PART III

EPILOGUE
CHAPTER XI

CONCLUSION
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The study of the social and environmental factors affecting the incidence and distribution of some communicable diseases was undertaken to identify factors which influence the spatio-temporal distribution of these diseases like Cholera, Smallpox, Malaria, Dysentery-Diarrhea and Tuberculosis and to examine the regional pattern thereof in all the fourteen districts of Ganga-Yamuna Doab. For investigation of the causative factors, this study has further proceeded on the basis of carefully selected number of variables to be employed through computer and multivariate analysis.

In this study the data were collected for thirtyone (31) years from 1951-1981 for fourteen districts of the Doab. For each districts, the data were organized into twenty two (22) columns (dependent 5 and 17 independent variables) and all the factors were employed in the correlation matrix, the correlation were computed with the help of computer programming system. Further on the basis of indices that were obtained, 'Factor Analysis' was attempted which included the preparation of correlation matrix for the variables. Here the method of principal factoring followed by the varimax rotation method was used in order to highlight regional picture of socio-environmental factors.
Multiple regression method was conducted in order to develop better comprehensions about the relationship between various variables considered in the analysis, as it shows better application for explaining the variability in deaths as seen by the postulated determinants and their relative strength in explaining such variability.

I. Socio - Environmental Influences

In the first part of the thesis, five chapters are included, among these the conceptual framework of the research problem, the physical-environmental setting, socio-cultural and demographic background, the state of health and hygiene including food-nutritional conditions of the people of Ganga-Yamuna Doab have been examined.

The socio-cultural and demographic study shows that the ethnic composition of various population groups and their socio-religious thinking, rituals and habits have close connection with some of the selected communicable diseases and mortality conditions. The selective type of mortality in such ethnic and social group is very common in almost all the districts of the region.

Similarly, the complex demographic conditions as being associated with fast growing numbers, enormous increase in the agricultural density of the population, a progressive growth in young age group composition as well as simultaneous
increase in non-working populations have been setting out conditions for high dependency burden and poor resources are main notable factors in the poor health conditions which closely favour to a highly increased mortality rate from various diseases.

The present state of poor health, unhygienic conditions, scarcity of clean drinking water, and pollution of the soils by the infected faceal material is the main source of spreading Cholera, dysentery and diarrhea diseases from community to community. The present available measures by the clinical facility or in the form of bed and hospitals are not upto the mark and often found to increase the incidence of mortality from various diseases.

The study shows that poor food-supply alongwith its decennial drops in man-land-ratio, yearly shortages in terms of quantitative and qualitative levels the calorie intake seems to have affected the nutritional status of the people and has also lowered the resistance of the body through under nutritional or malnutritional disorder leading to the afflictions of many communicable diseases.

II. Geographico-regional Pattern of the Diseases

The second-part of the thesis comprises five chapters. The first three chapters deal with the regional pattern of the diseases while the remaining two chapters investigate cause and effect relationship in the related phenomenon of disease and mortality among fourteen districts of the Doab.
In the sixth chapter the historical outline of the diffusion and ecology of the selected communicable diseases have been discussed. A comparative assessment of the regional decennial pattern of the diseases has been presented in the seventh chapter, while the combined perspective of the prevailing vulnerability of all five diseases is presented in the Eighth chapter.

The ecology of cholera disease in its historical perspective over the regional pattern of the Doab (chapter VI) shows that four districts Aligarh, Fatehpur, Kanpur and Allahabad were severely attacked by such mortality during twelve decades between 1861-71 to 1971-81, while in districts Meerut and Agra the severity of the disease was relatively less and also the prevailing frequency of incidence in Etawah, Mathura, Farrukhabad and Bulandshahr districts was quite moderate. In the same corresponding period the prevailing susceptibility to Cholera was fairly low in Etah, Muzaffarnagar and Mainpuri districts but the districts of Saharanpur in its overall situation enjoyed relative freedom from the scourge of Cholera mortality.

Further, an analysis of the regional pattern of Cholera disease in the Doab for the decade 1951-61 (chapter VII) shows that four districts Meerut, Bulandshahr, Aligarh and Allahabad were highly susceptible to this disease, while in the decade 1961-71 the position has slightly improved for the two districts Bulandshahr and Aligarh. However, the disease in high intensity makes its appearance in two new districts of Agra
and Kanpur. But in the following decade (1971-81) Aligarh and Muzaffarnagar appeared highly vulnerable and Agra and Kanpur remained as the same. In the middle Doab the position is comparatively better, while in the lower Doab the position in the decades 1961-71 and 1971-81 the situation in Kanpur has deteriorated. However, even in 1981 after a gap of thirty years a continuous belt of high incidence of Cholera deaths running through the districts of Aligarh, Agra and Kanpur can be identified. There is also an isolated district of Muzaffarnagar which shows high intensity of this disease to this distributional pattern of the region.

