Linking 'Soft' With 'Hard': A Case of Health System Planning in a Developing Country

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Abstract

In recent years, Bangladesh, like many developing countries, has given high priority to the development of primary health care. The twin aims of the programme are to extend coverage of health services in rural areas and improve the overall health of the country's population. In 1993, the European Commission (EC) initiated a project called the Thana Functional Improvement Pilot Project (TFIPP) which is providing assistance to the Ministry of Health and Family Welfare (MOHFW) of the Government of Bangladesh. The objective of the TFIPP is to develop an efficient and effective operational system to deploy a health service in the country designed by the Government and the World Bank in partnership. The TFIPP consists of four functional units and one of these is the Operations Research and Social Development (ORSD) unit. The ORSD is the youngest unit among all and was formally created in 1997. Since then it became an integral part of the TFIPP. This study describes how the ORSD unit applied OR models in conjunction with systems methodology to locate health facilities at the community level. First systems methodology was applied to develop knowledge and understanding about the problem, to identify variables interacting in the health system and to determine what affects the quality of services. Some of these variables were then considered to formulate location models as a maximum covering location problem (MCLP) so as to find suitable sites for health facilities in rural Bangladesh.

Background

In Bangladesh, a unit of local government is known as a "thana". Typically, a thana has a population measured in tens to hundreds of thousands. Each thana consists of about ten to fifteen "Unions". In 1993, the European Commission (EC) initiated the Thana Functional Improvement Pilot Project (TFIPP). The EC-sponsored project is providing assistance to the Ministry of Health and Family Welfare (MOHFW) of the Government of Bangladesh. Recently, the Government, in conjunction with the World Bank, has developed a comprehensive health policy to extend the coverage of primary health care. The objective of the TFIPP is to develop an efficient and effective

operational system so that the partnership of the Government and the World Bank can deploy a health service in the country. As its name implies, the TFIPP operates at the Thana level and below. The relationship between the Government, the World Bank, the EC and TFIPP is shown in Figure 1. The TFIPP consists of four functional units, which are working in an integrated manner in order to achieve its objective. The functional units are:

1. Training and Communication
2. Public Health
3. Management Intervention, and
4. Operations Research and Social Development (ORSD) unit.

