DEMOGRAPHIC AND SPATIAL ASPECTS OF THE HEALTH CARE DELIVERY SYSTEM IN MALAWI

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ABSTRACT: The central objective of this paper is to assess the demographic and spatial aspects of the health care delivery system in Malawi. Using the most recent data from the Ministry of Health of the Government of Malawi and other governmental agencies, the paper examines the provision of health care facilities in relation to population distribution and the relative accessibility of the services taking into consideration the distance factor. The policy implications of a rapidly expanding population on the provision of adequate health care facilities are also highlighted. The paper concludes that the health care delivery system in Malawi has deteriorated during the post-independence era as evidenced by the prevailing high rates of basic social indicators such as infant and maternal mortality. There is also strong evidence to suggest that there are striking regional inequalities in the provision of health care facilities.

INTRODUCTION

As Meade, Florin and Gesler (1988) note, a health care delivery system consists more than ill people and the practitioners who diagnose and treat illnesses. The system, if it is to be successful in its objectives, should also try to enhance health. Prevention, a healthy care environment, and good relationships between patients and medical personnel are also essential components of a health care system (Schaefer 1974, Gesler 1984, Meade et al. 1988). While realizing that a health care delivery system is a complex entity which consists of disease complexes as well as a number of factors such as governmental system, economic system, cultural system, resources, environment, etc., plus the interplay among all these, the main focus of this paper is to briefly assess the demographic and spatial aspects of the health care delivery system in Malawi.

Specifically the paper examines the current structure of the health care delivery system in Malawi within the Central Place Theory framework or spatial/functional organization of facilities. The basic question under examination in this paper is the extent to which regional inequalities in the distribution of health care resources exist in the country. Using the most recent available data from the Ministry of Health (MOH) of the Government of Malawi and other governmental agencies, the paper discusses the provision of health care facilities in relation to population distribution and the relative accessibility of the services. The policy implications of a rapidly expanding population on the provision of adequate health care facilities are also highlighted.

Located in southeastern Africa astride the Great Rift Valley of Eastern Africa, Malawi is one of the poorest countries in the world. In terms of the World Bank's basic economic indicators Malawi is ranked sixth from the bottom of the list of Third World African states (World Bank 1990). The per capita GNP in 1989 was estimated at US$240.00. Based on the 1977 mortality conditions, the life

expectancy at birth is estimated at 45 years. Although mortality rates have been declining, albeit slowly, fertility rates have remained stubbornly high. The total fertility rate, which is the average number of children that a Malawian woman would expect to give birth to if she experiences the 1977 fertility pattern throughout her reproductive years, is estimated to be 7.6 (NSO 1984). The population growth rate, estimated at 3.6 percent, is among the highest in the world. This growth rate translates into a population doubling time of less than 19 years. Considering the country's relatively poor resource endowment, it is unlikely that the living and health standards of the majority of the people in the country will improve unless the rapid rate at which the population is growing is curbed.

DEMOGRAPHIC TRENDS

Since independence in 1964, Malawi has more than doubled its population from 4 million in 1966 to an estimated 8.75 million in 1992 (NSO 1984 and 1987). The final results of the 1987 Population and Housing Census give a total of about 7.98 million persons as compared to 5.55 million in the 1977 census. This implies that the total population had increased by 44 percent during the 1977-1987 intercensal period with an implied intercensal annual population growth rate of 3.6 percent, considerably higher than the previous 1966-1977 intercensal growth rate of 2.9 percent. The large influx of Mozambican refugees into Malawi during the past decade is partly to blame for the high population growth rate (Morna 1988, House and Zimalirana 1992b). But even if the refugees, numbering about 1 million, were excluded from the computations of the growth rate, it would still be high by African and world standards at a level of 3.3 percent.

As far as the spatial distribution of population is concerned, Malawi is one of the most densely populated countries in Africa, at 85 persons per square kilometer in 1987. This is the fourth highest population density figure in Africa. Administratively, the country is divided into three regions (Northern, Central and Southern) and twenty-four districts (counties). There are marked regional and district variations in population density in the country. For example, in 1987 the densities varied from 34 in the Northern Region to 88 in the Central Region to 125 in the Southern Region (NSO 1991). At district level the range in densities is even greater, from 16 persons per square kilometer in Rumphi district in the Northern Region to 300 persons per square kilometer in Blantyre and Chiradzulu districts in the Southern Region. When arable density is used, population pressure is even heavier.

