INFLUENCE OF SOCIO-ECONOMIC FACTORS ON PREVALENCE OF CHRONIC DISEASES AMONG ELDERLY IN INDIA

Dissertation submitted to the Jawaharlal Nehru University in partial fulfilment of the requirements for the award of the Degree of

MASTER OF PHILOSOPHY

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July 21, 1995.

CERTIFICATE

This is to certify that this dissertation entitled **"INFLUENCE OF SOCIO-ECONOMIC FACTORS ON PREVALENCE OF CHRONIC DISEASES AMONG ELDERLY IN INDIA"**, submitted by **Mr. SUDHIR KUMAR** in partial fulfilment of the requirements for the award of the degree of **MASTER OF PHILOSOPHY** is a bonafied work to the best of my knowledge.

We recommend this dissertation to be placed before the examiners for evaluation.

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Sudhir Kumar

SUDHIR KUMAR

July 21, 1995

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CHAPTER 1

INTRODUCTION

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INTRODUCTION

Aging as it concerns to an individual and to population are two different aspects. To an individual, it is a continuous, unidirectional and irreversible process. It starts from birth of an individual, passes through childhood-adulthood, old age and ends at death. It has chronological as well as biological dimensions. Biologically, the beginning of old age in an individual connotes different conditions or changes occurring in one's life, viz., the onset of graying of hair, boldness, loosening of skin, visual impairment, deficiency in functioning of vital physical components. The definition of chronological age of the aged varies from society to society and from time to time. Throughout, the present study, unless stated otherwise, reference of the "aged" or "older age" groups relate to persons aged sixty and above.

Population aging, on the other hand, refers to the increase in proportion of the persons defined as 'old' in the population. The present century has witnessed the population aging as a result of demographic transition i.e.

the decrease in fertility and mortality. Fertility decline reduces the number of births and thus leads to narrowing of the population base. Mortality decline leads to higher expectation of life thus contributing to higher survival of the aged. So both these processes lead to increase in the number and proportion of the aged.

Table 1.1

Size, Growth Rate and Percentage of the Elderly Population for Major Regions of the World, 1950-2025

	1950	1970	1980	1990	2000	2025
World						
Size (in million)	201.0	305.8	382.4	487.2	616.6	1194.6
Annual growth rate(%)	--	2.1	2.3	2.4	2.8	2.7
Percentage of total	8.0	8.3	8.6	9.2	9.8	14.1
More developed regions						
Size (in million)	94.6	148.9	173.5	207.1	236.4	343.8
Annual growth rate(%)	—	2.3	1.5	1.7	1.4	1.5
Percentage of total	11.4	14.2	15.3	17.1	18.5	24.5
Less developed regions						
Size (in million)	106.4	158.9	208.4	281.8	376.2	855.4
Annual growth rate(%)	--	2.0	2.7	3.0	2.8	3.3
Percentage of total	6.3	6.0	6.3	6.9	7.6	12.1

Note: More developed regions include North America, Japan, all regions of Europe, Australia, New Zealand and U.S.S.R. Less developed regions include Africa, all regions of Latin America, other East Asia, all regions of South Asia, Melanesia and Micronesia - Polynesia.

Source: United Nations, *World Population Prospects 1992*, New York: United Nations, 1993, pp.284-289.

Table 1.1 provides the population of the aged in the world over time and their break-up in more developed and less developed regions. According to it, the world population of the aged reached 201 million in 1950. It comprised eight per cent of the total population. This population of elderly rose to 382 million in 1980 and is expected to reach 617 million by 2000 and 1195 million by 2025, thus making 8.6,9.2 and 14.8 per cent respectively. Moreover, the aging phenomenon is not common throughout the world. The percentages of aged to total population vary significantly for developed and developing countries. In 1980, aged comprised 15.3 per cent in more developed region, while it was 6.3 per cent in less developed region. But, the absolute number of aged was 170 million in more developed region and 210 million is less developed region. Aged are expected to increase at the rate of 1.7 per cent per annum in more developed region and at the rate of 3.0 per cent in less developed region during 1980-90. Thus the rate of growth of the aged is much higher in less developed countries.

Table 1.2

Growth of Elderly Population Aged 60 and above by Sex, India, 1901-2001

Year	Persons	Males	Females
1	2	3	4
1901	12.1	5.5	6.6
1911	13.2	6.2	7.0
1921	13.5	6.5	7.0
1931	14.2	6.9	7.3
1941	18.0	6.9	9.2
1951	19.6	9.7	9.9
1961	24.7	12.4	12.4
1971	32.7	16.9	15.8
1981	44.0	22.5	21.5
1991	55.3	28.2	27.1
2001	75.9	38.2	37.7

Source: Sharma S.P., Xenons P., *Aging in India: Demographic Background and Analysis based on Census Materials,* New Delhi: office of the Registrar General & Census Commissioner, India, 1992, pp. 92-94.

Table 1.3 gives the percentage of aged to total population over time for India. Compared to the global situation, the percentage of aged in India is much lower i.e. 6.50 per cent in 1981. But, when it is multiplied by the large base of Indian population, it comes to a huge number. In 1981, around 13.6 per cent of the world's elderly were in India. Age composition of Indian population has experienced considerable change. In 1901, aged comprised only 5.1 per cent. The aged percentage continuously rose during 1901-81 except during 1921-31 and 1941-51. The percentage of aged is expected to rise to 6.6 per cent by 1991 and to 7.7 per cent by 2001.

Table 1.3

Percentage of population aged 60 and above to general population by sex, India, 1901-2001

Year	Persons	Males	Females
1	2	3	4
1901	5.1	4.6	5.6
1911	5.2	4.8	5.7
1921	5.3	5.0	5.7
1931	5.1	4.9	5.4
1941	5.7	5.4	5.9
1951	5.4	5.2	5.7
1961	5.6	5.5	5.8
1971	6.0	5.9	6.0
1981	6.4	6.4	6.5
1991	6.6	6.5	6.6
2001	7.7	7.6	7.9

Source: Sharma S.P., Xenons P., *Aging in India: Demographic Background and Analysis based on Census Materials,* New Delhi: office of the Registrar General & Census Commissioner, India, 1992, p.31.

Table 1.4

Percentage of population aged 60 and above for major states of India by Place of Residence, 1981

State	Total	Rural	Urban
Andhra Pradesh	6.7	7.1	5.1
Bihar	6.8	7.1	5.0
Gujarat	6.0	6.3	5.2
Haryana	6.3	6.6	5.6
Himachal Pradesh	7.5	7.7	5.1
Jammu & Kashmir	5.8	6.1	4.5
Karnataka	6.6	7.0	5.7
Kerala	7.5	7.6	7.1
Madhya Pradesh	6.6	6.8	5.1
Maharashtra	5.9	5.8	6.0
Orissa	6.4	6.6	4.7
Punjab	7.8	8.4	6.1
Rajasthan	6.0	6.3	5.2
Tamilnadu	6.4	6.7	5.8
Uttar Pradesh	6.8	7.2	5.4
West Bengal	5.6	5.5	5.7

Source: Census of India, 1981, Series I India Part-IV A, Socio-Cultural Tables, 1988.

Within India, the aging phenomenon is not uniform owing to the different pattern of demographic transition in different states. Inter-state variation in percentage of aged in 1981 shows that it was highest for Punjab (7.8%) followed by Kerala (7.5%) and Himachal Pradesh (7.5%) (Table 1.4). No state had the aged population less than five per cent. Increasing number of aged world-wide and in India has drawn the attention of the social scientists and social workers on the problems faced by them. Loneliness, dependency on progeny or relations, undesirability in the changing family set-up, health problems are some of the major problems faced by them.

Among the above factors, health is obviously a factor that has significant bearing in the lives of the aged. It determines what activities or tasks one can or cannot engage in. The presence or absence of good health also has a bearing on the likelihood of being able to successfully complete certain activities. Poor health can make aged persons dependent on others even for some of the basic necessities of life.

Aging is generally accompanied by degeneration of vital physical organs. This makes aged more likely to be afflicted from chronic diseases than the younger age-groups. A chronic condition is one that is permanent or that will incapacitate the individual for a longer period of time.[1] As these diseases stay for a longer period of time, they cause a lot of economic burden on family. This also causes depletion of saving to a considerable extent. In the present time, as a result of modernization, the family ties are weakening and joint families are breaking. As a result,

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1. Park J.E., Park K., *Text Book of Preventive and Social Medicine*, Jabalpur: M/s Banarasidas Bhanot, 1991, p.235.

the elderly would lack family support and these diseases would bring a lot of miseries in the lives of the aged. These diseases afflict to an individual in socio-economic environment which is supposed to play an important role. Given this background, it is important to study the problem of chronic diseases among aged and associated socio-economic factors. There has not been any study on the prevalence of chronic diseases among aged in India mainly due to lack of data. The present study is an attempt in this direction. To be specific, the objectives of the present study are as follows:

(1) To study the prevalence of some chronic diseases among aged in India. The diseases studied are: hypertension, heart diseases and diabetes;

(2) To identify the socio-economic factors associated with the prevalence of chronic diseases mentioned above.

The present study has been organised as follows. A review of the past studies related to influence of socio-economic factors on health and chronic diseases is presented in the second chapter. In the next chapter, a conceptual framework has been developed to analyse the prevalence of chronic diseases. Hypotheses, measurement of variables, methodology and limitations of the study are also gives in this chapter. The fourth chapter deals with analysis of data. In this chapter differentials in prevalence rate of chronic diseases by age, sex and rural-urban residence has been presented. To find the influence of socio-economic factors on prevalence of chronic diseases, step-wise regression analysis is also performed. The last and fifth chapter summarizes the results obtained from data analysis and on the basis of it, some policy recommendations are suggested.

CHAPTER 2

REVIEW OF LITERATURE

CHAPTER 2

REVIEW OF LITERATURE

Only a few studies have been conducted regarding the effect of socio-economic factors on hypertension, heart diseases, diabetes and other chronic diseases. This chapter presents a review of the available relevant studies. The review has been categorised into four sections. The first section presents the review of studies related to general health. The second section deals with studies related to blood pressure and hypertension. The third section reviews studies related to heart diseases. In the last section studies related to diabetes are reviewed. The review is carried out chronologically within each category.

General Health

Preston[1] (1975) examined the change in relationship between mortality and level of economic development for developing and developed countries. The data on life expectancy at birth and per capita national income was plotted for

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1. Preston, S.H., "The Changing Relation between Mortality and Level of Economic Development", *Population Studies*, Vol.29 (2), 1975, pp.231-248.

1930's and 1960's. The graph showed an upward shift for the later period. The author fitted a logistic curve between expectation of life at birth and per capita national income for 1930's and 1960's. The sample correlation coefficient between these variables was 0.89 and 0.88 respectively. The author, however, has argued that the factors exogenous to country's current level of income may not show the complete effect on expectation of life at birth. 75-90 per cent of the growth in life expectancy is due to factors exogenous to current level of income. Income growth per se accounts for only 10-25 percent.

Manton[2] (1982) discussed the relation between morbidity and mortality as life expectancy increases. The discussion is based on the basic epidemiological relation that prevalence is a function of incidence and duration. The basic relation suggests that " if incidence is unchanged then mortality reduction leading to life expectancy increase can only occur by increasing the duration of the disease and consequently its prevalence." This phenomenon is a necessary consequence of the basic mathematical relation. The author discussed the reason for the increase in the duration

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2. Manton, K.G., "Changing Concepts of Mortality and Morbidity in the Elderly Population"; *Milbank Memorial Fund Quarterly/Health and Society*, Vol.60(1), 1982, pp.183-244.

of chronic disease. One way to increase the duration is to eliminate lethal sequela e.g. pneumonia and to affect the basic rate of progression of disease process. Another way to increase the duration is to change the rate of progression of the primary disease process. In the latter case, duration and hence expectation of life is increased by reducing disease severity. This may occur through clinical efforts (e.g. hypertension control) as well as health promoting behaviour. Thus, though prevalence might increase, the average severity of the disease is decreased. Without treatment, mortality risks could rise, average duration and hence prevalence would fall.

Fries[3] (1983) analysed the changes in morbidity along with changes in life expectancy. He explained the above reviewed hypothesis and argued that when longevity increases, the period of morbidity may be shortened if the average onset age of a marker of morbidity (first heart attack, first dyspnea from emphysema or other) can increase more rapidly than does life expectancy from the same age. If it does, then the period between that marker and the end of life is shortened. Absolute compression of morbidity

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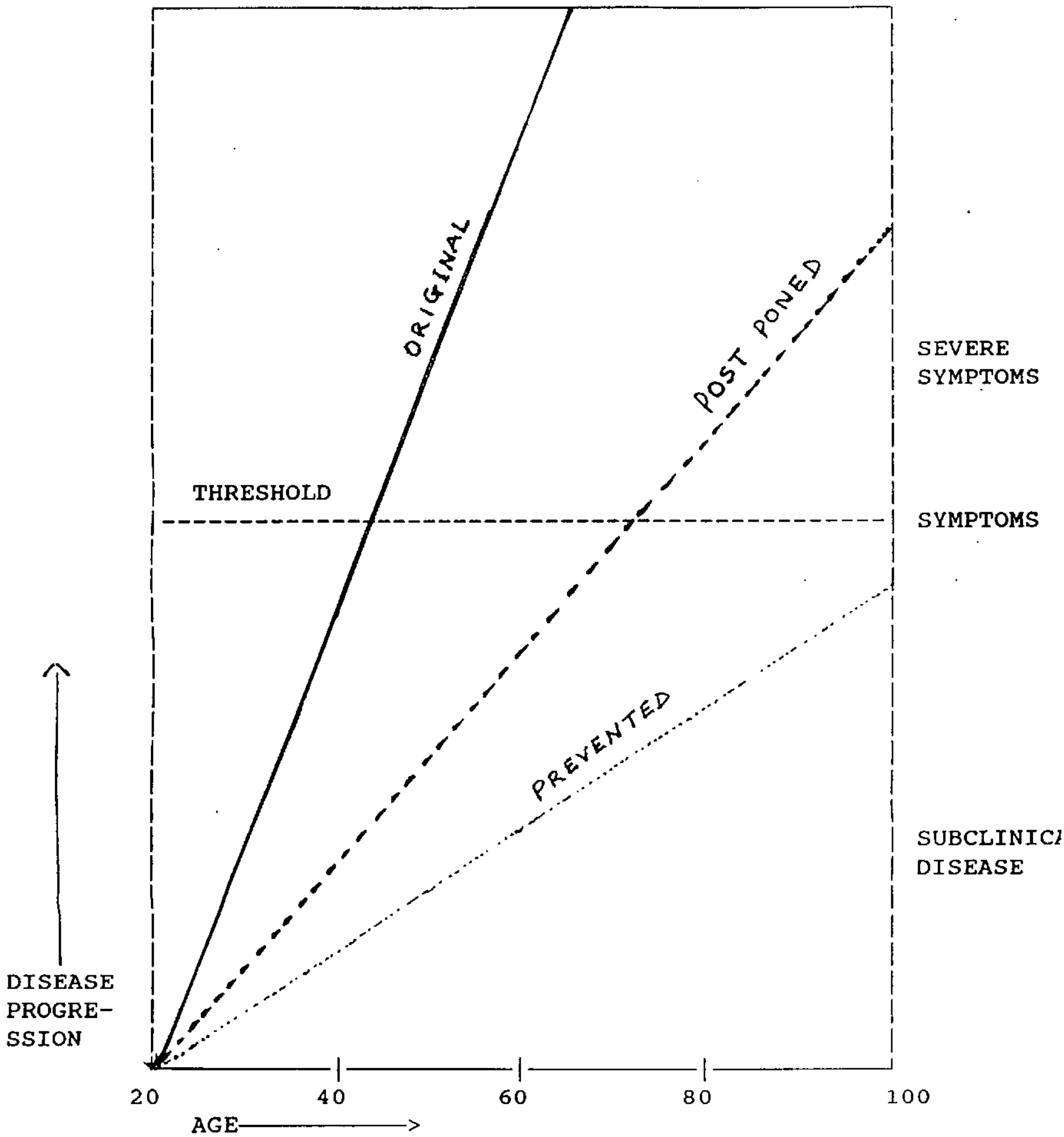
3. Fries, J.F., "The Compression of Morbidity", *Milbank Memorial Fund Quarterly/ Health and Society*, Vol.61(3), 1983, pp.397-419.

FIGURE 2.1



ORIGINAL
POST PONED
PREVENTED
THRESHOLD
SEVERE SYMPTOMS
SYMPTOMS
SUBCLINICA
DISEASE
DISEASE PROGRE-SSION
20
40
60
80
100
AGE

occurs if age-specific morbidity rates decrease more rapidly than age-specific mortality rates. Relative compression of morbidity occurs if the amount of life after the first chronic morbidity decreases as a percentage of life expectancy.