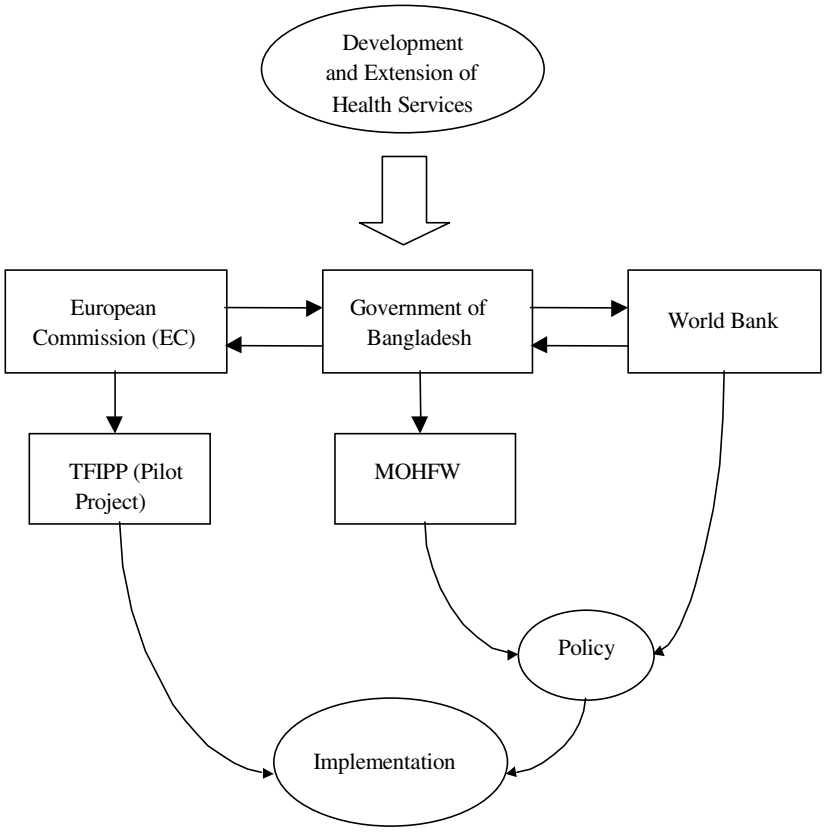
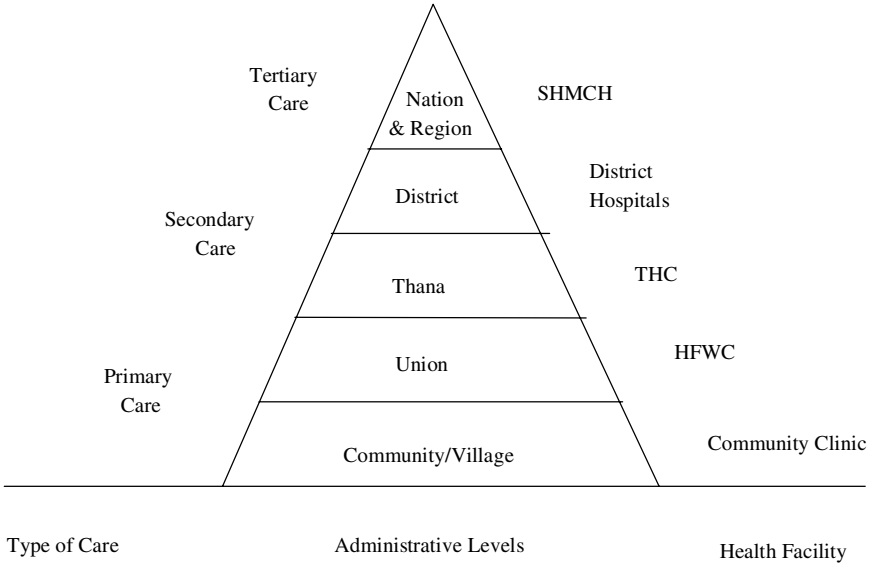


FIG. 1*: Health policy development and implementation bodies*

The ORSD is the youngest unit among all and was formally created in 1997. Since then it has become an integral part of the TFIPP. The unit is making plans to ensure that there is an equitable and efficient system for the delivery of health facilities throughout the country. For some considerable time, the Government's national health policy has been based on a health care system with three levels of services from primary health care to specialised care. Primary health care includes treatment of common diseases, preventive and promotive health care at community/village, union, and thana levels. The health delivery system at thana level and below consists of a Thana Health Complex (THC), Health and Family Welfare Centers (HFWCs) and Community Clinics (CCs). Figure 2 shows the administrative divisions at the national level and health facilities at each level. This study is concerned with the location of CCs at the community/village level. The functions of this type of facility is to deliver a mix of health services which is called the Essential Services Package

(ESP). This includes provision for reproductive health, child health, communicable disease control, limited curative care, and behaviour change communication.



Note: SHMCH - Speciatized Hospital and Medical College Hospital
THC - Thana Health Complex
HFWC - Health and Family Welfare Centre

FIG.2: *Hierarchy of public health care system in Bangladesh*

This study describes how the ORSD unit applied location-allocation models in conjunction with systems methodology to locate health facilities at the community level. The decision making process involved in the study is shown in Figure 3. First a systems approach was applied to develop conceptual maps of the health services planning problem. The purpose was to develop knowledge and understanding about the problem, identify variables interacting in the system and determine what affects the quality of services. Some of these variables were then considered to formulate location models so as to find suitable sites for community clinics.

