8.1 Introduction

Kerala has achieved considerable mortality decline and consequently high improvement in life expectancy in the last century. This is comparable to developed countries in 1970s despite the fact that the state has low per capita income and less nutrient intake. Several studies attribute this achievement to intervention by the state which provided superior primary healthcare, water and sanitation after the state formation in 1956. On contrary, despite such role of state intervention, a group of scholars argued for the role of socio-cultural factors such as education and scattered pattern of settlements etc. However, there was no clarity on the contributory role of socio, economic and state components to the mortality decline and consequent improvement in life expectancy in Kerala. Lack of such information becomes a matter of concern when in recent years most of the developed countries have achieved further improvement in life expectancy while the situation in Kerala has remained relatively stagnant.

Theoretically, the decline in mortality and improvement in life expectancy can be linked to the epidemiological transition. According to the theories of epidemiological transition, the early stages of mortality reduction are characterised by decline in deaths due to infectious and parasitic diseases and other primary healthcare-oriented causes including the causes related to maternal and child care that favor to the younger age groups. However, such situation will be replaced to the decline of death from chronic/degenerative diseases and accidents and injuries mainly from the adult and old ages which expand life expectancy to the advanced ages namely ‘the stage of delayed degenerative diseases’. Though there were studies that identified the path of epidemiological transition by analysing the pattern of death and its causes at different age groups in developed countries, such studies are rare in Kerala. This lacunae limits the understanding of the causes behind the slowdown in life expectancy improvement in Kerala and hampers the efforts to tackle it.

Both the theoretical and empirical understanding of epidemiological transition indicates the crucial role of state intervention for achieving the ‘advanced stage of
epidemiological transition’. In the initial stages, the state intervention is characterised by focus on primary healthcare in addressing the challenges of infectious/parasitic diseases as well as providing maternal and child care. However, changes in focus of healthcare are inevitable when the transition brings additional challenges like chronic/degenerative diseases and accidents/injuries mainly among adult and older ages. At this stage, what is needed is more curative and promotive healthcare while keeping the existing primary or preventive care. Studies in countries which have achieved advanced stage of epidemiological transition indicate commendable level of state healthcare initiation including the provision of superior curative medical care and promotive strategies such as awareness programmes against sedentary lifestyle, alcohol and tobacco consumption. However, the information on how the state can cope-up with the challenges arising out of epidemiological transition is highly lacking in Kerala. The dearth of information further constraints the evaluation of effectiveness of existing state strategies and limit its intervention to address the challenges posed by epidemiological transition.

Considering the above research gaps, the thesis explores epidemiological transition and state health expenditure. It specifically explores the following objectives (i) To critically review the state approach towards the epidemiological transition (ii) To track the pattern of mortality pattern in Kerala (iii) To trace the changes in the causes of death in the state (iv) To analyse the recent disparity in the level of mortality and causes of deaths among the sub-groups (v) To assess the morbidity pattern of the current epidemiological scenario and (vi) To analyse the trends and composition of public healthcare expenditure in the course of epidemiological transition in the state.

For analysing the epidemiological transition, the study largely followed the methodology put forward by Olshansky and Ault in 1986 and Sullivan 1971. It reviewed various historical documents and examined the compositional pattern of state’s health-related expenditure and applied causal analysis as methodology to evaluate the impact of state intervention on epidemiological transition in Kerala. It used secondary level of information, which contain, mortality information from Census (indirectly estimated) and Sample Registration System (SRS), causes of death from Causes of Death Survey – Rural, Survey of Medically Certified Causes of
Deaths, Directorate of Health Services and Vital Registration System and morbidity information from National Sample Survey Organisation (NSSO) at their 42nd, 52nd and 60th round survey for the analysis. While analysing the state health acts, policies and expenditure, the study used various historical documents and data from princely states of Travancore, Kochi, British government and the government of Travancore-Kochi for the period prior to the state formation and Plan documents, including FYPs, budget documents and other policy documents and acts of Central, State and Local Self Governments for the periods after the state formation.

