Tamil Novels as the guide. Some local researches by the Department of Community and the Family medicine were also table as evidence in the view of influence of Tamil tradition in mental health.

Reference

1. Somasundaram, D. J., Prabakaran S. and Sivayokan, S.(1993). War Stresses and Psychological Problems n the OPD, General (Teaching) Hospital, Jaffna and District Hospital, Tellipallai. Jaffna Medical Association (JMA) Annual Sessions, Jaffna, JMA.
2. Sivarajah, N. (2007). War and Health in Northern Sri Lanka-How did the people survive? Professor C. Sivagnanasundram Memorial Lecture. Jaffna, University of Jaffna.
3. Sivayokan, S. (2011). Waiting in limbo:Psychological impact of disappearance.
4. Sri Lanka College of Psychiatrists Annual Sessions. Colombo, Sri Lanka College of Psychiatrists.
5. Oration.Somasundaram, D. (1997). "Treatment of Massive Trauma due to War." Advances in Psychiatric Treatment3: 321-331.
6. Somasundaram, D. (1998). Scarred Minds. New Delhi, Sage Publications.

7. Somasundaram, D. (2001). "War Trauma and Psychosocial Problems: Out Patient Attendees in Jaffna."
8. International Medical Journal8: 193 -197.
9. United Nations (UN) (2012). Convention against Torture (CAT),Article 14 Comment 3. Geneva, United Nations, from http://www2.ohchr.org/english/bodies/cat/docs/GC/CAT-C-G-3.pdf
10. World Health Organization (2005). The New Mental Health Policy of Sri Lanka. WHO. Colombo,
11. WHO.Retrieved 31 August 2013,.World Health Organization and UNHCR (1996). Mental Health of efugees. Geneva, WHO.World Health Organization (WHO) (2003). Mental Health in Emergencies. Geneva, WHO, from http://www.who.int/mental_health/media/en/640.pdf

Corporate Governance Developments in Sri Lanka

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1. Introduction

Corporate governance issues have attracted much of the attention of academics, researchers,investors, regulators, and policy makers with the collapse of mega corporate entities - Enron and WorldCom and recent global financial crisis. This has also been witnessed increasingly in Sri Lanka with the collapse of Pramuka Bank and Golden KeyCredit Card Company. In light of these developments, Institute of Chartered Accountants of Sri Lanka (ICASL), the Securities and Exchange Commission (SEC)in conjunction withthe Colombo Stock Exchange (CSE) have introduced a number of voluntary and mandatory codes of best practice of corporate governance in order to improve corporate governanceof listed companies in Sri Lanka. The primary objective of this paper is to provide an overview of corporate governance issues and to discuss corporate governance developments in Sri Lanka.

2. Background to corporate governance issues

The agency theory is the dominant theoretical perspective underlying corporate governance issues. The agency perspective of corporations was first introduced by Berle and Means (1932), who observe a separation between ownership and control in large US corporations. The separation of ownership and control in large corporations with diffuse ownership makes it difficult for shareholders to monitor management's decisions. This gives managers the freedom to pursue their own objectives at shareholders' expense (Berle and Means, 1932). Building on Berle and Means's argument, Jensen and Meckling (1976) systematically apply the principal agent perspective to model the potential agency costs resulting from agency problems in corporations. The agency problem arises from the agency relationship whereby one party (the principal) appoints another party (manager) to act on his/her behalf in the corporation. By providing a new paradigm of the firm as a "nexus of contracts" mainly between the principal and his/her agents, agency theory advances our understanding of the firm beyond that offered by the "legal entity" concept in law, or the "factor of production" concept in economics (Alchian and Demsetz, 1972; Jensen and Meckling, 1976). The agency cost theory adds therefore a new dimension to the theory of firm.

Jensen and Meckling (1976, p. 308) define the agency costs as the sum of (1) the monitoring expenditures by the principal, (2) the bonding expenditure by the agent, and (3) the residual loss. Given the considerable losses to the economy as a whole that follow from agency costs (Alchian and Demsetz, 1972; Jensen and Meckling, 1976), agency theory is considered as a dominating theoretical and empirically valid perspective in the governance of corporations (Shleifer and Vishny, 1997; Eisenhardt, 1989).