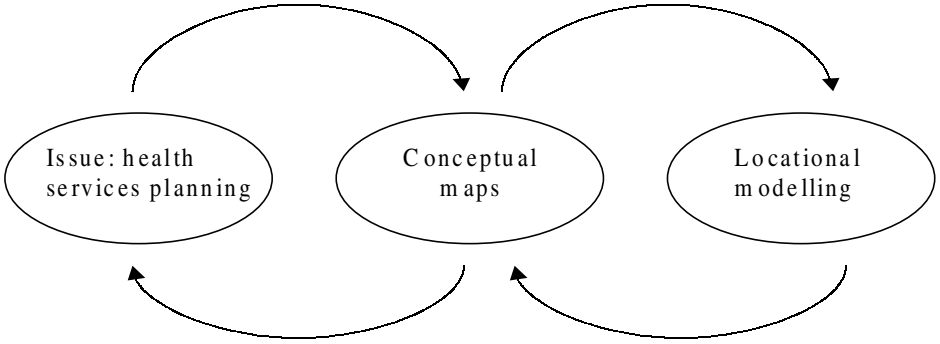


FIG 3: *Blending 'soft' and 'hard' approaches within the health services planning problem.*

The Conceptual Maps of the Health Services Planning Problem

Between February 1995 and October 1996 TFIPP conducted a community survey amongst about 12,000 people. The purpose of the study was to collect baseline data and information on health service knowledge, attitude and practice. The ORSD has also conducted a number of studies specifically aimed at understanding peoples' attitude towards the public health services (Batlama, 1997), to investigate the relationship between poverty level, health service knowledge and utilization of health services (Anwar, 1997, Saha, 1997), and to determine the effect of distance on the utilization of ambulances (Anwar *et al*., 1998). Based on these items of research, the ORSD unit has developed a conceptual map of demand and supply of health services in rural Bangladesh. There are four key elements in the conceptual map (Figure 4) which are:

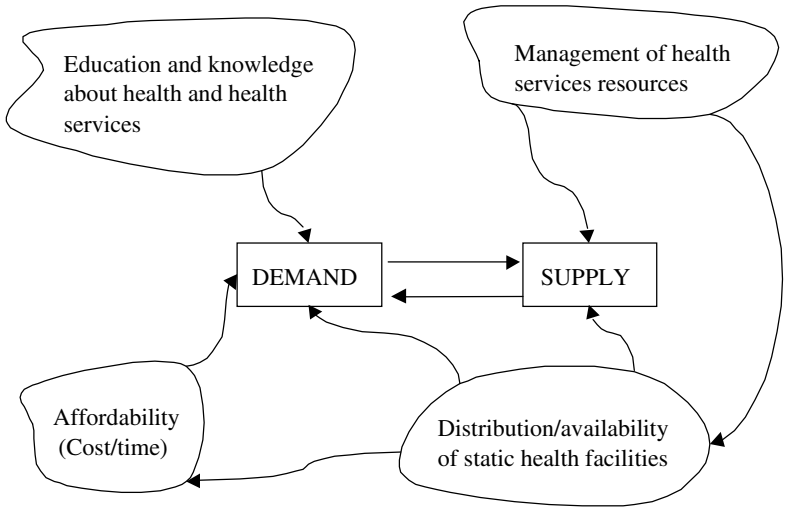


FIG. 4: *The conceptual map of the health services planning problem*

- Education and knowledge of rural people about health and health services.
- Management of resources related to health services.
- Distribution/availability of static health facilities.
- Affordability (cost/time).

This map has been further elaborated in Figure 5. The purpose of the mapping process was to understand the problem and develop knowledge about the interaction effect of the variables in the system. The elements such as education and knowledge, distribution of health facilities and affordability jointly determine the level of demand for health services. The management of the health resources element directly and indirectly through the distribution of health facility element determines the level and quality of supply of health services. While these elements affect one part of the system more than the other, the element of the distribution of health facilities affects both supply and demand. Through the mapping process the indirect impact of education and the direct effect of the management of health resources on health services became apparent to the decision makers. Most of the variables of these elements cannot be quantified and therefore intervention programmes and accountable management systems would improve the quality of health services. Some variables can be rationally quantified and these variables can be used for location modelling taking into account the government health policies. In this study an attempt has been made to model the health facility deployment system at the community level

incorporating variables such as travel-distance, affordability, location of existing facilities and availability of other infrastructural facilities and services. Therefore we concentrate on the community clinics.