The composition of the population itself is heavily skewed towards the younger age-groups. In 1987, 48 percent of the total population was under the age of 15, as compared to 45 percent in 1977 and 44 per cent in 1966 (Kalipeni 1992). A very young population such as this one results in a high dependency ratio. In 1966 the dependency ratio was 92 dependents per 100 persons in the economically productive 15-65 age group. In 1987, the ratio had risen to 103 dependents for every 100 persons. The significance of this large contingent of young people can best be appreciated in terms of pressures it imposes upon the social and demographic system. As will be discussed below, Malawi has failed to achieve its economic and health provision goals. What is gained by technological development is absorbed by the high consumption rate of an expanding population. With so many dependent young people who are vulnerable to the vagaries of an unforgiving environment, the country's health and educational facilities have become overburdened. The failure to provide adequate educational and health facilities is reflected in the low rate of literacy, estimated at 25 percent and a high infant mortality rate, estimated at 151 infant deaths per 1,000 births (Kalipeni 1993).

HEALTH STATUS OF THE POPULATION

Many of the environmental and cultural factors associated with ill health elsewhere in Africa are also present in Malawi. As noted in the preceding section, the mildly warm tropical environment of Malawi encourages a host of micro-organisms, disease agents and insect carriers, which are responsible for killing or debilitating thousands of Malawians, especially children. The varied micro-climates in the country favor the presence of important vectors such as mosquitoes which make malaria difficult to control, the water snails that transmit bilharzia, and the flies that transmit onchocerciasis, to mention a few (Teesdale, Chitsulo and Werler 1983, Kalipeni 1985). The high population densities which have resulted in degraded environments, massive soil erosion and acute shortages of arable land mean that agricultural output in many areas is inadequate to meet basic subsistence needs. The end result has been widespread malnutrition in the country (Msukwa 1984).

The Government of Malawi concedes that, with an infant mortality rate of 151 per thousand, a crude death rate of 21.8 per thousand, and an estimated life expectancy of 45 years, the current health status of the population is unsatisfactory (Malawi Government 1986, p. 112). Females in Malawi report a large proportion of children who die by the time they reach various ages of childhood. For example, by the time children reach an age of 5 years, about three-tenths of all the births have died; and by the time they reach 10 years about one-third of the total births have died (NSO 1984, p. 54). These high losses imply a very low expectation of life. In general, relatively few diseases are responsible for the bulk of infant's and young children's death. In terms of Omran's (1971) epidemiologic transition, the major causes of death among infants and children are still largely infectious and nutritional diseases.

In a recent study of the determinants of infant mortality in the country, Kalipeni (1993) has identified significant regional differentials in infant mortality rates. There is a clear cluster of spectacularly high infant and childhood mortality in the districts of the Central Region, particularly Mchinji, Dowa, Salima, Dedza, Kasungu and Lilongwe with infant mortality rates ranging from 185 to 228 infant deaths per 1,000 births. From these districts, infant mortality levels fall progressively in the Northern and Southern Regions. Districts in the Northern Region have some of the lowest infant mortality rates in the country with Chitipa district's rate of 106 as the lowest in the country. The results in Kalipeni's (1993) study also indicate that, at the regional and district levels, the variation of infant mortality is strongly associated with a number of demographic and socioeconomic variables such as female education and age at first marriage of females.

Adult mortality, is also quite high by African and world standards. Results of the 1977 census gave a crude death rate of about 25 per 1,000 population per year. Recent estimates indicate that the crude death rate has declined considerably to 21 deaths per 1,000 people (NSO 1984, 1991). It is estimated that on the basis of derived age sex patterns of mortality prevailing in Malawi during the 1977 census, males and females are expected to live approximately 38 and 41 years respectively. Recent data shows that life expectancy has increased to 43 and 46 for males and females respectively. At the regional level, the three regions of the country present a markedly different picture of the level of mortality in the general population. As measured by crude death rates, the probability of dying and life expectancy in 1977, the Northern Region had the lowest level of mortality among the three regions with crude death rates of 22 and 18 for males and females respectively. The Central Region had the highest with crude death rates of 31 and 27 for males and females respectively. The Southern Region, with crude death rates of 25 and 21 for males and females respectively, occupied a place in between, but closer to the Northern Region than to the Central Region. Recent data from the 1987 census confirms the persistence of these regional differences in the status of health as measured by infant and adult mortality.