The study has been divided into eight chapters. The first chapter (Introduction) describes the motivation for study, the review of literature, research gaps, research problems, objectives and methodology and data as an introduction to the thesis. The second chapter (Epidemiological Transition and State Health Policies) critically reviews the healthcare policy and acts at different level of the governments in addressing the epidemiological challenges. The third chapter (Mortality Trends and Its Decomposition) explores the pattern of mortality changes in Kerala and contribution to life expectancy from different age groups for males and females separately across various decades in a centurial period of time. In the fourth chapter (Pattern of Causes of Death Structure), the study focuses on examining the pattern of causes of deaths in the state and their contribution to the improvement in life expectancy. The fifth chapter (Regional Disparities in Mortality and Its Causes) explores the relationship between mortality decline and improvement in life expectancy with changes in morbidity in order to understand the quality of life in Kerala. In the sixth chapter (Pattern of Morbidity and Change in the Quality of Life), the study investigates the pattern of changes in mortality decline and life expectancy improvement along with contribution of major group of diseases across the districts in Kerala to identify whether the districts follows a unique feature in epidemiological transition. The seventh chapter (Epidemiological Transition and State Health Expenditure) focuses on examining the pattern and composition of state health expenditure and its causal relationship with epidemiological transition. The eighth and final chapter (Summary and Conclusion) summarises major findings and presents the conclusion.
8.2 Summary of Major Analytical Chapters

Epidemiological Transition and State Health Policies

The second chapter (Epidemiological Transition and State Health Policies) focuses on healthcare intervention by state at policy level in coping with the epidemiological transition. The study specifically focuses on (i) the major policies that have significant impact on the epidemiological transition in Kerala and (ii) how do the focuses of these policies vary across the historical periods.

In order to explore these questions, the study categorised analytical periods into five categories as; (i) Pre-state formation (Before 1956) (ii) Era of state healthcare expansion (1956-1970) (iii) Consolidation period of state intervention (1970-1985), ( iv) Moment of outpacing private healthcare (1985-2000) and (v) Re-enforcing state healthcare (since 2000). The pre-state formation critically reviews the policies and priorities of princely states of Travancore and Kochi, British government as well as Travancore-Kochi state government after the independence. Similarly, the analysis for post-state formation period (ii to v periods) comprise of the policies and approaches of Central, State and LSGs for the healthcare in Kerala.

While examining the healthcare approaches in Kerala before its formation, the study found that various governments had given considerable attention to the health status of its citizens. The princely states of Travancore and Kochi had heightened focus against ‘social epidemics’ such as plague, cholera and small pox etc in the beginning of 20th century and introduced vaccination programmes. Besides, universal education, school feeding programme and sanitary programmes also helped them attain better health status. Though the British government established medical institutions in Malabar, they failed to make much impact because of the unpopularity of modern allopathic medicine. This was evident from the higher death rates in Malabar due to epidemics and contagious diseases, which were high compared to other parts of Kerala. Madras Public Health Act -1939 and Travancore Kochi Public Health Act -1955 facilitated the reduction in deaths as the state made strict rules to prevent the contagious/infectious diseases and brought in accountability and administrative clarity by assigning power to the health administrators.

Substantial level of state intervention in healthcare is evident in Kerala, both at the Central and State level since its formation in the year 1956. The approach of both
GOI and GOK was mostly focused on improvement in MCH services, reduction of deaths from communicable diseases and population control, and therefore focused towards to the expansion of primary healthcare. In 1960, the GOK expanded its healthcare infrastructure including the work force, healthcare services and health awareness programmes. Such initiations continued till mid 1980s. The implementation strategy of GOK was very comprehensive and the focus was on integrating programmes such as water and sanitation, housing, nutrition, family planning, education etc, which were even better than GOI’s directions. Though, deaths from infectious diseases and other primary health-oriented causes is mostly controlled in Kerala by 1970s, the state is experiencing high level morbidity and mortality from non-communicable diseases in recent decade. However, there was scant evidence of comprehensive state intervention against these new challenges until 2000s. This situation require for an estimation of consequent changes in the epidemiological outcomes to understand the impact of mismatches of state intervention on the epidemiological transition.

Mortality Trends and its Decomposition

The third chapter, ‘Mortality Trends and its Decomposition’ explores the epidemiological transition in Kerala at various historical time periods using information on mortality. The chapter specifically examined; (i) The historical time periods that recorded largest gain in life expectancy and (ii) who were the beneficiaries (age and sex) and by how much. While analysing the mortality data, the study used methods such as Life Expectancy (LE), Temporary Life Expectancy (TLE), Annual Relative Change in TLE, Probability of Death Curves, Survival Curves, Median age of death and Decomposition of LE.

