Decentralized Resource Allocation in Primary Health Care:

Formal Methods and their Application in Britain and Pakistan.

By

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To my children
Sidra, Sammon, and Sulaiman
for their patience and co-operation
letting me to complete this research

Abstract

The aim of this thesis is to develop analytic methods to support the implementation of decentralization in primary health care. Decentralization may be defined as the delegation of decision-making power from central management to middle or local management for coordinated control. To be an effective mechanism for coordinated control it needs to be implemented by systematic methods. This doctrine generally comes from the experience of implementing decentralization in the industrial sector. This thesis develops systematic methods of resource allocation to support the implementation of decentralized primary health care in Britain. The thesis also considers the transferability of methods to support the implementation of decentralization to Pakistan.

The work reported in this thesis is based on case studies carried out in health districts in both Britain and Pakistan. Based on the reported work this thesis concludes that decentralization could be beneficial for both British and Pakistani primary health care systems, provided its implementation is supported by appropriate analytic methods.

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Chapter One

Introduction

1.1 Introduction

The objective of this research is to develop analytic methods to support decentralized resource allocation in primary health care. Decentralization may be defined as delegation of decision-making power from central management to middle or local management for coordinated control. However to be an effective mechanism for coordinated control it needs to be implemented systematically (Cordiner, 1956). In this context the present research develops analytic methods to support decentralized primary health care in Britain and also focuses on the transferability to Pakistan of these methods. Work reported in this thesis is based on case studies carried out in health districts in both Britain and Pakistan.

Interest in decentralization of primary health care arises from the declaration of the Alma Ata Convention in 1978, at which member countries of the UN agreed to ensure health for all by the year 2000 (WHO, 1981). This declaration acknowledged, among many other aspects, the potential of primary health care to save resources by making people less dependent on hospital care.

These influential international developments undoubtedly affected the climate of opinion in Britain in the direction of a greater attention to primary health care, and also to the decentralized delivery of health services which had been identified as a key to success. Over the period many District Health Authorities began to implement decentralization. This tendency was reinforced in the London area by another factor, the effects of RAWP. The method of allocating resources to Regions by the RAWP formula, although it assisted moving towards geographically equitable resourcing, had as one result severe financial cuts in all the Thames Regions, resulting in a reduction in the acute service sector. This put enormous pressure on primary health care in London. There were therefore extra reasons for adopting decentralization, in particular, in the inner city health districts of the Thames Regions. Serious efforts to implement decentralization gained momentum from the mid-1980's.

In the literature, decentralization is regarded as a mechanism for the achievement of end results by improving the quality of decision-making and providing incentives for innovation at the local level. According to Cordiner (1956) decentralization does not take place with the declaration of a policy of decentralization. It needs painstaking efforts to develop mechanisms for implementation so that issues such as the size of decentralized units, business objectives, resource allocation, performance measurement etc. can be effectively resolved.

The main objective of this research as already mentioned is to develop analytic methods to support decentralization in primary health care. To this end we have examined: a) whether formal methods of implementing decentralization are applicable to primary health care resource planning, b) to what extent they are being followed in the implementation of decentralized primary health care in Britain, and c) what issues remain to be tackled.

These issues are examined firstly, in terms of the process of implementing decentralization in Tower Hamlets Health Authority in East London. We then focus attention on the transferability of methods to implement decentralized primary health care in Pakistan. The questions addressed are whether a decentralized policy of delivering primary health care will be useful, and if so, then how decentralization can be implemented.

This issue has been analyzed in detail in the light of Pakistan's government health policy (Government of Pakistan, 1990) and after consultation with local and international experts working in Pakistan's health system. Based on the evidence that decentralization of primary health care delivery in Pakistan is relevant in tackling existing problems, we show how decentralization can be implemented by reference to the specific cases of Dera Ismail Khan (DIK) and Thatta health districts.

1.2 Thesis Plan

The work reported in this thesis is organized into twelve chapters. The first chapter briefly explains the objectives of the research and overall thesis plan. Chapter Two examines general concepts of decentralization and analytic methods to support decentralization. As a result of this examination we conclude that decentralization needs to be implemented by innovative formal practical methods.

In Chapter Three attention is focused on the relevance of decentralized planning generally in the British National Health Service (NHS) and specifically in primary health care. Based on this discussion arguments are presented that decentralization has not previously been given adequate attention in the NHS. This in turn has restricted the capacity of primary health care organizations to deliver appropriate care. However it is argued that due to pressure on resources most District Health Authorities (DHAs) in Britain have started decentralizing community health care (a component of primary health care).

Chapter Four examines the particular case of Tower Hamlets Health Authority to ascertain how decentralization (called locality planning) is being implemented. This Chapter also develops methods of preparing base-line information for locality profiles, and explains how base-line information can be displayed and manipulated using a Geographical Information System (GIS).

Attention is then directed towards resource allocation methods. Chapter Five, concentrating on the particular case of district nursing services, develops methods to make available necessary input data for resource allocation. Chapter Six develops resource allocation models. Two alternative integer programming models are developed to allocate nurses to localities. This Chapter demonstrates the feasibility of using rational methods to allocate resources for decentralized planning. Having studied Tower Hamlets, attention is then focused on the possibility of implementing similar decentralization in Pakistan. Chapter Seven examines the existing organizational framework and resource allocation methods for health care, and especially primary health care, in Pakistan. This analysis reveals that primary health care is facing immense problems which could potentially be resolved by the decentralization of the existing structure of service provision.

Chapter Eight shows how decentralization might be implemented in a specific health district, that of Dera Ismail Khan (DIK). A method of setting locality boundaries, based on union councils as a basic unit, is explained. Corresponding locality profiles are developed and the Tower Hamlets version of a GIS is adapted to display geo-linked data.

In Chapter Nine a resource allocation problem is considered, that of the

Expanded Programme for Immunization (EPI) in DIK District. Immunization is carried out by visiting children in their homes, analogous to the district nursing service in Tower Hamlets. So the integer programming models already developed for allocating district nurses have been adopted to allocate vaccinators to localities such that union councils' need are satisfied.

The nature of 'need' for an immunization service is relatively straight-forward, and as a result there was no occasion to apply the needs identification model developed in Chapter Five. Chapter Ten presents another, more complex example, that of out patient services in the Thatta district of Sind province of Pakistan, and uses it to demonstrate the transferability of the need model based on the principles of the RAWP formula.

The results of this analysis are then used in Chapter Eleven for resource allocation. It is argued here that utilization of out-patient service is significantly influenced by the travel time or cost necessary to access facilities. This factor, not present in the cases of district nursing or vaccination services already discussed, necessitates a method of forecasting utilization for any particular configuration of health facilities. This is achieved in Chapter Eleven by the use of a gravity model formulation, applied to health facility location in the Mirpur Sakro taluka (tehsil) of the Thatta district.

Finally Chapter Twelve draws conclusions based on the work reported in this thesis. It is argued that decentralization could bring about improvements for both British and Pakistani primary health care systems, or indeed elsewhere in less developed countries, provided that necessary analytic methods to support decentralization are developed and followed.

Chapter Two

General Concepts of Decentralization and Formal Methods to Implement Decentralization

2.1 Introduction

This chapter is designed to examine the general theories of decentralization. Starting from a consideration of the basic question of why centralized planning methods proved to be dysfunctional and decentralized planning came into favour, we consider both the benefits and the disadvantages of decentralization both in theory and in practice. This analysis leads to a discussion of what planning methods are appropriate to implement decentralization.

According to Mintzberg (1979) the term decentralization is commonly used in three different ways:

a) the delegation of formal decision-making power down a chain of authority - that is, vertical decentralization;

b) the delegation of decision-making power (formal or informal) to people whether inside or outside the line structure i.e. analysts, support specialists, and operatives - that is, horizontal decentralization, and

c) physical dispersal of services such as libraries, copying machines, and service personnel to be close to their users. In this third form decision-making power remains with the top level, therefore it is better described as deconcentration or relocation rather than decentralization.

The research described in this dissertation is mainly concerned with decentralization rather than mere relocation. Therefore the two essential forms, vertical and horizontal decentralization, are those which will be considered in this Chapter.

In a centralized structure decision-making power remains in the hands of a single individual or a group of powerful individuals, whereas in a decentralized structure decision-making power is delegated to many individuals each concerned with their own area of responsibility. However the delegation of decision-making power in an organization is a complex phenomenon (Mintzberg, 1979). Fesler (1965) acknowledged the complexities of distributing decision-making power and argued that centralization or decentralization may not be considered in absolute terms. Mintzberg in this respect also suggests that both centralization and decentralization should be treated not as absolutes, but rather as two ends of a continuum.

Thus Fesler (1965) and Mintzberg (1979) suggest that central authority is not eliminated by the implementation of decentralization. For example, funds may be earmarked for a department to spend without further reference to a central authority. Alternatively, the decision on how to perform tasks may be delegated, but with subordinates required to work toward certain measurable results. This is the approach which has been followed in the work reported in this thesis.

A discussion of the need for decentralization, as opposed to centralization, started to appear at the end of the nineteenth century when the size and complexity of various organizations started to grow. It was the later years of that century which witnessed the emergence of the large, single-product, multi-functional enterprise in steel, meat packing, tobacco, oil, and so forth (Chandler, 1962).

These centrally controlled organizations, also known as unitary form or U-form organizations (Williamson, 1975), managed to increase profits by decreasing costs through administrative coordination. However as their operations expanded such organizations came to face serious difficulties. Williamson (1975) summarizes these difficulties as indecomposability, incommensurability, non operational goal specification, and confounding of strategic and operational decisions.

The term *indecomposability* means an inflexibility of structure to cope with changing environments both inside and outside the organization. A centralized organization needs to develop elaborate internal coordination among its parts, which could involve substantial costs. Williamson calls this an intrinsic interconnectedness between parts. For a centralized organization this internal coordination makes establishing external coordination still harder.

Thompson (1967), tackling the issue of external coordination, argues that an organization is always embedded in a large system. Some of its parts are necessarily interdependent with agencies not subordinated to the organization. In this case the problem is not only that of coordination but that of adjustment to constraints and contingencies.

Thompson argues that rational organizations must be able to deal with problems which arise from external contingencies. To Thompson this means that a rational organization facing a heterogeneous environment should identify homogeneous segments and establish independent units to deal with each. This implies that an organization operating in a difficult or rapidly changing environment needs to assign small portions of it to single units. There are a number of common examples of this. For example, organizations which are engaged in a business that cross national boundaries tend to establish semi-autonomous units based on regions. Large multi-product retail establishments, facing heterogeneity on the input side, create specialized buying units. But a centrally controlled structure lacks the flexibility which such arrangements permit; its units are prevented from adjusting and establishing coordination with interdependent units. This can, of course, result in a chaotic situation.

Williamson's second aspect of difficulty for centralized organizations is that of *incommensurability*. The overriding aim of achieving organizational goals calls for commensurate authority and responsibility. In a centralized organization, however the authority of decision-making lies with top management, while the responsibility for achieving preset goals falls on the lower levels. This phenomenon of incommensurate authority and responsibility leads to *non-operational goal specification,* in which goals are set without the participation of those who must achieve them. In this situation those on whose actions the realization of high-level enterprise objectives depends are likely to fall behind in achieving those objectives because of a lack of motivation.

Sloan (1954) suggests that the causes of success and failure mainly lie with two key factors, those of motivation and opportunity. Sloan relates motivation to incentive compensation, and opportunity to decentralization.

To effect motivation among employees, social scientists have suggested several alternatives (Maslow, 1943; Argyris,1959; Scott, 1962; Herzberg, 1963). One of them is to allow individuals who are responsible for output to decide targets for themselves. In a centralized structure however such lower level participation is not encouraged.

Opportunity, whenever it arises, can best be seized by those at the periphery close to the scene. As already mentioned, centralized management does not allow its operational units to adjust, on their own, in response to contingencies. This results in the loss of opportunity.

The *confounding of strategic and operational decisions* is the crux of the problem in centralized planning. This has serious implications. During the late nineteenth and early twentieth century the development of large centralized departmentally functionalized organizations put impractical burdens on top management, who tended to concentrate on departmental responsibility and on day-to-day operations, rather than on the strategic issues for which they were also responsible.

According to Rosenhead (1982), this myopic focus was dramatically exposed in the sharp recession of 1920-2. This experience led some firms (at first only a few) to think seriously about the need to devise long-run plans to handle future uncertainties. Top management would need to spare themselves from day-to-day operations if they were to concentrate on strategic planning. To give top management space to carry out this new function, General Motors and DuPont (and others subsequently) instituted multidivisionalization. Corporate executives were insulated from operations to concentrate on policy and planning.

Centralized methods emanated from the traditional control tactics of an early period of factory management. Owing to their inherent limitations, centralized control methods could not cope with a dynamic organization's requirements. In view of this change a trend from centralized to decentralized planning methods started gradually to emerge.

Indeed, although public discussion of decentralization began before the turn of the century, it was only after the second world war that practical moves towards decentralization became wide-spread. This feature is clearly connected with the rapid changes in technology of that period, coupled with the development of an array of techniques by economists, management scientists, and computer analysts. These developments, which were seen as a tactic for centralized control by many, have also a great deal of potential for implementing decentralization in a systematic way - as will be shown in this thesis

2.2 The Philosophy of Decentralization

Decentralization is regarded as bringing about improvements in efficiency and flexibility which enhance an organization's capacity to absorb risks and to react successfully to a changing environment. Pfeffer (1978) states that "survival of an organization, an open social system, requires the maintenance of favorable exchange relationships with other groups and organizations in the environment".

Uncertainty is the characteristic of the environment which has a central role in the discussions of organizational design in the literature. Burns and Stalker (1961) and Dills (1958) specifically argue for a decentralized organizational structure when the environment is uncertain. As we have already seen, Thompson (1967) suggests that an organization facing a heterogenous task environment seeks to identify homogenous segments and establish structural units to deal with them. Hage and Aiken (1970), Hall (1963), Pugh, Hickson, Hinings and Turner (1969), Bennis (1964), Likert (1967), and Mills (1975) cited by Pfeffer (1978), all consider that environmental uncertainty is the principal determinant of structure. As has already been argued, in an uncertain environment a decentralized structure is to be preferred.

Decentralization helps both in implementing technological changes, and in personnel development. It is argued in the literature that technological changes on one hand influence organizational structure and on the other hand are themselves influenced by the organizational structure (Pfeffer, 1978). To some, the use of technology results in recentralization and to others, a decentralized, less formalized structure facilitates rapid technological growth by innovative thinking (Hage and Aiken 1970 cited in Pfeffer, 1978). More specifically:

a) those organizations which adopt new technology for routinization and automation will tend to have centralization, and

b) those organizations which employ new technology for the work of specialist groups such as system analysts, electronic engineers, and financial analysts will tend to operate through autonomous specialties.

Autonomous segments are considered to be more innovative and flexible for the reason that the personnel of autonomous units are motivated and guided by a mechanism of self control (Chandler, 1962). It has been mentioned elsewhere that in a decentralized structure top level management is relieved of day-to-day operations, thus having the opportunity to concentrate on longer term strategic planning. Conversely, the employees in the middle and lower ranks of managerial hierarchies have the opportunity to react to the changing environment, which motivates them to act as leaders and to improve the quality of their decision-making.

Motivation, as we have already seen, makes people give more to their jobs. And motivation in turn depends upon their degree of individual freedom, discretion, and control over their work. The opportunity to make decisions and to be involved can help to provide personal satisfaction. (There is, however, an underlying assumption that personal goals are broadly compatible with those embedded in the organization's policies.)

Motivation encourages strategic responsiveness among individuals, leading to innovation. Innovation is an aspect of entrepreneurship, which does not thrive under standardized external control. The entrepreneur takes his/her own risks to earn personal rewards. Mintzberg (1979) says that no control system managed from headquarters can substitute for this kind of motivation. Child (1984) argues that delegated responsibility has proved to be helpful to many organizations in developing their stock of managers capable of assuming a 'general management' position.

Proponents of decentralization argue that it has all those qualities necessary for an organization's growth and success. Nevertheless although decentralization is beneficial it does raise several issues. For example, in stratifying operational and strategic boundaries there is need for careful consideration - if people among whom decentralization is taking place feel their interests are threatened they will tend to resist the process of change.

The philosophy of decentralization, as we have seen, is based mainly on arguments that decentralization encourages innovative thinking, allows flexibility, and inspires motivation. However there is no specific method available to implement these aspects of decentralization rationally. Neither can these benefits be expected to be realized within a short span of time (Chandler, 1962).

However some of the aspects of decentralization are susceptible to rational design - such as the specification of organizational structure, size of independent units, and mechanisms for coordination, resource allocation, and performance measurement. These matters are comparatively tangible, and rational methods are available to implement them. In this thesis the main concern is with the implementation of decentralization via such rational methods. The following section therefore concentrates on some of these issues involved in the implementation of decentralization.

2.3 Issues in Implementing Decentralization

We have seen that in a decentralized structure decision-making power may be delegated either vertically or horizontally. The following subsections consider the implications of each of these forms for decision-making and the associated issues to be resolved:

2.3.1 Vertical Decentralization:-

Vertical decentralization is concerned with the delegation of decision-making power down the chain of authority from a strategic point to middle line (Mintzberg, 1979). This form of decentralization is based on the delegation of formal decision-making power; therefore choices about the type of decision and the extent of authorization need to be made. Three basic questions need to be answered. These questions are:

a) what decision power should be delegated,

b) how far down the chain, and

c) how should the use of authority be coordinated.

Normally certain selected functions are decentralized, while others are retained under central authority.

Dale (cited in Pfiffner and Sherwood, 1960) found that in corporations where vertical decentralization takes place, manufacturing and marketing decision are commonly decentralized while finance and legal decisions are kept under central authority. Khandwalla (1973) supports these findings.

Lawrence and Lorsh (1967) find rather more precisely that in vertical decentralization, decision-making power tends to rest at the level where necessary information can best be accumulated. This implies that within the organization the power of decision-making on a particular topic may be vested in different specialties at different levels of the hierarchy. A feature, therefore, of vertically decentralized organization is the significant role of *'work constellations'*, which are "quasi-independent cliques of individuals who work on decisions appropriate to their own level in the hierarchy" (Mintzberg, 1979). These constellations may be formal or informal, but are only loosely coupled with each other.

A particular case of vertical decentralization is that of parallel decentralization. Parallel decentralization refers to delegation of decision-making power for many different types of decisions to the same level in an organization (Mintzberg, 1979). For example, finance, marketing, and production decisions may be made by the divisional managers in the middle line. This is common in units grouped on the basis of markets or geographical boundaries. This structure is commonly known as "divisionalization". In this case each division is decoupled from the others. Necessary decision-making power is given to each division to make all those decisions that affect its own product or the services within its domain. In other words, vertical parallel decentralization is preferred to give market-based units the decision-making power they need to function. This decentralization can also be selective: for example, marketing and manufacturing may be devolved to the divisions, but finance and acquisition maintained at the center.

The important issue in vertical decentralization (either selective, parallel or both) is that of the design of coordinated control systems to ensure that autonomy is well used. Mechanisms are needed to ensure that each unit contributes to high level entrepreneurial goals. Mintzberg (1979) suggests three types of mechanism to ensure coordination i.e. direct supervision, work standardization, and performance control.

Direct supervision means the authorization of major resource commitments by lower level managers, with central intervention if limits are transgressed. Too much direct supervision can however result in illusory decentralization. Work standardization increases the role of analysts, who need to design the work system, and arrangements for monitoring it. (Effectively, this amounts to an element of horizontal decentralization.) From the point of view of middle management, therefore, this form of coordinated control can be viewed (or feared) as a form of centralized control. (Horizontal decentralization will be further discussed later in this Chapter.)

Finally there is the establishment of a performance control mechanism. In this case decentralized units are made self-sufficient with their own specified domain so that their performance can be measured against established standards. Many writers such as Sloan (1954), Chandler (1962), and Khandwalla (1974) have found a link between vertical decentralization and the use of sophisticated performance control system.

2.3.2 Horizontal Decentralization:-

Horizontal decentralization is considered to shift power from managers to non-managers, i.e. from line managers to staff managers such as analysts, support specialists, and operatives (Mintzberg, 1979). According to Mintzberg there are two situations in which horizontal decentralization takes place.

The first of these is when an organization relies for coordination on a system of standardization. In this case decision-making power is delegated to the analysts, whether formally or informally. For example, job designers and work study analysts have more power than operatives, and perhaps even than do production schedulers and planners. The latter categories are confined to deciding what and when to produce, whereas the former are involved in deciding how to produce.

The second case of horizontal decentralization is where an organization depends upon specialists' knowledge. In this case, according to Mintzberg (1979), an organization must put power where its knowledge is, namely with the experts, whether they be in the technostructure, support staff, operating core, or middle line. They do not merely advise; they start participating actively in decision-making.

Mintzberg (1979) identifies three types of decision-making power which experts can accumulate:

1) *Informal expert power* superimposed on a traditional authority structure. For example a maintenance man gives advice to a line manager about making a technical choice which the line manager does not understand.

2) *Expert power merged with formal authority.* This arrangement is required when an organization becomes increasingly dependent upon expert knowledge. In other words, the separation of decision-making from expert advice becomes artificial or impractical. In this situation horizontal decentralization may take place selectively, with the experts having power for some decisions but not for others. This

merging of expert power with formal authority is sometimes expressed by combining line managers and experts into a joint task force to share the power of decision-making.

3) *Expert power with the operatives.* This type of decentralization takes place where operatives themselves are experts - for example in nursing or social work. Decentralization here takes place in both vertical and horizontal dimensions. The organization is vertically decentralized because decision-making power, within the operatives' own areas of work, rests in the hands of the operatives themselves, who are at the bottom of the hierarchy. It is horizontally decentralized because power rests with a large number of non-managers - the professional operatives. The result is that the more professional an organization, the more likely is a decentralized structure in both dimensions.

Hage and Aiken (1967) found in a study of sixteen health and welfare organizations that more highly trained staff tend to participate more in decision-making. In another study, comparing nurses and sanitary staff work, Palumbo (1969) concluded that nurses' work involved specialized skills for which they required a decentralized structure in both vertical and horizontal dimensions to accomplish their professional work.

Horizontal decentralization with power to experts is normally meritocratic in nature rather than democratic. Marschak (1959) called for a democratically decentralized organization having elected managers to take full advantages of decentralization. Mintzberg (1979) also favours democratic decentralization where every member of the organization is given equal rights to elect their managers. However practical examples of such democratic decentralization are largely confined to private clubs etc.

In horizontal decentralization, as we have seen, decision-making power could be either with the analysts, specialists at the operational level, or with every member of the organization to elect their managers. All these forms have different implications - such as operatives losing power to analysts, professionals having control of selective decision-making concerning their own areas, and every one having power by means of electing managers. In all these forms, broadly speaking, there is a common issue involved i.e. the design of systems of coordinated control, as we have discussed in the case of vertical decentralization.

Both vertical and horizontal decentralization depend upon structure. Before deciding to decentralize it is necessary to examine what is the current structural configuration of an organization, to determine whether it is suitable for decentralization, and what would be the form of structure likely to emerge as a result of decentralization.

Mintzberg (1979) describes five structural configurations within which different types of control mechanisms can be exercised. These are simple structure, machine bureaucracy, professional bureaucracy, divisionalized form, and adhocracy. These are briefly discussed below:

1) *Simple structure* normally has little or no technostructure with few support staff, little division of labor, minimum differentiation among its units, and a small managerial hierarchy. Coordination in a simple structure is effected largely by direct supervision. This type of structure tends to be vertically centralized.

2) *Machine bureaucracy* is highly specialized with routine operating tasks, formalized operating and coordinating procedures. This type of structure has a tendency for limited horizontal decentralization.

3) *Professional bureaucracy* relies on the standardization of skills through training and indoctrination. It hires duly trained and indoctrinated specialists or professionals as operatives. Professionals are given considerable control over their own work. This means that professionals work relatively independently but closely with their clients. This type of organization depends upon skills and therefore as we have seen needs both vertical and horizontal decentralization.

In a professional bureaucracy the professionals are not only in control of their work, but they also seek collective control of the administrative decisions that effect them - for example the hiring of colleagues, promotion procedures, and the distribution of resources. Controlling these decisions requires control of the middle line of an organization. A full time administrator who wishes to have any control at all in structures of this kind must be a certified member of the profession, and preferably be elected by the professional operatives or at least appointed with their blessing.

4) *Divisionalization* is most common in the private sector. In this form, divisions are created according to the markets served and are then given control over the operating functions required to serve those markets. This form needs vertical parallel decentralization.

5) *Adhocracy*, the term used by Toffler (1970) refers to the formation of tasks forces to accomplish specialized tasks. In this case a specialized unit within an organization is created and placed under project managers etc. with adequate decision-making power in that particular area. It entails a high level of job specialization based on formal training.

Given knowledge of the existing organizational structure, and knowledge of the kind of skills on which an organization depends, a reformer or reorganizer can suggest whether the existing structure can with advantage be decentralized, and what would be a suitable future structure for the organization. Once this has been decided, the next issue to be handled is that of developing a mechanism for coordinated control.

As already explained coordinated control in each type of decentralization, whether vertical or horizontal, can be exercised through either direct supervision, work standardization, or performance control. Of these, a performance control system is considered by Mintzberg and others to be preferable for decentralized units. However, decentralized units before agreeing to the measurement of their performance require that the area of their operation is clearly defined, that resources are adequately provided, and that an appropriate local information system is available.

Once such an area is defined then change has to take place in a systematic way. Child (1984) suggests that "changes are to take place in a systematic way by modification in procedure, delegation, management style and so forth". In this respect an organization needs not only to identify the areas where change has to take place but must allow sufficient time to facilitate negotiation and adjustment in compliance with the proposed management change.

After the broader issues have been identified and the areas defined, then decentralization has to be implemented step by step. There are some common formal methods to be followed as discussed below.

2.4 Methods to Implement Decentralization

Some of the issues which need to be tackled before implementing decentralization have been considered above in the light of general theories of decentralization. It has also been mentioned that these issues need to be tackled in a systematic way. In this section some of these steps are highlighted in the light of literature and empirical studies elsewhere.

Johns (1973) has the view that the achievement of successful management change without some measure of consultation is quite doubtful. Child (1984) makes similar points, emphasizing in particular the need to give careful attention to issues where conflicting interests are involved. Miles (1965) says that participation helps in achieving compliance. Davis (1969), and Kiesler (1978) have also supported group problem solving to achieve decentralization. Pfeffer (1978) considers the use of external consultants beneficial, because of their impartiality. Consultation, whether internal or external, helps to ensure that everyone understands the reasons behind the change; this understanding is necessary to minimize resistance to the change.

This discussion in the literature on problem of implementing decentralization is based largely on the industrial (private) sector. Decentralization in the social sector is a relatively new idea and there are few examples where decentralization has taken place. Local government units in Britain have however been following a policy of decentralizing personal social services. By and large their process of decentralization has been following a common pattern. There will be more discussion of decentralization of social services in the following Chapters.

2.5 Conclusions:-

The philosophy of decentralization argues that coordinated decentralization is useful especially for those organizations which depend upon skilled knowledge, and operate over a large geographical territory surrounded by an uncertain environment. There are however some issues involved which have to be tackled carefully in a systematic way. Before making an attempt to implement decentralization the organization's existing structure must be analysed so that appropriate control mechanisms can be devised.

Based upon the knowledge of an organization's structure (simple, machine bureaucracy, professional bureaucracy, divisionalized, or adhocracy) a planner can in principle decide which type of decentralization (vertical, horizontal, or combination of both) would be most suitable and what the reorganized structure should be. Once the design of a new organization is decided then the mechanisms for coordinated control have to be developed.

It is clear that a complex, large, organization depending upon professional skills would benefit from a decentralized structure. In this respect the following Chapter examines the relevance of decentralization to the National Health Service (NHS) in Britain.

Chapter Three

Decentralized Planning in the NHS

3.1 Introduction

In Chapter Two the general theories of decentralization were discussed. It was argued broadly that the policy of decentralization benefits those organizations which:

a) are large and complex in structure,

b) depend upon coordination among their parts within the structure, and

c) need coordination with relevant units outside the structure.

The British National Health Service (NHS) is a typical example of a large complex organization with three major components - hospital care, community care, and the family practitioner service (FPS). Within these components there are many interest groups involved: many types of medical and non-medical professionals working in the Health Service, the general public receiving service from it, politicians, and groups of related social and voluntary services etc. Because of this diversity of interests, coordination both inside and outside the formal structure is needed to deliver services effectively. In the NHS a policy of decentralization could therefore prove suitable to achieve coordinated, self-motivated control. This chapter examines the extent to which the policy of decentralization has been followed in the NHS, and its implication for the delivery of services with special attention to community health care.

The NHS in England and Wales came into being on the 5th of July 1948. The aim of the legislation which brought it into being was to promote "the establishment in England and Wales of a comprehensive health service designed to secure improvements in the physical and mental health of the people of England and Wales and the prevention, diagnosis and treatment of illness." The creation of the NHS put responsibility on the state to provide free medical care to its citizens; however some parts of the service were later made subject to charges such as prescription fees. The legislation also established a firm commitment on the part of the government to develop and improve the country's system of health care.

The NHS, since its inception, has been confronted by a number of issues which restricted its ability to deliver appropriate health care. The major issues reported in the literature are:

a) ever increasing demand as compared to resources, and

b) continued inequality in service provision both before and after the establishment of the NHS.

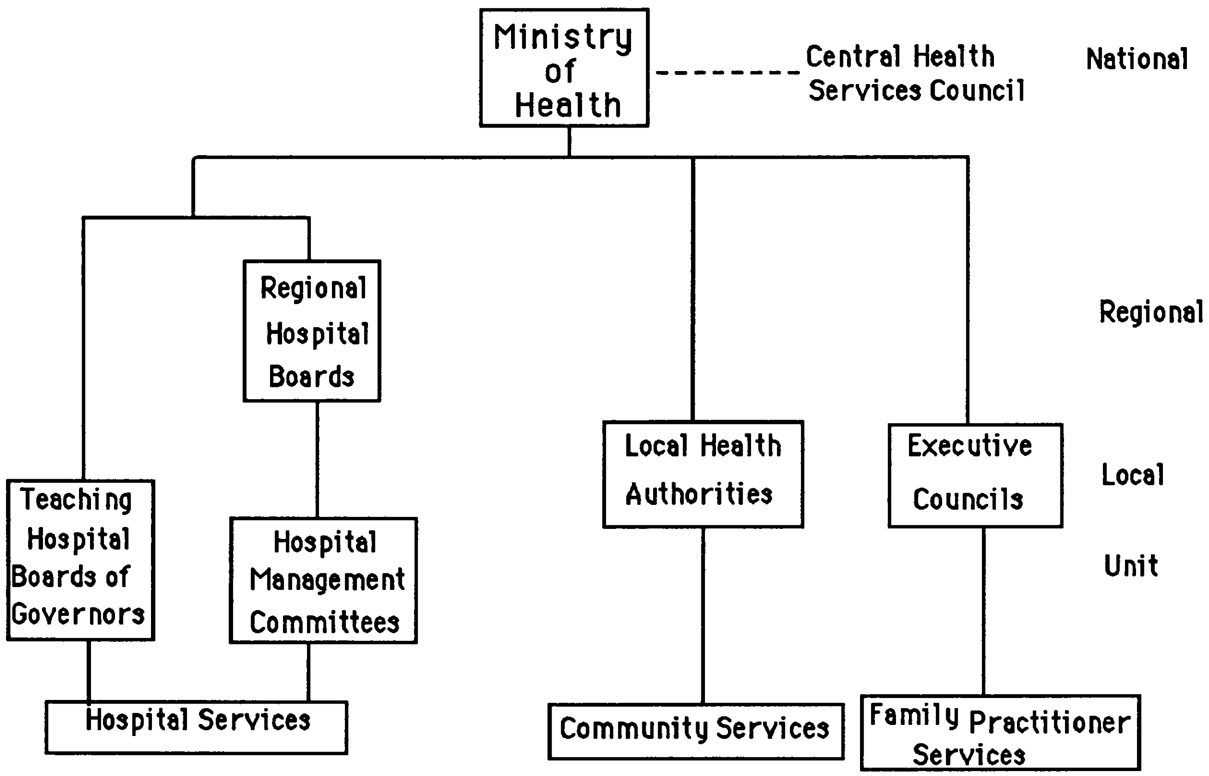
Inequality in service provision is largely attributed to the past and present organizational framework of the NHS, which is seen as biased towards hospital interests. Critics recognize that biased interests have on one hand led to improvements in service for acute in-patient care; however, on the other hand, the needs of the chronically ill and disabled have been neglected through the lack of emphasis on Primary Health Care (PHC). This aspect is examined further in the following section.

3.2 Organizational Framework of the NHS, and PHC

The three principal types of care provided by the NHS are hospital care, community care, and the family practitioner service (FPS). To begin with, hospital care was administered by Regional Hospital Boards. The NHS had at that time 15 Regional Hospital Boards, and under them there were Hospital Management Committees to run the hospitals. Teaching hospitals were under Boards of Governors. General practitioner services were administered by Executive Councils while local health authorities ran the community health service.

These services were organized under a tripartite structure represented in Figure 3.1.

Figure 3.1: The National Health Service 1948-1974



Source: Levitt, 1976

The Minister of Health was made personally responsible to Parliament for the provision of all hospital services on a national basis. The Minister was also responsible for the Public Health Laboratory Service, the blood transfusion service, and research concerned with the prevention, diagnosis and treatment of illness. He had indirect responsibility for the family practitioner and local authority health services.

The local health authorities were the county councils and borough councils. Through their health committees they provided community and environmental health services including mental and child welfare, health visiting, home nursing, vaccination and immunization, care and after-care for mental illness and mentally subnormal patients, and the maintenance of health centres.

Executive Councils were established (usually to match the local health authorities) to administer the family practitioner services. These councils received their finance directly from the Ministry of Health.

During 1948 to 1974 the NHS faced a number of problems. These were due to inherited conflicts among different interest groups together with a fault in the organizational structure. The initial tripartite structure severely inhibited coordination in the functioning of the three components of health care.

In 1956 Sir John Maude (one of the member of the Guillebaud committee) expressed the view that "the NHS having three sets of bodies had no organic connection with each other" (Levitt, 1976). The main consequence was a lack of coordination between preventive care, general practice, and hospital care. This in turn pushed primary care (a combination of community care and general practice) into the background.

The Guillebaud Report (Ministry of Health, 1956) was followed by a number of other consultative documents. All of them sharply criticized the tripartite structure and emphasized the need for a unified health service. The Porritt Report (Medical Services Review Committee, 1962), by the representatives of the medical profession, was the first to suggest a unification of health services. In 1962, Enoch Powell, the Minister of Health, approved the development of district general hospitals for population units of 125,000 people. The Bonham-Carter Report (DHSS, 1969) on the functions of district general hospitals then emphasized the need to plan hospital and community health services jointly.

But the Gillie Report (Ministry of Health, Central Health Services, and Standing Medical Advisory Committee, 1963), Salmon Report (Ministry of Health and Scottish Home and Health Department, 1966) and Cogwheel Report (Ministry of Health, 1967) all recommended the need to recognize different professions in decision-making within the NHS. The Gillie Report rejected unification of administration in favor of much greater efforts in developing the role of general practitioners. It suggested that family doctors alone could effectively coordinate the resources of hospital and community care on behalf of their patients, in relation to individual family and working conditions (Levitt, 1984). The Salmon Report recommended the development of a senior nursing staff structure and an increase in the status of the profession in hospital management. The Cogwheel Report on the other hand proposed specialty groupings that would arrange clinical and administrative medical work more sensibly.

All of the above reports acknowledged the complexity of the organizational framework and the corresponding need for effective management. However, the Gillie, Salmon and Cogwheel Reports can be distinguished from the rest in the way that they recognized the need to establish specialty groups (work constellations in Chapter 2) and to empower them adequately. In this respect these reports provide evidence of the need for decentralization in the NHS along lines which are common for a professional bureaucracy.

Although disillusionment with existing structural arrangements was expressed in the Guillebaud Report in 1956 there were to be no major changes for more than twenty years. In 1967, the Health Minister, Kenneth Robinson, started to examine the administrative structure of the health service. He published the first Green Paper (Ministry of Health, 1968) whose central theme was the unification of health services; this was followed by the Seebohm Report (HMSO, 1968).

The Green Paper of 1968 recommended the unification of health services by area, under a new body called an Area Board. These were to replace Regional Hospital Boards (RHB), Boards of Governors, Hospital Management Committees, and Executive Councils, and take over certain functions previously held by local health authorities.

The Seebohm Report contained suggestions regarding the unification of personal social services, including those administered by local authority departments. The proposals from the Seebohm Report were accepted by the government and implemented through the Social Services Act 1970.

In February 1970 the Health Minister, Richard Crossman, published "The Future Structure of the NHS" known as the Second Green Paper (DHSS, 1970). The Second Green Paper envisaged:

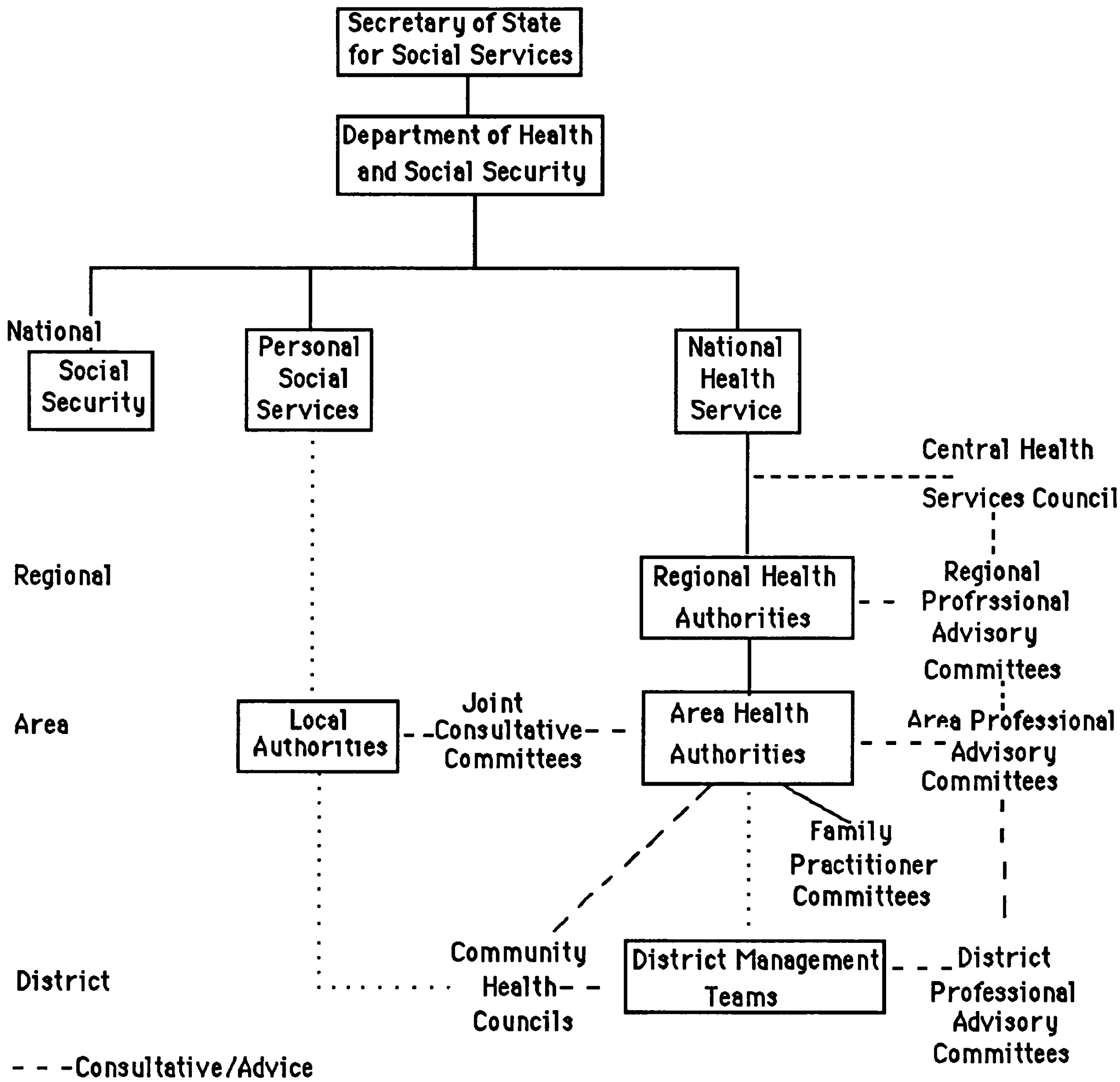
a) the development of new health authorities independent of local government and directly responsible to the central government department,

b) the continuation of public health and personal social services under local governments, and

c) co-terminous boundaries of the new health authorities with those of local governments.

In June 1971, the new Conservative government's Secretary of State, Sir Keith Joseph, issued a Consultative Document (DHSS, 1971), revising the original Green Paper's plan in certain respects. Based on this consultative document and two other studies, by Brunel University's Health Service Organization Research Unit and by McKinsey & Co., a White Paper "National Health Service Reorganization: England" was published in August 1972 (HMSO, 1972). This was followed by the National Health Service Reorganization Bill. This Bill was finally passed on 5th July 1973 to implement changes by 1st April 1974. The new administrative structure as a result of the 1974 reorganization is given at Figure 3.2.

Figure 3.2: The Reorganized National Health Service 1974



- - -Consultative/Advice
· · · · ·Other
———Accountability

Source: Levitt,1976

The reorganized structure shows unification of all the three components of health care under a new tier called Area Health Authority (AHA). Ninety three AHAs were set up in England and Wales. The boundaries of AHAs in most cases were identical with those of the metropolitan districts and non-metropolitan counties established by the Local Government Act

1972. The populations covered by the AHAs ranged from 1/4 million to over one million. AHAs with relatively large population were subdivided into districts. Accordingly there were 34 single-district Areas, 23 Areas divided into 2 districts, 16 into 3 districts, 11 into 4 districts, 3 into 5 districts, and 6 into 6 districts.

AHAs were responsible for planning and providing services. Day-to-day executive responsibilities were delegated to the Area Team of Officers (ATO) in single district Areas, and to the District Management Team (DMT) in other than single districts Areas. The activities handled in the district were the basic services associated with the district hospital, and the community health service previously run by the local authority health department. ATOs had to coordinate the work of DMTs, to advise the AHA on developing area-wide policies, and informing AHA of local needs. In single district Areas there were no DMTs, and ATOs took on the work of DMTs.

Critics indicated that the 1974 reorganization had two major limitations. Firstly, according to Levitt (1976), "the staff working inside the NHS and outside bodies were not in a position to fully understand the thinking behind the change and consequently they were disinclined to make the new system work." Secondly according to Clark and Starky (1988), it did not distribute decision-making power appropriately among its professional groups. We have already mentioned that the Gillie, Salmon and Cogwheel Reports had given identical views, of the need to distribute decision-making power more appropriately among professionals within the NHS, according to their areas of concern.

In Chapter Two, we explained two important principles regarding managerial arrangements:

a) within the organization, work constellations (professional groups) must be identified and adequately empowered to avoid conflicts, and

b) while implementing management change it is necessary to ensure that all the relevant parts understand the reasons behind change.

Unfortunately neither the initial managerial arrangements nor the 1974 reorganization in the NHS appeared to have followed these important principles.

The 1974 reorganization followed the Porritt Report's (Medical Services Review Committee, 1962) recommendations to unify the services. However the resultant structure had an unnecessary tier of management: the Area Health Authorities (AHAs). This structure, according to Levitt (1984), was based on the assumption that the DHSS and RHAs would concentrate on strategic planning, while districts would concentrate on day-to-day operation. The tier of AHAs was inserted to take the combined responsibility of strategic and operational planning. It is important to note that the decade of 1970s was a period when management thinkers and practitioners were widely arguing for a bifurcation of strategic and operational responsibilities to avoid managerial ambiguity. But the NHS reorganization in 1974 followed the opposite policy. The creation of AHAs was assumed to integrate the three components of health care under a unitary command. But, practically it had associated with it

a) managerial ambiguity by amalgamating strategic and operational planning at area level, and

b) lack of accountability below AHAs.

As ATO and DMT officers were on the same managerial level, so ATOs could not give orders to the DMT, nor could the DMT be held accountable for their work. Under such an arrangement it was difficult for AHAs to achieve their objective i.e to integrate the three components of health care under a unitary command.

From study of the theoretical principles of decentralization and structural arrangements (Chapter Two) and their comparison with the underlying practices in the reformed NHS, it emerges that the NHS lacked formal approaches towards both organizational design and the distribution of power. Eventually the 1974 reorganization was seen to have limitations.

The limitations of the 1974 reorganization led to the institution of a Royal Commission in May 1976. The Royal Commission was to consider the interests both of the patients and of those who worked in the NHS, and the best use and management of the financial and manpower resources of the NHS (HMSO, 1979). The Royal Commission mainly identified problems related to the managerial arrangements of the NHS. The commission said that "in the NHS there were too many tiers, too many administrators of all disciplines, a failure to make swift decisions and a consequent waste of money."

Based on the Royal Commission findings, the Government published its views in a consultative paper entitled Patients First (DHSS, 1979), which proposed the delegation of power so that decisions would be made nearer to the patients by setting up District Health Authorities (DHAs) and removing the AHAs. On the basis of Patients First, the second reorganization of the NHS took place in 1982. The DHAs, according to a circular issued in May 1981 (HC(81)6), were made responsible for integrated plans for the provision and development of primary health care and general hospital services.

The 1982 reorganization for the first time recognized the need for the planning of primary care, and made DHAs the responsible bodies. However it did not make any changes in the organizational framework or decision-making processes below DHAs. Clark and Starky (1988) hold that the 1982 reorganization demonstrated the same basic failure as the 1974 reorganization- it did not redistribute power.

Levitt (1984) states that the government, despite the 1982 reorganization, became concerned about ever-escalating costs, which it attributed to the poor quality of management in the NHS. Accordingly, the Secretary of State set up a team led by Sir Roy Griffiths, Managing Director of Sainsbury's, to advise him privately. The Griffiths Report, called "The NHS Management Inquiry" published in 1983, found that in the NHS, at each level of management, there was no one person accountable for action. Decisions were made through consensus management. This in turn caused delay in decision-making.

The Griffiths Report (DHSS, 1983) suggested the appointment of General Managers at unit, district, and regional levels. At the DHSS level the Griffiths Report suggested that the Secretary of State should set up a Health Service Supervisory Board (HSSB) with a Management Board (MB) accountable to it. The HSSB was proposed to formulate polices and the MB to help in implementing those policies. The Griffiths Report was accepted by the government with implementation through Circular HC(84)-13 in 1984.

The Griffiths Report suggests arrangements analogous to those of a divisionalized management structure. We have already mentioned in Chapter Two that a divisionalized structure needs parallel selective decentralization in both vertical and horizontal dimensions. Coordination can be achieved by either direct supervision, work standardization, or performance control. Griffiths is more inclined towards direct supervision. But too much direct supervision restores centralized control as already argued in Chapter Two. In the case of the NHS, a policy of decentralization is needed because of the involvement of many professional groups, and representation of all the three components of health care within the Health Service Supervisory Board and Management Board. The Griffiths Report however does not seem to have spelled out such arrangements. Clark and Starky (1988) also make similar remarks saying that "Griffiths makes the right diagnosis but prescriptions for action are too vague".

The government beside implementing Griffiths general managerial thoughts, subsequently embarked on further changes in the NHS. These changes were published in the White Paper Working for Patients (HMSO, 1989). The White Paper outlined seven key measures to reform the NHS. These measures, and the justifications claimed for them, were:

1) to make the health service more responsive to the needs of patients, as much power and responsibility as possible should be delegated to local level;

2) to stimulate a better service to the patient, hospitals would be able to apply for a new self-governing status as NHS Hospital Trusts;
3) to enable hospitals which best meet the needs and wishes of patients to get the money to do so, the money required to treat patients would be able to cross administrative boundaries;
4) to reduce waiting times and improve the quality of service, to help give individual patients appointment times they can rely on, and to help cut the long hours worked by some juniors doctors, 100 new consultant posts would be created over the following three years;
5) to help the family doctor improve services to patients, large GP practices would be able to apply their own budgets to obtain a defined range of services direct from hospitals;
6) to improve the effectiveness of NHS management, regional, district and family practitioner management bodies would be reduced in size and reformed on business lines, with executive and non-executive directors; and
7) to ensure that all concerned with delivering services to the patient make the best use of the resources available to them, quality of service and value for money would be more rigorously audited.

The government planned to implement these reforms in three main phases between 1989 and 1991. The main idea behind these reforms is to establish an 'internal market' system within the NHS where health authorities and hospitals act as buyers and sellers of services. So far there has been mixed reaction towards the new approach. However there are some interesting aspects of the new structure (from the perspective of this research), such as establishing small size managerial units at every level in the NHS and delegating/decentralizing decision-making power as much as possible. These are the main themes of effective decentralization as mentioned in Chapter Two.

Previously there has not been such a substantial attempt in the NHS to implement effective decentralization. We have argued in the light of the literature that due to faulty managerial principles in the past, hospital care has dominated over primary care. One of the repercussions of the dominance of hospital care is the inadequate organization of primary health care. The overall attitude towards primary health care is now changing. Primary health care is recognized as a backup service for hospital care. It has the potential to save resources without diminishing patient service. NHS resources are already under enormous pressure. Resources allocation and use is influenced by managerial arrangements, the appropriateness of which can have a significant impact on the delivery of different types of services. In the following section we concentrate on the impact of the resource allocation process on the delivery of various services in the NHS.

3.3 Resource Allocation in the NHS

Until the 1974 reorganization, NHS expenditure covered hospital care, general medical services, pharmaceutical services, dental services, ophthalmic services etc. Community health care services were paid for out of the local authority rates and exchequer rate support grants.

The allocation of resources within the NHS was based on a historical incremental system. That system had incorporated a great disparity among regions as well as among services. In 1972 the British government in its White Paper on reorganization announced that "the allocation of available funds to health authorities will be designed to reduce progressively the disparities between the resources available to different regions, and to achieve standards and improvements in services with due regard to national, regional, and area priorities."

To achieve this a Resource Allocation Working Party (RAWP) was appointed in 1975 with the following term of reference:

> "To review the arrangements for distributing NHS capital and revenue to RHAs, AHAs [now abolished], and Districts respectively with a view to establishing a method of securing, as soon as practicable, a pattern of distribution responsive objectively, equitably and efficiently to relative need and to make recommendations" (DHSS, 1976).

The Working Party however concerned itself only with the distribution of financial resources among regions. Allocation of resources to particular services was entirely left to local planning and decision-making within the framework of national and regional guidelines. This approach, although it helped to make substantial progress towards achieving equity among regions, did not affect the inequality between districts or between services. The implication of resource allocation on geographical equity, and on the delivery of services is examined below.

3.4 Resource Allocation and Geographical Equity

The Working Party stated in its report (1976) that "the methods used to distribute financial resources to the NHS have, since its inception, tended to reflect the inertia built into the system by history. They have tended to increment the historic basis for the supply of real resources (eg facilities and manpower); and by responding comparatively slowly and marginally to changes in demography and morbidity, have also tended to perpetuate the historic situation". To move the NHS resource allocation process from a historical incremental system to a rational approach, the Working Party devised a mechanism to move towards equal opportunity of access to health care for people at equal risk.

In making a recommendation to re-distribute financial resources, the Working Party developed criteria of relative need which were supported by readily available and reliable statistical data, and were as simple as possible. The approaches adopted for revenue and capital expenditures were similar. We will therefore concentrate on allocation of revenue expenditures in this Chapter.

The need criterion for revenue expenditure is based on the size of population weighted by service use, and by mortality as a proxy for morbidity. The RAWP formula expresses this need criterion in terms of weighted populations for the provision of seven types of services (non-psychiatric in-patient, out-patients, mental illness in-patients, mental handicap in-patients, community services, ambulance services, and family practitioner committee

(FPC) administrative services) for each region. These weighted populations are then combined together to derive a target share of health service expenditure to be allocated to each Regional Health Authority (RHA).

In arriving at weighted populations for the various regions, the Working Party faced an overwhelming problem: the lack of objective and reliable figures indicating the need of the population for health care. There was a considerable range of statistics collected on the usage of NHS facilities; however there were no generally acceptable figures available on morbidity. The possibility of using General Household Survey figures was considered but rejected as insufficiently reliable because of a) self-reported illness, and b) being based on a very small sample.

Instead of using data from these sources, the Working Party used the Standardized Mortality Ratio (SMR) as a proxy for morbidity. The SMR for any population group is calculated by dividing the actual number of deaths suffered by the group in a year, by the number of deaths that would be expected in that group if the national death rates were to prevail. An SMR value of above 1 indicates that there are more deaths in the area than expected.

The mathematical expression of the original RAWP formula (subsequently revised in 1988 and further simplified in 1989) for producing weighted populations is given below:-

$$WP_r = P_n * A_r / \Sigma_r A_r \qquad (3.1)$$

where

$$A_r = \Sigma_c \Sigma_k \Sigma_s RP_{ks} * (NB_{cks} / NP_{ks}) * SMR_{cs} \qquad (3.2)$$

and

WP_r represents weighted regional population

P_n represents estimated national population

RP_{ks} represents estimated regional population of age k and sex s

NB_{cks} represents national average number of daily occupied beds in condition c, of age k and sex s in the base year

NP_{ks} represents national population in age k and sex s in the base year

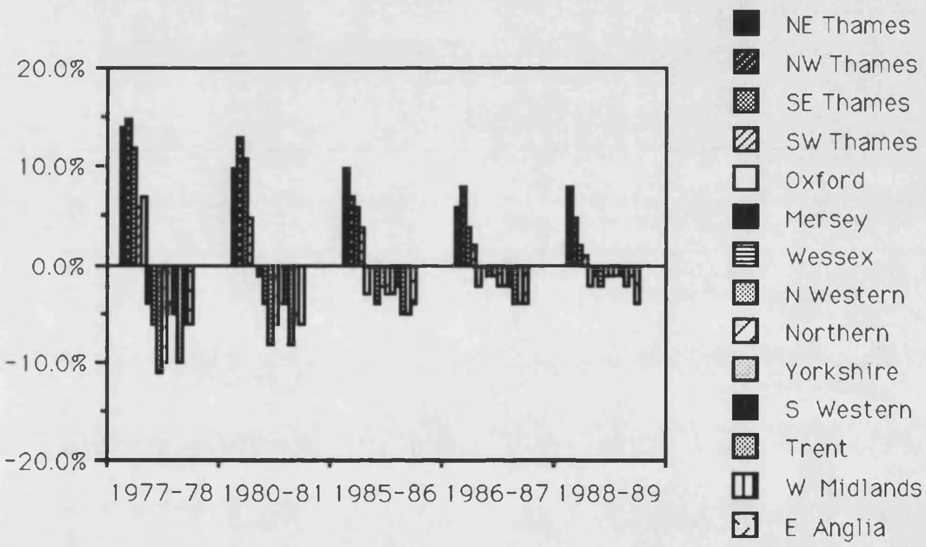
SMR_{cs} represents standardized mortality ratio for condition c, sex s

Relationship (3.2) expresses the summation of regional population over age, sex and condition multiplied by service use rate and SMR. It gives a measure of the expected need for service in each region. The first equation is then a multiplication of the national population forecast by the rate of need for service in each region expressed as a fraction of the total need for service, to derive the region's weighted population.

This weighted population calculated from expression (3.1) is then adjusted to take account of inter-regional flows of patients. Each region's weighted population is reduced or increased depending upon whether the region is a net importer or exporter of patients. If appropriate, the population is adjusted for London weighting of staff salaries. After all these adjustments the nationally available revenue is then distributed in proportion to each region's weighted population to arrive at a revenue target allocation for each RHA. This is augmented by a further sum to cover the existing costs of teaching hospitals-the Service Increment for Teaching (SIFT).

The target revenue allocation arrived at by the RAWP formula is compared with the revenue actually allocated to each RHA in the previous year to find how far each RHA is from achieving its target. Figure 3.3 shows the distance from target expressed as a percentage of each region's allocation from 1977-78 through 1988-89. It can be seen that over time there has been substantial progress in moving regions towards their targets.

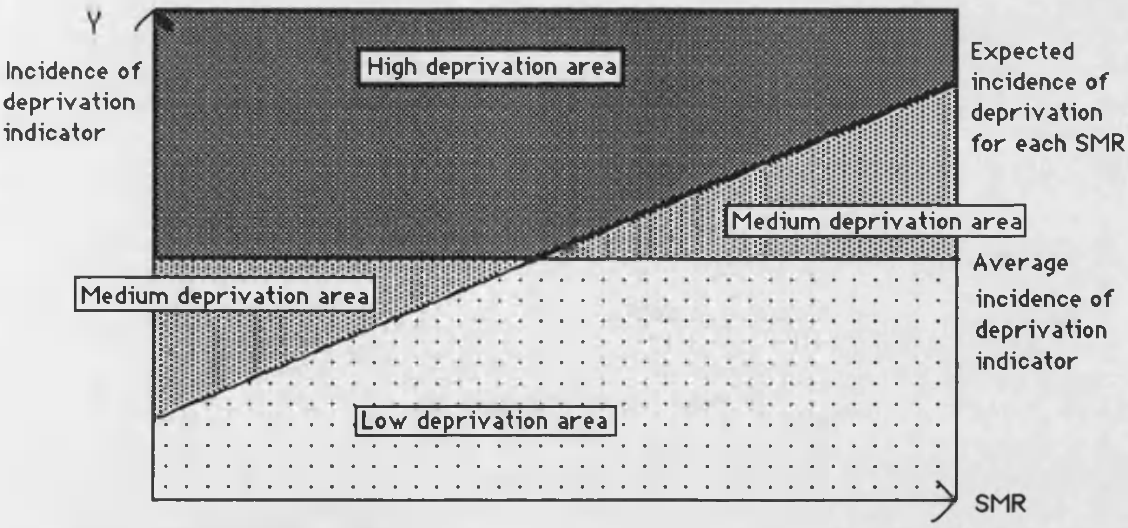
Figure 3.3: Distance from target allocation from 1977/78 through 1988/89



The RAWP Working Party also recommended that the process for assessing target allocations to regions should be used at sub-regional level. Accordingly a Joint Working Group was appointed by the Thames Regions and the DHSS to agree on a method of assessing sub-regional target allocations. The working group recommended that sub-regional allocations should be based upon a population weighted in a fashion similar to that in the RAWP Report, with the addition of a 'deprivation factor'.