The influence of various factors indicated by Factor Analysis shows that the deterioration in the nutritional quality of food has gradually led to lower resistance, while poor-standards of living due to high dependency burden in the population has a strong correlation with cholera mortality. Again poor literacy levels and low income leading to ignorance show strong correlation with cholera mortality. The poor state of the health in juvenile and senile segments of the population have revealed strong correlation with cholera disease mortality.

Another socio-cultural factor related to particular ethnic groups of the population and showing a correlation with cholera is the congregation of large number of people for religious purposes. Allahabad and Saharanpur show high correlation with cholera among the Hindus and this may be due to the congregation of the people for bathing purposes at the time of *Kumbhfair* at Allahabad and at other time at Haradwar in Saharanpur district.
It is, however, quite apparent that the failure of medical beds and other clinical facilities delivered by the curative agencies have also been responsible for a high rate of mortality in spatio temporal perspective.

The ecology of smallpox disease in its historical perspective of the regional analysis over the Doab shows that four districts Meerut, Aligarh, Kanpur and Allahabad have suffered severely from the attacks of the disease during the period of twelve decades between 1861-71 to 1971-81, while in the districts of Bulandshahr and Farrukhabad the severity of the disease was relatively less. Again it is observed that mortality incidence in Saharanpur, Muzaffarnagar and Etawah districts took place quite moderately, while Etah and Agra districts in this regional pattern show low range of incidence of mortality. The districts of Fatehpur, Mathura and Mainpuri have been almost free from the disease.

Further an analysis of the smallpox disease in the comparative decennial pattern of the Doab shows that two districts Allahabad and Agra were much severely hit by the same mortality during 1951-61 while the situation some what worsened in the decade 1961-71. As a result the districts of Kanpur along with Allahabad and Agra saw the appearance of the disease in highly vulnerable form, while in the following decade (1971-81) the disease disappeared in Allahabad, and a new district, Aligarh appeared along with old districts Kanpur and Agra, in high vulnerability. It is apparent that in the
entire regional pattern two upper Doab districts of Muzaffarnagar and Meerut appear as contiguous areas of smallpox incidence and in Central Doab, Mathura and Aligarh form another vulnerable area, while Etawah and Kanpur constitute a third vulnerable area of smallpox disease. This means that even in the decade 1971-81, which claims eradication of smallpox*, the persisting scars of the disease, after a lapse of thirty years by 1981, in the form of a continuous belt of mild to low and high incidence of smallpox deaths run through Muzaffarnagar, Aligarh, Agra and Kanpur.

As a result of factor analysis it appears that the low quality of food and poor nutritional status in various segments of the population have given rise to poor health situations of the people. The dependency burden which shows low economic levels of the population indicates strong correlation with smallpox deaths. Another factor which shows a correlation with smallpox mortality is the religious and cultural taboo or rituals which prevail in the ethnic composition of the Hindu and Sikh populations of this study in Allahabad district. These ethnic populations reflect a high susceptibility to the disease while other groups like Muslims and Christians were not affected by the smallpox mortality incidence.

The ecology of malaria disease in its regional historical perspective of the Doab shows that four districts Kanpur,
Bulandshahr, Saharanpur and Meerut have greatly suffered from malaria mortality during the span of eleven decades between 1871-81 to 1971-81, whereas in the districts of Agra, Farrukhabad, Aligarh, Muzaffarnagar and Allahabad, the prevailing severity of the disease was relatively less. The distributional pattern in this period shows moderate incidence of malaria in the districts of Mainpuri and Etawah, while in Etawah and Mathura districts the low vulnerability prevailed across the Doab. It was only Fatehpur district which was almost free from malaria mortality in the corresponding period of this study.

Again an analysis of Malaria disease in the comparative regional pattern of the Doab during the decade 1951-61 shows that three districts Meerut, Bulandshahr and Aligarh have badly suffered from malaria mortality, while in the decade 1961-71 the vulnerability of the disease continued to be high in the above mentioned districts and instead covered a new district of Kanpur in this distributional pattern. The situation did not improve in the decade 1971-81, consequently Kanpur, Meerut and Aligarh showed high susceptibility to the disease, but Bulandshahr district was replaced by two districts of Saharanpur and Muzaffarnagar in overall spatio-temporal pattern of the Doab. The overall position is that upper Doab districts have severely suffered from the malaria mortality, while the Central Doab districts were partially affected in the decades 1961-71 and 1971-81 and the two lower Doab districts were relatively free from high susceptibility to malaria. In 1981 after a gap of thirty years
a continuous belt of high malaria mortality incidence runs through the districts of Saharanpur, Muzaffarnagar, Meerut, Bulandshahr, Aligarh, Agra, Etawah and Kanpur.