An incremental model of chronic disease has been proposed by Fries. This model is characterised by early age at onset, progression at various rates and passage of a symptomatic threshold. Symptomatic threshold is the level of disease at which time a clinical diagnosis may be made. The model is shown in figure 2.1

Weatherby[4] et al., (1983) examined the relation between mortality at older ages and development, inequality and health care. He used the data on mortality at ages 50 and above in female populations of 38 countries and controlled for variation in quality of mortality data. On the basis of multivariate analysis, he found that economic development, economic distributional inequality and basic primary health care have independent cross-national effect on cause of death structures and these effects were not found to be uniform across the age-intervals. The study indicated that

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4. Weatherby N.L., Nom C.B., Isaac L.W., "Development, Inequality, Health Care, and Mortality at the Older Ages: A Cross-National Analysis"; *Demography*, Vol.20(1), 1993, pp.27-42.

as improvement occurs in levels of living and health care, age-specific death rates decline except at the oldest ages at which point they might increase. The author attributed it to the fact that with improvement in the above mentioned factors, the life-span is not increasing and decline in mortality at younger ages is compensated at very old ages. Moreover this study indicated that the improvement in living standards and health care decreases the mortality due to acute diseases because these are more easily and economically to be controlled. Thus mortality due to chronic diseases increase.

Alter and Riley [5] (1989) examined the relation between frailty,[6] sickness and death in British friendly societies in nineteenth century. The records of these societies showed a strong increase in age-specific morbidity from 1860's to the 1890's, when mortality rates among their members decreased. The author explained the inverse association between morbidity and mortality by a model which emphasized that medical intervention reduces the early death. The people surviving early death due to medical

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5. Alter G. and Riley J.C., "Frailty, Sickness, and Death: Models of Morbidity and Mortality in Historical Populations", *Population Studies*, Vol.43(1), 1989, pp.25-45.

6. Fraility implies the individual's susceptibility to disease/injury.

intervention accumulate a sort of frailty. These 'frail' people are more susceptible to disease and population composition by frailty changes. This in turn, increases the morbidity.

Deeg[7] et al., (1989) attempted to predict longevity in the elderly. The study was based on the Dutch longitudinal study among the elderly. A probability sample of 3149 persons from the population of Netherlands was selected. Initially sample persons aged 65-99 years were followed from 1955 for 28 years. Vital status and cause of death were ascertained in 1983 for 84 per cent of the original sample. 16 per cent were lost-to-follow-up. Multivariate regression models were used to predict the realized probability of dying (RPD), a measure of longevity based on actual survival time, sex and age at base time. Predictor variables (which included physical, mental and social indicators of health status)explained only 20.2 per cent of total variance of RPD.

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7. Deeg D.J.H., Zonneveld R.J.V., Maas P.J. and Habbema J.D.F., "Medical and Social Predictors of Longevity in the Elderly: Total Predictive Value and Interdependence", *Social Science and Medicine*, Vol.29(11), 1989, pp.1271-1280.

Crimmins[8] et al., (1989) studied the changes in life expectancy at different ages between 1970 and 1980 in United States. The authors devised the method to estimate the years spent in disability. On the basis of their analysis, it was found that the gain in life expectancy was more at younger ages than in older ages between 1970-80. However, the gain in life expectancy was nil for age-group (85+.) The major portion of gain in life expectancy at older ages i.e. 60-65, 65-70 and 70-75 was spent in disability.

Olausson[9] (1991) analysed total mortality for elderly Swedish men and women by social class. The population under study was derived from 1960 population census and covered all men and women born between 1896 and 1914 who were economically active in 1960. Deaths in the study population between the ages 65-83 were followed during the period 1961-79. The population was divided into four classes: first, professional occupation and intermediate occupation; second, non manual occupation; third, skilled manual occupation; and fourth partly skilled and unskilled occupation. On the basis of comparison, the author found the mortality

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8. Crimmins E.M., Saito Y. and Ingengneri D., "Changes in Life Expectancy and Disability Free Life Expectancy in the United States", *Population and Development Review*, Vol.15(2), 1989, pp.235-267.

9. Olausson P.O., "Mortality among the Elderly in Sweden by Social Class", *Social Science and Medicine*, Vol.32(4), 1991, pp.437-440.

was lowest in the first class followed by third, fourth and the second respectively for men, while the sequence for women was first, second, third and fourth. This phenomenon was attributed to differential hardness in life by class. However, it was doubted that the lower mortality in third and fourth class than second class for men was due to earlier retirement of manual labourers due to poor health.

Murray and Chen [10] (1992) discussed various approaches to the interaction between morbidity (sickness) and mortality change. He compared the prevalence of chronic illness[11] in United States, Rural Kerala, Rural India and Rural Bihar. The prevalence of chronic illness was highest in the United States followed by Rural Kerala, Rural India and Rural Bihar respectively. Thus, a negative correlation between death rate and prevalence of chronic illness was found. However, the authors have cautioned against the tendency to conclude that morbidity is likely to rise during health transition. They argued that in developing countries, the prevalence of acute disease is higher than in developed countries and

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10. Murrary C.J.L. and Chen L.C., "Understanding Morbidity Change", *Population and Development Review*, Vol.18(3), 1992, pp.481-503.

11. Chronic illness in this paragraph is meant for reported chronic illness.

while measuring morbidity, the case-fatality rate should be given due weightage.

Blood Pressure and Hypertension

Srivastava et al.,[12] (1979) analysed the influence of some correlates of blood pressure viz., age, sex, weight, body build and socio-economic status on its distribution in a rural Indian community. The survey was carried on 1325 adults in five villages in Jhansi district of U.P. (reference time of the survey is not known). The analysis revealed that systolic and diastolic blood pressure level rose with increasing age, weight and body build. However, the correlation coefficient between socio-economic status and blood pressure was not significant. But there was a tendency of increase in blood pressure with higher social status. After the age of forty, women had higher levels of systolic blood pressure (SBP) than men.

Verma and Srivastava [13] (1983) studied the prevalence of hypertension in north India. The study was based on the

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12. Srivastava R.N., Verma B.L., Kumar A., Srivastava J.P., "The Influence of Some correlates of Blood Pressure on its Distribution in an Indian Rural Community", *Journal of Epidemiology and Community Health*, Vol.8(3), 1979, pp.279-85.

13. Verma B.L. and Srivastava R.N., "Hypertension in Indian Rural Adults", *International Journal of Epidemiology*, Vol.12(3), 1983, pp.374-375.

survey done in two communities in 1971-72 and in 1977-78. Hypertension was prevalent in four per cent adults at the time of survey. Moreover the survey showed that the prevalence of hypertension was more among females than in males.

Patrick et al., [14] (1983) studied the impact of changing way of life on blood pressure. The study was based on a cross-sectional survey in the Micronesian island of Popane. Communities were sampled at three levels of impact of modernization: the capital town of Kolonia, an intermediate area and a remote area. No difference in salt intake was noted for the three areas. The people in the most modern area were younger and heavier. No consistent ecological differences were found in blood pressure levels. Since, there were considerable variation in modernity within each area, a Guttman - type scale of individual modernity was developed. No consistent trend of blood pressure was observed with modernity. However, among males (controlling for age) in the most modern area both systolic and diastolic pressure increased consistently with increasing modernity. Significant increases in diastolic blood pressure (DBP) were found

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14. Patrick R.C., Prior I.A.M., Smith J.C. and Smith A.H., "Relationship between Blood Pressure and Modernity among Ponapeans", *International Journal of Epidemiology*, Vol.12(1), 1983, pp.36-44.

with modernity for all males, Kolonia males and males residing in intermediate areas. When body mass as well as age were controlled, the strength of the trend decreased. Among Kolonia Males, the increase of diastolic blood pressure with increasing modernity remained highly significant but that of systolic pressure marginally significant.

Rao et al.,[15] (1984) analysed the factors related to blood pressure. The study was based on a random sample of 961 rural and 1073 urban women chosen from North Arcot district in Tamilnadu. The mean systolic blood pressure was found 101.4 and 105.3 for rural and urban areas respectively. The mean diastolic blood pressure was 65.9 and 68.0 for rural and urban areas respectively. The relation of blood pressure was examined with selected socio-economic, obstetric and maternal factors. For rural women, blood pressure showed significant association with parity and weight. The blood pressure of urban women showed significant association with age and income.

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15. Rao P.S.S., Inbaraj S.G., Subramaniam V.R., "Blood Pressure Measures among Women in South India", *Journal of Epidemiology and Community Health*, Vol.38(1), 1984, pp.49-53.

Gopinath et al.,[16] (1994) studied the hypertension in young ages 15-24 years. The study was based on a random sample of 6543 carried out during 1985-87 in urban population of the entire union territory of Delhi. The prevalence rate of hypertension was 30.9 per thousand for both sexes, 41.2 per thousand for males and 21.7 per thousand for females. Hypertension was much higher in 20-24 year age-group than in 15-19 year age-group. Five risk factors viz., vegetarianism, family history, regular exercise, obesity, alcohol consumption were examined. Out of these family history, smoking, obesity, alcohol consumption were found to be associated risk factors.

Gilbert et al.,[17] (1994) studied the prevalence of hypertension and determinants of blood pressure. The study was based on a survey done in K.V. Kuppan panchayat in rural South India. The sample size of the study was 1027

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16. Gopinath N., Chanda S.L., Sood A.K., Shekhawat S., Birdra S.P.S., Tandon R., "Epidemiological Study of Hypertension in Young (15-24 yrs) Delhi Urban Population", *Indian Journal of Medical Researh*, Vol.99(1), 1994, pp.32-37.

17. Gilberts E C A M, Arnold M J C W, Grobbee D E, "Some Determinants of Blood Presure in a South Indian Community",*Journal of Epidemiology and Community Health*, Vol. 48 (3), 1994, pp. 258-262.

adults(456 men, 571 women. The data was collected on blood pressure (systolic and diastolic), age, body weight, height, pulse rate, salt intake, socio-economic class. Multiple regression analysis was applied to identify determinants of blood pressure. The analysis identified age, body weight and pulse rate as the most important determinants of high blood pressure. The prevalence of hypertension in the highest socio-economic group was 22.5 per cent i.e. more than twice of the prevalence in lowest socio-economic group(8.8 per cent).

Harrap[18] (1994) reviewed the role of gene and environment in hypertension. On the basis of the review, it was found that it is very difficult to separate the role of genes and environment. This is because, the two are not additive and the interaction between genes and environment also play an important role. He was of the view that variation in blood pressures within population is largely contributed by genetic factors and geographical variation are largely the results of environmental factors.

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18. Harrap S.B., "Hypertension: Genes versus Environment", The Lancet, vol.344 (8916), 1994, pp.169-171.

Heart Diseases

Malhotra[19] (1967) studied the geographical variations in ischaemic heart disease in railways population in various part of India. The study was based on a survey done in 1963 by Ministry of Railways to ascertain the number of deaths due to ischaemic heart disease among railway employees in different parts of India. Mortality rate due to ischaemic heart disease was 59 per lakh employees during 1958-62. Death rate was highest among class I & II employees followed by class III and class IV employees respectively. Large regional variations in mortality rate were noted with highest in Southern Zone and lowest in Northern Zone. This indicates that environmental factors may be playing some role. The study attempted to find the association of death rate due to ischaemic heart disease and socio-economic factors, stress and strain, dietary factors, smoking but did not find any consistent relationship. The author, however, doubted the lack of association due to problem of measurement.

Sarvotham and Berry[20] (1968) analysed the prevalence of Coronary Heart Disease (CHD) in an urban population in

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19. Malhotra S.L., "Epidemiology of Ischaemic Heart Disease in India with Special Reference to Causation", *British Heart Journal*, Vol.29(6), 1967, pp.895-905.

20. Sarvotham S.G. and Berry J.N., "Prevalence of Coronary Heart Disease in an Urban Population of Northern India, *Circulation*, Vol.37, 1968, pp.939-53.

northern India. The study was based on a prevalence survey of CHD carried out in Chandigarh on a sample of 2030 persons aged thirty years and above. The prevalence rate of CHD was found to increase with age, socio-economic status and with sedentary nature of occupation. CHD prevalence was found to be positively associated with hypertension and obesity. CHD prevalence rate was found to be positively associated with hypertension and obesity. CHD prevalence rate 45.9 per thousand for men and 55.7 per thousand for women. For aged sixty and above, it was 164.0 per thousand and 144.0 per thousand respectively.

Rose and Marmot [21] (1981) challenged the common belief that CHD prevalence is higher in higher social class. The data was used from a survey of 17530 London civil servants aged between 40 and 64 (the White Hall Study). Employees in lowest grade were compared with those in top (administrative) grade. The age-adjusted prevalence rate was higher in lowest grade by 53% per cent for angina, 77 per cent for ischaemic type electrocardiographic abnormalities and 75 per cent for prevalence of electrocardiographic abnormality among men with angina. At follow-up, the seven and a half

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21. Rose G., Marmot M., "Social Class and Coronary Heart Disease", *British Heart Journal*, Vol.45(1), 1981, pp.13-19.

year coronary mortality was 3.6 times higher in lowest than top grade. These social class differential were partly explained by known coronary risk factors: men in lower grade smoked more and exercised less; they were shorter and overweight; had higher blood pressure and lower levels of glucose tolerance. The authors have argued that the higher prevalence of CHD in higher social class during earlier studies might have been due to higher coronary risk factors among them at that time.

Leigh[22] (1986) studied interrelationship between occupational hazards and heart disease. Fatal injury rate with industry was taken as proxy for safety hazards. Fatal heart attack rates were taken as proxy for heart disease. Holding age, race and gender constant, significant association was found between safety hazards and heart disease. The author concluded that hazardous working condition puts physical and psychological stress on most workers which engender or exacerbate heart disease.

Kennel and Belanger[23] (1991) studied the epidemiology of heart failure. The study was based on 34 years of fol-

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22. Leigh J.P., "Occupational Hazards and Heart Attacks", *Social Science and Medicine*, Vol.23(11), 1986, pp.1181-1185.

23. Kannel W.B., Belanger A.J., "Epidemiology of Heart Failure", *American Heart Journal*, Vol.121(3), 1991, pp.951-57.

low-up of Framigham study data which provide clinically relevant insights into prevalence, incidence, secular trend, prognosis and modifiable risk factors for the occurrence of heart failure in a general population sample in U.S. The heart failure was found to increase with age and was found to be associated with CHD and hypertension.

Backer et al.,[24] (1994) studied the variation in heart disease rate within a small area in Belgium. The study population was all the residents of the city aged 25-69 years. CHD attack rate were calculated from the data of the "Ghent MONICA myocardial infarction register" for the period 1983-87. Twenty five demographic and socio-economic variables were used to find factors. Two factors, one related to family status and other related to socio-economic status was used to find association with CHD attack rate. CHD attack rate was found negatively associated with socio-economic status.

Diabetes

Unfortunately, there are only few studies related to effect of socio-economic factors on diabetes except the following study. It is reviewed in the following paragraph.

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24. Backer G de, Thys G., Craena Ide, Verhasselt V., Hernauu Sde, "Coronary Heart Disease Rates within a Small Urban Area in Belgium", *Journal of Epidemiology and Community Health*, Vol.49(4), 1994, pp.344-347.

Friis[25] et al.,(1986) assessed the interrelation among diabetes, depression and employment status. A case-control design was employed in which cases (n=56) were currently active diabetic patients and the controls were non-diabetic. Depression was measured by CED-S scale. On the basis of the study, diabetes was found associated with both depression and unemployment. Being unemployed was the most significant predictor of depressive symptomology followed by being diabetic.