Health authorities were classified by the joint working group as high, medium, or low in social deprivation, according to their assessed scores on three indicators. These indicators were; a) the percentage of New Commonwealth immigrants; b) the percentage of households lacking basic amenities; and c) the percentage of pensioners living alone (Wiles, 1984). The joint working group sought to identify those health authorities where an abnormally high or low incidence of each indicator of deprivation was not reflected in the SMR, and thus where an allocation weighted only by SMRs was inadequate. This was done as shown graphically in Figure 3.4.

Figure 3.4: Health authorities calssification



Source: Wiles, 1984

In Figure 3.4 the x-axis represents the SMR and the y-axis represents the incidence of deprivation factor. Each health authority was plotted on this graph. One line was drawn to represent the average incidence of deprivation factor, another line to represent the expected incidence of deprivation corresponding to each SMR. Those areas which were above both lines were classified as being of high deprivation, those which were below both lines were classified as being of low deprivation, and those which fell between were classified as being of medium deprivation.

The joint working group recommended that the weighted population of high deprivation areas should be increased by 5% and that of medium deprivation areas by 3%. Recommendations were also made to change the mechanism which allow for adjustments with respect to differential local costs, regional and supra-regional services, cross-boundary patient flows, and teaching hospital costs in distributing resources among districts.

The responses of Thames RHAs to the joint working group's recommendations varied (Wiles, 1984). For example the South East Thames RHA considered that the joint working group's system for calculating the deprivation factor was unsatisfactory and therefore resolved not to make any special allowance for deprivation. It decided to exempt resourcing for service for mentally handicapped people from the RAWP process, and instead to determine funding on the basis of the Region's plan. The South West and North West Thames RHAs, on the other hand, used sub-regional allocation systems based on the recommendations of the joint working group. However from the financial year 1985/86 onward, both abandoned the formal use of the sub-regional RAWP formula, and instead allowed the allocation of resources to be determined by the Regional Strategic Plan. However this itself is developed in the light of the RAWP recommendations.

The North East Thames Regional Health Authority (NETRHA) initially developed a system broadly in line with that recommended by the joint working group. However, its inpatient census held in Autumn 1981 revealed that certain categories of people such as elderly living alone, and semi-skilled and unskilled manual labourers were much more likely to be hospitalized than others. In calculating sub-regional RAWP targets for 1984/85 the RHA therefore changed the criteria for weighting populations. The new criteria allowed for an additional usage of hospital beds in an area where the population contains a high proportion of people in the 'lower' social classes. The proportion of people living on their own was however not used, on the grounds that this in part reflects the age and sex structure of the population, which was already used in the weighting process.

The RAWP formula encountered difficulties at sub-regional level, as is evident by the variations in the Thames Regions' approaches to measuring need. Similarly in the global distribution of the NHS revenue expenditure, the RAWP method also attracted sharp criticism. One criticized aspect was the use of a full age band SMR while ignoring social deprivation. The use of full age band SMR takes resources away from regions where there are a high proportion of premature deaths to regions having residential care or nursing homes for elderly. There were also arguments that errors may occur due to use in the original formula of condition-specific SMRs, as in certain conditions such as bronchitis, asthma etc. death statistics may be low but the use of health services by people with such conditions is often very high.

Likewise there were strong arguments that social deprivation also influences the pattern of service use. Ignoring the social deprivation factor is likely to deprive those regions where populations are already underprivileged. (A number of indicators of social deprivation have been developed, largely based on census data. This will be further discussed in Chapter Five.) In view of such limitations the NHS Management Board was asked in December 1985 to review the operation of the RAWP formula to find improved ways in which the relative geographic need for hospital and community health care could be measured.

The Management Board in its report (DHSS, 1988) made recommendations for changes in the methods of measuring need. The most important among them are:

a) to use SMR under 75 years of age instead of full age band.

b) to use SMR with an elasticity of 0.44, subsequently adjusted to be 0.5 for simplicity (Mays, 1989). In the original RAWP formula a 1:1 relationship between mortality and need is assumed. The analysis carried out by a consultancy team, consisting of Coopers and Lybrand in association with medical geographers from Queen Mary College, London and Professor Brian Jarman of St Mary's Hospital Medical School (DHSS, 1987), concluded that the current 1:1 SMR / need relationship used in the RAWP formula appeared to be excessive and should be a half or less. The new relationship indicates that needs increase at a diminishing rate with increase in SMR (Mays, 1989).

c) to drop disaggregation of SMR by condition, and

d) to incorporate a social deprivation factor (see Chapter Five).

The method of deriving each region's weighted population in the original formula, as given in equation (3.1), remained unchanged. However a change in the method of estimating need in the original formula (see equation (3.2)) was recommended. The new relation is given at equation (3.3).

$$A_r = \Sigma_k \Sigma_s \; RP_{ks} * (NB_{ks}/NP_{ks}) * SMR_r^a < 75 * U_r \ldots\ldots\ldots\ldots\ldots (3.3)$$

where

NB_{ks} represents national average number of daily occupied beds in age k and sex s,

$SMR_r^a<75$ represents standardized mortality ratio under 75 years of age in region r employed with an elasticity 'a', and

U_r represents the social deprivation factor in region r.

All the other variables are as previously defined.

The revised formula given in equation (3.3) derives expected service need for each region. It expresses the summation of the regional population over age and sex multiplied by service use rate, SMR under 75 years of age (with an elasticity 'a'), and a social deprivation factor U_r. Thus revised 1988 RAWP formula does take into account premature deaths and social deprivation. However the government almost at once introduced a new system for funding Regions and Districts in its White Paper Working for Patients (HMSO, 1989). According to these revised arrangements, from April 1990 allocations were to be based on each Region's resident population. Regions were to pay each other directly, and therefore more quickly and in full, for the work they do for other Regions' cross-boundary flows. Under the new arrangements the government has arranged that the Thames Regions will receive a slightly higher level of funding than the rest- some three percent higher per head of population- to reflect the higher costs of and demands on service in the capital in particular.

Although the new arrangements replace the use of the RAWP formula, the government has made it clear that the principle of an equitable geographical distribution of financial resources will be retained (Mays, 1989). According to the revised arrangements both RHAs and DHAs will be funded on a capitation basis. The government has also stated in the White Paper that the RAWP system has proved a useful method of producing a more appropriate distribution of resources nationally. The government has applied it over the years to such effect that the major differences have gone and it is no longer necessary.

The RAWP system can be seen as an attempt to secure a more rational approach to the allocation of health service resources. The emphasis of the new, market-based system now being introduced is ensuring greater efficiency in the use of resources. One way of achieving a cost effective health care service is to strengthen primary health care. According to Wiles (1984), in the Thames Regions a high proportion of expenditure goes to out-patient services (11.6% as against 10.2% for England as a whole). This is considered to be due to inadequate primary health care.

The inadequacy of primary health care was also acknowledged by the government in its White Paper Promoting Better Health (HMSO, 1987). In this the government declared a policy designed to make primary health care efficient, effective, and flexible. The most important aspect of this policy was the coordination of interrelated agencies for increased uptake of services. To incorporate this characteristic into the organization of primary health care, there has been a trend in the NHS to deliver primary health care on a more decentralized basis. In the following section the idea of decentralization in primary health care is further examined.

3.5 Decentralization of Primary Health Care

Primary health care broadly speaking includes three elements of service-Family Practitioner Service (FPS), community health care, and personal social services. FPS is provided in the community by family doctors, dentists, pharmacists, and opticians. These services are organized under Family Practitioner Committees (FPC). District Health Authorities provide community health care which includes community nurses, health visitors, school nurses, midwives, and other allied professions. Health-related social services such as residential care for the elderly mentally ill etc. are provided by Local Authority personal social services.

At present there exists little organizational framework to encourage coordination among the range of primary health care services, or with outside non-statutory organizations. The 1974 reorganization attempted to establish a system of coordination between health and personal social services by creating Joint Consultative Committees (JCCs). These committees, within each Area, were comprised of members of county councils and health authorities. In 1977 the DHSS via its circular HC(77)17 required health and local authorities, with the advice of JCCs, to set up Joint Care Planning Team (JCPTs). JCPTs were to be made up of officers of the respective authorities and were to include, wherever appropriate, officers from housing, social and health services. JCPTs were to advise JCCs who in turn would make proposals to their constituent authorities.

To help local authorities to provide social services to keep patients in the community rather than in the hospital, a system of joint funding was also established in 1976. The joint funding system allowed health authorities to fund developments in social service departments on the understanding that the cost would gradually be transferred. The system for both joint funding and joint planning have been widely criticized.

Joint financing was criticized because in most places the money was used primarily to cushion local authority cuts. Joint planning needed information to do its work effectively, but information in a useful form was generally unavailable (Levitt, 1984). This made coordinated planning slow and time consuming, and restricted joint financing operations. To tackle these problems and to establish coordination between interrelated parts of primary health care, the government committed itself through the 1987 White Paper Promoting Better Health (HMSO, 1987) to the development of primary health care teams. The White Paper states that patients can benefit from the sharing of tasks between family doctors and other members of the primary health care system. For example, trained nurses can provide vaccination and immunization and screening services, chiropodists can help elderly people to remain mobile, and physiotherapists can help patients with their disabilities.

The House of Commons Social Services Committee's 1987 Report on Primary Health Care (HMSO, 1987) even suggested that some social workers might work from the same premises as family doctors.

The government's commitment to continue its efforts to develop integrated and coordinated primary health care teams was in line with those ideas already surfaced in a number of studies on the subject. The Green Paper on primary health care (HMSO, 1986) , the Cumberlege Report on community nursing (DHSS, 1986), and the House of Commons Social Services Committee's 1987 Report on Primary Health Care (HMSO, 1987) all expressed the need to change the pattern of delivery of primary health care to make it responsive to local needs.

The 1987 White Paper enunciated the following objectives for the future development of primary health care:

1) to make services more responsive to the need of customers,

2) to raise the standards of care,

3) to promote health and prevent illness,

4) to give patients the widest range of choice in obtaining high quality PHC,

5) to improve value for money, and

6) to enable clear priorities to be set for FPS in relation to the rest of the health service.

This policy has contributed to the trend in Britain towards the provision of community health services on a decentralized localized basis. There are however considerable differences in the approaches to decentralized planning adopted by different DHAs, as well as in the extent to which services are being decentralized. For some DHAs it is merely a decentralization of services and for some it is a real devolution of service planning and delivery (Taket and Curtis, 1989). These various approaches are examined below.

3.6 Approaches to Decentralization in Community Health Care

It has already been mentioned that the term Primary Health Care covers the whole range of health and health-related services provided outside hospitals. For the sake of brevity we will concentrate on the delivery of community health care provided by the NHS.

We may distinguish between the conceptual and operational aspects of the decentralization of community health. The conceptual aspect revolves around two alternative schemes, those of decentralization on the basis of locality planning, and of decentralization on the basis of a neighbourhood nursing service (NNS). The operational aspect concerns the extent to which services are decentralized and how.

The concept of a neighbourhood nursing service originates from the Cumberlege Report (DHSS, 1986). The NNS aims to bring district nurses, health visitors, and school nurses together on a team basis. It requires each DHA to identify neighbourhoods for the purpose of planning, organizing and providing nursing and related primary care services. Each neighbourhood is expected to have a population of between 10,000 and 25,000.

Local authorities had, in most places, already decentralized their services into neighbourhoods. Cumberlege therefore recommended that neighbourhood nursing services be provided within the same boundaries. Each NNS should be headed by a manager chosen from within the profession, having both managerial and clinical skills.

Locality planning on the other hand is a relatively well established concept which derives from the World Health Organization's 'global strategy for health for all by the year 2000' (WHO, 1981) and its strategy for the European Region (WHO, 1985). Locality planning aims to provide community health services to comparatively larger geographical areas called localities or patches, rather than to neighbourhoods. Localities are to be made up of one or two local authority neighbourhoods, so that collaboration between the health authority and local authority is made as easy as possible.

The purpose of locality planning is to provide a community health care service that is more appropriate and accessible to the local population, to facilitate a team approach in providing primary care services, and to increase collaboration between all those concerned with the provision of these services. Locality planning is based on four key ideas:

1) integration of services to facilitate and encourage better communication within and between staff groups through a closer alignment of catchment areas;

2) collaboration with complementary and non-statutory services through local information resources;

3) the encouragement of flexibility and innovation by increased decentralization and effective working arrangements to meet the specific needs of local planning; and

4) the increased uptake of appropriate services by means of improving professionals' knowledge of the services available.

Each of the above areas needs to be accommodated in the evolution of a desirable management change.

Neighbourhood nursing and locality planning both aim to provide decentralized services, for coordination with other services within the community. However they have different strengths. Neighbourhood nursing establishes a compact self-contained managerial unit within the nursing profession where it is easier to establish the accountability of an individual manager. On the other hand, it gives a high profile to community nurses which may in turn make coordination and collaboration difficult with other staff groups concerned with the provision of primary health care, such as midwives, physiotherapists, speech therapists, learning difficulties staff etc.

Locality planning, by contrast, has a wider basis. It requires a multi-disciplinary approach as it tends to involve all groups of services in community health care planning. The role of locality managers as coordinators may in turn dilute accountability. However mechanisms are available (see Chapter Two) to resolve this situation, either by appointing project managers with the blessing of all the professions concerned or (in principle, at least) by democratically electing managers, depending upon the nature and local circumstances of an organization.

The operational aspect of the reorganization of community health care includes the decentralization of management, budgets, service delivery, planning, and information gathering. An investigation by the King's Fund

Primary Health Care Group (Newsletter, 1987) revealed plans to decentralize community health services which proved to have considerable diversity across health districts.

The King's Fund questionnaire was circulated at the beginning of September 1987 to all health districts. A strikingly high total of 161 health districts (out of 190) participated in the survey by replying to the questionnaire. Of these responding districts 140 had plans to decentralize their community health services either on the basis of NNS teams or localities. Out of these 140 districts, 108 intended to appoint locality managers. Of these 108 districts, 54% favoured having locality managers who both managerial as well as clinical skills i.e. generic managers, while in the remainder locality managers would not necessarily be generic.

The survey not only found diversity of managerial arrangements but also that the districts were divided over the decentralization of managerial functions. The survey asked which of five managerial functions (management, budgets, service delivery, planning, and information gathering) it was intended to decentralize. Of the 140 decentralizing districts, 36% stated they intend to decentralize all of the five functions, 27% four functions, 20% three, 11% two, and 5% only one.

From the survey report it is obvious that the term decentralization means different things to different districts. This diversity in the process of decentralization is in line with theory - that the model of decentralization needs to respond to local circumstances. It is therefore necessary to concentrate on a single district health authority and develop rational methods to show how resources may be allocated in decentralized planning.

3.7 Conclusions

In this Chapter we have shown that the structural and resource allocation mechanisms in the NHS have considerable conceptual gaps as compared to the mechanisms described in Chapter Two. The essential principles of organizational structure argue that decision-making power must be distributed to the level where the knowledge and skill of an organization lies.

Clark and Starky, Cumberlege, Gillie, Salmon, and Cogwheel have all argued for the need to redistribute decision-making power in the NHS appropriately among all professions rather than vesting it in a few hands. The lack of distribution of adequate decision-making power among professionals has allowed hospital care to dominate over primary health care. This fact was also noted by the Griffiths Report on community care which recommended that "central government should ensure that there is a Minister of State in DHSS, seen by the public as being clearly responsible for community care" (HMSO, 1988).

Community health care in the past not only suffered because of lack of attention to the organizational framework, but also because of inadequate resourcing. Currently there does not appear to be any technique developed by the NHS to allocate resources for community health care based on the needs of local populations. Nor has any mechanism been devised to distribute resources between localities emerging as a result of decentralization. To achieve decentralization there are several issues to be resolved and corresponding mechanisms to be developed.

To implement decentralization, districts are following different approaches, influenced by particular local circumstances. We will therefore concentrate on the process of decentralization of community health care in one district, Tower Hamlets District Health Authority (THDHA). The purpose of this research is to show the feasibility of rational planning methods in decentralized resource allocation. The following chapter concentrates on the background to decentralization in THDHA, and develops population profiles to be used for a Geographical Information System (GIS), as well as for 'need' forecasting for the district nursing service.

Chapter Four

Methods for Localized Planning: Tower Hamlets Background and Developments

4.1 Introduction

This Chapter examines the process of implementing decentralized or localized planning for community health care in Tower Hamlets, and describes methods to tackle some of the issues in implementing decentralization. The broad aim of pursuing a policy of decentralization in Tower Hamlets is to achieve a more efficient and effective use of scarce resources (Taket and Curtis, 1989).

Tower Hamlets District Health Authority (THDHA) is one of the sixteen health authorities within the administrative boundary of NETRHA. Tower Hamlets is an inner city district with a high population density varying from 26.39 to 140.4 people per hectare among its nineteen wards (Census 1981). In 1986 the national population density per hectare was 2.36, in England and Wales 3.3, and in London as a whole the population density per hectare was 43.10 (Annual Abstract of Statistics, 1988 and Regional Trends, 1989). According to the Office of Population Census and Surveys (OPCS) 145,200 people lived in Tower Hamlets in 1981; according to the London Research Center's (LRC) estimate, this will increase to 159,940 in 1991, an increase of 10.3%. By comparison the estimated population growth in the UK is 1.26%, in England and Wales 1.35%, and in London 1.54% (Central Statistical Office(CSO), 1989). The higher population growth rate in Tower Hamlets is partially due to a high crude birth rate, which was recorded as 19.0 live births per thousand residents in 1986 (national crude birth rate 13.3, London rate 14.6 according to CSO, 1989) and partially due to recent developments in the Docklands area.

The health condition of Tower Hamlets people is generally poor. In 1987 the percentage of children born with a birth weight below 2500 grams was 9.2% as compared with 7.2% in England and Wales (Tower Hamlets DHA, 1989). Similarly the infant mortality rate (IMR), defined as deaths per thousand live births, in Tower Hamlets at 10.6 was higher than the UK of 9.0, England and Wales 8.4 and London 8.7 in 1988 (CSO, 1990 and Tower Hamlets DHA, 1989). An SMR of 1.13 in Tower Hamlets in 1988 is considerably higher than London's SMR 0.98 and that for England and Wales at 0.99 (CSO, 1990). The general fertility rate, defined as the number of births per thousand females aged between 14 and 44, is 92.4 as compared with the national rate of 63, and London's of 63 in 1988 (CSO, 1990). All these conditions add to the pressure on health care resources in Tower Hamlets.

The district's population has a high proportion of ethnic minority groups, especially those from the Indian sub-continent. This is shown in Table 4.1 for the year 1981.

Table 4.1: Country of birth of all residents in Tower Hamlets

Ethnic origins	Population in %
England, Wales, Scotland, and Northern Ireland	81.10
India, Pakistan, and Bangladesh	8.20
Other Commonwealth countries	2.40
Caribbean	2.50
Republic of Ireland	2.30
Mediterranean	1.30
Asian	1.10
European	1.00
Others	0.10

Source: Tower Hamlets Local Authority

Ethnic groups are not evenly distributed throughout the district. The proportion of ethnic minority groups among the Tower Hamlets electoral wards varied from 9.60% to 60.23%. The high concentration of ethnic minorities, and other factors such as age structure, housing amenities, and the socio-economic conditions of the population, influence the use of health resources (Tower Hamlets Health Inquiry, 1987). In Tower Hamlets, according to the LRC's 1986 estimates by ward, the proportion of the population under five varied from 5% to 15% (1986 national estimate 6.3%), the proportion of elderly varied from 5% to 15% (1986 national estimates 15.3%), the proportion of houses lacking amenities varied from 5% to 30% (1981 national estimates; 1.9% without fixed bath, 2.7% without an internal water closet, and 0.3% without either an internal or external water closet), and unemployment varied from 10% to 40% (1986 national estimates 11.1%). The proportion of overcrowded households varied from 10% to 55%.

Since OPCS does not produce ward-based population estimates we have relied on LRC's estimates for the Tower Hamlets population. These statistics depict a comparatively poor socio-demographic structure in Tower Hamlets. Ward-specific figures on the socio-demographic profile of Tower Hamlets were organized as part of a district information system, in the form of a series of maps (Tower Hamlets DHA, 1988) This work is described in more detail in section 4.3.

In view of the comparatively poor socio-demographic structure there is substantial pressure on health resources in Tower Hamlets. To enable the delivery of community health care to cater better for local community needs, Tower Hamlets DHA is following a policy of decentralization. The background to the decentralization of community health care in Tower Hamlets is described below.

4.2 Background

The process of decentralization in Tower Hamlets began during 1985/86 with an emphasis on integration, collaboration, flexibility, innovation, and the uptake of appropriate services. These concepts, as already explained in Chapter Three, are the main characteristics of the decentralization of community health care. In this Chapter we are concerned with the tools to make these concepts operational.

To achieve decentralization, it was decided to organize a community health care service on the basis of geographical areas smaller than the district.

So a primary issue was to define clearly the basic management units and their geographical boundaries, within which to plan the delivery of an appropriate decentralized service.

These management units may be based either on neighbourhoods or localities (as explained in Chapter Three). In Tower Hamlets, the basic management units are intended to be based on localities to represent more or less homogenous communities. Each locality is intended to have an overall manager for coordination and facilitation of the team approach in the delivery of service.

We have argued in Chapter Two that for decentralized units integrated with other related parts of the PHC, the centralist organizational structure has to be dismantled into self-sufficient autonomous segments. In this respect the geographical sub-division of the community health service in Tower Hamlets is following both the theory and the practice of decentralization as applied elsewhere. For example, to implement decentralization in Du-Pont, General Motors, Jersey Standard, and Sears Ltd., their centralist structure was dismantled into integrated, autonomous divisions (Chandler, 1962). A similar approach is evident in local government in England and Wales. Many local authorities, for instance Camden, Hackney, Haringey, Islington, Lambeth and Lewisham in the London Metropolitan Area, have decentralized their personal social services in this way (Gregory, 1985). Outside metropolitan London, Walsall and Birmingham have also decentralized social services. All these local authorities sub-divided their service delivery to an area or neighborhood level (Mainwaring, 1988).

After deciding upon the sub-division of the previously centralist structure, the next question is how sub-division is to take place and what is to be the sizes of the sub-divided units.

In Tower Hamlets the work to achieve decentralization had already started before we began in 1988 to develop methods of tackling some of the issues involved. Before describing our work, we first concentrate on the initial exercises that had taken place in Tower Hamlets towards implementing decentralization.

To achieve decentralization in Tower Hamlets, initially, a draft strategy for implementation was prepared and the geographical boundaries of localities were defined. These are briefly discussed below.

4.3 Draft Strategy for Implementation

A strategy for the implementation of decentralization in Tower Hamlets was drafted in 1987. According to the draft strategy the task of implementing decentralization was to take place through a series of discussions and consultations among the various staff groups. The strategy for implementation envisaged a phased programme starting with a pilot programme to be carried out in one or two localities. The health authority also outlined some of the issues to be tackled before any pilot project was to take place. The major issues outlined were defining the boundaries of localities, preparing an information system, and developing a resource allocation mechanism.

4.4 Definition of Locality Boundaries

The boundaries of localities were defined initially by an inter-disciplinary working group, which included health authority staff, workers from the primary health care development project within the district, and academics from the Queen Mary and Westfield College (QMW) (Malin, 1987 cited in Taket and Curtis, 1989).

The working group carried out a detailed examination of the factors which affect the choice of appropriate boundaries. The group identified a set of four "super-patches" (later called localities) - North East, North West, South East, and South West - which were further sub-divided into a set of patches. (Later this sub-division was abandoned). The initial boundaries of super-patches are shown in Figure 4.1. These super-patches were intended to represent basic management units for the delivery of community health care, so that the provision of all major services would take place from sites within the super-patch boundary.

In defining super-patches the major factors considered were:

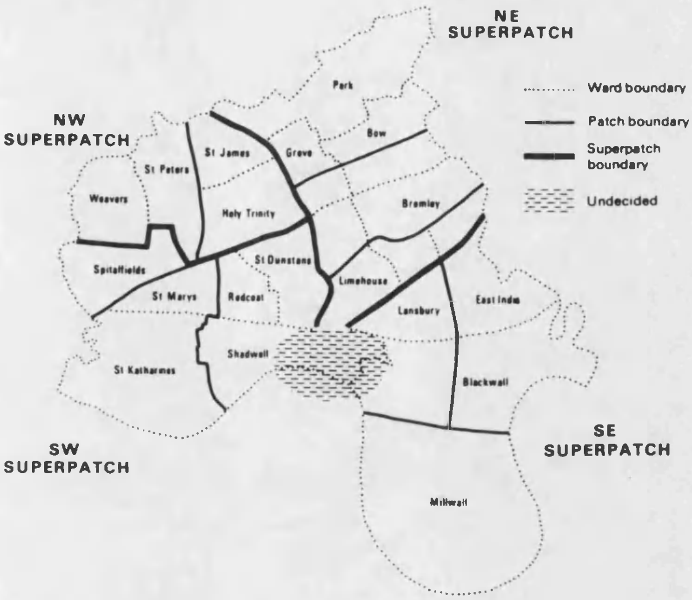
(a) natural communities where people live, work and socialize together,

(b) the transportation network (for ease of access),

(c) the pattern and catchment area of health service professionals, and

(d) boundaries provided by post code and census enumeration districts.

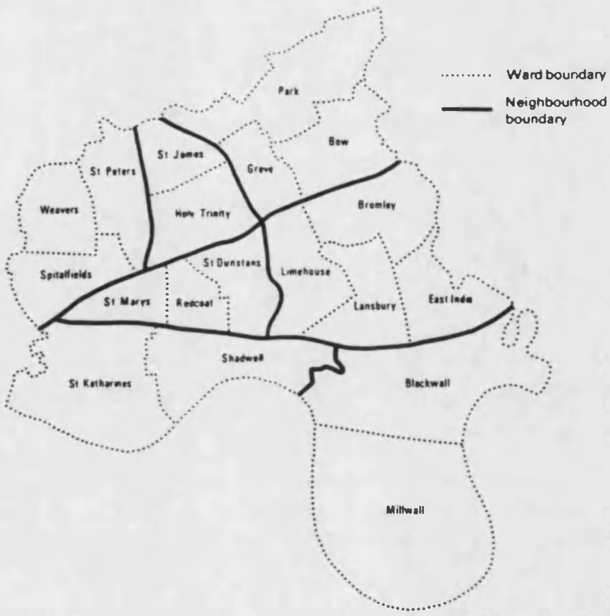
Figure 4.1: Locality boundaries proposed initially for Tower Hamlets



Care was taken to minimize cutting across ward boundaries. However in the case of both the North East and South East super-patches, there were areas in which patches cut ward boundaries, as may be seen from Figure 4.1. This was a result of an initial decision to follow distinct geographical boundaries such as canals and railways line. In all cases however the patches respected the census enumeration district boundaries.

While the task of considering the boundaries of the localities was out for consultation, the Tower Hamlets Local Authority adopted a policy of decentralization of its personal social services. In deciding boundaries for decentralized units, the local council decided to respect the old London borough boundaries (Taket and Curtis, 1989). These existed prior to the creation of Tower Hamlets. This policy resulted in a decentralization on the basis of seven neighbourhoods (Bethnal Green, Globe Town, Bow, Poplar, Stepney, Wapping, and Isle of Dogs) as shown in Figure 4.2.

Figure 4.2: Local authority neighbourhoods in Tower Hamlets since 1986

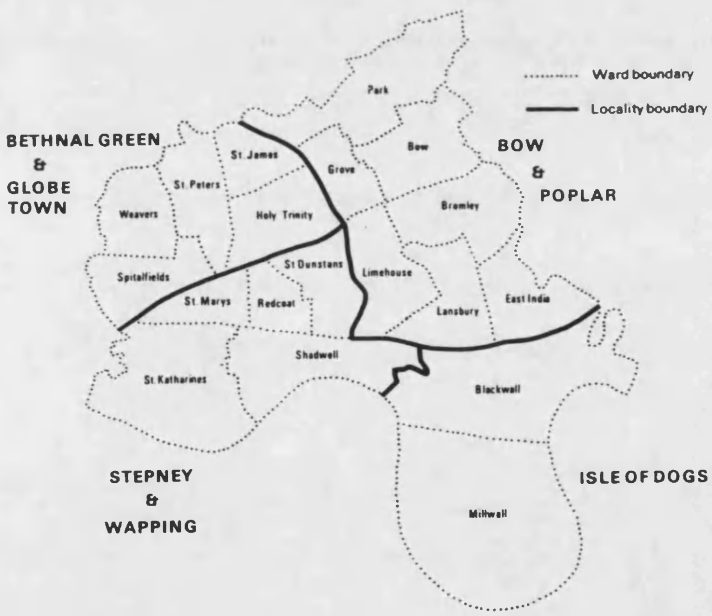


From Figures 4.1 and 4.2 it is clear that there was substantial mismatch between health authority locality and local authority neighborhood boundaries. In view of the importance of collaboration between local authority and health authority staff, it was decided to reconsider the question of boundaries within the health authority. So a second exercise was carried out to produce a new set of boundaries.

The second attempt accepted as a constraint that the local authority neighborhood boundaries should not be crossed. However for reasons of economy of scale it was considered impractical to propose as many as seven localities corresponding of the local authority neighbourhoods (Taket and Curtis, 1989).

Recognizing the importance of GPs in the provision of primary health care, a survey of GPs had also been carried out by the Primary Care Development Project (cited by Taket and Curtis, 1989) which included asking GPs to identify their catchment areas. For many doctors their catchment area was spread over the whole district. However, about one third of the doctors identified catchment areas smaller than the whole district. Examining GP's areas and local authority neighbourhoods, it was then decided to combine neighbourhoods into four super-patches and abandon sub-division into smaller patches. Super-patches, now to be called localities, were renamed as 1) Bethnal Green and Globe Town, 2) Bow and Poplar, 3) Isle of Dogs, and 4) Stepney and Wapping - shown in Figure 4.3. The new plan did not cut across any enumeration district, ward, or neighborhood boundaries.

Figure 4.3: Second proposal for locality boundaries in Tower Hamlets



Once the boundaries were settled, it was then necessary to concentrate on the other issues. An immediate and important one was the development of a mechanism to establish intersectoral collaboration within the delivery of primary health care. This necessitated the setting up of a local information system.

The following section concentrates on our work, starting in January 1988, of developing a local information system for implementing decentralized or localized planning.

4.5 Information Needs for Localized Planning

In the previous section we described two tactical steps which had already been taken in Tower Hamlets to implement decentralization. The exercise of defining locality boundaries was intended to make community health care boundaries compatible with those of other services to assist interagency co-ordination. This in turn required the development of a base-line information system for locality planning to facilitate both the coordination and the uptake of services in Tower Hamlets.

The need for the provision of local information has been widely expressed by those who are involved in the process of decentralization of community health care. In a workshop on this topic held at the King's Fund Centre in June 1987, several locality managers from North Devon Health Authority, Central Birmingham Health Authority, and from Exeter Health Authority were of the view that information about local health needs together with the data available from OPCS and local authorities is of considerable value for planning purposes. Similarly, others from Bloomsbury Health Authority, and from the Center of Health Economics at York University agreed that for locality planning it is necessary to have information which would be used to achieve the efficient use of services. The elements which should be included in the information set are;

(a) population profiles to show the social, physical, and environmental characteristics of the local population;

(b) an assessment of health needs; and

(c) a service profile in terms of provision and use of service.

Roy Carr-Hill of the University of York reported his recent research which indicated a wide-spread ignorance of existing services and service providers. So it is important that local information is widely provided to all those who are concerned with primary health care. We therefore developed locality profiles for Tower Hamlets. The process is explained in the following sections.

4.6 Preparation of Locality Profiles

In order to develop locality profiles, information was obtained from a number of sources. Before starting the task of collecting and collating data, a proposal was drawn up which suggested the variables to be included and the sources of their availability. Consultation took place between Professor Jonathan Rosenhead of the London School of Economics, Dr Sarah Curtis of the QMW, Ann Taket of the Department of Community Medicine, Tower Hamlets Health Authority, and the author of this thesis. It was decided to include the following data in a base-line information system for population profiles.

(a) data on socio-demographic profiles of each ward and locality,

(b) data on health service provision within the district and localities, and

(c) data on community health service activities within the district.

These data were collected from different sources and have been presented in the form of locality profiles with the help of street maps of all the four localities in Figures 4.4, 4.5, 4.6, and 4.7. These profiles illustrate the boundaries of localities and the supply points of various services, together with socio-demographic information on each locality. Salient features of the data set included in the locality profiles are discussed below.

4.6.1 Demographic Data:-

The demographic data was collected on an electoral ward basis. Two types of data were collected from OPCS; firstly the 1981 Census, and secondly vital statistics from 1981 to 1985.

Census data was the only source used to obtain information regarding demographic and socio-economic conditions at ward level. The variables included in the census data are population density per hectare in each ward, percentages of population over 65, of elderly living alone, of children under five, of lone parents, of unskilled workers, of unemployed, of population lacking housing amenities, of overcrowded houses, of population migrated during last 12 months, of ethnic minority groups, and composite indicators- also called Jarman underprivileged area scores or UPA8, which will be further discussed in Chapter five.

The census data initially collected on a ward basis has been aggregated for the localities and are given in Table 4.2.

Table 4.2: Locality based census variables (1981)

Census Variable	Localities			
	Bethnal Green and Globe Town	Bow and Poplar	Isle of Dogs	Stepney and Wapping
Population	38,163	58,869	15,476	37,488
Density/hec.	99.92	73.29	32.93	97.52
% over 65	16.39	14.44	10.58	14.88
% elderly alone	7.40	6.03	4.97	6.45
% under 5	7.05	6.35	7.48	7.36
% lone parents	3.08	4.23	4.87	3.30
% unskilled	8.78	11.33	12.01	12.30
% unemployed	15.62	14.35	18.59	16.15
% lacking housing amenities	7.40	5.39	1.28	9.54
% moved house last year	12.06	10.86	11.19	12.37
% ethnic minority	24.81	14.18	15.55	28.16

Source, OPCS Census 1981

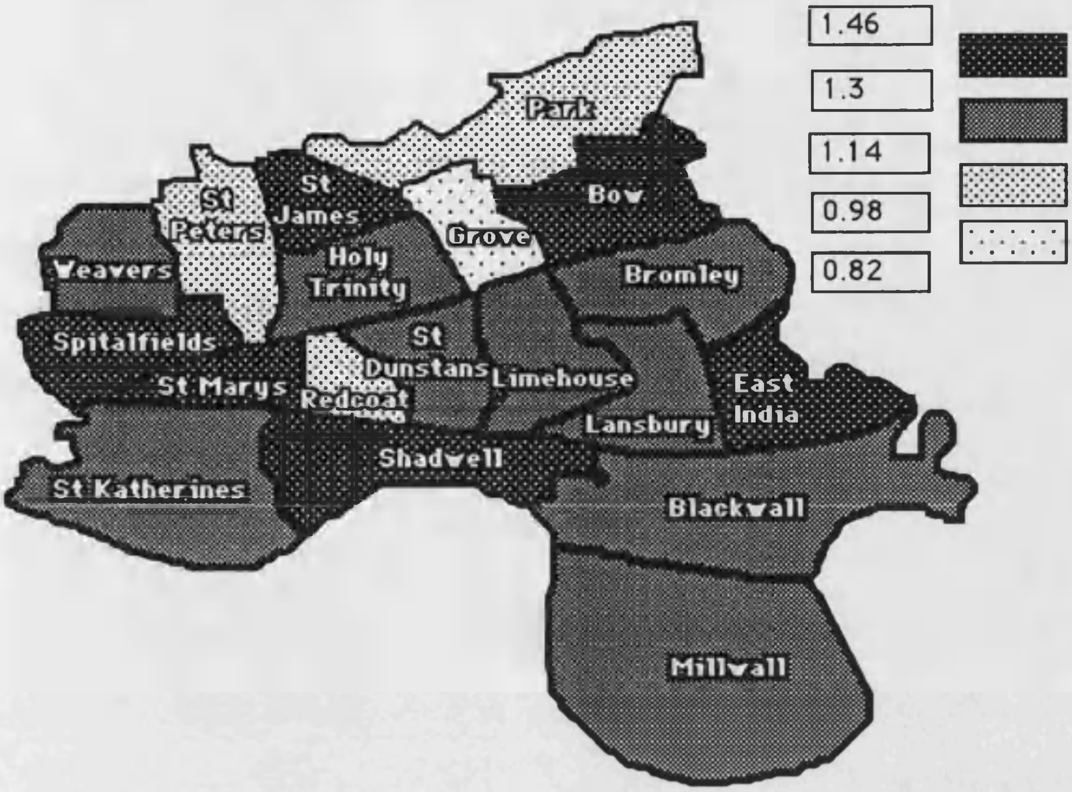
The foregoing table provides some details of the population characteristics of each locality. For example Bethnal Green and Globe Town has a relatively high population density per hectare. The percentage over 65, and the percentage of elderly living alone is also comparatively high in Bethnal Green and Globe Town. Stepney and Wapping on the other hand has relatively high proportions of unskilled workers, of households lacking amenities, of households moved last year, and of ethnic minority groups. Similarly in the Isle of Dogs the proportion of population who are lone parents, or unskilled, or unemployed is relatively high. Tower Hamlets as a whole is a deprived inner part of the London Metropolitan Area. Further sub-classification of localities with respect to demographic conditions helps to identify areas within the districts where the social and material conditions of life are particularly poor and so have a greater need for health care.

Census data, in its present form, has two major limitations which make it unsuitable for use as a need indicator for health care. Firstly, it can be up to a decade old. OPCS does not provide ward-based population estimates for intercensal years, and the estimates which are commercially available are limited to the age and sex structure of ward populations. Secondly, census data does not give any information on morbidity which can be used as a need indicator for health care. To substitute for this as a measure of need for health care, there has been a trend in Britain to produce composite area indicators using census data. These indicators will be further discussed in Chapter Five.

Another set of data which OPCS provides is vital statistics. This includes live births, still births, and deaths for specific age and sex groups. These statistics available on a yearly and ward basis reflect in a general way the pressure on health care services. Based on these data a Standardized Mortality Ratio (SMR) can be derived (using the method described in Chapter Three) which helps to compare the overall health situation between areas.

SMRs for Tower Hamlets at ward level were derived using the OPCS vital statistics from 1981 to 1985. Figure 4.8 shows the considerable variation in SMR between the different wards in Tower Hamlets. SMRs are further used and discussed in Chapter Five.

Figure 4.8: Standardized mortality ratios by ward



There were two main objectives in collecting and collating population profiles; firstly to develop a base-line information system for coordination of inter-related agencies, and secondly to develop a set of suitable data to be used for resource allocation mechanisms. SMRs are one of the data elements used to identify the general health condition in each ward. However in order to identify a need for service provision other data are required, concerned with the current availability of health services, and health service activities. These data, as part of our base-line information system, are discussed below.

4.6.2 Health Service Provision:-

As already mentioned, Roy Carr-Hill's research indicates a widespread ignorance of existing services and service providers in the community, both of which affect the uptake of services. Tower Hamlets while implementing decentralization was also seeking to improve service uptake by enhancing professionals' knowledge about the provision of primary health care and of related services within the district. Information on service provision of community health care was collected directly in a series of meetings with the managers of the respective services, whereas information regarding GPs and personal social services was collected by the FPC and the local authority.

Community health services consist of district nursing, health visiting and school nursing, community physiotherapy, services for people with learning difficulties, mental health, and family planning. Information about these services is given in Table 4.3. This table gives a comprehensive picture of the type of services being offered, their objectives, number of staff where appropriate, and their location. These services are briefly described here:

(i) The community physiotherapy service is designed to tackle the problems of children, and of mentally handicapped, elderly and disabled people. To provide this service there were at the time of this study four physiotherapists for adults and two for paediatric work. There was an open referral system, and planning reportedly took place as demand arose. The service was also reported as under-staffed. It was decided in the draft decentralization strategy that the future provision of this service would be continued on a district-wide basis from a central location in Tredegar House rather than on a locality basis.

(ii) The learning difficulties service for people with mental handicap aims at:

(a) assuring a person's presence in the community by creating an environment that provides as many opportunities as possible;

(b) creating an environment that assures a person's participation in the local community;

(c) enhancing a person's involvement in decisions made about his/her life;

(d) ensuring the development of a person's competence by building on individual skills; and

(e) enhancing the level of respect afforded to the person.

As a step towards the fifth accomplishment the Community Mental Handicap Team has changed its name to the Community Team For People With Learning Difficulties. It is felt that the term 'learning difficulties' more appropriately describes some of the problems that clients experience. This service at the time of this research was being provided centrally from Sewardstone Road, Bethnal Green by a group of 25 staff. From these, separate staff groups called the East Team and the West Team covered the whole district.

(iii) The district nursing service provides out-of-hospital care such as injections, dressings, medications, etc. The district nursing service is organized throughout the district on a team basis including district nurses, enrolled nurses, and auxiliary staff. At the time of this research these teams were being managed and planned across the district by three managers. However it was pre-planned that the teams would be reorganized to operate on the basis of the proposed set of localities. In addition there were some district-wide special teams for the homeless and diabetic services.

(iv) The health visiting and school nursing service aims to monitor the developmental progress of children under 5 by home visiting, and to carry out health promotion and prevention of diseases among school age children in the 100 or so schools throughout the district. This service was also organized at the time of this research on a team basis, consisting of health visitors, a health promotion nurse, a school nurse, and auxiliary staff. There were three service managers mainly responsible for their teams' operations. Some of the staffs also provide family planning service as well as help with chest diseases by home visiting.

(v) The community psychiatric nurses provide service for people who are mentally ill. The service is generally of two types, i.e. primary or continuing care and service for stroke rehabilitation. This service was at the time of the study already being provided by teams for the proposed localities; however for the time being these teams were not based in their respective localities. In addition some services were also being provided at the district and at the regional level.

(vi) The family planning service is provided by trained medical and nursing staff. It gives free and confidential advice to women and men of all ages, supplies contraceptives free of charge, performs pregnancy testing and cervical smears, and advises on fertility. Service delivery was centrally organized on a session basis throughout the district in health centers.

More details regarding all community services mentioned here are provided in Table 4.3.

After collecting information regarding health service provision our next objective in developing a base-line information system was the collection of data regarding health activities. This is described below.

4.6.3 Health Service Activity:-

In the NHS there has been pressure to include geocodes in health information systems. The Steering Group on Health Services Information chaired by Mrs Korner (DHSS, 1985) recommended systematic inclusion of the post-code of each patient's home into the activity data for hospital and community health services.

The Korner Information System, at the time when we were collecting data, was still under development, so that post-coded activity data was not available. Once this system does become operative, it is expected to solve the problem of identifying the need for health care in smaller geographical areas. For the time being we have however collected case-load information, at each health centre, regarding district nursing service only. We intend to use this information in the following Chapters:

(a) to demonstrate the extension of RAWP methods to derive need for the district nursing service at ward level, and

(b) to use need data as input to the resource allocation methods for district nursing in Tower Hamlets.

A further discussion on the activity data to be used for resource allocation is presented in Chapter Five. In the following section we concentrate on the collection of information related to statutory services provided within Tower Hamlets.

4.6.4 General Practice and Social Service:-

Data on general practice, as a part of primary health care, has to be included in our population profiles because of inter-agency coordination. Information on general practices in Tower Hamlets is given in Table 4.4.

The Tower Hamlets Health Inquiry Report published in 1987 found that there were 90 GPs working in Tower Hamlets from a total of 43 surgeries. Of the doctors, 21% worked single handed, 31% worked with one other doctor and only 16% worked in a practice comprising four or more doctors. By comparison the British Medical Association Report (BMA, 1983) showed that in England and Wales 13% doctors worked single handed, 18% worked with one other doctor, and 25% worked in practices with five or more doctors. The Acheson Report (London Health Planning Consortium, 1981) stated that "as a general rule a number of doctors working from the same premises with ancillary help will be better able to provide a continuous and accessible service to their patients than the GP working single-handedly and without support staff". In this respect the GP service in Tower Hamlets is lagging behind. Hull, Livingstone and Dunford (1984) also found that the development of group practices in Tower Hamlets was lagging behind the rest of the country by about 15 years.

The Acheson Report, and the Government's Green Paper on Primary Health Care (DHSS,1986), both expressed concern about the high numbers of elderly doctors practicing in inner city areas. The study by Dennis and Salvage (1984) found that in Tower Hamlets 22% of doctors were over 60, while 9% were over the age of 70. By comparison the BMA Report (BMA, 1983) found that in England and Wales 13% of GPs were aged over 60, and 2% were aged over 70. These figures suggest a considerable deficiency in the GP service which in turn affects the general health status in Tower Hamlets. Altogether these factors require substantial changes in the provision of the GP service in Tower Hamlets. However our purpose in the work reported here is confined to the inclusion, in the locality profiles, of information about GPs' locations, the time of practice, and the kind of services being offered. The information collected is displayed in Table 4.4.

Personal social services in Tower Hamlets, as already mentioned, have been decentralized to the level of neighbourhoods. The whole district is divided into seven neighbourhoods. The provision of different personal social services is summarized in Table 4.5.

The aim of developing a base-line information system to produce locality profiles is to enable primary health care workers to coordinate with other services being provided within the community. These locality profiles are the first of their kind in Tower Hamlets which depict information regarding all the four localities in a single document. Prior to that a pilot patch profile was prepared for a single ward, Millwall, in 1986.

The data collected for the preparation of locality profiles were further used to develop a prototype Geographical Information System (GIS), which is discussed in the following section.

4.7 Geographical Information System (GIS)

Our attempt to produce base-line information as one of the tactical steps towards decentralization has been achieved by producing locality profiles. Information collection is not a "one-off" activity. It needs to be updated regularly to help planners manipulate and analyze data for planning and resource allocation. So we have concentrated on the use of computer technology and produced locality information on a prototype Geographical Information System (GIS) developed by the Computer Science Department and the Health Care and Health Research Group of QMW. Our task in this exercise was to produce input variables for the GIS.

In recent years Geographical Information Systems have become efficient at handling data based on geographical zones (Curtis and Taket, 1989). The early systems for handling geographical data were purely cartographic, with the emphasis on display rather than on analysis and manipulation. However the recent generation of Geographical Information Systems can manipulate and analyze data, and are much more flexible in dealing with data for geographical zones which are not identical (Curtis and Taket, 1989 cited Green, 1985).

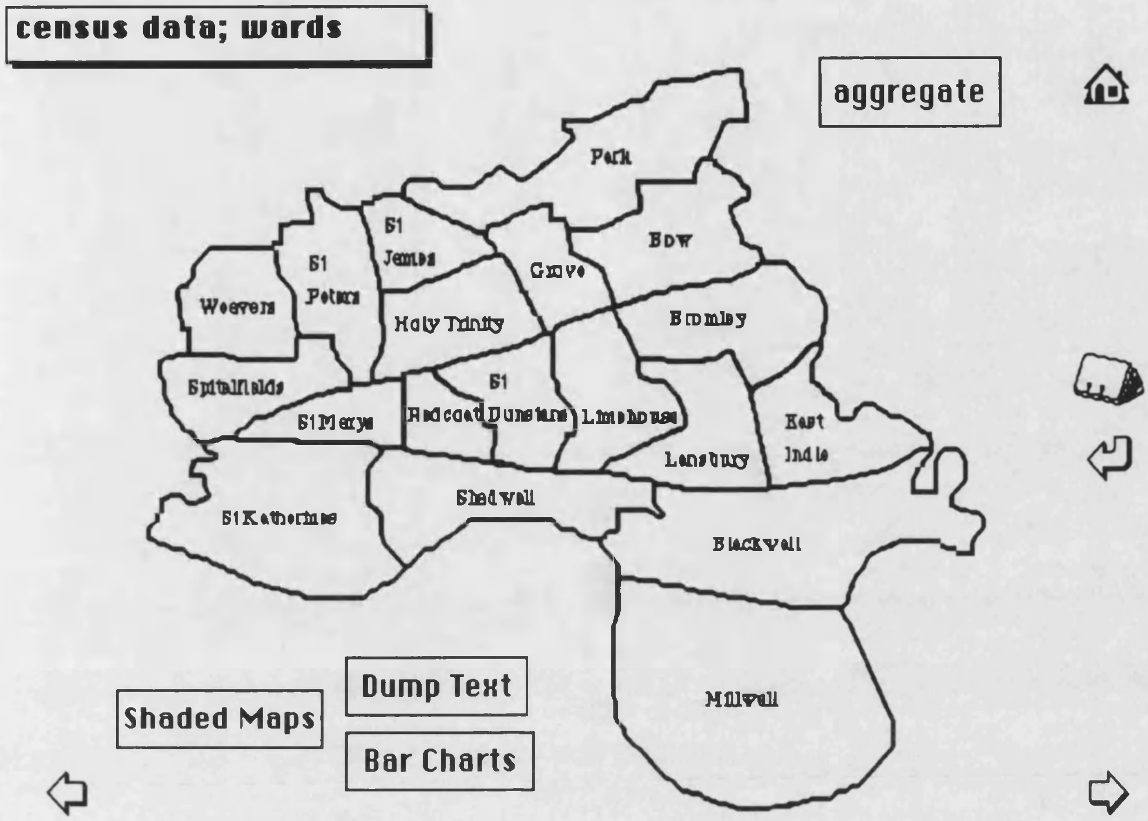
GISs basically operate on geocoded data. In the NHS, as already mentioned, emphasis has been placed on the importance of including geocodes in a health information system (Steering Group on Health Service Information, 1985). With this development, the use of sophisticated GISs for health service management information systems began to emerge as a possibility (Curtis and Taket, 1989). At a recent seminar on GIS and Small Area Analysis organized by the Operational Research Society (June 1990) speakers from the Department of Health and health authorities as well as academic researchers demonstrated the need and practicability of a GIS for health care analysis in smaller areas. However it was commonly argued that a GIS needs to be developed for each organization separately, keeping in view their local circumstances and the level of data analysis.

In the case of Tower Hamlets the information must be presented on the basis of wards, localities, and neighbourhoods to facilitate the operation of decentralized community health care. A prototype GIS has been developed for the Tower Hamlets DHA to carry out the basic functions of displaying geographically-linked data in the form of maps, graphs, and numerical lists.

The GIS manipulates and displays the geographical data on an Apple Macintosh computer using Hypercard software. The system is simple and easily understood, especially by those people who are not familiar with computers. During its initial stage of development, in the summer of 1988, the GIS was demonstrated by Dr. S.E. Curtis , with the assistance of the author, to the community health care staff in Tredegar House, Tower Hamlets. These health authority workers showed great interest in the system and were appreciative of our efforts.

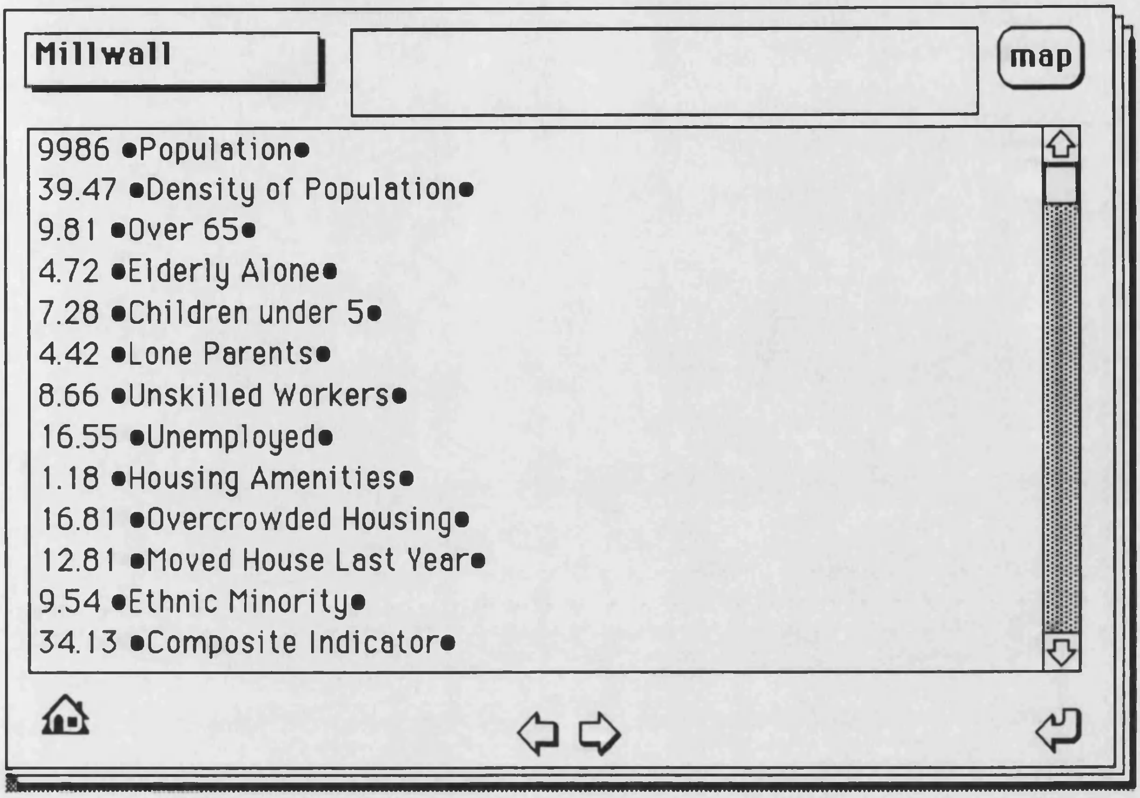
The GIS is flexible in providing a range of ward, locality, and neighborhood-specific information. Information can be displayed in the form of figures, bar charts, and shaded maps. All the stacks of information included in the GIS are linked with templates containing maps of Tower Hamlets including ward, neighbourhood, or locality boundaries. A map with ward boundaries is shown in Figure 4.9. This template has linked with it a stack of nineteen cards each containing census data for an individual ward.

Figure 4.9: A map card from census data stack



This system can be operated simply. For example, to see details of the census data for Millwall, one has to put the cursor on Millwall and click on the name. The screen will then immediately display a card on the screen for Millwall, as shown in Figure 4.9a. Similarly to aggregate data for localities, neighbourhoods, or a whole district one has only to click on a rectangle showing "Aggregate" in Figure 4.9. This system is also capable of weighting variables if required; the method is demonstrated in Figure 4.10.

Figure 4.9a: A data card from census data stack



Similarly bar charts and shaded maps can also be produced for different variables by clicking on corresponding rectangles on the screen. For example Figure 4.11 shows a bar chart of the percentage of elderly people living alone throughout the district, while the same data is shown in the form of a shaded map in Figure 4.11a. From Figure 4.11a it is easy to establish that the electoral ward St. James has the highest and Holy Trinity, Park, Redcoat, St. Marys, St. Peters, and Weavers have a comparatively high concentration of elderly people living alone. This indicates, for example, that there will be an extra need for nursing care in these wards. Likewise all the data variables included in the GIS can be combined and analyzed for localities or neighbourhoods in order to assist appropriate decision making.

The data variables which are included as input for the GIS are given at

Appendix 1 along with their sources. This system is by no means fully developed. So far it has only been used to collate and display geographically organized information. However the system developers at QMW are of the view that further collaboration with health authority personnel would be necessary to establish a mechanism for modifying, and updating the system (Curtis and Taket, 1989).

4.8 Conclusions

In Tower Hamlets the process of decentralization, by the time we started, had already established a draft strategy for implementation, and boundaries for the localities. The decentralization is progressing step by step in a very systematic way. While developing a locality based information system and coordinating the development of the GIS, we found that the various staff groups were fully aware of the objectives of decentralization and had pre-planned the delivery of their service accordingly. This awareness, as mentioned in Chapter Two, is necessary to make the management change a success.

Various developments such as defining the locality boundaries, specifying the managerial arrangements, developing the information system, and devising methods to derive need, are seen as positive steps towards the decentralized delivery of service. However the process of decentralization of community health care is an on-going activity. There are several other issues to be resolved in achieving decentralization.

One of the important issues to be tackled in achieving coordinated decentralization, as described in Chapter Two, is to make decentralized units self-sufficient. It was mentioned at the beginning of this Chapter that the prime objective of decentralized or localized planning is to allocate scarce resources appropriately. The next step towards decentralization, in Tower Hamlets, will be to allocate resources between localities. In the following Chapter we will concentrate on rational methods that are applicable to the identification of need and the allocation of resources within a decentralized organization providing a community health care service. In Chapter Six we will illustrate the use of these methods by applying them to the district nursing service in Tower Hamlets.