The result of factor analysis shows that rainfall and relatively high annual range of temperatures were identified for the breeding of malarial mosquitoes and transmission of the disease in spatio-temporal pattern of the region. The socio-economic factor as related to the supply of food deficient in quantity and quality as indicated by caloric intake and food factors have been significant factors in the deterioration of health of the people in highly affected mortality districts of upper-central and lower Doab. The poor prevailing health in various groups of the masculine and feminine segments of population alongwith the rural and urban characteristic features are also attributed to a high mortality rate in the vulnerable parts of the Doab mentioned above. The low income levels due to the high dependency ratio in the population has also accentuated the state of poor health. Also similar conditions influencing poor health in juvenile and senile segments of non-working population have revealed strong correlation with high malaria incidence. The poor economic situations related to low literacy condition has also shown high correlation with malaria mortality.
The differential facilities in both sectors of the rural and urban population and the common factors related to the accessibility and non-accessibility in the medical delivery factors of medical delivery system shows positive role in influencing the deaths and distributional pattern of malaria disease in the entire Doab. Further, in contrast to the highly urbanized areas, where clinical and medical bed facilities in hospitals are relatively good compared to the rural areas in the districts of Saharanpur, Muzaffarnagar, Etah, Mainpuri and Farrukhabad, malaria deaths could be found high in spatio-temporal perspective across the Doab. The role played by the upper Ganga canal and the lower Ganga as well as other canals passing through these districts in the region have been identified as significant factor in the spread of malaria disease and mortality incidence in its frequent form.

The districts of Meerut, Aligarh, Kanpur and Allahabad show low vulnerability to malaria owing to less favourable conditions of mosquito-breeding by its multivariat analysis.

The ecology of dysentery and diarrhea disease in its historical perspective over the regional pattern of the Doab shows that four districts, Saharanpur, Aligarh, Agra and Kanpur suffered badly from such mortality during the eleven decades between 1871-81 and 1971-81, whereas in three districts Muzaffarnagar, Bulandshahr and Allahabad the
severity of the disease was relatively less. Further this analysis shows that Fatehpur, Mathura, and Meerut districts were moderately hit by the bowel mortality incidence, while three districts Etah, Farrukhabad and Etawah show low incidence in the Doab. The district of Mainpuri is relatively free mortality area in overall regional pattern for the corresponding period.

Further an analysis of the regional pattern of dysentery and diarrhea disease in a comparative sense for the decade 1951-61 over the Doab shows that two districts Kanpur and Bulandshahr were highly susceptible to these diseases, while in the decade 1961-71 the position has slightly improved for Bulandshahr but high mortality prevailed in Kanpur and two new districts of Aligarh and Meerut were added to the disease. Again the severity of this disease in the decade 1971-81 affected four districts among them Kanpur, Aligarh and Meerut retained their previous status, while the district of Muzaffarnagar shows a new high susceptibility to the dysentery and diarrhea diseases. In the overall regional distributional pattern, the upper Doab districts show high susceptibility to bowel diseases, while in the middle Doab the districts with high incidence are Aligarh, Agra and Etawah during 1961-71 and 1971-81 and in the lower Doab, Kanpur again shows high incidence. Thus in 1981 after a lapse of thirty years, there is a continuous belt of these bowel diseases running through Saharanpur,
Muzaffarnagar, Meerut, Aligarh, Agra, Etawah and Kanpur.

The result of factor analysis shows that climatic factors particularly range of temperature and rainfall show positive correlation with the disease. The poor hygienic conditions associated with contaminated food by house flies also give rise to sickness and high mortality incidence even in better fed areas of Saharanpur, and Muzaffarnagar of the upper Doab. Another factor which seems to promote the disease is the congestion leading to poor living conditions. The deteriorating condition of Kanpur in respect of this disease is mainly because of the overcrowding and persons living under unhygienic conditions.

