UGC MINOR RESEARCH PROJECT ON

AFFLUENCE AND DISEASES, SHIFTING BURDEN OF COMMUNICABLE DISEASES IN KERALA

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1.1 Introduction

The epidemiological transition is a process, starting from the point of time when infectious diseases were predominant cause of death and ending when non communicable diseases dominates the causes of death.Epidemiolological transition is a concept which closely follows the demographical transition.

In underdeveloped countries acute infectious and deficiency diseases are predominant and chronic non-communicable diseases are the characteristics of modernization and advanced levels of development. This concept is usually referred to as the "epidemiological transition". The most important indicators of this transition are changes in the pattern of mortality, especially the cause of death, as well as changes in morbidity.

The top causes for mortality worldwide in the 2000 excluding injuries, were non-communicable diseases; this is projected to be top cause by the year 2030. 76% of the deaths in the world expected to be due to non-communicable diseases (NCDs).

The change in causes of death from Communicable diseases is a major cause of concern for developing countries. These diseases are expensive to treat and manage, and consume a major share of the already stretched healthcare budgets. In developing nations complications from the diseases occur at relatively younger ages and reduce the productivity of the labour force due to lack of proper medical care at an early stage.

1.2 Concept

Epidemiological transition (ET) theory was first postulated in 1971.It has developed alongside the demographical transitions over time. However, understandings of mortality transitions and associated epidemiological changes remain poor both for public health practitioners and laymen.

Over past few decades developing countries witnesses an increase in the number of people suffering from non-communicable diseases. The Epidemiological transition has four step or stages; 1. Pestilence and famine, 2. Receding pandemics, 3.Degenerative and man-made diseases, 4 Delayed degenerative diseases. As a country develops from under developed to developed nation it passes through these stages.[1] As Kerala is a unique state according to its human development is concerned the recent increase in both from non-communicable diseases and communicable diseases, it is a problem worth studying The project proposes to study the shifting burden of diseases from communicable diseases to non-communicable diseases in Kerala[2].

1.3 Importance of the study

Government assures healthcare to all its citizens, but it is the private sector which 80% of all outpatient and 60% of all in-patient care. Private hospitals accounts for 68% of all hospitals in the country .Healthcare financing also an issue worth exploring. 5.0% of the GDP was spent on healthcare in 2010, less than any other BRIC nation, out of which the government spend was a meager 0.9%. Further, 74% of total health spending in India was out-of-pocket (OOP), with only 14% of the population being covered by some form of health insurance.

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[1] The Epidemiologic Transition: A Theory of the Epidemiology of Population Change
Abdel R Omran, The Milbank Memorial Fund Quarterly, Vol. 49, No. 4, Pt. 1, 1971 (pp. 509–38).

[2] Universal Health Coverage in Kerala Through a Primary Care Pilot Project Final Report, Department of Health and Family Welfare, Government of Kerala , Sireesha Perabathina,2016

High private healthcare spending as well as high out of pocket spending in India is placing a considerable financial burden on households. The 60th national morbidity and healthcare survey of the National Sample Survey Organization provides an opportunity to examine the impoverishing effect of healthcare spending in India.

Kerala witnessed a drastic fall in death rates in the last century. The changes in causes of death with mortality reduction in the state have not been researched much. Such uresearch helps in exploring the main causes of mortality reduction such as environmental and behavioural changes, nutritional improvement, healthcare facilities, social and economic factors and the timely intervention of the state governments. Therefore, there is a pressing need to undertake systematic and comprehensive understanding of changing cause of death structure in Kerala.

1.4 Objectives of the study

The objectives of the present study are a follows

1. To analyse the epidemiological transition of Kerala
2. To analyse the shifting burden of non-communicable diseases in Kerala

1.5 Methodology

The present study proposes a hypothesis testing that epidemiological transition has not taken place in Kerala. To test whether epidemiological transition happened in Kerala in testing of hypothesis is proposed as "there has been no epidemiological transition in Kerala" as null hypothesis. To test the hypothesis, secondary data from the annual reports of Department of health, Kerala for the years 2006 to 2010 are tabulated and analysed. Testing of hypothesis is done using student T test.

A survey on the epidemiological transition has been attempted as part of methodology to find out the implications. Major causes of mortality and morbidity are analysed using simple averages and trends.

1.6 Research design

The present research report is designed to be presented in five chapters. The first chapter introduces the research problem. It includes an introduction to the research problem in hand, a review of the scope an importance of the problem, objectives of the research, methodology and research design.

The second chapter discusses the review of literature on the research topic. Review of literature on Epidemiological transition in the global arena and national wise are explored. Studies on Kerala's epidemiological transitions are also discussed.

The third chapter analyses the concepts researched chalking out an overview of the research problem. It traces out an overview of the concept of epidemiological transition. It also examines the health sector of India and especially Kerala.

Fourth chapter is an analysis of the research problem an conclusion. Taking the samples from three districts an attempt is done to test the hypothesis that there has not been an epidemiological transition in Kerala. To test this proposition data is collected on the reported cases of communicable and non-communicable diseases

Fifth chapter summarises the summary and conclusions in the fourth chapter.

Chapter II

REVIEW OF LITERATURE

2.1 Introduction

Theories of epidemiological transition insist that the cause of death structure is a major criterion for identifying its stages of transition. According to the basic theory, higher level of death due to the lifestyle and degenerative diseases can visible with the reduction in deaths due to infections and parasites in earlier stages of the transition. Moreover, the burden of death and diseases will also shift from younger to Ault and older ages in these stages (Omran, 1971). But, the advanced theories of epidemiological transition discuss a further possibility of decline in deaths mainly from lifestyle and degenerative diseases

Epidemiological transition is a complex process encompassing demographic (mortality), epidemiological, and health care transitions. It is demonstrated by rise in life expectancy at birth due to changes in the fertility, mortality, and morbidity contours of a population. Demographic (mortality) transition decreases birth and death rates and cause changes in the age structure; epidemiological transition echoes changes in the causes of death, from infectious (pandemic) diseases to non-communicable (degenerative, human-made) diseases (Caldwell: 1990[3]; Ryan Johansson; 1990., p.147)[4].

2.2 Review of Literature

The causal mechanisms of demographic changes are unclear and distinct variations in patterns, places, determinants, and consequence of population changes are observed in the case of epidemiological transition (Omran: 1982, p.172)[5]. Three fundamental changes

[3] Caldwell, J.C. 1990, 'Introductory thoughts on health transition', in Caldwell et al. 1990.
[4]S. Ryan Johansson, The health transition: the cultural inflation of morbidity during the decline of mortality, Ethics in Society, Stanford University, California 94303–2155, USA

[5] Abdel R. Omran**,** The Epidemiologic Transition Theory. A Preliminary Update,*Journal of Tropical Pediatrics*, Volume 29, Issue 6, 1 December 1983, Pages 305–316,https://doi.org/10.1093/tropej/29.6.305

in the configuration of a population's health profile take place during epidemiological transition: (i) mortality decline due to infectious diseases, injuries, and mental illness; (ii) shift of the burden of death and diseases from the younger to the older groups; and (iii) change in health profile from one dominated by death to one dominated by morbidity. Epidemiological transition implies change in the morbidity profile from acute, infectious, and parasitic diseases like plague, smallpox, and cholera to non-communicable diseases like cardiovascular diseases, cancer, diabetes, and neoplasms which are, degenerative, and chronic.[6]

A third component of health transition is health care transition brought about through changes in the patterns of the organised social response to health condition. Chronic non-communicable diseases (NCDs) have replaced communicable diseases as the most common causes of morbidity and premature mortality worldwide. About 80% of the burden occurs in low / middle-income countries, and 25% is in individuals younger than 60 years. Noncommunicable diseases (NCD) currently cause more deaths than all other causes combined and NCD deaths are projected to increase from 38 million in 2012 to 52 million by 2030.

Report of the 2010 global survey,WHO[7] found out that i**n** decreasing order of prevalence, the following are among the major sources of funding for NCDs: government revenues (84% of countries), international donors (56%), health insurance (39%), and earmarked taxes (20%)[8]. Four major NCDs (cardiovascular diseases, cancer, chronic respiratory diseases and diabetes) are responsible for 82% of NCD deaths. In India ,NCD is responsible for 50% of all deaths.(1) Kerala is a state in India which has health indicators at

[6] Barry, G., Bronowski, J., Risher, J. & Huxley, J. 1963, Health and Wealth: Man's Fight Against Sickness and Want, Macdonald, London
[7] Global status report on noncommunicable diseases 2010, ISBN 978 92 4 156422 9 (NLM classifi cation: WT 500) ISBN 978 92 4 068645 8 (PDF)
[8] ibid

par with developed countries like life expectancy, literacy rate, fertility rates, maternal and child health indicators.

However, rapid urbanization, increasing affluence, international migration, changing age structure and changing lifestyle have placed Kerala in a situation where we are facing an ever increasing burden of Non communicable diseases. We are currently in third stage of epidemiological transition as the prevalence of both NCDs as well as its risk factor is continuing to rise changes in mortality patterns and increases in life expectancy, with subsequent impacts on population, have been documented in industrialised countries since the 19th century. Early studies on population change over time were overviewed from a demographic rather than epidemiological .

Landry introduced the term 'demographic transition' in describing secular changes in fertility and mortality in 1934, later reprinted in English[9]. This idea was further developed in association with socio-economic development[10]. In 1971, Omran proposed a theory of 'epidemiological transition[11]', which grew out of the demographic transition model and incorporated more detailed consideration of particular diseases as causes of death. He particularly based this on mortality changes in England, Wales, Japan, and Sweden during the 19th century[12].

This ET theory, in five propositions, describes changing population patterns in terms of fertility, life expectancy, mortality, and leading causes of death[13]. The first

[9] Landry A. The demographic revolution. Pol Popul Rev. 1987;13:731–40.

[10] Notestein F. Population – the long view. In: Schultz TW, editor. Food for the world. Chicago: Chicago University Press; 1945. pp. 37–57.

[11] Omran AR. The epidemiologic transition theory. A preliminary update. J Trop Pediatr. 1983;29:305–16.[PubMed]

[12] Omran AR. The epidemiologic transition theory revisited thirty years later. World Health Stat Q. 1998;51:99–119.

[13] ibid

proposition states that mortality is an important aspect of population dynamics. The second proposition describes changes in disease and mortality patterns, as 'pandemics of infectious disease are gradually shifted by degenerative and man-made diseases as the leading cause of morbidity and main cause of death'.