The above review suggests that the chronic diseases; hypertension, heart diseases and diabetes, are associated with each other. This implies that a person suffering from one of the above disease has a higher chance of being afflicted with the other diseases. Studies related to blood pressure and hypertension have been examined in relation to age, sex, salt intake, physical exercise, obesity, smoking and socio-economic status. Generally blood pressure and hypertension rise with increase in age, obesity and smoking. There are no consistent result about the relation with salt intake and socio-economic status. The lack of relation in some studies with salt intake is generally attributed to

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25. Friis R. and Nanjundappa G., "Diabetes, Depression and Employment Status", *Social Science and Medicine*, Vol.23(5), 1986, pp.471-475.

measurement problems.[26] In studies related to heart disease and diabetes, hypertension has been recognised as one of the important risk factor. Hence, the factors influencing hypertension and blood pressure become the factors influencing heart diseases and diabetes. In most of the studies related chronic diseases, the prevalence rises with socio-economic status. But, in some studies, the reverse has been noted. The reverse phenomenon has been attributed to better awareness among higher class and consequently health friendly life-style.[27]

26. Patrick R.C., Prior I.A.M., Smith J.C. and Smith A.H., *op. cit.*, pp.36-44.

27. Rose G., Marmot M., *op. cit.*, pp.13-19.

CHAPTER 3

CONCEPTUAL FRAMEWORK AND METHODOLOGY

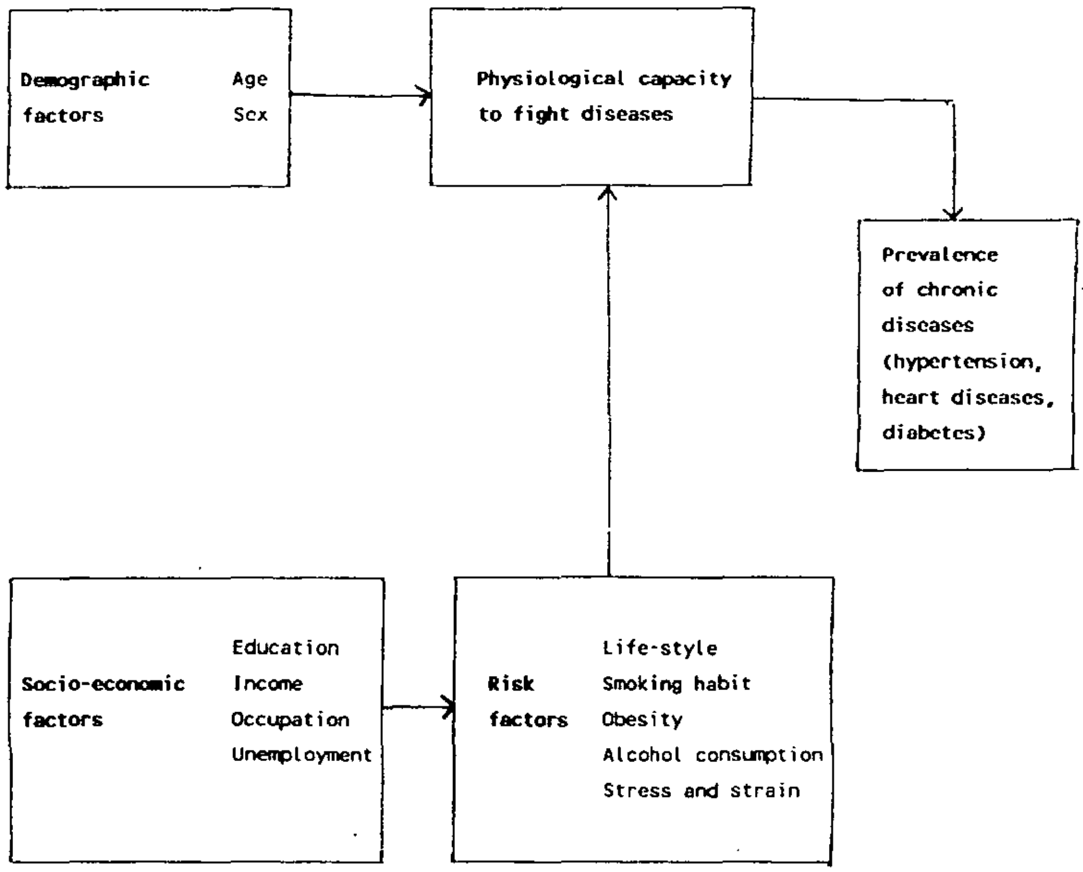
CHAPTER 3

CONCEPTUAL FRAMEWORK AND METHODOLOGY

A framework for analysing the prevalence of chronic diseases and the methodology of this study is presented in this chapter. The first section of the chapter deals with the conceptual framework of the prevalence of chronic diseases within which the study is to be conducted. In this section, a brief description of the selection of the variables and the hypotheses of the study are also given. In the second section, measurement of variables, sources of data, the methodology and limitations of the study are given.

The literature reviewed in the previous chapter, suggests that there are two kinds of factors responsible for a disease. These are genetic or hereditary and the environmental factors. Here, environmental factors include socio-economic and cultural environment. Genetic factors are largely responsible for the individual variation in disease prevalence. But at population level, i.e., for different population subgroups and for geographic variation in prevalence of chronic diseases, socio-economic factors are largely responsible. A conceptual framework to analyse the state-wise variation in prevalence of chronic diseases has been presented below in the context of socio-economic factors. Genetic factors are beyond the scope of the present study.

Figure 3.1: CONCEPTUAL FRAMEWORK



The above framework is composed of a number of concepts. These concepts are demographic factors, socio-economic factors, 'risk factors', 'physiological capacity to fight diseases' and prevalence of chronic diseases. Demographic factors include characteristics such as age and sex.

The second concept is socio-economic factors. It includes those socio-economic characteristics which influence the life-style and other habits of the people in such a manner that it ultimately influences the prevalence of chronic diseases. The third concept is 'risk factors'. 'Risk-factors', here include the factors like life-style, smoking habit, alcohol consumption, obesity, stress & strain. These factors are called 'risk factors' in epidemiological studies related to some chronic diseases because they influence the disease prevalence. The next concept is 'physiological capacity to fight diseases.' This concept is used to connote the decline in capability to fight diseases when a person advances in age or has some associated risk factors. Here, 'physiological capacity to fight diseases' does not include genetic or hereditary connotation. The "prevalence of chronic diseases" represents the proportion of aged with chronic diseases at a point of time. The selection of variables and linkage between the above discussed concept are discussed below.

Demographic Factors

Among demographic factors, age and sex are important variables. As a person advances in age, the functional efficiency of various organs decreases. This affects his/her capacity to fight diseases. Sex is also an important variable while analysing morbidity statistics. This is because of differences in body structure and immunological capacity between two sexes.

Socio-economic Factors

Socio-economic factors are likely to influence the capacity of people to fight diseases through various 'risk factors' like diet, physical activity, smoking habit, medication and stress & strain etc. associated with different socio-economic statuses. Among socio-economic factors, the variable educational attainment, income, occupation and unemployment has been considered in the analytical framework. The likely impact of the above mentioned socio-economic factors are discussed below.

Educational attainment or literacy is one of the important index of social development. It affects the belief and attitude of the people. It influences the prevalence of chronic diseases directly and indirectly. It affects directly in the sense that educated people are more aware of the problems and start taking preventive measures. It influences indirectly through their impact on income and occupation which are discussed below.

Income is also an important factor that influences the prevalence of chronic diseases. Income affects diet and capacity to afford medication. Rich people may become obese due to over eating and lack of physical activities. This in turn reduces the capacity to fight diseases. Rich people are also able to afford medication. Medication help these people to survive for longer time. But inspite of medication they are generally afflicted from one or other diseases. Thus higher income may generally lead to higher prevalence of chronic diseases like hypertension, heart diseases and diabetes.

Occupation from which man earns his livelihood has an important bearing on health status. For example, if a person is engaged in sedentary kind of occupation then he has to work less physically. Lack of physical activity is one of the risk factors which influence the capacity to fight diseases.

Unemployment also affects the prevalence of diseases. Unemployed persons generally have less income. These people also have stress due to their work status. This, in turn, can increase the prevalence of diseases.

The above discussed socio-economic factors are also related to each other. For example, people with higher education tend to have higher income, more settled occupation and vice-versa. Thus people with higher education would posses the negative influence of the more income and settled occupation on chronic diseases. Moreover unemployment rate has been found higher among educated people than uneducated people.

The third concept is the 'risk factors'. Socio-economic factors by itself does not affect the disease prevalence. But, it influences the prevalence indirectly through certain 'risk-factors' like life-style, smoking habit, obesity, stress & strain associated with the socio-economic statuses.

The fourth concept in the framework is the 'physiological capacity to fight diseases'. This is affected by demographic factors such as age and sex and 'risk factors' discussed in the previous paragraph.

The next and the final concept in the framework is the prevalence of chronic diseases. This is the dependent variable of the present study as shown in the diagram 3.1. In brief, the present conceptual framework depict the linkage between demographic & socio-economic factors and prevalence of chronic diseases.

Hypotheses

Based upon the above framework, the following hypotheses are proposed.

(1) The prevalence of chronic diseases is higher in the states where there are more persons engaged in non agricultural activities.

(2) The prevalence of chronic diseases is higher in the state where there is more unemployment.

(3) Higher the literacy in the state, higher is the prevalence of chronic diseases.

Measurement of Variables

This section deals with the measurement of the variables that have been selected for the study. We first describe the measurement of the dependent variables followed by independent variables.

Prevalence of chronic diseases is the dependent variable of the present study. The indicator used to measure this is the prevalence rate. The definition of the prevalence rate is given as follows:

Prevalence of a specific disease

$$= \frac{\text{Total number of persons suffering from the specific disease}}{\text{Total number of persons}} \times 1000$$

Using the above formula, the prevalence of chronic diseases viz., hypertension, heart diseases and diabetes are separately estimated for elderly by sex and residential background (rural and urban).

Independent variables that have been selected for the study are measured in the following manner:

Table 3.1

Measurement of Independent Variables

	Variable	Indicator
1.	Education	Percentage of literate elderly to total elderly
2.	Occupation	Percentage of elderly in non agricultural activities
3.	Unemployment	Unemployment rate among elderly
4.	Income	Per capita state domestic product

Unemployment rate among elderly has been calculated in the following manner.

Unemployment rate among elderly

$$= \frac{\text{Total number of unemployed elderly}}{\text{Total number of elderly in labour force}} \times 100$$

Here, unemployed persons are comprised of those who are marginal workers or non-workers and are seeking or available for work. Labour force is comprised of those persons who belong to one of the following categories: main worker;

marginal worker; and non-worker but seeking or available for work.

Using the above indicators, the independent variables are measured for elderly by sex and residential background except for income. Unfortunately state domestic product cannot be estimated separately for rural-urban or for sexes. For the purpose of analysing the data, the same per capita state domestic product is used for rural-urban and both the sexes.

Sources of Data

The data that are used in this study are taken from secondary sources. The data for the dependent variables i.e., prevalence of chronic diseases (hypertension, heart diseases, diabetes) among aged is obtained from 42nd round of National Sample Survey. This survey was conducted during 1986-87 to asses the nature and dimensions of the socio-economic problems of the elderly. The survey covered the whole of Indians unions except (i) Ladakh and Kangil district of Jammu and Kashmir and (ii) the rural areas of Nagaland. The sampling procedure adopted for the survey is a two-stage stratified design. The first stage units (f.s.u.) were villages in the rural areas and the urban frame survey block of the National Sample Survey Organisation (NSSO) in the urban areas. The second stage units were household is both the sectors. The sample villages were selected with probability proportional to population with replacement in the form of two independent interpenetrating sub-samples. The sampling frame of the survey was households having at least one member of age 60 years and above. Three households were selected using circular systematic sampling. If the selected f.s.u. consisted less than three households in the frame, then all such households were selected for the survey.

In this survey, respondents were asked about their suffering from some of the chronic diseases (hypertension, heart diseases, diabetes) along with other questions related to socio-economic and health problems. Respondents were required to answer about this according to their knowledge and perception. No medical check-up was done to ascertain the validity of the response. The morbidity statistics that is obtained from this survey is reported morbidity.[1]

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1. During the sample survey, NSSO asked respondents whether they have problem of blood pressure or not. According to the response NSSO has provided data on the prevalence of problem of blood pressure. During old age, people generally suffer from hypertension but they can also suffer from hypotension rarely. As no figure is available about prevalence of hypotension, it is assumed that these people are suffering from hypertension.

Sources for the independent variables are given in table 3.2.

Table 3.2

Sources for the Independent Variables

	Variable	Source
1.	Literacy	Socio-cultural tables, Census of India, 1981
2.	Percentage of workers in nonagricultural activities	General Economic tables, Census of India, 1981
3.	Unemployment rate	General Economic tables, Census of India, 1981
4.	Per capita state domestic product	Economic Survey 1993-94

Methodology

The methodology to analyse the data is the most important step. Error done in choosing the methodology has bearing on results. This calls for utmost care while choosing the method to analyse the data. The present section describes the methodology used.

For a comprehensive understanding of the prevalence of chronic diseases, the differentials by age, sex and residential background are examined. To study differentials, the prevalence rates are cross-classified by the above noted characteristics.

In the next step, a correlation matrix of the dependent and independent variables is prepared. Correlation matrix helps in understanding the nature of relationship i.e. positive or negative that exists between the two variables. This also gives the indication regarding the problem of multicollinearity.

After this, the influence on dependent variable (i.e. prevalence rate for each sex and residence separately) due to independent variables has been examined. To examine, regression analysis has been used. Regression coefficient estimates the change in the dependent variable holding other variables constant, for a unit change in the independent variable. The present study takes into account more than one explanatory variable. The multiple regression equation has been taken as follows:

$$X_i = a + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7$$

$i = 1, 2, 3,$

where

X_1, X_2, X_3 are the prevalence of hypertension, heart diseases and diabetes respectively.

X_4, X_5, X_6, X_7 are independent variables.

a is the intercept value.

b_4, b_5, b_6, b_7 are the regression coefficients.

In multiple regression analysis, we estimate a, b_4, b_5, b_6, b_7. When Multiple regression analysis is used, it is necessary to know, how parameters get changed when new variables are added one by one in the model. For this, step-wise regression analysis is used. This technique tells us the contribution of an added variable in explaining the prevalence of disease, and also helps to see whether the regression coefficient of new variable is statistically significant to include in the model or not.

Here, it is important to know whether the fit and the estimated coefficients are statistically significant or not. In order to do that t-test is used to test the significance of regression coefficients and F-test is used to test goodness of fit.

Limitations of the Study

There are various limitations of the present epidemiological study. It is mainly because, we do not have the necessary data. However, it is important to know the limitations. The limitations of the present study are as follows:

(1) In the present study, prevalence rate of chronic diseases has been estimated from the data collected by

National Sample Survey Organisation. This agency asked the interviewer about their suffering from chronic diseases and no medical check-up was done to ascertain the validity of response. In this kind of survey, the data generally suffers from under estimation. It is due to the fact that a certain proportion of population do not come to know about disease because of their ignorance. However, the under estimation could not be estimated because, we could not find any parallel survey done to estimate the prevalence of chronic diseases (dealt in the present study) in India. Despite this limitation, the data has been used to study the variation in prevalence rate because if the extent of under estimation remain the same in all the states then the state-wise variation in prevalence of disease would not differ. Moreover, there is no reason to believe that the extent of under estimation would drastically differ from one state to the other. Hence, in the present study we assume that the extent of under estimation is the same in all the states.

(2) In the present study, per capita state domestic product has been taken as an indicator of income. It is because we do not have any other indicator of income.

Unfortunately, this cannot be separated for rural-urban or for sexes. So, while analysing the variation in disease prevalence for each residential background and sex, the same per capita state domestic product has been used.

CHAPTER 4

ANALYSIS OF PREVALENCE OF CHRONIC DISEASES

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ANALYSIS OF PREVALENCE OF CHRONIC DISEASES

This chapter deals with the analysis of prevalence of chronic diseases among elderly during 1986-87. An analysis of the socio-economic factors that influences state-wise prevalence has been carried out for both sexes and rural-urban separately. To have a comprehensive understanding of the nature of data, first age, sex and rural-urban differential in the prevalence of chronic diseases are examined. Later, state-wise differentials in the prevalence of chronic diseases have been studied. In the last, regression analysis has been conducted to study the influence of socio-economic factors on the prevalence of chronic diseases.

AGE-DIFFERENTIAL IN PREVALENCE OF CHRONIC DISEASES

Table 4.1

Age-differential in the Prevalence Rate of Chronic Diseases for Rural and Urban Areas, India 1986-87

	Rural Age-group			Urban Age-group		
Chronic Diseases	60-64	65-69	70+	60-64	65-69	70+
Hypertension	25.0	27.8	35.1	70.2	76.8	89.3
Heart Diseases	12.6	15.8	23.3	24.4	29.9	31.9
diabetes	7.9	8.0	7.6	21.4	24.4	25.1

Source : National Sample Survey Organisation, *Sarvekshna*, Vol. 15(2), Oct-Dec. 1991.

Table 4.1 gives the prevalence rate of chronic diseases for aged by further age-group break-up. The prevalence rates are arranged for both sexes combined but separately for rural and urban areas. The table shows that the prevalence rate of diseases increases consistently by age for both rural and urban areas except for diabetes in rural areas. For example, prevalence rate of heart diseases is 12.6, 15.8, 23.3 per thousand for age-group 60-64, 65-69 and 70+ respectively in rural areas.