More recent years have witnessed an explosion of research on corporate governance issues in emerging markets such as China and Asian and East European countries. These studies (e.g., Faccio et al., 2001; Allen, 2005; Morck et al., 2005; Young et al. 2008) suggest that, in addition to the traditional principal agent problems, in emerging markets where ownership is concentrated and legal protection for minority shareholders is rather weak, majority shareholders tend to expropriate minority shareholders through various means like tunnelling, insider trading, dividend policy and leverage. This principal–principal perspective of agency problem affects decisions made by managers and consequently corporate performance (Faccio at al., 2001; Morck et al., 2005)

3. Definition of corporate governance

The above discussion indicates the important of corporate governance mechanisms to use resources efficiently and effectively in order to meet the interest of all the stakeholders. There is no single and generally accepted definition of corporate governance and existing definitions vary widely. A claimholders/ financiers-focused definition is given by Shleifer and Vishny (1997). They put it as "the ways in which suppliers of finance to corporations assure themselves of getting a return on their investment" (Shleifer and Vishny 1997, p.737). A similar focus can be seen in Denis and McConnell (2003, p.2) who define corporate governance as "the set of mechanisms-both institutional and market-based that induce the self-interested controllers of a company (those that make decisions regarding how the company will be operated) to make decisions that maximize the value of the company to its owners (the suppliers of capital)". A somewhat broader definition is provided by the Cadbury Committee (1992) which defines it

as "the system by which companies are directed and controlled". Similarly, Zingales (1998, p.499) broadly defines a governance system as "the complex set of constraints that shape the ex-post bargaining over the quasi-rents generated by the firm".

It is very clear from the above variety of definitions that corporate governance plays a central role in the direction and control of the corporations in order to ensure the interest of shareholders and other stakeholders are met through efficient and effective use of resources. A central theme of corporate governance research revolves around the establishment of mechanisms aimed at attenuating the conflict of interest between shareholders and managers, as well as between majority shareholders and minority shareholders, thereby mitigating agency costs. This is the predominant issue underlying corporate governance theories. To solve the agency problems various governance mechanisms have been devised such as monitoring by the board of directors/ large shareholders,providing equity ownership and compensation to managers, the use of debt financing, the discipline by capital markets and the managerial labour market, the market for corporate control and so on.

4. Development of corporate governance in Sri Lanka

Since 1977, Sri Lanka has adopted open economic policies. In line with these policies government has privatised many of the state owned enterprises and private corporate sector has emerged as a major player in the economy. The number of listed firms has more than doubled from 141 in 1977 to 294 in 2014.Since then governance of corporations has become one of the important considerations in Sri Lanka. As in other emerging markets like China and other Asian countries, corporate governance in Sri Lanka has evolved and developed in line with the economic liberalization policies undertaken in the country. Furthermore, corporate governance system in the UK also significantly influenced corporate governance developments in Sri Lanka as the country had been subject to British colonial rule for over 150 years (Senaratne&Gunaratne, 2008, Senaratne, 2011). In order to attract foreign direct investment, organizations such as the World Bank and International Monetary Fund (IMF) have also promoted better governance for their member countries and wider networks.

Initial corporate governance developments in Sri Lanka began in the late 1990s with the introduction of a voluntary code of best practice on matters relating to the financial aspects of corporate governancein 1997by the Institute of Chartered Accountants of Sri Lanka (ICASL).This was based on the recommendations of the 'Financial Aspects of Corporate Governance Committee' which was led by Sir Adrian Cadbury and had a remit to review those aspects of corporate governance relating to financial reporting and accountability (also known as the Cadbury Code- 1992 and the first code of corporate governance introduced in the UK). Thisfirst ICASL Code outlined a number of recommendations around the structure and responsibilities of the board of directors; the role of auditors; transparency of financial reportingand the rights and responsibilities of shareholders.

There were further developments in the corporate governance in the UK with respect to structure and operations of the board, directors' remuneration, accountability and audit, relations with institutional shareholders, and the responsibilities of institutional shareholders. Based on these developments, ICASL issued the 'Code of Best Practice on Corporate Governance' in March 2003 replacing the previous code introduced in year 1997.

ICASL Code (2003) introduced principles on corporate governance under two main captions namely, The Company and Institutional Shareholders. While the formersection provided principles on corporate governance in relation to four main aspects: directors; directors' remuneration; relations with shareholders; and accountability and audit, the lattersection provided principles on corporate governance in relation to institutional investors and other investors. In the UK, it was expected that institutional shareholders can play an effective role in the governance of corporations.

In addition, a number of supplementary codes and guidelines on specific aspects or areas of corporate governance also were developed in Sri Lanka, namely (i) 'ICASL Code of Best Practice on Audit Committees 2002' to provide detail guidance on the scope and functions of the audit committee of listed companies, (ii) 'Code of Corporate Governance for Banks and Other Financial Institutions 2002' issued by the Central Bank of Sri Lanka and (iii) 'Guidelines for Listed Companies in respect of Audit and Audit Committees 2004' issued by the Securities and Exchange Commission (SEC).