The third proposition explains that children and young women experience the most profound impacts of ET, resulting in declining infant and maternal mortality and reduced fertility rates. The fourth proposition links long-term population changes in health and disease patterns to demographic, economic, and social determinants and mortality changes. The final proposition outlines three basic variants of ET that are functions of 'peculiar variations in the pattern, the pace, the determinants and the consequences of population change'.

Omran[14] proposed three stages of transition as underlying the changes in patterns of mortality and morbidity. The first stage, 'the age of pestilence and famine', is characterised by high and fluctuating mortality due to epidemics, famines and war, and poor living conditions. In this stage, a combination of high crude death rate, high fertility rate, and low life expectancy at birth (between 20 and 40 years) results in slow population growth. The most common causes of death are infectious and parasitic diseases, especially among children and women of child-bearing age.

The second stage, 'the age of receding pandemics', witnesses declining mortality rates, initially high but later decreasing fertility, and life expectancy at birth increasing to around 55 years. The major driving forces in this stage of transition are sanitation improvements, control of major outbreaks of infectious diseases, and medical breakthroughs (including contraception). While infectious diseases remain as major causes

[14] ibid

of death, non-communicable diseases (NCDs) start to increase steadily. The third stage, 'the age of degenerative and man-made disease', is characterised by decreasing and relatively stable low mortality and increasing life expectancy at birth to over 70 years, manifesting in a population that is ageing. In this stage, NCDs dominate causes of death, with many deaths attributable to cardiac and cerebrovascular ailments, chronic lung and metabolic diseases, cancers, injuries, and stress-related disorders.[15]

In 1983, Omran recognised the need to update his theory to incorporate a more extended description of the transition, as emerging analyses of transition patterns based on historical data did not fit the original model[16]. Omran later acknowledged the presence of one and possibly two additional stages to his original theory of ET. He added the fourth stage as 'the age of declining cerebrovascular mortality, ageing, lifestyle modifications and resurgent diseases', during which life expectancy continues to increase (up to 80–85 years), and the mortality attributed to cardiovascular diseases declines and stabilises as a result of improved medical care and lifestyle modifications. Omran's fifth stage was characterised by the emergence of new diseases (HIV/AIDS, hepatitis) and re-emergence of old diseases (cholera, malaria, diphtheria, tuberculosis, plague)[17] which were already being described by others .[18]In his original fifth proposition, Omran proposed three basic variants of transition, but later added an additional model, similar to the classic model but starting several decades later and passing faster through the different stages of the transition [19] the Adult

[15] Olshansky SJ, Ault AB. The fourth stage of the epidemiologic transition: the age of delayed degenerative diseases. Milbank Q. 1986;64:355–91. [PubMed]
[16] Omran AR. The epidemiologic transition. A theory of the epidemiology of population change. Milbank Mem Fund Q. 1971;49:509–38. [PubMed]
[17] Rogers RG, Hackenberg R. Extending epidemiologic transition theory: a new stage. Soc Biol. 1987;34:234–43. [PubMed]
[18] Caselli G, Meslé F, Vallin J. Epidemiologic transition theory exceptions. Genus. 2002;9:9–51.
[19] . Armelagos GJ, Brown PJ, Turner B. Evolutionary, historical and political economic perspectives on health and disease. Soc Sci Med. 2005;61:755–65. [PubMed]

and older ages to the oldest ages of life[20] . This stage is evident in almost all developed countries which is termed as the 'stage of delayed degenerative diseases'.

According to Omran (1971)[21], the earlier three stages of epidemiological transition27 are characterised by a substitution of degenerative diseases for infections and parasites in a society. However, the fourth stage (stage of delayed degenerative diseases) argued by Olshansky and Ault (1986)[22] is characterised by a substitution of ages at which degenerative diseases tends to kill. In effect, it was a redistribution of death which progressively distributed from young and Ault ages to oldest ages where degenerative diseases remain major cause of death. Considering this prominent link of causes of death and the age of death event in the recognition of the stages of epidemiological transition, the chapter follows the methodology forwarded by Olshansky and Ault (1986).[23]

According to the theory of epidemiological transition, the first stage of mortality-reduction takes place when the cause of death shifts from infectious to chronic-degenerative diseases. It can be seen in the redistribution of age at death from younger to older ages (ages more than 50). But, the advanced stage of epidemiological transition (age of delayed degenerative diseases) proposed by Olshansky and Ault (1986)[24] suggested that there was a possibility of further reduction of deaths from older to the oldest age groups (ages more than 80).The first concern in analysing the pattern of mortality is availability of reliable data. Prior to 1970,the only source from which reliable data could be estimated was

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[20] Olshansky and Ault, 1986; Rogers and Hackenberg, 1987;Frenk et. al, 1990)

[21] Omran AR. The epidemiologic transition. A theory of the epidemiology of population change. Milbank Mem Fund Q. 1971;49:509–38. [PubMed]

[22] The fourth stage of the epidemiologic transition: the age of delayed degenerative diseases. Olshansky, Ault AB.

[23] The fourth stage of the epidemiologic transition: the age of delayed degenerative diseases, Olshansky, Ault AB.

[24] ibid

the decennial census in India. Different scholars (Namboodiri, 1968; Bhattacharjee and Shastri, 1976[25]; Nag, 1983[26], Bhat and Rajan, 1990; James, 2001)[27] have relied on this to analyse the patterns of mortality in Kerala due to inadequacies in the functioning of Vital Registration System.

P.G.K. Panikar, studied the health transition of Kerala and found out that Kerala has made significant advances in health transition in terms of the rate of mortality and pattern of morbidity. He point out that high morbidity rates still persist. There are different causes for this apparently paradoxical phenomenon. The most important are different factors governing the health status, spread of education, especially female education, and of medical care facilities. It has to be duly acknowledged that State government is the principal agent in the promotion of education, universal literacy, and expansion of medical care facilities aimed at 'health for all',.

The high rate of incidence of acute communicative diseases, despite the advances in preventive measures is a major cause for concern. The causes for the persistence of infectious diseases - the diseases of poverty - are not far to seek. They are unfavourable environment, lack of access to safe drinking water, and sanitary facilities for the majority of the households in the State.[28]

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[25] Bhattacharjee, P J, G N Shastri (1976). Population in India: A Study of Interstate Variations. New Delhi: Vikas Publications House

[26] Nag, M (1983). Impact of Social and Economic Development on Mortality: Comparative Study of Kerala and West Bengal. Economic and Political Weekly, 18 (19/21): 877-900

[27] P. G. K Panikar; C. R. Soman', in Population and Development Review, Vol. 12, .pp.805-810.

[28] Prof. P. G. K. Panikar, Health Transition in Kerala (Abstract) KRPLLD,1999

Chapter III

EPIDEMIOLOGICAL TRANSITION AN OVERVIEW

3.1 Introduction

Kerala witnessed a remarkable decline in mortality and high advancement in life expectancy during the last century. As discussed earlier, this change is comparatively better than other Indian states and is often comparable with the developed countries (Parameswaran, 2000; Franke and Chasin 2000)[29]. However, it was also argued that the per capita income and the level of nutrient intake in this period were low in Kerala (CDS/UN, 1975; Panikar and So man, 1984). Hence, the situation presented itself as a paradox to the development theories of the time which considered per capita income and improvement in nutrient intake as essential for mortality reduction. Therefore, these changes in Kerala was highlighted as unique and often referred to as 'Kerala Model' of development (CDS/UN, 1975; Parayil, 2000; Sen,1997)[30]. However, there was no proper documentation about how much gain in life expectancy have achieved in Kerala through mortality change during that period.

A comprehensive assessment of mortality trends necessitates an investigation into the expected pattern of change based on the experience from developed countries. The mortality reduction is closely linked to the shifts in diseases pattern. The shift occurs in the cause of death pattern from infectious to chronic-degenerative diseases in the first stage of mortality-reduction. (Omran, 1971)[31]. This leads to a distribution of death from younger to older ages (ages more than 50). But, later the transition moves from older ages to oldest ages known as the age of delayed degenerative diseases (Olshansky and Ault 1986)[32]. At this stage, there is further postponement of deaths from older to the oldest age groups (ages more than 80) as a result of bringing down deaths from degenerative diseases in adult ages to older ages (Olshansky and Ault, 1986; Rogers and

[29] Franke, Richard W. 2008. Local Planning: The Kerala Experiment. Paper presented at the Left Forum. Cooper Union: New York. 15 March 2008. Published in Spannos, Chris. 2008. *Real Utopia: Participatory Society for the 21st Century*. Oakland, CA: AK Press. Pages 130−135.
[30] , Amarthya Sen (1997). Radical Needs and Moderate Reforms. In Dreaze, J, A Sen (eds), Indian development: Selected Regional Perspective. New Delhi: Oxford University Press.
[31] Omran, A R (1971). The Epidemiological Transition: A Theory of Epidemiology of Population Change. Milbank Quarterly, 49: 509-38.
[32] Omran, A R (1971). The Epidemiological Transition: A Theory of Epidemiology of Population Change. Milbank Quarterly, 49: 509-38.

Hackenberg, 1987[33]; Frenk et al, 1990). Although it is well known that Kerala has moved from younger age mortality to older ages, the extent of transition to oldest ages (delayed degenerative disease pattern) remains unknown.

The general shift from acute infectious and deficiency diseases characteristic of underdevelopment to chronic non-communicable diseases characteristic of modernization and advanced levels of development is usually referred to as the "epidemiological transition". The most evident indicators of this transition are changes in the pattern of mortality, particularly in relation to the cause of death, as well as changes in morbidity. These changes require a change in the approach of national authorities to the emerging problems and in WHO collaborative programmes in response to national efforts.

3.2 The epidemiological transition

The epidemiological transition is the shift from infectious and deficiency diseases to chronic non-communicable diseases. It is thought to be a unidirectional process, beginning when infectious diseases were predominant and ending when non-communicable diseases dominated the causes of death. This transition is more complex and dynamic because the health and disease patterns of a society evolve in diverse ways as a result of demographic, socioeconomic, technological, cultural, environmental and biological changes. It is a continuous transformation process, with some diseases disappearing altogether and others appearing out of the blue or re-appearing. This also indicates that such a process is not unidirectional. A reversal of the trend sometimes occurs. Outstanding examples are the emergence of new infectious diseases like AIDS, and the increase in infections that were previously controlled, such as tuberculosis and dengue fever.