Age-differential in prevalence rate of chronic diseases (for both the sexes combined) by major states of India are provided in table 4.2 and 4.3 for rural and urban areas respectively. These rates indicate a tendency of increase in prevalence rate by age but the increase is not consistent in all the states. For rural areas, there is consistent increase in prevalence rate of hypertension in only five states (Andhra Pradesh, Bihar, Kerala, Tamilnadu, West Bengal), while for heart diseases only in six states (Bihar, Karnataka, Kerala, Orissa, Punjab, Uttar Pradesh) and for diabetes in two states (Jammu & Kashmir, Maharashtra). For urban areas, the consistent increase in prevalence rate was noted only in six states (Andhra Pradesh, Bihar, Kerala, Madhya Pradesh, Maharashtra, West Bengal) for hypertension, in six states (Bihar, Jammu & Kashmir, Punjab, Tamilnadu, Uttar Pradesh, West Bengal) for heart diseases and in four states (Gujarat, Karnataka, Uttar Pradesh, West Bengal) for diabetes.

Table 4.2

Prevalence Rate of Chronic Diseases in Rural Areas for Major States of India by Age-group, 1986-87

State \ Age-group	Hypertension 60-64	Hypertension 65-69	Hypertension 70+	Heart diseases 60-64	Heart diseases 65-69	Heart diseases 70+	Diabetes 60-64	Diabetes 65-69	Diabetes 70+
Andhra Pradesh	34.2	38.0	44.7	12.9	12.0	26.5	14.1	8.5	13.2
Bihar	9.4	9.6	20.5	5.2	8.6	12.0	12.1	12.5	11.4
Gujarat	22.5	13.6	22.4	7.0	21.8	7.5	7.2	6.2	9.9
Haryana	22.0	13.8	20.4	12.0	2.3	28.3	4.3	8.5	0.0
Jammu & Kashmir	77.5	92.0	85.8	21.5	29.9	25.6	1.0	3.3	7.2
Karnataka	16.9	13.5	41.4	3.6	5.4	12.0	4.9	17.7	16.3
Kerala	61.0	78.7	92.4	30.6	30.9	34.4	25.0	18.1	17.4
Madhya Pradesh	5.5	18.7	11.5	4.6	8.2	5.3	0.8	3.0	2.9
Maharashtra	17.1	14.8	27.5	8.3	4.7	6.8	2.7	4.9	7.1
Orissa	19.0	41.0	34.9	15.1	16.8	23.2	4.8	7.9	3.7
Punjab	34.6	55.6	42.4	15.0	20.1	28.5	6.7	9.1	6.0
Rajasthan	17.4	9.9	9.5	7.0	6.4	9.7	6.3	2.0	1.0
Tamil Nadu	20.0	25.2	41.5	17.3	14.1	19.5	12.3	13.8	12.4
Uttar Pradesh	8.7	7.4	9.7	6.8	18.3	27.4	2.6	1.9	2.0
West Bengal	87.6	98.5	99.0	44.9	43.2	67.7	10.7	9.0	11.6

Source: National Sample Survey Organisation, Sarvekshana, Vol.15(2), Oct-Dec 1991.

Table 4.3

Prevalence Rate of Chronic Diseases in Urban Areas for Major States of India by Age-group, 1986-87

State / Age-group	Hypertension			Heart diseases			Diabetes		
	60-64	65-69	70+	60-64	65-69	70+	60-64	65-69	70+
Andhra Pradesh	84.4	96.2	107.5	31.4	24.3	35.1	23.1	28.2	20.7
Bihar	45.1	174.7	197.1	15.4	22.3	28.4	12.4	16.8	13.6
Gujarat	60.0	97.1	91.6	21.8	48.8	26.8	16.0	27.5	32.3
Haryana	46.8	27.7	30.4	48.9	29.9	31.3	16.3	14.4	9.4
Jammu & Kashmir	109.8	109.3	112.3	21.8	23.9	46.7	9.1	0.0	7.3
Karnataka	56.9	54.9	92.0	12.0	7.0	12.4	17.0	31.1	43.7
Kerala	104.2	105.1	169.4	26.7	41.2	22.6	28.9	18.2	19.4
Madhya Pradesh	43.2	43.8	73.6	17.0	16.6	16.9	10.2	19.6	17.7
Maharashtra	68.1	73.6	97.9	25.2	21.6	21.6	33.2	25.5	24.5
Orissa	48.0	45.7	113.7	21.6	28.0	24.1	15.5	37.4	19.7
Punjab	73.1	89.0	77.1	13.7	26.1	32.5	17.2	15.1	28.1
Rajasthan	34.5	67.7	42.6	29.6	22.2	28.6	8.0	7.5	5.2
Tamil Nadu	69.5	73.3	67.3	15.2	19.0	25.0	34.8	29.0	45.6
Uttar Pradesh	37.3	32.1	45.7	20.1	24.0	25.4	6.8	13.8	14.2
West Bengal	134.8	139.0	166.3	48.9	61.6	74.7	31.0	36.4	37.4

Source: National Sample Survey Organisation, Sarvekshana, Vol.15(2), Oct-Dec 1991.

SEX-DIFFERENTIAL IN PREVALENCE OF CHRONIC DISEASES

Table 4.4 gives the sex-differential in prevalence rate of chronic diseases. The table clearly shows that the prevalence of hypertension is reported to be more in case of females than males but difference is marginal. Prevalence of heart diseases is marginally higher among female elderly in rural areas but the reverse is noted in urban areas. Prevalence of diabetes is higher among males in both rural and urban areas.

Table 4.4

Sex-differential in Prevalence Rate of Chronic Diseases among Elderly for Rural and Urban Areas, India, 1986-87

	Rural			Urban		
Diseases	Male	Female	Diff.	Male	Female	Diff.
Hypertension	28.7	29.1	-0.4	74.4	84.3	-9.9
Heart Diseases	16.6	17.3	-0.7	30.3	25.5	4.8
Diabetes	9.4	5.4	+4.0	26.2	19.7	6.5

Source : National Sample Survey Organisation, *Sarvekshna*, Vol. 15(2), Oct-Dec. 1991.

Table 4.5

Prevalence Rate of Chronic Disease among Rural Elderly by Sex and their Differential for Major States of India, 1986-87

	Hypertension			Heart diseases			Diabetes		
State	Male	Female	Diff.	Male	Female	Diff.	Male	Female	Diff.
Andhra Pradesh	38.0	51.6	13.6	16.5	22.2	5.7	12.2	7.6	-4.6
Bihar	15.1	9.4	-5.7	8.8	7.2	-1.6	15.6	13.1	-2.5
Gujarat	20.6	18.9	-1.7	12.6	10.0	-2.6	5.7	10.0	4.3
Haryana	18.2	21.0	2.8	15.5	16.7	1.2	20.8	0.0	-20.8
Jammu & Kashmir	69.6	107.3	37.7	17.9	37.7	19.8	3.5	4.9	1.4
Karnataka	21.0	28.0	7.0	5.6	9.0	3.4	16.8	5.4	-11.4
Kerala	70.5	94.4	23.9	27.3	21.2	-6.1	30.0	11.2	-18.8
Madhya Pradesh	11.0	11.9	0.9	7.0	4.4	-2.6	2.3	1.9	-0.4
Maharashtra	19.9	19.3	-0.6	7.6	5.0	-2.6	7.3	1.0	-6.3
Orissa	32.0	27.2	-4.8	12.9	19.7	-6.8	5.5	5.0	-0.5
Punjab	32.2	60.8	28.6	18.2	27.5	9.3	5.5	9.4	3.9
Rajasthan	12.6	11.8	-0.8	6.7	9.0	2.3	3.3	2.8	-0.5
Tamil Nadu	26.7	31.0	4.3	18.3	15.0	3.3	14.4	10.4	-4.0
Uttar Pradesh	9.7	7.5	-2.1	16.2	18.9	-2.7	3.1	0.8	-2.3
West Bengal	89.5	89.7	0.7	50.3	48.8	1.5	12.7	6.8	-5.9

Source: National Sample Survey Organisation, Sarvekshana, Vol.15(2), Oct-Dec 1991.

Table 4.5 and 4.6 has presented the sex differential in prevalence of chronic diseases (for major states of India) for rural and urban areas respectively. The tables indicate no consistent pattern for all the states. In rural areas, hypertension is more prevalent among female elderly than among male elderly in nine states (Andhra Pradesh, Haryana, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Punjab, Tamilnadu, West Bengal). In urban areas, it is more prevalent among female elderly in ten states (Andhra

Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Orissa, Punjab, Rajasthan, Tamilnadu, West Bengal). Heart

Table 4.6

Prevalence Rate of Chronic Diseases among Urban Elderly by Sex and their Differential for Major States of India, 1986-87

	Hypertension			Heart diseases			Diabetes		
State	Male	Female	Diff.	Male	Female	Diff.	Male	Female	Diff.
Andhra Pradesh	84.0	107.9	23.9	31.5	29.5	-2.0	22.6	25.0	2.4
Bihar	46.0	34.4	-11.6	28.6	14.1	-14.5	19.5	7.5	-12.0
Gujarat	81.4	79.2	-2.2	35.4	24.5	-10.9	21.2	29.3	8.1
Haryana	38.5	33.4	-5.1	39.6	29.9	-9.7	10.8	13.6	2.8
Jammu & Kashmir	101.0	134.8	33.8	31.2	29.2	-2.0	6.6	5.3	-1.3
Karnataka	60.2	77.5	17.3	13.5	9.0	-4.5	33.6	23.3	-10.3
Kerala	124.4	155.0	30.6	34.6	36.9	2.3	23.3	31.0	6.7
Madhya Pradesh	42.1	60.1	18.0	20.7	8.9	-11.8	12.4	8.5	-3.9
Maharashtra	72.3	57.2	-15.1	24.7	8.5	-16.2	30.0	25.2	-4.8
Orissa	51.6	122.4	70.8	19.5	28.3	8.8	27.8	34.3	6.5
Punjab	72.9	73.0	0.1	25.3	20.6	-4.7	23.6	12.6	-11.0
Rajasthan	40.0	55.4	15.4	35.4	16.8	-18.6	8.8	4.2	-4.6
Tamil Nadu	64.2	81.3	17.1	19.9	19.0	-0.9	41.5	28.9	-12.6
Uttar Pradesh	40.3	36.4	-4.3	25.2	19.7	-5.5	14.7	6.7	-8.0
West Bengal	144.2	149.2	5.0	57.9	67.4	9.5	41.4	23.3	-18.1

Source: National Sample Survey Organisation, Sarvekshana, Vol.15(2), Oct-Dec 1991.

diseases are more prevalent among male elderly in eight states(Andhra Pradesh, Haryana, Jammu & Kashmir, Karnataka, Punjab, Rajasthan, Tamilnadu, West Bengal) for rural areas while the prevalence is more is twelve states for urban areas (Andhra Pradesh, Bihar, Gujarat,Haryana, Jammu & Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Tamilnadu, Utter Pradesh). Diabetes is mo prevalent among males in twelve states for rural areas (Andhra Pradesh, Bihar, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Tamilnadu, Uttar Pradesh, West Bengal) and in ten states for urban areas (Bihar, Jammu & Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Tamilnadu, Uttar Pradesh, West Bengal).

RURAL-URBAN DIFFERENTIAL IN PREVALENCE OF CHRONIC DISEASES

Table 4.7

Rural-Urban Differential in Prevalence Rate of Chronic Diseases among Elderly Males and Females, India, 1986-87

	Male			Female		
Diseases	Rural	Urban	Diff.	Rural	Urban	Diff.
Hypertension	28.7	74.4	45.7	29.2	84.3	55.1
Heart Diseases	16.6	30.3	13.7	17.3	25.5	11.8
Diabetes	9.4	26.1	16.7	5.4	19.7	14.3

Source : National Sample Survey Organisation, *Sarvekshna*, Vol. 15(2), Oct-Dec. 1991.

Table 4.7 is the same as table 4.4 except that it is the prevalence rate of chronic diseases in terms in of rural-urban differential. The table shows as expected, that the prevalence of all three diseases is much more in urban areas than in rural areas for both the sexes.

Table 4.8

Prevalence Rate of Chronic Diseases among Elderly Males by Rural/Urban for Major States of India, 1986-87

	Hypertension			Heart diseases			Diabetes		
State	Rural	Urban	Diff.	Rural	Urban	Diff.	Rural	Urban	Diff.
Andhra Pradesh	38.0	84.0	46.0	16.5	31.5	15.0	12.2	22.6	10.4
Bihar	15.1	46.0	30.9	8.8	28.6	19.8	15.6	19.5	3.9
Gujarat	20.6	81.4	60.8	12.6	35.4	22.8	5.7	21.2	15.5
Haryana	18.2	38.5	20.3	15.5	39.6	24.1	20.8	10.8	-10.0
Jammu & Kashmir	69.6	101.0	31.4	17.9	31.2	13.3	3.5	6.6	3.1
Karnataka	21.0	60.2	39.2	5.6	13.5	7.9	16.8	33.6	16.8
Kerala	70.5	124.4	53.9	27.3	34.6	7.3	30.0	23.3	-6.7
Madhya Pradesh	11.0	42.1	31.1	7.0	20.7	13.7	2.3	12.4	10.1
Maharashtra	19.9	72.3	52.4	7.6	24.7	17.1	7.3	30.0	22.7
Orissa	32.0	51.6	19.6	12.9	19.5	6.6	5.5	27.8	22.3
Punjab	32.2	72.9	40.7	18.2	25.3	7.1	5.5	23.6	18.1
Rajasthan	12.6	40.0	27.6	6.7	35.4	28.7	3.3	8.8	5.5
Tamil Nadu	26.7	64.2	37.5	18.3	19.9	1.6	14.4	41.5	27.1
Uttar Pradesh	9.6	40.3	30.7	16.2	25.2	9.0	3.1	14.7	11.6
West Bengal	89.5	144.2	54.7	50.3	57.9	7.6	12.7	41.4	28.7

Source: National Sample Survey Organisation, Sarvekshana, Vol.15(2), Oct-Dec 1991.

Table 4.9

Prevalence Rate of Chronic Diseases among Elderly Females by Rural/Urban for Major States of India, 1986-87

	Hypertension			Heart diseases			Diabetes		
State	Rural	Urban	Diff.	Rural	Urban	Diff.	Rural	Urban	Di
Andhra Pradesh	51.6	107.9	56.3	22.2	29.5	7.3	7.6	25.0	17
Bihar	9.4	34.4	25.0	7.2	14.1	6.9	13.1	7.5	-5
Gujarat	18.9	79.2	60.3	10.0	24.5	14.5	10.0	29.3	19
Haryana	21.0	33.4	12.4	16.7	29.9	13.2	0.0	13.6	13
Jammu & Kashmir	107.3	134.8	27.5	37.7	29.2	-8.5	4.9	5.3	0
Karnataka	28.0	77.5	49.5	9.0	9.0	0.0	5.4	23.3	17
Kerala	94.4	155.0	60.6	21.2	36.9	15.9	11.2	31.0	19
Madhya Pradesh	11.9	60.1	48.2	4.4	8.9	4.5	1.9	8.5	6
Maharashtra	19.3	57.2	37.9	5.0	8.5	3.5	1.0	25.2	24
Orissa	27.2	122.4	95.2	19.7	28.3	8.6	5.0	34.3	29
Punjab	60.8	73.0	12.2	27.5	20.6	-6.9	9.4	12.6	3
Rajasthan	11.8	55.4	43.6	9.0	16.8	7.8	2.8	4.2	1
Tamil Nadu	31.0	81.3	50.3	15.0	19.0	4.0	10.4	28.9	18
Uttar Pradesh	7.5	36.0	28.5	18.9	19.7	0.8	0.8	6.7	5
West Bengal	89.7	149.9	60.2	48.8	67.4	18.6	0.8	23.3	16

Source: National Sample Survey Organisation, Sarvekshana, Vol.15(2), Oct-Dec 1991.