One of the important developments in corporate governance in Sri Lanka is the introduction of theCode of Best Practice on Corporate Governance (2008) by ICASL and the Securities and Exchange Commission (SEC)in conjunction withthe Colombo

Stock Exchange (CSE)for voluntary compliance of listed companies in conjunction with the mandatory rules on corporate governance. The mandatory rules have been incorporated into the Listing Rules of the Colombo Stock Exchange and have been adopted by all listed companies from the financial year commencing on 1st April 2008.The Section Seven of the Listing Rules (the section on continuing listing requirements) deals with these rules on corporate governance that prescribes

- the minimum number of nonexecutive and independent directors to be present on the board,
- the criteria for determining 'independence' of non-executive directors,
- disclosures required to be made in respect of the directorate, and
- the minimum requirements to be met in respect of the audit committee and the remuneration committee.

As a further development in the mandatory codes, the Central Bank of Sri Lanka (CBSL) has also introduced a mandatory code of corporate governance in theform of the Banking Act Direction No. 01 of 2008 on Corporate Governance for Licensed Commercial Banks in Sri Lanka in April 2008.All licensed commercial banks were expected to comply fully with this code by 1st January 2009. The objective of this code is to promote a healthy and robust risk management framework for banks with accountability and transparency through policies and oversight by the board of directors. Additionally, the CBSL has issued Direction, No. 03 of 2008 on Corporate Governance for finance companies registered under Section 2 of the Finance Companies Act, No. 78 of 1988. It sets out principles and rules in relation to finance companies based on the same aspects described above. The compliance with this code is also mandatory from year 2009. Mandatory rules on corporate governance for banking and finance companies are required due to their economic and social vulnerability to the country (Senaratne, 2011).

All these developments in the corporate governance in Sri Lanka were mainlybased on the series of corporate governance developments that had taken place in the UK.Since corporate Governance is a dynamic force that keeps evolving to address new issues and challenges, the Institute of Chartered Accountants of Sri Lanka and the Securities and Exchange Commission of Sri Lanka once again taken a joint initiative to review and revise the Code of Best Practice on Corporate Governance, issued in 2008taking into account the changes taking place in other parts of the world.

This revision took into consideration relevant developments in best practices worldwide and emerging matters specific to Sri Lanka.Corporates are encouraged to adopt this Code in discharging their corporate governance responsibilities.

Key amendments in this version include;

- reporting internal control, risk management and related responsibilities of the Audit Committees and Boards of directors.
- reporting requirements of the remuneration committees.
- role of the company secretary in Corporate Governance.
- communication with shareholders.
- disclosure and approval of major and material transactions, including those with related parties.
- sustainability reporting

5. Conclusion

Major Concerns of Corporate Governance includes align the interests of managers and shareholders, prevent managers from pursuing own interests, prevent high and excessive executive pay, overcome agency costs associated with the separation of ownership and control and avoid abuse of power. In Sri Lanka, ICASL, SEC, CSE and Central Bank of Sri Lanka have taken several measures to improve the governance of listed companies. Firstly, ICASL introduced voluntary codes, which do not prescribe the corporate behaviour in detail but try to secure sufficient disclosures on corporate governance so that stakeholders of corporate entities can assess the corporate governance practices and respond in an informed way. However, through joint initiatives of ICASL, SEC and CSE mandatory codes on corporate governance have been introduced in addition to comprehensive voluntary codes to improve governance of listed companies. However, there is a lack of rigorous empirical research to assess the effectiveness of the corporate governance practices in Sri Lanka.

References

- Alchian, A. A., and Demsetz, H., 1972.Production, information costs, and economic organization. American Economic Review, 62(5), pp. 777-95.
- Allen, F., 2005.Corporate governance in emerging economies. A research paper prepared for conference on Corporate Governance at the Said Business School, Oxford University.
- Berle, A. A., and Means, G.C., 1932. The Modern