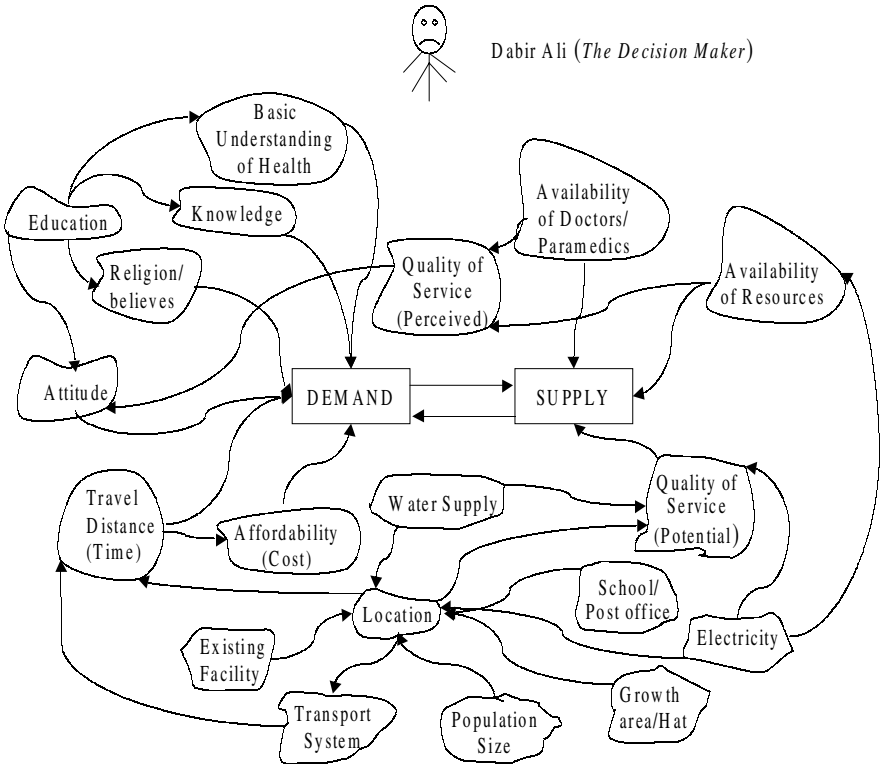


FIG 5*: The extended conceptual map of the health services planning problem*

Location-allocation models

Where should the community clinics be located? In Bangladesh, as in many developing countries, there is a strong negative correlation between the distance from a place where health provision is available and the rate of utilization of the service (Khan, 1988, Rahman *et al*., 1982). Accordingly, the location problem is more appropriately considered as a maximum covering location problem (MCLP) (Church and ReVelle, 1974) to try and ensure that as many people as possible are within a given distance of facilities. The objective in a MCLP is to maximise the population who are expected to use the facilities, and this is measured by the number who live within a given radius around a facility which provides health care using a fixed number of facilities. To try and locate the best sites, we have used the Teitz and Bart (1968) heuristic for facility location.

Government Policy and Location of Community Clinics

In a recent document, the Government of Bangladesh (MOHFW, 1998), in conjunction with the World Bank, developed some policy guidelines as to how rural health facilities be deployed. These guidelines relate to physical accessibility and population coverage.

Physical Accessibility: The Community Clinics (CCs) must be accessible within half an hour travel-time. It is perhaps simpler, from the point of view of modelling, to

think in terms of travel-distance rather than travel-time. In rural Bangladesh most people walk to service facilities. So, for most people, there is a direct correlation between time and distance. Therefore, the maximum travel-time was translated by TFIPP into a maximum travel distance. Many studies on location of facilities in developing countries have used these two, (almost) equivalent, metrics. Distance can be easily measured, and studies of the behaviour of patients allows this to be translated into a travel time. It must be remembered that in an agricultural community, attending a health centre means both the loss of income and the loss of time from one's land, which affects the whole family, particularly at certain times of the agricultural calendar. In the case of CCs, the maximum travel distance (S) was considered to be 2 km. However, in the analysis more than one such upper limit on travel-distance was considered in order to find its effect on the population coverage and number of facilities.

Population Coverage: With respect to the level of coverage by one CC, the Government has suggested three service delivery options. These are:

1. One CC per 1500 population
2. One CC per 3000 population, and
3. One CC per 6000 population.

The coverage issue was discussed amongst Government planners and decision-makers in a consensus building workshop, where the task was to identify the best service delivery option. However, no concrete suggestion came out as to which alternative option is to be considered for implementation. It would be appropriate to argue that the coverage issue should not be looked at in isolation, rather be analyzed in conjunction with the maximum travel-distance.