Figure 4.10: A card showing method of aggregating variables

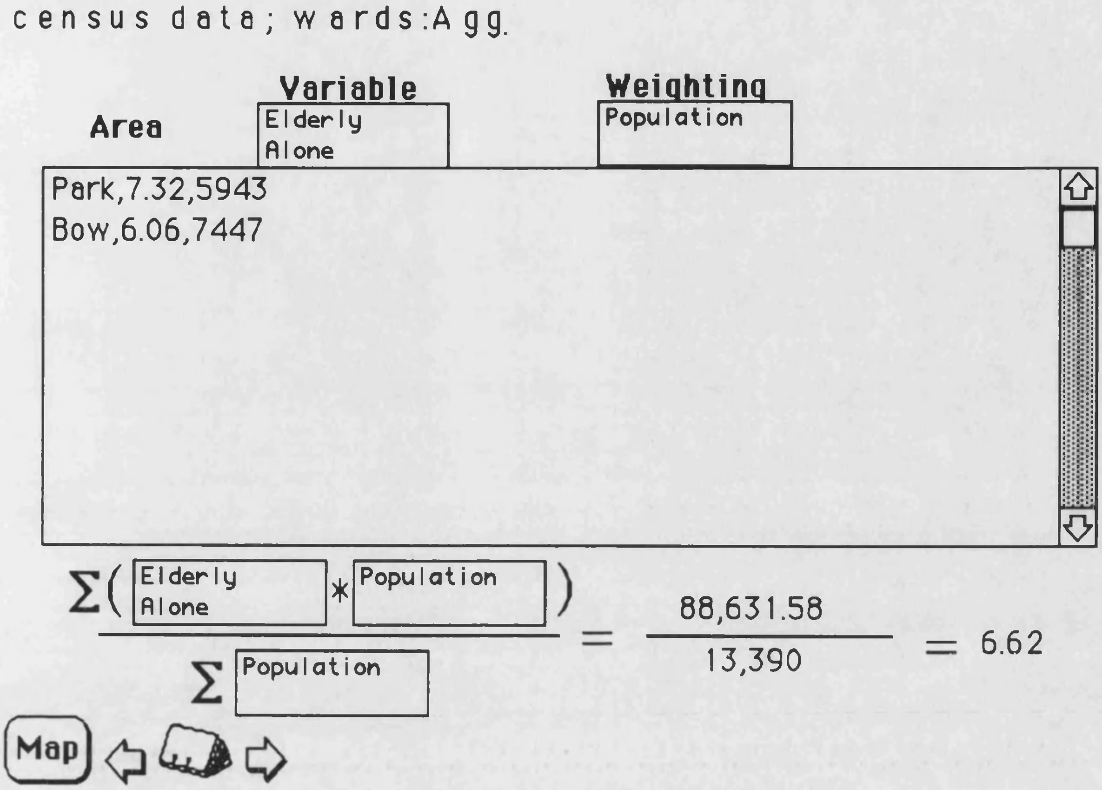


Figure 4.11: A card from bar charts stack

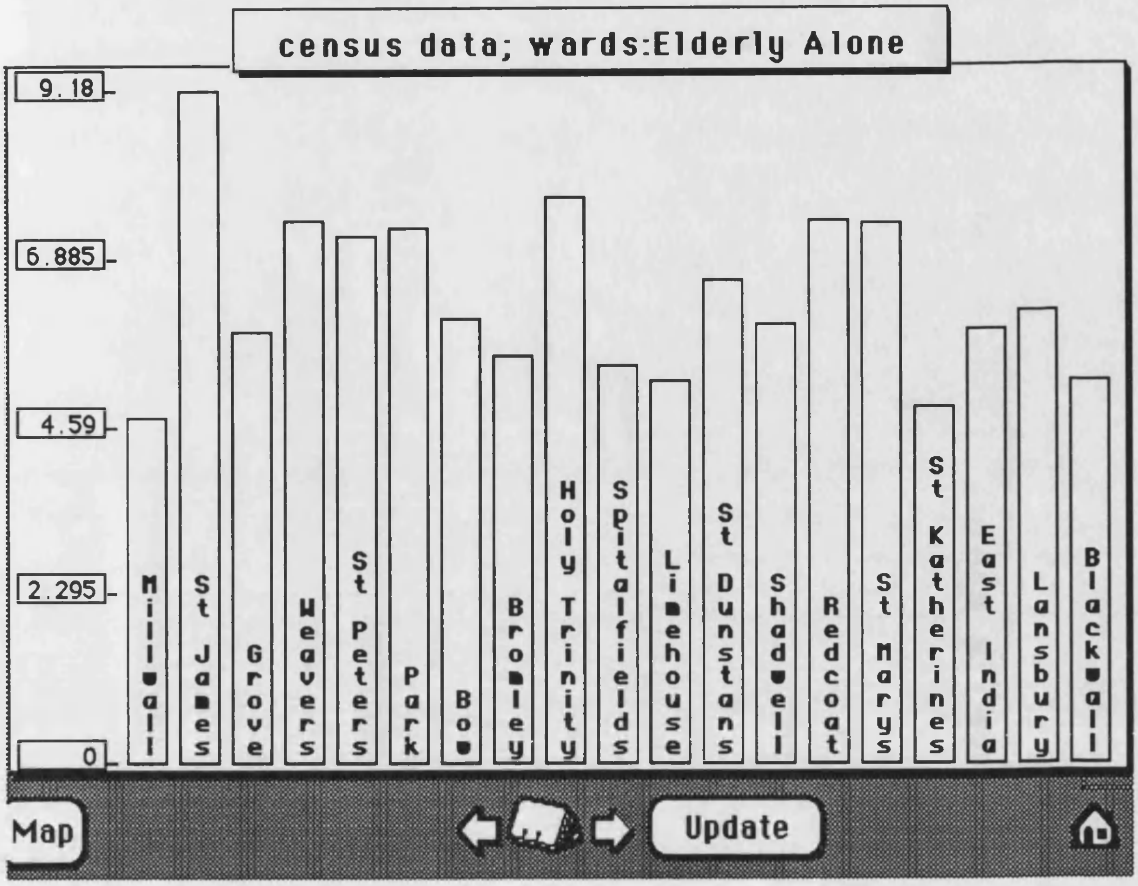
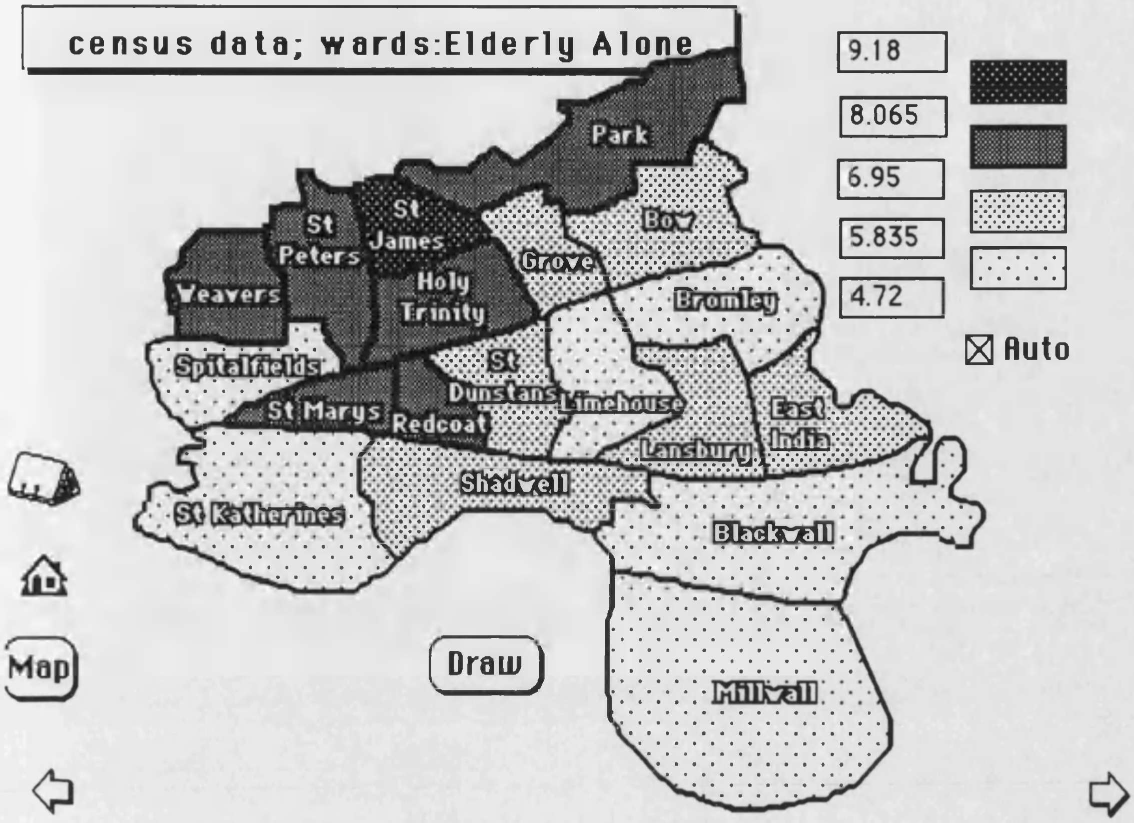
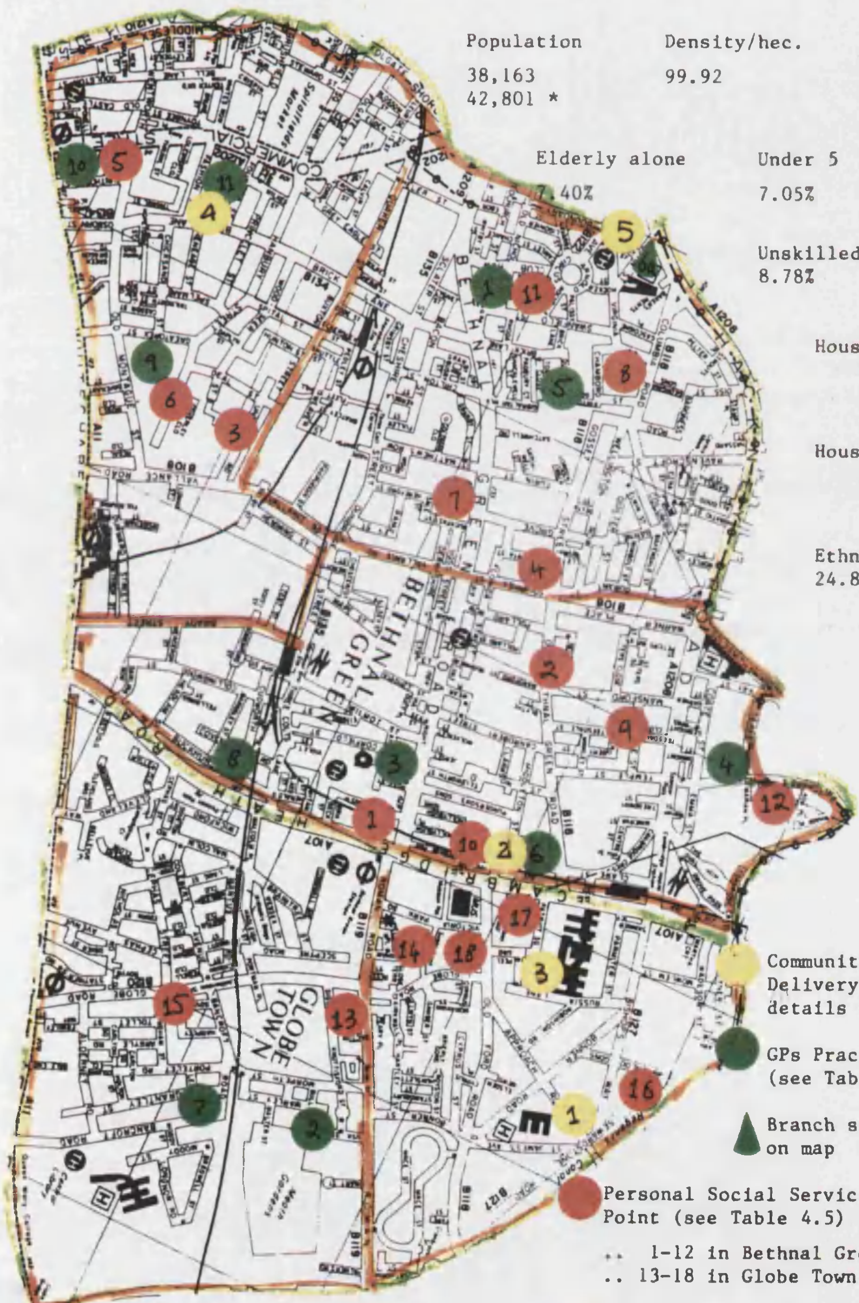


Figure 4.11a : A card from shaded maps stack



BETHNAL GREEN AND GLOBE TOWN

Figure 4.4



Population	Density/hec.	Over 65
38,163 42,801 *	99.92	16.39

Elderly alone	Under 5	Lone Parents
7.40%	7.05%	3.08%

Unskilled	Un-employed
8.78%	15.62% 22.3% **

Household lacking amenitites
7.40%

Household moved last year
12.06%

Ethnic minorities
24.81%

Community Health Care Delivery Points (for details see Table 4.3)

GPs Practices (see Table 4.4)

Branch surgery number 6 on map

Personal Social Services Delivery Point (see Table 4.5)

.. 1-12 in Bethnal Green n'hood
.. 13-18 in Globe Town n'hood

Ward Boundaries (see Figure 4.3)

Neighbourhood Boundaries (Figure 4.2)

* 1991 estimates (LRC)
** 1986 estimates (LA)
All other figures from 1981 census

BOW AND POPLAR

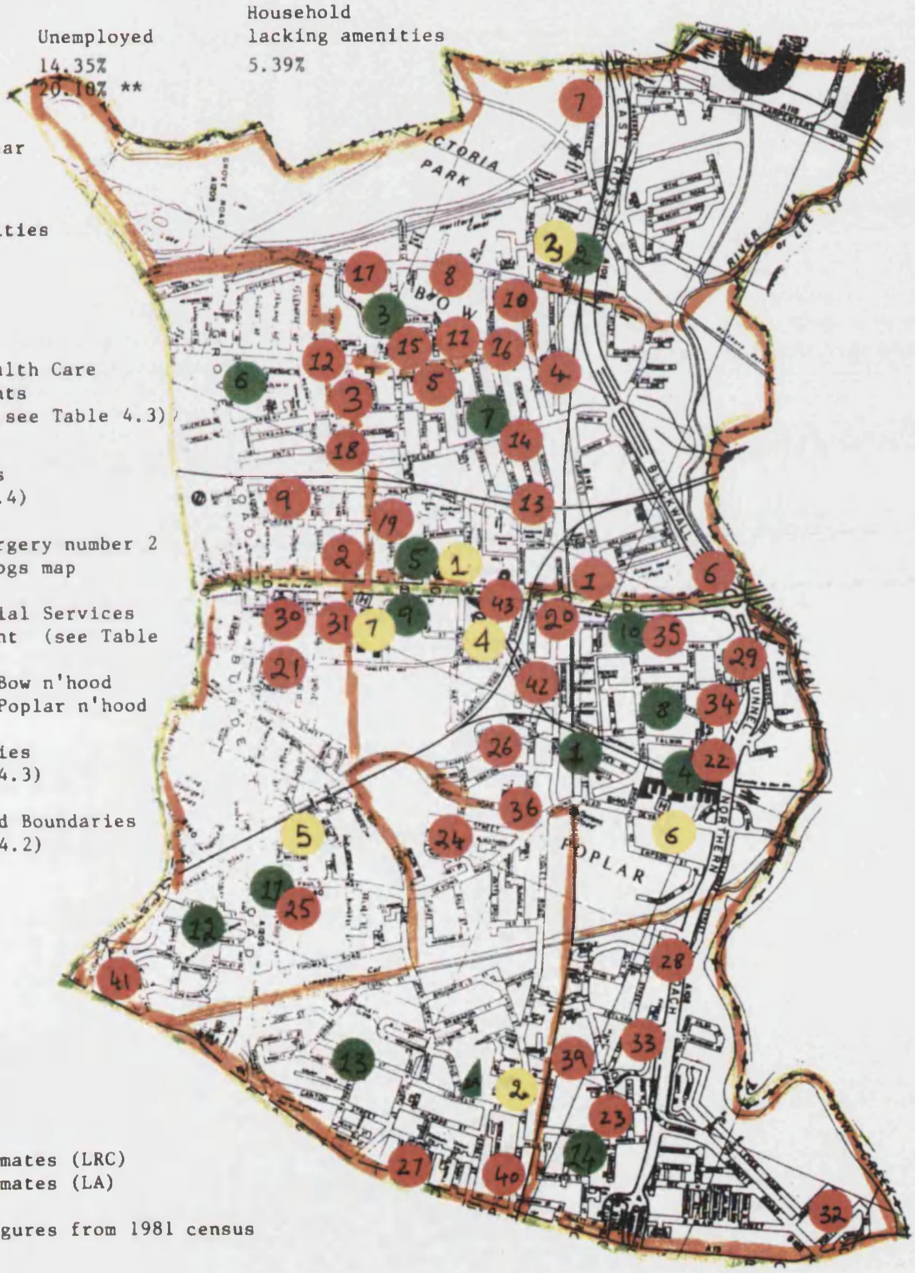
Figure 4.5

Population	Density/hec.	Over 65	Elderly alone	Under 5	Lone Parents
48,869 55,186*	73.29	14.44%	6.03%	6.35%	4.23%

Unskilled	Unemployed	Household lacking amenities
11.36%	14.35% 20.10% **	5.39%

Household moved last year
10.86%

Ethnic minorities
14.18%



Community Health Care Delivery Points (for details see Table 4.3)

GPs Practices (see Table 4.4)

Branch of surgery number 2 on Isle of Dogs map

Personal Social Services Delivery Point (see Table 4.5)
.. 1-19 in Bow n'hood
.. 20-41 in Poplar n'hood

Ward Boundaries (see Figure 4.3)

Neighbourhood Boundaries (see Figure 4.2)

* 1991 estimates (LRC)
** 1986 estimates (LA)

All other figures from 1981 census

STEPNEY AND WAPPING

Figure 4.6

Community Health Care Delivery Points
(for details see Table 4.3)

GPs Practices (see Table 4.4)

a - branch of surgery number 3 on map
b - branch of surgery number 4 on map

Personal Social Services
Delivery Point (see Table 4.5)
.. 1-9 in Stepney neighbourhood
.. 10-18 in Wapping neigh'hood

Ward Boundaries (see Figure 4.3)

Neighbourhood Boundaries
(see Figure 4.2)

Population 37,488
43,884*

Density/hec. 97.52

Over 65 14.88%

Elderly alone 6.45%

Under 5 7.36%

Lone Parents 3.3%

Unskilled 12.3%

Unemployed 16.15%
23.6% **

Households lacking amenities
9.54%

Household moved last year
12.37%

Ethnic minorities 28.16%

* 1991 estimates (LRC)
** 1986 estimates (LA)

All other figures from 1981 census

Figure 4.7

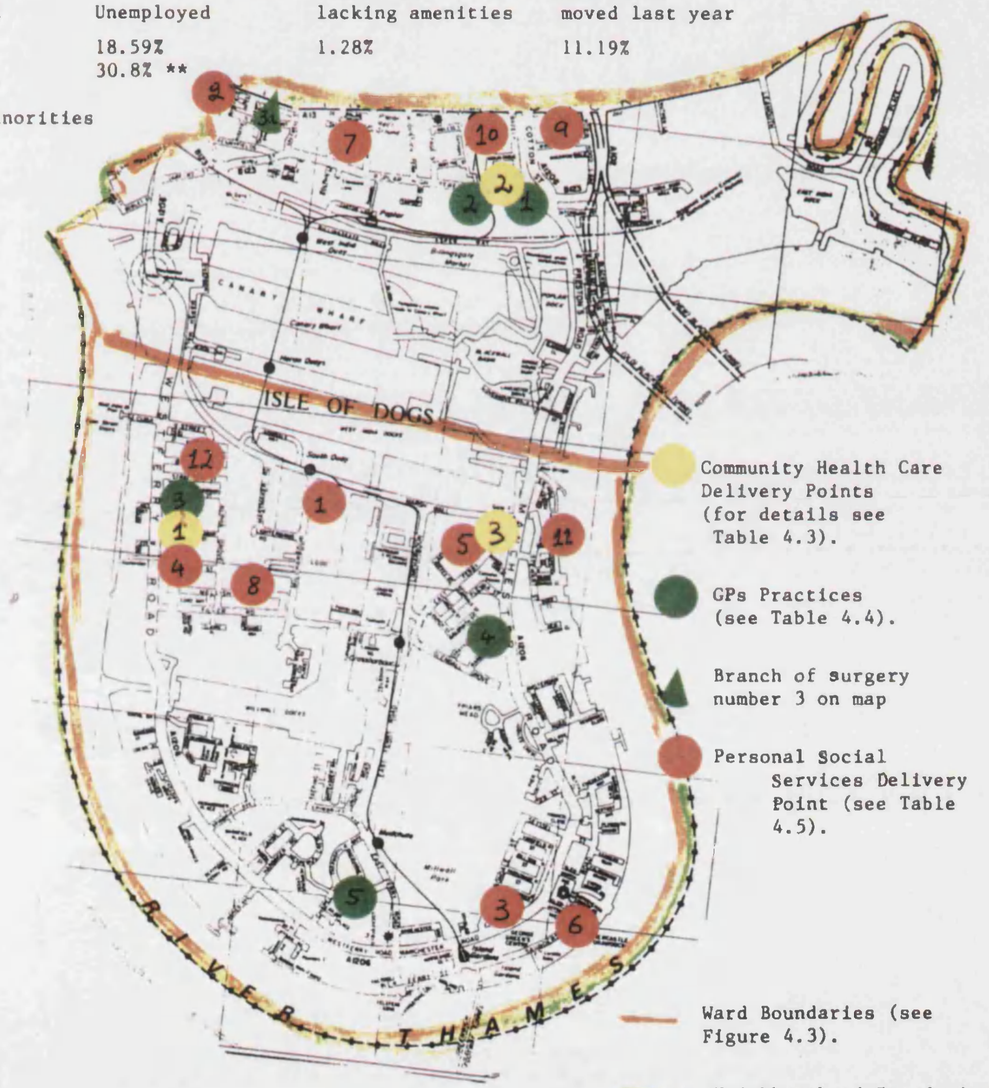
ISLE OF DOGS

Population	Density/hec.	Over 65	Elderly alone	Under 5	Lone Parents
15,476* 18,072	32.93	10.58%	4.97%	7.48%	4.87%

Unskilled	Unemployed	Household lacking amenities	Household moved last year
12.01%	18.59% 30.8% **	1.28%	11.19%

Ethnic minorities

15.55%



Community Health Care Delivery Points (for details see Table 4.3).

GPs Practices (see Table 4.4).

Branch of surgery number 3 on map

Personal Social Services Delivery Point (see Table 4.5).

Ward Boundaries (see Figure 4.3).

Neighbourhood Boundaries (see Figure 4.2).

* 1991 estimates (LRC)
** 1986 estimates (LA)

All other figure from 1981 census

Table 4.3: Information on community health care services

Services	Objectives	Service Type and Staff Provision	Location Bethnal Green and Globe Town	Bow and Poplar	Stepney and Wapping	Isle of Dogs
Community Physio-therapy	Childern, Mentally handicapped, Eldrly and Disabled	Group of six staff Four for adults Two for paediatric	District based service is being provided on open referal basis from Tredegar House. (No 1 on map of Bow and Poplar), Fig 4.5			
Learning Difficulties	Assuring person's presence, participation, skill development, and respect in community	1) Team for learning difficulty:Two community teams with staff of 10 each.	East and West teams operating from 130 Sewardstone Road Bethnal Green for the whole district. (No 1 on map of Bethnal Green and Globe Town), Fig 4.4			
		2) Respite care for children in a six bedded house.	Location under planning stage. It will be for the whole district.			
		3) Assessment and habilitation by 5 staff.	Service for the whole district from 130 Sewardstone Road Bethnal Green.(Map 1, Bethl Gr and Globe Town)			
		4) Service for people with challinging behaviour by 8 staff.	Service for the whole district from 130 Sewardstone Road Bethnal Green (Map 3, Bethl Gr and Globe Town)			
		5) Resource centre for families: staff unknown	Service for the whole district from 130 Sewardstone Road Bethnal Green (Map 4, Bethl Gr and Globe Town)			
District Nursing	To provide out of hospital care: Injection,dressing,medication etc.	Thirteen teams each having steength from 4 to 9 staff including district nursing, enrolled nursing and auxiliary staff.(total 93 staff) Services being managed by three service managers.	Bethl Green health centre Cambridge Heath Road E2 (Map 2) Greenwood health centre, Peel Grove E2 .(Map 3) Spitalfields health centre, 9-11 Brick Lane E1 (Map 4)	Chrisp St. health centre (Map 2) Ruston St. health centre(Map 3) Wellington Way health centre (Map 4)	Gill St health centre E14 (Map 1). Steel Lane health centre (Map 2) Wapping health centre(Map 3)	Barkantine health centre, West Ferry .Road E14 (Map 1) South Poplar health centre, 268-269 Poplar High St. (Map 2)
			In addition to above some staff provides district based service for homeless, diabetic,and machiavellian.			
Health Visiting and School Nursing	To provide care health promotion, and prevention of diseasefor children under five and school going.age.	Fifteen teams operating throughout the district on locality basis to provide care in community and about 100 schools. Total 101 staff including health visiting,health promotion nurse, school nurse, auxiliary staff and some family planning staff.	Bethnal Green health centre, (Map 2) Greenwood health centre (Map 3) Spitalfields. health centre (Map 4)	Chrisp Street health centre (Map 2) Ruston St. health centre(Map 3) Wellington Way health centre (Map 4)	Gill Street health centre (Map 1) Steel Lane health cent (Map 2) Wapping health cent. (Map 3)	Barkantine health centre (Map 1) South Poplar health centre (Map 2)

Table 4.3(cont)

Services	Objectives	Service Type and Staff Provision	Location Bethnal Green and Globe Town	Bow and Poplar	Stepney and Wapping	Isle of Dogs
Health Visiting and School Nursing (cont.)				Loepold St. clinic (Map 5) Newmill clinic, Empson St. E3 (Map 6)		Island clinic, Roserton St. E14 (Map 3)
Mental Health	To provide care for elderly mentlly ill, primary care,and continuing care/ stroke rehablitation	Staff teams are operating on locality basis. Total no. of Community Psychiatric Nurses=18 two of them provide service on district level. Teams are sometimes based out of their respective localities for example team for Bethnal Green & Globe Town are located in Stepney & Wapping.		St. clement's Hospital (Map 7)	Steel Lane health centre (Map 2)	Barkantine health centre (Map 1) South-Poplar health cen. (Map 2)
			District wide services from: Tredegar House (crisis intervevtion), St.Clement's Hospital(community injection & community support), 13 New Road E1(alcohal related problems informal), Map 5, Fig 4.6 Region wide service from St. Clement's Hospital (drug misuse clinic)			
Family Planning	To provide free and confidential for men and women, contracep-supplies, pregnancy testing,cervical semears, fertility advice, and rubella test etc.	About 8 regular and 6 locum doctors provide service with the help of nurses in 30 sessions per week.	Greenwood health centre, (Map 3) Monday 1.30 to 3.3 pm Thursday 9.30 to 11.30 Rochell Clinic Mildmay Mission Hospital,Austin St. E2(Map 5) Alternate Friday 1.30-3.30pm Spitalfields health centre (Map 4) Monday 5-7pm Wednesday 9.30 -1130(Bengali speaking clinic) Friday 1.30-3.30	Leopold St (Map 5) Monday 5 to 7pm. Newmill clinic, Empson St E3. (Map 6) Thu. 1.30-3.30 pm Ruston St (Map 3) Thursday 5 to 7 pm Wellington Way(Map 4) Thursday 4.30 to 6.30 pm	St. George clinic Cable St. E1 (Map 4). Wednessday 9.30-11.30 Bengali speaking clinic Steel Lane health cent. (Map 2) Wednessday 1.30 to 3.30 pm	Barkantine health centre. (Map 1) Tuesday 1.30 to 3.30 pm. Island clinic. (Map 3) Wednessday 5 to 7 pm

Please see map for locality one on Fig 4.4, two on 4.5, three 4.6, and four 4.7

Coulour code for all services is yellow

Bethnal Green and Globe Town: GP Practices

Name and Address (M-male F-female)	Telephone	Surgery hours		Other sessions
Dutt, G.C. (M) **Sarwar, S.** (F) 103 Bethnal Green Road, E2 Practice No 1 on map *Wait your turn system*	739 4837 Emergency 556 1821	M 9.00–11.00 T 9.00–11.00 W 9.00–11.00 Th 9.00–11.00 F 9.00–11.00 S 9.00–11.00	4.00–5.30 4.00–5.30 4.00–5.30 4.00–5.30	Wednesday 2–3.30 pm Mothers Clinic Ante-natal by appointment only Contraceptive services available
Fernando, A.C. (M) **Betts, J.C.** (M) **Hanley, M.T.** (M) 82A Roman Road, E2 Practice No 2 on map *Wait your turn system*	980 3023 Emergency 556 1821 Emergency 254 2883 Dr. Betts	M 10.00–11.30 T 10.00–11.30 W 10.00–11.30 Th 10.00–11.30 F 10.00–11.30 S 10.00–11.30	5.00–7.00 5.00–7.00 5.00–7.00 5.00–7.00 for emergencies only	Maternity and Contraceptive services available
Leibson, M. (M) 488A Bethnal Green Road, E2 Practice No 3 on map *Wait your turn system*	739 5497 Emergency 556 1821	M 9.30–11.30 T 9.30–11.30 W 9.30–11.30 Th 9.30–11.30 F 9.30–11.30	4.30–6.00 4.30–6.00 4.30–6.00	Contraceptive services available
St. John (M) **Rahman, R.** (M) **Stagles, M.** (M) 367 Hackney Road, E2 Practice No 4 on map *Wait your turn system*	739 8859 Emergency 639 3445	M 10.00–12.00 T 10.00–12.00 W 10.00–12.00 Th 10.00–12.00 F 10.00–12.00 S 10.00–12.00	4.30–6.30 4.30–6.30 4.30–6.30 4.30–6.30 for emergencies only	Contraceptive services available Ante-natal and post-natal clinic – Monday 2–4 pm
Taylor, V.M. (F) **Pollen, R.** (F) **Hardy, J.N.** (M) 61 Barnet Grove, E2 Practice No 5 on map *Appointment system*	739 6677 Emergency 556 1821	M 9.00–11.00 T 9.00–11.00 W 9.00–11.00 Th 9.00–11.00 F 9.00–11.00 S 9.30–11.00	4.00–6.00 4.00–6.00 4.00–6.00 4.00–6.00 4.00–6.00 for emergencies only	Ante-natal clinic – Tuesday 2–4 pm Wellwoman clinic – Wednesday 2–4 pm Baby Clinic – Thursday 11–1 pm Maternity and Contraceptive services available
Walter, J.P.W. (M) **Maxwell, C.** (M) **Webster, G.** (F) **Nunns, M.E.B.** (F) Bethnal Green Medical Mission 305 Cambridge Heath Road, E2 Practice No 6 on map *Appointment system and wait your turn system for children and emergencies*	739 3277	M 9.00–11.00 T 9.00–11.00 W 9.00–11.00 Th 9.00–11.00 F 9.00–11.00 S 9.00–11.00	4.30–6.00 4.30–6.00 4.30–6.00 4.30–6.00 4.30–6.00	Chiropody for over 60's – Wednesday 1.30–3.30 pm Ante-natal – Thursday 2–4 pm Contraceptive services available
Nunns, M.E.B. The Surgery, Mildmay Mission Hospital Hackney Road, E2 Branch Surgery No 6a on map *Wait your turn system*	739 2331 Δ	M 9.30–10.30 T 9.30–10.30 W 9.30–10.30 Th 9.30–10.30 F 9.30–10.30	4.30–5.30 4.30–5.30 4.30–5.30 4.30–5.30	Chiropody for over 60's – every 3rd Wednesday of the month 11–12.30 Contraceptive services available
Brinkenhoff, W.O. (M) 141 Bancroft Road, E1 Practice No 7 on map *Wait your turn system*	790 3010	M 11.00–12.00 T 11.00–12.00 W 11.00–12.00 Th 11.00– 1.00 F 11.00–12.00 S 11.00–12.00	5.30–7.00 5.30–7.00 5.30–7.00 5.30–7.00 5.30–7.00 by appointment	Contraceptive services available
Brynberg, M. (M) **Pettiford, C.H.** (M) **Hick, D.C.** (M) 129 Buckhurst St., E1 Practice No 8 on map *Wait your turn system*	247 1730	M 9.30–11.30 T 9.30–11.30 W 9.30–11.30 Th 9.30–11.30 F 9.30–11.30 S 9.30–11.30	5.00–6.30 5.00–6.30 5.00–6.30 5.00–6.30 5.00–6.30	Ante-natal care and cervical smears during Dr. Hick's morning surgery. Contraceptive services available. District nurse available Monday–Friday at 11 a.m. and Thursday evening at 5 p.m.
Osen, H.E. (M) 1 Davenant House, Old Montague Street, E1 Practice No 9 on map *Wait your turn system*	247 3876	M 10.00–12.00 T 10.00–12.00 W 10.00–12.00 Th 10.00–12.00 F 10.00–12.00 S – Su 10.00–12.00	5.30–7.00 5.30–7.00 5.30–7.00 5.30–7.00 –	Contraceptive services available
Rosen, M.H. (M) Denning Point, 31 Commercial Street, E1 Practice No 10 on map *Wait your turn system*	247 4696 Emergency 289 3406	M 8.30–10.30 T 8.30–10.30 W 8.30–10.30 Th 8.30–10.30 F 8.30–10.30 S 10.00–12.00	2.00–3.00 4.00–6.00 2.00–4.00 for emergencies only	Contraceptive services available

Bethnal Green and Globe Town (cont.)

Name and Address (M-male F-female)	Telephone	Surgery hours		Other sessions
Wootliff, A.B.	247 7070	M 9.30–11.30	5.00–6.30	Ante-natal, family planning
Spitalfields Health Centre		T 9.30–11.30	5.00–6.30	and cervical smears by
9–11 Brick Lane, E1	Emergency	W 9.30–11.30	5.00–6.30	appointment
Practice No 11 on map	247 7070	Th 9.30–11.30	5.00–6.30	
Wait your turn system		F 9.30–11.30	5.00–6.30	
Mellins, D.H.	247 7070	M 9.30–11.30	5.00–6.30	Family planning and
Spitalfields Health Centre		T 9.30–11.30	5.00–6.30	immunisation by appointment
9–11 Brick Lane, E1	Emergency	W 9.30–11.30		
Practice No 11 on map	247 4554	Th 9.30–11.30	5.00–6.30	
Wait your turn system		F 9.30–11.30	5.00–6.30	
Safir, J.G.	247 7070	M 9.30–11.30	5.00–6.30	Immunisation by appointment
Spitalfields Health Centre		T 9.30–11.30	5.00–6.30	Contraceptive services
9–11 Brick Lane, E1		W 9.30–11.30		available, infant welfare
Practice No 11 on map		Th 9.30–11.30		Wed. pm
Wait your turn system		F 9.30–11.30	5.00–6.30	
		S 9.00–12.00	by appointment	
Bingham, S.J.	247 7070	M 9.30–11.30	5.00–6.30	Infant welfare Wed. pm,
Spitalfields Health Centre		T 9.30–11.30	5.00–6.30	diabetic clinic by appointment,
9–11 Brick Lane, E1		W 9.30–11.30	5.00–6.30	contraceptive services
Practice No 11 on map		Th 9.30–11.30	5.00–6.30	available
Wait your turn system		F 9.30–11.30	5.00–6.30	
		S By appointment		

(All on Fig. 4.4) Colour code green

Bow and Popular: GP Practices

Name and Address (M-male F-female)	Telephone	Surgery hours		Other sessions
Baron, J.D. (M) 237 Campbell Road, E3 Practice No 1 on map *Wait your turn system*	987 7555 Emergency 987 7555	M 9.00–11.00 T 9.00–11.00 W 9.00–11.00 Th 9.00–11.00 F 9.00–11.00 S 9.00–11.00	4.00–6.00 4.00–6.00 4.00–6.00 4.00–6.00 for emergencies	Vaccination clinics – Tues. 1.30–3 pm Ante-natal clinic – Thurs. 1.30–3 pm Contraceptive services available
Hardiman, J.H. (M) **Lucas, S.V.** (F) Ruston Street Clinic, E3 Practice No 2 on map	980 1652			Maternity and contraceptive services available
Hardiman, J.H. Ruston Street Clinic *Wait your turn system*	980 1652	M 9.00–11.00 T 9.00–11.00 W 9.00–11.00 Th 9.00–11.00 F 9.00–11.00	5.00–6.30 5.00–6.00 5.00–6.30 5.00–6.30	
Lucas, S.V. Ruston Street Clinic *Appointment system*	980 1652	M 9.00–11.00 T W 9.00–11.00 Th 9.00–11.00 F 9.00–11.00		
Hayton, M.I. (F) **Hodgetts, E.** (F) **Shawcross, J.** (F) 35 St. Stephens Road, E3 Practice No 3 on map *Wait your turn system*	980 1760	M 10.00–11.30 T 10.00–11.30 W 10.00–11.30 Th 10.00–11.30 F 10.00–11.30 S 10.00–11.30	5.00–6.30 5.00–6.30 5.00–7.00 5.00–6.30 for emergencies only	Ante-natal Clinic – Monday afternoon by appointment Wellwoman clinic – Tuesday afternoon by appointment Well baby clinic – Thursday 1.30–3.30 pm Hypertension clinic – Friday afternoon by appointment Contraceptive services available
Hurley, P. (M) 2 Denbury House, Talwin Street, E3 Practice No 4 on map *Wait your turn system*	980 4386	M 10.00–12.00 T 10.00–12.00 W 10.00–12.00 Th 10.00–12.00 F 10.00–12.00 S 10.00–12.00	5.00–6.30 5.00–6.30 5.00–6.30 5.00–6.30 by appointment	Contraceptive services available
Jenkins, D. (M) **Keys, D.W.** (M) **Meyer, M.** (F) 35 Bow Road, E3 Practice No 5 on map *Appointment system*	980 3130	M 9.00–12.00 T 9.00–12.00 W 9.00–12.00 Th 9.00–12.00 F 9.00–12.00 S 9.00–12.00	4.30–5.30 4.30–5.30 4.30–5.30 4.30–5.30 for emergencies	Practice nurse available Monday–Friday 9–1 pm Cervical smear clinic Thursday 2–4 pm Contraceptive services available
Nagpal, V.S. (M) **Budhdeo, S.M.** (M) 3 Ivanhoe House, 130 Grove Road, E3 Practice No 6 on map *Wait your turn system*	980 1767	M 9.30–11.30 T 9.30–11.30 W 9.30–11.30 Th 9.30–11.30 F 9.30–11.30 S 9.30–11.30	5.30–7.00 5.30–7.00 5.30–7.00 5.30–7.00	Maternity and contraceptive services available by appointment Immunisation services available Cervical smear clinic
Rosewarne, D. (M) 110 Tredegar Road, E3 Practice No 7 on map *Wait your turn system*	980 1822	M 10.00–12.00 T 10.00–12.00 W 9.30–11.30 Th 10.00–12.00 F 10.00–12.00 S 10.00–12.00	5.00–7.00 5.00–7.00 at 33 St. Stephens Road 5.00–7.00 5.00–7.00	Contraceptive services available
Rushton, D.H. (M) **Rushton, G.J.** (M) 1 Birchdown House, Devons Road, E3 Practice No 8 on map *Wait your turn system*	980 1888	M 10.00–12.00 T 10.00–12.00 W 10.00–12.00 Th 10.00–12.00 F 10.00–12.00 S 10.00–12.00	5.00–6.30 5.00–6.30 5.00–6.30 5.00–6.30	Contraceptive services available
Taylor, B. (M) 3–5 Merchant Street, E3 Practice No 9 on map *Appointment system and wait your turn system for emergencies*	980 3676	M 10.00–11.45 T 10.00–11.45 W 10.00–11.45 Th 10.00–11.45 F 10.00–11.45 S 10.00–11.00	5.00–6.00 5.00–6.00 5.00–6.00 5.00–6.00 for emergencies	Ante-natal and Family Planning clinic – Thursday 1.30–3.00 pm
Jumaily, A. (M) 38 Stroudley Walk, E3 Practice No 10 on map *Wait your turn system*	981 4742	M 10.00–12.00 T 10.00–12.00 W 10.00–12.00 Th 10.00–12.00 F 10.00–12.00 S 10.00–11.00	4.00–6.00 4.00–6.00 4.00–6.00 4.00–6.00 emergencies only	Ante-natal and Family Planning clinic – Thursday 1.30–3.00 pm Baby clinic – Tuesday 1.30–3.00 pm

Bow and Popular (cont.)

Name and Address (M-male F-female)	Telephone	Surgery hours		Other sessions
Bhaiwala, Z.S. (F) **Bhaiwala, B.Z.** (M) 1 Butler House, Burdett Road, E14 Practice No 11 on map *Appointment system*	987 5597 Emergency 558 4711	M 9.45–11.00 T 9.45–11.00 W 9.45–11.00 Th 9.45–11.00 F 9.45–11.00 S 9.30–10.30	4.30–6.30 4.30–6.30 4.30–6.30 4.30–6.30 for emergencies only	Ante-natal and coil clinic – Friday 2–3 pm
Jain, A.K. (M) **Jain, V.K.** (M) 264 Burdett Road, E14 Practice No 12 on map *Appointment system*	515 5001 Emergency 263 8511	M 9.30–11.30 T 9.30–11.30 W 9.30–11.30 Th 9.30–11.30 F 9.30–11.30 S 10.00–11.30	5.00–6.00 5.00–6.30 5.00–6.30 5.00–6.30	Family Planning – Thursday 10–12 Ante-natal – Wednesday 10–11.30 am Baby immunisation during surgery hours
Godfrey, M. (M) **Swadi, B.S.** (M) **Ashrafuzzaman, M.** (M) 74–78 Gough Walk, E14 Practice No 13 on map *Appointment system and wait your turn system*	515 4701			
Godfrey, M.		M T W 10.00–11.00 Th F	2.00–3.00 2.00–3.00 2.00–3.00	Contraceptive and maternity services available
Nagrath, K.D. (M) 21 Brownfield Street, E14 Practice No 14 on map *Wait your turn system*	987 2774	M 10.00–11.30 T 10.00–11.30 W 10.00–11.30 Th 10.00–11.30 F 10.00–11.30 S 10.00–11.30	4.30–6.00 4.30–6.00	Contraceptive and maternity services available
Swadi, B.S. **Ashrafuzzaman, M.**		M 9.00–11.00 T 9.00–11.00 W 9.00–11.00 Th 9.00–11.00 F 9.00–11.00 S 9.00–11.00	4.30–6.00 4.30–6.00 4.30–6.00 4.30–6.00 for emergencies only	

(All on Fig. 4.5) Colour code green

Table 4.4 (cont.)

Stepney and Wapping: GP Practices

Name and Address (M-male F-female)	Telephone	Surgery hours	Other sessions
Basu, S.N. (M) 1 Barnardo Gardens Barnardo Street, E1 Practice No 1 on map *Wait your turn system*	791 1502	M 9.30–11.00 5.00–6.15 T 9.30–11.00 5.00–6.15 W 9.30–11.00 5.00–6.15 Th 9.30–11.00 – F 9.30–11.00 5.00–6.15 S 9.30–10.30 for emergencies only	Maternity and Contraceptive services available
Dunford, A.P. (M) **Killeen, N.** (F) **Buszewicz, M.J.** (F) Wapping Health Centre 22 Wapping Lane, E1 Practice No 2 on map *Appointment system (except Wed & Fri p.m.)*	481 9376 Emergency 556 1826	M 9.30–11.30 4.00–6.00 T 9.30–11.30 4.00–6.00 W 9.30–11.30 4.00–6.00 Th 9.30–11.30 4.00–6.00 F 9.30–11.30 4.00–6.00 S 9.30–11.00 for emergencies only	Family Planning Clinic – Tues 2–4 pm Ante-natal Clinic – Wed 2–4 pm Baby Clinic – Thurs 1.30–3.30 pm
Harris, B.T. (M) **Claff, H.R.** (M) **Edmondson, M.E.** (F) **Hull, S.A.** (F) **Young, M.R.** (M) **Jones, E.J.** (F) Steels Lane Health Centre 384–398 Commercial Road and Branch Surgery at 12–14 Nightingale House, Thomas More Street Practice No 3 and Branch Surgery on map Δ *Appointment system with wait your turn system for emergencies only*	791 0831 Emergency 556 1821 488 3653		
Harris, B.T. **Claff, H.R.** **Edmondson, M.E.** **Hull, S.A.** **Young, M.R.** **Jones, E.J.** Steels Lane Health Centre	791 0831 Emergency 556 1821	M 9.00–12.00 3.30–6.15 T 9.00–12.15 4.30–6.00 W 9.00–12.00 2.00–6.30 Th 9.00–11.30 4.00–6.00 F 9.00–12.00 2.00–6.00 S 9.00–12.00	Baby Clinic – Monday 1–3.30 pm Ante-natal – Tuesday 2–4.30 pm Well-woman & Family Planning Clinic – Wednesday 2–3.30 pm Baby Clinic – Thursday 1–3.30 pm
Young, M. 14 Nightingale House Thomas More Street	488 3653 Emergency 488 3653	M 9.00–11.30 2.30–4.30 T 9.00–11.30 5.00–6.00 W 9.00–11.30 3.00–6.00 Th 9.00–11.30 4.00–5.00 F 9.00–11.30 S 9.00–12.00 at Steels Lane	Baby Clinic – Wednesday 1–2.30 pm
Holzer, E.M. (M) **Habershon, R.** (M) **Dean, T.** (M) 45–47 Ben Johnson Road, E1 Practice No 4 on map *Wait your turn system*	790 1059 Emergency 790 1059	M 9.00–11.00 4.00–6.00 T 9.00–11.00 4.00–6.00 W 9.00–11.00 4.00–6.00 Th 9.00–11.00 F 9.00–11.00 4.00–6.00 S 9.00–11.00	Ante-natal Clinic – Tuesday 2–3.30 pm Contraceptive services available
14 Biscay House Ocean Estate Mile End Road, E1 Branch Surgery on map Δ *Wait your turn system*	790 4151 Emergency 790 1059	M 9.00–11.00 3.30–4.30 T 9.00–11.00 3.30–4.30 W 9.00–11.00 3.30–4.30 Th 9.00–11.00 – F 9.00–11.00 3.30–4.30	Ante-natal Clinic – Friday 2–3.30 pm
Hossain, M.N. (M) **Islam, K.H.** (M) **Khanam, S.** (F) 136 Cannon Street Road, E1 Practice No 5 on map *Wait your turn system and appointment system for clinics*	790 1585 Emergency 790 1585	M 10.00–12.00 5.00–6.30 T 10.00–12.00 5.00–6.30 W 11.00–12.30 Th 10.00–12.00 5.00–6.30 F 10.00–12.00 5.00–6.30 S – – Su 9.30–11.30	Ante-natal, post-natal and family planning clinic on Tuesday 1–3 pm Thursday 1–3 pm Friday 1–3pm
Kerawala, J.L. (M) **Pahwa, B.K.** (M) 5 Brayford Square, E1 Practice No 6 on map *Wait your turn system*	790 2136 Emergency 790 2136	M 9.30–11.30 5.00–6.30 T 9.30–11.30 5.00–6.30 W 9.30–11.30 5.00–6.30 Th 9.30–11.30 F 9.30–11.30 5.00–6.30	Contraceptive services available
Leahy, J.D. (M) 94 Whitehorse Lane, E1 Practice No 7 on map *Wait your turn system*	790 2658	M 9.30–11.30 5.00–7.00 T 9.30–11.30 5.00–7.00 W 9.30–11.30 5.00–7.00 Th 9.30–11.30 F 9.30–11.30 5.00–7.00 S 9.30–11.30	Contraceptive services available
Mitchell, R.T.C. (M) 300 Commercial Road, E1 Practice No 8 on map *Wait your turn system*	790 2978 Emergency 790 2978	M 9.30–11.00 5.00–6.00 T 9.30–11.00 5.00–6.00 W 9.30–11.00 5.00–6.00 Th 9.30–11.00 F 9.30–11.00 5.00–6.00 S 10.00–??	Maternity and contraceptive services Child immunisations Cervical cytology in surgery

Stepney and Wapping (cont.)

Name and Address (M-male F-female)	Telephone	Surgery hours		Other sessions
Docherty, J.N. 24 Batty Street, E1 Practice No 9 on map *Wait your turn system:* *long consultations by appointment*	488 4240	M 9.30–11.00 T 9.30–11.00 W 9.30–11.00 Th 9.30–11.00 F 9.30–11.00	5.00–6.30 5.00–6.30 5.00–6.30 5.00–6.30	Maternity and contraceptive services available
Prince, J.A. 24 Batty Street, E1 *Wait your turn system*	488 4240	M 9.30–11.00 T 9.30–11.00 W 9.30–11.00 Th 9.30–11.00 F 9.30–11.00 S By appointment	5.00–6.30 5.00–6.30 5.00–6.30 5.00–6.30	Contraceptive services available
Halper, N.H. 24 Batty Street, E1 *Wait your turn system*	265 0096	M T W Th F	1.30–4.30 1.30–4.30 1.30–4.30 5.00–6.30 1.30–4.30	
Kurzer, L. (M) 588 Commercial Road, E14 Practice No 10 on map *Wait your turn system*	790 2546	M 10.00–12.00 T 10.00–12.00 W 10.00–12.00 Th 10.00–12.00 F 10.00–12.00 S 10.00–12.00	4.30–6.00 4.30–6.00 4.30–6.00	Cervical cytology smears and vaccinations by appointment Maternity and contraceptive services available
Livingstone, A.E. (F) **Kallaway, T.M.C.** (M) **Widgery, D.J.** (M) Gill St. Health Centre, 11 Gill Street, E14 Practice No 11 on map	515 2211			
Livingstone, A.E. *Appointment system*	515 2211	M 9.00–11.00 T W 9.00–11.00 Th 9.00–11.00 F 9.00–11.00 S 9.00–11.00	3.30–6.00 4.30–6.30 5.00–6.00 – alternate weeks by appointment – 3.30–6.00 for emergencies only at 2 Cordelia Street	Ante-natal – Tuesday afternoons Cervical cytology smears by appointment Maternity and contraceptive services available
Kallaway, T.M.C. *Appointment system*	515 2211	M 9.00–11.00 T 9.00–11.00 W 9.00–11.00 Th 9.00–11.00 F – S 9.00–11.00	3.30–6.00 4.30–6.30 – 3.30–6.00 3.30–6.00 for emergencies only at 2 Cordelia Street	Maternity and Contraceptive services available
Widgery, D.J. (M) *Appointment system*	515 2211	M 9.00–11.00 T 9.00–11.00 W 9.00–11.00 Th – F 9.00–11.00 S 9.00–11.00	3.30–6.00 4.30–6.00 – 3.30–6.00 3.30–6.00 for emergencies only at Cordelia Street	Contraceptive services available

(All on Fig. 4.6) Colour code green

Isle of Dogs: GP Practices

Name and Address (M-male F-female)	Telephone	Surgery hours		Other sessions
Kothari, C.V. (M)	987 3536	M 10.00–12.00	4.30–6.00	Contraceptive and maternity
South Poplar Health Centre		T 10.00–12.00	4.30–6.00	services available
206 Poplar High St. E14		W 10.00–12.00		
Practice No 1 on map		Th 10.00–12.00	4.30–6.00	
Appointment system		F 10.00–12.00	4.30–6.00	
Robson, J.P. (M)	987 4011			
Taylor, J.R. (F)				
Jewell, J.A. (M)	Emergency			
Boomla, K.R.F. (M)	556 1821			
Self, J.E. (F)				
South Poplar Health Centre,				
260 Poplar High Street, E14				
Practice No 2 on map				
2 Cordelia Street, E14	515 4860			
Branch Surgery No 10a on map				
Robson, J.P.	987 4011	M 9.00–11.00	5.00–6.00	
South Poplar Health Centre		T 9.00–11.00		
Appointment system and wait	Emergency	W 10.00–12.00	4.00–6.00	
your turn for emergencies	556 1821	Th 9.00–11.00	4.00–6.00	
		F 10.00–12.00	4.00–6.00	Ante-natal clinic and
2 Cordelia Street	515 4860	S 9.00–11.00	for emergencies	classes Monday 2–4 pm
By appointment			at 2 Cordelia	Child health clinic
			Street	Tuesday, Thursday 1.30–3.00 pm
Boomla, K.R.F.	987 4011	M 9.00–11.00	5.00–6.00	Wellwoman clinic –
South Poplar Health Centre		T 10.00–12.00	4.00–6.00	Wednesday 9–10 am
Appointment system and wait	Emergency	W 9.00–11.00		Heart disease prevention
your turn for emergencies	556 1821	Th 10.00–12.00	4.00–6.00	clinic by appointment
		F 9.00–11.00	4.00–6.00	
2 Cordelia Street	515 4860	S 9.00–11.00	for emergencies	
By appointment			at 2 Cordelia	
			Street	
Jewell, J.A.	515 4860	M 9.00–11.00	4.00–6.00	
2 Cordelia Street		T 9.00–11.00	4.00–6.00	
Appointment system	Emergency	W 9.00–11.00		
	556 1821	Th 9.00–11.00	4.00–6.00	
South Poplar Health Centre,		F 9.00–11.00	4.00–6.00	
By appointment	987 4011	S 9.00–11.00	for emergencies	
			only	
Taylor, J.R.	515 4860	M 9.00–11.00	4.00–6.00	Ante-natal/post-natal
2 Cordelia Street		T 9.00–11.00	4.00–6.00	Tuesday 2–4 pm
Appointment system	Emergency	W 9.00–11.00	4.00–6.00	Child health clinic
	556 1821	Th 9.00–11.00		Tuesday, Thursday 1.30–3.00 pm
South Poplar Health Centre,		F 9.00–11.00	4.00–6.00	
By appointment	987 4011	S 9.00–11.00	for emergencies.	at South Poplar Health
			only	Centre
Self, J.E.	515 4860	M 9.00–11.00	2.00–6.00	
2 Cordelia Street		T 9.00–11.00	4.30–6.00	
Appointment system	Emergency	W	4.00–6.00	
	556 1821	Th 9.00–11.00	2.00–6.00	
South Poplar Health Centre,		F 9.00–11.00	4.00–6.00	
By appointment	987 4011	S 9.00–11.00	for emergencies	
			only	
Nebrajanhi, V.T. (M)	515 5551	M 10.00–11.30	5.00–6.30	Contraceptive services
Shah, S.A. (F)		T 10.00–11.30	5.00–6.30	available
61 Quarterdeck, Millwall		W 10.00–11.30	5.00–6.30	
Practice No 3 on map		Th 10.00–11.30		
Wait your turn system		F 10.00–11.30	5.00–6.30	
		S 10.00–11.30		
60 East India Dock Road	515 5525	M 9.30–11.00	4.30–5.30	
Branch Surgery Δ on map		T 9.30–11.00	4.30–5.30	
Wait your turn system		W 12.00– 1.00		
		Th 9.30–11.00		
		F 12.00– 1.00	6.30–7.00	
Yogadeva, S. (M)	987 4231	M 9.30–11.00	4.30–6.00	Ante-natal care, contraceptive
519 Manchester Road,		T 9.30–11.00	4.30–6.00	services and cervical cytology
Isle of Dogs		W 9.30–11.00	4.30–6.00	available
Practice No 4 on map		Th 9.30–11.00		
Appointment system		F 9.30–11.00	4.30–6.00	
Mahajan, V. (M)	515 4601	M 10.00–11.30	5.00–6.30	Ante-natal and post-natal
1 Julian Place,		T 10.00–11.30	5.00–6.00	clinics – Tuesday
Isle of Dogs		W 10.00–11.30	5.00–6.00	12.00–1.30 pm
Practice No 5 on map		Th 10.00–11.30		Contraceptive services
Appointment system – wait your turn system for emergencies		F 10.00–11.30	5.00–6.30	available

(All on Fig. 4.7) Colour code green

Source: City and East London FPC and Primary Care Development Project (1987)

Table 4.5. Neighbourhood Profiles

Name :- Bethnal Green Neighbourhood Offices:- 255 Cambridge Heath Road E2 0 HQ Telephone 739-4344 (Map 1)

Senior Officers	1) Chief Executive, 2) Assistant Chief Executive, 3) Social Services Manager, 4) P.O Social Work, 5) P.O Residential & Day Care.
Children's Homes	Nelson Gardens, 1 Nelson Gardens E2 (Map 2) 16 places
Day Nurseries	Mary Hughes, 22 Underwood Road E1 (Map 3) 60 places including special care. .
Play Groups	1) Avebury Estate Roberta St. E2 (Map 4) 20 places 2) Gatehouse Toynbee Hall Commercial St. E1 (Map 5) 25 places 3) Robert Montefiore Deal/Hanbury St. E1 (Map 6) 40 places
Homes for Elderly People	Sarel House Buckfast St. E2 (Map 7) 37 places
Sheltered Accommodation	1) Mondela House Virginia Road E2 (Map 8) 28 places 2) Peachey Edwards House Teesdale House E2 (Map 9) 20 places
Luncheon Clubs	1) Hollybush Old People's Meeting Hall Kedlestone Walk E2 (Map 10) 2) St Hilda's Estate 18 Club Row E2 (Map 11) 3) Toynbee Hall Day Centre 28 Commercial St. E1 (Map 5)
Day Centre for People with Mental Illness	Pritchards Road E2 (Map 12) 75 places.