Table 4.10

Prevalence Rate of Chronic Diseases among Aged by Rural/Urban for Major States of India, 1986-87

	Hypertension			Heart diseases			Diabetes		
State	Rural	Urban	Diff.	Rural	Urban	Diff.	Rural	Urban	Diff.
Andhra Pradesh	43.0	95.2	52.2	18.6	30.6	12.0	10.5	23.7	13.2
Bihar	12.5	41.3	28.8	8.0	22.6	14.6	12.0	14.6	2.6
Gujarat	19.8	80.4	60.6	11.3	30.5	19.2	7.7	24.7	17.0
Haryana	19.1	36.3	17.2	15.9	35.5	19.6	3.7	12.2	8.5
Jammu & Kashmir	83.3	112.1	28.8	24.8	30.4	5.6	4.0	6.1	2.1
Karnataka	23.6	67.2	43.6	6.9	11.8	4.9	12.4	29.5	17.1
Kerala	78.0	135.1	57.1	32.0	35.2	3.2	19.9	26.3	6.4
Madhya Pradesh	11.3	49.9	38.6	5.9	15.8	9.9	2.1	14.3	12.2
Maharashtra	19.7	79.8	60.1	6.7	22.9	16.2	4.8	27.9	23.1
Orissa	29.9	67.0	37.1	18.2	21.6	3.4	5.2	21.6	16.4
Punjab	42.7	78.0	35.3	21.6	24.2	2.6	7.0	20.6	13.6
Rajasthan	12.2	46.4	34.2	7.8	27.1	19.3	3.1	6.9	3.8
Tamil Nadu	28.2	70.7	42.5	17.1	19.6	2.5	13.0	36.6	23.6
Uttar Pradesh	8.7	38.8	30.1	17.3	23.1	5.8	2.2	11.5	9.3
West Bengal	93.4	146.3	52.9	51.7	61.1	9.4	10.5	34.6	24.1

Source: National Sample Survey Organisation, Sarvekshana, Vol.15(2), Oct-Dec 1991.

Table 4.8, 4.9 and 4.10 gives the rural-urban differential in prevalence rate of chronic diseases under study (for major states of India) for males, females and both the sexes combined respectively. The prevalence of chronic diseases is much more in urban areas than in rural areas for all the states for both sexes combined (table

4.10). Moreover, if the disease prevalence is considered separately for males and females then also the same trend is observed except in a few cases (table 4.8 and 4.9).

Having discussed the differential in prevalence of chronic diseases by age, sex and residential background, the following sections deal with the variation in dependent and independent variables under study taking state as a unit. The following sections also deal with regression analysis. The analysis would proceed in the following order: rural males, rural females, urban males and urban females. In each of the above noted section. The variation in prevalence rate of hypertension, heart diseases and diabetes are presented first. This is followed by interpretation of the results obtained from the correlation matrix of dependent and independent variables. In the last, results of step-wise regression analysis for prevalence of hypertension, prevalence of heart diseases and prevalence of diabetes are discussed.

RURAL ELDERLY MALES

Table 4.11 gives the prevalence rate of hypertension, heart diseases and diabetes among rural elderly males for India and its major states. Table 4.12 gives the mean, standard deviation and coefficient of variation of the variables under study for the fifteen major states of India. Independent variables of the study are presented in table 4.13 for the major states of India.

Table 4.11

Prevalence Rate of Chronic Diseases among Rural Elderly Males for India and its Major States, 1986-87

State/India	Hyper tension	Heart Diseases	Diabetes
Andhra Pradesh	38.0	16.5	7.6
Bihar	15.1	8.8	13.1
Gujarat	20.6	12.6	10.0
Haryana	18.2	15.5	0.0
Jammu & Kashmir	69.0	17.9	4.9
Karnataka	21.0	5.6	8.4
Kerala	70.5	27.3	11.2
Madhya Pradesh	11.0	7.0	1.9
Maharashtra	19.9	7.6	1.0
Orissa	32.0	12.9	5.0
Punjab	32.2	18.2	9.4
Rajasthan	12.6	6.7	2.8
Tamilnadu	26.6	18.3	10.4
Uttar Pradesh	9.6	16.2	0.8
West Bengal	89.5	50.1	6.8
All India	28.7	18.1	7.5

Table 4.12

Mean, Standard Deviation and Coefficient of Variation of Dependent and Independent Variables for Rural Elderly Males

Variable		Mean	Standard Deviation	Coefficient of Variation
Prevalence rate of hypertension	(X_1)	32.4	24.6	75.9
Prevalence rate of heart diseases	(X_2)	16.1	11.1	68.9
Prevalence rate of diabities	(X_3)	11.1	8.3	74.8
Literacy rate	(X_4)	29.5	13.6	46.1
Percentage of workers in nonagricultural activities	(X_5)	15.0	6.0	40.0
Unemployment rate	(X_6)	0.8	0.8	100.0
Per capita state domestic product	(X_7)	3734.9	1253.7	33.6

Table 4.13

Independent Variables for Major States of India (Rural Elderly Males)

State	Literacy rate (1981) in percentage	Percentage of workers in non agricultural activities (1981)	Unemployment rate (1981) in percentage	Per capita state dome product in (1986-87) at current prices
Andhra Pradesh	23.3	19.7	0.3	3211
Bihar	26.4	8.2	0.4	2111
Gujarat	32.8	13.5	0.6	4893
Haryana	16.8	15.6	0.8	5537
Jammu & Kashmir	12.6	14.0	0.3	3420
Karnataka	33.5	14.4	0.3	3787
Kerala	64.2	32.4	3.0	3076
Madhya Pradesh	20.8	9.2	0.5	2772
Maharashtra	32.9	12.4	0.7	5363
Orissa	43.0	11.2	0.4	2763
Punjab	18.1	17.1	0.3	6274
Rajasthan	15.5	13.9	1.4	2923
Tamil Nadu	39.7	17.7	0.4	3677
Uttar Pradesh	20.4	7.3	0.2	2444
West Bengal	43.6	17.7	1.6	3542

The Table 4.11 shows that the prevalence of hypertension varies form 9.6 per thousand in Uttar Pradesh to 89.5 per thousand in West Bengal. The prevalence rate of hypertension for India as a whole is estimated as 28.7 per thousand. The coefficient of variation of prevalence of hypertension is 75.9 per cent according to table 4.12. It is found to be highest in the state of West Bengal (87.5) followed by Kerala (70.5), Jammu & Kashmir (69.6) and Andhra Pradesh (38.0) respectively. It is lowest in the state of Uttar Pradesh (9.8) followed by Madhya Pradesh (11.0), Rajasthan, (12.6) and Bihar (15.1) respectively.

The prevalence of heart diseases varies from 5.6 per thousand in Karnataka to 50.1 per thousand in the state of West Bengal. The prevalence of heart diseases for India as a whole is estimated to be 18.1 per thousand. The coefficient of variation of prevalence of heart diseases is 68.9 per cent. It is found to be highest is the state of West Bengal (50.1) followed by Kerala (27.3) Tamilnadu (18.3) and Punjab (18.2) respectively. It is lowest in the state of Karnataka (5.6) followed by Rajasthan (6.7), Madhya Pradesh (7.0) and Maharashtra (7.6) respectively.

The prevalence rate of diabetes is estimated as 7.5 per thousand for India as a whole. It varies form negligible in Haryana to 13.1 per thousand in Bihar. The coefficient of variation of prevalence of diabetes is 74.8 per cent. It is highest in the state of Bihar (13.1) followed by Kerala (11.2), Tamilnadu (10.4) and Gujarat (10.0) respectively. It is lowest in the state of Haryana (0.0) followed by Uttar Pradesh (0.8), Maharashtra (1.0) and Rajasthan (2.8) respectively.

Among the explanatory variables, the variable unemployment rate has the highest variation with coefficient of variation of 100.0 per cent. It ranges form 0.2 per cent in Uttar Pradesh to 3.0 per cent in Kerala. All other explanatory variables have moderate level of variation. The variable, literacy rate has a coefficient of variation of 46.1 per cent. It ranges form 7.3 per cent in Uttar Pradesh to 32.4 per cent in Kerala. The variable participation in nonagricultural activities has a coefficient of variation of 40.0 per cent. It ranges from 7.3 per cent in Uttar Pradesh to 32.4 per cent in Kerala. The variable per capita state domestic product shows 33.6 per cent coefficient of variation. It varies form Rs. 2111 per annum in Bihar to Rs. 6274 per annum in Punjab.

To understand how the dependent and independent variables covary with each other, zero-order correlation coefficients are computed. The matrix which represent the zero-order correlation coefficients is given in the Table 4.14.

From the zero-order correlation matrix, three relations can be established.

(i) Correlations between dependent variables;

(ii) Correlations between dependent variables; and

(iii) Correlations between dependent and independent variables.

Table 4.14

Correlation Matrix between Dependent and Independent Variables for Rural Elderly Males

	x1	x2	x3	x4	x_5	x_6	x7
x_1	1.0000	0.8394***	0.3223	0.4516	0.6166**	0.5269	-0.0442
x_2		1.0000	0.2906	0.4391	0.4837	0.4903	0.0019
x_3			1.0000	0.5432	0.7310***	0.5287	-0.0111
x_4				1.0000	0.5958**	0.6298**	-0.1434
x_5					1.0000	0.7603***	0.1572
x_6						1.0000	-0.0970
x_7							1.0000

** implies the significance at 1% level of significance.
*** implies the significance at 0.1% level of significance.

Correlations between Dependent Variables

The table 4.14 shows that there is a high positive correlation between prevalence of hypertension and prevalence of heart diseases with a correlation coefficient of 0.84. It is statistically significant at 0.1 per cent level of significance. But the variables prevalence of hypertension and prevalence of diabetes and prevalence of heart diseases and prevalence of diabetes have positive but weak correlations with correlation coefficient of 0.32 and 0.29

respectively. This suggests that there is a tendency of higher prevalence of diabetes in the states which have a higher prevalence of hypertension or heart diseases.

Correlations between Independent Variables

Among independent variables literacy of rural aged males, participation in nonagricultural activities and unemployment have mutually positive correlations. Participation is nonagricultural activities and unemployment rate shows the maximum correlation with correlation coefficient of 0.76. It is statistically significant at 0.1 per cent level of significance. The next higher correlation is between literacy and unemployment with correlation coefficient of 0.63 which is statistically significant at one per cent level of significance. Literacy and participation in nonagricultural activities also has positive and significant (at one per cent level of significance) correlation. The variable per capita state domestic product has negative correlation with literacy and unemployment but positive with participation in nonagricultural activities. But all these are statistically insignificant.

The above analysis of correlation shows that correlation coefficient between participation in non-agricultural activities and unemployment is high. This poses the problem of multicollinearity if they are used in the same equation. To avoid it, alternative regression equations are formed from standard regression equation in such a way by keeping other variables in the same manner and interchanging the above two variables. The regression equations thus formed are as follows:

Regression equation (first selection) :

$$X_i = a + b_4 X_4 + b_5 X_5 + b_7 X_7 \qquad i = 1,2,3$$

Regression equation (second selection) :

$$X_i = a + b_4 X_4 + b_6 X_6 + b_7 X_7 \qquad i = 1,2,3$$

where

a represent the intercept value;
b_4, b_5, b_6, b_7 represent regression coefficients; and X_1, X_2, X_3 represent dependent variables; and X_4, X_5, X_6, X_7 represent independent variables.

Correlation between Dependent and Independent Variables

The prevalence of hypertension has positive correlation with literacy, participation in nonagricultural activities and unemployment but no correlation with per capita state-domestic product. Participation in nonagricultural activities shows highest correlation with prevalence of hypertension (correlation coefficient 0.62). This is statistically significant at one per cent level of significance. The second and third highest correlations are with unemployment and literacy but these are not statistically significant.

The prevalence of heart diseases has positive correlation with literacy, participation in nonagricultural activities and there is no correlation with per capita state domestic product. The unemployment rate shows the highest correlation with prevalence of heart diseases followed by percentage of workers in nonagricultural activities and literacy rate respectively. But none of these is statistically significant. The third dependent variable i.e. prevalence of diabetes also has positive correlation with literacy, participation in nonagricultural activities and unemployment rate but no correlation with per capita state domestic product has been found. The prevalence of diabetes shows maximum correlation with participation in nonagricultural activities with correlation coefficient of 0.73. This coefficient is statistically significant at one per cent level of significance. The other explanatory variables, viz., literacy rate and unemployment rate do not show statistically significant correlation coefficient with prevalence of diabetes.

Regression Analysis of Prevalence of Hypertension

Table 4.15 presents the results of step wise regression for both the selections. From table 4.15, it can be seen that the highest $\bar{R}^2$ is 0.33. The corresponding F- value is 7.972 which is statistically significant at five per cent level of significance. Only a single variable viz., participation in nonagricultural activities explains the above mentioned variation. The regression equation thus fitted is as follows:

$$X_1 = \underset{(-0.359)}{-5.131} + \underset{(2.824^*)}{2.512}\, X_5$$

$\bar{R}^2 = 0.332$ $\qquad$ $F = 7.972^*$

Note: Figures in bracket are the respective "t" values.

From the above equation, when the percentage of workers in nonagricultural activities increases by one per cent, the prevalence of hypertension increases by 2.5 per thousand. This relationship is in the expected direction and the regression coefficient is statistically significant at five per cent level of significance.

Table 4.15

Results of Regressions Analysis of Prevalence of Hypertension among Rural Elderly Males

Variable	Regression coefficient (R.C.)	Standard error of estimate (S.E.E.)	Beta	t	$\bar{R}^2$	F
Selection 1						
Step 1						
X_5	2.512	0.890	0.617	2.824*	0.332	7.972*
Intercept	-5.131	14.279		-0.359		
Step 2						
X_5	2.605	0.922	0.639	2.825*	0.301	4.009**
X_7	-0.002836	0.00436	-0.145	-0.639		
Intercept	4.075	20.519		0.199		
Step 3						
X_5	2.384	1.239	0.585	1.924	0.242	2.494
X_7	-0.00243	0.00438	0.124	-0.502		
X_4	0.154	0.549	0.085	0.280		
Intercept	1.315	23.514		0.056		
Selection 2						
Step 1						
X_6	17.373	7.773	0.527	2.235*	0.222	4.996*
Intercept	19.461	8.063		2.414*		
Step 2						
X_6	13.249	10.242	0.402	1.294	0.185	2.589
X_4	0.359	0.562	0.199	0.639		
Intercept	11.962	14.342		0.834		
Step 3						
X_6	13.258	10.694	0.402	1.240		
X_4	0.365	0.590	0.202	0.619	0.112	1.586
X_7	0.00465	0.00499	0.0238	0.093		
Intercept	10.044	25.431		0.395		

Note * implies significance at five per cent level of significance.
£ implies significance at ten per cent level of significance.

Regression Analysis of Prevalence of Heart Diseases

Table 4.16 presents the results of the step-wise regression analysis for both the selections. From table 4.16, it is evident that the highest $\bar{R}^2$ is 0.182. The corresponding F-value is 4.114 which is not statistically significant at five per cent level of significance. However, the F-value is significance at ten per cent level of significance. Only a single variable viz., unemployment explains the above mentioned variation. The regression equation thus formed is as follows:

$$X_2 = \underset{(2.834^{*})}{10.622} + \underset{(2.028^{£})}{7.328\,X_6}$$

$\bar{R}^2 = 0.182$ $\qquad\qquad$ $F = 4.114^{£}$

Note: Figures in bracket are the respective "t" values.

From the above equation, it is clear that prevalence of heart diseases increases by 7.3 per thousand when unemployment increases by one per cent. The relationship is in the expected direction and the regression coefficient is significant at ten per cent level of significance.

Table 4.16

Results of Regression Analysis for Prevalence of Heart Diseases among Rural Elderly Males

Variable	R.C.	S.E.E.	Beta	t	$\bar{R}^2$	F
			Selection 1			
Step 1						
X_5	0.893	0.448	0.484	1.993£	0.175	3.971£
Intercept	2.733	7.195		0.380		
Step 2						
X_5	0.636	0.567	0.344	1.121	0.148	2.211
X_4	0.192	0.252	0.234	0.762		
Intercept	0.934	7.686		0.122		
Step 3						
X_5	0.651	0.622	0.352	1.046	0.071	1.354
X_4	0.185	0.276	0.226	0.673		
X_7	-0.000187	0.00243	-0.021	-0.077		
Intercept	1.601	11.807		0.136		
			Selection 2			
Step 1						
X_6	7.328	3.613	0.490	2.028£	0.182	4.114£
Intercept	10.622	3.748		2.834		
Step 2						
X_6	5.294	4.751	0.354	1.114	0.147	2.200
X_5	0.177	0.261	0.216	0.680		
Intercept	6.923	6.652		1.041		
Step 3						
X_6	5.306	4.947	0.355	1.073	0.075	1.378
X_4	0.185	0.273	0.225	0.677		
X_7	0.000610	0.00231	0.069	0.264		
Intercept	4.412	11.763		0.375		

Note * implies significance at five per cent level of significance.
£ implies significance at ten per cent level of significance.