corporation and private property, New York: Macmillan Publishing Co.
- Cadbury, A. (1992). Report of the Committee on the Financial Aspects of Corporate Governance, Cadbury Report. London: Gee Publishing London.
- Central Bank of Sri Lanka.(2002). Code of Corporate Governance for Banks and Other Financial Institutions. Colombo: Central Bank.
- Central Bank of Sri Lanka.(2008). Banking Act Direction No. 01 of 2008 on Corporate Governance for Licensed Commercial Banks. Retrieved from www.cbsl.lk.
- Central Bank of Sri Lanka.(2008). Finance Companies (Corporate Governance) Direction, No. 3 of 2008.Retrieved from www.cbsl.lk.
- Colombo Stock Exchange.(2010). Listing Rules. Retrieved from www.cse.lk.DiMaggio, P.J. & Powell, W.W. (1983). The Iron Cage Revisited: Institutional
- Denis, D., and McConnell, J., 2003. International corporate governance. Journal of Financial & Quantitative Analysis, 38 (1), pp. 1–36.
- Eisenhardt, K. M., 1989. Agency theory: An assessment and review. Academy of Management Review, 14: 57–74.
- Faccio, M., Lang, L. H., & Young, L. (2003, July). Debt and expropriation.InEFMA 2001 Lugano Meetings.
- Jensen, M., and Meckling, W. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. Journal of Financial Economics, 3(4), 305-60.
- Morck, R., Wolfenzon, D., and Yeung, B., (2005) Corporate Governance, Economic Entrenchment and Growth. Journal of Economic Literature, 43(3), pp. 655–720.
- OECD.(1999). OECD Principles of Corporate Governance. Paris: OECD. Reed, D. (2004). Corporate Governance Reforms in Developing Countries.
- Samarakoon, L. (1999). The Ownership Structure of Sri Lankan Companies. Sri Lankan Journal of Management, 4 (3&4), 143-157.
- Securities and Exchange Commission of Sri Lanka.(2004). Guidelines for Listed Companies in respect of Audit and Audit Committees. Colombo: SEC.
- Senaratne, S. &Gunaratne, P. S. M. (2008). The Anglo-Saxon Approach to Corporate Governance and its applicability to Sri Lanka. Proceedings from Fifth International Conference on Business Management.Faculty of Management Studies and Commerce, University of Sri Jayewardenepura, Sri Lanka.
- Senaratne, S. (2011). Corporate governance reforms in Sri Lanka. Sri Lanka Journal of Advanced Social Studies, 1(1).
- Shleifer, A., and Vishny, R., 1997. A survey of corporate governance. Journal of Finance, 52 (2), pp. 737-783.
- The Institute of Chartered Accountants in England and Wales. (1999). Internal Controls: Guidance on Directors on the Combined Code. Turnbull Committee Report.
- The Institute of Chartered Accountants of Sri Lanka.(2002). Code of Best Practice on Audit Committees. Colombo: ICASL.
- The Institute of Chartered Accountants of Sri Lanka.(1997). Code on Best Practice on matters relating to Financial Aspects of Corporate Governance. Colombo: ICASL.
- The Institute of Chartered Accountants of Sri Lanka.(2003). Code of Best Practice on Corporate Governance. Colombo: ICASL.
- The Institute of Chartered Accountants of Sri Lanka.(2008). Code of Best Practice on Corporate Governance. Colombo: ICASL.
- The Institute of Chartered Accountants of Sri Lanka.(2013). Code of Best Practice on Corporate Governance. Colombo: ICASL.
- Young, M. N., Peng, M.W., Ahlstrom, D., Bruton, G. D., and Jiang, Y., 2008. Corporate governance in emerging economies: A review of the principal–principal perspective. Journal of Management Studies, 45 (1), pp. 196–220.
- Zingales, L., 1998. Corporate Governance, The New Palgrave Dictionary of Economics and Law. MacMillan, London.

Ground Water Pollution in Jaffna Peninsula

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1. Introduction

The Jaffna Peninsula has four main aquifer systems, namely Chunnakam (Valikamam area), Thenmaratchi, Vadamaratchi and Kayts, of which the Valikamam area is intensively cultivated in the Jaffna Peninsula. The water available within these limestone aquifers is predominantly used for domestic and irrigation purposes. Intensive irrigation, higher inorganic fertilizer usage along with increases in population growth associated with resettlement has the potential over time for over-extraction of groundwater resources and deterioration in water quality. There is currently a deficit in long-term monitoring of the quantity of water stored and extracted from these aquifers along with changes in the water quality.

An assessment of the vulnerability of groundwater for irrigation and drinking purposes has become a necessary and important task for the management of present and future groundwater quality in the Chunnakam aquifer. The suitability of water for any use is determined not only by the total amount of salt present in the water but also by the type of salt that is present. Water quality or suitability for use is judged on the potential severity of problems that can be expected to develop during long-term use. It is, therefore, essential to establish baseline information on water quality and availability to assist in long-term planning whilst ensuring the integrity of supply for the Jaffna Peninsula. Even though several studies have been undertaken on groundwater quality in the Peninsula, no systematic studies have been carried out to characterize the chemical quality and recharge potentials of aquifers in the Jaffna Peninsula.