Name:- Globe Town Neighbourhood Offices:- 62 Roman Road E2 0PG Telephone 739-4344(Map 13)

Senior Officers	1) Chief Executive, 2) Assistant Chief Executive, 3) Social Services Manager, 4) P.O Social Work, 5) P.O Residential & Day Care
Day Nurseries	University House, Sugar Loaf Walk, E2 (Map 14) 60 places
Playgroups	1) Salvation Army, Sigsworth Hall Globe Road E2 (Map 15) 24 places 2) Wellington Gardens Com Centre E2 (Map 16) 16 places
Sheltered Accommodation	Hugh Platt House Patriot Sq E2 (Map 17) 17 places
Luncheon Clubs	1) St Margaret's Day Centre, 21 Old Ford Road E2 (Map 18) 2) Vietnamese Luncheon Club, 21 Old Ford Road E2 (Map 18)

Please see map on Fig. 4.4
Colour code is red

Table 4.5(cont): Neighbourhood Profiles

Name:- Bow

Neighbourhood Offices:- Bow House, Bow Road E3
Telephone 980-4414 (Map 1)

Senior Officers	1) Chief Executive, 2) Assistant Chief Executive, 3) Social Services Manager, 4) P.O Social Work, 5) P.O Residential & Day Care.		
Children's Homes	1) 123 Tredegar Road E3 2) Dave Adams House 12 Norman Grove E3	(Map 2) (Map 3)	9 places 20 places
Day Nursaries	Overland Lefever Walk Parnell Road E3	(Map 4)	60 places
Playgroups	1) Bow Baths, Sutherland road E3 2) Bow Flyover, 223 Bow Road E3 3) Little Acorn Cadogan Terrace E9 4) Ranwell Estate, Poultney Close E3 5) Rhondda Grove 8c Morgan St. E3	(Map 5) (Map 6) (Map 7) (Map 8) (Map 9)	24 places 20 places places not known 35 places 30 places
Homes for Elderly People	Donnybrook, 135 Parnell Road E3	(Map 10)	42 places
Day Centres for Elderly People	John Bond Centre, Beale Road, E3	(Map 11)	20 places
Sheltered Accommodation	1)10 Norman Grove E3 2) 55 Lawrence Close Malmesbury Road E3 3) Appian Court, 87 Parnell Road E3 4) Gawthorne Court, Mostyn Grove, E3 5) John Bond House, 20 Wrights Road E3 6) Vic Johson House, Armagh Road E3	(Map 12) (Map 13) (Map 4) (Map 14) (Map 15) (Map 16)	32 places 30 places 30 places 31 places 12 places 32 places
Linked Flats	Donnybrook, 135 Parnell Road E3	(Map 4)	
Luncheon Clubs	1) Appian Court, Parnell Road E3 2) Ranwell, 1 Butley Court E3	(Map 4) (Map 17)	
Hostels for People with Learning Dis-abilities	William Tuson House, 109/127 Antill Road E3	(Map 18)	16 places
Day Centres for People with Learning Dis-abilities	Coburn S.E.C, 1/3 Coburn Street E3	(Map 19)	30 places

Please see map on Fif 4.5
Colour code is red

Table 4.5(cont): Neighbourhood Profiles

Name:- Poplar

Neighbourhood Offices:- Bow House, Bow Road E3 2SE
Telephone 980-4414(Map 20)

Senior Officers	1) Chief Executive, 2) Assistant Chief Executive, 3) Social Services Manager, 4) P.O Social Work, 5) P.O Residential & Day Care	
Children's Homes	1) 8 Windermere House, 74 Eric Street, E3 2) Edward Smith House 60 William Guy Gardens E3	(Map 21) 9 places (Map 22) 16 places
Day Nurseries	1) Langdon Park Family Centre, off St. Leonard's Rd E14 2) Queen Mary, Tidey Street E3	(Map 23) (Map 24) 35 places
Playgroups	1) Burdett Estate, Wallwood Street E14 2) Lincoln Hall, Swaton Road E3	(Map 25) 25 places (Map 26) 25 places
Homes for Elderly People	1) Lansbury Lodge, 1 Grundy Street E14 2) Mount Everest, 88 Teviot Street E14 3) William Guy House, 52 St Leonard's Street E3	(Map 27) Closed (Map 28) 42 places (Map 29) 40 places
Homes for Elderly Mentally Ill People	Ullswater House, 10 Maplin Street E3	(Map 30) 27 places
Day Centres for Elderly People	1) John Orwell Centre, Southern Grove, E3 2) Mount Everest, 88 Teviot Street E14 3) William Guy Centre, 52 St Leonard's Street E14	(Map 31) 80 places (Map 28) 20 places (Map 29) 20 places
Work Centres for Elderly/ Disabled People	Fancis Bristow Centre, Southern Grove, E3	(Map 31) 90 places
Sheltered Accommodation	1) Edith Brinson House, 106 Oban Street E14 2) Spey Street, Block 28, Flat 55 Spey St. Estate E14 3) William Guy Gardens, Flat 17 Telwin Street E3	(Map 32) 32 places (Map 33) 27 places (Map 34) 16 places
Linked Flates	Mount Everest, 88 Teviot Street E14	(Map 28)
Luncheon Clubs	1) Bromley Public Hall, Bow Road E3 2) Fern Street Settlement, Fern Street E3 3) Langdon Pak, 7 Byron Street E14 4) Salvation Army Hall, Kerbey Street E14 5) Trinity Street Day Centre, East India Dock Rd. E14	(Map 35) (Map 36) (Map 37) (Map 38) (Map 39)

Poplar (cont)		
Hostels for People with Learning Disabilities	Douglas House, 68 Campbell Road E3	(Map 40)
Day Centres for People with Learning Disabilities	William Binson House, Anold Road E3	(Map 41) 125 places
Homes for Physically Disabled People	Charles Key Lodge, 40 Southern Grove E3	(Map 31) 28 places
Day Cente for People with Physical Disabilities	Wilfred Reeve Centre, Southern Grove E3	(Map 31) 100 places

Please see map on Fig 4.5
colour code is red

Table 4.5(cont): Neighbourhood Profiles

Name:- Stepney

Neighbourhood Offices:- Cheviot House Commecial Road E1
Telephone 790-1818 (Map 1)

Senior Officers	1) Chief Executive, 2) Assistant Chief Executive, 3) Social Services Manager, 4) P.O Social Work, 5) P.O Residential & Day Care.
Playgroups	Stifford & Exmouth Estate Clubroom, Brayford Sq.E1(Map 2) 24 places
Homes for Elderly People	Braybrooke 216 Stepney Way E1 (Map 3) 58 places
Luncheon Clubs	1) Bangladeshi Luncheon Club, Dame Colet House Ben Johnson Road E1 (Map 4) 2) Dame Colet House, Ben Johson Road E1 (Map 4) 3) Exmouth Cornwood Road Exmouth Estate E1 (Map 5) 4) Israel & Emily Cussins, Beaumont Hall 2 Beaumont Grove E1 (Map 6) Kosher 5) Ocean Rest-a-While Cafeteria, Shandy St. E1 (Map 7) 6) Whitechapel Mission, 212 Whitechapel Road E1 (Map 8)
Day Centre for People with Physical Disability	James Olley Centre Brunton Place E14 (Map 9)

Name:- Wapping

Neighbourhood Offices:- Limehouse Town Hall
646 Commercial Road E14
Telephone:- 515-3229(Map 10)

Senior Officers	1) Chief Executive, 2) Assistant Chief Executive, 3) Social Services Manager, 4) P.O Social Work, 5) P.O Residential & Day Care.
Children's Homes	Hannah Long House, 23 Swedenborg Gardens Crowder Street E1 (Map 11) 20 places
Day Nurseries	Mary Sambrook, 125 The Highway E1 (Map 12) 60 places
Playgroups	1) Shadwell Day Centre, Lansbury Institute The Highway E1 (Map 13) 35 places 2) The Ensign Glamis Road E1 (Map 14) 3) Wapping Youth Club Watts Street E1 (Map 15) 12 places
Homes for Elderly People	Fitzgerald Lodge, 24 Sutton Street E1 (Map 16) 64 places
Sheltered Accommodation	John Lawder House, 12 Gill Street E14 (Map 17) 32 places
Linked Flates	Fitzgerald Lodge, 24 Sutton Street E1 (Map 16)
Luncheon Clubs	Barley Mow, Old People's Centre, Three Colt Street E14 (Map 18)

Please see map on Fig 4.6
Colour code is red

Table 4.5(cont): Neighbourhood Profiles

Name:- Isle of Dogs

Neighbourhood Offices:- Unit D Great Eastern Enterprise, Mill Harbour E14 Telephone 538-4571

Senior Officers	1) Chief Executive, 2) Assistant Chief Executive, 3) Social Services Manager, 4) P.O Social Work, 5) P.O Residential & Day Car
Children's Homes	1) 188 Timberlog Lane Basildon 7 places 2) 24 The Greensted Basildon 7 places 3) 42 The Greensted Basildon 8 places 4) 3 Maplin Gardens Basildon 8 places
Day Nurseries	1) Charles Blaber House, 54 East India Dock Road E14 (Map 2) 35 places 2) George Green Centre, 80 Manchester Road E14 (Map 3) 50 places
Playgroups	1) Alpha Grove Community Centre, Malabar St E14 (Map 4) 24 places 2) Island House, 4 Roserton Road E14 (Map 5) 25 places 3) Rainbow Calders Wharf, Saundersness Road E14 (Map 6) 16 places 4) Will Crooks Estates, 1-3 Wigram House Wades Place E14 (Map 7)
Day Centres for Elderly People	George Green Centre Manchester Road E14 (Map 3) 80 places
Sheltered Accommodation	John Tucker House, 40 Mellish Street E14 (Map 8) 34 places
Luncheon Clubs	1) Chinese Luncheon Club, St Matthias School Bullivant St E14 (Map 9) 2) Discovery House, Newby Place E14 (Map 10) 3) Samuda, 44 Stewart Street E14 (Map 11) 4) 40 Stratford St. West Ferry Road E14 (Map 12)
Kitchen	Newby Place E14 (Map 10)

Please see map on Fig. 4.7

Colour code red

Source:- Local Authority (1988)

Chapter Five

Methods of Deriving Input Data for Resource Allocation

5.1 Introduction

In Chapter Four we developed population profiles for use in the decentralized planning of community health care in Tower Hamlets. The base-line information was collected and collated for population profiles which were then input to a prototype GIS. Having developed a base-line information system the next step in the process of implementing decentralization is the rational allocation of resources. For this, as already mentioned, we will consider resource allocation for the delivery of the district nursing service in Tower Hamlets. This service operates by nurses visiting patients in their homes; therefore two data elements, need for service and nurses' travel time to visit patients, are essential for resource allocation in the district nursing service. The present chapter explains the methods used to derive service need and travel time data.

The objectives and type of services delivered by district nurses have been described in Chapter Four. District nurses are administratively based in health centres and travel to visit their patients. The need of patients for services offered by district nurses varies between types of patient (and indeed from patient to patient). Below we derive need estimates for the year 1991 in Tower Hamlets for three age categories: 5-14, 15-64, and over 65. Separate teams of health visitors provide care for children under five - therefore this age group has been excluded from the exercise.

As explained in Chapter Three, to identify the health care needs of each Region's population, the NHS used the RAWP formula from 1977 to 1990. This formula for funding has recently been replaced by funding on a capitation basis. However the government in its recent white paper Working for Patients acknowledges that the RAWP formula has proved a useful method of producing a better national distribution of resources by significantly reducing regional inequalities (HMSO, 1989). As the principles of the RAWP formula have been considered useful in identifying equitable needs, the need for district nurses in each ward will be derived following the principles of the RAWP formula.

The RAWP formula is based on four elements - service activity, population, SMRs, and indicators of social deprivation. In the following sections we interpret each of these variables in terms of the Tower Hamlets district nursing service.

5.2 Service Activity and Population

A data set comprising age and sex specific service activity in 1989 (the latest available information) was obtained from district nursing returns based on the Korner information system in Tower Hamlets (see Chapter Four). The Korner information system at the time of the study was in an early stage of development. Therefore there were doubts about some service activity data, and in particular that regarding children under five. It seems that in cases where the age of the patient was omitted by the district nurse, the patients were recorded as under five by the system. To counter-act this presumed error, a possibility, suggested by a locality manager in Tower Hamlets, was to add all cases recorded as under five into the category of elderly patients. This was justified on the grounds that it is mostly old people who are seen by the district nurses and who are therefore most likely to have been erroneously recorded as under five. Since the numbers included were vary small, and for simplicity, this argument was accepted and the number of patients under five were added into the category of patients over 65.

After making the necessary adjustments in the service activity data the next requirement was population data for the years 1989 and 1991. The 1989 population was required to derive the service activity rate to be applied to the 1991 population in order to derive the expected service use for the year 1991.

To estimate the service activity rate during 1989, population figures for the same year were also required. The LRC (London Research Centre) estimates of ward populations by age and sex for the years 1986 and 1991 were obtained via Tower Hamlets local authority. From these figures, an estimated population for the year 1989 was obtained using linear interpolation.

The method of linear interpolation used for estimating population between any two periods is that of Manual X: Indirect Techniques For Demographic Estimation (UN,1983). Consider the line defined by the points (x_1,y_1) and (x_2,y_2). A third point (x,y) would lie on this line if the following relation holds:

$$(y_2 - y_1)/(x_2 - x_1) = (y - y_1)/(x - x_1) \quad \ldots\ldots\ldots\ldots\ldots\ldots (5.1)$$

that is, if the slope of the line defined by (x_1,y_1) and (x_2,y_2) is exactly the same as the slope of that defined by (x_1, y_1) and (x, y). Suppose that the value of x is known, but not that of y. Solving for y in equation 5.1, the following expression is obtained:

$$y = \emptyset y_2 + (1.0 - \emptyset)y_1 \ldots\ldots \quad (5.2)$$

where

$$\emptyset = (x - x_1)/(x_2 - x_1) \ldots\ldots \quad (5.3)$$

Equations (5.2) and (5.3) provide a way in which linear interpolation can be performed in two simple steps. First, calculate the value of ø, the "interpolation factor", solely by using the values of the observed abscissae (x-values). Then, use equation (5.2) to calculate the desired interpolated ordinate, y.

To estimate Tower Hamlets ward-based age and sex specific populations for the year 1989, years were taken as x's and populations as y's. The known x-values are $x = 1989$, $x_1 = 1986$, and $x_2 = 1991$. The known y-values are y_1 = population of 1986, and y_2 = population of 1991. Using linear interpolation, the unknown values of y, i.e. the ward-base age and sex specific population for the year 1989 were derived. They are given in Appendix 2.

5.3 SMRs

The methods for deriving SMRs and their importance in identifying need for health care were discussed in Chapter Three. It was also explained there that the RAWP review committee (DHSS, 1988) recommended that to identify need a) SMRs under 75 years should be used to take account of premature death, and b) SMRs should be used with an elasticity of 0.5 because with an increase in SMR the rate of increase of need for service decreases.

In what follows SMRs have in consequence been employed with an elasticity of 0.5. However, since we are calculating the need for service in three different age categories, it is not appropriate to use the SMR under 75 years (as recommended in the RAWP review report) in each case. Ideally, appropriate age-specific SMRs should be employed; however using SMRs for areas as small as a ward are problematic, mainly because of the small number of deaths. This problem has also been recognized by Curtis and Taket (1989) who suggest combining the data on deaths from several years. We estimated ward-based SMRs by combining the data on deaths from 1981 through 1985. It was not possible, however, to disaggregate SMRs into age and sex specific rates at ward level, as in various cases the data was too limited to permit reliable estimation. In order to use age and sex specific SMRs at ward level, we suggest that data on deaths for at least ten years should be combined.

5.4 Indicators for Social Deprivation

Social conditions are now well recognized as influencing the need for health care. However there is no unique indicator of social deprivation. A number of researchers have produced such indicators. The most important among them are the UPA8 (Under Privileged Areas) indicator, Scott-Samuel's 'objective indicator' of the need for primary health care (1984), Thunhurst's (1985) method of defining areas of poverty, and Townsend's indicators of material deprivation. All these indicators are related to identifying the need for health care.

The Department of Environment has also developed its own urban deprivation indicators in the context of urban development policy. However their indicators, according to Curtis and Taket (1989), were measures of general social conditions rather than specific indicators of the relative need for health care.

UPA8, developed by Professor Brian Jarman (1983), is a weighted sum of 8 census-based variables. It represents the factors perceived by GPs as determining the pressure on their workload. The weights were determined from a national survey of GPs carried out by St. Mary's Hospital Medical School. The score is calibrated so as to vary from -50 to +50 with a mean of zero. Higher scores mean greater deprivation.

Scott-Samuel (cited in Thunhurst, 1985) criticized Jarman's indicator of deprivation for its requirement of a complex and expensive survey process as well as its need for elaborate statistical computations. Scott-Samuel (1984) developed his own 'objective indicator' of the need for primary health care. For this purpose Scott-Samuel considered permanent sickness rates as an indicator of need. He took from the national census the proportion of population unemployed due to permanent sickness. By concentrating on Merseyside and Cheshire local government districts Scott-Samuel correlated the range of census variables with permanent sickness, and identified 10 census variables that independently explained 25% or more of the variance in the permanent sickness rate. These 10 variables were transformed, standardized, and then given weights according to their correlation with permanent sickness. By this process Scott-Samuel produced a deprivation index. However this approach according to Thunhurst (1985) employs methods comparable to those used by Jarman.

Thunhurst argues that health care needs are multidimensional and that the problem of identifying need can be approached from this point of view. The Thunhurst approach is based on an empirical study defining areas of poverty in Sheffield. It used a wide data set of 18 census variables that gave evidence of deprivation in about two dozen areas, later extended to 30 areas as a result of grassroots survey (Thunhurst, 1985). The Thunhurst approach is indeed useful to measure general social conditions and was adopted for policy formulation by a number of departments throughout the City Council. However use of the Thunhurst approach as a specific indicator of relative need for health care service planning is unclear. Jarman's indicator as we mentioned must be survey-based, which involves time and cost. Scott-Samuel on the other hand uses variables with weights calculated from their correlations, which according to Thunhurst (1985) is a rather circular process of deriving a more complex indicator out of correlated variables.

However, the method of deriving a deprivation index developed by Townsend, Simpson and Tibbs (1984) is fairly simple and straight forward. The Townsend deprivation index adds together the 'Z-scores' of four census variables to represent material deprivation. These deprivation variables are:

1) the percentage unemployed;

2) the percentage of households without car;

3) the percentage of households which are not owner occupied; and

4) the percentage of households which are overcrowded.

Each of these variables is standardized to have a mean of 0 and a standard deviation of 1 by means of the transformation

$$Z_i = (X_i - X) / S_i \quad \ldots\ldots(5.4)$$

where X and S_i are the mean and standard deviation of X_i.

The unemployment and overcrowding variables are skewed towards the lower percentages, and so before standardization they are transformed to produce normal distributions, using the log transformation $Y = \ln(X + 1)$ where X is the untransformed variable (Townsend, Phillimore, Beattie, 1986).

As the method of calculating the Townsend index is fairly simple, easily understandable, and its use has also been preferred by Tower Hamlets Health Authority, we have therefore in this study used Townsend's ward-based index scores of deprivation (Tower Hamlets Health Authority, 1989), as input to a method for deriving the need for district nursing service. Ward-based Townsend deprivation index scores are given in Appendix 2.

5.5 Model for Deriving the Need for District Nursing Service

The model is designed to derive ward-based need for each of three age categories of patients. It derives service activity rates for each category of patients for the year 1989 and applies them to the estimated future population of 1991. After that the extent of need for each category of patients is derived by taking into account ward specific SMRs (with an elasticity of 0.5) and Townsend social deprivation indicators. The notation adopted is as follows:

j the jth ward,

k the kth age group, and

s the sth sex.

The data available to the model is:

WP_{jks} estimated population in ward j, age group k, and sex s for the year 1991,

DP_{ks} estimated total district population in age group k and sex s for the year 1991,

CL_{ks} average number of cases seen by district nurses in age group k and sex s for the year 1989,

P_{ks} estimated total district population in age group k and sex s for the year 1989,

SMR_j standardized mortality ratio based on 1981-85 data in ward j (see Appendix 2),

U_j transformed Townsend deprivation index score in ward j (see Appendix 2)

The model for estimating need is

$$N_{jk} = \sum_s WP_{jks} * (CL_{ks} / P_{ks}) * SMR_j^a * U_j \quad \ldots\ldots\ldots\ldots\ldots\ldots (5.5)$$

where

N_{jk} is need for service in 1991 in ward j age group k , and

a is the SMR elasticity, equal to 0.5.

Equation (5.5) is the multiplication of age, sex, and ward specific service activity rates per population in 1989 by corresponding population estimates for 1991 to produce expected future service activity - which is then adjusted according to SMRs and social deprivation. The Townsend deprivation index has zero mean. It is transformed by

U = {(Townsend index / 3 * standard deviation) + 1}

to give an indicator with an average value of 1.

Need is then combined for both sexes. The need for district nursing service derived for each ward and age category is given in Table 5.1.

Table 5.1: Ward-based need for district nursing service

	Need			
Wards	5-14	15-64	65+	All ages
Blackwall	35	1055	5517	6608
Bow	33	1095	6824	7978
Bromley	49	1796	9938	11782
East India	26	931	6106	7063
Grove	10	433	3048	3491
Holy Trinity	29	1007	9042	10079
Lansbury	31	1201	7713	8945
Limehouse	39	1454	8791	10283
Millwall	47	1798	7557	9402
Park	14	621	5138	5772
Redcoat	18	789	6635	7442
Shadwell	67	1721	9856	11643
Spitalfields	97	2242	11729	14068
St. Dunstans	45	1394	11186	12626
St. James	25	965	7228	8219
St. Katherines	80	2561	10201	12842
St. Marys	43	1262	8125	9430
St. Peters	41	1401	9350	10792
Weavers	52	1473	11492	13017
Total need	782	25199	155476	181457
No. of cases seen in 1989	408	14492	92556	107456
% excess over 1989 cases	92%	74%	68%	69%

It can be observed that these estimates of need for the year 1991 are substantially greater then actual service delivery in 1989 - indeed they are 69% higher. This gap represents only to a limited extent an increase in population and its need for service; by far the greater part is accounted for by the extent to which current (1989) case-load underestimates the actual level of need.

Having derived estimates of need our next essential data element for resource allocation, as mentioned earlier, is an estimate of nurses travel time. This is explained in the following section.

5.6 Travel time Between Health Centres and Wards

To provide nursing care, district nurses visit patients in their homes. A complication in the calculation of nurses' travel time is that although nurses are administratively based in health centres, they may in practice start their day's work by travelling from their own homes to the patients. Since nurses' travelling patterns are generally not known, we will nevertheless assume for simplicity that nurses work by travelling from the health centres.

In Tower Hamlets the district nursing service is delivered from eleven health centres, and geographically Tower Hamlets is divided into nineteen electoral wards. We may regard travelling as taking place between health centres and wards.

In order to construct a travel time matrix between health centres (supply points) and wards (need points), a map of the road network and travel times by car between health centres and all traffic junctions in Tower Hamlets were obtained from the Geography department of the London School of Economics. (Car travel time was used because it is known that nurses normally travel to patients using their own cars.) The road network map was then superimposed on the land-use map of Tower Hamlets to determine those traffic points which coincide with the residential areas in each ward. From these only the maximum travel time that a nurse would require to travel from a health centre to a ward was used. This was done in order to give maximum allowance for nurses' travel time. By this method we constructed a 11*19 matrix of the maximum travel time between health centres and wards which is given in Appendix 3.

5.7 Conclusions

We have in this chapter identified the equitable need for each ward in Tower Hamlets using the principles of the RAWP formula, and defined a measure of travel time that nurses would require to travel between health centres and wards. In the following Chapter we will utilize these data as an input parameters to allocate district nurses for localized planning.

Chapter Six

Resource allocation: A case study of the district nursing service in Tower Hamlets

6.1 Introduction

In Chapter Five we developed a method for deriving the need for a district nursing service on a ward basis. We also explained that the extent of need for services offered by district nurses varies with age. Accordingly we calculated need for district nursing services in Tower Hamlets for three categories of patients - in age groups 5-14, 15-64, and over 65. The present Chapter considers resource allocation for the district nursing service - one of the tactical steps towards achieving decentralization in primary health care.

The district nurses in Tower Hamlets are administratively based in 11 health centres and travel to visit their patients in their own homes. Our objective is to allocate district nurses to the health centres within each locality in such a way that the need of each patient group in each ward is satisfied equitably while the total annual travelling time by the district nurses is minimized.

In developing a method of this kind it would in principal have been desireable to work interactively with responsible decision-makers. In this case such access was not feasible. However Ann R. Taket of the Department of Community Medicine, Tower Hamlets Health Authority agreed to act as a 'proxy' decision-maker in this respect.

As a result of these discussions, it was decided to develop a resource allocation mechanism corresponding to two alternative ways of delivering the district nursing service:

a) service to be organized on a locality basis, with health centres serving the populations of wards falling within the locality boundaries; and

b) localities remain as managerial units for the health centres within their boundaries, but district nurses from any health centre are able to be allocated to service the populations of any wards within the district.

The objective of analyzing the situation in two ways is primarily to examine the implications of removing locality based restrictions on service delivery.

Accordingly we have developed two alternative mathematical models, one disallowing cross boundary flows, and the other permitting them. The following two assumptions were made:-

1) the average number of patients that may be seen by a district nurse in a day was taken to be 8, 7, and 6 in age groups 5-14, 15-65 and over 65 respectively; and

2) in practice it is known that district nurses may start a day's work from home to go on their rounds. In the absence of data about their actual travelling patterns it was assumed in this study that, as an approximation, a district nurse will travel from her base in the health centre to the patient. A measure of the cost of this travelling is the maximum travel time between health centres and the residential areas of wards of residence. The estimation of these times was described in Chapter Five. The models are explained in the following sections.

6.2 Model One

Model One, in which service is provided strictly within the context of existing localities, aims to allocate an integer number of district nurses to each locality so that the proportion of need met is as equal as possible across all wards and across all patient categories (the equity constraint), and so that the total travelling time of nurses is minimized. The model is described below.

In the description of model the following indices are used:-

p the pth locality,

$j(p)$ the jth ward in locality p,

$i(p)$ the ith health centre in locality p,

k the kth patient age group.

The data available to the model is:-

P the number of localities (4 in this case),

m_p the number of wards in locality p,

n_p the number of health centres in locality p,

K the number of patient age groups (3 in this case)

$Need_{j(p)k}$ the need of patient group k in ward j(p), expressed as number of visits per year

a_k the average number of visits to patient group k that can be made by a district nurse in a day (taken as 8, 7, and 6 for age groups 5-14, 15-64, and over 65 respectively),

$T_{i(p)j(p)}$ the traveling time between health centre i(p) and ward j(p),

Z number of district nurses to be allocated in Tower Hamlets (given as 75),

W number of working days in a year (assumed to be 260).

ADFMAX a given value permitting deviation from 100% equity in service delivery.

The variables in the model are:-

z_p the number of nurses to be allocated to locality p (integer),

$X_{i(p)j(p)k}$ the number of whole time equivalent nurses in health centre i(p) in locality p who are deployed to serve patient group k in ward j(p) (a continuous variable that may take any real value).

α_{max} the maximum proportion of total need which can be satisfied (see constraint (d) below).

α_{min} the minimum proportion of total need which can be satisfied (see constraint (e) below).

The objective function is to minimize the total annual travel time by the district nurses:

$$\text{Minimize } \sum_p \sum_{i(p)} \sum_{j(p)} \sum_k W * a_k * X_{i(p)j(p)k} * T_{i(p)j(p)k}$$

The constraints are:-

a) all the nurses must be allocated:

$$\sum_p z_p = Z$$

b) in each locality the sum of the nurses allocated to the health centres must equal those allocated to the locality:

$$\sum_{i(p)} \sum_{j(p)} \sum_{k} X_{i(p)j(p)k} = z_p \quad \text{for } p = 1,..,P$$

c) each health centre must have at least one nurse:

$$\sum_{j(p)} \sum_{k} X_{i(p)j(p)} \geq 1 \quad \text{for } i(p) = 1,...,n_p;\ p = 1,..,P$$

d) the maximum need that is satisfied must be less than or equal to α_{max}:

$$\sum_{i(p)} (W{*}a_k/Need_{j(p)k}){*}X_{i(p)j(p)k} \leq \alpha_{max} \text{ for } k=1,...,K;\ j(p)=1,...,m_p;\ p=1,..,P$$

e) the minimum need that is satisfied must be greater than or equal to α_{min}:

$$\sum_{i(p)} (W{*}a_k\ /Need_{j(p)k}){*}X_{j(p)i(p)k} \geq \alpha_{min} \quad \text{for } k=1,...,K;\ j_{(p)}=1,...,m_p;\ p=1,..,P$$

f) the deviation from equity, that is, the difference between maximum and minimum ward proportions of need met, must not exceed a given value:

$$\alpha_{max} - \alpha_{min} \leq ADFMAX$$

g) the non-negativity and integrality conditions:

$z_p \geq 0$ and integer $p = 1,..,P$

$X_{i(p)j(p)k} \geq 0 \quad k = 1,...,K;\ j(p) = 1,...,m_p;\ i(p) = 1,...,n_p;\ p = 1,..,P$

$\alpha_{max}, \alpha_{min} \geq 0.$

This model with ADFMAX equal to zero is infeasible, that is $\alpha_{max} = \alpha_{min} = \alpha$; this can be shown by substituting

$$\sum_{i(p)} X_{i(p)j(p)k}$$

from relation (d) into equation (b) giving

$$z_p = (\alpha / W) * \sum_{j(p)} \sum_k (Need_{j(p)k} / a_k) \quad p = 1,.., P$$

With only variable, α, there are insufficient degrees of freedom for the z_p's to take integer values.

6.3 Model Two

In this model, it is assumed that localities remain as managerial units for the health centres within their boundaries, but district nurses from any health centre are able to be allocated to serve the populations of any ward within the district. This assumption has been made to examine the implications of removing locality based restrictions on service delivery. The aim is the same as in Model One, to allocate an integer number of district nurses to each locality in such a way that the proportion of the need, of each patient group in each ward, that is met is the same (the equity constraint), and that the total time travelled by nurses is minimized.

The notation used is similar to that used in Model One. The following indices (mostly the same as in Model One) are used :

p	the pth locality,
j	the jth ward,
i(p)	the ith health centre in locality p,
k	the kth patient age group.

The data available to the model is:-

P	the number of localities (4 in this case),
N	the number of wards,

n_p the number of health centres in locality p,

K the number of patient age groups (3 in this case)

Need $_{jk}$ the need of patient group k in ward j, expressed as number of visits in a year

a_k the average number of visits to patient group k that can be made by a district nurse in a day (which are taken 8, 7, and 6 for age groups 5-14, 15-64, and over 65 respectively),

$T_{i(p)j}$ the traveling time between health centre i(p) and ward j,

Z number of district nurses to be allocated in Tower Hamlets (given as 75)

W number of working days in a year (assumed to be 260).

The variables in the model are:-

z_p the number of nurses to be allocated to locality p (an integer variable),

$X_{i(p)jk}$ the number of nurses to be allocated to health centre i in locality p to serve patient group k in ward j (a continuous variable),

y_{jp} allocate or not ward j to locality p (a 0-1 variable)

α the measure of equity (a continuous variable).

The objective function is to minimize the total annual travel time by the district nurses:

$$\text{Minimize } \sum_p \sum_{i(p)} \sum_j \sum_k W * a_k * X_{i(p)jk} * T_{i(p)jk}$$

The constraints are:-

a) all the nurses must be allocated:

$$\sum_p z_p = Z$$

b) in each locality the sum of the nurses allocated to the health centres must equal those allocated to the locality:

$$\sum_{i(p)} \sum_j \sum_k X_{i(p)jk} = z_p \quad \text{for } p=1,\ldots,P$$

c) each health centre must have at least one nurse:

$$\sum_j \sum_k X_{i(p)jk} \geq 1 \quad \text{for } i(p) = 1,\ldots,n_p;\; p = 1,\ldots,P$$

d) each ward must be assigned to a locality:

$$\sum_p y_{jp} = 1 \quad \text{for } j = 1,\ldots,N$$

e) district nurses allocated to locality p may only serve a set of wards that have been allocated to locality p:

$$X_{i(p)jk} \leq \text{Need}_{jk} * y_{jp} \quad \text{for } k = 1,\ldots,K;\; j = 1,\ldots,N;\; i(p) = 1,\ldots,n_p;\; p=1,\ldots,P$$

f) the proportion of need that is satisfied is the same for all patient groups in every ward throughout the district:

$$\sum_p \sum_{i(p)} W * a_k * X_{i(p)jk} = \text{Need}_{jk} * \alpha \quad \text{for } k = 1,\ldots,K;\; j = 1,\ldots,N$$

(There is no longer a need for the extra degrees of freedom provided by upper and lower limits for α)

g) there is an upper bound on the number of nurses that can be allocated to a locality:

$$z_p \leq 50 \quad \text{for } p= 1,\ldots,P$$

(This was introduced because the computer package used requires the user to specify upper bounds on integer variables.)

h) non-negativity and integrality conditions:

$z_p \geq 0$ and integer $p = 1,\ldots,P$

$y_{jp} = 0,1 \quad j = 1,\ldots,N; \; p = 1,\ldots,P$

$X_{i(p)jk} \geq 0 \quad k = 1,\ldots,K; \; j = 1,\ldots,N; \; i(p) = 1,\ldots,n_p$

$\alpha \geq 0.$

Both models are similar in that their objective is to allocate nurses to localities. However they solve the problem by assuming two different methods of service delivery. Model One considers service delivery strictly within a prescribed set of health centres and wards in a locality - disallowing cross boundary flows. Model Two, on the other hand, considers that each locality comprises only a set of health centres which can deliver service to any set of wards which may not coincide with preset locality boundaries. The models were run on the mathematical programming system Sciconic and the solutions obtained are explained below.

6.4 Solution of Model One

Model One is infeasible with a 100% equity constraint. To obtain a feasible solution the equity constraint was relaxed and some variation was allowed to occur in the proportion of need satisfied. By allowing equity to deviate by 6% the model gave a feasible solution. The model was then solved several times allowing equity to deviate by 10%, 15%, 20%, and 25% respectively in order to examine its impact on the allocation of nurses to the localities and on total travel time. A brief summary of these results is given in Table 6.1.

Table 6.1: Results from the solution of Model One with various equity levels

Annual travelling time*	8,974	8,874	8,786	8,696	8,603
Deviation from equity	6%	10%	15%	20%	25%
α_{max}	70.1%	70.8%	73.8%	76.3%	77.9%
α_{min}	64.1%	60.8%	58.8%	56.3%	52.9%
Number of nurses in localities					
1) Isle of Dogs	7	7	7	7	6
2) Bethnal Green & Globe Town	23	24	24	25	25
3) Stepney and Wapping	22	21	21	20	20
4) Bow & Polar	23	23	23	23	24

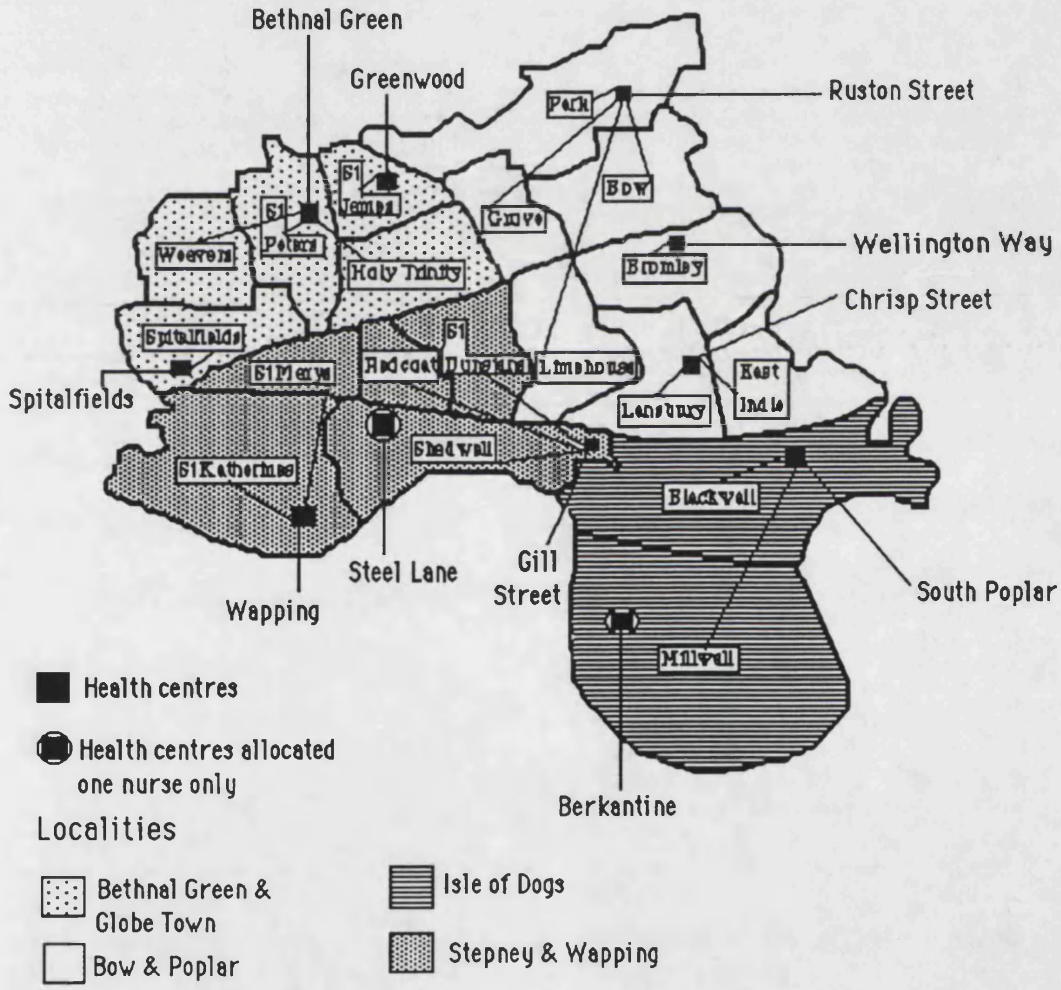
* in hours

Table 6.1 shows that with a 6% deviation from equity, the need that is satisfied for each ward and each age group remains within the limits of 70% and 64%. With a 25% deviation from equity, the distance travelled reduces only by 4%. A 4% saving in travel time is a very minor advantage to offset against permitting equity to deviate by 25%. Similarly the change in the pattern of the allocation of nurses to localities is also insignificant as equity is allowed to deviate from 6% to 25%. This suggests that nurses should be allocated so as to achieve a minimum deviation from equity.

Using a 6% permitted deviation from equity the number of nurses allocated to the localities, to individual health centres along with wards and each age group assigned is given in the Table 6.2. Varying the deviation from equity results in little change in the number of nurses allocated to the localities. Likewise the wards served by the health centres shown in Table 6.2 also remained unchanged when equity was allowed to deviate by up to 25%.

Model One does not permit cross boundary flows. This is illustrated in Figure 6.1 which shows the wards assigned to each health centre based on the results given in Table 6.2. We now proceed to discuss the results of Model Two.

Figure 6.1 : Allocation of district nurses to health centres and localities as a result of Model One solution (Wards to be served by health centres)



6.5 Solution of Model Two

In this model it is assumed that health centres have been allocated to localities, and the model assigns wards to localities while minimizing total travel time. The results are given in Table 6.3.

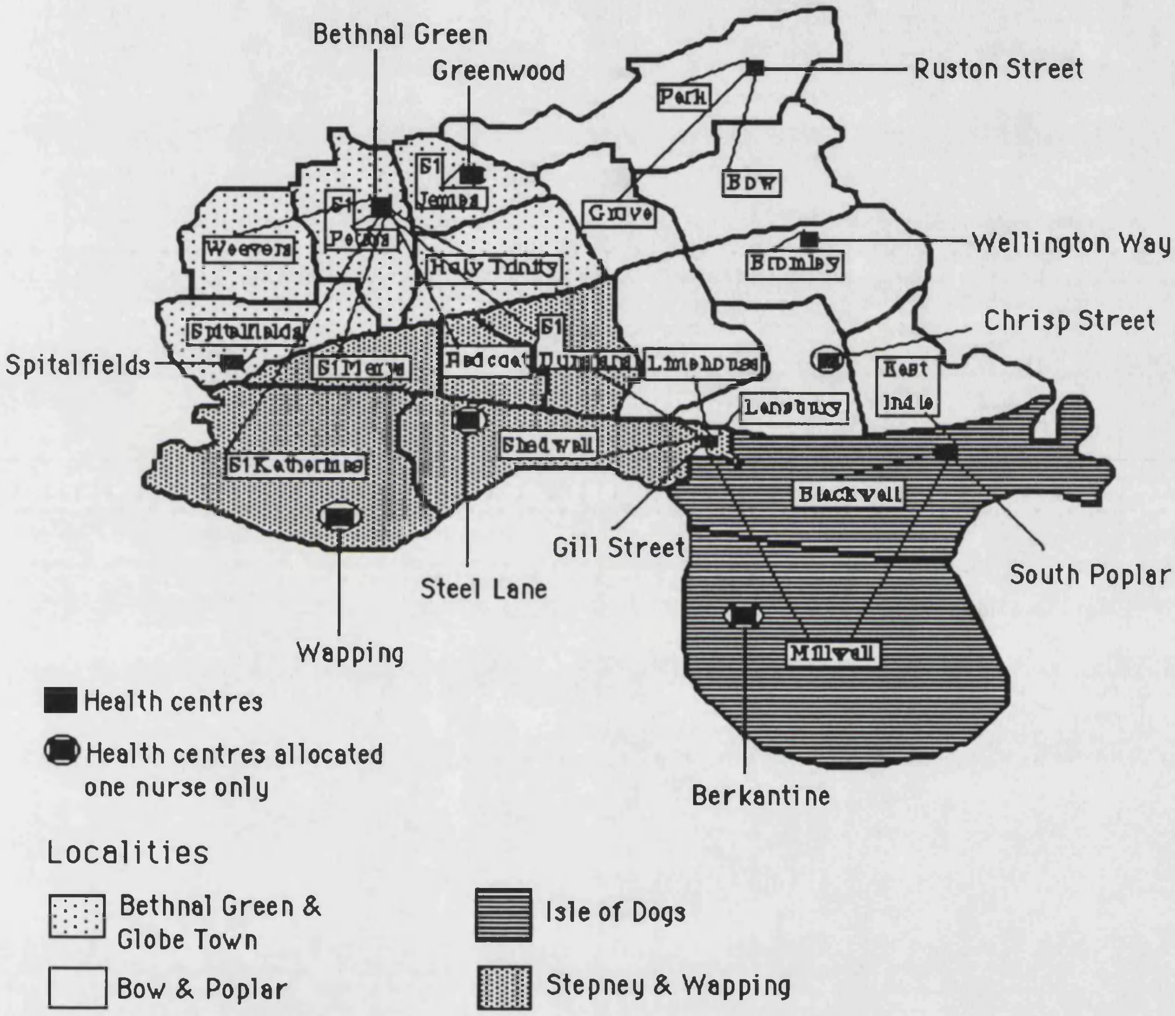
Table 6.3: Results from the solution of Model Two

Annual travelling time in hours	7,812.22
Need satisfied	65.9%
Number of nurses in localities	
1) Isle of Dogs	7
2) Bethnal Green & Globe Town	35
3) Stepney & Wapping	21
4) Bow & Polar	12

Table 6.3 shows that the travelling distance in Model Two is 13% less than that in the case of Model One with a 6% equity deviation. This means that by disregarding locality boundaries and allowing cross boundary flows there may be a considerable saving in travel time as well as more equity in service delivery. These are effectively economies of scales: against them must be set the managerial difficulties, and the lack of ability to respond sensitively to local needs which an organization without a meaningful geographical basis implies.

The allocation of nurses to localities and health centres to serve each age category of patients by ward is given in Table 6.4. Model Two offers a better solution in terms of travel time saving; however there could be other considerations. For example, Table 6.4 shows that Bethnal Green health centre has been allocated nearly 26 nurses. This is because as many as seven wards comprising 42% of the total district need are easily accessible to this health centre. This is an example of the potentially desirable consequences of nominally more efficient arrangements.

Figure 6.2: Allocation of district nurses to health centres and localities as a result of Model Two Solution (Wards to be served by health centres)



The allocation of wards to health centres is shown in Figure 6.2. Given the existing localities this allocation gives substantial cross boundary flows.

Since future service delivery is planned on a locality basis, allowing too many cross boundary flows may be problematic.

In the light of above analysis it is obvious that both the models have explored alternatives for allocating nurses. This exercise demonstrates that an interactive rational planning method can contribute to the implementation of decentralization in primary health care. The method is based on a flexible approach which gives choices to the decision-maker in order to make a rational decision.

6.6 Conclusion

We have demonstrated the feasibility of applying an integer programming approach to the allocation of nurses to health centres to serve an equal proportion of need in each ward. The two models were developed in consultation with the acting decision-maker from Tower Hamlets. In the first model we considered a situation where wards and health centres are pre-allocated to existing localities; while in the second only health centres are pre-allocated to existing localities, with unrestricted assignment of wards to health centres determined by the model.

Both models have given solutions which can be useful in policy formulation. The first model revealed that by allowing some deviation from equity of need satisfaction there could be some saving in travel time; however permitting the gap between maximum and minimum need satisfied to widen considerably gives only a trivial saving in travel time. The second model revealed that permitting flows to cross the boundaries of the existing localities significantly reduces travelling time.

Conducting the analysis from two different points of view enables a decision-maker to explore the implications of alternative priorities. The work reported in the present Chapter is necessarily only indicative; a fuller study could be conducted interactively with the responsible decision-making body. However this account does demonstrate that a systematic rational planning approach can contribute to the process of decentralized planning of primary health care in Tower Hamlets.

With this analysis we have completed our task in terms of decentralized resource allocation in Tower Hamlets. Of course the Tower Hamlets Health Authority has to tackle several other issues such as resource allocation for other community care services, performance indicators etc. before decentralization can become fully operative. In accordance with the general theories of decentralization described in Chapter Two, these can be expected to evolve gradually over a period of time.

Table 6.2: Allocation of district nurses to localities and health centres as a result of Model One solution

Localities/ health centres	Wards to be served	Number of nurses for age groups 5-14	15-64	65+	Total
1) *Isle of Dogs*					
Barkentine	-	0.00	0.00	1.00	1.0
South Poplar	Blackwall	0.01	0.41	2.48	
	Millwall	0.02	0.69	2.39	6.0
Locality Total		0.03	1.10	5.87	7.0
2) *Bethnal Green and Globe Town*					
Greenwood	St. James	0.01	0.34	2.97	3.3
Bethnal Green	Holy Trinity	0.01	0.35	3.71	
	St. Peters	0.01	0.49	3.84	
	Weavers	0.02	0.52	5.09	14.1
Spitalfields	Spitalfields	0.03	0.79	4.82	5.6
Locality Total		0.08	2.49	20.43	23.0
3) *Stepney and Wapping*					
Gill Street	Redcoat	0.01	0.28	1.73	
	St. Dunstans	0.01	0.49	4.60	
	Shadwell	0.02	0.60	4.35	12.1
Steel Lane	-	0.00	0.00	1.00	1.0
Wapping	St. Katherines	0.02	0.90	4.20	
	St. Marys	0.01	0.44	3.34	8.9
Locality Total		0.07	2.71	19.22	22.0
4) *Bow and Poplar*					
Chrisp Street	East India	0.01	0.33	2.51	
	Lansbury	0.01	0.42	3.17	6.5
Wellington Way	Bromley	0.02	0.63	4.18	4.8
Ruston Street	Bow	0.01	0.42	3.07	
	Grove	0.00	0.17	1.37	
	Limehouse	0.01	0.51	3.61	
	Park	0.00	0.24	2.31	11.7
Locality Total		0.06	2.72	20.22	23.0
District Total		0.24	9.02	65.74	75.0

Table 6.4: Allocation of district nurses to health centres and localities as a result of Model Two solution

Management units/ health centres	Wards to be served	Number of nurses for age groups 5-14	15-64	65+	Total
1) *Isle of Dogs*					
Barkentine	-	0.00	0.00	1.00	1.0
South Poplar	Blackwall	0.01	0.38	2.33	
	East India	0.01	0.34	2.57	
	Millwall	0.00	0.00	0.36	6.0
Locality Total		0.02	0.72	6.26	7.0
2) *Bethnal Green and Globe Town*					
Greenwood	St. James	0.01	0.34	3.05	3.4
Bethnal Green	Holy Trinity	0.01	0.36	3.82	
	Redcoat	0.01	0.28	2.80	
	St. Dunstans	0.00	0.00	0.49	
	St. Katherines	0.03	0.93	3.31	
	St. Marys	0.01	0.46	3.43	
	St. Peters	0.01	0.51	3.95	
	Weavers	0.02	0.53	4.85	25.8
Spitalfields	Spitalfields	0.03	0.81	4.95	5.8
Locality Total		0.13	4.22	30.65	35.0
3) *Stepney and Wapping*					
Gill Street	Lansbury	0.01	0.44	3.26	
	Limehouse	0.01	0.53	3.71	
	Millwall*	0.01	0.65	1.83	
	Shadwell	0.02	0.62	4.16	
	St. Dunstans*	0.01	0.51	3.23	19.0
Steel Lane	-	0.00	0.00	1.00	1.0
Wapping	-	0.00	0.00	1.00	1.0
Locality Total		0.06	2.75	18.19	21.0
4) *Bow and Poplar*					
Chrisp Street	Bromley	0.00	0.00	0.99	
	East India*	0.00	0.00	0.01	1.0
Wellington Way	Bromley*	0.02	0.65	3.20	3.9
Ruston Street	Bow	0.01	0.40	2.88	
	Grove	0.01	0.15	1.29	
	Park	0.01	0.22	2.16	7.1
Locality Total		0.05	1.42	10.53	12.0
District Total		0.26	9.11	65.63	75.0

* Wards allocated to more than one health centre and locality

Chapter Seven

Health Planning and Organization in Pakistan

7.1 Introduction

In previous chapters we have discussed the general concepts of decentralization, as well as formal methods to implement it. We have considered the application of some of these methods to the decentralization of primary health care in Britain, and have concentrated on a case study of Tower Hamlets District Health Authority.

One of the aims of our research is to examine the possibility of transferring some of the formal methods of decentralization to Pakistan in order to achieve decentralized primary health care. Accordingly this Chapter and the remainder of this thesis will concentrate on Pakistan. We will describe Pakistan's socio-economic background, overall planning and resource allocation processes, the specific problems of health care planning and delivery, the prospects for the decentralization of primary health care, and the prospects for the possible application of formal methods to implement decentralized or localized planning in primary health care.

Pakistan came into existence as a sovereign state on 14th August 1947, as a result of the partition of British India in accordance with the terms of the Indian Independence Act 1947. Pakistan at the time of independence comprised two wings: East Pakistan (now Bangladesh) and West Pakistan (now Pakistan). The wings were 1100 miles apart, having Indian territory between them. East Pakistan separated from West Pakistan and became Bangladesh as a result of political unrest followed by a war between India and Pakistan in 1971. All uses of the term 'Pakistan' in the remainder of this document refer to West Pakistan.

Pakistan comprises an area of 796,095 square kilometers. It is bounded to the west by Iran and Afghanistan, to the north by Afghanistan and China, to the east by India, and to the south by the Arabian Sea. Much of the country is mountainous with the Himalayas lying in the north, and plateaux and mountainous ranges covering the western side. There are fertile plains in the south-east.

Pakistan comprises four provinces each having its own capital city: North West Frontier Province (NWFP), Punjab, Sind, and Baluchistan. Their respective provincial capital cities are Peshawar, Lahore, Karachi, and Quetta. Islamabad is the capital of Pakistan. People in each of the provinces speak a different language; however Urdu is the main national language. Almost 97% of the population is Muslim. The mineral resources of Pakistan are coal, natural gas, iron ore, oil, chromite and gypsum. The principal agricultural crops are wheat, cotton, maize, sugar cane, and rice. These crops are farmed primarily in Sind (in the Indus Valley) and in the Punjab.

Pakistan is a one of the less developed countries with a rapidly growing population and poor socio-economic conditions. Pakistan's population, according to Federal Bureau of Statistics (FBS), Government of Pakistan, is growing at an average annual rate of 3.2% (FBS,1989). According to World Bank projections the population was expected to reach 111.6 million by the middle of 1990 (Zachariah and Vu, 1988).

Pakistan's GNP in 1984-85 was recorded at US$ 34 billion and per capita income was only about equivalent to US$ 359 (Lloyds Bank, 1986). There is a great deal of income disparity both within and between the urban sector and the rural sector. According to the 1981 census, 72% of Pakistan's population lives in the rural sector which is socially and economically deprived. Employment opportunities in the rural sector are negligible. Pakistan's overall literacy ratio (number of literate aged 10 years and above/population 10 years and above) in 1981 was only 26.2% (FBS,1989). Urban and rural literacy ratios of 47.1% and 17.3% respectively reveal the polarization between sectors.

In the preceding paragraphs we have given a brief introduction to Pakistan's demographic, and socio-economic structure. In Table 7.1 we compare Pakistan's demographic and socio-economic structure with some other developed and less developed countries.

Table 7.1 shows that Pakistan has a high annual population growth rate, birth rate, life expectancy at birth (among less developed countries only) and a low labour force participation rate {civilian labour force (10 years and above)/total population}. The apparently low unemployment rate arises because in Pakistan unpaid family helpers are counted as employed. The rest of the socio-economic structure is in line with those of other less developed countries.

We will now discuss the history of developments that have taken place in the social planning sector in general, and in the health sector in particular.

7.2 Historical Development of the Planning Process in Pakistan

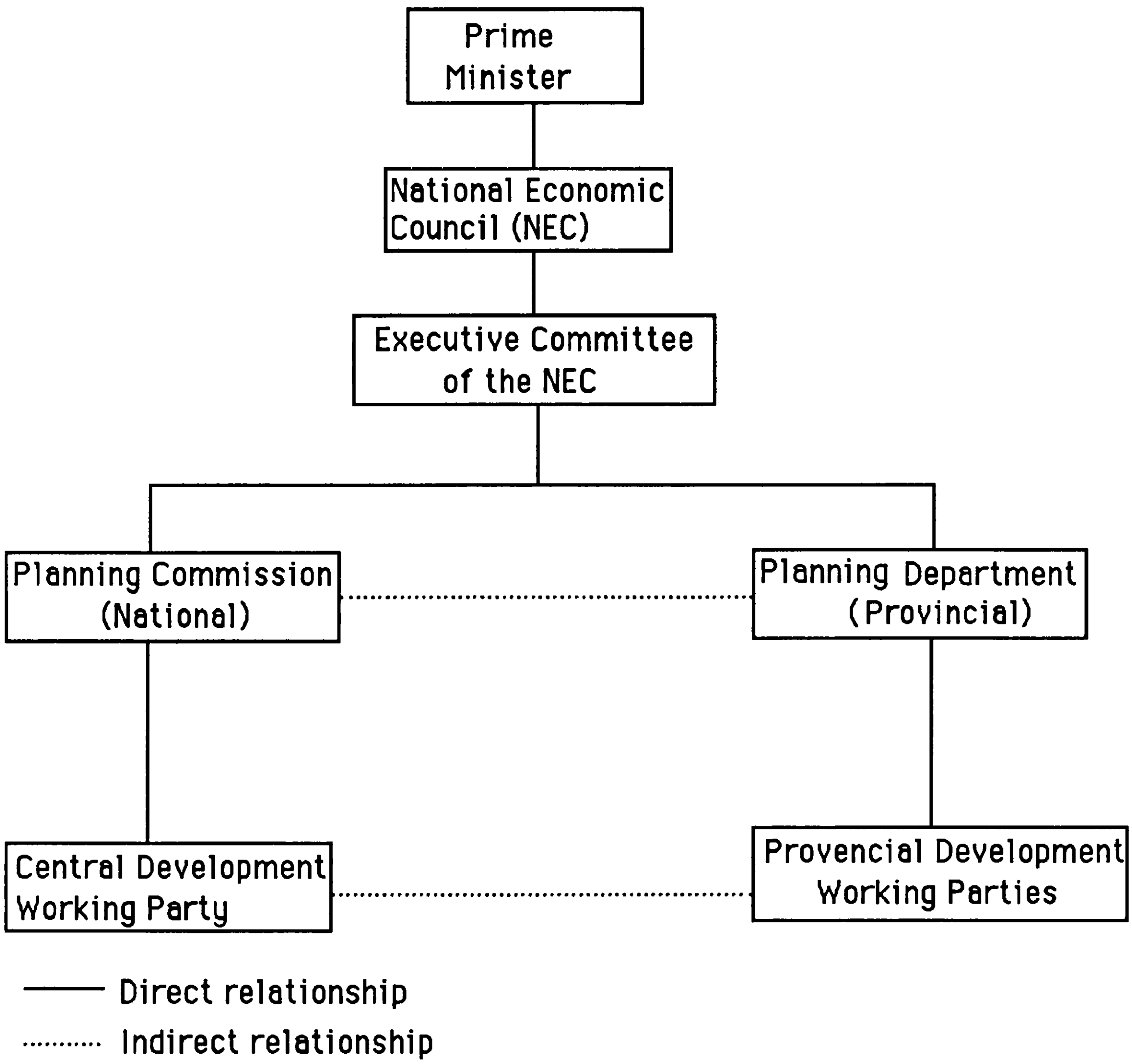
Pakistan, as already mentioned, gained independence from British colonial rule in 1947. At that time nearly ten million refugees migrated from India to Pakistan (Mahmud, 1970). Pakistan inherited a poor infrastructure and a bureaucratic framework inadequate to tackle the issues of rehabilitation of refugees, and to handle the enormous task of development.