The most recent scourge to hit the people of Malawi is the AIDS epidemic. The speed and intensity of its spread have reached alarming proportions in the country. Within 5 years of its start in 1985, over 7,000 AIDS cases had been reported, of which most had already ended in death (World Bank 1992; House and Zimalirana 1992a). Nationwide data on seroprevalence are not yet available although efforts are underway to measure the scale and characteristics of the epidemic. Prevalence estimates for around 1992 range from 8 to 10 percent for the adult population, compared to 7 percent for Uganda. If the higher estimates were to prove correct, Malawi would rank among the world's most heavily affected countries.

In short, the health status of the population of Malawi is dreary. Preventable communicable diseases and poverty-linked disorders related to poor environmental sanitation are the main causes of ill health and the high mortality rates. The rising incidences of promiscuity, particularly in urban areas, have cultivated a fertile ground for the uncontrollable spread of the AIDS pandemic. However, as noted above, infant mortality, crude death rates and life expectancy exhibit marked regional variations. It is important that the underlying factors behind these regional variations should be clearly researched and understood in order to effectively combat ignorance, poverty and disease in the country. Such an undertaking is beyond the scope of this paper.

SPATIAL ORGANIZATION OF THE HEALTH CARE SYSTEM

This section is primarily concerned with the spatial aspects of the health care delivery system in Malawi. On paper, the Malawi health care delivery system closely resembles Central Place Theory - - a complex geographic concept applied to the delivery of goods and services in general. Shannon and Dever (1974) showed how health care delivery systems can be modeled and then compared to actual systems using the tenets of Central Place Theory. The basic ideas are familiar to geographers: threshold and range, spatial/functional organization, and hierarchies of central places. As Gesler (1984) notes, the model is generally applied to facilities which deliver Western care. Services range from lowest order aid posts up through highest order teaching hospitals. Each service requires a certain threshold population to be viable and provides health care over a corresponding range or territory. In theory, each level of services is provided by facilities spread evenly throughout an area. Of course there are many distortions to this model caused by such factors as uneven population distribution and geographic barriers.

In Malawi the health services are centrally directed by the Ministry of Health. Although the Ministry of Health is the largest health service provider in the country, the 13 church denominations in Malawi provide more than 40 percent of the health services. The Ministry of Health (MOH) is responsible for the development of working objectives, plans, and strategies within the government's overall health goals. The working objectives of the MOH are derived from the government's national health goal which is "to raise the level of health of all the people of Malawi by providing a network of sound health facilities capable of reducing disease, protecting life, promoting better health, increasing productivity, and ultimately, promoting well being." (Malawi Government 1986).

The existing health services are delivered at 6 (spatial) levels of hierarchy, namely, health posts, health sub-centers, primary health centers/rural hospitals, district hospitals, central hospitals, special hospitals (UNFPA 1983). Each district has a district hospital. Two of these, in the cities of Blantyre and Lilongwe, have been designated central hospitals, and one, in Zomba, is a general hospital. One level below the district hospitals is a network of 41 primary health centers, each of which is supposed to serve a population of 50,000 people and provide support and supervision to four adjacent health subcenters. The services provided at primary health centers vary. The established

standard services include basic curative services, taking care of referrals from outreach posts, pre-natal, natal and post-natal care, well-baby care, nutrition clinics and all outreach services. On the other hand the subcenter, serving a population of 10,000, is the basic health facility and the base for the provision of primary health care and health education. Health posts, the most peripheral units, are sometimes located in public buildings, such as schools.

Data for 1989 indicate that there are only 48 district level hospitals and 41 primary health centers that are supposed to serve the 8.7 million people in the country. Under the principles of Central Place Theory, in order to provide adequate health services at a population threshold of 50,000 per primary health center, there would be need for an additional 85 primary health centers. Similarly the number of subcenters and health posts would have to be increased from current levels just to meet the basic needs of a rapidly expanding population. The idea of a well structured hierarchy of health facilities is excellent, but the issue at stake is whether these facilities are adequate in meeting the basic needs of the population. In the following sections we analyze available data to determine whether there exists spatial inequality in the distribution of these services in relation to population distribution as well as accessibility.