Based upon evidence, the study found that the death rate (CDR) in Kerala was very high in the early decades of 20th century hovering at around 35-40 per thousand population, a sign of early stages of epidemiological transition. The death rate later declined to 6-7 per thousand in 2000s. Though, the mortality declined steeply in recent years, peak change was visible between 1950-70s. The decline in the infant and child mortality rates in those years reflects their prominent share in the CDR decline. As a result of CDR decline, LE has improved in Kerala to 71.27 for males and 76.27 for females from about 25 years for both the males and females during this period.
However, there was gender difference in LE that is widening over the years, with low expected years for males. In order to understand changes in the mortality to LE, the study examined the absolute and relative changes in LE over the decades. Absolute changes in LE indicate that there was reversal of gain in absolute life expectancy change by replacing comparatively large absolute gain in LE at birth in advanced ages, than the younger ages. At the same time, analysis of TLE indicates that the younger age groups (ages 0-15) and young adults (ages15-40) and old adults (ages 40-60, except males) have already reached their maximum in contributing further increment in LE. Even though, the old adult males and older age groups (age groups over 60 years) have further potential in contributing to LE, there is stagnation in their mortality decline, which can also explain the widening sex gaps in life expectancy in the state. An analysis of Index of Annual Relative Change (ARC) in TLE indicates that youngsters had high advantage in improvement of life expectancy than the adults and old ages for whom relative change in ARC of TLE was unexpectedly lower than younger age group. Moreover, it reflects the absence of decline in mortality of the adults and elders, especially that of males which stands high in Kerala. The high pace in the changes of ARC of TLE between 1950s to 1970s made it the period of largest gain in the life expectancy in the history of Kerala.

In order to understand the importance of older ages and death in those ages, the study used probability of death and survival curves, median age of deaths and proportion of survival to the older and oldest ages. These exercises found that the state experiences considerable importance of elders in its mortality changes. However, the rate of survival to the older ages declined towards the last decade especially among males which in turn shows the stagnation of LE and TLE discussed above. Contribution of mortality decline from various age groups to the improvement in life expectancy was estimated to identify the possibility of ‘delayed degenerative stage’ of epidemiological transition in Kerala. In delayed degenerative stage of epidemiological transition, a comparatively higher contribution from the older ages to life expectancy improvement than from younger ages is to be expected. However, the decomposition of improvement in LE has shown that younger ages are still contributing more than a half the share in increment in LE (until 2000), denoting that the state has not yet entered into this advanced stage. Nevertheless, there is overall progress in the
percentage contribution of adult and older population, especially for females which might explain signs of advance stage.

**Pattern of Causes of Death Structure**

The fourth chapter, ‘Pattern of Causes of Death Structure’, elaborates the changes in causes of deaths to the epidemiological transition in Kerala. Such an analysis was done to reveal the slow improvement of LE in Kerala, which was visible for the last few decades. Therefore, this chapter specifically looks at (i) the pattern of causes of deaths structure in Kerala (ii) contribution of changes in causes of deaths to the improvement in life expectancy (iii) beneficiaries of changes in causes of deaths (by age-groups and sex) and by how much. In order to explore these objectives, the study uses the rate of prevalence and probability of deaths by major causes, potential gain from major causes of deaths to LE and their actual contribution at various decades in the last century.

Analysis on causes of death behind the decline in the mortality in Kerala has shown that Plague, Cholera and Small Pox have commendable role in the initial stage of epidemiological transition that happened in Kerala during the end of 19th century and the early decades of 20th century. However, death from diarrhoea, Malaria and other fevers remained major causes of death until 1940s when the public initiation against these diseases started. The study found that the infectious diseases were controlled by 1970s and from then on the share of deaths due to non-communicable diseases as well as accidents and injuries rose to become dominant causes of deaths. The analysis of data from both Survey of Causes of Death- Rural (SCD_R) and survey of Medically Certified Causes of Death (MCCD) found that the deaths due to non-communicable diseases increased not only in relative but also in absolute terms. Remarkably, the Age Cause Specific Death Rates (ACSDR), mainly the circulatory diseases and neoplasm in both rural and urban areas have shown a sporadic increase in Kerala after 1970s. The probability of death from infectious diseases steadily declined, where non-communicable diseases remain with major probable cause of death disclosing a stark sex difference due to high susceptibility of males towards the circulatory diseases and neoplasm.

In order to understand the relevance of major causes of deaths in increment to LE, the study explored the potential and actual gain in LE. The analysis on potential
gain in LE shows that Circulatory diseases and Neoplasm have remained the first two important causes of deaths since 1970s. However, there was a shift in their potential gain in LE increment to the oldest ages, especially among females, showing their movement to the advance stage of epidemiological transition, while males lag, especially in the ages of 45-65. While analysing the improvement in LE during the last three- and-a- half decades in the state, the study found that while infectious and parasitic diseases were prominent contributors in 1976 and 1990-94, between 1990-94 and 2000-04, diseases of the circulatory system were the highest contributors. Though the circulatory diseases contributed positively in the later period mainly from 45-64 and 65+ age groups, their contribution and the increment in LE was meager. On the other hand, the contribution of other non-communicable diseases in 45-64 and 65+ age groups was either small or negative to the LE during the same period mainly for males.