[33]Extending epidemiologic transition theory: A new stage,Richard G. Rogers &Robert Hackenberg,Pages 234-243 | Published online: 23 Aug 2010

Several stages of transition may overlap in the same country. The decline in communicable diseases may be stagnant among some sectors of the population while non-communicable diseases may be increasing in another sector of the same population. This is still happening in many societies where the less wealthier sectors have a high incidence of infectious diseases among children while the affluent sectors show completely different patterns of illness.

3.3 Mechanisms involved in the epidemiological transition

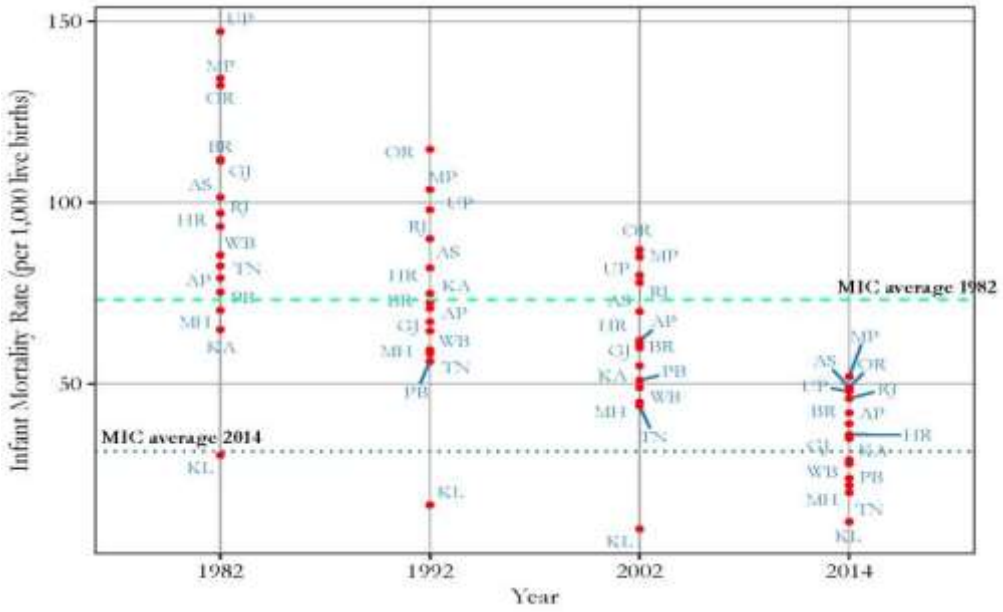
There are multiple factors responsible for epidemiological transition. These include demographical factors, risk factor change such as biological factors, emergence of drug-resistant strains, dual infection

3.4 Demographic changes

Demographic changes are a composed of variations in both mortality and fertility. As populations become healthier due to changes in standard of living, a reduction in mortality, particularly of infants and children occurs. It is followed later by a fall in fertility rates. As a result, more people will survive to adulthood. These people have the disease patterns of adults. In adults non-communicable diseases are at the top of list. Thee adults will also be exposed to geriatric diseases, such as cancer and cardiovascular diseases. Thus, the number of deaths from these diseases increases with the demographic change.

The infant mortality rate, that is, rate of mortality among 1000 live births in the first year of life has decreased, from 136 per 1000 live births in the early 1970s to 37 per 1000 live births in 2015 and to 34 per 1000 live births in 2016 .As shown in the figure 3.1 the rate at which IMR declined was sharp at the beginning and the rate declines in the recent times.

Figure 3.1 Infant mortality of India



The number of old people will increase as life expectancy increases. The change in demographical structure will lead to changes in disease patterns and problems characteristic of the geriatric population. This causes the total number of deaths to increase as a result of this demographical structural change

3.5 Changes in risk factors

Epidemiological transition involves change in risk factors. The risk factors involved in the epidemiological transition include biological factors such as micro-organisms, environmental factors, social, cultural and behavioural factors and the practices of modern medicine. These are explored briefly.

3.6 Biological factors

Microorganisms constantly undergo changes which enable them to survive in an increasingly hostile environment. In this three are two developments which must be taken in attention. One is the development of mechanisms that permit survival of the most adaptable microbes. The second is the development of defence mechanisms which allow their hosts to combat invaders. In this scenario, development of survival adaptations of microorganisms is more rapid than the development of

defence mechanism. This adaptive process of microbes involves finding and exploiting weaknesses in the defences of the host in this case humans. It can happen by means of several mechanisms: Change in antigenic identity, emergence of drug-resistant strains and dual infection.

3.7 The antigenic change

The antigenic change viruses are well known. It permits the emergence of virulent strains viruses, against which the population has no immunity. It causes a rapid spread of disease. It affects the whole population of all ages. Appearance of a new strain, causes preceding strains to disappear or become requisitioned for long periods of time and rarely reappear[34].

The appearance of a new strain of the virus can result in billions of cases of influenza and millions of deaths. These deaths are usually not recorded as due to the related diseases but are counted under the terminal cause of death, which is in most cases cardiac or chronic chest disease. This results in a impression that the incidence of these latter conditions is increasing which is misleading.

3.8 Emergence of drug-resistant new strains

With the invention of effective remedy for many infectious diseases, many experts assumed wrongly that these diseases would disappear. After many years of widespread use of certain antibiotics, it became clear that some strains of microbes could survive in the hostile environment of the drug. This has been chronic in diseases that needed long periods of therapy with antibiotics, for example tuberculosis.

Interruption of therapy or use of inappropriate treatment regimens in patients result in emergence of drug resistant new strains. This may due to limited resources that are available for treatment of patients suffering from these chronic diseases. This happens especially in developing countries. This results in the appearance of resistant strains. This change is caused by mutations in the organism.

[34] Chen L, Evans T, Anand S, Boufford JI, Brown H, Chowdhury M, et al., et al. Human resources for health: overcoming the crisis. Lancet 2004; 364: 1984-90.

The mutation reaches dominance in the presence of the antibiotic against which it has been developed. The development of resistance is not restricted to microorganisms but also occurs with parasites[35].

3.9 Dual or Secondary infection

Dual infection happens when one strain of microbes causes or happens with infection from other strain of micro-organisms. For example is the appearance of HIV infection, which affects much the same population already infected with tuberculosis. A significant increase in the occurrence of clinical tuberculosis happens with HIV infection. This produces two phenomena: first, the danger of developing active tuberculosis as a result of HIV infection increases; secondly, there is a surge in drug-resistant tuberculosis affecting HIV infected persons. These two infections spread to others from infected patients[36].

3.10 Environmental factors

There is evidence that certain changes in the patterns of diseases are the result of the development of environmental sanitation, particularly a clean water supply, sanitary disposal of waste and proper housing, in particular a decrease in the occurrence of communicable diseases such as cholera. On the other hand, environmental factors may cause a surge in the incidence of infectious diseases if they increase opportunities for transmission of infection vectors from the reservoirs of contagion to vulnerable hosts. It may be caused by promoting breeding of vectors of diseases or because of overcrowding. The major environmental factors in changing the patterns of diseases are as follows.

3.10.1 Exposure to environmental pollutants

[35] Aminov RI (2010). "A brief history of the antibiotic era: lessons learned and challenges for the future". Frontiers in Microbiology. 1: 134. doi:10.3389/fmicb.2010.00134. PMC 3109405

[36] Wejse C, Patsche CB, Kühle A Et al., Impact of HIV-1, HIV-2, and HIV-1+2 dual infection on the outcome of tuberculosis. International Journal of Infectious medicine, Dis. 2015 Mar;32:128-34. doi: 10.1016/j.ijid.2014.12.015. Epub 2014 Dec 12

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Exposure to environmental pollutants The release of waste products from industry and many other sources of hazardous waste into the environment, i.e. the air people breathe, the water people drink and the food people eat causes the increase in some ailments such as various types of cancer and chronic chest conditions.

Medical, occupational contacts and commercial and military use of atomic energy causes ionizing radiation which one of the main growing environmental pollutants. Atomic bomb explosions at Hiroshima and Nagasaki in Japan during the Second World War and the explosion of the nuclear reactor at Chernobyl in the former Soviet Union caused major environmental disasters. This atomic pollution caused thousands of deaths and very large numbers of cases of cancer. Several generations will be forced to pay the price. It is not only industry and wars that are responsible for pollution. More important are the conditions of life that contribute significantly to changes in the environment and hence to changes in the patterns of diseases. Excessive use of insecticides both in agriculture and in public health for vector control is another source of significant environmental pollution. Excessive use of cars, some of which are not well maintained, is well known as a source of air pollution and its effect on developing lung cancer is well documented.

3.10.2 Overcrowding

Migration from villages to towns facilitates the spread of infections, especially of diseases spread by air and those related to pollution. Collective care for children increases, for example in nurseries and day care centres with urbanization. This is found to be associated with the risk of spread of infections. Attendance at day care centres poses a real risk of illness to young children and also has an impact on parents and other family members. Acute respiratory infections, meningitis, H1N1, NIPA , scabies, etc. are increases in overcrowded communities.. When the population density is high incidence of epidemics are high and frequent.

A health facility represents a concentrated area of patients which is also a concentrated area of germs. The number of hospital-associated infections will typically rise in an emergency.

Reduction of overcrowding and a proper planning of the sites and services in health-care facilities must be a priority in emergencies.[37]

3.10.3.Other factors

Social, cultural and behavioural factors are closely related and interlinked. The shift from an agrarian to an industrialised society and its supplementary process of modernization produce changes that affect people's wellbeing.

3.11 Community interactions

In the past close community ties used to provide opportunities to share sorrow and happiness and to alleviate stress .This process have been severely affected by modernisation. This is exemplified by the traumatic encounter a rural person ha to make in urban setting. This frequently has a serious impact on mental health[38].

In the past, care of the elderly was essentially a family responsibility. Modernisation changed that and this is more evident in urban settings. Increase in care homes are an evidence of shifting of care from family to institutional set up. The elderly are now denied of the care and affection they crave, and lose opportunities to be part of family affairs. This adversely affects the mental and physical well-being.

3.12 Lifestyle changes

Life style changes that affect conditions of life and the way people live and works may cause many diseases, particularly non-communicable diseases. This affected health care in many areas. Lifestyles have gained wide importance in the health field. Life style includes the person specific behaviour affecting his/her interaction with the surroundings. These behavioural and social issues are changing social behaviour and social value systems. This translated to the individual sphere and

[37]WHO Website, http://www.who.int/water_sanitation_health/emergencies/qa/emergencies_qa9/en/

[38]Andreas EStucka Jutta, M Waltherta Et al. Risk factors for functional status decline in community-living elderly people: a systematic literature review, Social Science & Medicine,Volume 48, Issue 4, February 1999, Pages 445-469

affects physical and mental health of an individual. Behavioural pattern changes affect every sociocultural strata of community[39].