SPATIAL INEQUALITIES AND ACCESSIBILITY ISSUES

When looking at the spatial organization and distribution of facilities, a basic question one needs to ask is whether there is equality or inequality. One also needs some standards of equality to compare with actual distributions. A number of measures have been developed in the sub-discipline of medical geography to this end. A simple type of standard -- the Hill-Burton idea -- requires that doctor/population ratios or hospital bed/population ratios be approximately equal across certain spatial units (Gesler 1984). One-way analysis of variance can also be used to measure the extent of equality in the indicators across regions or districts. These are some of the techniques employed in this section to measure the extent of regional inequality in the provision of health services in Malawi. It must also be realized that there are inherent flaws in most of these techniques since the geographic unit of analysis, in this case district, is itself arbitrary. There is need for a comprehensive study of the location of health facilities in Malawi in relation to the population served in order to demarcate areas of service and identify those areas that are underserved by the current distributional pattern of health services.

As noted above, there were 48 district hospitals, 41 primary health centers, 219 full health subcenters, 309 dispensaries, 91 maternity centers and 31 health posts. The district hospitals are more or less evenly distributed across districts with at least 1 in each district. However, there are marked district and regional inequalities in the distribution of the other facilities. When the spatial distribution of the facilities is assessed in terms of the number of people served by each facility and the population per hospital bed, the results indicate that the standards set in the 1973 "National Health Plan for Malawi" are far from being attained 20 years later (see World Health Organization 1973 for the plan).

In 1989, only one district, Rumphi in the Northern Region, met the 1973 planned standard of one primary health center per 50,000 persons. The rest of the districts in the country were far from achieving this. However, 1983 data showed that 7 districts, most of them concentrated in the Northern Region had populations of less than 50,000 persons per primary health center (Malawi Department of Town and Country Planning 1987, p. 231). In other words it is becoming more and more remote to achieve the goals set forth by the government of Malawi twenty years ago. In general terms as depicted by rankings of population/facility ratios (data not shown here), districts in the Northern Region have better population/facility ratios than those experienced by districts in the Central and Southern Regions.

A simple one way analysis of variance confirms the existence of regional imbalances in the distribution of population/facility ratios (Table 1). For example, the F ratio(s) in Table 1 indicate that population per hospital bed is significantly smaller in the Northern Region than the Central and Southern Regions. This is also true of population per district hospital and population per primary health center. The regional differentials of population per health subcenter were not statistically significant although the Northern Region was still in a favorable position compared to the other two regions. In most instances, the Central Region appears to have the worst ratios. Thus, apart from the Government's failure to meet its own standards in the provision of health facilities using Central Place Theory's guiding principles, the available facilities are inequitably distributed across region and district.

Maldistribution of health facilities is not the only problem. There is also the problem of accessibility to the few facilities. One of the important objectives of the Ministry of Health's plan is to improve access to modern health services. In the plan accessibility is seen mainly in terms of walking distance as walking is the most common means of transport for at least 90 percent of the total population. Indeed, in developing countries many people, perhaps the majority, walk to obtain health care (Jackman 1972) although many other forms of transportation are used as well (e.g. buses, bicycles, boats, motorcycles, etc.). Apart from one comprehensive survey conducted by the Malawi Department of Town and Country Planning in the early 1980s in preparation for the national physical development plan, data on accessibility to health facilities is virtually non-existent.

Based on the sample survey carried out in various parts of the country by the Malawi Department of Town and Country Planning, 89 percent of people who reported visiting an under-five clinic travelled by foot; in the case of visits to dispensaries and hospitals 82 percent and 36 percent respectively went by foot (Malawi Department of Town and Country Planning 1987). For those visiting hospitals the most common mode of transport was travel by bus, which accounted for 39 percent. Those walking to health facilities tended to travel considerably longer distances beyond 5 kilometers although generally not beyond 50 kilometers. Of the respondents travelling by foot to under-five clinics, 34 percent walked beyond 5 kilometers to reach the clinics. The corresponding figures for dispensaries and hospitals were 44 percent and 67 percent respectively. The data from this clearly indicate that the majority of the people are not within easy reach of the health facilities.

IMPLICATIONS OF RAPID POPULATION GROWTH

As noted earlier, any efforts at trying to meet the basic health needs of the people of Malawi are likely to be frustrated by a rapidly growing population. Social services such as health and educational facilities not only directly improve welfare and living standards, but also make an essential contribution to the development of human capital, itself a major factor in the speed and effectiveness with which a country can develop (World Bank 1992). At current population

Table 4. One Way Analysis of Variance of Health Facilities in Relation to Population by District with Region as Class Variable.