2.0 Chemistry of Crude Oil

Petroleum (or crude oil) is a complex, naturally occurring liquid mixture containing mostly Hydrocarbons, but containing also some compounds of oxygen, nitrogen and sulfur. The elemental composition of petroleum is much less variable than that of coal: 83-87% carbon, 11-16% hydrogen, 0-4% oxygen plus nitrogen, and 0-4% sulfur. Note that most crude oils contain substantially more hydrogen than coals. Crude oils can be classified in a number of ways. Consider first a crude oil that is in the very early stages of being produced from kerogen. The long-chain compounds in the kerogen will not have broken apart to a great extent, because the oil or kerogen has not yet been buried very deeply (so it has not been exposed to high temperatures in the earth), nor has it been buried for a very long time. The carbon atom chains in this oil are likely to be very long. These long chains give the crude oil two properties:

- They make it dense because long, straight chains of molecules can be packed tightly, resulting in a large mass per unit volume.
- They also make it difficult for the molecules to flow past one another, making the crude oil more viscous (slower to flow and harder to pump).
- Petroleum compounds can be divided into two main groups.
- Hydrocarbons
- Heteroatom compounds

Hydrocarbons are usually measured as Total Petroleum Hydrocarbons. (TPHs). The heteroatom compounds are those that contain not only carbon and hydrogen but also heteroatom such as Sulphur, Nitrogen and Oxygen. Hydrocarbons are in generally grouped into three categories:
1)Saturated 2) Unsaturated 3)Aromatic

Environmental contamination by petroleum hydrocarbons is the most common site contamination issue encountered by environmental professionals. The nature of petroleum hydrocarbon contamination is highly variable. Petroleum hydrocarbons themselves are diverse mixtures of chemical components. Site characterization as well as risk assessment is best accomplished with insight on site-specific contaminant compositions. The components of petroleum and petroleum products number in the tens of thousands. They range in molecular weight from methane (16) to very large uncharacterized components with molecular weight in the thousands. The toxicity of the components varies immensely. Overall, the components of these mixtures have only two common properties: They are derived from petroleum and they contain hydrocarbon functional groups (C-H).

The more common functional categories of compounds found in petroleum products are n-alkanes, branched alkanes, cycloalkanes, and aromatic compounds. In certain mixtures there are other functional categories

present (alkenes, mercaptans, porphorins, etc.). In the environment, petroleum component mixtures are subject to weathering effects such as volatilization, biodegradation, partitioning into water, oxidation, and photo degradation. These effects change the distribution of components in a mixture and change the chemical composition of components as well.

2.1 Environmental Degradation

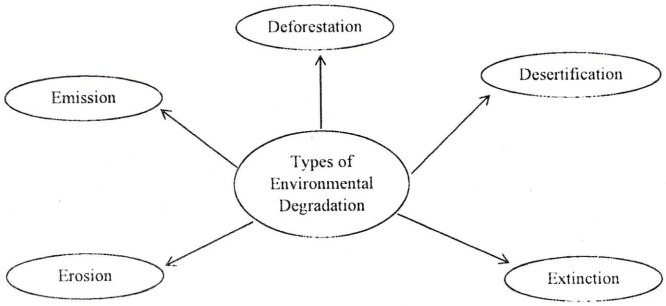

Fig.1 Types of environmental degradation

In the environment, volatilization, biodegradation, partitioning into water, and photo degradation alter the component profile of diesel fuel. N-alkanes are considerably more biodegradable than branched alkanes and alkyl aromatics, and their peaks in the profile quickly attenuate. Lower boiling components are more biodegradable, more water-soluble, and more volatile than higher weight components and are removed from the mixture sooner.
The effect of this "weathering" process is that the component profile shifts to the higher boiling range and loses the regularly spaced n-alkane peaks.

All petroleum hydrocarbon mixtures undergo similar degradation in the environment. Even after considerable weathering, the profiles for the resultant residuals have a conspicuous "signature" revealing their petroleum product precursor.

Dispersed oil:
Usually means oil in ground water in the form of small droplets. Dispersed oil will contain both aliphatic & aromatic HCs.
Dissolved oil:
Usually means oil in ground water in a soluble form. Aliphatic HCs in generally low soluble in water. Aromatic HCs together with things like organic acid that form the bulk of dissolved oil.

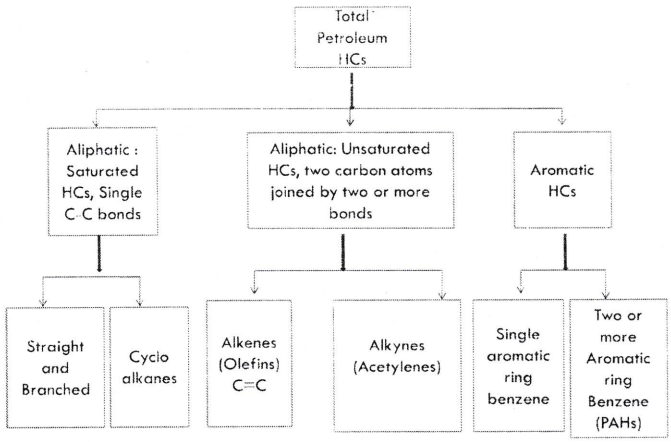

Fig.2 Total petroleum hydrocarbons types

2.2 Ground Water Contamination

Groundwater can become contaminated, by many of the same pollutants that contaminate surface water. Pollution of groundwater occurs when contaminants are discharged to, deposited on, or leached from the land surface above the groundwater. Even if there are no industrial and domestic pollution sources in the area, it is important to realize that the water may not be free from contaminants, and should be tested before human consumption.