The planning machinery in Pakistan evolved through a number of different stages (Mahmud, 1977). The first stage was from 1947 to 1953 when a Development Board was established to make attempts at economic coordination and planning. The Development Board prepared the first six-year development plan for 1951 to 1957. The second stage of development in the planning process began with the creation of the Planning Board in 1953, later renamed the Planning Commission of Pakistan - as a separate division of the Ministry of Finance and Economic Development. The creation of the Planning Commission marks the institutionalization of the planning process. The final shape of institutional arrangements in the planning process, given in Figure 7.1, emerged in 1971, after the dismemberment of Pakistan and the creation of Bangladesh.

Figure 7.1 shows that planning takes place at federal and provincial levels. At federal level the National Economic Council (NEC) is responsible for overall financial, commercial, social and economic planning. The NEC approves both five-year plans and annual development plans (ADP). The Prime Minister is the Chairman of the NEC, and all Federal Ministers and

Governors as well as Chief Ministers of the provinces are member of the NEC.

Figure 7.1: Institutional arrangements for planning in Pakistan



There is an Executive Committee of the NEC called the ECNEC to supervise the implementation of the economic policies laid down by the NEC. The ECNEC also sanctions provincial and federal development schemes costing more than US$1.0 million and approves moderate changes and sectoral adjustments within the overall plan. The Federal Finance

Minister chairs the ECNEC, and the Federal Ministers for Commerce, Communication, Education, Food and Agriculture, the Deputy Chairman of the Planning Commission, Provincial Governors/Chief Ministers, Provincial Planning/Finance Ministries are members of the ECNEC.

The ECNEC is assisted by the Central Development Working Party (CDWP). The CDWP is chaired by the Secretary of the Planning Commission. Other members are representatives of the Economic Affairs Division and the Finance Division of the Federal Ministry of Finance, the appropriate Mininstry/Department and heads of the Provincial Planning and Development Departments. The CDWP reviews development schemes submitted by provincial governments and federal ministries costing more than US$1.0 million and submits them for approval to the ECNEC. Any development scheme submitted by a federal ministry costing between US$0.25 to US$1.0 million can be approved by the CDWP itself.

The NEC, the ECNEC, and the CDWP are decision-making bodies concerned with resource allocation for federal and provincial development schemes. The federal and provincial governments are represented on these bodies. Plans are formulated at federal and provincial levels. Federal ministries formulate plans which are then examined and coordinated by the Planning Commission, under national guidelines laid down in the five-year plan, and submitted to the appropriate body (NEC, ECNEC, or CDWP) for decision-making. To examine and coordinate plans the Planning Commission has a counterpart in each ministry with appropriate expertise.

Plans at provincial level are formulated by provincial departments and are coordinated by the Planning and Development Department of each province. These plans are then submitted to the Provincial Development Working Party (PDWP) for decision-making provided the cost involved is between US$100K and US$1 million. Any plan costing over US$1 million is submitted to the ECNEC. All plans involving costs up to US$1 million are formulated and approved at provincial level whereas plans costing over US$1 million are approved at federal level, where all the federal and provincial ministries are represented.

The allocation of resources for the planning process is decided by the NEC. All the resources to be distributed are federal funds. Federal level project are financed first. The remaining funds are then sub-divided among the various geographical areas, giving due consideration to the stage of development of each area. Funding by the NEC for the provinces is in the shape of block allocations and is not sub-divided by sectoral programmes (Mahmud, 1977).

We now proceed to the specific case of health planning. The origin of health planning in Pakistan dates back to pre-partition British India. The first modern step to organize health planning started with the establishment of the "Health Survey and Development Committee" commonly known as "Bhore Committee" in October 1943. The main objectives of the Bhore committee were:

a) to conduct a broad survey of the prevailing position in regard to health conditions and health organization, and

b) to make recommendations for future developments.

The Bhore Committee reported in 1946 (Government of British India, 1946). The main goals which it identified were:

a) to make health facilities adequate and accessible to individuals in need of care,

b) to lay special emphasis on preventive care, and

c) to secure active community cooperation in the development of health programmes.

After independence, health planning became an integral component of federal social and economic development planning. The government appointed a number of commissions and expert groups to look into the health sector development process (Mahmud, 1977). However with the adoption of a new constitution in 1973, health became purely a provincial subject. Since this change the federal government has only been concerned with national planning, coordination, liaison with international agencies, and organizing health services in federally administered areas such as Islamabad and tribal areas. The organizational arrangements for the delivery of provincial health services, also called state owned health services, are further described in section 7.4.

Pakistan at the time of its creation lacked both basic infrastructure and organizational frameworks. There has since been substantial development in organizational frameworks to handle the task of development and planning both at federal and provincial level. However health care planning lacks a rational approach, and resources are decided on a historical incremental basis irrespective of relative needs or geographical equity. This is further discussed in the following section.

7.3 Health Infrastructure in Pakistan

Pakistan (east and west wings) at the time of its creation inherited a very limited health care infrastructure. According to Social Indicators of Pakistan (FBS, 1985), in 1948 there were only 1,104 registered doctors, 300 hospitals, 741 dispensaries and 14,117 hospital and dispensary beds. There were 204 nurses, 37 lady health visitors and no dental doctors or other paramedical staff. Among health education institutions there was only one medical college and ten schools for training nurses in 1947 (Mahmud, 1970). These facilities were quite insufficient to meet population needs. A further strain on health service provision was the ten million people who migrated from India facing serious health problems and requiring urgent care. To meet these overwhelming demands and to keep pace with the ever increasing need for health care, there has been substantial growth in Pakistan's health care infrastructure. This is shown, at both provincial and federal levels, in Table 7.2.

The extent of inter - provincial inequality is brought out in Table 7.3. Here, following Bevan (1988), we have taken population per facility as the criterion.

From information in the Pakistan Statistical Yearbook (FBS,1989) 1988 estimated populations for Punjab, Sind, NWFP, and Baluchistan have been calculated respectively as 59.6, 23.8, 16.6, and 5.4 millions. These estimates were then used to produce the figures for facilities per population in each province which are given in Table 7.3. Examination of Table 7.3 shows that health facilities in Pakistan are distributed between provinces without consideration of need and equity. This is explained below.

The Pakistan Demographic Survey (FBS, 1986) shows that the Punjab has the highest infant mortality rate (IMR) of 111.8 per 1000 live births (compared with a national average of 105.6), and second highest crude death rate of 10.2 (national average 10.1). Despite having such poor health indicators the Punjab has the widest negative deviations from the national average of facilities per population, in the cases of hospital, hospital beds, and dispensaries. Similarly in Sind province where the infant mortality rate is 107.7 (the second highest among the four provinces), there is a 95% negative gap below the national average in case of MCH centres. On the other hand health indicators in NWFP (IMR 82.4 and crude death rate 9.3) are the lowest among the four provinces, but provision of health care facilities is above the national average except in the case of rural health facilities. Further analysis below confirms that there is no consistent health provision policy among all the four provinces.

In all five types of facilities included in Table 7.3, Punjab has negative deviations from the national average. Sind has two positive and three negative deviations, the NWFP has four positive and one negative deviation, Baluchistan has four positive and one negative deviation from the national average. The ranking of the four provinces, together with their positive or negative deviations from the national average, is shown in Table 7.4.

Table 7.4: Ranking of provinces in terms of facilities

Ranks	Hospitals	Beds	Dispensaries	MCH centres	RHCs etc.
1	+ F	+ F	+ S	+ F	+ B
2	+ B	+ S	+ B	+ B	- P
3	- S	- B	+ F	- P	- S
4	- P	- P	- P	- S	- F

Punjab = P, Sind = S, NWFP = F(Frontier), Baluchistan = B

We can deduce from Tables 7.3 and 7.4 that in Pakistan health service provision takes place without criteria of equity or consistent policy. Inequitable health service provision also deprives the rural sector. Although some 72% of Pakistan's population lives in the rural sector, nonetheless almost all hospitals are located in urban areas, to which the rural population has either very limited or no access. Rural institutions like Rural Health Centres (RHCs), Sub-RHCs, and Basic Health Units (BHUs) providing primary care (on an average of one for 17 thousand population) have a number of problems; often no service after midday, inadequate medicines, no emergency service etc. (Further discussion regarding problems of rural health facilities is contained in Chapter Eight). This has been acknowledged in recent statements on government health policy (Government of Pakistan, 1990).

We have argued in this section that the distribution of health service facilities between provinces and between the urban and rural sectors is irrational. This is within a context of substantial improvement in the overall provision of health care infrastructure in Pakistan since 1947. Correspondingly there has also been a substantial increase in health manpower employment by the federal and provincial governments. The health employment situation as in 1987 is given in Table 7.5.

Table 7.5: Health manpower in Pakistan, 1987

Health manpower	Doctors	Dental Surgeons	Nurses	Lady Health Visitors(LHVs)	Midwives
Numbers	51,020	1,630	16,661	3,928	10,650
Average population served	2,005	63,899	6,014	7,046*	2,599*

Source: FBS, 1989; * for females in child bearing age

As we can see there has been a substantial increase in health manpower in Pakistan, and there has been a corresponding increase in the number of institutions providing health education. According to the Annual Report of Director General Health (Health Division,1984), there are 22 medical colleges (1 in 1947) including two for females, and 27 training institutes for nurses and midwives (10 in 1947).

Another aspect of medical care in Pakistan is ayurvedic and homeopathic systems of medicine which is utilized by a large number of people. To encourage proper education in the ayurvedic and homeopathic systems of medicine and to curb quackery, the Government has established two organizations; the National Council for Tibb, and the National Council for Homeopathy (Health Division, 1984). These organizations recommend to the government institutions which teach the ayurvedic and homeopathic systems of medicine and train qualified hakeems and homeopaths. However in this respect the Government of Pakistan (1990) acknowledges in its recent health policy that "there is a lack of any comprehensive evolution of traditional medical sector which includes unoni and homeopathy systems" and commits itself to bring about further improvements.

Within the context of improvement of infrastructure for health care provision another factor, which should be considered, is whether increased service provision has been effective or not. One way of answering this question is to examine the impact on health indicators such as death and infant mortality rates. Comparison between such indicators during 1976-79 and 1984-87 shows that health indicators in Pakistan have in fact deteriorated. For example the average death rate of 10.5 per thousand population during 1976-79 increased to the level of 11.0 during 1984-87; similarly the infant mortality rate of 94.2 during 1976-79 has increased to the level of 113.0 during 1984-87. This implies that despite an increase in health care facilities there has been no impact on health indicators. One of the reasons, as we have been arguing, is the lack of consistent and equitable planning of health service provision among all four provinces and between the urban and rural sectors. This fact is also acknowledged by the Government of Pakistan (1990) in its recent health policy statement that "there is lack of effectiveness of planning process". This implies that overall health service planning and organization needs effective managerial approaches. In this regard we will concentrate on a particular case of primary health care in the remainder of this thesis.

7.4 Primary Health Care in Pakistan

Health, as already mentioned, is a provincial government responsibility; therefore each province has its own Directorate of Health headed by a director who in turn is responsible to the Secretary of the Provincial Health Department. The Director of Health is concerned with the administration of hospitals, dispensaries, Mother Child Health (MCH) centres and RHCs, BHUs etc. Teaching hospitals and special institutions are under the direct control of Provincial Secretaries.

All the managers of provincial health services from Secretary to ADHO are qualified doctors. The managerial structure of the health directorate in each province is based on districts. The number of districts in each province varies depending upon the size and population of the province. In each district the health directorate provides curative and primary care separately through the following two groups:

1) *District headquarter hospital.* This is headed by a Medical Superintendent (MS). The district headquarter hospital provides curative services. The MS is a practicing physician or surgeon. District headquarter hospitals provide specialist services in the fields of medicine, surgery, paediatrics, midwifery and dentistry. 2) *State owned health services.* This branch of the health service is headed by a District Health Officer (DHO), sometimes assisted by Assistant District Health Officers (ADHOs). The DHO's organization includes all government dispensaries, MCH centres, RHCs and sub-RHCs, as well as BHUs at sub-district (tehsil or taluka) level. Certain categories of preventive health care staff such as sanitary inspectors, sanitary supervisors, and vaccinators are also under the control of the DHOs. The state owned health services mainly provide primary care. Basically these institutions are the first contact with health care for ordinary illnesses. Patients with an illness at an

advance stage or in an emergency are advised to go to the district headquarter hospital. At present there is no referral system between primary health care units and the district headquarter hospitals.

In addition to the above there are several other agencies which provide primary and preventative care such as a) municipal health services purely for urban dwellers, b) the population (family) planning programme, and c) the health establishment of the Red Crescent Society, as well as private clinics offering either western medicine or indigenous medical services. All these services are provided by different organizations. There is no system of coordination between these organizations, so the services which they offer overlap.

The Government of Pakistan (1990) in its recent health policy statement recognizes that there is an absence of inter-agency coordination. It also acknowledges that state owned health services are delivered by an extremely centralized bureaucratic system. Most of the DHO's organizations encompass both urban and rural populations scattered over a large territory. A DHO organization which is centrally controlled with its headquarters in an urban locality is too large to exercise effective control. This factor has influenced the Government of Pakistan's health policy which intends to delegate power to lower levels. We will therefore explore next the scope for overall decentralization of the delivery of primary health care in Pakistan.

7.5 Scope for Decentralization of PHC In Pakistan

Decentralization in overall government planning or in health care planning is not a new concept to Pakistan or any other developing country. Most developing countries, including Pakistan, when they gained independence from the British colonial rule inherited a bureaucratic and highly centralized system of planning and organization. This centralized system restricted the developing countries' institutional capacity to promote socio-economic development plans, especially in rural areas. Many African countries in particular have acknowledged this, and have made attempts to decentralize government machinery to regions, field administration and also to local governments (Commonwealth Secretariat, 1987). Important among them are Botswana, Gambia, Ghana, and Nigeria, and (outside Africa) are India, Sri Lanka, and Papua New Guinea, all of whom have moved towards decentralized government systems. Pakistan also is in transition from a centralized to a more decentralized system of government. Autonomous elected provincial assemblies, and elected local bodies in each district have already been established. There are several functional areas, including delivery of health care in Pakistan, where planning takes place at provincial level.

The concept of decentralization of primary health care, as explained elsewhere, gained global momentum when all the UN member countries signed an agreement at a joint WHO/UNICEF Conference at Alma Ata in 1978. It was declared that primary health care was the most promising vehicle for "attaining the target of health for all by the year 2000 as a part of overall development in the spirit of social justice" (WHO,1978). This new approach adopted by Britain and other European countries such as France, Spain, Portugal, Yugoslavia, and Finland is already having an impact on the pattern of primary health care delivery. Outside Europe, China, India, Mexico, Philippines, Sudan, and Costa Rica provide examples of decentralizing primary health care (Taket and Curtis, 1989).

These international developments have certainly influenced Pakistan. The latest evidence is the Pakistan government's recent health policy which specifically states that "for effective control it is important that an administrative unit should be manageable, within physical reach of beneficiaries and must be under community control" (Government of Pakistan, 1990). This clearly demonstrates the government's preference for decentralization of the future delivery of health care.

Decentralized or localized health planning, as we have already explained in Chapter Two, relies on a small managerial units with well defined areas of operational responsibility together with adequate resources. Tower Hamlets DHA, for example in Britain, as discussed in Chapter Four is systematically applying some of the common managerial principals of decentralization. In order to achieve decentralization in Pakistan it will be necessary to follow the managerial principals of decentralization.

But before making an attempt to implement decentralization, as already explained in Chapter Two, it is necessary to examine the relevance of decentralization to Pakistan. To assist in this examination the author of this thesis held discussions with local and foreign experts to find their views on the problems of health care delivery and planning, based on their experience of working in Pakistan's health care system, and possible remedies. These discussions took place during a visit to Pakistan for data collection in August-September 1990. The essence of these discussions is given below.

Dr Nabil S Al Tawil, the Chief of Mission of WHO in Pakistan, based in Islamabad, raised some vital issues about Pakistan's health care system and expressed the view that these issues need to be tackled immediately (Al Tawil, 1990). According to Dr Tawil the health care system in Pakistan lacks an effective administration and adequate information; these deficiencies cause the health care service to be less effective than it could be. According to Dr Tawil's estimates roughly 16% to 18% of the population is covered by the state owned health care services in Pakistan. Regarding the non availability of adequate information, Dr Tawil said that it sometimes causes Pakistan to lose aid from foreign donor agencies. This deficiency is also recognized by the Government of Pakistan (1990) in its health policy, where it is noted that due to a lack of research aimed at providing base-line health care data, there is no adequate information system available at either national or local level.

The author also held a series of discussions with Dr John H Bryant, Professor and Chairman of the Department of Community Health Sciences of the Agha Khan University, Karachi and his team members (Bryant, 1990). Dr Bryant was of the view that it is necessary to decentralize the delivery of primary health care in Pakistan to make the service more appropriate and effective. There is a need to establish local information systems, and to revise the drug supply system. These two latter areas were also mentioned specifically by Dr Sardar Ali, Director Health Service, NWFP, Peshawar (Ali, 1990). Talking about the absence of an adequate health information system Dr

Ali mentioned that in general it is difficult to get any timely health related information. The centralized system of drug procurement and supply, according to Dr Ali, was proving highly inefficient and limiting the attractiveness of the state owned health services. Drugs are centrally procured at provincial headquarters and the onward distribution takes place through the DHOs office. This results in both loss of time, and drugs theft. Due to the inadequate supply of drugs, doctors in the RHCs cannot provide adequate care. This in turn affects doctors' morale adversely as well as causing patient dissatisfaction. The government is spending very considerable funds on health service provision but unfortunately their benefits do not reach the general public, thus restricting the service's effectiveness.

Dr Ali was also critical of excessive centralization at the provincial level, which keeps him occupied with heavy routine duties and does not leave time to concentrate on planning. His views in this respect were very much in line with the criticism of the limitations of centralized planning discussed in Chapter Two. There were, however, plans for some functions currently performed at provincial level to be decentralized to district level. Similarly, representatives of the Pakistan Doctors Association, NWFP and doctors in the NWFP health service all supported decentralization of the health care delivery system to make the service more appropriate and effective.

There is thus a good deal of both objective and subjective evidence that health care in Pakistan, specifically in the rural sector, lacks effectiveness. There is too much centralization at provincial as well as at district level (which will be further discussed in Chapter Eight), drugs are seldom available at rural facilities and decision-making is too far from the scene. All of these problems, although serious, are not beyond solution and could be resolved in order to utilize existing resources more effectively. All that is required is effective, simple rational planning, together with a change in attitude which now seems to be taking place.

The Government of Pakistan in its 1990 health policy has certainly demonstrated a first healthy sign of a change in attitude from centralization to decentralization in health planning and organization. The policy acknowledges various problems of the health care delivery system - such as urban and rural disparity, the heavy loads on hospitals, inadequate staffing at RHCs and BHUs, non-availability and poor quality of drugs, and centralized health management. To tackle all these problems the government has now decided to introduce positive changes in the delivery of health care. Its policy in terms of primary health care is to ensure that primary health care is available to the entire population by the year 2000.

We have already explained in the light of the views of local and international experts that decentralization of primary health care is necessary to deliver appropriate care. This too is evident from the recent Pakistan government health policy. However policy alone does not translate into actions, mechanisms are required to achieve the desired results. Therefore, in Pakistan as in Britain, there is a need to establish proper organizational frameworks with adequate authority and responsibility, with self sufficient resources, and standards for performance to transform the policy of decentralization into action. Without that, we fear, the policy will remain a mere documentary exercise.

7.6 Conclusion

In this Chapter we have explained the organizational frameworks for overall economic development planning in Pakistan. The historical developments and current organization of health care that have taken place were specifically examined. We have shown that Pakistan's government has adequately developed an infrastructure for health care, which however has associated with it provincial, urban and rural disparities.

Our analysis shows that the increase in health care facilities has had no impact on health indicators such as death rates, infant mortality etc. There are a number of problems such as too much centralization, shortage of drugs due to the long channel of procurement and supply, lack of coordination among various health care delivery agencies, and lack of base-line information on health care data. All these problems make health care service less effective.

Our discussions with local and foreign experts in the field of health care in Pakistan reveal that decentralization of health care service is necessary to overcome several of the difficulties. The Government of Pakistan's Health Policy (1990) is a step towards encouraging decentralization in the delivery of primary health care. Thus appropriate mechanisms will have to be developed to translate policy into action.

We therefore plan to show the feasibility of some of the methods to implement decentralization by concentrating on one district, that of Dera Ismail Khan in the following Chapters. We will show how to divide the district into smaller self-sufficient managerial units or localities, how to develop base-line information, and how to apply rational resource allocation mechanism among localities.

Table 7.1: Comparison of Pakistan's demographic and socio-economic structure with some of the developed and less developed countries

Countries	Population (million)	Annual growth rate %	Density Per km2	Proportion urban pop. %	Crude birth rate	Crude death rate	Life expectancy at birth	Per capita income US$	Labour force participation%	Unemployment
Egypt	50.2	2.6	50	48	34	9	63	660	40.9	5.4
India	815.6	2.2	247	27	32	11	58	340	33.4	N.A
Indonesia	174.8	2.1	92	27	28	9	61	440	65.3	N.A
Japan	122.8	0.4	329	78	11	7	78	8,903	63.9	2.6
Pakistan	106.3	3.2	133	31	45	13	55	350	27.6	3.9
Sri Lanka	16.6	1.5	237	21	22	6	71	420	67.1	13.6
UK	57.1	0.2	234	91	14	11	75	9,282	47.1	8.1
USA	246.3	1.1	26	73	16	9	75	19,810	61.8	4.7

Sources 1) The World Development Report, The World Bank, 1990,
2) Statistical Abstracts of the USA, 1990,
3) Annual Abstract of Statistics, UK, 1990,
4) Japan Statistical Yearbook, 1990,
5) FBS citing UN and other international agencies,
Data presented in this table are mostly based on estimates for the year 1988.

Table 7.2: Health infrastructure in Pakistan as on 1.1.1988

Controlling Authority	Hospitals		Dispensaries		Tuberclosis clinics		Mother child health centres		Rural health centres		Sub-health centres		Basic health units(BHUs)	
	No	Beds	No	Beds	No	Beds	No	Beds	No	Beds	No	Beds	No	Beds
Federal Capital Territory	4	680	280	-	-	-	3	15	3	-	3	-	12	-
Punjab	258	25,024	1,154	2,001	51	-	448	-	241	1,926	635	-	1,544	-
Federal	1	360	5	-	1	-	-	-	-	-	-	-	-	-
Provincial	127	17,914	150	302	25	-	169	-	241	1,926	635	-	1,544	-
Local Bodies	28	637	830	1,560	5	-	171	-	-	-	-	-	-	-
Other gov't dept.	57	1,921	126	119	-	-	-	-		-	-	-	-	-
Private	45	4,192	43	20	20	-	108	-		-	-	-	-	-
Sind	251	19,466	1,577	393	128	-	154	91	62	764	476	-	226	510
Federal	3	1,262	14	-	-	-	4	26	-	-	-	-	-	-
Provincial	78	8,545	102	14	121	-	36	-	62	764	476	-	226	510
Local Bodies	8	1,106	701	46	1	-	28	19	-	-	-	-	-	-
Other gov't dept.	22	1,575	153	33	1	-	21	20	-	-	-	-	-	-
Private	140	6,978	607	300	5	-	65	26	-	-	-	-	-	-
NWFP	152	9,465	590	339	16	106	325	44	69	392	39	-	606	-
Federa	-	-	3	-	-	-	-	-	-	-	-	-	-	-
Provincial	117	7,992	510	257	12	106	246	26	69	392	39	-	606	-
Local Bodies	2	90	12	8	-	-	-	-	-	-	-	-	-	-
Other gov't dept.	23	820	43	51	-	-	14	-	-	-	-	-	-	-
Private	10	563	22	23	4	-	65	18	-	-	-	-	-	-
Baluchistan	45	2,702	267	133	16	-	68	-	42	420	27	-	315	-
Federal	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Provincial	30	1,813	239	65	16	-	65	-	42	420	27	-	315	-
Local Bodies	-	-	5	-	-	-	-	-	-	-	-	-	-	-
Other gov't dept.	8	386	22	68	-	-	1	-	-	-	-	-	-	-
Private	7	503	-	-	-	-	2	-	-	-	-	-	-	-
All country total	710	57,337	3,868	2,866	211	106	998	150	417	3,502	1,180	-	2,703	510

Source: Pakistan Statistical Year Book (FBS,1989)

Table 7.3: Facilities per population in each province (pop. in 000s) in 1988

Province/ Facilities	Punjab@	Sind	NWFP^	Baluchistan	National
Population (000)	59,598	23,802	16,591	5,418	105,409
Rural Population	42,980	13,491	14,507	4,571	75,551
Population < 5	7,079	3,055	2,131	682	12,947
Female 15-49	15,650	6,252	4,354	1,422	27,678
Hospitals	274.65	214.43	116.84	142.58	207.50
Distance from national average %	-32.36	-3.34	+43.69	+31.29	0.00
Beds	2.77	1.91	1.86	2.46	2.34
Distance from national average %	-18.38	+18.38	+20.51	-5.13	0.00
Dispensaries	30.89	13.91	25.54	17.12	23.64
Distance from ** national average %	-30.66	+44.20	+8.04	+27.58	0.00
MCH centres*	66.27	104.57	24.94	31.88	53.59
Distance from national average %	-23.66	-95.13	+53.46	+40.51	0.00
RHCs/Sub-RHCs & BHUs**	17.63	17.66	20.32	11.90	17.57
Distance from national average %	-0.34	-0.51	-15.65	+32.27	0.00

@ Includes both population and facilities of Federal Capital
^ Includes population of Federally Administered Tribal Area (FATA)
* For female of child bearing age and children < 5
** For rural population only
Note:- private facilities are not included

Chapter Eight

Decentralized Planning Methods for PHC in Pakistan: A Case Study in Dera Ismail Khan (DIK) District

8.1 Introduction

Dera Ismail Khan (DIK), founded in 1469, is the southern most district of the NWFP province of Pakistan. It is bounded on the north by the Bannu district, on the east by the Indus river, on the south by Dera Ghazi Khan (DGK) district, and on the west by Tribal Areas (Figure 8.1). The total area of the district is 9,005 square kilometers.

DIK consists of a dry alluvial plain. The summer is very hot, the temperature in June reaching in excess of 40 degrees centigrade. The winter is quite cold and the temperature in January can fall quite close to zero degrees. Industrially DIK is under developed. According to the Population Census Organization (PCO), in 1981 there were only seven industrial units in textiles, flour milling, and engineering (PCO, 1983). Recently some units for processing vegetable oil and a sugar mill have been added.

In DIK there are several educational institutions including one university, the Gomal University of DIK. (The author of this thesis obtained a Master's degree in Business Administration in 1977, among the first group to graduate from this university). Among other institutions there are three degree colleges, one intermediate college, one polytechnic, one vocational training institute, and a number of high, middle, and primary schools. Most of the institutions which offer higher education are concentrated in the city area proper of DIK.

The majority (81.7%) of DIK's population lives in the rural area. Some 90% of the rural population is illiterate and unskilled. The average household income in rural areas is less than Rs 500 p.m. (Kundi, 1984). The rural population depends mainly upon agriculture. Irrigation in the north eastern section of the district depends upon a canal from the Indus river, whereas irrigation in other parts of the district relies either on tube wells or on rain and flood waters from the western hills. The canal from the Indus river is now being extended to cover some parts of the western and south western plains (called Damaan) which comprise a major part of the district. The major crops are wheat, sugar cane, rice, rape and mustard seeds, and maize.

Most of the population in rural areas lack basic facilities such as communications, piped drinking water, proper sanitation, and health and education services. According to the 1981 census about 29% of the rural population uses pond water for all purposes. The non availability of proper drinking water, together with inadequate sanitation, causes diseases such as guinea worm (an insect which grows in the human body from one joint to another), diarrhoea, and malaria.

The total population of the DIK was 635,000 in 1981, and is expected to reach 900,000 by the middle of 1991. (These are estimated figures - see section 8.4). Of the 1981 population 2.8% were infants (below one year), and 15.5% were children under five. The number of women of child bearing age (15-49) was 127 thousand, about 43% of the female population. The overall population density in DIK was 70.6 persons per square kilometer in 1981 (national 105.8, provincial 148.4) which by 1991 is estimated to become nearly 100 persons per square kilometer (national 144, provincial 209).

Living conditions in DIK are extremely poor. There are no reliable data regarding health indicators such as death, infant mortality rates (IMRs), live or still births etc. available at district level, neither is there any system to produce such data at district level in Pakistan. However in 1984 DIK's District Council (the local government body for rural areas) carried out a survey under the sponsorship of UNICEF. This survey indicated that in DIK's rural population the death rate per thousand population was 10.6 (national 10.1; provincial 9.3). The survey report shows that among the rural population 1,422 infants died in 1983/84 (Kundi, 1984). Since there is no live birth data available at district level it is therefore difficult to work out IMR per 1000 live births. The main causes of infant mortality are diarrhoea, typhoid, bronchitis, and malnutrition. Most of these deaths are avoidable with effective preventative care. To meet the population's need for acute hospital care there is one district headquarter hospital for the whole district, whose nearly 0.9 million population is scattered over 9005 square kilometers. This hospital is not even very well equipped and patients with acute illness or requiring advanced surgery are advised to go to the teaching hospital at the provincial capital - Peshawar. For the rural population there are 4 rural civil hospitals, 7 RHCs, 43 BHUs, 32 dispensaries, and 5 MCH centres which normally deliver primary care.

Primary health care facilities in urban areas do not exist except for those in the private sector. The living conditions in DIK's urban area are not much different from those in rural areas. In urban areas the majority of the households use hand pumps and to a lesser extent piped water for drinking. According to the 1981 census, only 27% of housing units had a separate kitchen. Separate bathrooms were available in the same percentage of the units. Three and four percent of the housing units were sharing kitchen and bathroom facilities with others. 70% and 69% respectively had no kitchen and bath room facility (PCO, 1983). Similarly 84% of the housing units had toilets without flush. Such poor and unhygienic living conditions create very serious health problems for people in an urban area. This in turn increases the work load on hospitals, especially on outpatient departments.

In the rural sector there are a reasonable number of primary health care facilities; nevertheless the major problem with these facilities is of effective and appropriate delivery of care. The author of this thesis during his field trip visited some of the RHCs, BHUs, and dispensaries of DIK in the company of Dr M A Saleem, ADHO. It was observed that in almost every institution appropriate staff had been appointed, but the presence of staff, the availability of medicines, and the general maintenance conditions were extremely unsatisfactory. Some photographs of these institutions are included in Figure 8.2 to give a graphic impression of the appalling conditions of health care delivery in DIK's rural sector.

Such a weak and ineffective system of PHC delivery is a result of several managerial flaws. These defects will become clear by further examining the managerial arrangements of the DHO's organization. In DIK the DHO is the head of the organization, assisted by three ADHOs, one each for DIK, Tank, and Kulachi tehsils. Tehsils are sub-district units which are further discussed later in this chapter. All the three ADHOs are based in the district headquarters at DIK. For administration, the monitoring of sanitation, the prevention of food adulteration etc. the DHO himself and all ADHOs travel within their specified areas using official transport.

This practice of centralized control appears to be inappropriate because of:

a) lack of effective administration. The overall authority lies with the DHO who is too far from the scene, with administration carried out only through the DHO's and ADHOs field visits;

b) doctors in rural health institutions and ADHOs are at the same managerial level. Doctors in rural health centres are centrally controlled by DHO. ADHOs on field visits cannot influence local doctors towards compliance with overall organizational objectives;

c) quite inadequate links between local doctors and preventive care staff. The preventive care staff are organized in two categories. The staff for sanitation, food adulteration, spraying for malaria control etc. are centrally controlled by DHO via ADHOs. The immunization staff carry out vaccinations of infants through a separate programme called Expanded Programme for Immunization (EPI). Vaccinators are also centrally controlled by DHO, who is in turn assisted by a programme manager to run EPI throughout the district.

All the components of primary and preventive care mentioned above are highly interdependent but unfortunately coordination between these components is difficult to achieve. Although frequent field visits are made by the DHO and ADHOs, interconnectedness among the parts of the DHO's organization does not seem to exist. This limitation of centralized control is in line with the common criticism (see Chapter Two) 'that a centralized organization needs to develop elaborate internal coordination among its parts, which involves substantial costs'.

The government is spending substantial sums of money on primary health care facilities, staff, and medicines but unfortunately the benefits do not reach the public. The whole system of primary health care appears to be ineffective and incapable of realizing value for money. In order to make the delivery of PHC effective there is a need to reorganize the whole system by establishing self-sufficient decentralized and localized administrative units. Decentralized and localized units should be based on areas smaller than the district, so that the delivery of all components of PHC can be integrated.

In Chapter Two we demonstrated that a policy of decentralization has been successful in industrial and social sectors of developed countries. We are convinced that decentralization in the delivery of PHC in DIK (and elsewhere) would also deliver benefits for the public, and bring economies of scale by making the service effective and appropriate to local needs. To implement decentralization the first step is to decide on the size of each decentralized managerial unit. In the following section we will look at the possible choice of boundaries for decentralized managerial units (alternatively called localities) in DIK.

8.2 Setting Boundaries for Localities

We have been arguing in this thesis that certain tasks are preconditions for the implementation of decentralization. Just as in Tower Hamlets, decentralization in DIK requires the identification of manageable localities based on homogenous populations, data availability, and coordination with other inter-related agencies. In Tower Hamlets an important factor in designing localities was to avoid crossing existing boundaries of electoral wards and local government neighbourhoods - which has advantages in terms of data collection and inter-agency coordination. Likewise in the case of DIK we have examined those functions for which a district is already sub-divided in order to identify possible locality boundaries.

The district of DIK has three main functions for which it is geographically sub-divided. For the purpose of district administration and land revenue, the district is divided into three sub-district levels called tehsils. The names of these tehsils are Tank, Kulachi, and DIK - the district also gets its name from this last tehsil. For each tehsil there is an assistant commissioner and a tehsildar, for administration and land revenue purposes respectively. These tehsils are further sub-divided into super revenue areas (Qanoongo Halqas), and revenue areas (Patwar Halqas) mainly for land revenue purposes.

The second function for which the district is sub-divided is for elections to the provincial assembly. The district of DIK is divided into five such constituencies. The boundaries of two of these constituencies, Tank and Kulachi, are coterminous with their tehsil boundaries. However DIK tehsil, being the largest, has been further sub-divided into three constituencies. These three constituencies represent the inner and outer city, the south western rural sector, and the north eastern rural sector.

The third type of sub-division relates to the district's local democratic bodies-the municipal committee (MC), town committees, and the district council. The municipal committee is elected by the urban population to serve urban dwellers within the main city area. For election purpose the MC area of DIK is divided into seventeen electoral wards, each ward electing one representative. The municipal committee is headed by a chairman elected by its members. A town committee is elected by the town population to serve its dwellers. Towns are normally smaller than cities but larger than villages, serving as business centres for the surrounding rural population. In DIK there are two towns having their own elected committees; one in tehsil Tank and the other in the north eastern sector of tehsil DIK-known as Paharpur.

The district council, on the other hand, under the Local Government Ordinance 1979, is responsible for rural development. This includes the drinking water supply, preventive health care, sanitation, primary education, social welfare, rural roads and streets etc. The district council is in turn based on 31 union councils each having its own elected representative (Kundi, 1984). The district council, like the municipal committee, is also headed by a chairman elected by representatives from union councils.

There are two basic alternative options for a possible sub-division into health localities. These are to establish health localities which match either the size of tehsils or the size of provincial assembly constituencies. Of these two options the second appears more manageable in terms of size, of economy, and of coordination especially with the elected members of the provincial assemblies (MPAs).

We have seen in Chapter Seven that the Government of Pakistan (1990) in its health policy is committed to set up manageable units of health care delivery under community control. The policy aims at establishing District Health Boards and Health Committees in every district. The policy says that the District Health Board "will have members of the Parliament and Provincial Assembly, Chairman of the district council, senior official of the Health Department and District Population Welfare Officer as its members. The District Health Officer will be the Secretary of the Board. The Provincial Department of Health will nominate a suitable official to act as coordinator of the Board. The District Health Board will be responsible for advising, implementing and monitoring health and population activities of the district". It also says that "Health committees of elected representatives will be formed at the union council and village level to monitor and oversee the functioning of various health programmes".

From the policy it is obvious that the members of the provincial assembly (MPA), Parliament, and union councils would be given a vital role to coordinate and participate on the behalf of community. It would therefore be most appropriate that the existing DHO's organization be decentralized into five localities, each corresponding to the boundary of a provincial assembly constituency.

Of the five proposed localities, Tank and Kulachi are coterminous both with their tehsil and provincial assembly constituencies. DIK tehsil is however further sub-divided into three localities which we may call Damaan (to represent the south and south western rural sectors), Dera (to represent the inner and outer city), and Paharpur (to represent the north and north eastern rural sectors). The proposed localities of DIK tehsil are shown in Figure 8.3. Due to travelling difficulties and time constraints on the author's field trip, the work reported in this thesis concentrates on these three proposed localities of the DIK tehsil.

When deciding locality boundaries in Tower Hamlets (Chapter Four), the interdisciplinary planning group preferred that health localities not cross electoral ward boundaries. This was desirable because: a) wards were considered as basic geographical units for data collection and analysis, and b) Tower Hamlets local government's decentralized units (neighbourhoods) also respected ward boundaries.

Likewise in DIK the basic geographical units which would be convenient for data collection and analysis are the local government's union councils. Union councils are the district council's basic unit with elected representatives. The district council's service delivery and planning takes place principally in terms of union councils. Therefore we propose to use the union councils as the subdivision for data purposes for health localities.

However in the case of two of our localities, Dera and Paharpur, we have needed to make some assumptions. Firstly two union councils called Muryali and Yarik respectively cross locality boundaries, leaving rural dwellings called Dhap Chabac and Budh in other localities (Figure 8.4). In order to remain within the proposed locality boundaries, and to be coterminous with the provincial assembly constituencies, we have included rural dwelling Dhap Chabac in the Dera locality and Budh in the Damaan locality. Secondly Paharpur locality also has one town committee in Paharpur town. Since we do not have adequate information about the working of town committees, we have therefore combined the areas of Paharpur town committee and Band Korai union council (which comprises the surrounding villages of Paharpur) for data collection. This assumption was made because, unlike the municipal committee area of DIK, the DHO's organization does deliver primary health care in towns. This exercise gives us three localities, i.e. Damaan, Dera, and Paharpur with 10, 5 and 10 union councils as their basic units.

After setting locality boundaries for decentralized units (which in practice would be done in a more detailed manner than above), the next task is to decide upon the managerial arrangements, the development of a local information system, and the development of mechanisms for resource allocation to make decentralization operational. In the following section we will concentrate on managerial arrangements for localities.

8.3 Managerial Arrangements

Health localities in Tower Hamlets and elsewhere in Britain are to be headed by locality managers. We have also seen in Chapter Three that locality planning in Britain varies across health districts. Similarly in DIK it would be appropriate for this matter to be tackled locally, and indeed to evolve over a period of time. However in what follows we identify a possible scheme for establishing localized managerial arrangements.

In DIK each health locality should be headed by managers - who will be referred to in what follows as locality health officers. Locality managers should be made responsible for the delivery of an integrated PHC service within their localities. These locality managers together with managers of other related health services and public representatives should be included as members in District Health Board. The establishment and the size of membership of District Health Boards, as we already explained, is committed by the government in its health policy of 1990 .

Locality managers should be based at their respective headquarters, and should carry out mobile clinics within their localities. In this respect the Pakistan government too has committed itself in its 1990 health policy to the establishment of mobile units for unserved and underserved areas (Government of Pakistan, 1990). Locality managers should also arrange appointments for acute cases in district or provincial headquarter hospitals.

We expect that the proposed arrangements will not involve additional cost. If there is any it should, however, be available as the government intends to increase the expenditure on health care, presently under 2% of the GNP, to 5% (Aga Khan University and Government of Sindh, 1989; Government of Pakistan, 1990). The suggested management change should on the other hand help to realize greater value for money. For example in almost every proposed locality there are adequate facilities which are underused. These facilities should be able to accommodate a new organization.

Similarly in the district there are many senior doctors available with specialized professional skills who are already at the maximum of their pay scales. Some doctors are even drawing salaries equivalent to MS or DHO. These senior doctors can not be promoted because of non-availability of posts. This in turn has negatively affected doctors' motivation and initiative. This factor has been recognized by the government, which acknowledges the need to open up better career opportunities for doctors via its 1990 Health Policy. Promoting doctors as locality managers would help to revive their confidence in the service and achieve the government's objectives.

The use of vehicles for mobile clinics will not involve an additional burden. There are a number of vehicles already available within the DHO's organization for field visits. These field visits involve substantial costs (officers' travelling expenses and vehicles running cost) with comparatively few benefits. Under the revised arrangements the costs of vehicles running and officers travelling will have greater utility.

We have in this section discussed the possibilities of revising managerial arrangements to implement decentralization. Such revised managerial arrangements could provide a tactical strategy of delivering appropriate primary health care to utilize existing resources in a more effective manner. The suggested management change would also help the government to move purposefully towards the objective of health for all by the year 2000.

After setting up decentralized units and making appropriate managerial arrangements the next task in implementing decentralization would be to develop a base-line information system. This is explained in the following section by developing population profiles.

8.4 Population Profiles

Just as in Tower Hamlets, in DIK the development of a local information system is important for inter-agency coordination and an increased uptake of service. Also the Government of Pakistan has recognized the need for a base-line health information system in its recent health policy. In this respect our efforts could provide an initial guideline for action.

In DIK the smallest feasible geographical areas for data collection are union councils. This base-line information on union councils can then be collated for localities. In our development of locality profiles we will include demographic, health services provision, health services activity, and other health related services data as in the case of Tower Hamlets.

Our sources of data are a) Population Census Organization (PCO) for 1981 census data, b) Federal Bureau of Statistics (FBS) and World Bank for demographic estimates, c) DHO's organization for health service provision, health service activity data, and d) the District Family Planning Office for the provision of family planning services. The salient features of the data collected are described below.

8.4.1 Demographic Data:-

Both PCO and FBS are part of the Statistics Division of the Federal Government of Pakistan. The PCO is mainly responsible for the decennial population census. It produces age and sex specific census data with several variables down to tehsil level. In addition to that it also provides total male and female population data together with additional variables such as the literacy ratio, educational attainment levels, household size, and religious minorities of each and every village.

The FBS produces population estimates and other statistical information during the intercensal period. The FBS however does not produce age and sex specific demographic estimates. It rather estimates total population using average annual growth rates based on past census populations. However the World Bank produces age and sex specific demographic estimates for almost every country (Zachariah and Vu, 1988). In order to estimate age and sex specific population figures for DIK tehsil we used the World Bank's national estimates as a starting point. Although population estimates derived in this way are less than totally satisfactory, this is the best that can be done with available data. Before explaining the methods used for population estimation, we will briefly describe the profiles of the three localities of the DIK tehsil.

The DIK tehsil is spread over 4557 square kilometers, and consists of 25 union councils and a municipal committee. Each union council is made up of a number of small rural dwellings located near to each other. We have proposed that DIK tehsil be sub-divided into three localities for decentralized health planning purposes. The three proposed localities of Damaan, Dera, and Paharpur are based on 10, 5, and 10 union councils respectively.

In order to collect population data for union councils we first aggregated the 1981 census data of each rural settlement to union council level. This was done with the help of a list (provided by Mr Muhammad Naeem Khan Qasuria, District Engineer of the District Council DIK) which groups rural settlements under each union council. The population data was further collated for the three localities of DIK tehsil, as shown in Table 8.1.

Table 8.1: Population by sex, household size, and literacy ratio of proposed localities of D I K

Area	Population both sexes	Male	Female	Household size	Literacy ratio %
Damaan	123,148	65,492	57,656	5.89	8.34
Dera*	59,097	31,891	27,206	6.21	8.68
Paharpur	137,136	72,679	64,475	6.04	9.60

* excluding population of the Municipal Committee area

It may be noted that the figures for Dera locality in Table 8.1 do not include the population living in the Municipal Committee (MC) area. This is because, as mentioned before, the primary health care facilities of the DHO's organization such as RHCs, BHUs, MCHs etc. operate mainly in rural areas.

Since the population census data is almost a decade old, it is desirable to include recent demographic estimates in the population profiles. Demographic estimates were therefore derived for 1991 for the three localities of DIK tehsil. For this purpose we utilized the World Bank's national projections for 1990 and 1995 (Zachariah and Vu, 1988). The estimated population of DIK and its union councils was derived by the following steps. (We are grateful for advice from Mr Murphy (1990) of the LSE Population Studies department on the method to be followed.)

Step 1) From the World Bank's age and sex specific national projections for the years 1990 and 1995, age and sex specific estimates were first derived for the national population for the year 1991. This was done by using linear interpolation, as described in Chapter Five (see UN,1983).

Step 2) From these figures age and sex specific estimates for the population of NWFP were then derived. The basis of this estimation was an assumption that the 1981 age and sex specific ratios of provincial population to the national population remained unchanged in 1991.

Step 3) Demographic estimates were then derived for the district from the provincial estimates by applying the same method as in step 2. In the same way DIK tehsil and union council demographic estimates were arrived at.

The estimated union council population figures derived in this way are given in Appendix 4. Of these estimates, those variables which are likely to influence the pattern of health service use were collated for each locality, and are given in Table 8.2.

Table 8.2: Locality based estimated population for 1991

Localities	Population	Under 1 year	1-5 years	Over 75 years	Women of child bearing age
Damaan	150,906	5,194	22,692	832	31,997
Dera*	83,468	2,873	12,551	462	17,386
Paharpur	193,742	6,668	29,133	1,069	41,203

* excluding MC population

These variables can help health workers in various ways. For example, vaccinators may need to plan future vaccination programmes by identifying the number of children under one year, family planning workers may need to know the number of women of child bearing age to identify their target group, and so on.

This method of demographic estimation is oversimplified, so that the direct utility of the figures is limited. However it fulfills our objective of demonstrating how to prepare population profiles by including demographic data of geographical units as small as union councils. In Pakistan an appropriate organization like FBS has branch offices in almost every district with relevant statistical staff. To derive accurate demographic estimates using appropriate methods should not in principal be a problem for the FBS. Since the government is now emphasizing the need for the development of base-line information, the work on population profiles reported here may help to mobilize the PCO and FBS to produce census data and demographic estimates based on smaller areas.

The current health planning system in Pakistan does not take account of population counts or any other indicators such as vital statistics. Indeed western type vital statistics are not produced in Pakistan. Municipal committees and union councils are supposed to register births and deaths in their respective areas. But unfortunately little attention is given to registering such events, nor does the government give any importance to publishing such data. This makes the activity of registering births and deaths voluntary. This aspect of data collection and publication needs government's attention. At present SMRs, IMRs, and births rates are produced only on the basis of sample surveys which may be helpful for the understanding of demographic structure, but according to Bevan (1989) have limited usefulness for planning purposes.

Health planning without consideration of population counts and other need criteria is unjustifiable. It has resulted in a great deal of inequality in health care provision. Further inequalities will become clearer when we discuss health service provision in each locality of DIK tehsil in the following section.

8.4.2 Health Service Provision:-

Data on the provision of health services, under the DHO organization, was obtained from the office of the DHO, DIK during the author's field trip in the summer of 1990. This data includes the number of rural hospitals, RHCs, BHUs, dispensaries, sub-health centres, medical, and para medical staff in each institution. Since most of these services are locally delivered, it was therefore possible to collate service provision data on the basis of proposed localities. This information is given in Table 8.3.

Table 8.3: Locality based health care facilities in DIK tehsil

Items/Localities	Damaan	Dera	Paharpur	Total
Rural Hospitals & RHCs	1	-	3	4
BHUs	10	1	6	17
Dispensaries	2	3*	10	15
MCHs	-	-	2	2
Doctors/Medical Officers	12	3	14	29
Dental Surgeon	1	-	1	2
Medical Technician	24	2	19	45
Compounders/Dispensers	5	5	13	23
Lady Health Visitor	11	1	9	21
Midwife	5	-	1	6
Traditional Birth Attendant/ Dai	8	2	21	31
Operation Theatre Facility	-	-	2	-
X-ray Facility	-	-	2	-

* includes 2 travelling dispensaries

The facilities in Table 8.3 deliver service in rural areas. Additionally there are a number of preventive services under DHO's organization: the monitoring of sanitation, prevention of food adulteration, spraying for malaria control, and the school health service. These services are based at district headquarters and cover both urban and rural areas. Beside these the Expanded Programme of Immunization (EPI) under the DHO is designed to immunize children by visiting from door to door. Vaccination units are located in RHCs and BHUs, with a number of vaccinators provided with motor-bicycles to travel from village to village and immunize children under one year and between 4 and 5 years of age. The number of EPI centres in each locality are: Damaan 5, Dera 2 (including 1 for MC DIK and its surrounding rural area), and Paharpur 9.

Outside the DHO organization the District Population Welfare Office provides a service and advice on family planning through its family welfare centres located throughout the district. Within DIK tehsil there are nine family welfare centres which according to localities are: Damaan 2, Dera 2, and Paharpur 5.

The statistics on health service provision in Table 8.3, and those in the above paragraph, show the lack of equity in health service provision between localities. The Dera locality is worst-off in many cases. There is only one BHU for the whole population of about 83,468. Likewise there is only one doctor for every 28 thousand people, far below the national average of one for about two thousand. Inequalities among all the three localities are evident from Table 8.4 which shows resident population per facility unit.

Table 8.4: Estimated resident population per facility unit by localities

Localities/ pur Facilities	Damaan	Dera	Pahar
Rural hospitals & RHCs	150,906	-	64,581
BHUs	15,091	83,468	32,290
Dispensaries	75,453	27,823	19,374
Doctors	12,576	27,823	13,839
LHVs*	5,444	33,810	8,556

* only for children <5 year and women of child bearing age

Table 8.4 demonstrate the magnitude of inequalities in health service provision between localities. It also suggests that DIK tehsil is far below the national and provincial averages. This attempt to prepare population profiles and look at population in relation to health care facilities is an example which could help planners to identify pitfalls and set priorities for future provision.

It is also relevant to examine health service activities at each centre. At each health establishment there is an outpatient register to record daily attendance of patients. It includes information on sex, two age categories i.e. patients under 12 years and over 12 years, status as new patient or old patient, and preliminary diagnosis. Due to time limit and travel difficulties it was not possible to collect all these data; however a statement showing aggregate sex specific old and new patients seen at each centre was obtained from headquarters for the year 1988. For the sake of brevity we have combined total health service activity data of outpatients in all institutions (assuming they were treated in their own area) and collated them by locality. This shows that the number of outpatients treated in Damaan, Dera, and Paharpur localities were 37,074, 13,157, and 64,636 respectively.

From these statistics it is clear that primary health care service coverage varies across the three localities. For example the percentage of outpatients to the resident population in Damaan is 25%, in Dera only 16%, and in Paharpur 33%. This indicates that need is being selectively suppressed by the uneven distribution of facilities.

We have in this section demonstrated that there are adequate sources available to obtain and record a wide variety of data helpful for the preparation of locality profiles. Locality profiles using maps and relevant information for all the three localities of DIK are given in Figures 8.5, 8.6, and 8.7. Such profiles would enable health service agencies to plan, coordinate, and set priorities for future provision. After showing the feasibility of preparing population profiles and their importance in service provision we will now discuss briefly how to adapt the GIS for locality planning.

8.5 GIS for DIK

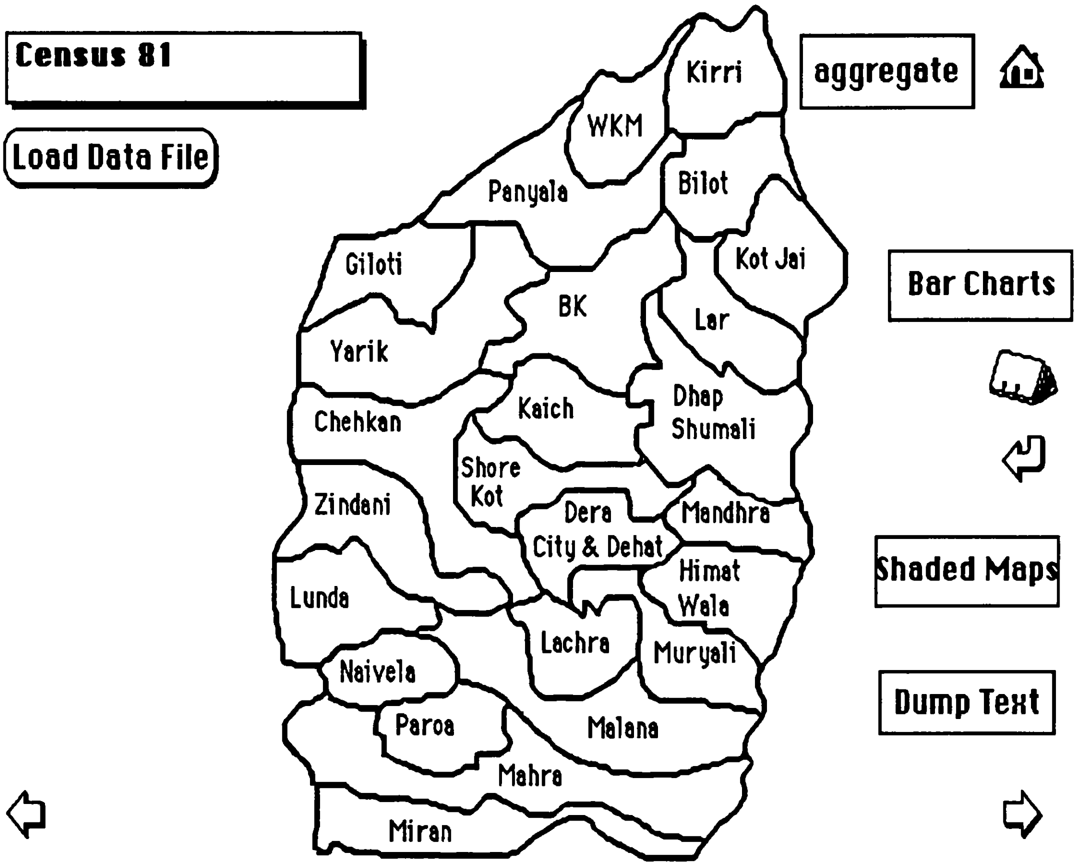
Information gathering is not a one-off activity. It is rather a continuous process requiring frequent updating and ready access to information as required. In this respect we have attempted to adapt the prototype GIS, which was developed for Tower Hamlets, for use in locality planning in DIK. We are grateful for the help, in this aspect of the work, given by David Edmondson of the Computer Sciences department at QMW who was originally responsible for the programming of the Tower Hamlets

GIS.

We have already explained, in the context of Tower Hamlets, that manipulation and analysis of geolinked data on population, health service provision, health activity, and other services is a possibility with the recent generation of GIS. The use of GIS has not been limited to Britain or other industrially developed countries; less developed countries are also making progress in developing GISs for planning purposes. The British Computer Society recently (1990) held a specialized conference on this topic. A variety of speakers from both developed and less developed countries spoke on the use of GISs in less developed countries. Similarly speakers at workshop, held at Lisbon, Portugal in 1987, organized by the Aga Khan Foundation Geneva, the Aga Khan University, Pakistan and the National School of Public Health, Ministry of Portugal (Aga Khan Foundation, 1988) argued that microcomputer based management information systems are valuable managerial tools in PHC development in less developed countries. Professor Bryant of the Faculty of Health Sciences, Aga Khan University, is developing a microcomputer based information system whose special focus is the squatter settlements (Kachi abadies) of Karachi (Aga Khan Foundation, 1988).