In the analysis which follows, in addition to the Government's policy guidelines, we also employed the following assumptions and constraints:

Village size: While carrying out the survey in the study area it was evident that neither the local people (users) nor the health authority (providers) would accept location of facilities in very small villages. Locating desirable facilities where a village population exceeds some threshold has often been used in similar studies of developing countries (Patel, 1979, Moore and ReVelle, 1982). There is no set rule or guideline of the Government of Bangladesh on the population that a village must have to be chosen as a facility site. However, the previous locational decisions show that all the existing CC sites had more than 1000 people. In this study we have considered a village as a feasible facility site for a CC provided it has a minimum population of 1000 people.

Uncapacitated facility: CCs are meant to organize immunization activities, treat diarrhoeal diseases and fever cases, and work for the family planning programmes in the rural areas. Since these are outpatient facilities, no constraint has been imposed on their capacity. However, in this study, the variation in the demand for services among the facilities has been reduced by including a minimum population constraint for a village to be a potential centre. Since it is uncommon for several large villages to be close together, the demand will tend to come from one large village and the

sparser population around it. Any further variation of workload could be handled by allocating health personnel according to the demand at the facilities.

Other facilities: In addition, the presence of electricity and acceptable water supplies were considered as other criteria for feasible CC sites.

Study Area Profile

The initial plan of this study was to deal with the problem of locating Community Clinics in three unions such as Lokhpur union (Thana Fakirhat, District Bagherhat), Pairaband union (Thana Mithapukur, District Rangpur) and Bakshimul union (Thana Burichaung, District Comilla). However, because of data problems, the locational analysis of CCs was conducted only at Lokhpur union. It is one of nine unions in Fakirhat Thana, situated towards the centre-western part of the Thana and only 8 kms from the division headquarter Khulna. Its close proximity to metropolitan Khulna and a good communication with Bagerhat and Port Mongla has given the union a different characteristic with respect to socio-economic acitivities. The study area has a total population of about 17 thousand persons of whom about 36% are considered to be literate. Agriculture is the main economic activity in this area. At present, one HFWC and six CCs provide health care to the local people. There are 9 primary schools and 2 high schools in the study area.

Lokhpur union consists of nine mouzas/villages. The mouzas were identified on a 1:8-scaled map produced by the Health Assistance of Lokhpur union. The networks of roads and rural footpaths in the area was updated on the map with the help of the head surveyor. Each link on the network was identified and measured and this data was used to compute a 9x9 distance matrix using a shortest path algorithm.

Locational Analysis of Community Clinics

Taking into account the government policies and other constraints (mentioned above), the following analysis was done:

1. *Maximum travel distance = 2 kms and minimum population = 1000 people.*

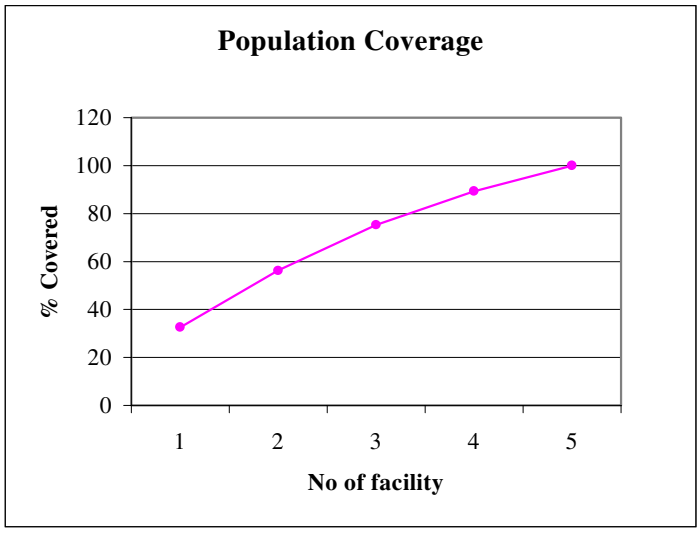


FIG. 6: *Trade-off curve*

The results of the analysis is shown in Figure 6. It shows that only 4 CCs are required to cover 90% of the population in the union within 2 kms travel-distance. An extra CC will supply health care to the remaining population. With these solutions, the workload at the clinics varies between approximately 2400 and 4800 people.