Regional Disparities in Mortality and its Causes

The fifth chapter, ‘Regional Disparities in Mortality and its Causes’ of the study examines the current status of epidemiological transition across the districts in Kerala. More specifically, it analyses the mortality indices such as death rates, LE and TLE and causes of deaths during the year 2008. The study found that crude death rates (on an average 6.3 per 1000 people) and high level of life expectancy at birth (on an average of 70.6 and 77.9 years for males and females respectively) are almost similar with all districts maintaining state averages. Similarly, the disparity in sex-wise LE is visible across all the districts as similar with that of state averages. The analysis on TLE between the age group 0-80 shows minor disparities among districts. However, the study found gender disparity in TLE in the age group 0-80, in which 0-15, 15-40 and 40-60 has almost reached their maximum in those age intervals (except the males at 40-60) in all districts; therefore gender difference attributes to delay in completion of male TLE among ages 40-60 and 60-80 ages.

While analysing the pattern of major causes of death, the study found that the group of non-communicable diseases stands highest. It is followed by group of accidents and injuries and group of infectious/parasites and other primary healthcare-oriented causes which is similar across all the districts. Proportionately higher deaths due to group of non-communicable diseases and accidents & injuries across all the
districts, shows that the state in general has entered into the higher stage of epidemiological transition without any polarisation. The analysis on CSDR shows that Heart Attack is the prominent cause of death followed by Asthma, Paralysis and Accidents and Injuries. The high prevalence of death due to heart-related diseases are visible in all the age groups (except 15-40 where Accidents and Injuries are prominent) which similar in all the districts. Remarkably, death ratio due to major causes is relatively low among females compared to males in all age groups.

**Pattern of Morbidity and Changes in the Quality of Life**

In the sixth chapter (Pattern of Morbidity and Changes in the Quality of Life), the study explores the increment life expectancy and quality of life in Kerala by taking into account the changes in mortality and morbidity over the years in the context of epidemiological transition. It specifically focuses on (i) the changes in the morbidity pattern in Kerala over the decade (ii) relationship of morbidity across different socio-economic groups and (iii) changes in the quality of life along with changes in mortality and morbidity in the state. For these purposes, it relied on logistic regression and a combined mortality and morbidity index, namely Disability Free Life Expectancy (DFLE). The study considered morbidity rates as well as two proxies of disability namely, Restricted Activities (RA) and Confinement to Bed (CB).

An overview on the prevalence of morbidity rates shows considerable increase across the decades in the state. Both the Proportion of Person reporting Commencement of ailments (PPC) and Proportion of Ailing Person (PAP) are proof of it. Out of 1000 people, 240 males and 261 females were morbid in Kerala in 2004, which is considerably higher than the national averages. In order to avoid the elements of perception on ailments, the study also analysed the rate of hospitalisation and expenditure for healthcare, which corroborated with increase in morbidity in the state over the decades. Remarkably, females live with high morbidity in both rural and urban areas in the state. The study also compared the difference in the probabilities in morbidity and hospitalisation by using Odds Ratio. The Odds Ratio indicates increasing trend in morbidity and hospitalisation by age and Monthly Per capita Consumption Expenditure (MPCE) sub-groups in the state, while it is on decline in those with higher education. Urbanites have less probability of morbidity.
and hospitalisation than their rural counterparts. Remarkably, there was no statistical significance for the probability of gender difference in morbidity as well as hospitalisation in the state.

While using DFLE, in order to understand the health status in the ongoing decline in mortality and consequent improvement in LE with changes in morbidity, the study found a decline in the quality of life in the state over the years. DFLE adjusted with morbidity indicates only 72.2 and 63.2 per cent of LE for males and females. Similarly, DFLE adjusted with Restricted Activity has shown only 89 percentage of total LE can be considered as better life without having any disability constraining people into their day life activities for both males and females. At the same time, DFLE adjust with severe disability such as Confinement to Bed was only 96 per cent of LE in the year 2004. When comparing the DFLEs between 1995-96 and 2004, it is evident that DFLE in proportion to LE declined, indicating a paradoxical movement with increase in human longevity and quality of life that is evident in both rural and urban areas. Notably, though urbanites have lower life expectancy in 2004, they have better DFLE than rural people. The proportionate share of DFLE to LE at all the three level indicates decline towards the oldest ages, showing severe loss of quality in the older ages. An examination on contributory factors by decomposition analysis found prominent role of chronic/degenerative diseases in the loss of healthy years. Impact of these diseases is worst towards the quality of life towards the older ages.