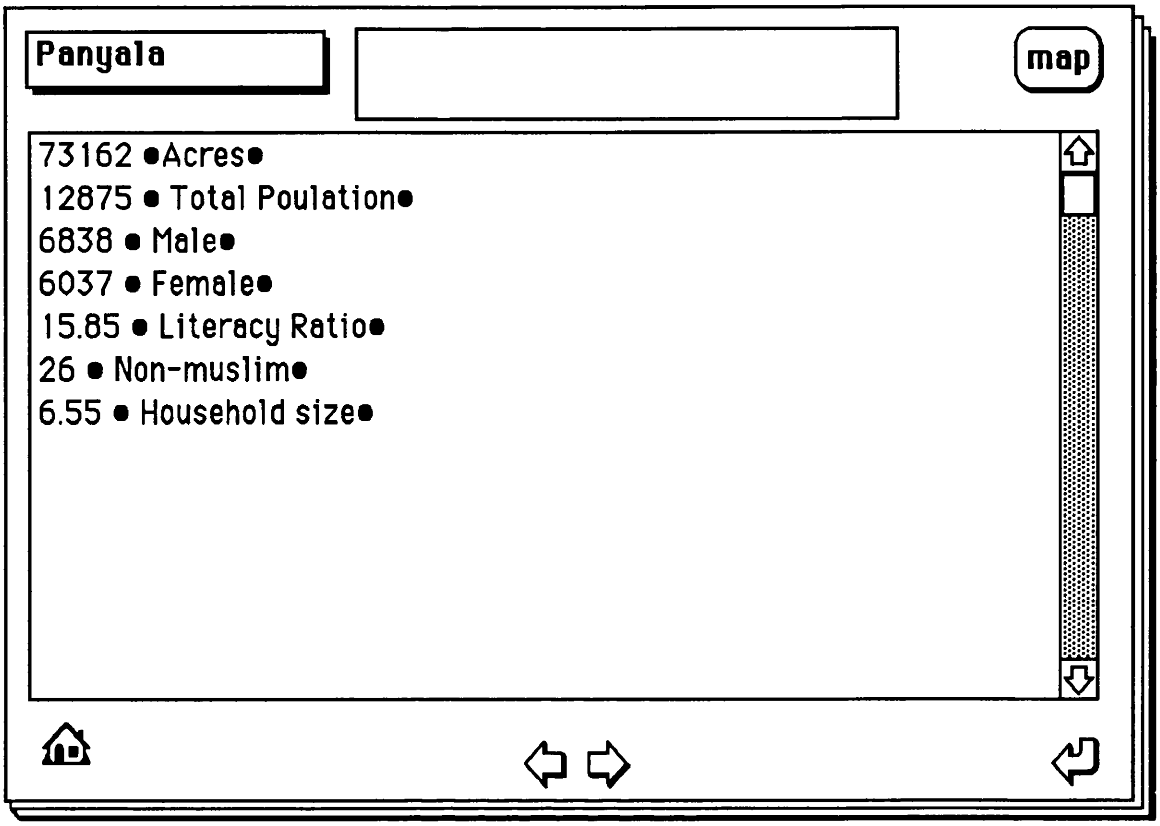
The Government of Pakistan is committed to the use of computer technology to develop an adequate information system for health care. In view of these developments we have therefore adapted the GIS for the DHO's organization of DIK based on an Apple Macintosh using Hypercard software. This system is user friendly and simple to operate without requiring much previous skill, as explained in Chapter Four. The adapted version of GIS primarily creates geolinked data card stacks for each union council as shown in Figures 8.8 and 8.9. The adapted version of the Tower Hamlets package is available for this purpose; however if further development of the software is required, consultation with its originators would be necessary.

Figure 8.8: A map card from census data stack



Note:- This sketch of DIK tehsil was manually drawn to fit into a standard crad size of hypercard software
Kirri = Kirri Khaisore
BK = Band Kurai and Paharpur
WKM = Wanda Khan Mohammad

Figure 8.9: A data card from census data stack



8.6 Conclusions

In the present Chapter we have demonstrated that primary health care delivery in DIK lacks effective management and coordination both within the organization and with other health related agencies. Nevertheless field visits are made by DHO and ADHOs which incur substantial costs, with benefits which are relatively trivial. Different components of the service are uncoordinated. Health care is delivered without medicines, making health institutions underutilized and limiting doctors' initiative. The result is a whole system of PHC both fragile and fruitless for the general public. This in turn results in a waste of scarce national resources.

Among several reasons for an ineffective PHC, the most important is that of centralized control which makes service delivery dysfunctional. To tackle the issues arising out of this situation we recommend the decentralization of primary health care delivery. We have examined various factors affecting the choice of boundaries for localized planning units. The important factors considered were the feasibility of data collection, the possibility of coordination within the organization and among inter-related agencies, and the revival of the confidence of doctors, politicians, and the general public in service delivery. Based on our analysis of these factors we showed how to establish localities.

Having established localities we then examined various sources of data. Sufficient sources for data collection are available in Pakistan, but unfortunately are under-utilized. We have obtained data from various local, national, and international sources and developed population profiles based on union councils and localities. These profiles are the first of their kind in Pakistan, and may help in setting directions for future health service provision and more rational planning.

We have also examined the possibility of using advanced technology in less developed countries, and have adapted the prototype GIS, initially developed for Tower Hamlets, to be used for localized planning in DIK. With these developments some of the tactical issues in implementing decentralization in DIK have been tackled. However decentralization is a continuous process which requires several issues to be tackled; one among them is the appropriate allocation of resources. In the following Chapter we will demonstrate the feasibility of applying integer programming methods to allocate resources for the Expanded Programme of Immunization in DIK.

Figure 8.1

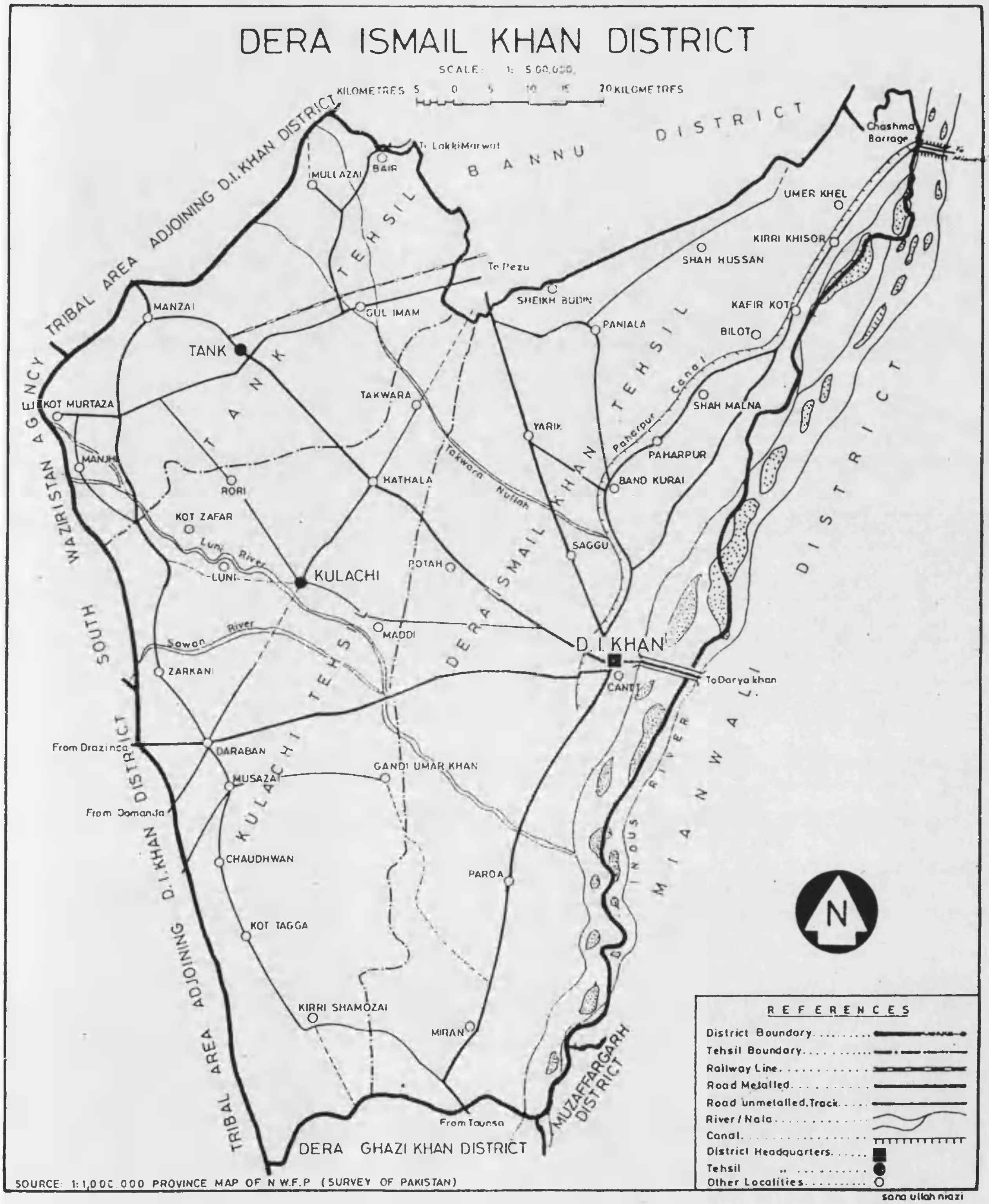
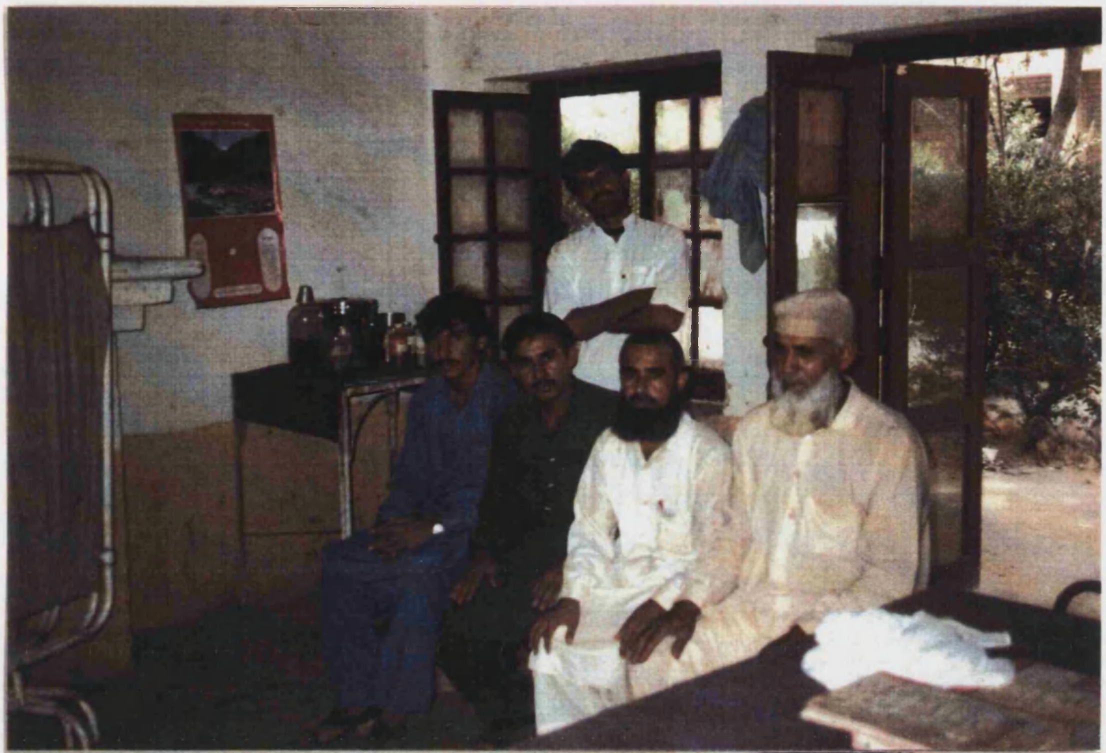
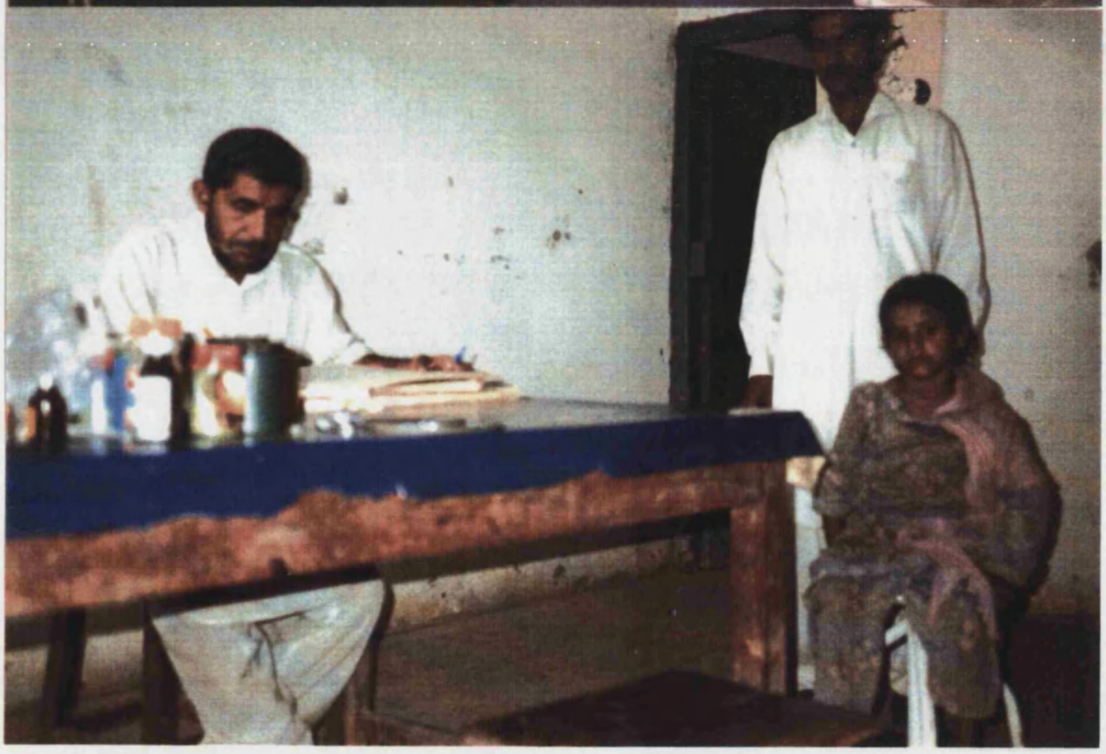

DERA ISMAIL KHAN DISTRICT
SCALE 1: 500,000
KILOMETRES 5 0 5 10 15 20 KILOMETRES
BANNU DISTRICT
TRIBAL AREA ADJOINING D.I. KHAN DISTRICT
SOUTH WAZIRISTAN AGENCY
TANK TEHSIL
DERA ISMAIL KHAN TEHSIL
KULACHI TEHSIL
MIANWALI DISTRICT
MUZAFFARGARH DISTRICT
DERA GHAZI KHAN DISTRICT
Chashma Barrage
UMER KHEL
KIRRI KHISOR
SHAH HUSSAN
KAFIR KOT
BILOT
SHEIKH BUDIN
PANIALA
SHAH MALNA
PAHARPUR
Paharpur Canal
BAND KURAI
YARIK
SAGGU
To Lakki Marwat
BAIR
MULLAZAI
To Pezu
GUL IMAM
MANZAI
TANK
KOT MURTAZA
TAKWARA
Takwara Nullah
MANJHI
HATHALA
RORI
KOT ZAFAR
Luni River
LUNI
KULACHI
POTAH
MADDI
Sawan River
D. I. KHAN
CANTT
To Darya khan
ZARKANI
From Drazinda
DARABAN
MUSAZAI
GANDI UMAR KHAN
From Domanda
CHAUDHWAN
PAROA
INDUS RIVER
KOT TAGGA
KIRRI SHAMOZAI
MIRAN
From Taunsa
N
REFERENCES
District Boundary
Tehsil Boundary
Railway Line
Road Metalled
Road unmetalled. Track
River / Nala
Canal
District Headquarters
Tehsil
Other Localities
SOURCE: 1:1,000,000 PROVINCE MAP OF N.W.F.P (SURVEY OF PAKISTAN)
sana ullah niazi

Figure 8.2: Graphic presentation of some of the health facilities in DIK





Top:- Dispensing room of a Rural Hospital, Panyala.

Bottom:- Medical Technician filling in record before examining a child in the Basic Health Unit, Sheru Kohna.

Figure 8.2 (cont.)

Top:- Basic Health Unit closed at mid day.

Bottom:- An ordinary track for access to the above BHU - seen in the background.

Figure 8.2 (cont.)

Top:- Para medical staff in front of the Rural Health Centre, Kot Jai

Bottom:- Dr M. A. Saleem, ADHO (second from the right) and his staff returning from field visit of the Rural Hospital, Panyala.

Figure 8.3: Proposed Locality Boundaries of DIK Tehsil

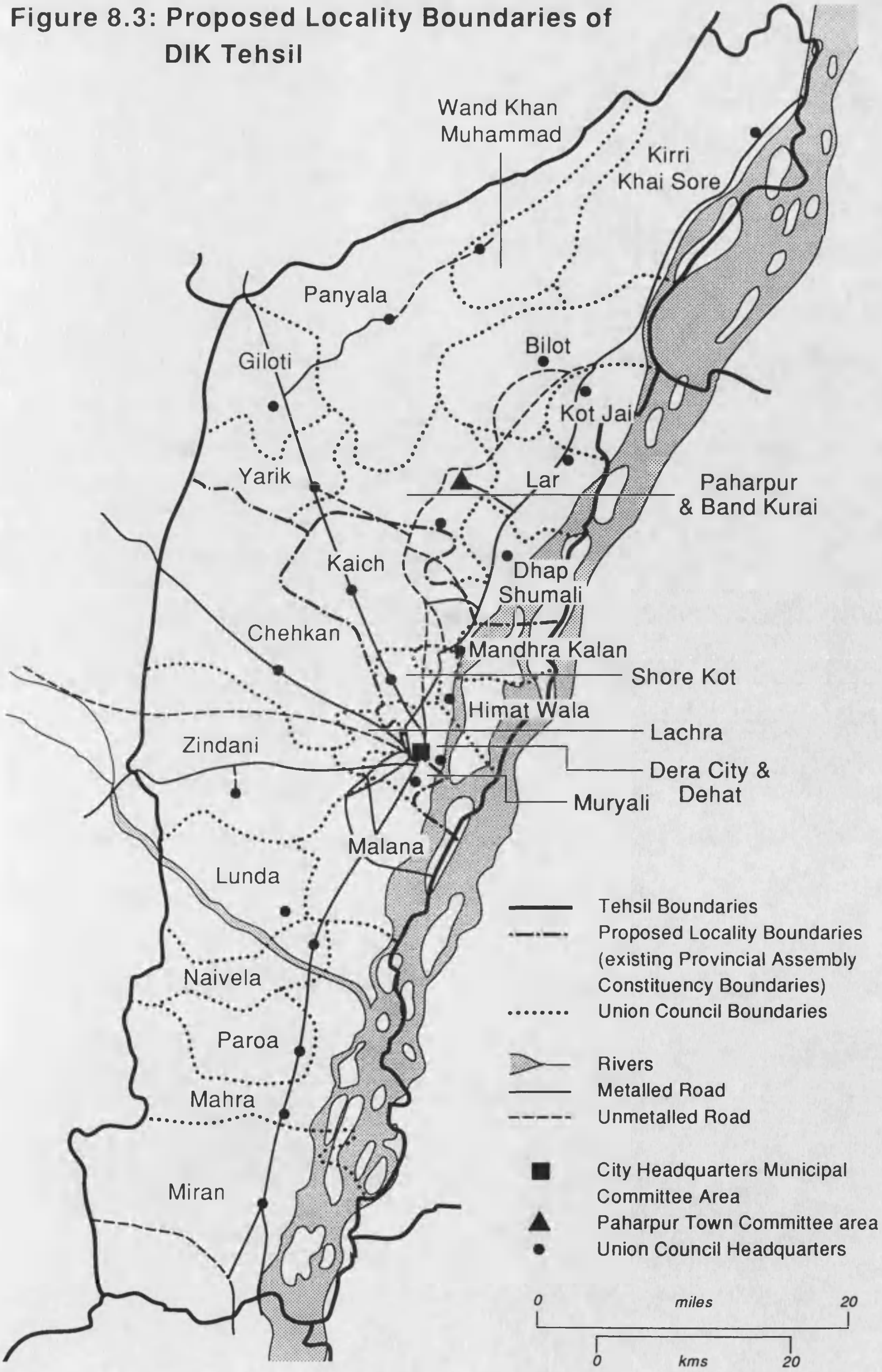


Figure 8.4: Localities crossing union council boundaries

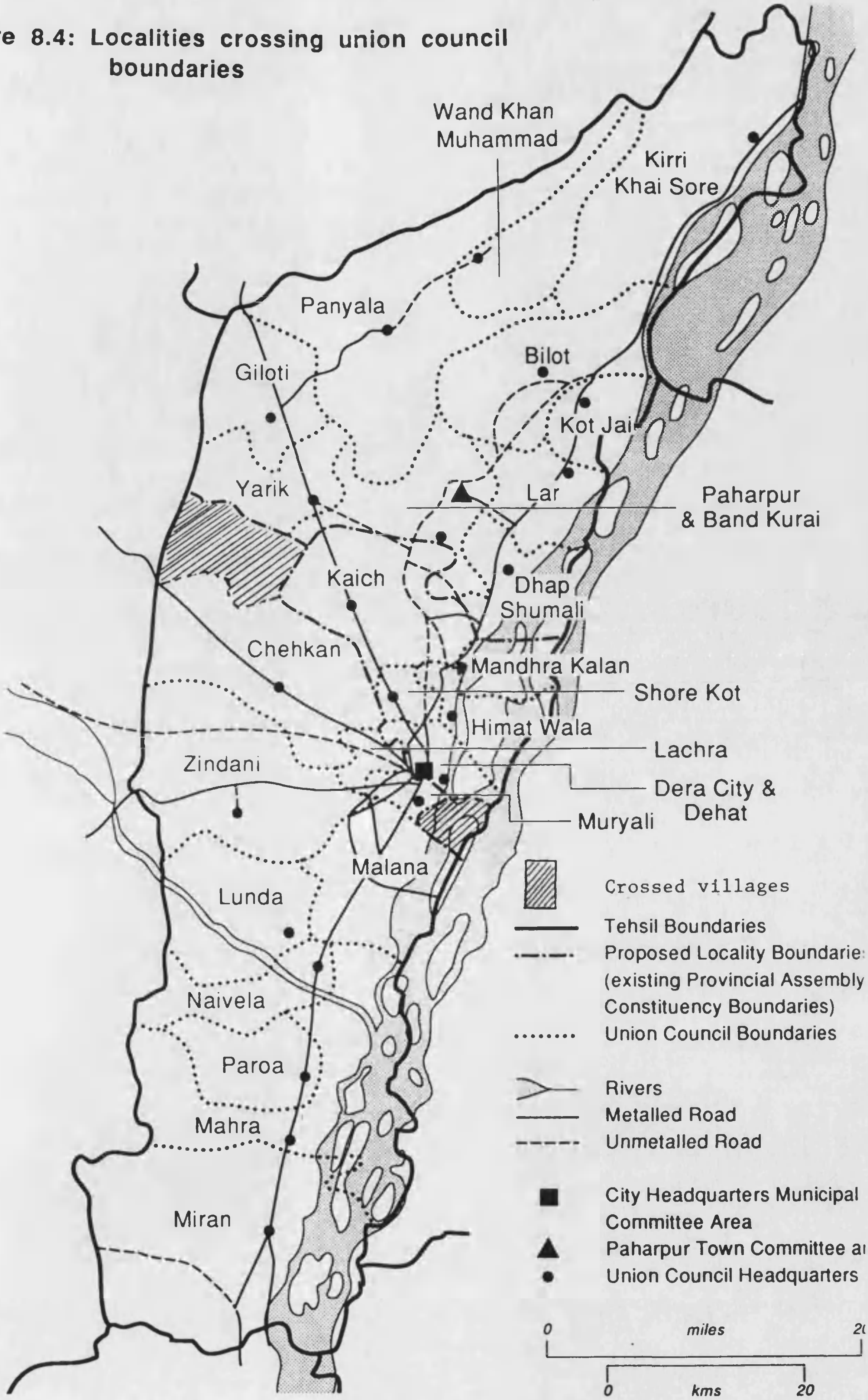


Figure 8.5: Damaan Locality

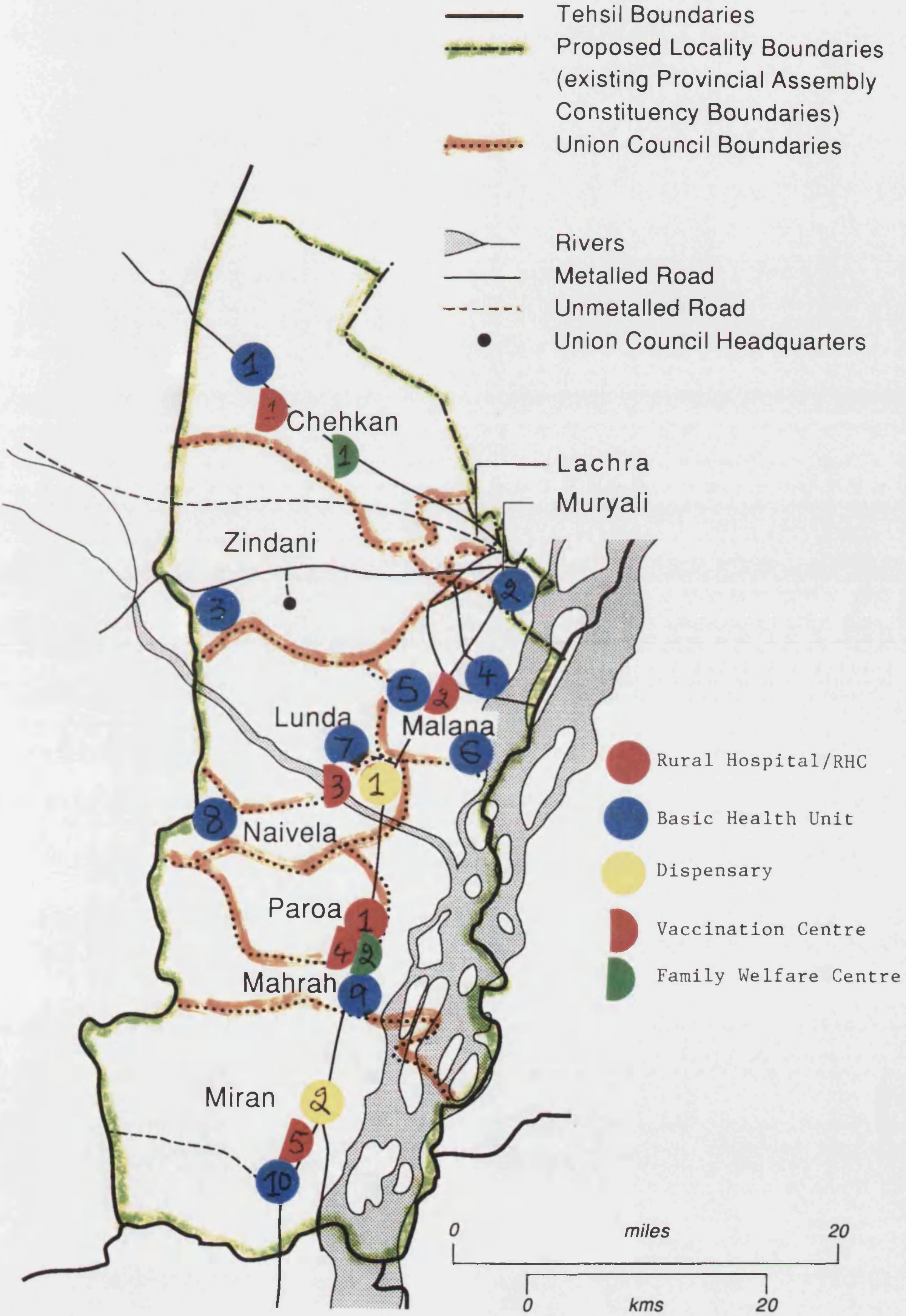


Figure 8.5 (cont.)

Details of health facilities	Location	Location on map
Rural Health Centres	Paroa Union Council	1
Basic Health Units	Potah, Chehkan Union council	1
	Muryali, Muryali Union Council	2
	Sheru Kohna, Zindani Union Council	3
	Malana Union Council	4
	Fateh, Zindani Union Council	5
	Roda, Malana Union Council	6
	Darabin Khurd, Lunda Union Council	7
	Rashid, Naivela Union Council	8
	Mahrah Union Council	9
	Ramak, Miran Union Council	10
Dispensaries	Naivela Union Council	1
	Miran Union Council	2
Vaccination Centres	Potah, Chehkan Union Council	1
	Malana Union council	2
	Darabin Khurd, Lunda Union Council	3
	Paroa Union Council	4
	Ramak, Miran Union Council	5
Family Welfare Centres for family plannin service	Chehkan Union Council	1
	Paroa Union Council	2

Figure 8.6: Dera Locality

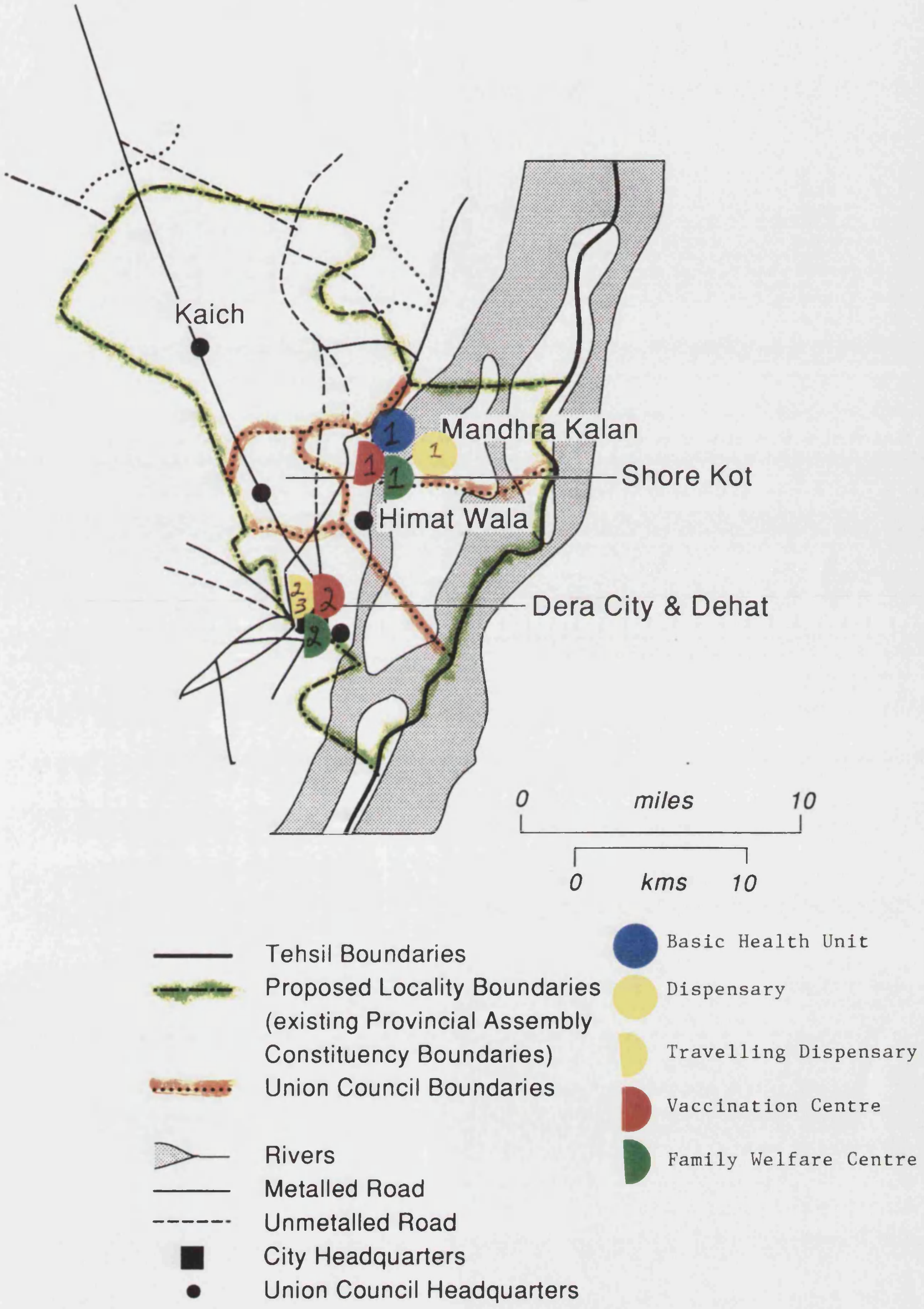


Figure 8.6 (cont.)

Health Facilities	Location	Location on map
Basic Health Unit	Budhani, Mandhra Kalan Union Council	1
Dispensaries	Mandhra Kalan Union Council	1
	Behari Colony travelling dispensary	2
	Ratta Kulachi travelling dispensary	3
Vaccination Centres	Budhani, Mandhra Kalan Union Council	1
	Dera City	2
Family Welfare Centres for family planning service	Mandhra Kalan Union council	1
	Dera City	2

Figure 8.7: Pharpur Locality

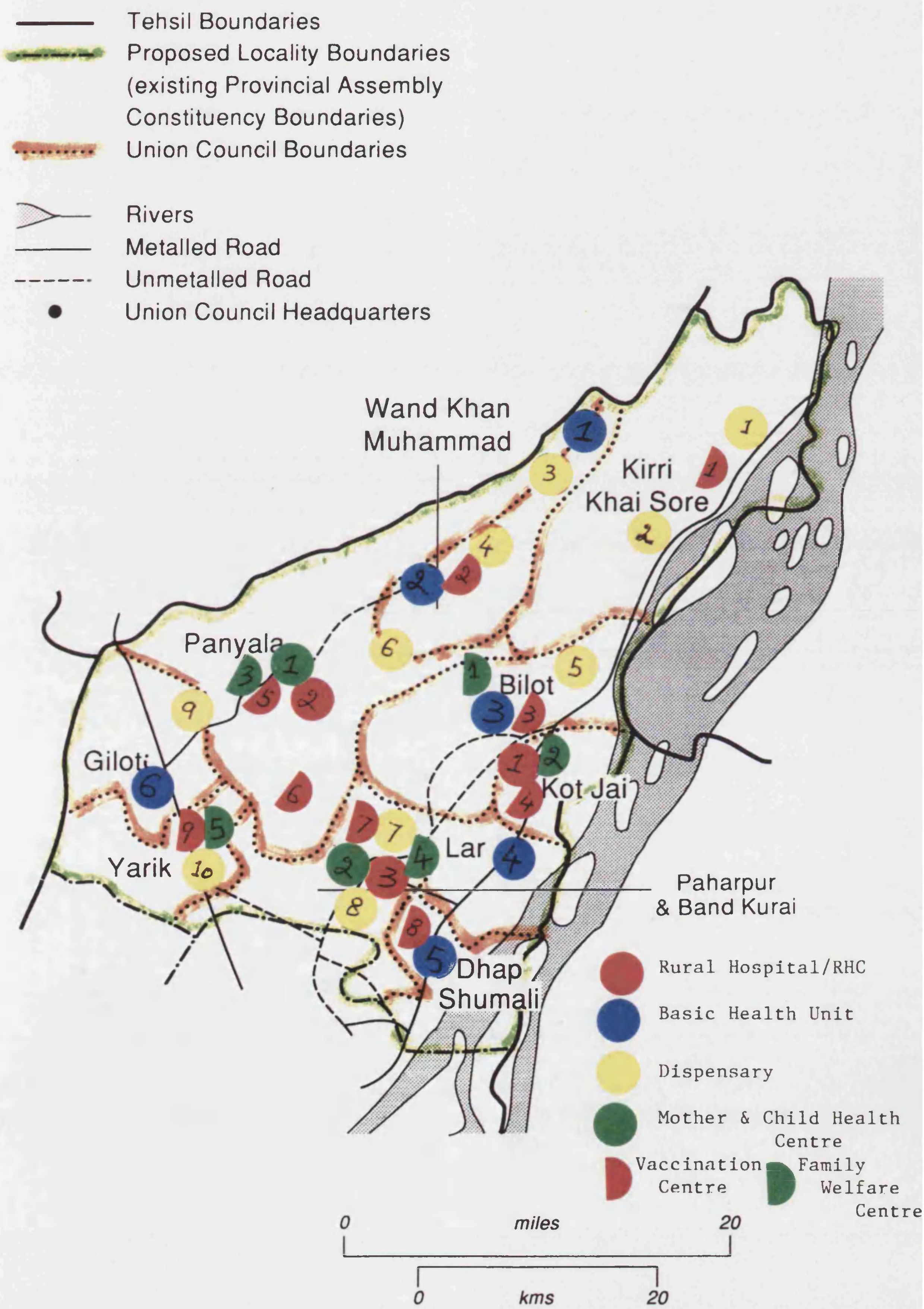


Figure 8.7 (cont.)

Health Facilities	Location	Location on map
Rural Hospitals/ RHCs	Kot Jai Union Council	1
	Panyala Union Council	2
	Paharpur Town	3
Basic Health Units	Baggi Qamar, W K M Union Council	1
	Abdul Khail, W K M Union Council	2
	Kotla Lodhian, Bilot Union Council	3
	Hafizabad, Lar Union Council	4
	Awan, Dhap Shumali Union Council	5
	Giloti Union Council	6
Dispensaries	Umar Khail, Kirri Khaisore Union Council	1
	Kirri Khaisore Union Council	2
	Rehmani Khail, W K M Union Council	3
	Katta Khail, W K M Union Council	4
	Bilot Union Council	5
	Lohani, W K M Union Council	6
	Katghar, Bilot Union Council	7
	Band Kurai Union Council	8
	Bahadury, Giloti Union Council	9
	Yarik Union Council	10
Mother and Child Health Centres		
	Panyala Union Council	1
	Paharpur Town	2
Vaccination Centres	Madi Khail, Kirri Khaisore Union Council	1
	Abdul Khail, W K M Union Council	2
	Kotla Lodhian, Bilot Union Council	3
	Kot Jai Union Council	4
	Panyala Union Council	5
	Wanda Madat, Panyala Union Council	6
	Paharpur Town	7
	Awan, Dhap Shumali Union Council	8
	Yarik Union Council	9
Family Welfare Centres		
fòr family planning service	Bilot Union Council	1
	Kot Jai Union Council	2
	Panyala Union Council	3
	Paharpur Town	4
	Yarik Union Council	5

Chapter Nine

Resource Allocation In Pakistan: A Case of Allocating Vaccinators in DIK District

9.1 Introduction

In Chapter Eight, when considering an implementation of decentralized primary health care in DIK (a health district of Pakistan), we defined locality boundaries, prepared locality profiles for base-line health information, and adapted the Tower Hamlets version of GIS to display base-line information. We now consider a decentralized resource allocation mechanism. This is done by taking, as an example, the Expanded Programme of Immunization (EPI) to allocate vaccinators to localities for the year 1991. The objective of EPI is to protect children against infectious diseases.

According to the Government of Pakistan (Health Division,1986) infectious diseases are a major problem in the country. Thousands of children die of Measles, Pertussis, Poliomyelitis, Tuberculosis, Diphtheria, and Tetanus. Many more are crippled, blinded and spend the rest of their lives with one or more complications of these maladies. To vaccinate children under five against these six diseases the Government of Pakistan is running EPI where vaccinators visit children in their houses to immunize them.

The immunization service in DIK is delivered by home visits of vaccinators. This form of service delivery is analogous to the situation of district nurses in Tower Hamlets. We have therefore adapted the integer programming models which were developed in Chapter Six to allocate district nurses in Tower Hamlets. To do this the input data required were the need for vaccination and estimated travel time between various need and supply points. These are further explained in the following sections.

9.2 Need for Immunization Service

The method of calculating need for the vaccination service is much simpler than that used for the district nursing service in Tower Hamlets. It is fairly straight forward because each child that is born has to be vaccinated. Therefore the 'criterion of need' calculation is based on the population of children. However it is necessary to know which age categories are to be considered and how immunization is to be carried out during childhood.

The most common schedule of immunization provided at various stages during childhood is given in Table 9.1. From Table 9.1 it is clear that vaccinators deal with two age categories of children i.e. 0-1 year and 4-5 years. However Table 9.1 also shows that there are five stages of vaccination for a child under one year which means that each child in the age category of 0-1 has to be visited five times in a year. This implies that the need for immunization in this age category is five times the population of this age category. Similarly the need of children between 4 and 5 years however is simply the same as the total population in that age category.

Based on this criterion the need for the vaccination service in each union council of DIK tehsil has been calculated for the year 1991. The estimates of need for the vaccination service are based on the population estimated for the year 1991. We have already explained in Chapter Eight the methods of estimating 1991 populations for each union council.

Table 9.1: Schedule for immunization

Age	Immunization	Dose
Neonatal	BCG	
3 months	DPT* Poliomyelitis	1st dose
5 months	DPT Poliomyelitis	2nd dose
10 months	DPT Poliomyelitis	3rd dose
1 year	Measles	
5 years	Diphtheria, Tetanus, and Poliomyelitis	

Source:- (Hull and Johnston, 1987)
*Diphtheria, Pertussis, and Tetanus

The age specific need of each union council for the vaccination service is given in Table 9.2. While preparing locality profiles we did not include the population of DIK municipal committee area (comprising DIK city population) on the grounds that most of the DHO's primary health care facilities deliver service in the rural areas of the tehsil. However EPI covers not only rural areas, but also DIK's municipal committee area. Therefore, in this exercise, we have included the need of children from DIK city and combined it with the need of the union council called Dera Dehat (comprising surrounding villages of DIK). This was done because both the city and the surrounding villages of DIK municipal committee area are served from the same vaccination centre.

9.3 Travel Time Estimation

The second data set required to allocate vaccinators is the estimated travel times between vaccination centres and union councils. In DIK tehsil there are sixteen vaccination centres which deliver the immunization service throughout 25 union councils (including municipal committee area as well). The estimated travel times between vaccination centres and union councils were calculated using the DIK tehsil road network map. DIK tehsil is spread over 4,557 square kilometers. All union councils and the municipal committee area are interconnected by roads, most of which are metalled. However some union councils are not directly linked by metalled roads, and unmetalled roads or ordinary tracks are used. In order to estimate travel times for such cases we have measured distances on metalled roads and on unmetalled and ordinary tracks, where appropriate.

Within each union council, most of the population resides within the vicinity of the union council's headquarters although there are number of small villages scattered nearby. We have therefore estimated the travelling time between union council headquarters and vaccination centres. The method used is as follows;

1) all the union councils and vaccination centres were located on the road network map;

2) with the help of a map measure, distances between union councils and vaccination centres were measured. For each vaccination centre and union council, distances on metalled and where appropriate on unmetalled and ordinary track were taken separately in kilometers;

3) based on these distances motor bicycle travelling times were calculated. Motor bicycle travelling time was taken because vaccinators are mostly provided with motor bicycles for this purpose (although within the city vaccinators may walk or use bicycles);

4) assuming an average speed of 30 km/hour on metalled roads and 10 km/hour on unmetalled or ordinary tracks, travel times both on the two road surface types were obtained separately in minutes; and

5) the travel times on metalled roads and unmetalled or ordinary tracks were combined to give total travel time between each vaccination centre and each union council in minutes. A matrix of travel times between vaccination centres and union councils is given in Appendix 5.

The data on need and travel times was then used to carry out an exercise to allocate vaccinators to localities. This is explained in the following section.

9.4 Allocation of Vaccinators

In DIK tehsil there are sixteen vaccination centres and 25 union councils. Vaccinators start their day's work from the vaccination centre by collecting vaccines. To keep vaccines at the required temperature vaccinators are provided with a special ice box as shown in Figure 9.1. As mentioned earlier in this Chapter, the delivery of vaccination service in DIK is analogous to the district nursing service in Tower Hamlets; therefore the integer programming models already developed in Chapter Six have been adapted to the problem of the allocation of vaccinators.

Just as in the Tower Hamlets case, we have assumed that the decentralized service may be delivered in two ways. In Model One we have assumed that there are three localities in DIK tehsil each comprising a set of vaccination centres and union councils. Future service delivery takes place strictly within the prescribed locality boundaries - disallowing cross boundary flows. Model Two considers that the three localities serve primarily as managerial units for the set of vaccination centres located within them. These vaccination centres can serve any set of union councils throughout the tehsil - allowing cross boundary flows. As explained in Chapter Six, the objective of analyzing the situation in two ways is to examine the implications of removing locality based restrictions on service delivery.

Both models were applied to the new data. The objective of both models is to allocate vaccinators to localities so that the proportion of need that is satisfied is nearly equal (Model One) or equal (Model Two) across all union councils and across all age categories, and the total travelling time of vaccinators is minimized. The following assumptions are made:

a) a vaccinator can conveniently visit and vaccinate 5 children per day. The number of children assumed to be vaccinated per day is unexpectedly low because vaccinators have to visit children in their homes and because of travelling difficulties and improper roads within each union council. With this assumption we will see that both models suggest that, with the current level of provision, the need that can be satisfied will remain below 59%. This situation is not out of line with the government's expectation for the EPI Plan that "after four years of this Plan at least 50 per cent of the children of the country should have been vaccinated" (Health Division, 1986);

b) there are 273 working days in a year (365 less 52 weekly offs, less 40 public holidays and other leaves); and

c) travel time between vaccination centres and union councils has been taken as a measure of cost.

The explanation of the two models given in Chapter Six will not be repeated here; the main differences in data categories are given in Table 9.3.

Table 9.3: Changes in the set of data between Tower Hamlets and DIK models

Notation	Tower Hamlets	DIK
p	4 localities	3 localities
j	19 wards	25 union councils
i	11 health centres	16 vaccination centres
k	3 age categories	2 age categories
W	260 working days	273 working days
Z	75 district nurses	46 vaccinators

9.5 Solution of Model One

Model One, in which service is delivered strictly within the context of proposed locality boundaries, gave a feasible solution when 3% deviation from equity was allowed. The model was then solved repeatedly allowing deviations from equity of 5%, 10%, 15%, 20%, and 25% in order to examine the impact on the allocation of vaccinators to localities and on travel time. A summary of results is given in the Table 9.4.

Table 9.4: Results from the solution of Model One with various equity levels

Annual travelling time in hours	22,370	22,098	21,376	20,529	19,781	19,132
Deviation from equity	3%	5%	10%	15%	20%	25%
α_{max}	58.6%	59.5%	61.9%	62.6%	63.9%	65.6%
α_{min}	55.6%	54.5%	51.9%	47.6%	43.9%	40.6%
Number of vaccinators in each locality						
1) Damaan	16	16	15	15	15	15
2) Dera*	12	12	13	13	13	13
3) Paharpur	18	18	18	18	18	18

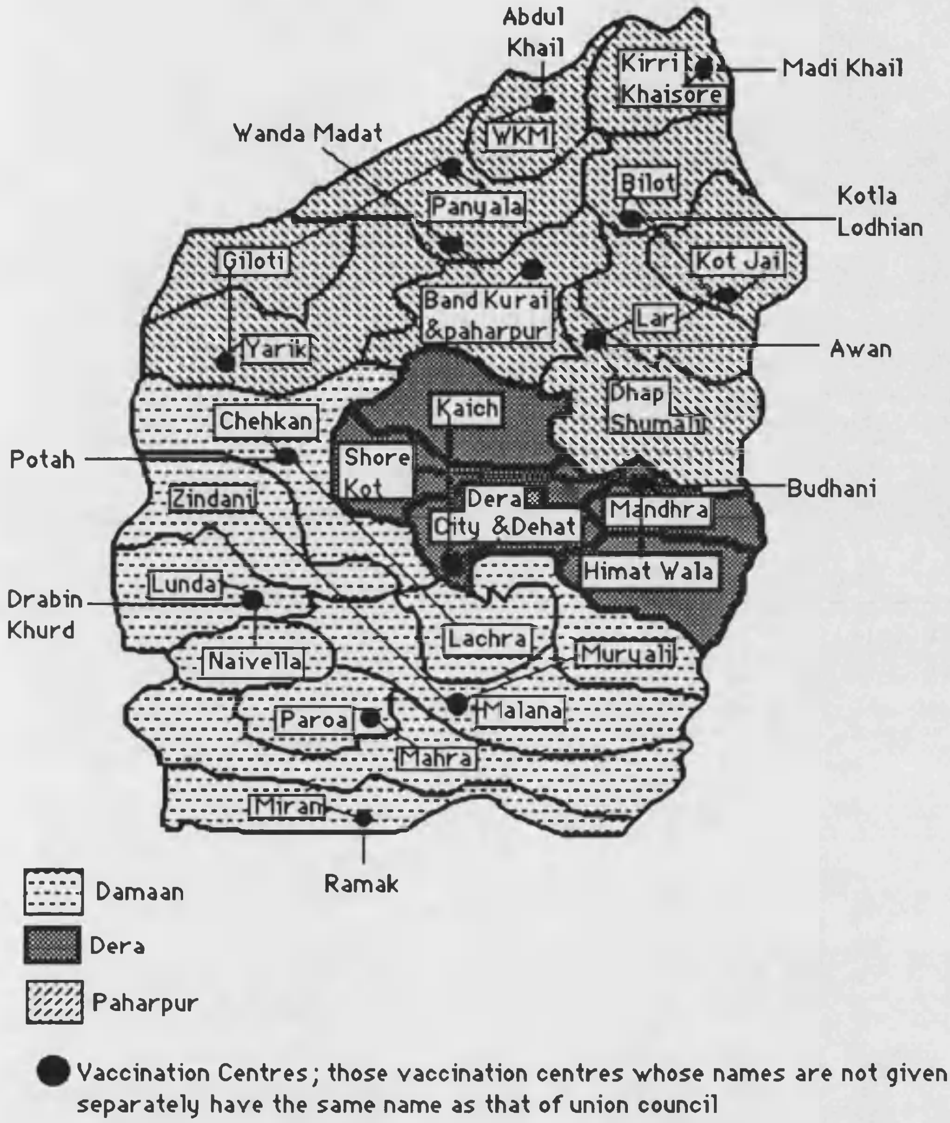
α_{max} and α_{min} are measure of maximum and minimum equity in satisfying need
* including city

Table 9.4 reveals that with a 3% deviation from equity, the need that could be satisfied for each union council and each age category is within the limits of 58.6% and 55.6%. The table also shows that as the deviation from equity increases, the distance travelled reduces; so permitting equity to vary by 25% rather than 3% results in a 14.5% saving in travel time. Otherwise it is evident that the overall allocation pattern to localities does not show any major change.

Although 14.5% is a considerable reduction in travel time, it must be set against the importance of child immunization. The two dimensions are incommensurable, but priority must clearly be to the latter, suggesting that vaccinators should be allocated with a minimum feasible deviation from equity.

Using Model One with a 3% permitted deviation from equity the number of vaccinators allocated to the localities and individual vaccination centres to serve each union council and each age category is given in Table 9.5. Union councils to be served by vaccination centres are also shown graphically in Figure 9.2.

Figure 9.2: Allocation of vaccinators to vaccination centres and localities as a result of Model One solution (Union Councils to be served)



9.6 Solution of Model Two

Model Two considers the allocation of vaccinators in a situation where localities comprise only a set of vaccination centres which can serve any set of union councils throughout the tehsil. Results obtained from the solution of Model Two are given in Table 9.6.

Table 9.6: Results from the solution of Model Two

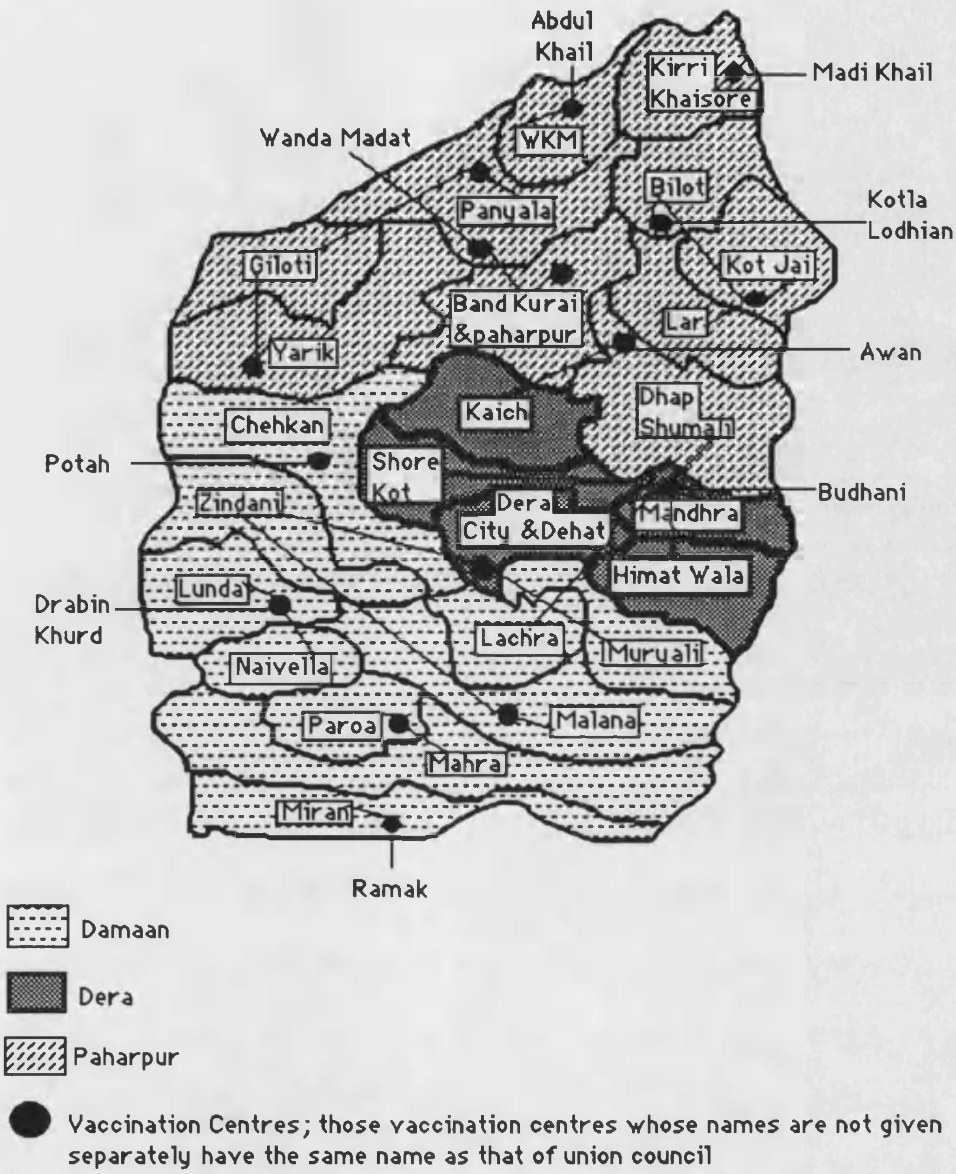
Annual travelling time in hours	19,192
α	57.1%
Number of vaccinators by localities	
1) Damaan	11
2) Dera (including city)	16
3) Paharpur	19

α is a measure of equitable need satisfied

Table 9.6 shows that the travelling time in Model Two is 14.2% less than that in case of Model One with a 3% equity deviation. There is 57.1% need satisfied equitably in each union council and in each age category. This means that by disregarding locality boundaries and allowing cross boundary flows there may be reasonable saving in travel time.

The allocation of vaccinators to localities and vaccination centres to serve each age category in each union council is given in Table 9.7. Union councils to be served by each vaccination centre are also shown in Figure 9.3. Given the proposed localities, Figure 9.3 illustrates that this solution allows some cross boundary flows, however the allocation pattern is less complicated than the comparable solution for Tower Hamlets due to the larger size of units and lower population density. However in order to reach a decision between implementing the solution of either Model One or Two, interaction with the responsible decision-making body would be required. It is

Figure 9.3: Allocation of vaccinators to vaccination centres and localities as a result of Model Two solution
(Union Councils to be served)



interesting to observe that the solution obtained by Model Two in particular is quite close to the actual pattern of vaccinator deployment on the basis of proposed localities, as can be seen in Table 9.8.

Table 9.8: Comparison of both models allocation with actual deployment of vaccinators on the basis of proposed localities

Localities	Actual allocation	1st Model's allocation	2nd Model's allocation
Damaan	9	16	11
Dera	15	12	16
Paharpur	22	18	19

Integer programming models have explored useful alternatives for the rational allocation of vaccinators for decentralized primary health care in DIK tehsil. As in Tower Hamlets, similarly in the case of DIK we are of the view that interactive rational planning methods can contribute to the implementation of decentralization, and that this approach should be adopted.

9.7 Conclusion

This Chapter reports the work which is of the first of its kind to demonstrate the feasibility of applying a rational planning technique in DIK tehsil for decentralized resource planning. The allocation pattern resulting from the integer programming models is not out of line with the actual deployment of vaccinators. There are adequate sources of data available which could enable analysts to develop models with a reasonable confidence. Nevertheless it is worth mentioning that the data used in the case of DIK are not as reliable as those used in Tower Hamlets - for example travel time data and population estimates.

However our work in this regard is only an indicative; a fuller study could be conducted interactively with a responsible decision-making body, perhaps with access to sources of more accurate data. Interactive and multi-disciplinary approaches in Tower Hamlets have been of great benefit, and these approaches could also contribute towards the implementation of decentralization in DIK.

After showing how resources should be allocated using rational methods we have almost completed our work of examining the possibility of transferring systematic methods of implementing decentralization to Pakistan. However decentralization needs to evolve over a period of time and there are several issues to be tackled, therefore in terms of Pakistan our work is just a preliminary step in the introduction of rational planning methods.