Behavioural pattern changes are introduced and influenced by mass media which is an important organ of modern times. There are many negatives in this influence towards behavioural pattern changes. These negative factors come mainly from advertisements. Advertise induce persons to buy those goods which are actually unnecessary for the individuals. The major threat in this influence is the bad health decisions persons are making. A major example of this is the use of baby formula instead of mothers' milk.

3.12 Decreased concern about moral values

Urbanization and industrialization have unfortunately been accompanied in some communities by a decreasing concern for moral and religious values and the appearance of lifestyles that have led to changes in the pattern of some diseases. An example of such a change in this century is the so-called sexual revolution. It has simply meant more sexual activity. This is well demonstrated by the rapid spread of sexually transmitted diseases (gonorrhoea, syphilis, herpes simplex, hepatitis B and, more important, HIV infection). A factor that has facilitated sexual promiscuity is the widespread availability and use of contraceptives, which have alleviated the traditional fears of conception and led to promiscuous heterosexual relationships. An increase in the consumption of alcohol and of smoking is also evidence of decreased concern for religious values. Their effects on health are well known, as they are major risk factors for non-communicable diseases[40].

3.13 Human mobility

Human mobility affected spread of diseases. Examples of massive pandemics can be noted in history Well documented pandemics like Black Death in Europe in the 14th century and the cholera

[39]Barry M Popkin, Urbanization, Lifestyle Changes and the Nutrition Transition, World Development Volume 27, Issue 11, November 1999, Pages 1905-191

[40] Johanna F. Lindahl and Delia Grace ,The consequences of human actions on risks for infectious diseases: a review, Infection Ecology and Epidemiology. 2015; 5: 10.3402/iee.v5.30048.Published online 2015 Nov 27.

epidemics in the 19th and 20th centuries are result of human mobility.[41]The introduction of the human immunodeficiency virus that causes AIDS in many parts of the world has been directly related to human mobility.

3.14 Cultural transformations

Urbanization and industrialization accompanied by two significant cultural makeovers: the spreading out of education and the increased participation of women in the labour force caused intense alterations in the underlying forces of families and communities. This resulted in the use of contraceptives, which in turn reduced many of the problems related to reproduction. It extended birth intervals and have contributed to maternal and neonatal survival by decreasing exposure to high-risk pregnancies.

3.15 Modern medicine

Epidemiological transition have been caused changes occurred in the organization and quality of health services . The innovations and scientific expansions of the twentieth century have resulted in remarkable progress in the prevention and control of many diseases and in the active management of many others. One of the most histrionic victories has been the eradication of smallpox and reduction of polio. Reduction of disease and mortality from ailments for which there are available defensive vaccines such as diphtheria, tetanus and measles is another success.

But relaxation of vaccination efforts can very quickly result in the re-emergence of these diseases as happened with poliomyelitis in Pakistan and is now the case with diphtheria Kerala. Interventions through inoculation have been the key element in saving millions of lives each year and in decreasing serious impediments that often follow contagion, they actually do not modify the probability of becoming infected.

Cure-oriented intrusion methods of modern medicine permit the liberal use of antimicrobials and chemotherapeutic agents. This and an increasing number of manipulative processes increased the incidence of some side effects of diseases. In addition to side effects such as allergy, depression of

[41] Multiscale mobility networks and the spatial spreading of infectious diseases Duygu Balcan, Et. al.Edited by H. Eugene Stanley, http://www.pnas.org/content/early/2009/12/11/0906910106.short.

bone marrow activity and deafness, excessive use of antibiotics may cause what are described as superimposed infections. The excessive use of antimicrobials inhibits indigenous organisms that compete with external invaders and permits colonization and proliferation of organisms that are non-pathogenic under normal conditions.

Infections associated with manipulative techniques are another example, particularly under conditions where aseptic techniques are not strictly followed. The most evident of these is neonatal tetanus, which occurs through contamination of the umbilical stump. The spread of viral hepatitis B and C and HIV infection through the use of contaminated needles and through unscreened blood transfusions is another example in which intervention becomes a source of infectious disease. The use of equipment such as urethral catheters and endotracheal tubes permits organisms to gain access to otherwise healthy sterile organs.

3.16 Dynamics of epidemiological transition

From the above review of epidemiological transition, it is clear that there is no unique path in the transition that leads to low mortality, less incidence of communicable and deficiency diseases and an increase in incidence of chronic and non-communicable diseases. On the contrary, there are many paths, a multiplicity of stages, and no society has the same experience as any other.

The course of transition is very vulnerable and many obstacles are not easily overcome by the partial interventions prevailing in many parts of the world. The results are lack of continuity, slowing down and even regressions in transition. This is because socioeconomic transformation in developing countries has not affected all social classes and has increased the vulnerability of some groups. An example is the slowdown and reversal of the decline in mortality during the 1970s and 1980s. In many countries this was the result of austerity programmes, which led to the erosion of the health infrastructure and the elimination of intervention programmes. All these are responses to international forces beyond the control of those countries most affected by them.

3.17 Indicators of the epidemiological transition

It is difficult to identify particular indicators that demonstrate the changing pattern of disease. There are, however, demographic, mortality and morbidity indicators that can individually and collectively throw light on the subject.

Demographers have tended to concentrate on mortality patterns as the best indicator since they are fairly easy to measure and are unambiguous. There is also finality about death. However, overall mortality does not tell everything about health, hence the necessity to consider both mortality and morbidity indicators.

3.18 Morbidity indicators

It is important to realize that when fatal acute diseases dominate the health profile, mortality data often give an inadequate description of the prevailing health problems. With reduced incidence and fatality of many acute diseases and the emergence of chronic, often incurable but not immediately fatal conditions, causes of death would only reflect a small fraction of the complex health profile of the population.

Changes in the levels of sickness are extremely important to complete the picture of epidemiological transition. They are, however, very difficult to measure and a substantial proportion of ill people recover without help or involvement from the health services and are not recorded.

It is also important to differentiate between infection and disease. "Infection" implies that the causative agent has entered the body of the host and is multiplying, but not necessarily with the appearance of signs and symptoms. In contrast, the term "disease" refers to the occurrence of clinical manifestations. The latter causes the greater concern to health authorities. For example, hepatitis B infection may only result in an infected person becoming a carrier capable of transmitting infection to susceptible without evident clinical manifestations, at least for some years, and hence posing a covert threat to public health. This also applies to HIV infection.

Medical and epidemiologic uncertainties prevent an exact count of the number of diseases, infectious and non-infectious, that afflict human beings. There is no question that they are greater in number and variety than ever before.

Several examples have been given above of the changing pattern of communicable and non-communicable diseases and related factors. This review shows that there is a real pattern of decrease in the occurrence of diseases for which national immunization programmes are being implemented, specifically measles, diphtheria, poliomyelitis and tetanus, even though surveillance of these diseases has improved considerably. The reverse is observed with respect to malaria, which is showing an increase except in a few countries of the Eastern Mediterranean Region. Tuberculosis has shown a general decreasing trend, but is re-emerging and increasing in areas where HIV infection is spreading. The pattern of HIV infection shows evident continued increase.

Data on the incidence of chronic non-communicable diseases (i.e. the number of new cases per population unit per annum) would be ideal for depicting changing patterns of morbidity from these diseases. Unfortunately such data are not available in a comprehensive form that can be used to show patterns over time. Disease registers, such as those for cancer and for diabetes and data from surveys are all recent, and surveys are rarely carried out using standardized methodology. Reliance is therefore placed on mortality data.

Predictions of incidence based on several considerations, including demographic structure and prevalence of predisposing factors, have been tried with some diseases. For cancer it is predicted that the number of new cases of all types of cancer in the world will increase from the present estimated level of 10 million cases per year to 15 million cases in 20 years (by 2015). This increase is expected to be highest in the developing countries.

The limitations with respect to morbidity data for cancer also apply to cardiovascular disease morbidity. Indirect indication of patterns may be obtained from data concerning disease risk factors. Hypertension as a risk factor for cardiovascular diseases has been recognized since the 1950s. Several studies have examined the blood pressure levels of different population groups and the

magnitude of related hypertension. At the same time, during the past 20 years the methodology used for measuring blood pressure in surveys has become more standardized, and results are also reported in a more uniform manner (according to age and sex), using a definition of hypertension laid down by the World Health Organization in 1978. It is clear from these studies that the prevalence of hypertension in the age group 40 to 60 is not low and could increase by more than 30%. However, in some populations it is reported to be very low. Even with low figures, it is clear that the number of persons with hypertension is comparatively high. Also, morbidity is increasing because of demographic changes and the increasing prevalence of major risk factors for these diseases.

It is sometimes difficult to differentiate between communicable and non-communicable diseases. Researchers are discovering that some common illnesses with poorly understood patterns, once considered to be non-communicable diseases, may actually be at least partially the result of microbial infection. Examples are the relationship between Helicobacter pylori and peptic ulcer and the relation between human papilloma virus and cervical cancer. Also, rodent-borne Hantaviruses may play a role in hypertensive renal disease, and no doubt hepatitis B and C viruses are the main causes of primary hepatocellular carcinoma.

3.20 Other indicators

Both mortality and morbidity data are outcome indicators, and it is essential to supplement them with other indicators that reflect the social and behavioural changes occurring in the community. One of these indicators is the fertility pattern.

With respect to fertility, Table 3 shows that the crude birth rate did not show a significant decrease until recently, which suggests strongly that the decrease in fertility occurs after the change in mortality, particularly in infants and young children. The fertility rate in the Region decreased from 6.7 in 1970 to 5.2 in 1990.

3.21 Kerala Health Statistics

Kerala is the southernmost state of Kerala. According to 2011 census, Kerala's Population stood at 35,477,925 .Life expectancy at birth: 74.6 years (Census 2011).It is a state which a have an

HDI comparable to modern industrialised nations. Here is an attempt to overview the statistics of Kerala with a special reference to health scenario.

14% of all deaths in Kerala are caused by coronary heart disease In Kerala, lifestyle diseases like diabetes, heart disease, high blood pressure and obesity are the prevalent and their incidence is high. This result in high mortality and morbidity from heart disease. In Kerala mortality rates for coronary artery disease are 382 for men and 128 for women per 100,000. This is higher than other industrialized countries.