Pollution can come from two types of sources; point and non-point. Point sources are identifiable and localized sources of pollution. Point sources that can contaminate groundwater include landfills, buried gasoline or oil storage tanks, septic systems, industrial sources and accidental spills. Non-point sources tend to be in the form of pesticides and nutrients that enter the soil as a result of intense agricultural operations or the widespread use of road salts and chemicals.

2.3 Composition of Used Waste Oil

Used oil is any oil refined from crude oil or any synthetic oil that has been used and as a result of such use is contaminated by physical or chemical impurities. Used oils include spent automotive lubricating oils, spent industrial oils, and spent industrial process oils. The definition of used oil includes oil used for the purpose of lubrication that becomes contaminated as a result of such use and residues and sludge derived from used oil. The halogen family, or Group VIIA on the periodic table of elements, includes fluorine, chlorine, bromine, iodine, and astatine. (Astatine is a radioactive, man-made element with an extremely short half-life, and therefore, not a concern).

Chemicals containing both a halogen atom and a carbon atom are called "organic halogens." Examples of organic halogens include short chain alkanes like 1, 2-dichloroethane, hexachloroethane, and short chain (C10 - C13) chlorinated paraffin. Chemicals containing an atom from the halogen family but no carbon atoms are "inorganic halogens." Examples of inorganic halogens include sodium chloride (table salt) and thallium chloride. Total halogens include organic and inorganic halogens, except as noted in analytical procedures.

Lubricating oils are relatively heavy products. Petroleum distillates in order of decreasing volatility include:

- Petroleum ether or benzene, Gasoline, Naphtha, Mineral spirits, Kerosene, Fuel oils. Lubricating oils, Paraffin wax, Asphalt or tar

2.4 Potential Effects on The Environment and Human Health From Waste Oil

Used oil and waste fuel have historically been released to the environment through flaring, burning and fire practice, landfilling, indiscriminant dumping, accidental spills and through use as a dust control agent on roads. Burning and use in fire practices can lead to the release of unburned hydrocarbons, acid gases and metals that adhere to particulate matter in air (i.e. solid particles and liquid droplets) and eventually are deposited on soil and plants or in water. When hydrocarbons are released into water, a film of oil is initially formed on the surface where contaminants can be released and mixed with the water column and sediments. There are many ways oil can affect aquatic organisms ranging from coating the organism's skin, ingestion and absorption by surface breathing aquatic insects and tainting the flesh of fish, shrimp, clams and other edible organisms.

The direct release of used oil or waste fuel to soil can lead to contaminants entering the environment through volatilization, adsorption to solid organic matter, leaching into groundwater, or through surface runoff to oceans, lakes, rivers and streams. Many different plant species are very sensitive to the toxic effects of oil, while others are more resistant. The potential effects of used oil and waste fuel on human health is directly related to its physical properties and the types and levels of contaminants present. Highly volatile hydrocarbons are flammable and may present a risk of fire or explosion.

Highly volatile hydrocarbons are also more likely to be inhaled into a person's lungs, which can result in inflammation of the tracheobronchial tree, bleeding from alveolar membranes and the displacement of oxygen. Repeated inhalation can affect the central nervous system eventually leading to lethargy, headaches and coma. Ingestion of hydrocarbons can result in irritation of the gastrointestinal tract, abdominal pain, vomiting and nausea. Prolonged or repeated skin contact with used oil and waste fuel may cause severe irritation and dermatitis, and should be avoided.

Heavy metals and other contaminants found in used lubricating oil may also be absorbed through the skin. Heavy metals such as chromium, copper, lead, manganese, nickel and zinc are commonly found in used lubricating oil from friction wear on engine parts and can influence the effect the waste has on human health. Heavy metals can accumulate in the body and, although symptoms vary with the specific heavy metal, a person may be exhibiting metal poisoning if they experience any of the following: chronic pain throughout the muscles, tendons or other soft tissues of the body; a general feeling of discomfort, fatigue, and illness; forgetfulness and confusion; gastrointestinal complaints such as diarrhea, constipation, bloating, heartburn, and indigestion; dizziness; migraines and headaches; visual disturbances; or nervous system malfunctions including burning or numbness of the extremities.