**Epidemiological Transition and State Health Expenditure**

In the seventh chapter, i.e ‘Epidemiological Transition and State Health Expenditure’, the study investigates the role of state health expenditure in the epidemiological transition in Kerala from historical perspective. It specifically examines (i) changes in the pattern of health expenditure at Central, State and LSGs level (ii) improvement in medical infrastructure (in manpower and material infrastructure) and (iii) causal relationship between socio-economic and state expenditure variables on epidemiological transition. The study used various proportions and Compound Annual Growth Rates of state health expenditure, Per Capital availability of medical infrastructure and OLS regression for the analytical purposes.
While analysing the health expenditure prior to the state formation, the study observed that the princely state of Travancore has started separate allocation for public health since 1863, which considerably increased over later years. Such intervention can be seen in the high medical infrastructure availability in Travancore in those years. On the other hand, there was negligence as far as public health expenditure is concerned in Malabar areas of British government in the 19th century. Though the British government later allotted funds for healthcare and expanded the medical establishments across Malabar, due to unpopularity of modern medicine in Malabar, it did not have the expected impact. Such difference in state expenditure can be one of the prominent factors behind the disparity in the mortality rates and epidemiological transition among the states before the formation of Kerala.

After the independence in 1947 and later the state formation 1956, it is observed that the Central and state governments allocated significant funds for the healthcare services. The pattern of central government expenditure on healthcare indicates a steady decline in its total plan allocation, while the component of family planning rose. Similarly, the state health expenditure was also declining over the years in proportion to the total budget expenditure and state domestic income even though the health expenditure was increasing in absolute amounts. This indicates declining priority to the health sector in fund allocation. Besides, there was no clear evidence that the state has addressed epidemiological challenges by expanding infrastructure for curative care. On the contrary, there is a decline in capital expenditure and plan expenditure in public health sector in Kerala. Decline in both of these sub-heads shows a reduction of funds for assets like land, building, machinery and equipments as well as shrinking financial space for introducing new schemes after meeting regular expenses in health expenditure component. The exploration of various sub-heads of capital and revenue accounts has shown that focus of public healthcare in the state diverted to medical education, especially on medical colleges located in urban areas. On the other hand, the study found that LSGs, which have the pivotal responsibility in healthcare after the transfer of medical institutions following the implementation of Panchayati Raj act, was successful in expanding medical infrastructure, provision of safe drinking water and sanitation at the grass root level. However, there was scant evidence of efforts to allocate resources to tackle non-communicable diseases and healthcare requirement for elderly etc., posed by epidemiological transition.
While analysing the healthcare infrastructure, the study has found a significant level of improvement in material infrastructure such as medical institutions and beds as well as work force such as doctors, nurses and other para-medical staffs in the health sector in Kerala. In line with this improvement, the per capita availability of such infrastructure also increased. However, while comparing the spiraling numbers of in-patients and out-patients, the increase in the medical infrastructure was not sufficient which was evident from the decline in the ratio of medical infrastructure per patient for the institutions under both DHS and DME in Kerala. The examination of causal relationship between socio-economic and state expenditure with proxies for epidemiological transition (YMR and AMR) by using OLS regression found that there was no statistical dependency of state health expenditure on epidemiological transition. However, per capita NSDP taken as a proxy to economic improvement as well as literacy rate as proxy to social improvement indicates a significant relationship, making the prominent role of socio-economic factors in determining the epidemiological transition rather than the state health expenditure in Kerala. In other words, there was no significant impact of state intervention on current stage of epidemiological transition in Kerala.

8.3 Conclusion from the Findings

All the way through, the study tried to explore the epidemiological transition and state health intervention in Kerala. Analysis of changes in the mortality in state indicates that the state experienced high level of mortality reduction and consequent improvement in life expectancy in the past century, mostly because of the reduction in mortality of youngsters and women at their reproductive ages. This change occurred between 1950-70s, as several state initiations were carried out for improving primary healthcare and other supplementary activities that have significant impact on controlling deaths from infectious diseases and other primary healthcare-oriented causes. Since, the beginning of 1970s, the state was experiencing major challenges from non-communicable diseases as well as from accidents and injuries. However, there was no comprehensive evidence on state’s efforts to address these challenges except from changes in the last decade. The existing room for fulfilling TLE between 40-60 for males and 60-80 age groups for both males and females corroborates with the fact that adult mortality has not yet not declined to the lowest level, especially for the males. The low ARI for TLE for these age groups since 1970s are a confirmation
that the adult mortality was the major challenge for the state as there was no decline in AMR for males in the recent decades. Though there was high proportion of survival to the older ages, its ratio was declining especially for males. Remarkably, the share of contribution to increment in life expectancy was lower from adult and older ages to the life expectancy in Kerala until 2000s which shows that the state yet not entered ‘advance stage of epidemiological transition’.