Cad Death happen as the population ages .In Kerala, around 60% of CAD deaths in men and 40% of CAD deaths in women occur before the age of 65 years. In Kerala CAD deaths occur prematurely. Before 1970, CAD in the very young i.e. before the age of 40 was very rare in Kerala. CAD rate among men in this age group increased 39-fold by 1990 with at least 21% heart attacks occurring before age 40 and 50% before age 50.The high rates of premature heart disease in Kerala also results in a high economic burden .

CAD results in catastrophic health spending with 50% of this requiring distress financing in Kerala. As the state named as ubiquitous coconut, prevalence of heart disease in rural Kerala is 7%, which is nearly double that of north India and parallel the high levels of cholesterol. The prevalence of risk factors is high even in rural Kerala. Kerala have a prevalence of diabetes, high blood pressure, high cholesterol, smoking and obesity; inactivate lifestyle, and unhealthy alcohol consumption .The Prevalence of premature heart diseases in Kerala is because of increasing risk factors related to lifestyle. The causative factors are high consumption of alcohol, unhealthy diet along with very high intake of saturated fat as part and parcel of cultural, lack of physical activity, sedentary lifestyle and air-pollution.

As per cancer registry data, in Kerala there are 974 female cancer and 913 male cancer patients per million. In one year, Kerala has roughly 35,000 new cancer cases occurs. In this 50% of

cancers are in the throat, mouth and lungs in male & 15% in women caused by tobacco and alcohol habits. Actually in Kerala overall tobacco is responsible for 50% and diet for 10-20% of cancers. Breast cancer is the most common malignancy among the women in Kerala; about 30 to 35% is accounted by breast cancer.

According to the data available with the Thiruvananthapuram Cancer Registry, the prevalence rate in rural areas is 19.8 per 100,000; while in the urban areas, it is 30.5 per 100,000. Because of the Kerala population eat more meat than rest of the Indian population so the incidence of colorectal cancer in Kerala is about 5.5 per 100,000. Also it leads to increased risk for large bowel cancer. Also, the incidence of thyroid and ovarian cancers is up among women in Kerala.

Prostate cancer, the most common malignancy among men worldwide, is among the 10 leading cancers in Kerala. Kerala is known as diabetes capital of India as prevalence of diabetes is high i.e. 20% which is double the national average of 8%. As compared, the prevalence in Thiruvananthapuram was 17%, in Hyderabad & New Delhi 15%, and in Nagpur 4%.Cardiovascular disease is the foremost killer of people with diabetes. 80% of diabetic patients die from heart disease.

Only 40% of people with diabetes had adequate control of blood sugar. Among those with diagnosed diabetes, 17% received no treatment, 15% were on diet alone, and 68% were on medications. In Kerala, as compared to urban dwellers people from rural Kerala, paradoxically having higher rates of diabetes. In one large study the prevalence of diabetes was 19% in rural men and 22% in rural women compared to 12% in urban men and 17% in urban women.

People from Kerala have the highest cholesterol level in India that ranges from 197 to 229mg/dl compared to 157 to 180mg/dl nationally. In Kerala, Virtually every dish including vegetables, fish and even meat and bread are prepared by coconut, meat, milk and oil. So total fat intake in Kerala is 30% of the energy with 70% of that (20% of daily energy) coming from saturated fat.

3.21 Conclusions and recommendations

The changing pattern of diseases observed over recent years, from acute infectious and deficiency diseases to the chronic non-communicable diseases, is a continuous process of transformation with some diseases disappearing and others appearing or reappearing.

It is clear that infectious diseases are still an important public health problem and a major cause of death and of illness and will continue to be so for future generations. At the same time, non-communicable diseases are coming to the forefront as causes of illness and death, especially in countries where it used to be possible to control many communicable diseases. This transition is very vulnerable as many biological, environmental, social, cultural and behavioural factors have been responsible for structuring these patterns in the community. It is subject to breaks in continuity, slowdowns or even reversals of the transition.

Same country may experience overlapping of epidemiological transitional stages. This represents a challenge to national health authorities, which must continuously modify their health care services to address the needs created by this changing pattern of diseases. Epidemiological surveillance has a major role to play in identifying the chances and in planning how to address them and should be given the attention it deserves. Also, health authorities have an important duty to try and shape the transition in a positive way by all possible means.

The public has a major role to play, and hence the necessity for public health education and promotion of healthy lifestyles. Health education efforts to achieve positive behavioural changes are essential for the prevention and control of diseases. A carefully conceived media campaign can have a beneficial effect on changing behaviours related to the occurrence of diseases,

Chapter IV

Analysis

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4.1 Introduction

Kerala showed a remarkable decline in mortality and increase in life expectancy during the last century. This change is comparatively better than other Indian states and is often comparable with the developed countries. In this chapter the analysis of the communicable diseases in Kerala from 2009 to 2013. The epidemiologic transition shows paternal changes of demographical distribution in relation to paternal changes of mortality, fertility, life expectancy, and leading causes of death. The perspective has its origins in demography, but finds a compatible conceptual home in public health and epidemiology in particular.

All states of India had epidemiological transition ratios of 0·75 or less in 2014. By contrast, in 1990, only Kerala had a ratio of 0·75 or less, Goa (0·84) and the union territories other than Delhi (0·85) had ratios 0·76–1·00 and all other states had ratios of one or more, showing a major shift across all states between 1990 and 2016. The percent reduction of epidemiological transition ratios ranged from 55·2% to 75·4% across the states of India

4.2 Findings

Epidemiological transition level (ETL), which is defined as the ratio of all-age disability-adjusted life-years due to communicable, maternal, neonatal, and nutritional diseases (CMNND)s versus those due to Non Communicable Diseases and injuries together. Advancing epidemiological transition relates to a lower ratio indicates advancing epidemiological transition—i.e., larger burden of Non Communicable Diseases and injuries than CMNNDS. Deaths due to Non Communicable Diseases and injuries are far greater those due to communicable diseases in Kerala in 2013

The incidence of leading Non Communicable Diseases increased substantially in Kerala from 1990 to 2013, and a modest decrease was recorded in the age-standardised Non Communicable Diseases DALY rates. Non Communicable Diseases risk factors including high blood pressure, high plasma glucose, high total cholesterol, and high BMI increased from 1990 to 2013.

The incidence rate of the leading causes of injuries also increased from 1990 to 2013. The three leading individual causes of DALYs in Kerala in 2013 were ischaemic heart disease, chronic obstructive pulmonary disease and cerebrovascular disease; and the three leading risk factors for DALYs in 2013 were dietary risks, high systolic blood pressure, and high fasting plasma glucose.

Per capita disease burden measured as DALY rate has dropped by about a third in Kerala over the past 25 years. In Kerala The change to dominance of NCDs and injuries over CMNNDs occurred about a quarter century before other stats in India. In some districts , the burden of some of the leading CMNNDs remains to be very higher.

In 2013, Epidemiological transition level (ETL), ratio is lowest in Kerala had the lowest ratio of 0·16. Deaths due to communicable, maternal, neonatal, and nutritional diseases were 32·7% (95% UI 31·9–39·7) and those due to NON COMMUNICBLE DISEASESs were 67.3·2%.

4.3 Data analysis

The data analysis is given below.

Table 4.1

Percentage contribution of disease categories to total deaths by age groups

(Kerala 2013)

	All ages	**0–14 years (10·4% of total deaths)**	**15–39 years (11·4% of total deaths)**	**40–69 years (39·9% of total deaths)**	**≥70 years (38·2% of total deaths)**
Communicable, maternal, neonatal, and nutritional diseases	**23·5 (25·4–31·5)**	**80·8 (78·7–82·8)**	**29·1 (27·2–31·9)**	**17·4 (15·8–20·5)**	**23·0 (19·3–29·4)**
HIV/AIDS and tuberculosis	55 (5·1–5·6)	1·1 (1·0–1·2)	11·5 (11·0–12·1)	6·9 (6·5–7·2)	3·1 (2·8–3·4)
Diarrhoea, lower respiratory, and other common infectious diseases	15·5 (13·3–19·9)	35·3 (32·4–38·4)	10·1 (8·1–13·6)	8·7 (7·0–12·1)	19·0 (14·9–25·6)
Neglected tropical diseases and malaria	0·8 (0·4–1·1)	3·7 (1·8–5·3)	1·4 (0·7–1·8)	0·6 (0·3–0·7)	0·2 (0·1–0·3)
Maternal disorders	0·5 (0·4–0·5)	0·0 (0·0–0·0)	3·7 (3·3–4·1)	0·1 (0·1–0·1)	NA
Neonatal disorders	3·8 (3·6–4·1)	36·9 (35·7–38·2)	NA	NA	NA

	All ages	0–14 years (10·4% of total deaths)	15–39 years (11·4% of total deaths)	40–69 years (39·9% of total deaths)	≥70 years (38·2% of total deaths)
Nutritional deficiencies	0·5 (0·4–0·5)	2·2 (1·9–2·5)	0·3 (0·3–0·4)	0·3 (0·3–0·3)	0·3 (0·2–0·3)
Other communicable, maternal, neonatal, and nutritional diseases	0·9 (0·9–1·0)	1·7 (1·4–2·0)	2·0 (1·8–2·1)	0·9 (0·8–0·9)	0·4 (0·4–0·5)
Non-communicable diseases	**61·8 (58·2–64·0)**	**12·0 (10·6–13·5)**	**34·4 (33·1–36·4)**	**73·2 (70·4–74·9)**	**71·6 (65·5–75·4)**
Neoplasms	8·3 (7·9–8·6)	1·0 (0·8–1·1)	6·1 (5·8–6·3)	12·8 (12·2–13·2)	6·3 (5·8–6·6)
Cardiovascular diseases	28·1 (26·5–29·1)	0·5 (0·4–0·6)	12·7 (12·1–13·3)	33·8 (32·4–34·7)	34·3 (31·5–35·8)
Chronic respiratory diseases	10·9 (9·9–12·0)	0·3 (0·2–0·5)	2·1 (1·9–2·6)	11·7 (10·9–12·7)	15·6 (13·9–17·4)
Cirrhosis and other chronic liver diseases	2·1 (1·9–2·5)	0·2 (0·2–0·4)	3·4 (3·1–4·0)	3·3 (3·0–3·9)	1·0 (0·9–1·2)
Digestive diseases	2·2 (2·0–2·4)	0·7 (0·6–0·9)	2·5 (2·4–2·8)	2·7 (2·5–3·1)	1·9 (1·7–2·2)
Neurological disorders	2·1 (1·8–2·5)	0·6 (0·5–0·7)	1·4 (1·3–1·5)	0·9 (0·8–1·0)	4·0 (3·3–4·9)
Mental and substance use disorders	0·4 (0·3–0·4)	0·0 (0·0–0·0)	1·1 (0·8–1·2)	0·5 (0·4–0·6)	0·1 (0·1–0·1)
Diabetes, urogenital, blood, and endocrine diseases	6·5 (6·2–6·9)	0·8 (0·7–0·9)	4·2 (3·9–4·7)	7·2 (6·9–7·6)	8·2 (7·5–8·7)
Musculoskeletal disorders	0·1 (0·1–0·1)	0·0 (0·0–0·0)	0·1 (0·1–0·1)	0·1 (0·1–0·1)	0·1 (0·1–0·1)
Other non-communicable diseases	1·1 (0·9–1·3)	7·9 (6·7–9·2)	0·8 (0·7–1·0)	0·3 (0·2–0·4)	0·2 (0·1–0·3)