Table 9.2: Need for immunization service in each union council

Union Councils/ localities	Age categories 0-1 year	4-5 years	Total
Damaan			
Chehkan	4865	973	5838
Lachra	3110	763	3873
Lunda	2220	545	2765
Mahra	3155	774	3929
Malana	2780	595	3375
Miran	4205	1031	5236
Muryali	2780	682	3462
Naivella	2645	649	3294
Paroa	2085	511	2596
Zindani	3610	885	4495
Dera			
Dera City & Dehat	15630	3787	16417
Himat Wala	475	116	591
Kaich	3320	815	4135
Mandhra	1300	319	1619
Shore Kot	2855	701	3556
Paharpur			
Band Kurai & Paharpur	5800	1417	7217
Bilot	4760	1168	5928
Dhap Shumali	1930	474	2404
Giloti	215	52	2678
Kirri Khaisore	4295	1053	5348
Kot Jai	3055	749	3804
Lar	4840	1187	6027
Panyala	3130	768	3898
WKM	3195	784	3979
Yarik	1460	358	1818

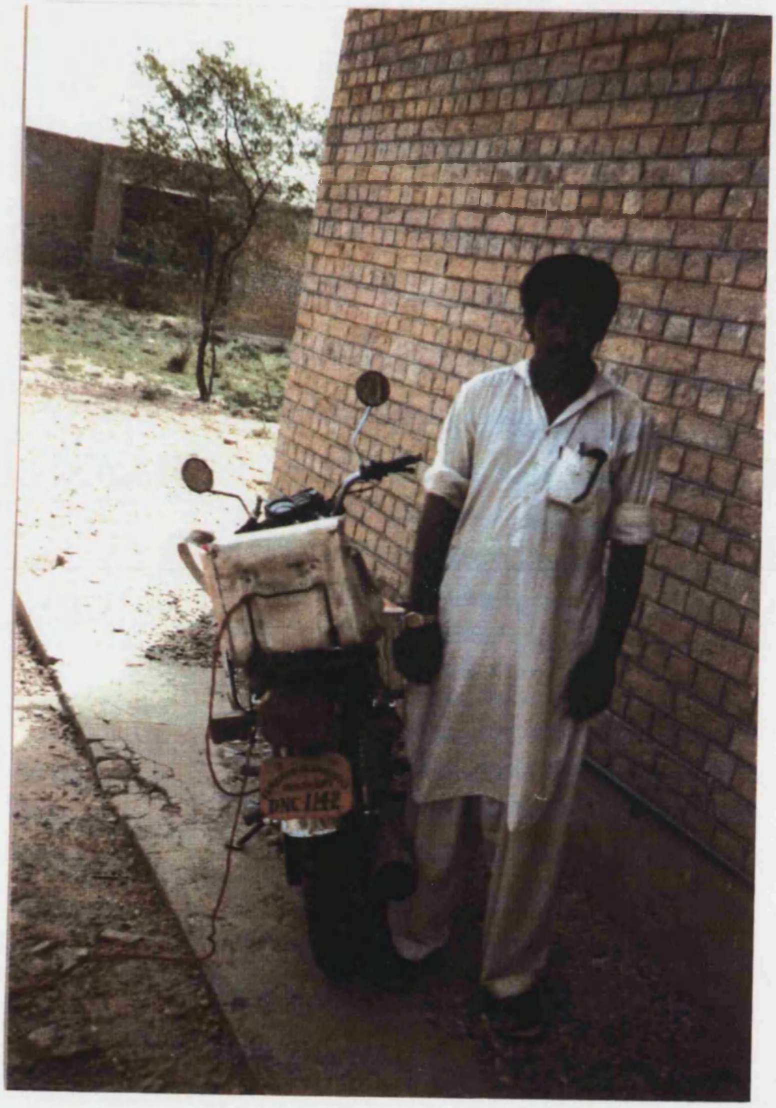
Table 9.5: Allocation of vaccinators to vaccination centres and localities as a result of Model One solution

Localities/ Vaccination centres	Union Councils to be served	Staff for each age group 0-1	5-4	Total staff
Damaan				
Darabin Khurd	Lunda	0.95	0.23	
	Naivella	1.13	0.28	2.6
Malana	Malana	1.04	0.26	
	Muryali	1.19	0.30	
	Zindani	1.47	0.36	4.6
Paroa	Mahra	1.35	0.34	
	Paroa	0.89	0.22	2.8
Potah	Chehkan	1.70	0.40	
	Lachra	1.31	0.34	3.8
Ramak	Miran	1.80	0.44	2.2
Locality Total		12.83	3.17	16.0
Dera				
Budhani	Himat Wala	0.20	0.05	
	Mandhra	0.53	0.13	
	Shore Kot	1.16	0.29	2.4
Dera City	Dera City & Dehat	6.42	1.54	
	Kaich	1.35	0.33	9.6
Locality Total		9.66	2.34	12.0
Paharpur				
Abdul Khail	WKM	1.37	0.34	1.7
Awan	Dhap Shumali	0.79	0.19	
	Lar	0.00	0.02	1.0
Kot Jai	Bilot	1.41	0.00	
	Kot Jai	1.31	0.32	
	Lar	1.97	0.46	5.5
Kotla Lodhian	Bilot	0.52	0.48	1.0
Madi Khail	Kirri Khaisore	1.75	0.43	2.2
Paharpur	Band Kurai &Paharpur	1.49	0.61	2.1
Panyala	Panyala	1.34	0.33	
	Giloti	0.66	0.21	2.5
Wanda Madat	Band Kurai &Paharpur	1.00	0.00	1.0
Yarik	Giloti	0.00	0.23	
	Yarik	0.62	0.15	1.0
Locality Total		14.23	3.77	18.0
Tehsil Total		36.72	9.28	46.0

Table 9.7: Allocation of vaccinators to vaccination centres and localities as a result of Model Two solution

Localities/ Vaccination centres	Union councils to be served	Staff for each age group 0-1	4-5	Total staff
Damaan				
Darabin Khurd	Lunda	0.93	0.23	
	Naivella	1.11	0.27	2.5
Malana	Malana	1.02	0.24	
	Zindani	0.23	0.00	1.5
Paroa	Mahra	1.32	0.32	
	Paroa	0.87	0.22	2.7
Potah	Chehkan	1.66	0.39	2.1
Ramak	Miran	1.76	0.43	2.2
Locality Total		8.90	2.10	11.0
Dera				
Budhani	Dhap Shumali	0.56	0.20	
	Himat Wala	0.20	0.05	
	Lachra	1.30	0.32	
	Mandhra	0.54	0.13	
	Shore Kot	1.19	0.29	4.8
Dera	Dera City & Dehat	6.54	1.58	
	Muryali	1.16	0.29	
	Zindani	1.28	0.37	11.2
Locality Total		12.77	3.23	16.0
Paharpur				
Abdul Khail	WKM	1.34	0.33	1.7
Awan	Kaich	1.39	0.34	1.7
Kot Jai	Bilot	1.48	0.00	
	Jot Jai	1.28	0.31	
	Lar	2.02	0.50	5.6
Kotla Lodhian	Bilot	0.51	0.49	1.0
Madi Khail	Kirri Khaisore	1.80	0.44	2.2
Paharpur	Band Kurai & Paharpur	1.62	0.40	
	Dhap Shumali	0.25	0.00	2.3
Panyala	Panyala	0.71	0.17	
	Giloti	1.32	0.32	2.5
Wanda Madat	Band Kurai & Paharpur	1.00	0.00	1.0
Yarik	Giloti	0.19	0.05	
	Yarik	0.61	0.15	1.0
Locality Total		15.50	3.50	19.0
Tehsil Total		37.17	8.83	46.0

Figure 9.1: A vaccinator with his vaccination kit at a rural vaccination centre



Chapter Ten

Method of identifying health care need for small areas on the basis of geographical equity: a case study in Thatta district.

10.1 Introduction

In Chapter Nine as a result of the straight forward nature of 'need' we could not apply the need identification model developed in Chapter Five. The present Chapter therefore concentrates on another example, of outpatient services in the Thatta district of the Sind province of Pakistan. The objective will be to examine the possibility of applying rational methods, largely based on RAWP principles, to identify health care need. Our analysis is based on small areas called Talukas (a sub-district level similar to a tehsil). The results of this analysis will be used in Chapter Eleven for resource allocation.

The RAWP formula, as already explained in Chapter Five, is based on four principal variables: a) size of population, b) service utilization, c) standardized mortality rates (SMRs) as a proxy for morbidity, and d) social or material deprivation. Availability of such data in Pakistan or in other less developed countries is a main limitation on the adoption of rational approaches. However the Community Health Sciences (CHS) department of the Aga Khan University (AKU), Karachi has recently conducted a demographic and socio-economic survey in Thatta district. The conduct of this survey and the production of a report (Karim, 1987) by the Community Health Sciences department was a result of collaborative efforts extended by many agencies such as 1) International Research Centre of Canada, 2) the Health Department of the Government of Sind,

3) the Planning and Development Department of the Government of Sind, and 4) Sind Bureau of Statistics.

The Thatta district of Sind province is located in the southern-most part of Pakistan. In 1981 it had a population of 761,039, of which most (90.4%) live in the rural sector. According to the 1981 census, Thatta district is divided into nine smaller units called talukas. Of these nine talukas, three talukas, i.e. Mirpur Sakro, Thatta, and Sujjawal, have mixed rural and urban populations. Karim (1987) therefore segregates the urban from the rural population in these three talukas and creates three additional talukas - thus raising the total number of talukas to twelve. These additional three talukas are notional and named as Gharo, Thatta Urban, and Sujjawal Urban respectively. All the twelve talukas of the district are then divided into three ecological zones, whose constituent talukas are:

Rural South: Kati Bunder, Kharo Chan, Jati, Shah Bunder,

Rural Central: Mirpur Sakro, Ghora Bari, Thatta Rural, Sujjawal Rural, Mirpur Bathoro, and

Urban: Gharo, Thatta Urban, Sujjawal Urban.

From all the twelve talukas data has been collected by sample surveys, and results have been collated and presented at the zone level. Due to the thin spread of population the sample design was based on 'cluster sampling'. The district was grouped into 250 rural and 25 urban clusters each containing about 500 households. Of these nine rural and three urban clusters were randomly selected. From all these selected rural and urban clusters a total of 6087 households were interviewed - on an average 500 households in each cluster. Among the total of

6078 households interviewed in the district there are 4,617 households from the rural and 1,470 households from the urban clusters respectively.

The survey operation was launched by the Health Minister for the Province of Sind, and the event was widely covered by television, radio and the local newspapers. Assistance was also sought from the local elected leaders, landlords and village elders to convince local populations to cooperate and participate in the data collection activity. The field work was carried out by 30 specially selected local interviewers provided by the Sind Bureau of Statistics. For the purpose of data collection five teams were created each consisting of six interviewers (4 females and 2 males). Each team under the supervision of a senior officer visited its corresponding households. Strict supervision was maintained, with spot checking in the field by the project director and three of his associates. Between 3 and 5 percent of the households were revisited by field supervisors for validity checks.

The quality of data, which has been collected as a result of a carefully organized and adequately supervised survey by a well established institute i.e AKU, seems to be reliable. This survey establishes a close link between the demographic, socio-economic and health situations - which is quite in line with the findings of similar studies elsewhere (Zaidi, 1988 and World Bank,1980). However it remains to be clarified how health planners can use this information to identify need and plan health care resources.

We have been able to utilize AKU's data to show how the RAWP formula could be applied to identify need for areas at sub-district levels. The author of this thesis is grateful to Dr John H Bryant, Dr Vincent De Wit, and Dr Mehtab S

Karim of the Community Health Sciences department, Aga Khan University for their permission to share their data as well as for their valuable guidance.

As already explained, the RAWP formula is based on four principle variables. Of these variables the availability of data representing deprivation and mortality statistics are major problems in terms of LDCs. AKU's data however helps us in Thatta district to analyze a number of socio-economic variables in order to construct a deprivation index and to work out SMRs.

10.2 Deprivation Index

Health care need is influenced by a number of demographic and socio-economic factors. This conclusion has been supported by several studies including the World Bank Health Sector Report (World Bank, 1980). In this context Zaidi (1988) explains that disease is a function of various socio-economic factors such as: water, sanitation, housing, education, nutrition, sex differences, and access to health facilities.

The study of the impact of these factors on health status, by Zaidi in terms of Pakistan, however does not address the question of equitable health planning resources specifically. In the case of industrially developed countries, the need for health care is identified by taking into account socio-economic conditions. Thus the RAWP methodology applied in Britain makes use of the Townsend Deprivation Index (as explained in Chapter Five). If a similar methodology is to be applied in a less developed country, then an index of deprivation appropriate to Third World circumstances is required.

To develop a deprivation index, data was initially examined on eleven socio-economic variables for the twelve talukas of Thatta district. These variables, together with abbreviations to be used in the present Chapter, are given in Table 10.1.

Table 10.1: Socio-economic variables

Abbreviations	Variables in percentages
SCH	population that had no schooling,
AGR	population having agriculture profession,
DST	households having problems of accessibility to health institutions in terms of distance,
CST	households having problems of accessibility to health institutions in terms of cost,
KCH	households living in kutcha houses or huts,
ELC	households without electricity,
WTR	households without piped water,
TLT	households without toilet amenities,
LND	households without land ownership,
HSE	households without house ownership, and
ROM	households living in one room.

Data on these variables for each taluka is presented in Table 10.2. From this table it is evident that the variables in each zone depict a fairly uniform socio-economic situation. It may be noted that the percentage of population with agriculture profession in Mirpur Sakro, as compared to other areas in the rural zones, is quite low and resembles that of urban areas. Indeed Mirpur Sakro is a growing taluka adjacent to Karachi district where the population's profession tends to be different than those in rural areas. It may also be noted that in many cases in the district the percentage of households without house ownership is fairly low. Indeed house ownership in rural areas of Pakistan is not a problem but the quality of housing stock is generally very poor. This is reflected in the case of Thatta district in substantially high percentages of household living in kutcha huts.

Table 10.2: Data list for each taluka

Zones/Talukas	SCH	AGR	DST	CST	KCH	ELC	WTR	TLT	LND	HSE	ROM
					Variables %						
Rural South											
Kati Bunder	82.3	23.3	43.2	40.3	94.5	95.3	60.6	93.2	72.9	8.9	58.1
Kharo Chan	94.7	24.8	84.6	55.7	96.0	99.9	99.2	97.6	67.5	4.9	87.0
Jati	93.3	19.3	38.6	82.2	90.6	99.6	98.8	79.4	74.2	58.8	63.1
Shah Bunder	94.0	17.8	47.2	88.5	97.8	99.3	97.7	66.9	83.6	42.8	83.6
Rural Central											
Mirpur Sakro	73.3	1.8	75.7	82.2	56.5	65.2	37.0	95.3	97.8	4.3	78.6
Ghora Bari	88.7	26.6	90.6	90.2	86.8	98.9	89.5	98.5	44.0	3.0	54.9
Thatta Rur	90.0	18.4	96.0	96.0	96.4	95.3	64.9	98.2	72.9	1.1	81.2
Sujjawal Rural	89.3	22.7	80.3	78.1	94.4	99.6	99.7	68.2	44.6	2.6	73.8
Mirpur Bathoro	97.2	15.4	88.3	87.2	95.1	98.5	89.1	80.4	93.2	3.0	78.5
Urban											
Gharo	76.7	1.5	17.4	38.7	18.7	34.9	1.3	17.0	94.9	9.8	39.1
Thatta Urb	59.6	1.1	63.4	42.7	13.2	14.5	0.4	5.7	95.2	12.8	23.8
Sujjawal Urban	79.2	1.6	25.6	77.1	37.1	46.6	0.0	16.4	90.1	9.5	46.2

Source CHS, AKU 1987

Generally Thatta district is one of the least developed districts in Pakistan (Karim, 1987). In this regard it was believed that the socio-economic variables given in Table 10.1 were likely to have considerable influence on the health status of such an area. However in many cases these variables are highly correlated. Our first step, therefore, was to reduce the number of variables and choose a subset that represent deprivation adequately and independently. We have used the technique of Factor Analysis to identify such a sub-set.

10.3 Factor Analysis

The general purpose of factor analysis is to find a way of condensing (summarizing) information contained in a number of variables into a small set of new composite factors with a minimum loss of information. More specifically (Hair *et al*, 1987) factor analysis can perform the following four functions:

a) identify a set of factors that are latent (not easily observed) in a large set of variables; this is also referred to as R factor analysis,

b) devise a method of categorising individuals into distinctly different groups within a large population; this is also referred to as Q factor analysis,

c) identify surrogate variables for subsequent analysis from a much larger set of variables, and

d) create a smaller set of variables to partially or completely replace the original set of variables for inclusion in subsequent analysis.

Our objective in using factor analysis in the present Chapter is mainly concentrated on the third objective i.e. to identify surrogate variables which could then be used to develop a deprivation index. The procedure and results of analysis are explained below.

10.3.1 Steps in Factor Analysis

Before discussing the steps used in deriving factors it is essential to decide about the method of deriving factors. There are two basic methods of factor analysis, called principal component analysis and common factor analysis, that an analyst can utilize to obtain factor solutions (Hair *et al*, 1987). The difference between principal component analysis and common factor analysis is that the earlier method considers the total variance associated with a set of variables whereas the latter considers only the common variance associated with a set of variables.

For the purpose of factor analysis it is important to understand the types of variance. In factor analysis, variance (also called total variance) consists of three kinds: 1) common, 2) specific, and 3) error (Hair *et al,* 1987). *Common Variance* is defined as that variance in a variable that is shared with all other variables in the analysis. *Specific Variance* is that variance associated with only a specific variable. *Error Variance* is that due to unreliability in the data-gathering process. When using principal component analysis, the total variance is considered and factors are derived that contain some small proportion of specific and in some instances error variance, but according to Hair *et al* (1987) not enough in the first few factors to distort the overall factor structure. Conversely, with common factor analysis, factors are derived based only on the common variance.

Selection of any of the above methods depends upon the researcher's objective. If the purpose is to summarize information into factors then the principal component analysis is a simpler and more appropriate form of analysis. We have already explained that our objective in the present Chapter is to summarize socio-economic data into factors; we have therefore applied principal component analysis to extract such factors. This method has also been applied by Pasha and Hassan (1982) for the development ranking of districts of Pakistan.

Factor extraction usually proceeds in the following six steps;

1) deriving correlation matrix,
2) initial estimation of factors,
3) criteria for the number of factors to be extracted,
4) extraction of unrotated factors,
5) deriving rotated factor matrix, and
6) using factor matrix results for subsequent analysis.

Step by step discussion of the process and results of factor analysis follows in the next section.

10.3.2 Discussion of the Process and Results of Factor Analysis

1) Correlation Matrix:-

Factor analytic procedures are based upon the initial computation of the matrix of intercorrelations among the variables. This correlation matrix is then transformed to obtain a factor matrix F (with elements a_{ij} also known as factor loadings).

The correlation matrix provides an initial indication of the relationships among variables. For the socio-economic variables used in our analysis, the correlation matrix is given in Table 10.3. From inspection of the correlation matrix, we see that most of the variables are related at +/- .50 or above. It is therefore difficult to derive complete and clear understanding of their relationships. To overcome this difficulty the set of variables is reduced to a smaller set of derived variables called factors as explained below.

Table 10.3: Correlation matrix

Variables	SCH	AGR	DST	CST	KCH	ELC	WTR	TLT	LND	HSE	ROM
SCH	1										
AGR	.76	1									
DST	.30	.47	1								
CST	.56	.28	.47	1							
KCH	.87	.89	.50	.53	1						
ELC	.90	.89	.46	.55	.99	1					
WTR	.86	.88	.51	.50	.93	.94	1				
TLT	.64	.74	.63	.47	.85	.86	.76	1			
LND	-.47	-.82	-.43	-.26	-.59	-.62	-.64	-.49	1		
HSE	.21	.07	-.48	.13	.13	.15	.26	-.08	.11	1	
ROM	.76	.54	.53	.58	.81	.80	.75	.78	-.25	.01	1

2) Initial estimation of factors:-

Before the extraction of factors an initial estimate of factors is obtained in order to observe the amount of variance accounted for by each factor. This estimate in turn provides guide line to decide about the number of factors to be extracted - which is discussed later in this Chapter. Using the SPSS package for principal component solutions we first obtained the initial factor estimates given in Table 10.4.

Table 10.4: Initial factors statistics

Factors	Eigenvalue	% Var	Cum %
1	7.00	63.6	63.6
2	1.53	13.9	77.6
3	1.09	9.9	87.5
4	0.60	5.4	92.9
5	0.35	3.2	96.1
6	0.22	2.0	98.1
7	0.12	1.1	99.2
8	0.05	0.5	99.7
9	0.02	0.2	100.0
10	0.00	0.0	100.0
11	0.00	0.0	100.0

Var for variance, Cum for cumulative

While studying Table 10.4 it is important to note that

a) it is possible to compute as many factors as there are variables; and

b) factors are always arranged in descending order of variance explained.

Thus in Table 10.4 the first factor accounts for more of the variance than the second and so on.

In Table 10.4 the first column shows that as many factors can be extracted as there are variables. The second column, of eigenvalues, gives a measure of the total variance explained by each factor. Column three contains the percentage of the total variance attributable to each factor. The last column gives information about the cumulative variance.

Based on initial factor statistics, the analyst next decides about the number of factors to be extracted - this indeed depends upon the examination of total variance explained by each factor as follows.

3) Criteria for the number of factors to be extracted:-

Several procedures have been proposed for determining the number of factors to be extracted (see Hair *et al*, 1987). One criterion suggests that only those factors be extracted whose eigenvalue is greater than 1. Based on this criterion, Table 10.4 shows that only three factors are of interest. We have therefore extracted three unrotated factors in the following step.

4) Extraction of unrotated factors:-

After deciding the number of factors to be extracted (three in the present case), the unrotated factor matrix F with its elements a_{ij} is derived. The factor matrix F with its elements a_{ij} is derived as follows:

$$F = V^{*}A^{1/2}$$

where V is the transformed correlation matrix of original variables normalized to unity. This is also called the principal component transformation matrix. A is the diagonal matrix with eigenvalues of factors as diagonal elements (for details please see Hotelling's Iterative Eigenvalue Solution in Tatsuoka, 1971). Using the SPSS package for principal component solutions we obtained the unrotated factors matrix given in Table 10.5.

The factor matrix in Table 10.5 provides the relationship between each factor and the original variables, represented by factor loadings a_{ij} (ith coefficient of jth factor). Factor loadings are the coefficients that make a linear combination of the variables and these coefficients are chosen so as to maximize the total variation accounted for by the first factor. Table 10.5 shows that the eigenvalue is the sum of the squares of the factor loadings (a_{ij}) down the corresponding column i.e $\Sigma_i a_{ij}^2 = E_j$. The eigenvalue represents the amount of variance accounted for by a factor.

Table 10.5: Unrotated initial factor matrix

Variables	Factor 1	Factor 2	Factor 3	Communality
SCH	.87	.27	.06	.84
AGR	.89	.01	-.44	.98
DST	.61	-.68	.18	.86
CST	.61	.03	.56	.69
KCH	.97	.09	-.02	.96
ELC	.98	.12	-.04	.98
WTR	.95	.17	-.09	.94
TLT	.87	-.18	-.09	.80
LND	-.66	.19	.60	.83
HSE	.07	.94	.02	.88
ROM	.83	-.01	.42	.85
Eigenvalues	7.00	1.53	1.09	-
Variation	63.60	13.90	9.90	-

Communality, on the other hand, is the proportion of the variation of the corresponding variable explained by the three factors. Communality is the sum of squares of the factor loadings along a row i.e $\Sigma_j a_{ij}^2 = C_i$.

After deriving the initial factor matrix (Table 10.5) the final factor matrix is extracted applying rotation, as explained in the following step.

5) Deriving factor matrix after rotation:-

Factor rotation is the process of rotating the reference axes about the origin to achieve a simpler and pragmatically more meaningful factor solution (Hair *et al*, 1987). The most common method of rotation is known as varimax rotation. Table 10.6 shows the factor loading matrix after applying varimax rotation.

As we can see from Table 10.6, although the factor matrix changes, the communality does not change. However, on the other hand, the percentage of variance accounted for by each factor does change. This is because rotation redistributes the explained variance between the individual factors. The final step in the process of factor analysis is to utilize the results of Table 10.6 for further analysis according to the researcher's objective.

Table 10.6: Final factor loading matrix after rotation

Variables	Factor 1	Factor 2	Factor 3	Communality
SCH	0.60	0.66	0.20	0.84
AGR	0.95	0.29	-0.04	0.98
DST	0.30	0.49	-0.73	0.86
CST	0.06	0.82	-0.04	0.69
KCH	0.73	0.65	0.02	0.96
ELC	0.75	0.65	0.05	0.98
WTR	0.76	0.59	0.10	0.94
TLT	0.57	0.64	-0.24	0.80
LND	-0.89	-0.00	0.22	0.83
HSE	0.06	0.13	0.93	0.88
ROM	0.32	0.87	-0.08	0.85

6) Using factor matrix results for subsequent analysis:-

We have already explained that factor analysis can be applied for various purposes. According to Hair *et al* (1987), having derived the factor matrix if the researcher's objective is to identify appropriate variables for subsequent analysis, the researcher could examine the factor matrix and select the variable with the highest factor loading as a surrogate representative for a particular factor dimension. Since our objective in this research is to reduce the number of variables to be used in the construction of a deprivation index on the lines of those of Townsend (Townsend, Phillimore, and Beattie, 1986) we have, therefore, selected three variables from the results in Table 10.6 as follows.

From Table 10.6 it is obvious that in factor one "agriculture profession" has the highest positive loading and households without land ownership the highest negative loading. This factor therefore represents a population that is agriculturist by profession but does not own land. This is a reflection of the true socio-economic condition in Sind province as well as in Pakistan. We can therefore select "agriculture profession", because of its high factor loading, as a surrogate variable that represents the particular dimension of factor one.

Similarly we have selected "households living per single room" as a surrogate variable to represent factor two and "households without house ownership" as a surrogate variable to represent factor three because of their highest factor loadings.

From the foregoing analysis we can now recommend that only three variables i.e "population with agriculture profession", "households living per single room" and "households without house ownership" represent material deprivation and may be used to construct a deprivation index.

It may be that in some situations data on these variables may not be available. In such cases another possibility would be to use "population without schooling" alone as an indicator for deprivation. This is recommended because:

a) these data are regularly available from census and other sources, b) as we can see from Table 10.3, "agriculture profession" and "households living per single room" are equally highly correlated with "population without schooling" (although only slightly correlated with "households without house ownership"), and c) Thunhurst (1991) also recommends that in the case of LDCs where detailed data on socio-economic conditions are not available literacy rates alone could be used as a scale for deprivation.

However in the present Chapter we will use the three variables identified above to derive a deprivation index based on the Townsend Z-scores method (Townsend *et al*, 1986). The Townsend deprivation index adds together the 'Z-scores' of four census variables to represent material deprivation. These are 1) the percentage unemployed, 2) the percentage of households without car, 3) the percentage of households which are not owner occupied, and 4) the percentage of households which are overcrowded. Each of these variables are given equal unit weight and standardized to have a mean of 0 and standard variation of 1 by means of the transformation

$$Z_i = (X_i - X) / S_i$$

where X and S_i are the mean and standard deviation of X_i. Before developing Z-scores, Townsend transforms the unemployment and overcrowding variables because of their skewness towards the lower percentages using the log transformation $Y = \ln(X+1)$ where X is an untransformed variable.

Likewise we have carried out an examination of the extent of skewness in the three variables chosen to construct our deprivation index. One method of doing this is 'the third-moment method'. This is defined as the mean of the cubed deviations from the arithmetic mean (Parsons,1974). Mathematically this is expressed as

$$M_3 = \Sigma(X-X)^3 / N$$

where M_3 is third moment (or average of the cubed deviations),

X is the original sample variable,

X is the arithmetic mean of the sample variable X, and

N is the number of observations.

To standardize the third moment it is divided by s^3 (standard deviation cubed). The resultant standardized third moment is referred as α_3. If the value of α_3 exceeds 0.5 in +ve or -ve direction, there is considered to be considerable skewness (Parsons, 1974). The values of α_3 for each of the three variables of interest (households living in a single room, agriculture profession, and households without house ownership) are shown in Table 10.7.

Table 10.7: Measure of skewness

Talukas	ROM	AGR	HSE	Transformed (ROM) SQ/100	Transformed Ln(HSE)
Kati Bunder	58.1	23.3	8.9	33.76	2.19
Kharo Chan	87.0	24.8	4.9	75.69	1.59
Jati	63.1	19.3	58.8	39.82	4.07
Shah Bunder	83.6	17.8	42.8	69.89	3.76
Mirpur Sakro	78.6	1.8	4.3	61.78	1.46
Ghora Bari	54.9	26.6	3.0	30.14	1.10
Thatta Rural	81.2	18.4	1.1	65.93	0.10
Sujjawal Rural	73.8	22.7	2.6	54.46	0.96
Mirpur Bathoro	78.5	15.4	3.0	61.62	1.10
Gharo	39.1	.5	9.8	15.29	2.28
Thatta Urban	23.8	1.1	12.8	5.66	2.55
Sujjawal Urban	46.2	1.6	9.5	21.34	2.25
X	64.0	14.5	13.5	44.62	1.95
s	20.0	9.7	17.4	22.38	1.10
α_3	-0.7	-0.4	1.8	-0.26	0.42

Detailed calculations may be seen at Appendix 6

Table 10.7 shows that there is a problem of negative skewness in variable

'ROM' with α_3 value at -0.7, and a substantial positive skewness problem in the variable 'HSE' with α_3 value of 1.8.

Normally in order to treat a problem of -ve skewness variables are raised by some power function, whereas in order to treat +ve skewness the log of variables is taken. As we see from Table 10.7 our two variables have skewness in different directions and therefore they should be treated differently. So in order to handle the -ve skewness problem of variable 'ROM' it was transformed by $(X)^2/100$, where X is the untransformed variable, and 100 is an arbitrary constant to keep the transformed figures reasonably small. On the other hand the variable 'HSE' was treated by means of the log transformation ln(X). It can be seen from Table 10.7 that the values of α_3, -0.26 and 0.42 respectively, after transformation of variables 'ROM' and 'HSE' do not exceed 0.5 in either direction. The third variable, i.e 'AGR', with its α_3 value -0.42 does not present any significant skewness problem so we have employed this variable to develop the deprivation index without further treatment.

Table 10.8: Calculation of Z-index

Talukas	Z1	Z2	Z3	Average	Z-index	Ranks
Kati Bunder	-0.49	0.91	0.21	0.21	1.12	9
Kharo Chan	1.39	1.06	-0.33	0.71	1.39	10
Jati	-0.21	0.49	1.92	0.73	1.41	11
Shah Bunder	1.13	0.34	1.64	1.03	1.57	12
Mirpur Sakro	0.77	-1.32	-0.44	-0.33	0.82	4
Ghora Bari	-0.65	1.25	-0.77	0.06	0.97	6
Thatta Rural	0.95	0.40	-1.68	-0.11	0.94	5
Sujjawal Rural	0.44	0.84	-0.90	0.13	1.07	8
Mirpur Bathoro	0.76	0.09	-0.77	0.03	1.01	7
Gharo	-1.31	-1.35	0.30	-0.79	0.56	2
Thatta Urban	-1.74	-1.39	0.54	-0.86	0.52	1
Sujjawal Urban	-1.04	-1.34	0.27	-0.70	0.61	3

In Table 10.8 the derivation of the resulting Z-index is shown. Z-scores for the variables "households living in single room", "population with agriculture profession" and "households without house ownership" for the corresponding area presented in columns labelled as Z1, Z2, and Z3. Z's values of each variable have been calculated using X and 's' values of the respective variables in Table 10.7. As in Chapter Five, the average z-score which has mean zero has been transformed into a Z-index with an average value of 1.

In Table 10.8 we have ranked talukas in increasing order of deprivation index score. As already explained, the Community Health Sciences (CHS) department of Aga Khan University (AKU) had divided the whole district into three ecological zones i.e. Rural South, Rural Central, and Urban. In Table 10.8 Rural South comprises the first four talukas, Rural Central comprises the second five talukas, and Urban comprises the last three talukas. According to Karim (1987) Rural South is the most deprived zone, Rural Central less deprived, and Urban is better then the rest. Our ranking of talukas on the deprivation index confirms this situation. We can see in Table 10.8 that the first four talukas, which belong to the Rural South zone are the most deprived. The second five talukas belonging to the Rural Central zone are less deprived, while the last three talukas, which are least deprived, belong to the Urban zone. Our analysis has the advantage over AKU's report, that it provides explicit analytical support; it also indicates relative deprivation at taluka level which can be used for planning purposes.

10.4 SMRs and Other Data Elements

Having derived a deprivation index another element required for the operationalisation of a planning method based on RAWP principles is a set of values for standardized mortality rates (SMRs). Mortality data were collected by the CHS department of AKU while conducting a demographic and socio-economic survey in Thatta district in 1987. Based on these data calculated SMRs for each taluka of Thatta district are shown in the Table 10.9.

As explained in Chapter Three, the SMR for any population group is calculated by dividing the actual number of deaths suffered by the group in a year, by the number of deaths that would be expected in the group if the national death rate were to prevail. In this respect SMR_{sj} in each sex s and taluka j has been calculated as follows;

$$ED_{sj} = P_{sj} * (TD_s / TP^s)$$

$$SMR_{sj} = OD_{sj} / ED_{sj}$$

where

ED_{sj} is expected deaths in taluka j sex s,

P_{sj} is population in taluka j sex s,

TD_s is total deaths in the district in sex s,

TP_s is total population of the district in sex s, and

OD_{sj} is observed deaths in taluka j sex s.

It may be noted that SMRs in Table 10.9 have been calculated using Aga Khan University's sample survey data of 1987. We can see from Table 10.9 that SMRs in most of the talukas belonging to Rural South zone are substantially higher than those for talukas in the Rural Central and Urban Zones. These results by and large show a great deal of harmony between high mortality stricken areas and the areas with high deprivation scores in Table 10.8. We have used SMRs to operationalise a formula based on RAWP principles for need identification.

Table 10.9: Calculation of SMRs for each Taluka

Talukas	Population M	Population F	Observed Deaths M	Observed Deaths F	Expected Deaths M	Expected Deaths F	SMRs M	SMRs F
Kati Bunder	723	639	16	15	12.23	8.82	1.31	1.70
Kharo Chan	741	579	16	15	12.53	7.99	1.28	1.88
Jati	822	711	16	9	13.90	9.81	1.15	0.92
Shah Bunder	790	662	10	8	13.36	9.14	0.75	0.88
Mirpur Sakro	896	795	17	9	15.15	10.97	1.12	0.82
Gharo Bari	933	806	13	9	15.78	11.12	0.82	0.81
Thatta Rural	703	636	15	5	11.89	8.78	1.26	0.57
Sujjawal Rural	662	606	13	4	11.19	8.36	1.16	0.48
Mirpur Bathoro	641	585	8	7	10.84	8.07	0.74	0.87
Gharo	737	671	12	9	12.46	9.26	0.96	0.97
Thatta Urban	844	831	13	16	14.27	11.47	0.91	1.40
Sujjawal Urban	793	739	8	8	13.41	10.20	0.60	0.78
Total	9285	8260	157	114				

Source of data CHS, AKU 1987.

Generally in Pakistan mortality data are not available and in such cases planners may have to develop alternative methods. One possibility, according to Thunhurst (1991) is to apply morbidity rates. Latest morbidity rates published by the Government of Pakistan are based on the first National Health Survey (FBS, 1986).

The morbidity rates published in Pakistan in 1986 are prevalence rates-the total number of cases of illness existing at any time per 1000 population-based on a survey of 11,000 households throughout the country (FBS, 1986). In the context of health planning among the regions of Pakistan, the survey results could be helpful to indicate comparative morbidity rates between provinces. However this survey does not consider morbidity below the provincial level which in turn renders the survey results unsuitable for planning below that level.

Other data available from the Government of Pakistan includes that on the incidence of diseases. These are gathered by provincial health departments from medical institutions (hospitals, dispensaries, basic health units Red Cross etc.), and so are service utilization data. This data is quite useful for estimating service utilization rates, which will be discussed later in this Chapter.

Within the context of proxy indicators for morbidity for analysis at sub-district levels, another possibility is to construct an index involving demographic characteristics. The most appropriate demographic characteristics for this purpose appear to be population under five, population over sixty five, and female population of child bearing age. This view is based on a recent workshop on "Health management information system for first level care facilities" in Sind province at which participants from the medical profession argued strongly that these categories of population generate most of their workload.

On the basis of their views we carried out statistical tests on the mortality and demographic data of Thatta district collected in the 1987 survey by the CHS department of AKU. In order to explore the statistical relationship between deaths and the three demographic variables i.e. population under five, population over 65, and female population of child bearing age, deaths were regressed upon the three demographic variables in three steps. The data elements and regression output are given at Appendix 7 and the resulting regression parameter estimates (regression coefficients) are given in Table 10.10.

Table 10.10: Regression coefficients for variation in deaths

Steps	% variance explained R^2 *100	(X coefficients) <5	65+	FCBA
1	59	-0.22	-0.19	0.00
2	59	-0.22	-0.19	-
3	53	-0.18	-	-

In Table 10.10 in step one death is treated as the dependant 'Y' variable whereas population under five, population over 65 and population of female of child bearing age are treated as independent (predictors) X_1, X_2, and X_3 variables respectively. The multiple regression model applied is as follows;

$$Y = C + b_1X_1 + b_2X_2 + b_3X_3$$

(where C is the regression constant, and the b's are regression coefficients corresponding to the independent X variables.)

The coefficient of determination i.e R^2 obtained as a result of multiple regression in step one shows that substantial variation i.e. 59% in the dependent variable is explained by all the three variables. However, in Table 10.10, the zero regression coefficient of variable FCBA clearly indicates that it is insignificant in the regression model and must be dropped. We therefore, in step two, carried out regression analysis without FCBA. As would be expected we can see in Table 10.10 that the value of R^2 remained unchanged.

We next need to examine the significance of b_1 and b_2 - the coefficients of the variables populations <5 and 65+. Using the standard t-test (for detail please see Hamburg, 1983) we found that the value for b_1 is significant at the 5% level, but b_2 is not significant. Indeed we can see from the regression model results in step three that 53% of the variance in deaths is explained by population <5 alone as compared to 59% variance explained in step two by both variables. Although we have observed that b_2 is not significant, we would however recommend that, in cases where mortality data are not available, population under five and population over 65 may be used to construct an index as a proxy for mortality- which is itself a proxy indicator for morbidity. The inclusion of population over 65 in the proposed index is recommended on the commonsense grounds that deaths in elderly population is a natural phenomenon which in turn affects health service utilization.

Moving away from the discussion of the alternative methods of deriving proxy indicators for morbidity we now concentrate on two other data elements, population estimates and service use rates required for a RAWP-based method. We will first consider the method of population estimation.

For the case presented in this Chapter we have assumed that health services are to be planned for the year 1993. Accordingly population forecasts for each taluka for the year 1993 are required. For this purpose we derived population forecasts for the year 1993 applying the method already explained in Chapter Eight. These population estimates are given in Appendix 8.

In Appendix 8, Part A comprises the derivation of the sex-specific population estimates of Thatta district for the year 1993, and Part B comprises the derivation of taluka population estimates for the same year. The population estimates have been derived as follows;

1) From the World Bank's sex-specific national projections for the year 1990 and 1995, sex-specific estimates were first derived for the population of Sind for the years 1990 and 1995. The basis of this estimation was an assumption (already explained in Chapter Eight) that the 1981 sex-specific ratio of provincial

population to the national population remained unchanged in 1990 and 1995.

2) From the 1990 and 1995 population estimates for Sind, the population estimate for the year 1993 for Sind province were derived using linear interpolation, as described in Chapter Five.

3) Population estimates for Thatta district for the year 1993 were then derived from the provincial estimates of the same year by applying the same method as in step 1.

4) Finally taluka population estimates for the year 1993 were derived in Part B of Appendix 8 in the same way.

We also need service use rates in order to operationalise a method of health care need identification based on RAWP principles. We have already explained that service use data is regularly published in the annual report of the Director General Health. The latest data available on service use are those of 1989 (Government of Pakistan 1990). Based on this data sex-specific outpatient service use rates were calculated using the number of cases treated in Thatta district in 1989. It should be mentioned that the number of cases treated are not subdivided by age group. Therefore in the present case the RAWP model would be limited to forecast need only on the basis of sex and not age groups.

In order to calculate service use rates for the year 1989, male and female populations for the same year were also needed. These were obtained by applying linear interpolation methods (as described in Chapter Five) between the 1981 census population and 1990 population estimates of Thatta district given in Appendix 8.

From the population estimates of 1989 (male 518882 female 476045) and the number of cases seen in 1989 (male 246037 and female 202148) in Thatta district, the service use rates for male and female population were calculated. These are 0.47 for male and 0.42 for female populations.

10.5 Need Model

Having established all these data sets we were then able to apply the RAWP model to derive relative need for each taluka as follows. The need model has been explained in Chapter Five. The mathematical expression of the model is

$$N_j = \sum_s TP_{sj} * (CL_s/P_s) * SMR_{sj}^a * U_j$$

where

N_j is the relative need for outpatient service in taluka j for the year 1993.

TP_{sj} is the estimated population of sex s in taluka j for the year 1993.

CL_s is the total number of outpatient cases treated in the district by health personnel in sex group s during 1989.

P_s is the total population of the district in sex s in 1989.

SMR_{sj}^a is the standardized mortality rate of sex s in taluka j with an elasticity a (a=0.5), and

U_j is the deprivation index score for taluka j.

Calculation of the relative need for each taluka for the year 1993 is given at Appendix 9. In Appendix 9 the columns under Population M and F contain estimated 1993 male and female populations in each taluka (TP_{sj} in the model).

These populations are then multiplied by the appropriate male and female service use rates (CL_s/P_s in the model) to get expected need i.e $\Sigma_s\, TP_{sj} * (CL_s/P_s)$ in the model. Service use rates are given in the columns under Service use rate M and F. As a result of this multiplication we obtain the expected need of male and female populations in 1993, in columns under Expected Need M and F.

In the middle and lower tables of Appendix 9 sex-specific expected need, weighted by mortality and deprivation, are derived. Firstly the sex-specific expected need of each taluka has been multiplied by the respective male and female $SMR^{0.5}$ (SMR_{sj}^{a} in the model). We thus obtain sex-specific need for each taluka taking into account mortality. This is presented for both sexes in columns under Need*SMRs.

The sex-specific need figures of each taluka are then adjusted according to the district's total sex-specific expected need. This is done because we assumed that the total district's SMR is 1. The method of adjustment is as follows;

$$\text{Weighted need} = \{\Sigma_s\, TP_{sj} * (CL_s/P_s) * SMR_{sj}^{a} \,/\, \Sigma_s\Sigma_j\, TP_{sj} * (CL_s/P_s) * SMR_{sj}^{a}\} *$$

$$\{\Sigma_s\Sigma_j\, TP_{sj} * (CL_s/P_s)\}$$

This operation gives us sex-specific need weighted by SMRs, and is presented in columns under Weighted Need A for M and F.

The male and female need weighted by $SMR^{0.5}$ have then been multiplied by deprivation scores (U_j in the need model). This operation gives us each taluka's need by sex taking into account both mortality and deprivation. This is present in columns under Need*Dep.

These need figures are then adjusted according to the total expected district's need as follows;

$$\text{Weighted need} = \{\Sigma_s TP_{sj} * (CL_s/P_s) * SMR_{sj}^a * U_j \,/\, \Sigma_s\Sigma_j TP_{sj} * (CL_s/P_s) * SMR_{sj}^a * U_j\} * \{\Sigma_s\Sigma_j TP_{sj} * (CL_s/P_s)\}$$

This operation gave us sex-specific need weighted by SMRs as well as deprivation U_j for each taluka. This is presented in columns under Weighted Need B for M and F.

Finally under the Total Need column combined weighted need of both male and female is aggregated. The identification of need based on RAWP principles has thus been operationalised for the first time in Thatta district of Pakistan.

We have mentioned elsewhere that in Pakistan there is an interest in the application of rational health planning methods. One practical example is a recent workshop on health management information systems, under the auspices of the Child Survival Project and the Government of Pakistan, where efforts were made to develop indicators to establish health MIS.

Another example is the wide cooperation between AKU, the Government of Sind, and the International Research Centre of Canada to conduct socio-economic and demographic surveys in Thatta district to reform health policies. As already explained, the AKU report (Karim, 1987) establishes a link between poor health and socio-economic conditions in Thatta district. Likewise poor socio-economic conditions outside Thatta in the rest of Pakistan or Third World have a great deal of influence on health status. This is evident as already mentioned from the World Bank's study (World Bank, 1980) and Zaidi (1988). It is therefore necessary to devise methods of equitable health service provision. Our work in this regard opens up ways of operationalising rational planning tool in one of the districts of Pakistan which can be extended to the rest of the health districts of Pakistan to formulate health policies on the basis of equality.

10.6 Conclusions

This chapter carries out an analysis of demographic and socio-economic data of Thatta district which is a poorly developed district of a less developed country. Our analysis, for the first time in Pakistan, has developed methods to quantify demographic and socio-economic characteristics of an area to identify the relative need for health services. Rational planning approaches in Pakistan or other LDCs are very restricted due to non-availability of data. Data which utilised in this Chapter was collected by the Community Health Sciences department of Aga Khan University. AKU's data are quite reliable; not only has it been collected under a careful planning scheme, but also we have seen that there is a good correspondence among the results of our different statistical analyses and with the findings of that of the AKU report (Karim, 1987). Such data are generally not available in Pakistan. In order to adopt rational approaches the Government of Pakistan will have to make mortality and socio-economic data a regular feature of its data bank. Where data are not available on the lines collected by the AKU, alternatively literacy ratios and data on demographic structure may be utilized.

Once the need of each taluka for health care has been identified, the next issue to be tackled is to determine manpower requirements at each rural health institution. For this purpose Mathematical Programming (MP) will be applied in the following Chapter.

Chapter Eleven

Resource Allocation for Rural Health Facilities: A Case study in Mirpur Sakro Taluka of Thatta District

11.1 Introduction

In the preceding Chapter we have shown methods for need identification for outpatient services in Thatta district on a taluka basis. In the present Chapter we concentrate on methods of allocating resources among rural health facilities. For this purpose we have carried out a case study in Mirpur Sakro taluka of Thatta district.

For the purpose of demonstrating the application of resource allocation methods for decentralized planning we assume that Mirpur Sakro taluka is equivalent to the size of one locality. (Various options for sub-dividing a district into localities are explained in Chapter Eight). Mirpur Sakro taluka has been considered equivalent to one locality because of its size (2,958 SQ.KM) and population which is expected to be 221,369 in 1993 (133,164 according to 1981 census). Mirpur Sakro taluka is sub-divided into eight union councils and two town committees. (One of its town committee Gharo was treated as a notional taluka in Chapter 10).

In order to provide health care service to the residents of Mirpur Sakro taluka there are eight health facilities. Of these there are two rural health centres located in Mirpur Sakro and Gharo town committees and six basic health units located in different union councils. The rural health centre located in Mirpur Sakro town committee is regarded as the taluka hospital - because of better diagnostic and to some extent in-patient service facilities. However all the health facilities in Mirpur Sakro taluka principally provide out-patient services.

In order to take advantage of out-patient services, patients travel from their place of residence to a rural health facility. The utilization of the service is significantly influenced by the travel time or cost necessary to access these facilities. The resource allocation problem therefore has to be tackled from a different point of view than was used in the case of district nursing or vaccination services delivery (explained in Chapter Six and Nine).

The basic difference between the delivery of a district nursing service or vaccination service and the current delivery of an out-patient service delivery is that in the former cases the server travels towards patients in their home of residence to deliver a service; whereas in the later case, patients travel towards facilities to receive a service. In the earlier situation it is possible to influence the behaviour of servers, so that integer programming models were useful to allocate resources. However in the current situation where the patients travel it is unrealistic to assume that their behaviour is controllable. Indeed the problem of predicting patient flows to health facilities so as to allocate resources accordingly is one for which the gravity model is appropriate. This has the advantage of explaining the transferability of a further planning tool, and is in line with the earlier finding that in order to implement decentralization different approaches will need to be adopted in different situations.

11.2 Gravity Model

The gravity model approach attempts to predict flows of patients between origins and destinations. The model assumes that patient flows from an area are in proportion to the need in that area and the available case-load capacity in all areas but are in an inverse relationship to the difficulty of geographical access in terms of travel time or cost (NETRHA, 1984).

Generally there are four type of gravity models - unconstrained, supply constrained (assumes that all supply will be used), demand constrained (assumes that all demand will be met), and doubly constrained (assumes that all supply will be used and all demand met). For health service planning, in which demand commonly outstrips service capacity, a supply constrained gravity model is the most relevant (Waring, 1991). The supply constrained gravity model is formulated as:

$$T_{ij} = O_j D_i B_i f_{ij} \quad \text{.......................................(11.1)}$$

where T_{ij} are the flows to facility i from area j,

O_j is the need in area j,

D_i is the current capacity at facility i,

B_i is the balancing factor to ensure that patient flow is equal to supply i.e $\Sigma_j\ T_{ij} = D_i$ (the supply constraint), and

f_{ij} is the deterrence function of travelling to facility i from area j.

The model is calibrated by choosing a deterrence parameter which gives good estimates of observed flows from origins to facilities. However according to Waring (1991) the process of choosing deterrence can be simplified as follows.

Consider a supply constrained gravity model:

$T^c_{ij} = O_j D^c_i B_i f_{ij}$ ....(11.2)

where T^c_{ij} are current flows to facility i from area j,

D^c_i is the current capacity at facility i, and all other indices are as already explained.

As the sum of the current flows to facility i equals the current capacity at i,

then $D^c_i = \Sigma_j T^c_{ij}$ ....(11.3)

$= \Sigma_j O_j D^c_i B_i f_{ij}$

$= D^c_i B_i \Sigma_j O_j f_{ij}$

which gives

$B_i = 1 / \Sigma_j O_j f_{ij}$

$T^c_{ij} = D^c_i (O_j f_{ij} / \Sigma_j O_j f_{ij})$

The term $O_j f_{ij} / \Sigma_j O_j f_{ij}$ can be interpreted as p_{ij}, the probability that facility i is used by j. The matrix p (with elements p_{ij}) may be estimated as

$p_{ij} = T^c_{ij} / D^c_i$ ....(11.4)

Assuming that the probability of the use of facility i by a patient in area j will be unchanged over time (i.e p_{ij}'s are constant), the problem of resource allocation can be handled by a mathematical programming model.

11.3 Application of Gravity Model

Before explaining the linear programming model we would like to explain some of the assumptions that have been made to apply the gravity model. In order to derive matrix p (with elements p_{ij}) we obtained patients' attendance records from eight health facilities of Mirpur Sakro taluka on a daily attendance basis for the month of August, 1991. This was a hectic exercise which required the author to travel on an average 200 km per day.

The author of this thesis thanks Dr De Wit Vincent of the CHS department, AKU for his permission to travel with his Thatta MIS and School Health teams in order to collect patients' attendance data. The author thanks Dr Ram Das, District Health Officer Thatta, and medical staff of Mirpur Sakro taluka health facilities for providing data from their daily attendance registers. The author also thanks Dr Amin Khuaja of School Health and Mr Amin of MIS team for their personal cooperation and company in completing this data collection exercise.

We have elsewhere explained that at each health facility a record of patients' daily attendance is maintained. This includes information regarding patients' sex, place of residence etc. From this data we obtained the attendance of patients' at various facilities from over sixty villages. From the patient flow data we observed that there was insignificant patient flows (about 1%) from the neighbouring talukas. We have therefore assumed zero cross boundary flows in the work presented in this Chapter.

Based on patients' attendance data we worked out the probability of patient flows (p matrix) from each of these villages to facilities using the method explained in equation 11.4 as follows.

$$p_{ij} = T_{ij}/D_i^c \quad \text{...(11.5)}$$

where

p_{ij} is the probability of patient flows to facility i from area j,

T_{ij} are the flows to facility i from area j, and

D_i^c is the current capacity of facility i.

In this case of calculating p_{ij} it was assumed that the current capacity at each facility is equal to the number of patients seen at that facility such that $p_{ij} \leq 1$ and $\Sigma_j \; p_{ij} = 1$.

As a result of equation 11.5, p matrix obtained is given in Appendix 10. (The actual number of patients seen from each area during 1990 are also shown in Appendix 10 - which will be discussed later in the present Chapter.)

Having achieved p_{ij}s we now concentrate on need data. We have already explained in Chapter Ten the method of deriving relative need for twelve talukas of Thatta district. Among them we also obtained need of Mirpur Sakro taluka and Gharo. We have already mention that Gharo was treated as a separate taluka in Chapter Ten. As a matter of fact Gharo was a notional taluka which has the status of a town committee. For the work presented here, we have assumed Gharo as a part of the proposed locality of Mirpur Sakro. The weighted need of Gharo has already been obtained in Chapter Ten. The weighted need of the Mirpur Sakro taluka (excluding Gharo) has been sub-divided among the rest of union councils and a town committee on the basis of the size of the population of each area.

This has been done on the basis of assumption that there is insignificant variation in the socio-economic conditions and SMRs among the populations below taluka level. In this regard we would argue on the basis of: a) eminent researchers from Pakistan such as Dr Mehtab S Karim of AKU, Dr Hafiz A Pasha and Dr Ely Urcelon of Applied Economic Research Centre, Karachi University hold views that rural populations in Pakistan below taluka level are considerably homogeneous in many respects including socio-economic and demographic conditions, and b) this is also explicitly evident from Tables 10.8 and 10.9 (Chapter Ten) that the variation among socio-economic conditions and SMRs between talukas of the same ecological zone is considerably small - this variation would be insignificant below taluka level. The weighted need of Mirpur Sakro taluka, sub-divided among town committee and union councils is given in Table 11.1.

Table 11.1: Input need data

Areas	Population 1993	Need 1993
Buhara	29776	11254
Choubandi	25511	9645
Ghulamullah	24076	9103
Mirpur Sakro	28044	10603
Takani	14307	5409
Karampur	20263	7661
Gujjo	26842	10148
Haji Girano	21300	8053
Gharo	17441	4113
Dhabeji	12061	4560

It may be mentioned that in Table 11.1 Mirpur Sakro and Gharo are town committees whereas all other areas are union councils. The need of Gharo was obtained in Chapter Ten. These data were then used in the linear programming model explained below.

11.4 Linear Programming Model

In the linear programming model the indices are

j area, in the present case there are ten areas,

i facility, in the present case there are eight facilities, the data item are

$Need_j$ relative need of area j,

P_{ij} probability of facility i being used by j,

TZ total available capacity i.e 52048 cases in a year,

the variables are

D_i capacity allocated to facility i,

α_j proportion of need at j satisfied, and

α_{min} minimum proportion of need satisfied.

The model is to maximise the minimum proportion of need satisfied:

$$\text{Maximise} \quad \alpha_{min}$$

subject to

a) capacity allocated to each facility must not exceed the total available capacity in taluka:

$$\Sigma_i D_i \leq TZ$$

b) proportion of need of each area that is satisfied must be defined by α_j:

$$\sum_i p_{ij} * D_i = Need_j * \alpha_j \quad \text{for all } j=1,\dots,M$$

this constraint is derived from

$$T_{ij} = p_{ij} * D_i$$

$$\sum_i T_{ij} = \sum_i p_{ij} * D_i$$

$$= Need_j * \alpha_j$$

c) proportion of need that is satisfied at j must be higher than the minimum proportion of need satisfied:

$$\alpha_j \geq \alpha_{min} \text{ for all } j = 1,\dots,M$$

d) proportion of need that is satisfied at j must not exceed 100%:

$\alpha_j \leq 100$ for all j = 1,....,M

This constraint has been introduced; a) to ensure that need satisfaction of area j does not exceed 100%, and b) to explore maximum equity that can be achieved by varying the value of upper bound.

e) non-negativity conditions are:

$D_i \geq 0$ for all i = 1,...,N

$\alpha_j \geq 0$ for all j = 1,....,M

$\alpha_{min} \geq 0$.

11.5 Solution of the Model

The model was solved using a mathematical programming package in 26 simplex iterations. Patient flows to health facilities derived by the solutions of model for the year 1993 are given in Table 11.2.

Table 11.2: Expected patients flow to health facilities

Health facilities	Expected patient flows in 1993	Patients seen during 1990	%Increase/ (Decrease)
Ghulamullah	3505	6067	(42.23)
Gharo	9499	6576	44.45
Jokhio Village	795	1745	(54.44)
Buhara	10776	8914	20.89
Mirpur Sakro	22518	19056	18.17
Ghariwah	1428	2700	(47.11)
Gujjo	1705	3088	(47.79)
Dhabeji	1821	3902	(53.33)

We can see from Table 11.2 that the model is predicting reduced capacity for Ghulamullah, Jokhio Village, Ghariwah, Gujjo, and Dhabeji between 42.23% and 53.33 as compared to the number of patients seen during 1990. On the other hand Gharo, Buhara, and Mirpur Sakro have been allocated a greater number of patients than those seen during 1990 (44.45%, 20.89%, and 18.17%) respectively. In brief the predicted patterns are based on the observed flows.