2.5 Disposal of Waste Oil

Once in the environment, the hydrocarbons that make up the base oil or fuel, the additives and many of the contaminants that are introduced through usage can significantly impair the quality of local soil, water, vegetation, fish and wildlife resources. For this reason, used oil and waste fuel should never be used as a dust suppressant on local roads, discharged directly to the ground, a lake or watercourse or sewage lagoon, open burned or placed in a landfill. Used oil should also never be used for fire practice although small quantities of waste fuel can be used under the direct supervision of a trained firefighter.

Reprocessing and burning for heat recovery in a certified appliance are the safest, most environmentally responsible and cost effective local options for managing used oil. Businesses and industries that routinely generate large quantities of used oil (i.e. automotive service garages, trucking

and aviation companies, heavy equipment operators) should implement one of these options or arrange to transport their waste to a local collection center, re-processor or registered used oil or waste fuel appliance owner. Small generators and household do-it-yourselfers should donate used oil to local businesses that operate reprocessing or registered burning appliances, where the businesses accept such wastes.

Large generators of waste fuel should investigate the possibility of bringing off-spec fuel back into specification with the introduction of additives before other disposal options are considered. Where local reprocessing or reuse options are not available, used oil and waste fuel that is generated by commercial, industrial, institutional or government operations should be safely stored until it can be transported to a commercial recycler, re-refiner or registered hazardous waste receiver.

2.6 Measurement of Oil in Ground Water

- Gravimetric method (Oil and Grease in water by Hexane extraction method)
- Infrared absorption method
- Gas Chromatography

2.6.1 Gravimetric method

Gravimetric-based methods measure anything extractable by solvent and expressed in mg/L. An oily water sample is extracted by a solvent. After separating the solvent, it is placed into a flask. The flask has been weighed beforehand. Then the solvent is distilled, and collected. The flask containing oil is dried and weighed. From the initial weight, the amount of the oil and grease can be calculated.

Reference method	Country	Solvent used	Evaporation Temperature(^{0} C)	Status
ASTM D4281-95	USA	Feron	70	-
METHOD 5520 B	USA	n-hexane	85	In use
EPA 413.1	USA	Feron	70	-
EPA 1664 A	USA	n-Hexane	85	In use

Fig.3 Different gravimetric methods

2.6.2 Infrared absorption method

Acidified water sample is extracted with CFC solvent. The solvent is dried and oil is purified. Then a portion is placed in the IR instrument. Then the concentration is determined by using Beer-Lambert Law.

2.6.3 Gas Chromatography

Use to get details of different type of HCs in oil fraction. Small amount of sample is injected into the GC instrument. With a help of a carrier gas and chromatographic column, different type of HCs will leave the column at different time and be detected.

3. Summary

As the Peninsula is currently entirely dependent on groundwater as its sole source of water supply for domestic and agricultural use, the management of this resource is critical in order to avoid compromising this resource through saltwater intrusion. Whilst further research and monitoring of groundwater is required to establish safe and sustainable yields from the aquifers that predominate the Jaffna Peninsula the following tentative recommendations are suggested:

• The over use of inorganic fertilizers is assumed to be the source of excessive levels of inorganic nitrate observed in groundwater samples. Change in farmer behavior through extension trainings in the use of fertilizers as well as possibly considering a reduction in subsidies on fertilizers are possible approaches that could be considered.

• Assess the potential for rainwater harvesting at the household levels through the pro-vision of roof top harvesting systems and associated storage tanks.

4. References

• Joe C. Raia and Dan D. Caudle, 1998. Methods for the analysis of oil and grease and sources of Variability in their application to produced waters from Oil and gas produc-tion operations.

• Daniel Solomon et.al, 2010. A new approach to the determination of oil and grease in water and wastes.

• D. Couillard and F.T. Tran., 2008. Mobile system for extracting spilled oil from beach sand.

• Dr. Thushyanthy Mikunthan, Dr. Meththika Vithanage, Dr. S. Pathmarajah, Mr. Ran-jith Ariyaratne and Dr. H. Manthrithilake., 2011. Hydrogeochemical Characterization of Jaffna's Aquifer Systems in Sri Lanka.

"Surviving with Typhoid" Challenges in The Context of Jaffna Peninsula

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Typhoid fever is a systemic infection caused mainly by Salmonella enterica subspecies enterica serotype Typhi. Typhoid fever is common and endemic in lower and middle income countries where unavailability of clean water, inadequate sanitation facilities and poor hygiene standards are common (Parry et al., 2011). The causative organism of typhoid fever, S. Typhi has no non human vectors and is transmitted orally through water, food or beverages handled by an individual who chronically sheds the bacteria through faeces or less commonly in urine. Improving the quality of water and improving sanitary conditions in endemic areas would help to control typhoid considerably. In addition, WHO and Center for Disease Control (CDC) recommend vaccination of individuals in high risk areas (WHO 2003, Morbidity and Mortality weekly report, CDC, 2014).