	All ages	0–14 years (10·4% of total deaths)	15–39 years (11·4% of total deaths)	40–69 years (39·9% of total deaths)	≥70 years (38·2% of total deaths)
Injuries	**10·7 (9·6–11·2)**	**7·2 (6·1–8·2)**	**36·5 (34·0–38·1)**	**9·4 (8·2–9·8)**	**5·4 (4·5–5·9)**
Transport injuries	2·9 (2·8–3·1)	1·2 (1·1–1·4)	11·6 (11·0–12·4)	3·0 (2·8–3·1)	0·8 (0·7–0·8)
Unintentional injuries	4·9 (4·1–5·3)	5·4 (4·4–6·2)	9·5 (7·8–10·3)	4·2 (3·4–4·5)	4·2 (3·4–4·6)
Self-harm and interpersonal violence	2·8 (2·4–3·1)	0·5 (0·4–0·6)	15·4 (13·8–16·5)	2·2 (1·7–2·4)	0·4 (0·3–0·5)
Forces of nature, conflict and terrorism, and executions and police conflict	0·0 (0·0–0·0)	0·0 (0·0–0·0)	0·0 (0·0–0·1)	0·0 (0·0–0·0)	0·0 (0·0–0·0)

The data are calculated in percentage at 95% uncertainty interval.

4.3 Communicable diseases analysis

In the following page an analysis is attempted to calculate the incidence of communicable vector borne diseases in kerala

4.3 Month wise cases & deaths due to Malaria (2009-2013)

From the table it's clear that the cases and deaths reported have increased. In 2012 the reported cases were 2130 which increased to 2299 in 2013, a 7.9 % increase. The deaths increased from 6 to 7.From 2012 to 2013 there were 10206 cases and 28 deaths in total.

Table 4.2

MALARIA CASES & DEATHS (2012-2013)

YEAR		2009		2010		2011		2012		2013		Total	
		Case	Death	Case	Death	Case	Death	Case	Death	Case	Death	Case	Deat
	Total	2130	6	1927	6	1804	3	2046	6	2299	7	10206	28

MALARIA : DISTRICT WISE CASES

Kasargode leads in malaria cases,

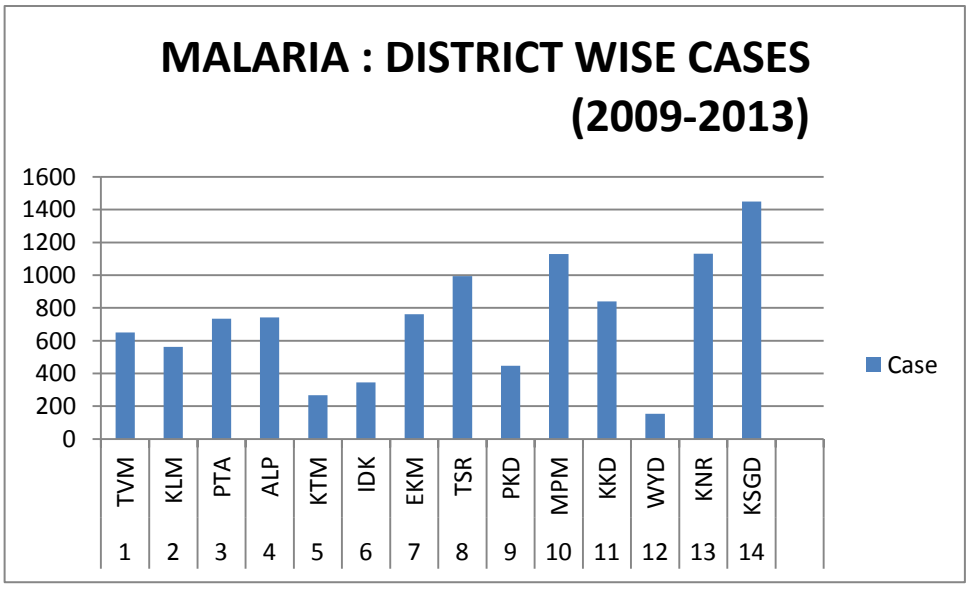
Table 4.3

MALARIA : DISTRICT WISE CASES

	YEAR	2006		2007		2008		2009		2010		Total	
	DISTRICT	Case	Death	Case	Death	Case	Death	Case	Death	Case	Death	Case	Deat
1	TVM	99	1	145	0	81	0	188	0	138	1	651	2
2	KLM	150	0	134	1	89	0	72	0	118	1	563	2
3	PTA	156	0	155	0	140	0	130	0	154	0	735	0
4	ALP	220	0	152	0	136	0	118	0	115	0	741	0
5	KTM	65	0	52	0	51	0	47	1	52	0	267	1
6	IDK	72	0	91	0	66	0	62	0	54	0	345	0
7	EKM	148	3	113	0	171	1	172	2	157	2	761	8
8	TSR	222	0	177	0	214	0	162	0	219	1	994	1
9	PKD	87	0	68	0	95	0	87	0	110	0	447	0
10	MPM	191	0	184	1	246	1	161	0	347	0	1129	2
11	KKD	182	2	161	1	143	0	125	1	228	2	839	6
12	WYD	21	0	27	0	24	0	38	0	44	0	154	0
13	KNR	237	0	225	3	211	1	222	0	235	0	1130	4
14	KSGD	280	0	243	0	137	0	462	2	328	0	1450	2
	Total	2130	6	1927	6	1804	3	2046	6	2299	7	10206	28

Figure 4.1

MALARIA : DISTRICT WISE CASES



4.4 DENGUE : CASES & DEATHS

The table 4.4 and figure shows that incidence of dengue fever has increased from 2597 cases to cases, ie a 154.8 and deaths increased from 6 in 2009 to 18 in 2013.the total incidence was 6431 and the total death toll was 67

Table 4.4

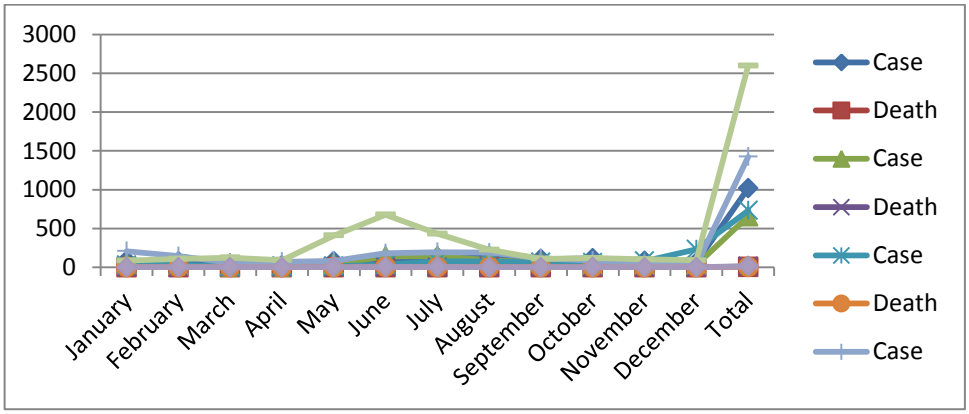
DENGUE : MONTH WISE CASES & DEATHS (2009-2013)

YEAR		2009		2010		2011		2012		2013		Total	
		Case	Death	Case	Death	Case	Death	Case	Death	Case	Death	Case	Death
	Total	1425	6	2597	17	2460	12	3425	14	4021	18	6431	67

Figure 4.2 analyses the incidence of Dengue in different months .It portrays sharp increase in months from April to August, peaking in June.

Figure 4.2

DENGUE:MONTH WISE CASES & DEATHS



4.5 CHIKUNGUNYA

From the table it clear that there were only 54 confirm cases of Chikungunya in 2009 which increased to 210 cases in 2013.,which is a massive 288.88% percentage increase..

Table 4.5 CHIKUNGUNYA INCIDENCE

CHIKUNGUNYA : SUSPECTED & CONFIRMED CASES (2009-2013)

Year	2009		2010		2011		2012		2013		Total	
	Sus	Con	Sus	Con	Sus	Con	Sus	Con	Sus	Con	Sus	Con
Total	70731	54	24052	1092	24685	470	13349	597	1708	210	134525	2423

4.6 LEPTOSPIROSIS

Leptospirosis incidence decreased from 1821case in 2009 to 1026 cases in 2013.