In this study Muslims, Christians and Sikhs show high correlation with dysentery and diarrhea mortality incidence, while Hindus show inverse correlation with such incidence. There is a positive connection of the Muslims population in Saharanpur and Muzaffarnagar with the disease, while inverse relationship exists with the Hindu ethnic composition of the population in the same districts. This seems to be related to the pattern of diet. The vegetarian diet is more compatible with the normal bowel activity while the non-vegetarian highly spiced diet being heavy, leads to quick upsetting of the bowels and in due course leads to dysentery and diarrhea mortality. Moreover, the paucity of clinical and medical bed facility has also influenced the incidence and distribution of the disease.
The ecology of tuberculosis disease in its historical perspective of the regional pattern shows that the three districts Allahabad, Kanpur and Agra have severely suffered from the tuberculosis mortality during the span of eleven decades between 1871-81 to 1971-81, whereas in Meerut, Aligarh and Saharanpur districts the severity of the attack was relatively less while in the same period mortality incidence in Bulandshahr, Etawah and Mathura districts was moderate. In this regional pattern the prevailing frequency of disease in Etah, Farrukhabad districts was relatively low and the two districts Mainpuri and Fatehpur have enjoyed relative freedom from the mortality in the corresponding period.

Moreover an analysis of the tuberculosis disease by a comparative assessment position in the regional pattern of the Doab for the decade 1951-61 shows that the three districts Agra, Kanpur and Allahabad were highly susceptible to the disease, while in the decade 1961-71 the position has slightly improved for Allahabad district whereby two districts Kanpur and Agra continued to be highly vulnerable in the region. Again in the decade 1971-81 the severity of attack from tuberculosis covered some new districts like Aligarh and Meerut in addition to Kanpur and Agra. It will, thus, be seen that Saharanpur, Meerut, Mu'azzarnagar in the Upper Doab and Aligarh, Agra, Etawah in the middle Doab and Kanpur in the lower Doab show high incidence of the disease while the rest of the Doab districts were free from the disease. This means
that even in 1981 after a gap of thirty years, a continuous belt of relatively low and high incidence of tuberculosis deaths runs through the districts of upper and middle doab from Saharanpur, to Aligarh, Mathura, Etah, Agra, Etawah and Kanpur.

The level of nutritional quality of food and poor status of these populations have played a significant role in the predominantly rural districts of Muzaffarnagar and Mainpuri, while in predominantly urban population districts this factor is less operative and shows inverse effect in the distributional pattern of mortality. The movement of rural population to urban areas make them susceptible to the disease in Aligarh, Mathura and Mainpuri districts, while the same factor in predominantly urban districts of Meerut, Agra and Kanpur show insignificant role for the spread of this disease. The literacy ratio of the population has played a significant role in the causation of disease and spreading the mortality incidence in Muzaffarnagar and Mainpuri districts but in overwhelmingly urban populated districts of Kanpur and Meerut, where the literacy level is high and health situations of such populations are better, the incidence of tuberculosis is not high. Again the susceptible groups of the juvenile and senile population in Muzaffarnagar and Mainpuri show high correlation with tuberculosis mortality, while work-force segments of the population were identified as significant determinants of mortality in Meerut, Agra and Kanpur districts.
It seems quite apparent that in industrially developed districts of Meerut, Agra and Kanpur having more busy life, the work-force segments of the population are more susceptible to the disease but in the same districts the non-working juveniles are relatively free from this disease owing to lesser involvement with any type of work. Moreover, the non-working population are more afflicted in the rural areas and on the contrary the working population are highly affected in those districts which are possessing big cities in the region.

As socio-cultural factors play some significant role. The Hindu ethnic community owing to its predominant vegetarian diet was found highly affected from the tuberculosis mortality, but the Muslim population due to the rich protein diet seems to have developed a resistance power to the disease and are less susceptible to tuberculosis mortality in the same predominantly urban districts of Agra and Kanpur. However, the relative position of Christian population in highly rural districts of Muzaffarnagar and Mainpuri seems to reveal some connection with poor health sickness and related casualties. Further, the clinical facility and bed hospital facility available in predominantly rural districts of Muzaffarnagar and Mainpuri show high correlation with such mortality but in highly urban districts of Meerut, Agra and Kanpur where medical facilities are available in better shape the tuberculosis mortality does not show any significant relation in overall spatio-temporal context of this study.
On the basis of regression analysis it is seen that Agra, Kanpur, Meerut, Aligarh, Etawah and Allahabad districts show high vulnerability to tuberculosis at the spatio-temporal perspective of this study in the Doab.