The analysis of the changes in causes of deaths confirms that there is a shift in causes of deaths from infectious diseases and other primary-oriented causes to non-communicable, chronic-degenerative diseases, accidents and injuries and hence to the epidemiological transition in Kerala. The predominant presence of non-communicable diseases and accidents and injuries are the major reason behind the slow decline in the death rates in the adult ages. The circulatory diseases, especially cardiac diseases and neoplasm, are major potential causes for further improvement in life expectancy. However, these diseases are negatively contributing to the life expectancy increment at least in the last three decades except slight positive increment from the circulatory disease in the last decade. Though there were positive contribution from the infectious and primary healthcare-oriented causes in the last three decades, negative contribution from non-communicable diseases have cancelled out much of the advantage, especially among males. The study confirms that the prevalence of non-communicable diseases and accidents and injuries are major reasons for the slowdown of life expectancy in Kerala. Further improvement in life expectancy is dependent upon reduction of such causes in the state.

The analysis of changes in morbidity pattern with decline in mortality found that the ill health of the people is on rise in Kerala, indicating loss of quality of life along with improvement in life expectancy. The DFLE analysis shows higher decline in quality of life in relatively better life expectancy sub-population such as females and rural people than males and urbanites. All the three level of DFLE analysis corroborates this fact. Besides, the loss in the quality of life is increasing towards the older ages, which shows that the health of survivors to older ages is becoming severe issue. Therefore, it can be assumed that the ongoing epidemiological transition creates a population with less quality of life in consequence with life expectancy increment and increasing survival to the older ages. Decomposition of loss in DFLE found that
non-communicable diseases are the prime causes for this decline in the quality of life especially towards the older ages. In short, both mortality and morbidity analysis of the study are in line with the fact that the state experiences severe challenges from epidemiological transition mainly that of ‘age degenerative and man-made’ diseases. Moreover, the high prevalence of morbidity and mortality from chronic/degenerative diseases and accidents & injuries, especially among males, hamper its achievement of ‘stage of delayed degenerative diseases’.

Several changes in cope-up with epidemiological transition were evident from the analysis of policies and acts by various governments. The princely state of Travancore had better measurements to improve the health status of their people than others which can be corroborated with the fact that Travancore was ahead in the epidemiological transition. Besides, the public health acts of Madras government and later Travancore-Kochi government focused on infectious/contagious diseases along with other measurements such as vaccination, universal education and school feeding programme etc. that led to mortality reduction prior to the state formation. However, Malabar region which received scant attention in healthcare from British regime, got special attention from governments after state formation which resulted in rapid expansion of medical infrastructure, vaccination and awareness programmes. Various documents of GOI and GOK indicates that nutritional programmes, water and sanitation, housing and literacy campaigns etc. were also functioning that could directly or implicitly impact the reduction of deaths from infectious disease and other primary health oriented causes apart from direct healthcare intervention. Since 1970, there was surge of non-communicable diseases causing high morbidity and mortality. Until the last decade, there is no evidence of a comprehensive policy or changes in acts to address these new challenges either at central, state or LSG level of government. The high death and morbidity from non-communicable diseases, accidents and injuries due to epidemiological transition that led to a decline in the quality of life shows the lack of policy response from the state.

The analysis of state health expenditure at various administrative levels indicate that the state spending on healthcare started since 19th century, at least in Travancore. A notable feature of health expenditure in the early decades of 20th century was its focus on epidemics/infectious diseases, which were formalised later
with the establishment of primary healthcare-oriented medical institutions, especially after the state formation. The pattern of health expenditure of central and state governments confirms their focus on primary healthcare mainly against infectious diseases and improvement of maternal and child health. Such focus on healthcare along with expenditure for other sub-heads such as water and sanitation, family planning, education and nutrition etc might have helped in achieving low death rates, mainly among younger age groups and mothers, before 1970.