Regression Analysis of Diabetes Prevalence

Results of step-wise regression analysis for both the selection are presented in table 4.17. From the table, it is evident that the highest $\bar{R}^2$ is 0.499. The corresponding F- value is 14.92 which is statistically significant at one per cent level of significance. Only a single variable viz., participation in nonagricultural activities explains the above mentioned variation. The regression equation thus formed is as follows:

$$X_3 = \underset{(-0.939)}{-3.910} + \underset{(3.863^{**})}{1.002}\, X_5$$

$\bar{R}^2 = 0.499$ $\qquad$ $F = 14.923^{**}$

Note : Figures in bracket are the respective "t" values.

From the above equation, it is clear that the prevalence of diabetes increases by one per thousand when the participation in nonagricultural activities increases by one per cent. The result is in the expected direction and the regression coefficient is significant at one per cent level of significance.

Table 4.17

Results of Regression Analysis for Diabetes Prevalence among Rural Elderly Males

Variable	R.C.	S.E.E.	Beta	t	$\bar{R}^2$	F
			Selection 1			
Step 1						
X_5	1.002	0.260	0.731	3.863**	0.499	14.923**
Intercept	-3.910	4.165		-0.939		
Step 2						
X_5	0.866	0.330	0.632	2.626*	0.478	7.405*
X_4	0.102	0.146	0.167	0.694		
Intercept	-4.863	1.467		-1.089		
Step 3						
X_5	0.916	0.358	0.668	2.557*	0.441	4.682*
X_4	0.080	0.159	0.131	0.503		
X_7	-0.00064	0.0014	-0.097	-0.459		
Intercept	-2.575	6.798		-0.379		
			Selection 2			
Step 1						
X_4	0.331	0.142	0.543	2.333*	0.241	5.443*
Intercept	1.341	4.570		0.293		
Step 2						
X_4	0.212	0.182	0.348	1.166	0.244	3.271£
X_6	3.432	3.318	0.309	1.034		
Intercept	2.270	4.646		0.489		
Step 3						
X_4	0.218	0.190	0.358	1.144	0.182	2.042
X_6	3.441	3.452	0.310	0.997		
X_7	0.000464	0.00161	0.070	0.288		
Intercept	0.359	8.210		0.044		

Note ** implies significance at one per cent level of significance.
* implies significance at five per cent level of significance.
£ implies significance at ten per cent level of significance.

RURAL ELDERLY FEMALES

Table 4.18 gives the prevalence rate of hypertension, heart diseases and diabetes among rural elderly women for India and its major states. Table 4.19 gives the mean, standard deviation and coefficient of variation of the variables under study for the fifteen major states of India. Independent variables of the study are provided on table 4.20 for the major states of India.

Table 4.18

Prevalence Rate of Chronic Diseases among Rural Elderly Women for India and its Major States, 1986-87

	Hypertension	Heart Diseases	Diabetes
Andhra Pradesh	51.6	22.2	7.6
Bihar	9.4	7.2	13.1
Gujarat	15.9	10.0	10.0
Haryana	21.0	16.7	0.0
Jammu & Kashmir	107.3	37.7	4.9
Karnataka	28.0	9.0	5.4
Kerala	94.4	21.2	11.2
Madhya Pradesh	11.9	4.4	1.9
Maharashtra	19.3	5.0	1.0
Orissa	27.2	19.7	5.0
Punjab	60.8	27.5	9.4
Rajasthan	11.8	9.0	2.8
Tamilnadu	31.0	15.0	10.4
Uttar Pradesh	7.5	18.9	0.8
West Bengal	89.5	48.8	6.8
All India	29.1	17.3	5.4

Table 4.19

Mean, Standard Deviation and Coefficient of Variation of Dependent and Independent Variables for Rural Elderly Females

Variable		Mean	Standard Deviation	Coefficient of Variation
Prevalence rate of hypertension	(X_1)	39.3	33.5	85.2
Prevalence rate of heart diseases	(X_2)	18.2	12.4	0.7
Prevalence rate of diabetes	(X_3)	6.0	4.2	70.0
Literacy rate	(X_4)	4.9	7.4	151.0
Percentage of workers in nonagricultural activities	(X_5)	16.7	10.5	62.9
Unemployment rate	(X_6)	3.5	3.5	100.0
Per capita state domestic product	(X_7)	3534.1	1255.4	35.5

Table 4.20

Independent Variables for Major States of India (Rural Elderly Females)

State	Literacy rate (1981) in percentage	Percentage of workers in non agricultural activities (1981)	Unemployment rate (1981) in percentage	Per capita state domestic product in (1986-87) at current prices
Andhra Pradesh	3.8	12.1	1.0	3211
Bihar	2.6	7.3	2.9	2111
Gujarat	6.4	11.1	2.7	4893
Haryana	1.2	24.3	4.8	5537
Jammu & Kashmir	0.7	18.3	0.8	3420
Karnataka	4.2	13.1	1.3	3787
Kerala	30.8	30.6	9.2	3076
Madhya Pradesh	1.5	6.0	1.6	2772
Maharashtra	2.9	5.7	1.7	5363
Orissa	3.7	18.7	1.8	2763
Punjab	2.1	41.2	4.7	6274
Rajasthan	0.9	12.4	4.6	2923
Tamil Nadu	5.1	9.9	1.2	3677
Uttar Pradesh	1.7	9.3	1.5	2444
West Bengal	5.7	30.4	13.3	3542

The table 4.18 shows that the prevalence of hypertension varies from 7.5 per thousand in Uttar Pradesh to 107.3 per thousand in Jammu & Kashmir. The prevalence rate of hypertension for India as a whole is estimated to be 29.1 per thousand. The coefficient of variation of this disease is 85.2 per cent according to table 4.19. Its prevalence is highest in the state of Jammu & Kashmir (107.3) followed by

Kerala (94.4), West Bengal (89.5) and Punjab (60.8) respectively. It is lowest in the state of Uttar Pradesh (7.5) followed by Bihar (9.4), Rajasthan (11.8) and Madhya Pradesh (11.9) respectively.

According to table 4.18, the prevalence of heart diseases for all India is estimated to be 17.3 per thousand. Its coefficient of variation is 68.1 per cent. It varies from 4.4 per thousand is Madhya Pradesh to 48.8 per thousand in West Bengal. It is highest in the state of West Bengal (48.8) followed by Jammu & Kashmir (37.7), Punjab (27.5) and Andhra Pradesh (22.2) respectively. It is lowest in the state of Madhya Pradesh (4.4) followed by Maharashtra (5.0), Bihar (7.2), and Rajasthan (9.0) respectively.

The prevalence rate of diabetes for all India is estimated to be 5.4 per thousand. The coefficient of variation of this is 70.0 per cent. It varies from negligible in Haryana to 13.1 per thousand in the state of Bihar. Prevalence of diabetes is highest in the state of Bihar (13.1) followed by Kerala (11.2), Tamilnadu (10.4) and Gujarat (10.0) respectively. It is lowest in Haryana (0.0) followed by Uttar Pradesh (0.8), Maharashtra (1.0), Madhya Pradesh (1.9) respectively.

Among the explanatory variables, the variable literacy of rural elderly women shows the highest variation with coefficient of variation of 151.0 per cent. It ranges from 0.7 per cent in Jammu & Kashmir to 30.8 per cent in Kerala. The variable representing the next highest variation is unemployment. The coefficient of variation of this variable is 100.0 per cent. It varies from 0.8 per cent in Jammu & Kashmir to 13.3 per cent in West Bengal. The coefficient of variation of the variable participation in nonagricultural activities is 62.9 per cent. It ranges from 5.7 per cent in Maharashtra to 41.2 per cent in Punjab. The other variable, per capita state domestic product, has been discussed in the earlier section on rural males.

Correlations between Dependent Variables

Table 4.21 shows that there is a high positive correlation between prevalence of hypertension and prevalence of heart diseases. The correlation coefficient between these two variables is 0.82 and it is statistically significant at 0.1 per cent level of significance. This correlation coefficient is very close to what was observed in the case of rural elderly males. The other variable prevalence of diabetes has positive correlation with both prevalence of hypertension and prevalence of heart diseases. But both are statistically insignificant.

Table 4.21

Correlation Matrix between Dependent and Independent Variables for Rural Elderly Females

	X1	X2	X3	X4	X_5	X_6	X_7
X_1	1.0000	0.8212***	0.3101	0.4561	0.6537**	0.4972	0.1670
X_2		1.0000	0.1277	0.0935	0.6675**	0.5587	0.1484
X_3			1.0000	0.4540	0.2333	0.2041	-0.2503
X_4				1.0000	0.3524	0.4889	-0.1489
X_5					1.0000	0.6598**	0.5079
X_6						1.0000	0.1067
X_7							1.0000

Note ** implies significance at one per cent level of significance.
*** implies significance at 0.1 per cent level of significance.

Correlations between Independent Variables

Among independent variable, literacy, participation in nonagricultural activities and unemployment show mutually positive correlation. Participation in nonagricultural activities and unemployment shows the highest correlation. The correlation coefficient between these two variables is 0.66 and it is statistically significant at one per cent level of significance. The next highest correlation is between per capita state domestic product and participation in nonagricultural activities but it is not statistically significant. All other variables also show insignificant correlations.

Correlations between Dependent and Independent Variables

The prevalence of hypertension shows the positive correlation with all the independent variables. It shows the highest correlation with participation in nonagricultural activities. The coefficient of correlation between these two variables is 0.65 and it is statistically significant at one per cent level of significance. The prevalence of hypertension has the second highest correlation with unemployment (correlation coefficient 0.50) but it is not statistically significant. The other independent variables viz., literacy and per capita state domestic product also show insignificant correlation coefficient with prevalence of hypertension.

The prevalence of heart diseases also has positive correlation with all the independent variables. In this case also, the highest correlation is observed with participation in nonagricultural activities (correlation coefficient 0.67) which is significant at one per cent level of significance. No other independent variable shows statistically significant correlation with prevalence of heart diseases.

The prevalence of diabetes shows positive correlation with all the independent variables except for per capita state domestic product. But none of the independent variables show statistically significant correlation with prevalence of diabetes.

Regression Analysis of Prevalence of Hypertension Prevalence

Table 4.22 presents the results of step-wise regression analysis. From the table 4.22, it is evident that the highest $\bar{R}^2$ is observed at second step which is 0.40. The corresponding F- value is 5.66 which is statistically significant at five per cent level of significance. The variables which explain the above mentioned variation are participation in nonagricultural activities and literacy. The regression equation thus fitted is as under :

$$X_1 = \underset{(0.289)}{3.722} + \underset{(1.165)}{1.750X4} + \underset{(2.544)}{1.790X5}$$

$\bar{R}^2 = 0.40$ $F = 5.66^*$

Note : Figures is bracket are the respective "t" values.

Table 4.22

Results of Regression Analysis of Hypertension Prevalence among Rural Elderly Females

Variable	R.C.	S.E.E.	Beta	t	$\bar{R}^2$	F
Step 1						
X_5	2.079	0.667	0.654	3.115**	0.383	9.700**
Intercept	4.661	13.051		0.354		
Step 2						
X_5	1.790	0.704	0.563	2.544*	0.400	5.661*
X_4	1.170	1.004	0.258	1.165		
Intercept	3.722	12.898		0.289		
Step 3						
X_5	2.055	.914	0.646	2.248*	0.358	3.608*
X_4	.949	1.136	0.209	0.835		
X_7	-0.00347	0.00726	-0.130	-0.478		
Intercept	12.652	22.950		0.551		
Step 4						
X_5	2.138	1.204	0.672	1.776	0.295	2.466
X_4	0.985	1.233	0.217	0.799		
X_7	-0.00367	0.00784	-0.138	-0.470		
X_6	-0.362	3.165	-0.0378	-0.114		
Intercept	13.127	24.410		0.538		

Note * implies significance at five per cent level of significance.
** implies significance at one per cent level of significance.

While looking at the role of individual variable participation in nonagricultural activities is the most important. The prevalence of hypertension increase by 1.8 per thousand when the participation in nonagricultural activities increases by one per cent, keeping other variables constant. It is significant at five per cent level of significance. The other variable literacy is positively related to prevalence of hypertension. prevalence of hypertension increases by 1.2 per thousand when literacy increases by one per cent keeping other variables constant. However it is not statistically significant.

Regression Analysis of the Prevalence of Heart Diseases

Results of step-wise regression analysis of prevalence of heart diseases are presented in table 4.23. It shows that the highest value of $\bar{R}^2$ is achieved at third step which is 0.446. The corresponding F- value is 4.75 which is statistically significant at five per cent level of significance. The variables that explain the above mentioned variation are literacy, participation in nonagricultural activities and per capita state domestic product. The regression equation fitted is as under :

$$X_2 = \underset{(1.924)}{15.236} - \underset{(-1.328)}{0.521\, X4} + \underset{(3.653^{**})}{1.152\, X5} - \underset{(-1.556)}{.00390\, X7}$$

$\bar{R}^2 = 0.446$ $F = 4.75^{*}$

Note : Figures in bracket are the respective "t" values.

From the above equation, it is evident that the participation in nonagricultural activities is the most important variable. Prevalence of heart diseases increases by 1.15 per thousand when participation in non agricultural activities increases by one per cent keeping other variables constant. This increase is statistically significant at one per cent level of significance. In the above equation, the

Table 4.23

Results of Regression Analysis for Prevalence of Heart Diseases among Rural Elderly Females

Variable	R.C.	S.E.E.	Beta	t	$\bar{R}^2$	F
Step 1						
X_5	0.788	0.244	0.668	3.232**	0.0403	10.447**
Intercept	5.001	4.766		1.049		
Step 2						
X_5	0.942	0.281	0.798	3.349**	0.410	5.869*
X_7	-0.00254	0.00236	-0.257	-1.078		
Intercept	11.422	7.611		1.501		
Step 3						
X_5	1.152	0.315	0.976	3.653**	0.446	4.749*
X_7	-0.00390	0.00251	-0.393	-1.556		
X_4	-0.521	0.392	-0.309	-1.328		
Intercept	15.236	7.919		1.924£		
Step 4						
X_5	0.961	0.403	0.814	2.383	0.425	43.589*
X_7	-0.00340	0.00263	-0.343	-1.295		
X_4	-0.604	0.413	-0.358	-1.462		
X_6	0.830	1.061	0.233	0.782		
Intercept	14.148	8.182		1.729		

Note * implies significance at five per cent level of significance.
** implies significance at one per cent level of significance.

relation between literacy and prevalence of heart diseases is negative which is in contrast to the expected direction. The reason for this is not clear. However, the regression coefficient is not statistically significant. Per capita state domestic product also shows negative relation with prevalence of heart diseases but the regression coefficient is not significant.

Regression Analysis of Prevalence of Diabetes

Table 4.24 provides the results of step-wise regression analysis for prevalence of diabetes. Table 4.24 shows that the highest value of $\bar{R}^2$ is achieved at the first step and it is 0.145. The corresponding F-value is 3.376 which is statistically significant at ten per cent level of significance. The variable that explains the above mentioned relation is literacy. The regression equation fitted in as follows :

$$X_3 = \underset{(3.932^{**})}{4.76} + \underset{(1.834^{£})}{2.57\ X_4}$$

$R^2 = 0.145$ $\qquad\qquad$ $F = 3.376^{£}$

Note : Figures in bracket represent the respective "t" values.

From the above equation, it is clear that the relation between literacy and prevalence of diabetes is in the expected direction. When literacy increases by one per cent, the prevalence of diabetes increase by 0.26 per thousand. This regression coefficient is significant at ten per cent level of significance.

Table 4.24

Results of Analysis of Diabetes Prevalence among Rural Elderly Females

Variable	R.C.	S.E.E.	Beta	t	$\bar{R}^2$	F
Step 1						
X_4	0.257	0.140	0.454	1.834£	0.145	3.376£
Intercept	4.760	1.211		3.932**		
Step 2						
X_4	0.242	0.144	0.426	1.675	0.114	1.898
X_5	- 0.000623	0.000848	-0.187	-0.734		
Intercept	7.040	3.339		2.109£		
Step 3						
X_4	0.162	0.168	0.286	0.967	0.106	1.552
X_7	-0.00124	0.00107	0.371	-1.154		
X_5	0.127	0.135	0.321	0.946		
Intercept	7.469	3.384		2.207*		
Step 4						
X_4	0.190	0.179	0.335	1.064	0.052	1.191
X_5	-0.0014	0.00114	-0.421	-1.235		
X_6	0.192	0.174	0.483	1.100		
X_7	-0.280	0.459	-0.234	-0.610		
Intercept	7.836	3.537		2.216£		

Note £ implies significance at ten per cent level of significance.
* implies significance at five per cent level of significance.
** implies significance at one per cent level of significance.