Table 4.6

LEPTOSPIROSIS

YEAR		2009		2010		2011		2012		2013		Total	
		Case	Death	Case	Death	Case	Death	Case	Death	Case	Death	Case	Death
	Total	1821	104	1359	229	1305	136	1237	107	1016	85	6738	661

4.7 Hepatitis- A: Incidence (2009-2013)

There were 6285 cases of Hepatitis A which decreased to 5181 cases in 2013**.**

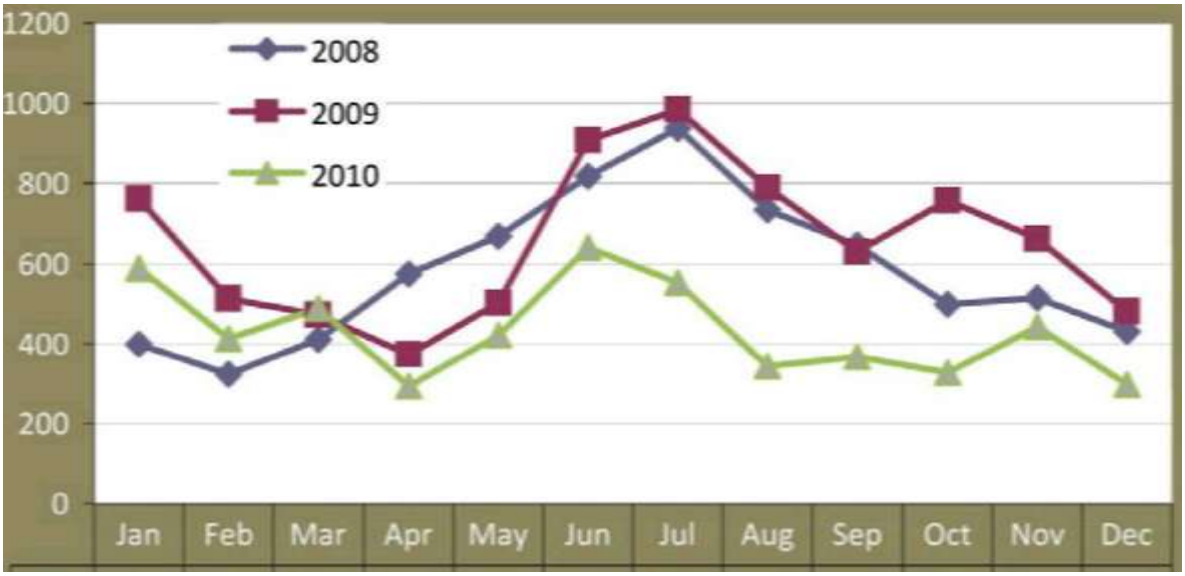
Table 4.7

Hepatitis- A: Incidence

	Year	2009		2010		2011		2012		2013		Total	
		Case	Death	Case	Death	Case	Death	Case	Death	Case	Death	Case	Death
	Total	6285	11	5350	4	6963	16	7844	22	5181	6	31623	59

Figure 4.3

Hepatitis- A: Incidence



4.8 TYPHOID: Incidence (2009-2013)

There were 15628 cases of typhoid in the state in the period 2009-2013

Table 4.8

TYPHOID: Incidence (2009-2013)

YEAR	2009		2010		2011		2012		2013		Total	
MONTH	Case	Death	Case	Death	Case	Death	Case	Death	Case	Death	Case	Death
Total	5417	9	3160	0	1890	0	2632	0	2529	2	15628	11

4.9 TYPHOID: DISTRICT WISE CASES & DEATHS (2009-2013)

Malappuram registered the highest incidence at 4005 and Kollam registered lowest incidence 191 cases

Table 4.9

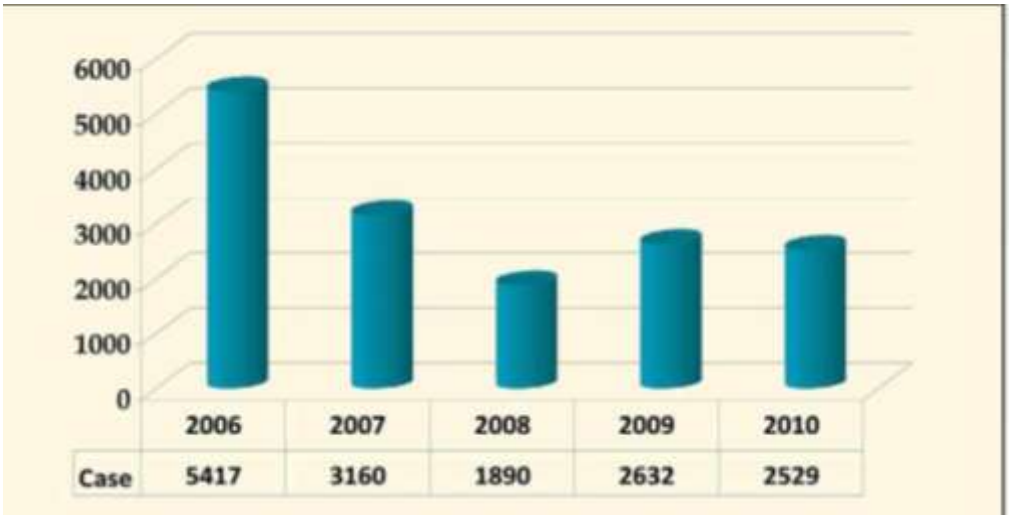
TYPHOID: DISTRICT WISE CASES & DEATHS (2009-2013)

YEAR		2009		2010		2011		2012		2013		Total	
DISTRIC		Case	Death	Case	Death	Case	Death	Case	Death	Case	Death	Case	Death
1	TVM	1260	0	182	0	88	0	298	0	257	0	2085	0
2	KLM	71	0	42	0	24	0	26	0	28	0	191	0
3	PTA	53	0	66	0	20	0	55	0	34	1	228	1
4	ALP	98	0	35	0	52	0	82	0	152	0	419	0
5	KTM	38	0	11	0	44	0	61	0	43	0	197	0

6	IDK	293	0	212	0	79	0	116	0	134	0	834	0
7	EKM	657	0	279	0	245	0	192	0	77	0	1450	0
8	TSR	18	0	51	0	53	0	112	0	91	0	325	0
9	PKD	850	9	591	0	584	0	526	0	669	0	3220	9
10	MPM	1544	0	1356	0	268	0	500	0	337	0	4005	0
11	KKD	202	0	211	0	232	0	183	0	199	0	1027	0
12	WYD	270	0	50	0	104	0	114	0	218	1	756	1
13	KNR	40	0	23	0	58	0	123	0	126	0	370	0
14	KSGD	23	0	51	0	39	0	244	0	164	0	521	0
	Total	5417	9	3160	0	1890	0	2632	0	2529	2	15628	11

Figure 4.4

TYPHOID: DISTRICT WISE CASES & DEATHS (2009-2013)



4.10 ADD: Incidence (2009-2013)

Acute Diarrheal Diseases registered a stable value at 17883cases, the total death were 18.

Table 4.10

ADD: Incidence (2009-2013)

YEAR	2009		2010		2011		2012		2013		Total	
Month	Case	Death	Case	Death	Case	Death	Case	Death	Case	Death	Case	Death
Total	370486	3	361882	6	310582	1	379078	3	366299	5	17883	18

4.11 Add: District Wise Cases & Deaths (2009-2013)

Malappuram registered the highest incidence at 377135 and Pathanathitta registered lowest incidence 38362 cases.

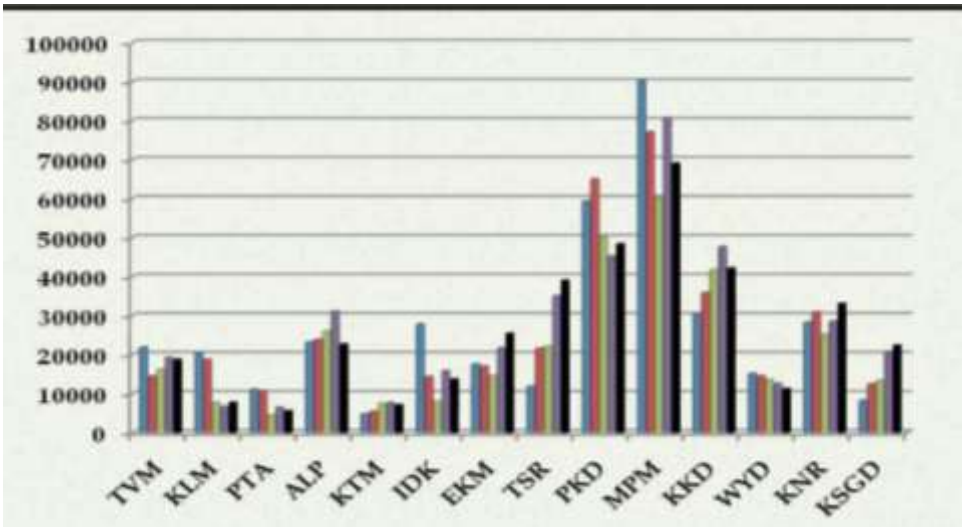
Table 4.11 ADD

DISTRICT WISE CASES & DEATHS (2009-2013)

YEAR		2006		2007		2008		2009		2010		Total	
DISTRICT		Case	Death	Case	Deat	Case	Deat	Case	Deat	Case	Death	Case	Death
1	TVM	21913	0	14454	0	16148	0	19299	0	18759	1	90573	1
2	KLM	20509	0	18755	0	7655	0	6637	0	7717	0	61273	0
3	PTA	11099	0	10747	0	4464	1	6464	0	5588	0	38362	1
4	ALP	23239	0	23822	0	25945	0	31111	1	22670	0	126787	1
5	KTM	4785	0	5408	0	7428	0	7643	0	7139	0	32403	0
6	IDK	27805	0	14342	0	7979	0	15833	0	13721	0	79680	0
7	EKM	17615	0	16993	0	14608	0	21677	0	25448	0	96341	0
8	TSR	11862	0	21560	2	22164	0	35025	2	39023	1	129634	5
9	PKD	59354	1	65002	3	50226	0	45215	0	48425	0	268222	4
10	MPM	90232	1	77028	1	60212	0	80653	0	69010	1	377135	3
11	KKD	30396	1	35902	0	41716	0	47664	0	42153	0	197831	1
12	WYD	15135	0	14544	0	13580	0	12571	0	11221	2	67051	2
13	KNR	28284	0	30902	0	25130	0	28529	0	33066	0	145911	0
14	KSGD	8258	0	12423	0	13327	0	20757	0	22359	0	77124	0
	Total	37048	3	36188	6	31058	1	379078	3	36629	5	178832	18

Figure 4.5 ADD

DISTRICT WISE CASES & DEATHS (2009-2013)



4.12 H1N1: Incidence (2010-2013)

Table 4.12

H1N1: Incidence (2010-2013)

YEAR	2010		2011		2012		2013		Total	
	Case	Death	Case	Death	Case	Death	Case	Death	Case	Death
Total	0	0	0	0	1578	31	1534	90	3112	121

4.13 H1N1: DISTRICT WISE CASES & DEATHS (2011-2013

Malappuram registered the highest incidence at 441 and Pathanamthitta registered lowest incidence 60 cases.