Since 1970, the state experienced high morbidity from the chronic degenerative diseases and from accidents & injuries, which required additional healthcare spending. However, there were considerable decline in the proportion of health expenditure in Central and State budgets/plans, indicating relatively lesser priority for healthcare in recent decades. The healthcare expenditure at Central, State and LSG levels were focused at maintaining the existing primary healthcare-oriented system or upgrading the sub-centres, PHCs and CHCs to its next levels until the last decade. Nevertheless, new institutions were started and specialty care added in medical colleges in the last decade against major diseases such as cancer, diabetes, cardiac diseases and accidents and injuries. But this support was not enough to address the epidemiological challenges mainly from the non-communicable diseases, which resulted in the mushrooming of private medical institutions in Kerala. However, high morbidity and slow down in mortality decline mainly from the adult ages and mounting health care expenditure indicates that such private care was not an adequate alternative in tackling the epidemiological challenges. Therefore, the study concludes that the state have to come up with focused policies to tackle the challenges from chronic-degenerative diseases by promotive or advanced curative care. Though there are initiation at all the levels of governments to address the challenges arising out of current stages of epidemiological transition, it is too early to assess the impact of such programmes to the overall health status in Kerala.

The study extends some insights to the theoretical understanding on epidemiological transition. It exhibits the determinant role of public health intervention as akin with other developing countries in epidemiological transition. However, the pace of transition from one stage to other and the socio-economic characters make it unique from the experience of developing countries. The pattern of
the transition in Kerala mostly resemble ‘the accelerated transition’ model of epidemiological transition’ which has gradual pace of change with fluctuating mortality from ‘age of pestilence and famine’ to ‘age of receding pandemics’, followed by a faster change to ‘age of degenerative disease’ with low mortality. Notably, the existence of slow process of modernization prior to the drop of mortality (primarily determined by sanitary and medical advances and general social improvement), differs Kerala from the typical experience from developing countries. The fast changes to ‘age of degenerative disease’, necessitates a quick response from the state to address non-communicable diseases along with providing care to its rapidly increasing elderly while maintaining the existing primary healthcare system. However, the limited financial resources of the state constrain its ability to curb these new challenges, while private healthcare moves to fill such vacuum as an alternative.

The low gain in life expectancy, high morbidity and increasing catastrophic burden raises questions on the viability of such alternatives in Kerala. Moreover, such situation resembles that of East European countries (former USSR countries, mainly Poland and Russia), who experienced a ‘delay’ on fourth stage of epidemiological transition. Notably, these countries were efficient in addressing infectious and respiratory diseases than U.K and other advanced countries through their centralised administrations. However, they failed in tackling the enormous increases in the cardiovascular diseases and violent deaths (man-made diseases) compared to other European states. The high prevalence of cardiovascular diseases and violence are the main cause of death in these countries which comes from lifestyle pattern especially alcohol, smoking and food consumption. Later, the mortality rate from such causes in these countries decreased with promotive strategies such as anti-alcoholic campaign and hike in price of hazardous commodities. Their experience suggests that it is high time for the state to focus on promotive/preventive care rather than medical care. It has to promote health insurances against catastrophic expenses to ease the burden from epidemiological transition. Moreover, such attempts can facilitate the state to advance stage (delayed degenerative) of epidemiological transition as experienced in most of the developed countries.
8.4 Policy Suggestion

The study indicates that the adult mortality, mainly from chronic/degenerative diseases, accidents and injuries, prevails at higher rates and their decline is very slow over the decades, even though the state have effectively controlled the deaths in the younger ages mainly from infectious diseases and other primary health-oriented causes. It also delays achieving the advanced stage of epidemiological transition in Kerala. Moreover, these diseases cause high morbidity and leads to a loss in quality of life that increases over the years in the state. The study suggests promotive/preventive strategies which can reduce exposure to such health hazards over advanced medical care, since such provisions are limited by the financial constrains of the state. Since the state experienced more challenges from circulatory diseases and neoplasm which are more related to lifestyles, including the consumption of alcohol, tobacco and other hazardous products, the state have to bring stringent laws to control their production, quality and distribution along with awareness against such products and diseases. Towards this end, the governments can involve educational institution, Kudumbashri and other NGOs along with its various administrative institutions. They can also promote indigenous knowledge for better life style such as yoga and meditation as an integrated action along with other initiatives.