URBAN ELDERLY MALES

Table 4.25 provides the prevalence rate of hypertension, heart diseases and diabetes among urban elderly males for India and its major states. Table 4.26 presents the mean, standard deviation and the coefficient of variation of the dependent and independent variables under study for the fifteen major states. Independent variables of the study are presented in table 4.27 for major states of India.

Table 4.25

Prevalence Rate of Chronic Diseases among Urban Elderly Males for India and its Major States, 1986-87

	Hypertension	Heart Diseases	Diabetes
Andhra Pradesh	84.0	31.5	22.6
Bihar	46.0	28.6	19.5
Gujarat	81.4	35.4	21.2
Haryana	38.5	39.6	10.8
Jammu & Kashmir	101.0	31.2	6.6
Karnataka	60.0	13.5	33.6
Kerala	124.4	34.6	23.3
Madhya Pradesh	42.1	20.7	12.4
Maharashtra	72.3	24.7	30.0
Orissa	51.6	19.5	23.6
Punjab	72.9	25.3	27.8
Rajasthan	40.0	35.4	8.8
Tamil Nadu	64.2	19.9	41.5
Uttar Pradesh	40.3	25.2	14.7
West Bengal	144.2	57.9	41.4
All India	74.4	30.3	26.1

Table 4.26

Mean, Standard Deviation and Coefficient of Variation of Dependent and Independent Variables for Urban Elderly Males

Variables		**Mean**	**S.D.**	**C.V.**
Prevalence rate of hypertension	(X_1)	70.9	32.0	45.1
Prevalence rate of heart diseases	(X_2)	29.5	10.7	36.3
Prevalence rate of diabetes	(X_3)	22.5	11.0	48.9
Literacy rate	(X_4)	57.8	10.4	18.0
Percentage of workers in non agricultural activities	(X_5)	77.5	6.3	8.1
Unemployment rate	(X_6)	2.5	1.7	68.0
Per capita state domestic product	(X_7)	3721.6	1233.8	33.2

According to table 4.25, the prevalence rate of hypertension varies from 38.5 per thousand in Haryana to 144.2 per thousand in West Bengal. The prevalence rate of hypertension for India as a whole is estimated as 74.4 per thousand. It's coefficient of variation is 45.1 per cent (table 4.26). The highest prevalence of this disease is in the state of West Bengal (144.2) followed by Kerala (124.4), Jammu & Kashmir (101.0) and Andhra Pradesh (84.0) respectively. It is lowest in the state of Haryana (38.5) followed by Uttar Pradesh (40.3), Madhya Pradesh(42.1) and Bihar (46.0) respectively.

Table 4.27

Independent Variables for Major States of India (Urban Elderly Males)

State	Literacy rate (1981) in percentage	Percentage of workers in non agricultural activities (1981)	Unemployment rate (1981) in percentage	Per capita state domestic product in (1986-87) at current prices
Andhra Pradesh	52.0	75.7	1.3	3211
Bihar	55.3	68.9	1.9	2111
Gujarat	66.1	84.3	1.6	4893
Haryana	51.3	79.5	2.2	5537
Jammu & Kashmir	40.2	78.2	1.2	3420
Karnataka	59.5	72.0	2.0	3787
Kerala	75.1	76.6	7.5	3076
Madhya Pradesh	56.5	74.7	2.6	2772
Maharashtra	67.1	82.5	2.9	5363
Orissa	59.8	67.5	1.5	2763
Punjab	45.8	82.2	0.8	6274
Rajasthan	50.9	75.8	4.2	2923
Tamil Nadu	68.3	79.1	1.8	3677
Uttar Pradesh	46.0	73.8	1.4	2444
West Bengal	72.7	92.0	4.1	3542

Table 4.25 shows that the prevalence of heart diseases among urban elderly males is estimated as 30.3 per thousand. It varies from 13.5 per thousand in Karnataka to 57.9 per thousand in West Bengal. The coefficient of variation for this disease is 36.3 per cent. It is most prevalent in the

state of West Bengal (57.9) followed by Haryana (39.6), Gujarat (35.4) and Rajasthan (35.4) respectively. It is least prevalent in the state of Karnataka (13.5) followed by Orissa (19.5), Tamilnadu (19.9) and Madhya Pradesh (20.7) respectively.

The prevalence rate of diabetes is estimated as 26.1 per thousand (table 4.25). Prevalence of this disease ranges from 6.6 per thousand in Jammu & Kashmir to 41.5 per thousand in Tamilnadu. Coefficient of variation of prevalence of diabetes is 48.9 per cent (table 4.26). It is most prevalent in the state of Tamilnadu (41.5) followed by West Bengal (41.4), Karnataka (33.6) and Maharashtra (30.0) respectively. It is least prevalent in the state of Jammu & Kashmir (6.6) followed by Rajasthan (8.8), Haryana (10.8) and Madhya Pradesh (12.4) respectively.

Among the explanatory variables unemployment shows the maximum variation. The coefficient of variation of this disease is 68.0 per cent. It ranges from 1.2 per cent in Jammu & Kashmir to 7.5 per cent in Kerala. The next highest variation is shown by per capita state domestic product with coefficient of variation 33.2 per cent. It has also been described in earlier section on rural males. The variable literacy shows the coefficient of variation of 18.0 per cent. It varies from 40.2 per cent in Jammu & Kashmir to

75.1 per cent in Kerala. The lowest variation is shown by the variable participation in nonagricultural activities. The coefficient of variation of this variable is 8.1 per cent. It varies from 67.5 per cent in Orissa to 92.0 per cent in West Bengal.

Correlations between Dependent Variables

Table 4.28 shows that there is moderate positive correlation between prevalence of hypertension and prevalence of heart diseases. The coefficient of correlation between these two variables is 0.59. It is statistically significant at five per cent level of significance. The variable prevalence of hypertension and prevalence of diabetes also have shown positive correlation but it is not statistically significant. The variable prevalence of heart diseases and prevalence of diabetes show no correlation.

Table 4.28

Correlation Matrix between Dependent and Independent Variables for Urban Elderly Males

	X_1	X_2	X_3	X_4	X_5	X_6	X_7
X_1	1.0000	0.5849	0.4092	0.4811	0.6206**	0.4570	0.0835
X_2		1.0000	-0.0149	0.2140	0.6754**	0.4002	0.0862
X_3			1.0000	0.7095**	0.3085	0.0861	0.1241
X_4				1.0000	0.3256	0.6072**	0.0034
X_5					1.0000	0.1637	0.5811
X_6						1.0000	-0.2016
X_7							1.0000

Note: ** implies significance at one per cent level of significance.

Correlations between Independent Variables

All the independent variables show positive correlation with each other except between per capita state domestic product and unemployment rate. The correlation coefficient between literacy and unemployment is 0.61. It is statistically significant at one per cent level of significance. The correlation coefficient between participation in non agricultural activities and per capita state domestic product is 0.58 which is significant at five per cent level of significance. The correlation between all other independent variables is statistically insignificant.

Correlations between Dependent and Independent Variables

The prevalence of hypertension shows positive correlation with all the independent variables. It shows the highest correlation with the participation in non-agricultural activities. The correlation coefficient between these two variables is 0.62 which is significant at one per cent level of significance. No other independent variable shows statistically significant correlation with prevalence of hypertension.

The prevalence of heart diseases also shows positive correlation with all the independent variables. It shows the maximum correlation with participation in nonagricultural activities. The correlation coefficient between these two variables is 0.68 and it is significant at one per cent level of significance. No other independent variable has shown statistically significant correlation with prevalence of heart diseases.

The prevalence of diabetes has positive correlation with all the independent variables. It shows maximum correlation with literacy with correlation coefficient of 0.71. It is significant at one per cent level of significant. No other independent variable shows significant correlation with prevalence of diabetes.

Regressions Analysis of Prevalence of Hypertension

The results obtained from step-wise regression analysis of prevalence of hypertension are arranged in table 4.29. It is evident from the table 4.29 that the highest $\overline{R}^2$ is achieved at third step which is 0.446. The corresponding F-value is 4.759 which is statistically significant at five per cent level of significance. The variables that explain the above mentioned variation are participation in non agricultural activities, unemployment and per capita state domestic product. The regression equation thus fitted is as follows:

$$X_1 = \underset{(-2.403^*)}{-210.288} + \underset{(2.861^*)}{3.830\, X_5} + \underset{(1.269)}{5.161\, X_6} - \underset{(-1.122)}{.00766\, X_7}$$

$\bar{R}^2 = 0.446$ $F = 4.759^*$

Note: Figures in bracket represent the respective "t" values.

While looking at the individual role of the independent variables, the participation in nonagricultural activities is the most important variable. When participation in nonagricultural activities increases by one per cent keeping other variables constant, the prevalence of hypertension increases by 5.2 per thousand. This regression coefficient is significant at five per cent level of significance. Unemployment also shows the positive relation with prevalence of hypertension but the regression coefficient is not significant. Per capita state domestic product shows negative relation with prevalence of hypertension as it did in earlier cases but regression coefficient is not significant.

Table 4.29

Results of Regression Analysis of Prevalence of Hypertension among Urban Elderly Males

Variable	R.C.	S.E.E.	Beta	t	$\bar{R}^2$	F
Step1						
X_5	3.181	1.115	0.621	2.853*	0.338	8.142*
Intercept	-175.78	86.702		-2.027£		
Step2						
X_5	2.875	1.045	0.561	2.752*	0.434	6.370*
X_6	6.848	3.821	0.365	1.792£		
Intercept	-168.916	80.241		-2.105£		
Step 3						
X_5	3.830	1.339	0.747	2.861*	0.446	4.759*
X_6	5.161	4.068	0.275	1.269		
X_7	-0.00766	0.00683	-0.295	-1.122		
Intercept	-210.288	87.526		-2.403*		
Step 4						
X_5	3.670	1.433	0.716	2.561*	0.403	3.364£
X_6	3.860	5.095	0.206	0.758		
X_7	-0.00757	0.00709	-0.292	-1.067		
X_4	0.381	0.835	0.124	0.456		
Intercept	-217.072	92.065		-2.358*		

Note £ implies significance at ten per cent level of significance.
* implies significance at five per cent level of significance.

Regression Analysis of Prevalence of Heart Diseases

The results obtained from step-wise regression for prevalence of heart diseases are given in table 4.30. Table 4.30 shows that the highest value of $\bar{R}^2$ is achieved at fourth step which is 0.552. The corresponding F-value is 5.31 which is statistically significant at five per cent level of significance. The regression equation fitted is as under:

$$X_2 = \underset{(-2.648^{*})}{-70.68} - \underset{(-1.303)}{0.315\ X_4} + \underset{(3.898^{**})}{1.619\ X_5} + \underset{(1.500)}{2.216\ X_6} - \underset{(-1.649)}{0.00339\ X_7}$$

$\bar{R}^2 = 0.552$ $F = 5.31^{*}$

Note: Figures in bracket are the respective "t" values.

Table 4.30

Results of Regression Analysis of Prevalence of Heart Diseases among Urban Elderly Males

Variable	R.C.	S.E.E.	Beta	t	$\bar{R}^2$	F
Step 1						
X_5	1.158	0.350	0.675	3.302**	0.414	10.906**
Intercept	-60.302	27.279		-2.211*		
Step 2						
X_5	1.619	0.386	0.944	4.197**	0.531	8.919**
X_7	-0.00401	0.00195	-0.462	-2.056£		
Intercept	-81.098	26.430		-3.068**		
Step 3						
X_5	1.487	0.415	0.867	3.580**	0.523	6.125*
X_7	-0.00331	0.00212	-0.381	-1.562		
X_6	1.138	1.262	0.182	0.902		
Intercept	-76.300	27.164		-2.809*		
Step 4						
X_5	1.619	0.415	0.944	3.898**	0.552	5.310*
X_7	-0.00388	0.00205	0.390	-1.649		
X_6	2.216	1.477	0.353	1.500		
X_4	-0.315	0.242	-0.307	-1.303		
Intercept	-70.684	26.690		-2.648*		

Note: £ implies significance at ten per cent level of significance.
* implies significance at five per cent level of significance.
** implies significance at one per cent level of significance.

While looking at the individual role of independent variables, it is clear that the participation in nonagricultural activities is the most important variable. Prevalence of heart diseases increases by 1.6 per thousand when participation in nonagricultural activities increases by one per cent, keeping other variables constant. This regression coefficient is significant at one per cent level of significance. Literacy is surprisingly showing negative relation with prevalence of heart diseases. However, the regression coefficient is not significant. Unemployment is showing positive regression coefficient as expected but it is statistically insignificant. Per capita state domestic product has negative regression coefficient (statistically insignificant) as it did in earlier sections also.

Regression Analysis of Prevalence of Diabetes

Table 4.31 presents the results obtained from step-wise regression for prevalence of diabetes. It shows that the highest value of $\bar{R}^2$ is achieved at second step which is 0.640. The corresponding F-value is significant at one per cent level of significance. The variables which explain the above mentioned relationship are literacy and unemployment. The regression equation formed is as follows:

$$X_3 = \underset{(-2.983^{*})}{-\ 32.088} + \underset{(5.161^{**})}{1.095\ X_4} - \underset{(-2.907^{*})}{3.501\ X_6}$$

$\bar{R}^2 = 0.640$ $F = 13.462^{**}$

Note: Figures in bracket are the respective "t" values.

Table 4.31

Results of Regression Analysis of Prevalence of Diabetes among Urban Elderly Males

Variable	R.C.	S.E.E.	Beta	t	$\bar{R}^2$	F
Step 1						
X_4	0.746	0.206	0.710	3.638**	0.465	13.180**
Intercept	-20.582	12.051		-1.708		
Step 2						
X_4	1.095	0.212	1.041	5.161**	0.640	13.462**
X_6	-3.501	1.293	-0.546	-2.707*		
Intercept	-32.088	10.759		-2.983*		
Step 3						
X_4	1.070	0.230	1.018	4.653**	0.613	8.378**
X_6	-3.478	1.344	-0.543	-2.588*		
X_5	0.116	0.309	0.066	0.374		
Intercept	-39.668	23.131		-1.715		
Step 4						
X_4	1.068	0.241	1.016	4.438**	0.576	5.747*
X_6	-3.566	1.469	-0.556	-2.427*		
X_5	0.168	0.413	0.096	0.408		
X_7	-0.00042	0.00204	-0.047	-0.205		
Intercept	-41.907	26.551		-1.578		

Note * implies significance at five per cent level of significance.
** implies significance at one per cent level of significance.

While looking at the individual role of independent variables, it is clear from the above equation that literacy is the most important variable. Prevalence of diabetes increases by 1.1 per thousand when literacy increases by one per cent keeping other variables constant. It is significant at one per cent level of significance. The other variable unemployment shows negative influence on prevalence of diabetes and the regression coefficient is significant at five per cent level of significance.

URBAN ELDERLY FEMALES

Table 4.32 provides the prevalence rate of hypertension, heart diseases and diabetes among urban elderly women for India and its major states. Table 4.33 gives the mean, standard deviation and the coefficient of variation of the dependent and independent variables for the fifteen major states. Table 4.34 presents the explanatory variables of the study for major states of India.

The prevalence rate of hypertension is estimated as 84.3 per thousand (table 4.32) for all India. The coefficient of variation for this disease is 49.0 per cent. It varies from 33.4 per thousand in Haryana to 155.0 per thousand in Kerala. It is most prevalent in the state of Kerala (155.0) followed by West Bengal (149.9), Jammu & Kashmir (134.8) and Orissa (122.4) respectively. It is least prevalent in the state of Haryana (33.4) followed by Bihar (34.4), Rajasthan (60.1) and Madhya Pradesh (60.1) respectively.