Population based data suggests that the annual global incidence of typhoid fever is approximately 27 million cases each year with 216,000 deaths. More than 90% morbidity and mortality occurs in Asian countries. In the year 1994, globally there was 17 million new cases were observed with 600,000 deaths. In 2004, 21.6 million new cases were observed but the number of deaths decreased to 216,000. According to the Ministry of Health Sri Lanka the number of typhoid patients in 2005 was 2376 and in 2014 the number declined to 1067. But in Jaffna peninsula the number of typhoid patients over a period of ten years were more or less same, in 2005 it was 342 and 2014 it was 321.

Typhoid fever is an acute illness. The first typical clinical manifestations include fever, headache, abdominal pain, relative bradycardia, splenomegaly and leukopenia. Fever is present in more than 90% of the cases. Classically, fever begins with a remittent fever during the first week, rising in a stepwise fashion, after which the fever becomes sustained. In endemic areas deviations from this classic pattern may occur frequently. In such areas a differential diagnostic test is essential to differentiate other febrile illnesses such as malaria, dengue, leptospirosis and rickettsial fevers from typhoid.

Unavailability of clean drinking water, inadequate sanitation facilities and poor hygiene standards are the main factors which influenced on the presence of typhoid fever in a region. In Jaffna peninsula in addition to the above factors, there were lack of currently available laboratory methods to diagnose typhoid fever. Introducing new laboratory methods, improve the sanitation facilities, improve the hygienic habits and availability of clean drinking water may reduce typhoid fever in Jaffna.

Laboratory methods for the identification of typhoid fever

- Currently available methods are blood culture, serological tests and Polymerase chain reaction on blood
- New methods Culture/ PCR Loop mediated isothermal amplification (LAMP)PCR

Blood culture is considered as the gold standard for diagnosis of typhoid fever. The definitive diagnosis of typhoid fever therefore requires the isolation of S. Typhi from blood or bone marrow of the patient. Although blood culture is considered the gold standard, it has been shown that blood culture is positive in only 45-70% of suspected typhoid fever patients (Wein et al., 2001, WHO 2003). The yield of blood culture depends on many factors such as the day of blood collection for culture, prior antibiotic treatment of the patient and technical factors such as volume of blood, volume of culture media, additives and time of incubation.

Continuous monitoring automated blood culture systems are shown to have excellent isolation rates with improved detection time and low contamination rates. However, in many developing countries conventional manual blood culture systems are still being used in areas where typhoid is endemic. The main limitation for the unavailability of automated blood culture systems is the high cost of instrumentation. In Sri Lanka blood culture facilities are not readily available in most government and private sector hospitals, although in recent years such systems have been introduced in some provincial state hospitals and major private sector hospitals. Due to unavailability of automated blood culture systems in Jaffna, possibly due to financial and other constraints, the conventional manual blood culture method is routinely used. The sensitivity of the conventional blood culture method was low in some previous Sri Lankan studies. It is clear that blood culture facilities

should be improved in Jaffna for diagnosis and appropriate management of patients.

Serological tests therefore continue to play a major role in the laboratory diagnosis of typhoid. The Widal test (Standard Agglutination Test) is the commonly used serological test in many developing countries. This is an agglutination test using the killed bacterial antigen suspensions of S. Typhi to detect the corresponding antibodies in the serum of patients suspected to have typhoid fever. The Widal test may give false positive results in patients infected with other enteric pathogens or in patients with other febrile illness such as malaria, dengue, leptospirosis and rickettsial fevers, in healthy people who are continuously exposed to enteric pathogens and people who have been vaccinated against typhoid fever. As interpretation of the Widal test depends on the presence of specific antibodies in the normal population serosurveillance studies are needed to determine baseline titres in healthy population of any given geographical area.

As early diagnosis and prompt treatment are essential for optimal management of typhoid fever, a rapid sensitive detection method for typhoid would be very helpful. PCR based assays have been developed and used as a diagnostic tool in typhoid fever.

To increase the sensitivity of PCR, a new method named as blood culture PCR performed on routine blood cultures was introduced, which increased the diagnostic sensitivity and took less than 8 hours to complete. Studies have focused on LAMP PCR (Loop mediated isothermal amplification), another new method which can be carried out in a single tube at a constant temperature and the detection of amplified product can be done by measuring turbidity or color. Finding new methods for use in the clinical settings especially would be useful for the routine diagnosis of typhoid.

Studies suggested that availability of clean drinking water is one of the major factor for the presence of typhoid fever in Jaffna. To reduce the typhoid fever in Jaffna the following actions should be taken:

- Urgent need for the laboratory facilities
- Increase the number of staff in the laboratories
- Availability of water and clean water for drinking
- Identify the defects in the sanitation system and rectify
- Health education