Variable	Region	Mean	F Ratio[a]
Population per hospital bed	Northern	433	5.18*
	Central	780	0.01486
	Southern	698	
Population per district hospital	Northern	112,519	4.06*
	Central	230,013	0.03237
	Southern	178,677	
Population per primary health center	Northern	86,855	5.89*
	Central	182,249	0.00930
	Southern	311,158	
Population per health subcenter	Northern	20,896	0.84
	Central	43,827	0.44764
	Southern	104,167	

Notes: [a] First value in each cell of this column is the F ratio and the second value is the probability value at which the F ratio would be statistically significant.

* Implies F ratio is significant at the 5% level of significance.

growth rates, maternal and child health clients will treble over the next 30 years if fertility does not fall in the near future (World Bank 1992; Srivastava 1989). With no change in fertility the annual budget allocations to health services would have to grow at between 3.5 and 4 percent per year. A moderate or rapid decline in fertility would mean huge savings of health expenditures allocated to merely keep up with population growth and such savings could be meaningfully used to expand service coverage and improve quality.

From a spatial and social equity perspective, the impact of rapid population growth on social services would adversely affect the poorest families in Malawi. Since such families tend to live furthest away from schools and health facilities, they are the last to be reached if service expansion is constrained by lack of funding, and the first to suffer from any enforced cuts in coverage or service quality (World Bank 1992). Similarly, since their incomes are lowest, they also tend to suffer most if attempts are made to introduce fees for the health facilities (World Bank 1990).

Srivastava (1989) has estimated that by the year 2002 the health facilities will have to be developed to the order of 70 percent just to cater for the needs of the increased population at the same

quality of service as in 1987. Growth of the population in the various age categories during the new health plan period of 1986 to 1996 is expected to be between 32 and 35 percent. The reported number of general (non-maternity) beds in various health units of Malawi in 1986 was 7,699. This implied the availability of just over one bed per 1,000 estimated population in 1986 or about 8 beds for every 100 square kilometer of land area. Srivastava (1989) calculates that to maintain the service level of 1986, by the years 1995 and 2000, the need for non-maternity beds in Malawi as a whole, as a result of population growth alone, will go up to 10,049 and 11,940 respectively (i.e. increases of 30.5 and 55.1 percent respectively). These calculations are also true for maternity beds.

In terms of budgetary provision, the estimated expenditure on the provision of health services by the Ministry of Health was K45 million in 1986. This expenditure in per capita terms was K6.18 or US$1.50. Using the same per capita expenditure and taking the size of population into account, the estimated annual budget for 1996 is K123 million, allowing for an inflation rate of 7 percent per annum (Srivastava 1989; Kalanje 1989). Thus, the Ministry of Health would have to come up with an additional K71 million in 1996 in order to provide the 1986 level of health to the population of Malawi. It is clear that population growth will continue to play a major role in the decline of the quality of health services in Malawi. With a poor resource base, it is doubtful that the government will be able to provide the same level of service in the future as today. Indeed, evidence indicates that the health care infrastructure is on the decline largely due to lack of funding and rapid population growth.

CONCLUSION

The discussion in this paper clearly paints a bleak picture for the health care delivery system in Malawi in the years to come. According to the epidemiologic transition, Malawi, like many other countries in the developing world, finds itself trapped on the borderline between the first stage of the transition, the age of pestilence and famine, and the second stage, the age of receding pandemics. While mortality rates have experienced a considerable decline during the past 30 years, there is no guarantee that they will continue to decline or remain at current levels. The brief analysis in this discussion indicates that modern health care facilities in the country are inadequate on two fronts.

First, basic indicators of health care provision have not been able to achieve the standards set forth in the health plan of the Government of Malawi that was launched twenty years ago. For example, population/facility ratios are higher today than they were 10 years ago. Generally there are over 100,000 people per a primary health center, twice the 50,000 people per a primary health center set in 1973. Although the budget allocation for health activities has increased from a low of 3.3 percent to well over 7 percent of the total budget allocation, the government has failed to provide adequate health facilities largely due to a rapidly expanding population that is doubling its size every 20 years or less. Second, there are conspicuous regional imbalances in the provision of health care facilities. The districts in the Northern Region have more facilities per capita compared to districts in the Central and Southern Regions. The Central Region has some of the worst population/facility ratios in the country. It is no wonder that basic indicators of health such as infant and adult mortality rates are highest in the Central Region in comparison to the other two regions. Life expectancies for districts in the Central Region are far below the national average.

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