Table 4.32

Prevalence Rate of Chronic Diseases among Urban Elderly Females for India and its Major States, 1986-87

State/India	Hypertension	Heart Diseases	Diabetes
Andhra Pradesh	107.9	29.5	25.0
Assam	133.8	38.4	28.3
Bihar	34.4	14.1	7.5
Gujarat	79.2	24.5	29.3
Haryana	33.4	29.9	13.6
Jammu & Kashmir	134.8	29.2	5.3
Karnataka	77.5	9.0	23.3
Kerala	155.0	36.9	31.0
Madhya Pradesh	60.1	8.9	8.5
Maharashtra	57.2	8.5	25.2
Orissa	122.4	28.3	34.3
Punjab	73.0	20.6	12.6
Rajasthan	55.4	16.8	4.2
Tamil Nadu	81.3	19.0	28.9
Uttar Pradesh	36.0	19.7	6.7
West Bengal	149.9	67.4	23.3
All India	84.3	25.5	19.7

Table 4.33

Mean, Standard Deviation and Coefficient of Variation of Dependent and Independent Variables for Urban Elderly Females

Variable		Mean	S.D.	C.V.
Prevalence rate of hypertension	(X_1)	83.8	41.1	49.0
Prevalence rate of heart diseases	(X_2)	24.2	14.8	61.2
Prevalence rate of diabetes	(X_3)	18.6	10.6	60.0
Literacy rate	(X_4)	19.6	9.1	46.4
Percentage of workers in non-agricultural activities	(X_5)	72.6	9.0	12.4
Unemployment rate	(X_6)	7.8	4.4	56.4
Per capita state domestic product	(X_7)	3721.5	1233.8	33.2

Table 4.34

Independent Variables for Major States of India (Urban Elderly Females)

State	Literacy rate (1981) in percentage	Percentage of workers in non agricultural activities (1981)	Unemployment rate (1981) in percentage	Per capita state domestic product in (1986-87) at current prices
Andhra Pradesh	16.0	61.9	3.3	3211
Bihar	16.6	64.6	9.2	2111
Gujarat	25.9	75.7	9.8	4893
Haryana	13.6	77.1	12.9	5537
Jammu & Kashmir	7.4	79.2	7.0	3420
Karnataka	20.6	64.2	3.5	3787
Kerala	41.8	66.4	14.6	3076
Madhya Pradesh	15.2	64.4	5.2	2772
Maharashtra	25.6	68.1	2.9	5363
Orissa	16.1	73.4	3.9	2763
Punjab	13.1	85.5	6.6	6274
Rajasthan	10.9	69.5	15.5	2923
Tamil Nadu	23.6	67.8	3.6	3677
Uttar Pradesh	14.2	76.3	6.4	2444
West Bengal	33.0	94.2	12.9	3542

According to table 4.32, the prevalence of heart diseases among urban elderly women is estimated as 25.5 per thousand for all India. The coefficient of variation of this is 61.2 per cent. It ranges from 8.5 per thousand in the state of Maharashtra to 67.4 per thousand in the state of West Bengal. It is highest in the state of West Bengal (67.4) followed Kerala (36.9), Haryana (29.3) and Andhra Pradesh (29.5) respectively. It is lowest in the state of

Maharashtra (8.5) followed by Madhya Pradesh (8.9), Karnataka (9.0) and Bihar (14.1) respectively.

Prevalence of diabetes is estimated as 19.7 per thousand (table 4.22) for all India. It shows 60.0 per cent coefficient of variation (table 4.33). It varies from 4.2 per thousand in the state of Rajasthan to 34.3 per thousand in the state of Orissa. It is most prevalent in the state of Orissa (34.3) followed by Kerala (31.0), Gujarat (29.3) and Tamilnadu (28.9) respectively. It is least prevalent in the state of Rajasthan (4.2) followed by Jammu & Kashmir (5.3), Uttar Pradesh (6.7) and Bihar (7.5) respectively.

Among the explanatory variables, the variable unemployment has the highest variation. The coefficient of variation of this variable is 56.4 per cent. It ranges from 2.9 per cent in Maharashtra to 15.5 per cent in Rajasthan. The variable literacy shows the second highest variation with 46.4 per cent coefficient of variation. It varies from 7.4 per cent in Jammu & Kashmir to 41.8 per cent in Kerala. The variable per capita state domestic product has been described in earlier section on rural males. The independent variable with least variation is participation in nonagricultural activities with 12.4 per cent coefficient of variation. It ranges from 61.9 per cent in Andhra Pradesh to 94.2 per cent in West Bengal.

Correlations between Dependent Variables

Table 4.35 shows that there is positive correlation between all three dependent variables. prevalence of hypertension has positive correlation with prevalence of heart diseases and the correlation coefficient is 0.69. It is statistically significant at one per cent level of significance. Correlation coefficient between prevalence of hypertension and prevalence of diabetes is not statistically significant. So is the case between prevalence of heart diseases and prevalence of diabetes.

Table 4.35

Correlation Matrix between Dependent and Independent Variables for Urban Elderly Females

	X_1	X_2	X_3	X_4	X_5	X_6	X_7
X_1	1.0000	0.6897**	0.5066	0.4886	0.2716	0.1096	-0.1465
X_2		1.0000	0.2685	0.4337	0.6728**	0.4798	-0.0256
X_3			1.0000	0.6802**	-0.0996	-0.2269	0.1661
X_4				1.0000	0.0247	0.2620	0.0289
X_5					1.0000	0.3277	0.3758
X_6						1.0000	-0.0381
X_7							1.0000

Note ** implies significance at one per cent level of significance.

Correlations between Independent Variables

All the independent variables show positive correlation with each other except for unemployment and per capita state domestic product. No correlation between independent variables is statistically significant.

Correlations between Dependent and Independent Variables

The prevalence of hypertension shows positive correlation with all the independent variables except with per capita state domestic product. In the later case it is negative. prevalence of hypertension shows maximum correlation with literacy (correlation coefficient 0.49) but it is not statistically significant. No other independent variable shows significant correlation with prevalence of hypertension.

The prevalence of heart diseases also has positive correlation with all the independent variables except with per capita state domestic product. In the later case it is negative but insignificant. Prevalence of heart diseases shows highest correlation with participation in nonagricultural activities (correlation coefficient 0.69). It is significant at one per cent level of significance. Prevalence of heart diseases has insignificant correlation with all other independent variables.

Prevalence of diabetes has a positive correlation with literacy and per capita state domestic product but negatively correlatedwith participation in nonagricultural activities and unemployment. Prevalence of diabetes shows highest correlation with literacy. The correlation coefficient between these two variables is 0.68 and it is statistically significant at one per cent level of significance. No other independent variable shows significant correlation with prevalence of diabetes.

Regression of Analysis of Prevalence of Hypertension

Table 4.36 provides the results of step-wise regression analysis for prevalence of hypertension. Table 4.36 reveal that the highest $\bar{R}^2$(.215) is achieved at third step. But the corresponding F-value (2.280) is not statistically significant. The only significant F-value (4.076) achieved isat the first step. So the regression equation obtained at the first step is taken as the most suitable equation. The regression equation thus fitted is a under :

$$X_1 = \underset{(1.722)}{40.492} + \underset{(2.019^{\pounds})}{2.214}\ X_4$$

$\bar{R}^2 = 0.180$ $\qquad\qquad$ $F = 4.076^{\pounds}$

Note : Figures is bracket are the respective "t" values.

Table 4.36

Results of Regression Analysis of Prevalence of Hypertension among Urban Elderly Females

Variable	R.C.	S.E.E.	Beta	t	$\bar{R}^2$	F
Step 1						
X_4	2.214	1.097	0.489	2.019£	0.180	4.076£
Intercept	40.492	23.519		1.722		
Step2						
X_4	2.185	1.090	0.482	2.004£	0.190	2.644
X_5	1.187	1.101	0.259	1.078		
Intercept	-45.068	82.729		-0.545		
Step 3						
X_4	2.212	1.074	0.488	2.060£	0.215	2.280
X_5	1.703	1.169	0.372	1.456		
X_7	-0.0100	0.00851	-0.300	-1.176		
Intercept	-45.801	81.446		-0.562		
Step 4						
X_4	2.435	1.144	0.537	2.128£	0.177	1.754
X_5	2.047	1.294	0.447	1.582		
X_7	-0.0112	0.00889	-0.337	-1.264		
X_6	-1.783	2.543	-0.191	-0.701		
Intercept	-56.581	84.799		-0.667		

Note £ implies significance at ten per cent level of significance.

The above equation reveals that literacy is the most important variable explaining the variation in prevalence of hypertension. When literacy increases by one per cent, prevalence of hypertension increases by 2.2 per thousand. This regression coefficient is significant at ten per cent level of significance.

Regression Analysis of Prevalence of Heart Diseases

Table 4.37 provides the results of step-wise regression analysis for prevalence of heart diseases. Table 4.37 reveals that the highest value of $\bar{R}^2$ (0.647) is achieved at the third step. The corresponding F-value (9.545) is significant at one per cent level of significance. The variables that explain the above mentioned variation are literacy, participation in nonagricultural activities and per capita state domestic product. The regression equation fitted is as under :

$$X_2 \quad - \underset{(-3.490^{**})}{68.598} + \underset{(2.667^{*})}{0.691 X_4} + \underset{(4.596^{**})}{1.297 X_5} - \underset{(-1.948)}{0.0040 X_7}$$

$$\bar{R}^2 = 0.647 \qquad F = 9.545^{**}$$

Note: Figures in bracket are the respective "t" values.

Table 4.37

Results of Regression Analysis of Prevalence of Heart Diseases among Urban Elderly Females

Variable	R.C.	S.E.E.	Beta	t	R^2	F
Step 1						
X_5	1.108	0.338	0.673	3.279**	0.411	10.752**
Intercept	-56.218	24.685		-2.277*		
Step 2						
X_5	1.091	0.290	0.663	3.755**	0.565	10.074**
X_4	0.680	0.288	0.417	2.365*		
Intercept	-68.305	21.825		-3.130**		
Step 3						
X_5	1.297	0.282	0.788	4.596**	0.647	9.545**
X_4	0.691	0.259	0.424	2.667*		
X_7	-0.00400	0.00205	-0.334	-1.948£		
Intercept	-68.598	19.656		-3.490**		
Step 4						
X_5	1.217	0.313	0.739	3.891**	0.628	6.916**
X_4	0.639	0.277	0.392	2.311*		
X_7	0.00372	0.00215	-0.310	-1.729		
X_6	0.414	0.615	0.123	0.673		
Intercept	-66.097	20.504		-3.224**		

Note £ implies significance at ten per cent level of significance.
* implies significance at five per cent level of significance.
** implies significance at one per cent level of significance.

From the above equation, it is clear that the participation in nonagricultural activities is the most important variable explaining the variation in prevalence of heart diseases. When participation in nonagricultural activities increases by one per cent keeping other variables constant the prevalence of heart diseases increases by 1.3 per thousand. This regression coefficient is significant at one per cent level of significance, The next important variable is literacy. Prevalence of heart diseases increases by 0.69 per thousand when literacy increases by one per cent keeping other variables constant. This coefficient is significant at five per cent level of significance. Per capita state domestic product shows negative correlation with prevalence of heart diseases but the regression coefficient is not significant.

<u>**Regression Analysis of Prevalence of Diabetes**</u>

Results of step-wise regression analysis for prevalence of diabetes are arranged in table 4.38. It reveals that the highest value of $\bar{R}^2$ (0.579) is achieved at the second step. The variables that explain the above mentioned variation are literacy and unemployment. The regression equation thus formed is as follows:

$$X_3 = \underset{(1.762)}{8.653} + \underset{(4.418^{**})}{0.925\ X_4} - \underset{(-2.420^{*})}{1.046\ X_6}$$

$\bar{R}^2 = 0.579$ $\qquad$ $F = 10.613^{**}$

Note: Figures in bracket are the respective "t" values.

Table 4.38

Results of Regression Analysis of Prevalence of Diabetes among Urban Elderly Females

Variable	R.C.	S.E.E.	Beta	t	$\bar{R}^2$	F
Step 1						
X_4	0.792	0.237	0.680	3.345**	0.421	11.191**
Intercept	3.070	5.079		0.605		
Step 2						
X_4	0.925	0.209	0.794	4.418**	0.579	10.613**
X_6	-1.046	0.432	-0.435	-2.420*		
Intercept	8.653	4.910		1.762		
Step 3						
X_4	.919	0.214	0.789	4.295**	0.561	6.959**
X_6	1.031	0.442	-0.429	-2.334*		
X_7	0.00109	0.00152	0.127	0.716		
Intercept	-4.610	7.550		0.611		
Step 4						
X_4	0.916	0.225	0.786	4.068**	0.518	4.765*
X_6	-1.000	0.500	-0.416	-1.999£		
X_7	0.00121	0.00175	0.141	0.691		
X_5	-0.0421	0.254	-0.036	-0.165		
Intercept	7.039	16.679		0.422		

Note £ implies significance at ten per cent level of significance.
* implies significance at five per cent level of significance.
** implies significance at one per cent level of significance.

The above equation shows that literacy is the most important variable explaining the variation in prevalence of diabetes. When literacy increases by one per cent keeping other variable constant, the prevalence of diabetes increases by 0.93 per thousand. This regression coefficient is significant at one per cent level of significance. Unemployment has indicated the negative relation with prevalence of diabetes against the expectation. The regression coefficient of unemployment rate is significant at five per cent level of significance.

To sum up, the above analysis finds the participation in nonagricultural activities as the most important factor influencing the prevalence of hypertension and heart diseases. Literacy has been another important factor influencing the prevalence of diabetes. These findings are briefly discussed in the next chapter.

CHAPTER 5

SUMMARY AND CONCLUSION

CHAPTER 5

SUMMARY AND CONCLUSION

This study has presented the prevalence of chronic diseases: hypertension, heart diseases and diabetes among aged on the basis of the data collected by National Sample Survey Organisation (NSSO) during 42nd round (1986-87). It has also attempted to analyse the influence of socio-economic factors on the disease prevalence, The study finds that the prevalence of chronic diseases increases by age. Hypertension has been found more prevalent among women than men and Diabetes has been found more prevalent among men than women. Prevalence of chronic diseases has been reported much more in urban areas than in rural areas. Analysis of data shows that the prevalence of heart diseases has been reported higher in the states where higher prevalence of hypertension has been reported and vice-versa. This finding in not unreasonable to explain because hypertension has been used as an important risk factor in the studies related to heart diseases.

The analysis of the influence of socio-economic factors has been carried out separately for rural males, rural females, urban males and urban females. An important observation of the study is that the influence of the socio-economic factors on the prevalence of the disease is not uniform in the above mentioned subgroups of the population.

Participation in nonagricultural activities has been found as an important factor influencing the prevalence of hypertension in all the above mentioned categories of the population. This finding is in support of our hypothesis. Occupation brings significant differences in the life-style of the people. People who are engaged in nonagricultural activities might be less physically active in urban areas. This difference in physical activities seems to be important for variation in prevalence of hypertension. Influence of participation in nonagricultural activities in rural areas is an interesting finding. This is because not much differences are observed in the life-style of agricultural and nonagricultural population in rural areas. Two possibilities are in offing for this. One, there may be differential awareness about the disease between two population. So, the people engaged in nonagricultural activities might have reported it better during the survey. Secondly, the nonagricultural population might be living near their place of work and are less physically active. Still, the reason is not very clear.

Participation in nonagricultural activities has come out as the most important factor influencing prevalence of heart diseases among rural females, urban males and urban females. The reason for this seems to be similar to what were offered in case of hypertension. Among rural males, the unemployment has come out as the most important factor. Unemployment brings tension among people and limitation of activities. This may be the reason for variation in prevalence of heart diseases in case of rural males. Literacy has been found to be the second most important factor influencing prevalence of heart diseases positively. But, this observation is true only in urban areas.

Literacy has been found as the most important factor influencing prevalence of diabetes positively among rural females, urban males and urban females. Among rural males, the participation in nonagricultural activities has come out as the most important factor. In urban areas, unemployment has surprisingly shown negative influence on diabetes prevalence. This is in contrast to our hypothesis.

The study has clearly indicated that the developmental factors like participation in nonagricultural activities and literacy have positive influence on prevalence of chronic diseases: hypertension, heart diseases and diabetes. The study has also found that the differences in the influence of these factors for different subgroups of the population may be attributed to differential life-style and awareness. These chronic diseases are generaly found more prevalent in higher socio-economic classes. But a study done by Rose and Marmot[1] (1981) found that coronary heart disease (CHD) prevalence was higher in lower social class than in higher class. The reason, they found was that the people belonging to higher social class were leading more health friendly life-style like consuming less alcohol, to smoke less and to exercise daily etc. Thus it can be inferred from the present and previous study that if people become aware of the problem and start to take preventive and health friendly measures then the prevalence of these diseases can come down to some extent. This calls for educational programmes. People should be made aware of the problems through mass media.

Target group i.e. those who are at higher risk of the diseases, should be identified to make such programmes more effective. Due to structural adjustment programme and modernisation, the danger of these diseases has become more. It is a known fact that these diseases remain for a very long period and incur a lot of expenditure on family and the

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1. Rose G. and Marmot M., *op.cit.*, pp.13-19.

state (because public health is the state duty according to article 47 of the constitution of India). So, the educational programmes which bring the preventive and health friendly measures to the high risk population is a cost-effective and prudent option.

The elderly population is growing very fast compared to earlier decades. With the increasing elderly population and the chances of increasing prevalence rate, the demand for health services would increase very fast. In this respect, the demand of health services should be forecasted and adequate arrangements should be made to meet the demand of health services.

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