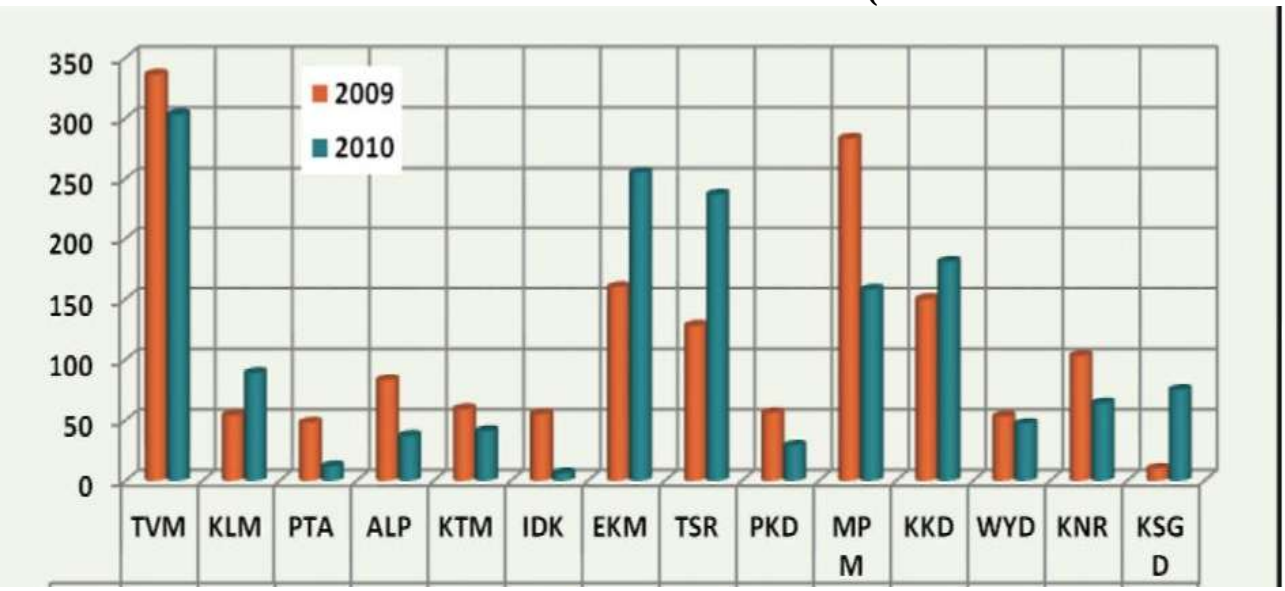
Table 4.12

H1N1: DISTRICT WISE CASES & DEATHS (2011-2013

YEAR		2011		2012		2013		Total	
DISTRICT		Case	Death	Case	Death	Case	Death	Case	Death
1	TVM	0	0	336	3	303	22	639	25
2	KLM	0	0	54	3	89	15	143	18
3	PTA	0	0	48	3	12	1	60	4
4	ALP	0	0	83	3	37	3	120	6
5	KTM	0	0	59	0	41	3	100	3
6	IDK	0	0	55	2	6	3	61	5
7	EKM	0	0	160	3	255	5	415	8
8	TSR	0	0	128	3	237	10	365	13
9	PKD	0	0	56	2	29	7	85	9
10	MPM	0	0	283	7	158	9	441	16
11	KKD	0	0	150	1	181	8	331	9
12	WYD	0	0	53	1	47	1	100	2
13	KNR	0	0	103	0	64	1	167	1
14	KSGD	0	0	10	0	75	2	85	2
	Total	0	0	1578	31	1534	90	3112	121

Figure 4.6

H1N1: DISTRICT WISE CASES & DEATHS (2011-2013



4.14 Communicable Diseases (2009-2013) THRISSUR

The table summarises the incidence of communicable diseases in Thrissur district. Acute Diarrheal Disease has the highest incidence in Thrissur. Deaths were largest in the case of Leptospirosis.

Table 4.12
Communicable Diseases (2009-2013) THRISSUR

	2009		2010		2011		2012		2013		Total	
DISEASE	**Case**	**Death**	**Case**	**Death**	**Case**	**Death**	**Case**	**Deat**	**Case**	**Death**	**Case**	**Death**
Malaria	222	0	177	0	214	0	162	0	219	1	994	12
Dengue	72	0	89	0	10	0	152	0	74	0	397	0
CG-Sus	93	0	333	0	36	0	74	0	45	0	581	0
CG-Conf	0	0	48	0	11	0	29	0	23	0	111	0
JE/AES	0	0	1	1	0	0	3	3	1	0	5	4
Lepto	247	11	202	47	75	20	97	11	31	1	652	90
Hepatitis-A	32	0	51	0	166	4	616	4	174	0	1039	8
Typhoid	18	0	51	0	53	0	112	0	91	0	325	0
Cholera	0	0	0	0	0	0	1	0	0	0	1	0
ADD	11862	0	21560	2	22164	0	35025	2	39023	1	129634	5
Hepatitis-B	1	0	5	0	2	1	13	1	14	1	35	3
H1N1	0	0	0	0	0	0	128	3	237	10	365	13

4.15 Communicable Diseases (2009-2013) KOTTAYAM

The table summarises the incidence of communicable diseases in Kottayam district. Acute Diarrheal Disease has the highest incidence in Kottayam. Deaths were largest in the case of Leptospirosis.48 cases.

Table 4.13
Communicable Diseases (2009-2013) KOTTAYAM

	2009		2010		2011		2012		2013		Total	
DISEASE	Case	Deat	Case	Deat	Case	Deat	Case	Deat	Case	Deat	Case	Deat
Malaria	65	0	52	0	51	0	47	1	52	0	267	1
Dengue	8	0	7	1	20	0	160	2	330	3	525	6
CG-Sus	149	0	10662	0	1	0	8	0	179	0	10999	0
CG-Conf	0	0	0	0	0	0	7	0	12	0	19	0
JE/AES	0	0	0	0	0	0	0	0	16	2	16	2
Lepto	89	7	81	22	48	7	75	10	56	2	349	48
Hepatitis-A	690	4	318	1	591	5	642	7	383	1	2624	18
Typhoid	38	0	11	0	44	0	61	0	43	0	197	0
Cholera	0	0	0	0	0	0	1	0	2	0	3	0
ADD	4785	0	5408	0	7428	0	7643	0	7139	0	32403	0
Hepatitis-B	12	1	9	1	20	3	34	4	13	1	88	10
H1N1	0	0	0	0	0	0	59	0	41	3	100	3

4.16 Communicable Diseases (2009-2013) ERNAKULAM

The table summarises the incidence of communicable diseases in Ernakulam district. Acute Diarrheal Disease has the highest incidence in Ernakulam. Deaths were largest in the case of Leptospirosis,66 deaths.

Table 4.14
Communicable Diseases (2009-2013) ERNAKULAM

	2009		2010		2011		2012		2013		Total	
DISEASE	Case	Death	Case	Death	Case	Death	Case	Deat	Case	Death	Case	Death
Malaria	148	3	113	0	171	1	172	2	157	2	761	8
Dengue	59	0	24	1	100	1	85	0	114	2	382	4
CG-Sus	1840	0	1882	0	4	0	0	0	7	0	3733	0
CG- Conf	0	0	65	0	0	0	3	0	4	0	72	0
JE/AES	0	0	0	0	0	0	0	0	0	0	0	0
Lepto	207	20	111	25	153	12	111	5	107	4	689	66

Hepatitis-A	**281**	**0**	**594**	**1**	**427**	**1**	**47**	**1**	**36**	**0**	**1385**	**3**
Typhoid	**657**	**0**	**279**	**0**	**245**	**0**	**192**	**0**	**77**	**0**	**1450**	**0**
Cholera	**9**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**9**	**0**
ADD	**17615**	**0**	**16993**	**0**	**14608**	**0**	**21677**	**0**	**25448**	**0**	**96341**	**0**
Hepatitis-B	**5**	**0**	**4**	**0**	**2**	**0**	**8**	**0**	**0**	**0**	**19**	**0**
H1N1	**0**	**0**	**0**	**0**	**0**	**0**	**160**	**3**	**255**	**5**	**415**	**8**

4.16 Conclusion:

In Kerala, the proportion of deaths due to cardiovascular diseases was highest in the Non Communicable Diseases categories, Deaths due to chronic respiratory diseases were lowest in Kerala. The proportion of total deaths in the 0–14 year age group is 2·1% in the Kerala which is lowest in the country.

In the 0–14 year age group, communicable, maternal, neonatal, and nutritional diseases (CMNNDs) were responsible for the majority of deaths, 73.5 % in Kerala. The proportion of deaths due to injuries in the 15–39 years age group is 42.5 % in Kerala. The proportion of deaths due to cardiovascular diseases was similar in 40 plus age groups, whereas the proportion of deaths due to chronic respiratory diseases was higher in the 70 years or older age group.Thrissur district leads in the death cases with 124 deaths in Communicable diseases.

Chapter V
Summary and Conclusion

5.1 Summary and findings

Epidemiological transition level (ETL), which is defined as the ratio of all-age disability-adjusted life-years due to communicable, maternal, neonatal, and nutritional diseases (CMNND)s versus those due to Non Communicable Diseases and injuries together. Advancing epidemiological transition relates to a lower ratio indicates advancing epidemiological transition—i.e., larger burden of Non Communicable Diseases and injuries than CMNNDS. Deaths due to Non Communicable Diseases and injuries are far greater those due to communicable diseases in Kerala in 2013

The incidence of leading Non Communicable Diseases increased substantially in Kerala from 1990 to 2013, and a modest decrease was recorded in the age-standardised Non Communicable Diseases DALY rates. Non Communicable Diseases risk factors including high blood pressure, high plasma glucose, high total cholesterol, and high BMI increased from 1990 to 2013.

The incidence rate of the leading causes of injuries also increased from 1990 to 2013. The three leading individual causes of DALYs in Kerala in 2013 were ischaemic heart disease, chronic obstructive pulmonary disease and cerebrovascular disease; and the three leading risk factors for DALYs in 2013 were dietary risks, high systolic blood pressure, and high fasting plasma glucose.

Per capita disease burden measured as DALY rate has dropped by about a third in Kerala over the past 25 years. In Kerala The change to dominance of NCDs and injuries over CMNNDs occurred about a quarter century before other stats in India. In some districts , the burden of some of the leading CMNNDs remains to be very higher.

In 2013, Epidemiological transition level (ETL), ratio is lowest in Kerala had the lowest ratio of 0·16. Deaths due to communicable, maternal, neonatal, and nutritional diseases were 32·7% (95% UI 31·9–39·7) and those due to NON COMMUNICBLE DISEASESs were 67.3·2%.

In Kerala, the proportion of deaths due to cardiovascular diseases was highest in the Non Communicable Diseases categories, Deaths due to chronic respiratory

diseases were lowest in Kerala. The proportion of total deaths in the 0–14 year age group is 2·1% in the Kerala which is lowest in the country.

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