2. *Maximum travel distance = 3 kms and minimum population = 1000 people.*

The results are presented in Figure 7. The health delivery system with only 2 CCs would be able to cover about 96% of the population.

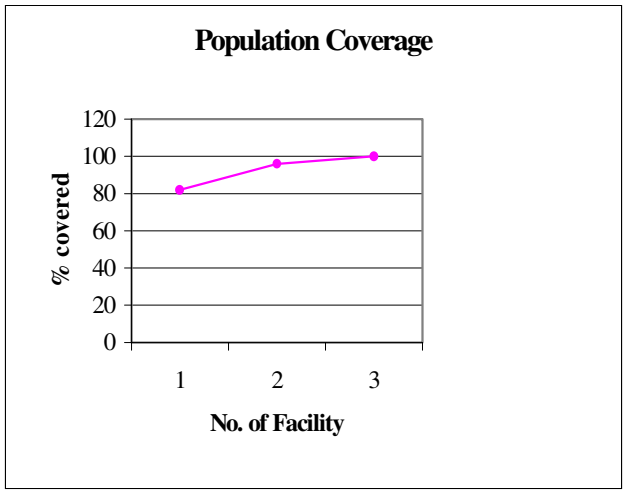


FIG. 7*: Trade-off curve*

3. *Maximum travel distance = 1.6 kms (1 mile) and minimum population = 1000 people.*

The results are presented in Figure 8. The optimal location of 6 CCs can cover about 96% of the population in the union.

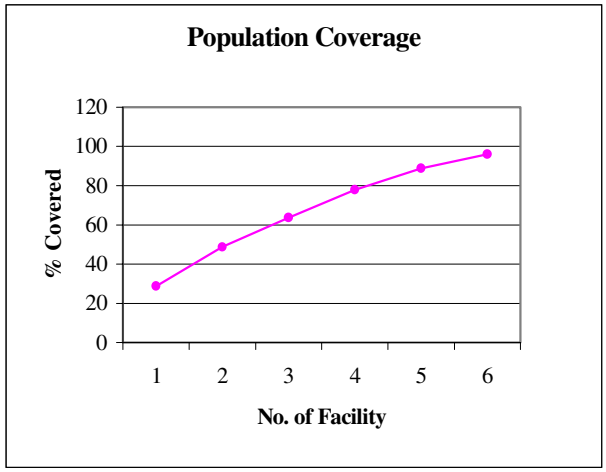


FIG. 8: *Trade off curve*

The analysis shows that if travel-distance is increased by 33% (from 2 kms to 3 kms), the number of CCs is decreased from 5 to 2 for approximately the same population coverage. Also, when the maximum travel-distance is reduced by half (from 3 kms to 1.6 kms), the number of CCs required increases from 2 to 6 for the same population coverage.

Conclusion

No method or methodology is able to offer a complete view of the complexities faced in projects. Each may provide insights that are useful for reflection and action. Many researchers have demonstrated that the blending of 'soft' and 'hard' methods produce richer picture for understanding complex relationships which leads to a better decisions (Pidd, 1996, Ackermann *et al*., 1997, Wolstenholme, 1999). In this study OR models were applied in conjunction with systems methodology to locate health facilities at the community level. First a conceptual map as a systems methodology was developed to learn about the problem, to identify variables interacting in the health system and to determine what affects the quality of services. Some of these variables were then considered so as to formulate a maximum covering location problem (MCLP) as an optimisation model to find suitable sites for health facilities in rural Bangladesh.

The analysis has suggested several sets of solutions with respect to the location of CCs for efficient delivery of heath care. Clearly, the objective of the study was not to find a single optimal decision, rather to develop and test feasible decision processes in the light of the government's health policies. The results, therefore, should be regarded as an aid to the local health planner's intuition and not as a total replacement for it.

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