As far as equity is concerned, this model suggests that the percentage of need of each area satisfied varies between 100% and 32.57% as may be seen from Table 11.3.

Table 11.3: Area-wise % of need satisfied

Areas	% Need satisfied
Buhara	100.00
Choubandi	32.57
Ghulamullah	32.57
Mirpur Sakro	100.00
Takani	68.58
Karampur	75.36
Gujjo	32.57
Haji Girano	32.57
Gharo	100.00
Dhabeji	100.00

We can see from Table 11.3 that there is a wide gap between maximum and minimum need satisfied. In order to improve the equity in the need satisfaction, the model was re-run with upper bounds 80%, 75%, and 73%. The area-wise percentage of need satisfied is given in Table 11.4.

Table 11.4: Changes in equity due to change in upper bound

Upper Bound % / Areas	Percentage need satisfied 80	75	73
Buhara	80.00	75.00	73.00
Choubandi	67.42	75.00	73.00
Ghulamullah	80.00	75.00	73.00
Mirpur Sakro	80.00	75.00	73.00
Takani	54.86	51.43	50.00
Karampur	80.00	75.00	73.00
Gujjo	26.06	45.27	57.74
Haji Girano	26.06	24.43	23.78
Gharo	80.00	75.00	73.00
Dhabeji	80.00	75.00	73.00

From Table 11.4, results with upper bound value of 73%, show that as many as seven areas can have equal amount i.e. 73% of their need satisfied. The two union councils Takani and Gujjo can have 50.00% and 57.74% of their need satisfied respectively which is a quite moderate deviation from the equity. However Haji Girano has 23.78% of its need satisfied. The main reason for this is a difficult accessibility of this union council to health facilities. Although just inside the North East boundary of this union council there is a health facility called Jokhio Village. But it is quite far from the centre of the union council. Therefore the population from Haji Girano prefers to travel to Buhara and Mirpur Sakro rather then to Jokhio Village. Haji Girano's population does not use this facility. Our results also confirm the views of Dr Amin Khuaja of AKU's school health team who frequently visits these areas.

We have discussed at length the equity situation as a result of model's predictions with varying upper bound. The capacity set by model as a result of varying upper bound are given in Table 11.5.

Table 11.5: Expected patient flows due to change in upper bound

Upper Bound %	Patient flows 80	75	73	Patients seen during 1990
Ghulamullah	9020	8456	8231	6067
Gharo	7599	7124	6934	6576
Jokhio Village	4625	5474	5328	1745
Buhara	8621	8082	7866	8914
Mirpur Sakro	18014	16888	16438	19056
Ghariwah	1347	1263	1230	2700
Gujjo	1364	3394	4692	3088
Dhabeji	1457	1366	1330	3902

From Table 11.5 it can be noticed that capacity allocation reasonably correspond to the number of patients seen during 1990 (except in case of Jokhio Village).

In the light of model's solution in Table 11.5 we can now decide resource allocation rationally. Below we concentrate on the example of allocating doctors to different health facilities. Suppose that in each facility there has to be a whole time doctor. In this case we have converted the above model into an integer programming model with some modifications.

11.6 Revised Integer Programming Model

The revised model is explained below. All the indices used in the revised model are same as in the earlier model, except that of D_i, which in the present case represents the integer number of doctors to be allocated to a facility i.

The model is to maximise the minimum proportion of need satisfied:

Maximise α_{min}

subject to

a) the number of doctors allocated to each facility must not exceed the total available doctors in taluka:

$$\Sigma_i D_i \leq TZ/3253$$

We have already explained that TZ is the total number of patients (52048) that can be seen in a year. There are total of 16 doctors available in the taluka which means that on an average a doctor can see 3253 patients in a year.

b) proportion of need of each area that is satisfied must be defined by α_j:

$$\sum_i p_{ij} * D_i * 3253 = \text{Need}_j * \alpha_j \quad \text{for all } j = 1,....,M$$

this constraint is derived from

$$T_{ij} = p_{ij} * D_i * 3253$$

$$\sum_i T_{ij} = \sum_i p_{ij} * D_i * 3253$$

$$= \text{Need}_j * \alpha_j$$

c) proportion of need that is satisfied at j must be higher than the minimum proportion of need satisfied:

$$\alpha_j \geq \alpha_{min} \text{ for all } j = 1,....,M$$

d) proportion of need that is satisfied at j must not exceed 100%:

$$\alpha_j \leq 100 \text{ for all } j = 1,....,M$$

This constraint, as already explained, has been introduced; a) to ensure that need satisfaction of area j does not exceed 100%, and b) to explore maximum equity achievement by varying the value of upper bound.

e) non-negativity conditions are:

$$D_i \geq 0 \text{ and integer} \quad \text{for all } i = 1,...,N$$

$$\alpha_j \geq 0 \quad \text{for all } j = 1,....,M$$

$$\alpha_{min} \geq 0.$$

11.7 Solutions of the Revised Integer Model

The integer programming model was run to obtain the number of doctors allocated to each facility. With 73% upper bound value (which gave maximum equity in Table 11.4) there was no feasible integer solution. The model gave only a feasible LP solution (that is a continuous solution) suggesting allocation of doctors as follows.

Table 11.6: Number of doctors to be allocated

Upper Bound %	Patient flows 73	Number of Doctors
Ghulamullah	8231	2.5
Gharo	6934	2.1
Jokhio Village	5328	1.5
Buhara	7866	2.4
Mirpur Sakro	16438	5.0
Ghariwah	1230	0.4
Gujjo	4692	1.7
Dhabeji	1330	0.4

The number of doctors as a result of LP solution given in Table 11.6 can also be simply obtained by dividing the number of patients by the number patients per doctor (3253). However we modified and ran the integer model supposing that district health management intends to allocate whole time doctors at each facility. In this regard we searched for a feasible integer solution by relaxing upper bound limit. The first optimum feasible integer solution was obtained with upper bound value of 87.83. The allocation of doctors is therefore given in Table 11.7.

Table 11.7: Number of whole time doctors to be allocated

Health Facilities	Number of Doctors
Ghulamullah	3
Gharo	2
Jokhio Village	1
Buhara	2
Mirpur Sakro	6
Ghariwah	0
Gujjo	2
Dhabeji	0

According to the allocation in Table 11.7, two health facilities Ghariwah and Dhabeji would close. The percentage of need satisfied by the integer solution for each area is given in Table 11.8. This table presents a comparison of equity with upper bound limits of 100%, 80%, 75%, and 73% and actual patients seen as percentage of need (from Appendix 10). We can see from Table 11.8 that in each solution there is a great deal of variation in the percentage of need satisfied as compared to that with upper bound value of 73%. (On the basis of that solution we have the allocation of doctors given in Table 11.6). However the situation of equity in Table 11.8, as a result of integer solution for whole time doctors allocation in Table 11.7, is quite reasonable. As we can see that there are only two areas whose need satisfaction is below 50% i.e. Haji Girano and Dhabeji (26.02 and 42.29 respectively). Whereas in case of all other areas need satisfaction is well above 50%.

Even the comparison of equity given by both LP solution with 73% upper bound and integer solution with that of actual percentage of patients seen from each area it is obvious that the proposals from the model bring about improvements in the equity.

Table 11.8: Comparison of equity as a result of integer allocations

Areas	% Need Satisfied					
Upper Bound %	100	80	75	73	Integer (88)	Actual
Buhara	100	80	75	73	68	83
Choubandi	33	67	75	73	52	36
Ghulamullah	33	80	75	73	88	54
Mirpur Sakro	100	80	75	73	85	85
Takani	69	55	51	50	55	58
Karampur	75	80	75	73	68	92
Gujjo	33	26	45	58	75	42
Haji Girano	33	26	24	24	26	27
Gharo	100	80	75	73	68	70
Dhabeji	100	80	75	73	42	127

Note:- % figures rounded up

In view of solutions explained above we present two options in this Chapter in order to allocate resources;

a) achieve maximum possible equity by allocating doctors to health facilities letting doctors time to be divided among facilities as a continuous variable (as shown by LP solution with 73% upper bound). In this respect there would be need of doctors time re-organization at various facilities so that maximum benefits could reach to the recipient of the service.

One way of allocating doctors, according to the proposals from the continuous solution, could be to allocate doctors according to the working days in a week. For example to allocate 2.5 doctors at Ghulamullah (Table 11.6), for the six working days in a week in Pakistan, two doctors should be allocated for the whole week and an additional doctor should provide service during three days of the week at this centre and then move to other centres as appropriate for the rest of the week, and

b) accept some degree of variation in equity by allocating whole time doctors to each facility (as shown by integer solution). In this case the management may have to close down those facilities where no doctor has been allocated. However closure of health centres may involve political complications specially when with current capacity only 65% need could be satisfied. In these situation it might be appropriate to downgrade such facilities to a level of dispensary by posting dispensers or medical technician.

Management can take any of the above options and allocate present resources rationally which would in turn benefit recipient of the service and quality of service. We have in the present Chapter shown the transferability of rational planning tool for resource allocation. We have in the present work concentrated only on one taluka due to time and resource limitations. Our models however can be easily extended for the whole district on the basis of talukas or zones considering them equivalent to a decentralized unit or localities.

11.8 Conclusions

We have in the present Chapter shown the feasibility of applying gravity model to determine patient flows as well as number of doctors to be allocated to health facilities of Mirpur Sakro taluka of Thatta district. Our attempt in this respect is of its first kind that shows the feasibility of transferring rational planning tool for implementing decentralized planning in a third world country.

We have shown the feasibility of applying rational planning tool in third world country's health planning situation with certain flexibility so that implementation of decision formulated as a result of rational approach could be possible. We have opened up new dimensions in decision making processes for health planning in Pakistan which is very much needed.

We have already mentioned in Chapter Ten that various international organizations such as Aga Khan University, Child Survival Project under UNICEF and many others are doing their best to introduce rational planning methods. The government of Pakistan itself emphasizing on economizing public sector resources to realize value for money. Its health policy as we already explained is a demonstration of government's efforts towards decentralized primary health care planning. We have in this respect attempted to contribute to the best of our level in the right direction.

We may mention here that during author's field work and discussion with eminent scholars, such as Dr John Bryant, Dr De Wit Vincent of the AKU, Dr Hafiz A Pasha, Dr Ely Urcelon of the Applied Economic Research Centre, Karachi, Dr S M Aqil Burney of the Karachi University, it was revealed that our work is likely to inspire further research aiming at Pakistan's social planning systems.

Chapter Twelve

Conclusions and Further Scope for Research

This research has developed methods to assist the process of implementing decentralization in the delivery of British primary health care, and demonstrated the transferability of decentralized planning methods to Pakistan. This has been done by case studies in a British District Health Authority (Tower Hamlets) and in Pakistani health districts (DIK and Thatta).

Decentralization, as presented in the literature and experienced in Tower Hamlets District Health Authority, needs to be implemented step by step, tackling all the related issues systematically, relying on both internal and external consultation, and where possible adopting a multi-disciplinary approach. For example, in Tower Hamlets, a draft strategy for implementing decentralization was initially developed and circulated for internal consultation. This strategy outlined a number of issues to be tackled such as defining locality boundaries, the development of locality profiles, the development of a GIS, and developing a resource allocation mechanism. This thesis shows that the process of implementing decentralization in Tower Hamlets has been progressing according to the strategy.

One aspect of achieving decentralization is that it needs to evolve over a period of time. This is shown by the experience of Tower Hamlets. The process of implementing decentralization began in 1985. Substantial progress has certainly been achieved. However there is much more to be done, for example on allocating resources for other community health care services such as health visiting and school nursing, community physiotherapy, services for people with learning difficulties, mental health, and family planning. All these services deal with different types of patient. So to plan these services rationally it would be necessary to develop mechanisms of need identification and resource allocation for each type of service separately, bearing in mind the nature of each service provision and its client group.

In Tower Hamlets Health Authority the strategy of implementing decentralization was arrived at through discussion and consultation among the various staff groups. This was followed by definition of locality boundaries by an inter-disciplinary working group, which included health authority staff, workers from the primary health care development project within the district, and academics from Queen Mary and Westfield College (QMW). Locality profiles were then established after consultation between Professor Jonathan Rosenhead of the London School of Economics, Dr Sarah Curtis of QMW, Ann Taket from the Department of Community Medicine of the Tower Hamlets Health Authority, and the author of this thesis. Development of the GIS took place as a result of coordination between the Health and Health Care Research Group of QMW, Computer Sciences Department of QMW, the Department of Community Medicine, Tower Hamlets Health Authority, and the author of this thesis.

Similarly in developing methods of need identification and resource allocation we relied on consultation and discussion with a number of eminent researchers and health planners. At each stage it was necessary to develop appropriate methods, which could then be dovetailed together. This is in line with generally accepted principles for the implementation of decentralization.

There is ample scope for extending a similar approach to the decentralized planning of resources for a number of other community health services in Tower Hamlets Authority - for example health visiting and school nursing, community physiotherapy, mental health, family planning, and services for people with learning difficulties. In each case though the approach will be similar, the resources and methods will be specific to the application.

Once resource allocation mechanisms for the various service groups of community health care have been developed, then the final step should be to set up a mechanism for coordinated control, to ensure that the decentralized structure is contributing towards the achievement of high level organizational goals. This requires establishing an agreed system of performance measurement - involving for example service throughput targets, and methods of measuring cost effectiveness and the quality of service delivered. In sum the process of implementing decentralization requires a great deal of further development work before decentralization will be fully operative.

In terms of implementing decentralization in Pakistan, the work reported in this thesis is the first serious attempt to consider and develop scientific methods for health care planning. Our analysis shows that in Pakistan there have been hardly any attempts in the past adequately to plan either health care resources in general, or decentralization in particular.

The Government of Pakistan indeed acknowledges in its health policy (Government of Pakistan, 1990) that in Pakistan there is "a lack of effectiveness in the planning process, a lack of effective health manpower planning both in numbers and in the content of training programmes, a lack of any comprehensive evaluation of the traditional medical sector which includes the Unoni and Homeopathy systems, and a lack of research aimed at providing base-line health care data." It also recognizes the problems of urban-rural disparity, the heavy patient load on hospitals, an inadequate supply of drugs, and an extremely centralized bureaucratic system. One of the government's strategies to tackle these problems is to decentralize the administrative structure of the health care system.

Our work takes the initiative and develops systematic planning methods to implement decentralization. We have outlined methods of drawing locality boundaries, established a base-line health care information system, adapted the Tower Hamlets version of a GIS to display geo-linked data, and developed equitable methods of resource allocation for one element of preventive care in DIK district.

The research has further been extended to demonstrate the transferability of the methods of identifying equitable need, based on the principles of the RAWP formula, by an application at taluka level in Thatta district for out patient services. The extension of the need model has also enabled us to demonstrate health service resource allocation for one locality of Thatta district based on gravity model principles.

The work reported here can serve as a demonstration project in two respects. It provides an example of the operational use of scientific methods in the local planning of health care resources. And it also suggests that there is ample scope for research in overall health care planning. The most urgent need is for the development of rational planning methods for the nationwide distribution of health care resources in Pakistan.

In this respect we have already shown the feasibility of equitable need identification below district level. In a similar manner provinces can distribute resources equitably among their districts, and federal government can distribute resources equitably among its provinces, federally administered trible areas and Kashmir. Our work of extending the method of equitable need identification is based on data collected by the Community Health Sciences Department of Aga Khan University - data which are generally not available in Pakistan. However in the light of statistical evidence based on this data, as well as in the judgement of eminent researchers, we have shown that in order to adopt rational approaches where adequate data are not available alternate data can be utilized to good effect.

Nevertheless it is evidently desirable that the Government of Pakistan should make mortality and socio-economic data a regular feature of its data bank. This will enable a variety of methods, currently available only locally and through the benefits of efforts and resources committed by the various departments of Sind Government, International Research Centre of Canada, and Aga Khan University, to be extended to other districts of Pakistan. Although in Pakistan the AKU report (Karim, 1987) established, as is generally the case for LDCs, that there is link between socio-economic conditions and poor health, however it remained to be clarified how health planners should use this information to identify need and plan health care resources. In this thesis we have shown that such data are helpful in the support of research and development in health planning. The examples of our work in DIK and Thatta district can be extended to other districts of Pakistan, as well as to other LDCs.

Within the context of decentralized primary health care at sub-district level there is need to develop mechanisms for services such as mother and child health, malaria control, prevention of food adulteration, sanitary control, school health, family planning, ambulatory care, drug procurement and supply system etc. All these areas need urgent attention for rational planning so that benefits can reach those who are in most need. We have shown, for example, that due to the non-availability of drugs, rural health institutions in Pakistan are losing their effectiveness. Very large sums are being spent by the government on drug procurement and supply, but their benefits do not reach the general public.

We have also explained that at present there is no referral system between rural primary health care units and the district headquarters hospital. On the other hand primary health care services in municipal committee areas are non-existent, with the exception of those provided by the local government and Red Crescent Society - which are too limited. In municipal committee areas the district headquarters hospital provides both acute secondary care by inpatient department and primary care by outpatient department. The result of this is that the district headquarters hospital remains substantially overcrowded. This in turn affects over-all hospital resources, creating problems for the acute inpatient service.

This situation demands that the provision of primary health care for the population living in the municipal committee areas should be organized separately on the lines those of RHCs etc. In the district headquarters hospital only those patients with appointments should be seen by outpatient consultants. In this respect a) extensive research is needed to establish primary health care facilities for the population living in the municipal committee areas that ensures an integrated system by taking into account the existing health service provision by various organizations - for example local government, Red Crescent Society, and other welfare trust facilities such as Edhi's; and b) there is need for an effective referral system between primary health care units and district headquarters hospital.

We have already explained that in Pakistan local governments and the Red Crescent Society provide limited primary health care service to the population in the municipal committee areas. The Edhi Trust on the other hand is a well known welfare Pakistani charitable organization which largly provides primary health care and ambulance service. Edhi Trust is now planning to establish health centres at every 50 km on highways and link roads throughout Pakistan (Edhi, 1991). It follows from the argument of this thesis that such activities should be carefully planned so that their benefits are adequately realized. Our work in the health planning area is only an initial step. However we hope that it may stimulate federal and provincial governments, academic institutions, international aid agencies, and welfare organizations to support research and development in health care planning. Pakistan's health care system both at local and national level has ample potential for research. We have shown that there are substantial data sources available which could be mobilized to collect appropriate data to support research and the use of rational planning techniques. There does not seem to be any insurmountable barrier; however progress in these matters depends very much upon the government's level of commitment to transform its policy into action.

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Appendix 1

Description of Variables in the Standard Data Stacks

Data Stacks	Variables	Source
Census:-	1) Total Population in a ward in 1981	OPCS*1981
	2) Density of population per hactor in a ward in 1981	"
	3) Percentage of the total population over 65 years of age in a ward in 1981	"
	4) Percentage of the total population elderly people living alone in a ward in 1981	"
	5) Percentage of the total population children under five years of age in a ward in 1981	"
	6) Percentage of the total population lone parents in a ward in 1981	"
	7) Percentage of the total population unskilled workers in a ward in1981	"
	8) Percentage of the total population unemployed people in a ward in 1981	"
	9) Percentage of the total population lacking basick housing amenities in a ward in 1981	"
	10) Percentage of population the total living in overcrowded houses in a a ward in 1981	"
	11) Percentage of the total population migrated within one year in a ward in 1981	"
	12) Percentage of the totalpopulation belonging to ethnic minority groups in a ward in 1981	"
	13) Jarman underprivileged areas indicators in a ward in 1981	"

Vital Statistics:-	1) Total live births took place in a ward	OPCS from 1981 thro-ugh 1985
	2) Live births took place in male babies in a ward	
	3) Live births took place in female babies in a ward	
	4) Total stillbirths occured in a ward	
	5) Still births occured in male babies in a ward	"
	6) Still births occured in female babies in a ward	"
	7) Total Deaths occured in a ward	
	8) Deaths occured in male population in a ward	"
	9) Deaths occured in female population in a ward	"
	10) Total Deaths occured among babies under one year of age in a ward	"
	11) Deaths occured among male babies under one year of age in a ward	"
	12) Deaths occured among female babies under one year of age in a ward	"
	13) Deaths occured among male population from 01-04 years of age in a ward	"
	14) Deaths occured among male population from 05-14 years of age in a wared	"
	15) Deaths occured among male population from15-24 years of age in a ward	"
	16) Deaths occured among male population from 25-34 years of age in a ward	"
	17) Deaths occured among male population from 35-44 years of age in a ward	"
	18) Deaths occured among male population from 45-54 years of age in a ward	"
	19) Deaths occured among male population from 55-64 years of age in a ward	"
	20) Deaths occured among male population from·65-74 years of age in a ward	"
	21) Deaths occured among male population from 75-84 years of age in a ward	"
	22) Deaths occured among male population from 85 years and above in a ward	"
	23) Deaths occured among female population from 01-04 years of age in a ward	"
	24) Deaths occured among female population	

from 05-14 years of age in a wared "

25) Deaths occured among female population from15-24 years of age in a ward "

26) Deaths occured among female population from 25-34 years of age in a ward "

27) Deaths occured among female population from 35-44 years of age in a ward "

28) Deaths occured among female population from 45-54 years of age in a ward "

29) Deaths occured among female population from 55-64 years of age in a ward "

30) Deaths occured among female population from 65-74 years of age in a ward "

31) Deaths occured among female population from 75-84 years of age in a ward "

32) Deaths occured among female population from 85 years and above in a ward "

Population Estimates:-	1) Esimated male population from 00-04 years of age	LRC** population estimates from 1982 through 1991
	2) Estimated female Population from 00-04 years of age	
	3) Estimated male population from 05-09 years of age	
	4) Estimated female population from 05-09 years of age	
	5) Estimated male population from 10-14 years of age	
	6) Estimated female population from 10-14 years of age	"
	7) Estimated male population from 15-19 years of age	"
	8) Estimated female population from 15-19 years of age	"
	9) Estimated male population from 20-24 years of age	"
	10) Estimated female population from 20-24 females	"
	11) Estimated male population from 25-29 years of age	"
	12) Estimated female population from 25-29 years of age	"
	13) Estimated male population from 30-34 years of age	"

14) Estimated female population from 30-34 years of age "

15) Estimated male population from 35-39 years of age "

16) Estimated female population from 35-39 years of age "

17) Estimated male population from 40-45 years of age "

18) Estimated female population from 40-45 years of age "

19) Estimated male population from 45-49 years of age "

20) Estimated female population from 45-49 years of age "

21) Estimated male population from 50-54 years of age "

22) Estimated female population from 50-54 years of age "

23) Estimated male population from 55-59 years of age "

24) Estimated female population from 55-59 years of age "

25) Estimated male population from 60-64 years of age "

26) Estimated female population from 60-64 years of age "

27) Estimated male population from 65-69 years of age "

28) Estimated female population from 65-69 years of age "

29) Estimated male population from 70-74 years of age "

30) Estimated female population from 70-74 years of age "

31) Estimated male population from 75-79 years of age "

32) Estimated female population from 75-79 years of age "

33) Estimated male population from 80-84 years of age "

34) Estimated female population from 80-84 years of age "

35) Estimated male Population from 85years and above "

	36) Estimated female Population from 85years and above	"
Mortality Data:-	1) Observed deaths in a ward	OPCS
	2) Expected deaths in a ward	
	3) Standerdized mortality rate (SMR) in a ward	
	SMR= (observed deaths/expected deaths)* 100	
Health Service Provision Data:-	1) Number of general practitioners in a locality/patch in 1987	DHSS***
	2) Number of district nurses in a locality/patch in 1988	"
	3) Number of enrolled nurses in a locality/patch in 1988	"
	4) Number of physiotherapists in a locality/patch in 1988	"
	5) Number of health visitors in a locality/patch in 1988	"
	6) Number of health promotion nurses in a locality/patch in 1988	"
	7) Number of school nurses in a locality/patch in 1988	"
	8) Number of community psychiatric nurses in a locality in a ward in 1988	"
	9) Number of auxiliary staff in a locality/patch in 1988	"
	10) Number of family planning sessions held in a week in a locality/patch in 1988	"
Social Service Provision Data:-	1) Number of places in children's home in a neighbourhood in 1988	Research and Inform-mation Tower Ham-lets Social Service
	2) Number of places in day nurseries in a neighbourhood in 1988	
	3) Number of places in home for elderly people in a neighbour-hood in 1988	
	4) Number of places in a sheltered	

accommodation in a neighbourhood in 1988 "

5) Number of luncheon clubs in a neighbourhood in 1988 "
6) Number of places in day centres for mentally ill in a neighbourhood in 1988 "
7) Number of places in day centres for elderly people in a neighbourhood in 1988 "
8) Number of linked flates in a neighbourhood in 1988 "
9) Number of places in hostels for people with learning difficulty in a neighbourhood in 1988 "
10) Number of places in day centres for people with learning disabilities in a neighbourhood in 1988 "
11) Number of kitchens in a neighbourhood in 1988 "
12) Number of places in homes for elderly mentally ill people in a neighbourhood in 1988 "

*OPCS:- Office of Population Census and Surveys
**LRC:- London Research Centre
*** DHSS:- Data was collected from the service managers during interviews

Appendix 2: Need calculation for district nursing service

	Population 1986		Population 1991		Interpolated population 1989		Service activity rate per 1000 pop	
Blackwall	M	F	M	F	M	F	M	F
5-14	407	389	451	428	433	412	12	29
15-64	1837	1829	1865	1895	1854	1869	138	149
65+	259	325	302	354	285	342	2661	5701
Bow								
5-14	555	544	614	623	590	591	12	29
15-64	2650	2811	2796	3009	2738	2930	138	149
65+	412	701	432	710	424	706	2661	5701
Bromley								
5-14	535	560	652	658	605	619	12	29
15-64	3057	3319	3264	3590	3181	3482	138	149
65+	496	714	481	732	487	725	2661	5701
East India								
5-14	393	431	411	412	404	420	12	29
15-64	2048	2116	2010	2153	2025	2138	138	149
65+	355	524	364	518	360	520	2661	5701
Grove								
5-14	284	276	303	295	295	287	12	29
15-64	1714	1751	1824	1877	1780	1827	138	149
65+	296	467	315	509	307	492	2661	5701
Holy Trinity								
5-14	401	372	517	489	471	442	12	29
15-64	2420	2518	2361	2512	2385	2514	138	149
65+	589	854	586	829	587	839	2661	5701
Lansbury								
5-14	383	337	511	505	460	438	12	29
15-64	2751	2815	2777	2810	2767	2812	138	149
65+	469	650	477	681	474	669	2661	5701
Limehouse								
5-14	504	464	603	542	563	511	12	29
15-64	2969	3036	2951	3061	2958	3051	138	149
65+	452	662	473	695	465	682	2661	5701
Millwall								
5-14	740	654	832	734	795	702	12	29
15-64	3890	3911	4150	4183	4046	4074	138	149
65 +	445	598	462	666	455	639	2661	5701
Park								
5-14	291	314	314	307	305	310	12	29
15-64	1891	2026	1889	2058	1890	2045	138	149
65 +	392	628	380	646	385	639	2661	5701

Appendix 2 (cont.)

Expected activity 1991 M	F	SMRs	SMR's SQRT	Depriva-tion	Expected need 1991 M	F	Total need
5	12	1.18	1.09	1.80	11	24	35
257	282	1.18	1.09	1.80	503	552	1055
804	2018	1.18	1.09	1.80	1571	3946	5517
7	18	1.35	1.16	1.13	10	24	33
386	448	1.35	1.16	1.13	507	589	1095
1150	4048	1.35	1.16	1.13	1509	5314	6824
8	19	1.25	1.12	1.63	14	35	49
450	535	1.25	1.12	1.63	821	975	1796
1280	4173	1.25	1.12	1.63	2333	7605	9938
5	12	1.35	1.16	1.34	8	19	26
277	321	1.35	1.16	1.34	432	499	931
969	2953	1.35	1.16	1.34	1508	4598	6106
4	9	0.82	0.91	0.90	3	7	10
252	280	0.82	0.91	0.90	205	228	433
838	2902	0.82	0.91	0.90	683	2365	3048
6	14	1.17	1.08	1.33	9	20	29
326	374	1.17	1.08	1.33	469	538	1007
1559	4726	1.17	1.08	1.33	2243	6799	9042
6	15	1.23	1.11	1.35	9	22	31
383	419	1.23	1.11	1.35	574	627	1201
1269	3882	1.23	1.11	1.35	1900	5813	7713
7	16	1.18	1.09	1.55	12	26	39
407	456	1.18	1.09	1.55	686	768	1454
1259	3962	1.18	1.09	1.55	2119	6671	8791
10	21	1.17	1.08	1.39	15	32	47
573	623	1.17	1.08	1.39	861	937	1798
1229	3797	1.17	1.08	1.39	1848	5709	7557
4	9	0.99	0.99	1.10	4	10	14
261	307	0.99	0.99	1.10	285	336	621
1011	3683	0.99	0.99	1.10	1107	4031	5138

Appendix 2 (cont.)

Red Coat								
5-14	322	289	354	342	341	321	12	29
15-64	2148	2190	2134	2176	2140	2182	138	149
65 +	450	712	439	708	443	710	2661	5701
Shadwell								
5-14	633	581	772	756	716	686	12	29
15-64	2719	2594	2858	2715	2802	2667	138	149
65 +	439	612	430	602	434	606	2661	5701
Spitalfields								
5-14	598	550	895	817	776	710	12	29
15-64	3068	1802	3485	2117	3318	1991	138	149
65 +	413	470	475	509	450	493	2661	5701
St. Dunstan								
5-14	500	458	649	571	589	526	12	29
15-64	2561	2551	2582	2632	2574	2600	138	149
65 +	581	794	567	789	573	791	2661	5701
St. James								
5-14	313	337	368	401	346	375	12	29
15-64	2041	2136	2004	2237	2019	2197	138	149
65+	422	754	407	611	413	668	2661	5701
St. Kathrine's								
5-14	826	676	1028	930	947	828	12	29
15-64	4182	3747	4643	4167	4459	3999	138	149
65 +	449	576	537	631	502	609	2661	5701
St. Mary's								
5-14	370	322	481	449	437	398	12	29
15-64	2069	1710	2089	1736	2081	1726	138	149
65 +	431	421	439	413	436	416	2661	5701
St. Peter's								
5-14	642	551	657	603	651	582	12	29
15-64	2959	3035	2959	3060	2959	3050	138	149
65+	544	822	522	768	531	790	2661	5701
Weavers								
5-14	559	537	725	706	659	638	12	29
15-64	2971	2753	2970	2838	2970	2804	138	149
65 +	568	923	579	869	575	891	2661	5701

4	10	1.11	1.05	1.21	5	13	18
294	324	1.11	1.05	1.21	375	413	789
1168	4036	1.11	1.05	1.21	1489	5146	6635
9	22	1.37	1.17	1.84	20	47	67
394	405	1.37	1.17	1.84	849	871	1721
1144	3432	1.37	1.17	1.84	2464	7391	9856
11	24	1.31	1.14	2.46	30	67	97
481	315	1.31	1.14	2.46	1354	888	2242
1264	2902	1.31	1.14	2.46	3559	8170	11729
8	17	1.2	1.10	1.70	15	31	45
356	392	1.2	1.10	1.70	664	730	1394
1509	4498	1.2	1.10	1.70	2810	8377	11186
4	12	1.46	1.21	1.31	7	18	25
277	333	1.46	1.21	1.31	438	528	965
1083	3483	1.46	1.21	1.31	1714	5514	7228
12	27	1.23	1.11	1.83	25	55	80
641	621	1.23	1.11	1.83	1300	1260	2561
1429	3597	1.23	1.11	1.83	2900	7301	10201
6	13	1.33	1.15	2.00	13	30	43
288	259	1.33	1.15	2.00	665	597	1262
1168	2355	1.33	1.15	2.00	2694	5431	8125
8	17	1.08	1.04	1.56	13	28	41
408	456	1.08	1.04	1.56	662	739	1401
1389	4378	1.08	1.04	1.56	2252	7098	9350
9	20	1.15	1.07	1.65	15	36	52
410	423	1.15	1.07	1.65	725	748	1473
1541	4954	1.15	1.07	1.65	2726	8766	11492

Appendix 3: Travel time (in seconds) between health centres and wards

Wards/Health Centres	Black-wall	Bow	Bro-mley	East India	Grove	Holy-trinity	Lans-bury	Lime-house
Barkantine	439	728	647	615	638	907	527	480
Bethnal Green	572	434	471	629	247	259	472	364
Chrisp Street	263	522	303	267	508	880	358	483
Gill Street	208	424	343	360	334	622	223	177
Greenwood	631	437	480	674	258	405	532	420
Ruston Street	479	179	249	461	191	599	465	430
South Poplar	119	506	320	188	510	829	287	403
Spitalfields	629	642	623	781	474	372	568	462
Steel Lane	471	628	552	623	527	549	432	369
Wapping	488	703	628	664	543	481	508	445
Wellington Way	482	373	241	409	359	759	467	433

Wards/Health Centres	Mill-wall	Park	Red-coat	Shad-well	Spital-fields	St. Dun stans	St. James	St. Kat-herines
Barkantine	423	762	597	492	826	625	752	821
Bethnal Green	715	368	201	415	369	344	193	354
Chrisp Street	503	523	541	552	887	549	622	882
Gill Street	350	458	294	249	572	322	449	567
Greenwood	774	330	257	508	516	420	156	501
Ruston Street	695	136	389	581	709	493	315	694
South Poplar	359	510	520	414	748	524	624	743
Spitalfields	772	617	301	472	298	406	442	357
Steel Lane	614	651	332	314	489	366	558	484
Wapping	631	687	369	390	399	403	512	394
Wellington Way	643	399	392	584	820	496	473	803

Wards/Health Centres	St. Marys	St. Peters	Wea-vers
Barkantine	656	907	879
Bethnal Green	174	259	130
Chrisp Street	675	880	787
Gill Street	360	622	587
Greenwood	321	405	276
Ruston Street	514	599	470
South Poplar	578	829	789
Spitalfields	248	363	337
Steel Lane	384	549	538
Wapping	316	481	471
Wellington Way	622	759	638

Appendix 4: Estimated 1991 age and sex population of Union Councils of DIK tehsil

Union Councils	Kirri Khaisore	Panyala	Giloti	WKM	Bilot	Kot Jai	Lar
Male 91							
0-4	2415	1771	1221	1792	2665	1741	2701
5-9	2033	1490	1028	1508	2243	1465	2273
10-14	1569	1150	793	1164	1731	1131	1754
15-19	1278	937	646	948	1410	921	1429
20-24	1109	813	561	823	1224	799	1240
25-29	1064	780	538	789	1174	767	1189
30-34	878	644	444	652	969	633	982
35-39	690	506	349	512	762	498	772
40-44	468	343	237	347	517	337	523
45-49	377	276	191	280	416	272	422
50-54	345	253	174	256	381	249	386
55-59	281	206	142	209	310	203	314
60-64	229	168	116	170	252	165	256
65-69	166	121	84	123	183	119	185
70-74	102	75	52	76	113	74	114
75+	82	60	41	61	90	59	91
	13085	9593	6618	9707	14440	9432	14631
Female 91							
0-4	2195	1590	1090	1640	2448	1538	2496
5-9	1893	1372	940	1415	2112	1327	2153
10-14	1382	1001	686	1033	1542	969	1572
15-19	1127	816	559	842	1257	790	1281
20-24	1060	768	526	792	1182	743	1205
25-29	964	698	479	720	1075	676	1096
30-34	786	569	390	587	877	551	894
35-39	596	432	296	445	665	418	678
40-44	449	326	223	336	501	315	511
45-49	343	249	170	256	383	241	390
50-54	322	233	160	241	359	226	366
55-59	248	180	123	185	276	174	282
60-64	216	156	107	161	241	151	245
65-69	140	102	70	105	157	98	160
70-74	84	61	42	63	94	59	96
75+	56	41	28	42	62	39	64
	11862	8593	5890	8862	13233	8314	13489
M<1	451	331	228	335	498	325	505
F<1	407	295	202	304	454	286	463
Total	859	626	430	639	952	611	968
4-5M	554	406	280	411	612	399	620
4-5F	499	361	248	373	557	350	567
Total	1053	768	528	784	1168	749	1187
1-5M	1964	1440	993	1457	2167	1416	2196
1-5F	1787	1295	888	1335	1994	1253	2032
Total	3751	2735	1881	2792	4161	2668	4229
Female 15-49	5325	3858	2644	3979	5941	3733	6056

Appendix 4 (cont.)

Band Kurai	Dhap Shumali	Yarik	Paharpur Locality	Kaich	Mandhra Kalan	Shore Kot	Himat-wala	Dera Dehat
2594	1081	839	18821	1922	720	1646	271	3699
2184	910	706	15840	1618	606	1385	228	3113
1685	702	545	12225	1249	468	1069	176	2403
1373	572	444	9957	1017	381	871	144	1957
1191	496	385	8643	883	331	756	125	1699
1143	476	369	8288	847	317	725	120	1629
944	393	305	6845	699	262	599	99	1345
741	309	240	5379	549	206	470	78	1057
503	209	163	3648	373	140	319	53	717
405	169	131	2938	300	112	257	42	577
370	154	120	2687	274	103	235	39	528
302	126	98	2190	224	84	192	32	430
245	102	79	1781	182	68	156	26	350
178	74	58	1291	132	49	113	19	254
110	46	35	796	81	30	70	11	156
88	36	28	636	65	24	56	9	125
14056	5856	4546	101964	10414	3900	8916	1470	20041
2264	994	727	16981	1643	678	1422	236	3186
1953	857	627	14649	1418	585	1226	204	2748
1426	626	458	10695	1035	427	895	149	2006
1162	510	373	8718	844	348	730	121	1635
1093	480	351	8201	794	328	687	114	1539
994	436	319	7457	722	298	624	104	1399
811	356	260	6082	589	243	509	85	1141
615	270	197	4613	446	184	386	64	865
464	203	149	3477	336	139	291	48	652
354	155	114	2655	257	106	222	37	498
332	146	107	2493	241	100	209	35	468
256	112	82	1917	186	77	161	27	360
223	98	71	1670	162	67	140	23	313
145	64	46	1085	105	43	91	15	204
87	38	28	651	63	26	55	9	122
58	25	19	433	42	17	36	6	81
12236	5371	3927	91778	8881	3667	7684	1277	17218
			193742					
485	202	157	3516	359	134	307	51	691
420	184	135	3152	305	126	264	44	591
905	386	292	6668	664	260	571	95	1282
595	248	192	4318	441	165	378	62	849
515	226	165	3860	374	154	323	54	724
1110	474	358	8178	815	319	701	116	1573
2110	879	682	15304	1563	585	1338	221	3008
1844	809	592	13829	1338	553	1158	192	2594
3953	1688	1274	29133	2901	1138	2496	413	5602
5493	2411	1763	41203	3987	1646	3450	573	7730

Appendix 4 (cont.)

Dera Locality	Chehkan	Zindani	Lachra	Muryal	Malana	Lunda	Naivell	Paroa	Mahra
8258	2260	2050	1760	1437	1366	1244	1485	1178	1770
6951	1902	1725	1481	1210	1150	1047	1250	991	1490
5364	1468	1331	1143	934	887	808	965	765	1150
4369	1196	1084	931	760	723	658	786	623	936
3792	1038	941	808	660	627	571	682	541	813
3637	995	903	775	633	602	548	654	519	779
3004	822	745	640	523	497	452	540	428	644
2360	646	586	503	411	390	355	424	337	506
1601	438	397	341	279	265	241	288	228	343
1289	353	320	275	224	213	194	232	184	276
1179	323	293	251	205	195	178	212	168	253
961	263	239	205	167	159	145	173	137	206
781	214	194	166	136	129	118	141	111	167
567	155	141	121	99	94	85	102	81	121
349	96	87	74	61	58	53	63	50	75
279	76	69	59	49	46	42	50	40	60
44741	12246	11104	9533	7788	7402	6738	8047	6381	9589
7165	1998	1826	1582	1267	1237	1141	1354	1059	1617
6182	1724	1575	1365	1093	1067	984	1168	914	1395
4513	1259	1150	996	798	779	719	853	667	1019
3678	1026	938	812	650	635	586	695	544	830
3461	965	882	764	612	598	551	654	512	781
3147	878	802	695	556	543	501	594	465	710
2566	716	654	567	454	443	409	485	379	579
1946	543	496	430	344	336	310	368	288	439
1467	409	374	324	259	253	234	277	217	331
1120	312	286	247	198	193	178	212	166	253
1052	293	268	232	186	182	167	199	155	237
809	226	206	179	143	140	129	153	120	183
705	197	180	156	125	122	112	133	104	159
458	128	117	101	81	79	73	87	68	103
275	77	70	61	49	47	44	52	41	62
183	51	47	40	32	32	29	35	27	41
38727	10800	9870	8549	6845	6687	6166	7317	5725	8741
83468									
1543	422	383	329	269	255	232	278	220	331
1330	371	339	294	235	230	212	251	197	300
2873	793	722	622	504	485	444	529	417	631
1895	519	470	404	330	313	285	341	270	406
1629	454	415	360	288	281	259	308	241	368
3524	973	885	763	618	595	545	649	511	774
6715	1838	1667	1431	1169	1111	1011	1208	958	1439
5835	1627	1487	1288	1031	1008	929	1102	863	1317
12551	3465	3154	2719	2200	2119	1941	2310	1820	2756
17386	4849	4431	3838	3073	3002	2768	3285	2570	3924

Miran	Damman Locality
2409	14699
2028	12372
1565	9548
1275	7777
1106	6750
1061	6473
876	5346
689	4201
467	2849
376	2294
344	2099
280	1711
228	1391
165	1008
102	622
81	496
13053	79635
2104	13187
1815	11376
1325	8305
1080	6770
1016	6369
924	5791
753	4723
571	3582
431	2700
329	2062
309	1936
238	1489
207	1297
134	843
81	506
54	336
11369	71271
	150906
450	2746
390	2448
841	5194
553	3372
478	2998
1031	6370
1959	11953
1713	10739
3672	22692
5104	31997

Appendix 5: Travel time (in minutes) between vaccination centres and union councils

Vacc. Centres / Union Councils	Budhani	DK City &Dehat	Yarik	Pahar-pur	Wanda Madat	Pany-ala	Abdul Khail	Madi Khail
Kirri Khaisore	92	134	204	86	140	284	344	32
Panyala	94	94	34	170	78	5	60	250
Giloti	78	66	32	148	92	30	90	224
WKM	160	160	100	236	150	60	5	282
Bilot	108	132	258	66	102	224	326	66
Kot Jai	46	86	146	40	74	208	268	60
Lar	40	68	140	26	68	192	252	76
Pahrpur &BK	60	68	120	5	42	170	230	102
Dhap Shumali	26	28	146	26	68	192	252	96
Yarik	80	46	5	120	150	50	110	222
Kaich	74	60	48	102	114	102	162	140
Mandhra	8	20	102	54	162	194	254	122
Shore Kot	14	16	40	172	182	78	138	148
Himat Wala	4	14	116	26	176	92	152	156
Chekan	40	36	86	72	196	150	210	224
Zindani	58	50	98	86	218	140	200	196
DK City&Dehat	14	8	60	40	196	100	160	148
Lachra	12	12	58	38	190	96	156	142
Muryali	20	10	66	48	196	104	164	152
Malana	34	22	82	64	216	112	172	176
Lunda	72	60	124	96	252	162	222	184
Naivella	78	66	130	104	242	170	230	192
Paroa	80	68	126	100	250	166	226	188
Mahra	92	80	138	114	264	180	240	202
Miran	114	102	160	134	290	200	260	222

Ktla Lodhian	Kot Jai	Awan	Ramak	Paroa	Drabin Khurd	Malana	Potah
62	52	134	166	146	106	96	152
186	212	170	144	124	84	74	100
224	186	142	130	110	70	60	86
186	230	224	210	190	150	140	166
84	58	130	176	156	126	66	142
50	5	76	140	120	80	70	120
64	14	50	128	108	68	58	120
90	40	70	120	100	60	50	120
100	40	44	112	92	52	42	80
222	160	114	134	114	74	64	66
180	88	42	182	162	122	112	102
234	66	44	146	126	86	76	52
250	92	68	92	72	50	40	52
234	70	58	132	112	72	62	44
268	110	104	146	126	86	76	12
314	190	120	158	138	98	58	90
248	84	72	114	94	54	44	40
246	82	70	116	96	56	46	42
256	92	80	106	86	46	36	54
270	104	96	52	32	14	5	72
300	142	128	56	36	26	34	94
304	150	136	48	28	26	52	112
300	146	132	20	5	28	54	114
314	160	146	10	10	38	66	126
334	180	166	6	16	54	86	154

Appendix 6 : Calculation of skewness

Talukas	X	(X-M)	(X-M)SQ	(X-M)CUB
(ROM)				
Kati Bunder	58.10	-5.89	34.71	-204.51
Kharo Chan	87.00	23.01	529.38	12180.23
Jati	63.10	-0.89	0.80	-0.71
Shah Bunder	83.60	19.61	384.49	7539.14
Mirpur Sakro	78.60	14.61	213.40	3117.47
Gharo Bari	54.90	-9.09	82.66	-751.50
Thatta Rural	81.20	17.21	296.13	5095.85
Sujjawal Rur	73.80	9.81	96.20	943.60
Mirpur Batho	78.50	14.51	210.49	3053.88
Gharo	39.10	-24.89	619.60	-15422.75
Thatta Urban	23.80	-40.19	1615.37	-64924.42
Sujjawal Urb	46.20	-17.79	316.54	-5631.83
Total	767.90		4399.77	-55005.56
Mean	63.99		M3	-4583.80
SD	19.15		A3	-0.65
(ROM)Squared/100				
Kati Bunder	33.76	-10.86	117.93	-1280.72
Kharo Chan	75.69	31.07	965.61	30005.41
Jati	39.82	-4.80	23.04	-110.57
Shah Bunder	69.89	25.27	638.76	16144.00
Mirpur Sakro	61.78	17.16	294.60	5056.38
Gharo Bari	30.14	-14.48	209.55	-3033.33
Thatta Rural	65.93	21.32	454.48	9688.92
Sujjawal Rur	54.46	9.85	96.99	955.26
Mirpur Batho	61.62	17.01	289.23	4918.80
Gharo	15.29	-29.33	860.11	-25225.19
Thatta Urban	5.66	-38.95	1517.21	-59097.55
Sujjawal Urb	21.34	-23.27	541.56	-12602.83
Total	535.39		6009.07	-34581.41
Mean	44.62		M3	-2881.78
SD	22.38		A3	-0.26
(AGR)				
Kati Bunder	23.30	8.78	77.00	675.68
Kharo Chan	24.80	10.28	105.58	1084.79
Jati	19.30	4.78	22.80	108.87
Shah Bunder	17.80	3.28	10.73	35.13
Mirpur Sakro	1.80	-12.73	161.93	-2060.50
Gharo Bari	26.60	12.08	145.81	1760.60
Thatta Rural	18.40	3.87	15.02	58.19
Sujjawal Rur	22.70	8.17	66.83	546.34
Mirpur Batho	15.40	0.88	0.77	0.67
Gharo	1.50	-13.03	169.65	-2209.70
Thatta Urban	1.10	-13.43	180.23	-2419.60
Sujjawal Urb	1.60	-12.93	167.06	-2159.19
Total	174.30		1123.38	-4578.72
Mean	14.53		M3	-381.56
SD	9.68		A3	-0.42

(HSE)				
Kati Bunder	8.90	-4.56	20.78	-94.71
Kharo Chan	4.90	-8.56	73.25	-626.86
Jati	58.80	45.34	2055.87	93216.42
Shah Bunder	42.80	29.34	860.93	25261.22
Mirpur Sakro	4.30	-9.16	83.88	-768.16
Gharo Bari	3.00	-10.46	109.38	-1143.90
Thatta Rural	1.10	-12.36	152.73	-1887.47
Sujjawal Rur	2.60	-10.86	117.90	-1280.23
Mirpur Batho	3.00	-10.46	109.38	-1143.90
Gharo	9.80	-3.66	13.38	-48.96
Thatta Urban	12.80	-0.66	0.43	-0.29
Sujjawal Urb	9.50	-3.96	15.67	-62.02
Total	161.50		3613.57	111421.15
Mean	13.46			
SD	17.35		M3	9285.10
			A3	1.78

LN(HSE)	LN(X)			
Kati Bunder	2.19	0.24	0.06	0.01
Kharo Chan	1.59	-0.36	0.13	-0.05
Jati	4.07	2.12	4.51	9.59
Shah Bunder	3.76	1.81	3.26	5.90
Mirpur Sakro	1.46	-0.49	0.24	-0.12
Gharo Bari	1.10	-0.85	0.72	-0.62
Thatta Rural	0.10	-1.85	3.44	-6.38
Sujjawal Rur	0.96	-0.99	0.99	-0.98
Mirpur Batho	1.10	-0.85	0.72	-0.62
Gharo	2.28	0.33	0.11	0.04
Thatta Urban	2.55	0.60	0.36	0.22
Sujjawal Urb	2.25	0.30	0.09	0.03
Total	23.40		14.64	7.02
Mean	1.95		M3	0.59
SD	1.10		A3	0.43

SD = Standard Deviation = SQRT(Σ(X-M)^2/N))
M3 =Average of the cubed deviations from mean
A3 is derived by M3/(SD)cubed for standardization
If the value of A3 exeeds 0.5 in + or - direction,
there is considerable skewness present

Appendix 7 : Regression Analysis

Talukas	Death %	< 5 %	65+ %	FCBA %
Kati Bunder	2.3	15.4	2.1	15.8
Kharo Chan	2.3	15.8	2.7	15.5
Jati	1.6	19.4	2.0	15.7
Shah Bunder	1.2	19.2	3.0	16.5
Mirpur Sakro	1.5	16.3	3.3	14.1
Gharo Bari	1.3	17.4	2.1	16.4
Thatta Rural	1.5	18.7	2.3	16.7
Sujjawal Rur	1.3	16.6	3.3	15.5
Mirpur Batho	1.2	19.1	2.0	19.3
Gharo	1.5	17.4	2.6	15.9
Thatta Urban	1.7	15.9	2.4	13.8
Sujjawal Urb	1.0	20.3	1.0	17.2

FCBA Female in child bearing age
Rur Rural, Urb Urban
Source of data CHS, AKU

Regression Output: Death upon all variables

Constant		5.79	
Std Err of Y Est		0.30	
R Squared		0.59	
No. of Observations		12.00	
Degrees of Freedom		8.00	
X Coefficient(s)	-0.22	-0.19	0.00
Std Err of Coef.	0.08	0.17	0.09

Regression Output: Death upon <5 and 65+

Constant		5.81
Std Err of Y Est		0.29
R Squared		0.59
No. of Observations		12.00
Degrees of Freedom		9.00
X Coefficient(s)	-0.22	-0.19
Std Err of Coef.	0.06	0.16

Regression Output: Death upon <5

Constant		4.68
Std Err of Y Est		0.29
R Squared		0.53
No. of Observations		12.00
Degrees of Freedom		10.00
X Coefficient(s)	-0.18	
Std Err of Coef.	0.05	

Appendix 8 : Population Estimates

Part A Provincial and district's population estimates

	NC 1981	WBNE 1990	WBNE 1995	NCS 1981	NCTh 1981
Male	43089811	58283000	66919000	9999205	391858
Female	38965286	53328000	61554000	9029461	369181
Total	82055097	111611000	128473000	19028666	761039

Forecast	Sind 1990	Sind 1995	Sind 1993	Thatta 1990	Thatta 1993
Male	13405090	15391370	14596858	536204	583874
Female	12265440	14157420	13400628	490618	536025
Total	25670530	29548790	27997486	1026821	1119899

Thatta 89M	518882
Thatta 89F	476045
Total	994927

Part B Taluka population estimates

	1981M	1981F	1993M	1993F	1993T
Kati Bunder	63217	58097	94194	84353	178547
Kharo Chan	37399	36750	55725	53358	109084
Jati	10448	10742	15568	15597	31164
Shah Bunder	8628	8275	12856	12015	24871
Mirpur Sakro	77787	71426	115904	103706	219609
Gharo Bari	53130	51426	79164	74667	153831
Thatta Rural	38732	35060	57711	50905	108616
Sujjawal Rur	43070	41596	64175	60394	124569
Mirpur Batho	34028	32893	50702	47758	98461
Gharo	6181	5669	9210	8231	17441
Thatta Urban	11342	10182	16900	14784	31683
Sujjawal Urb	7896	7065	11765	10258	22023
Total	391858	369181	583874	536025	1119899

NC National Census, WBNE World Bank National Estimates
NCS National Census Sind, NCTh National Census Thatta
Thatta's 1989 estimates would be needed for service use rates

Appendix 9 : Calculation of relative need

Talukas	Population M	Population F	Service use rate M	Service use rate F	Expected Need M	Expected Need F
Kati Bunder	94194	84353	0.47	0.42	44271	35428
Kharo Chan	55725	53358	0.47	0.42	26191	22410
Jati	15568	15597	0.47	0.42	7317	6551
Shah Bunder	12856	12015	0.47	0.42	6042	5046
Mirpur Sakro	115904	103706	0.47	0.42	54475	43557
Gharo Bari	79164	74667	0.47	0.42	37207	31360
Thatta Rural	57711	50905	0.47	0.42	27124	21380
Sujjawal Rur	64175	60394	0.47	0.42	30162	25365
Mirpur Batho	50702	47758	0.47	0.42	23830	20058
Gharo	9210	8231	0.47	0.42	4329	3457
Thatta Urban	16900	14784	0.47	0.42	7943	6209
Sujjawal Urb	11765	10258	0.47	0.42	5530	4308
Total					274421	225131

	SQRT(SMRs) M	SQRT(SMRs) F	Need * SMRs M	Need * SMRs F	Weighted Need A M	Weighted Need A F
Kati Bunder	1.14	1.30	50469	46057	48725	46617
Kharo Chan	1.13	1.37	29596	30702	28573	31075
Jati	1.07	0.96	7829	6289	7559	6365
Shah Bunder	0.87	0.94	5257	4744	5075	4801
Mirpur Sakro	1.06	0.91	57743	39636	55747	40118
Gharo Bari	0.91	0.90	33858	28224	32688	28567
Thatta Rural	1.12	0.75	30379	16035	29329	16230
Sujjawal Rur	1.08	0.69	32575	17502	31449	17715
Mirpur Batho	0.86	0.93	20494	18654	19785	18881
Gharo	0.98	0.99	4242	3422	4095	3464
Thatta Urban	0.95	1.18	7546	7327	7285	7416
Sujjawal Urb	0.77	0.89	4258	3834	4111	3881
			284246	222427	274421	225131

	Dep. Scores	Need * Dep. M	Need * Dep. F	Weighted Need B M	Weighted Need B F	Total Need
Kati Bunder	1.12	54572	52211	53460	50238	103698
Kharo Chan	1.39	39716	43195	38907	41563	80470
Jati	1.41	10658	8975	10440	8636	19076
Shah Bunder	1.57	7968	7538	7806	7253	15059
Mirpur Sakro	0.82	45713	32897	44782	31654	76436
Gharo Bari	0.97	31707	27710	31062	26663	57725
Thatta Rural	0.94	27569	15256	27008	14680	41688
Sujjawal Rur	1.07	33651	18955	32965	18239	51204
Mirpur Batho	1.01	19983	19070	19576	18349	37926
Gharo	0.56	2293	1940	2247	1867	4113
Thatta Urban	0.52	3788	3856	3711	3711	7422
Sujjawal Urb	0.61	2507	2367	2456	2278	4734
Total		280125	233970	274421	225131	499552

Appendix 10: Input data of patient flow probabilities in % (p matrix)

Patients seen in 1990	6067	6576	1745	8914	Actual pateints from each area A
Buhara UC	0.00	0.00	0.00	77.00	6864
Choubandi UC	0.00	15.29	100.00	3.70	3080
Ghulammullah UC	79.00	0.00	0.00	0.00	4793
Mirpur Sakro TC	0.00	0.00	0.00	2.00	178
Takani UC	0.00	0.00	0.00	8.51	759
Karampur UC	21.00	0.00	0.00	2.00	1452
Gujjo UC	0.00	13.53	0.00	0.00	890
Haji Ghirano UC	0.00	0.00	0.00	6.79	605
Gharo TC	0.00	42.35	0.00	0.00	2785
Dhabeji UC	0.00	28.83	0.00	0.00	1896
Total	100.00	100.00	100.00	100.00	

	Mirpur Sakro	Ghari-wah	Gujjo	Dhabeji		
Patients seen in 1990	19056	2700	3088	3902	B	Total A+B
Buhara UC	13.13	0.00	0.00	0.00	2502	9366
Choubandi UC	2.20	0.00	0.00	0.00	419	3500
Ghulammullah UC	0.87	0.00	0.00	0.00	166	4959
Mirpur Sakro TC	46.13	0.00	0.00	0.00	8791	8969
Takani UC	12.40	0.00	0.00	0.00	2363	3122
Karampur UC	15.07	100.00	0.00	0.00	5572	7024
Gujjo UC	1.40	0.00	100.00	0.00	3355	4245
Haji Ghirano UC	8.40	0.00	0.00	0.00	1601	2206
Gharo TC	0.40	0.00	0.00	0.00	76	2861
Dhabeji UC	0.00	0.00	0.00	100.00	3902	5798
Total	100.00	100.00	100.00	100.00		