**Perspective of Combined Diseases**:

An analysis of the five combined diseases in the regional pattern of the Doab for the decades 1951-61 and 1961-71 show that four districts Meerut, Bulandshahr, Aligarh and Kanpur were highly susceptible to all these diseases, but in the decade 1971-81 the position has slightly improved for Bulandshahr while some new districts like Muzaffarnagar and Saharanpur appeared as highly vulnerable. Thus, the upper Doab districts were comparatively more vulnerable and the middle doab districts were partially affected by the disease while in the lower Doab district in the decades 1961-71 and 1971-81 the situation with the exception of Kanpur is better. This means that these persisting vulnerability conditions even in 1981 after a lapse of thirty years show a continuous belt of five diseases running through the districts of Saharanpur, Muzaffarnagar, Meerut, Bulandshahr, Aligarh, Agra, Etawah and Kanpur.

The overall picture is that cholera was highly prevalent in Aligarh, Kanpur, Fatehpur and Allahabad districts and leaving Fatehpur, all these districts were also severely hit owing to smallpox mortality. In the same distributional pattern, Saharanpur
and Etah were identified relatively free from cholera incidence but Mainpuri and Mathura districts enjoyed relative freedom from smallpox incidence. The upper Doab districts of Saharanpur, Muzaffarnagar, Meerut, Bulandshahr alongwith Central Doab district of Aligarh and Kanpur have suffered from malaria mortality and meanwhile Mathura and Fatehpur in the same distributional pattern show lowest mortality incidence. The mortality from dysentery and diarrhea disease has greatly affected Saharanpur, Aligarh, Agra and Kanpur districts but in overall regional pattern Etah and Mainpuri were seen relatively free from such incidences. Further the persisting high vulnerability of the tuberculosis disease has severely affected Agra, Kanpur, Allahabad and relatively less in Meerut, but at the same time Mainpuri and Fatehpur districts were listed relatively free tuberculosis areas in the whole Doab.

It may therefore be concluded that socio-economic factors play a powerful role in the spread and mortality incidence of all the communicable diseases considered in this study.

In the case of cholera literacy and public education with regard to non-consumption of exposed food material, is extremely important. Further clean drinking water should be made available without delay. In spaces of religious congregation, these factors would be duly taken care of.
With regard to smallpox, it is not correct to say that the disease has been eradicated. The study shows that the disease does make its appearance in the districts of upper Doab. Further, religious taboos and lack of education promote the mortality incidence. Medical facilities which are far from satisfactory should be strengthened.

In the case of malaria, the mortality toll is high. Stagnation of water related to irrigation system has been the potential source of mosquito breeding. The economically poor segments of the population with poor nutritional level are much prone to the attack of the disease. While on the one hand environmental conditions be improved, on the other hand, the nutritional level of the people be strengthened so that they develop resistance to the disease.

Soils infected with contaminated water, particularly sevage water, indirectly promote dysentery and diarrhea diseases. Vegetable grown over large areas with the help of contaminated water and eaten in the raw form, and in some cases, even cooked ones, promote the disease. Moreover, when the disease has inflicted the persons due care at the initial stages, owing to ignorance, is not taken. It is therefore necessary that the flow of contaminated water be immediately checked, and people should be educated on a massive scale about the prevention of the disease.
Tuberculosis is a disease which is mainly the result of poor and inhospitable socio-economic conditions. The study shows that the incidence of the disease is on the increase in many districts of the area under study. People migrating from rural to urban areas in search of jobs, stay at highly unhygienic conditions. The extra ordinary crowding leads to poor housing conditions and the congestion denies the fresh air and the poor economic condition is responsible for the low nutritional diet. Immediate attention should be given to slums and squatter settlements and the social and economic conditions of the people be improved.

Thus, it is finally suggested that a rational planning of the health characteristics of the population and more health surveys for identifying inherent causes of poor-health be made throughout the Doab on a wider scale. It is also required to make a genuine effort for the implementation of the health-schemes, so that a balance may be created between rural and urban population sectors and thereby the existing gap between health and social standards of living should be minimized properly. Again it is needed to carry a block-development effort especially in rural areas and try to make a purposeful coordination between socio-economic requirements of the population and health facilities to be available for all people. Meanwhile it is also required to enhance employment opportunities and raise the agricultural levels by the livelihood classes so that a sound economic condition can
provide protective base and health of the masses be warded off from various kind of diseases. However, if some economic stability is created among the regional community and effective situation are created for the removal of diseases among susceptible groups and vulnerable areas, only then, with sufficient reason it may be hoped that viscious circle of poor health, sickness and high fatality rate from various kind of diseases may confidently be averted within a short period to come.