Another impact of ongoing epidemiological transition in Kerala is the spiraling catastrophic health expenditure mainly because of dependency over commercialised private medical care as the state medical institutes are inadequate for curative care as found in the study. To avoid such difficulties, the government has to expand the existing curative and palliative facilities and improve the quality of care in the state medical institutions. At the same time, there should be effective policy guidance for the private medical institution for fixing their fee for diagnostic test and other treatments. Most importantly, the government should strengthen the existing PHCs and CHCs and other grassroots-level institutions for early detection of chronic/degenerative diseases and promote the participation of such institutions for various campaigns and awareness programmes with the help of LSGs against these new epidemiological challenges. A major factor of spiraling of healthcare cost is attributed to the cost of the drugs and medical equipments. In this regard, the government has to assure the availability of life-saving drugs at affordable cost by controlling production and prices and by subsidizing the drug cost as well as
exempting the drugs from taxes and other duties. The government can also facilitate universal health insurance for its entire citizens in order to protect them from shocks of catastrophic health expenditure posed by epidemiological transition.

Epidemiological transition as well as demographic transition leads to survival to the older ages and hence the proportion of elderly people is on the rise in Kerala. However, high morbidity and disability towards the older ages raises concern over their health and healthcare. Relatively lower economic and educational status of most of the elderly in state than other age groups, and high survival of females, especially widows to the older ages, further escalates such concern. In this regard, the government has to effectively implement strategies that facilitate ‘healthy aging’ in the state. At the same time, it also needs to bring programmes to ensure better healthcare facilities in order to address the healthcare requirement of the elderly.

Finally, it must also be noted that Kerala is prone to the emergence or re-emergence of diseases which the studies explain as ‘fifth stage of epidemiological transition’. The intensive expansion of human habitats in the state during the last five decades, intruding into forest land, increase of solid waste and contaminated water logging as a result of unscientific urbanisation process, coupled with pollution and pesticides have created an environment congenial for new infectious diseases. At the same time, increasing bulk of elderly population with lower immunity and chronic morbidity, high density place of habitation and increased institutional arrangement like old age and nursing home, survival of compromised immunity people from HIV/AIDS patients and others who survive by medical technology such as chemotherapy and radiation enhance the social susceptibility to diseases in the state. Besides, high migrants specifically emigrants can further open the vulnerability to spread emerging diseases in a short time in the state where migrants are not only vulnerable but also may become as carriers of some the new emerging diseases. So far, the state is maintaining its existing health structure without any substantial modification. It has to factor in vulnerabilities to the emergence and re-emergence of diseases as noted as the fifth stage of epidemiological transition. Considering this, the government has to initiate new research activities in the health sector in Kerala.
8.5 Limitations & Scope for Future Work

Even though the study comprehensively analysed the epidemiological transition and the state intervention about a centurial period, it is not free from limitations. There is ample room for further research. Since there was no reliable data available on death and morbidity by socio-economic groups, the study limited its scope with state averages. However, if the state government makes publically available, the primary data on Vital Registration System (VRS) deaths by its causes which claims about cent percent coverage since 2010, perhaps the study can extend it estimation of stages of epidemiological transition among socio-economic groups in Kerala.

Secondly, the study did not focus on new-emerging and re-emerging diseases since the morbidity and death rates from these diseases are too little to compare with other diseases. However, such diseases and its prevalence are on rise in Kerala. In this regard, a further study is be possible by exploring the nature of such diseases, pattern of its prevalence by age, sex and region along with other characteristics as well as the ability of existing healthcare mechanism to prevent an epidemic of such diseases in the near future.

Though the study attempted for an efficiency analysis for state health intervention on epidemiological transition by using year of life expectancy at district level as proxies, it could not produce valid results. This is due to the fact that the changes in life expectancy at district level in Kerala are converged over the years. However, if probability of death at younger, adult and older ages at district level is used as proxies of the transition, such problems can be tackled. Such suitable information of probability of deaths at various ages at district level is available only for a single recent year limiting the number of observation into 14 districts. Nevertheless, such an analysis is possible for the coming years in which the suitable information of probability of deaths is available.

The available information on health expenditure from the budget documents are not in a format which can aid in grouping them by their focus of expenditure for specific care such as primary healthcare-oriented diseases, expenditure for curative care as well as for promotive healthcare expenditure. Perhaps, extended study at micro level by selecting a few samples of state medical institutions may provide more
clarity on the focus of state in addressing challenges from the epidemiological transition.

Finally, there was no comprehensive analysis on healthcare burden in Kerala in the context of its ongoing epidemiological transition. To a large extent, the lack of such information throws light on inadequate planning towards healthcare facilities in the state. This raises concern at a time when morbidity rates are rising, along with growing survival to old ages. Therefore the study finds a new scope of exploration into the epidemiological transition and healthcare burden in Kerala.