

of the Philippines, Development Academy

**Working Paper**

## Health Manpower: Profile, Stock and Requirements

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Philippine Institute for Development Studies

## Health Manpower: Profile, Stock and Requirements

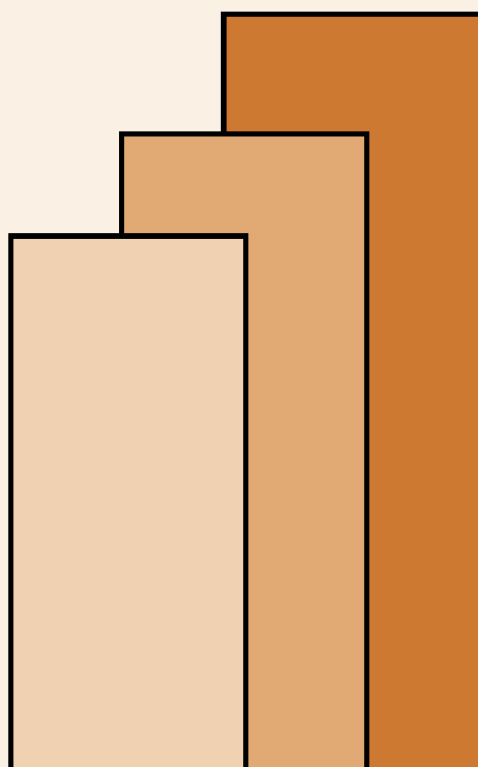
*Development Academy of the Philippines*

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November 1995

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# **HEALTH MANPOWER: PROFILE, STOCK AND REQUIREMENTS**

**Development Academy of the Philippines<sup>1</sup>**

## **I. INTRODUCTION**

### *A. Rationale*

The main social objective of the World Health Organization (WHO) and of its Member states is the attainment by all the peoples of the world by the year 2000 of a level of health that will permit them to lead a socially and economically productive life. Correspondingly, the ultimate goal of the Department of Health (DOH) is the attainment of **Health for All Filipinos by 2000**. This objective is in line with the present administration's goal of poverty alleviation and people empowerment since health is regarded as an indispensable concomitant to socio-economic development.

In realizing the goal, resources should be efficiently mobilized and effectively utilized. Of all the resources for health, human capital is assuredly the most important and crucial, for on it depends all forms of health care.

Notwithstanding the great importance attached to health manpower and the recent efforts of the DOH to address health manpower development with the creation of a health planning body, little importance has been paid to this sector.

Data on the number of health workers who are working in the Philippines are fragmentary, although the Professional Regulations Commission (PRC) has a list of ever-registered professionals. Likewise, there are no reliable data on the number of health workers leaving the country on a temporary or permanent basis.

Strange but true, the country has produced more than 65,000 doctors during the century, yet up to now many Filipinos die without ever seeing one. And despite the fact that doctors are one of the highest income earners among professionals in the country, their exodus continues unabated. (Sanchez, 1988).

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<sup>1</sup> This study was prepared by Ma. Virginita Alerta-Capulong, Angelo C. Bernardo, Anne Rose D. Cabuang, Eduardo T. Gonzalez, Augusto S. Rodriguez, Rowena N. Termulo, and Jesse M. Tuason.

In the Philippines where preventable deaths and illnesses can usually be traced to the absence of a medical worker in the area, health manpower planning is vital not only for the efficient utilization of the existing health manpower but also for the training and more equitable placement of future manpower resources. Thus, this study will provide basic data and information on the status of health professionals in the country. These data will serve as inputs not only for health manpower planning, but more importantly, for the preparation of a rational health care financing scheme appropriate for the country.

An inventory of the existing manpower personnel and an analysis of the factors affecting health manpower supply and demand will aid policy makers in planning and providing market incentives to correct manpower imbalances and ultimately achieve an efficient health care financing system.

### *B. Objectives of the Study*

The objectives of the study are:

1. To prepare an inventory and present a profile of physicians, dentists, nurses, midwives, medical technologists and pharmacists;
2. To determine the respective requirements for these health manpower categories;
3. To come up with their corresponding supply-demand projections and to analyze supply-demand gap with reference to factors affecting the supply and demand of health manpower;
4. To examine the main factors affecting the supply of and requirements for health manpower;
5. To analyze regional manpower imbalances and determine the factors which result in regional maldistribution;
6. To provide an overview and assessment of the functions of each type of manpower in each institutional setting (private or public) and analyze the level of skills and training required and acquired, subject to data availability; and
7. To recommend appropriate policies to correct imbalances, and assess relative efficacies in solving the imbalances.

### *C. Review of Related Literature*

The World Health Organization (1991) notes two prominent issues in the area of health human resource. It states that great disparities still exist within countries, especially between urban and rural areas, and between countries. Some developing countries export a large number of medical personnel while in other countries unfavorable population:physician ratios persist, especially in rural areas. The other issue is that the training of health personnel, including medical doctors, is still not sufficiently oriented towards primary health care, and career prospects and salaries in government service are often not sufficiently attractive to retain staff and to induce them to work in those areas where they are most needed.

Several foreign studies have investigated various methods of tracking these problems while local researchers are just about scratching the surface.

Feldstein seeks to explain effective economic demand for manpower. He came up with an overview of the medical care sector showing the sequence of interplay of three major medical care markets: a set of educational markets which determines the demand and supply of health manpower schooling; a set of manpower and factor markets which influence institutional demands for, and supply of, manpower, capital and other factors; and a set of institutional markets which deals with changes in the demand for and supply of institutional settings.

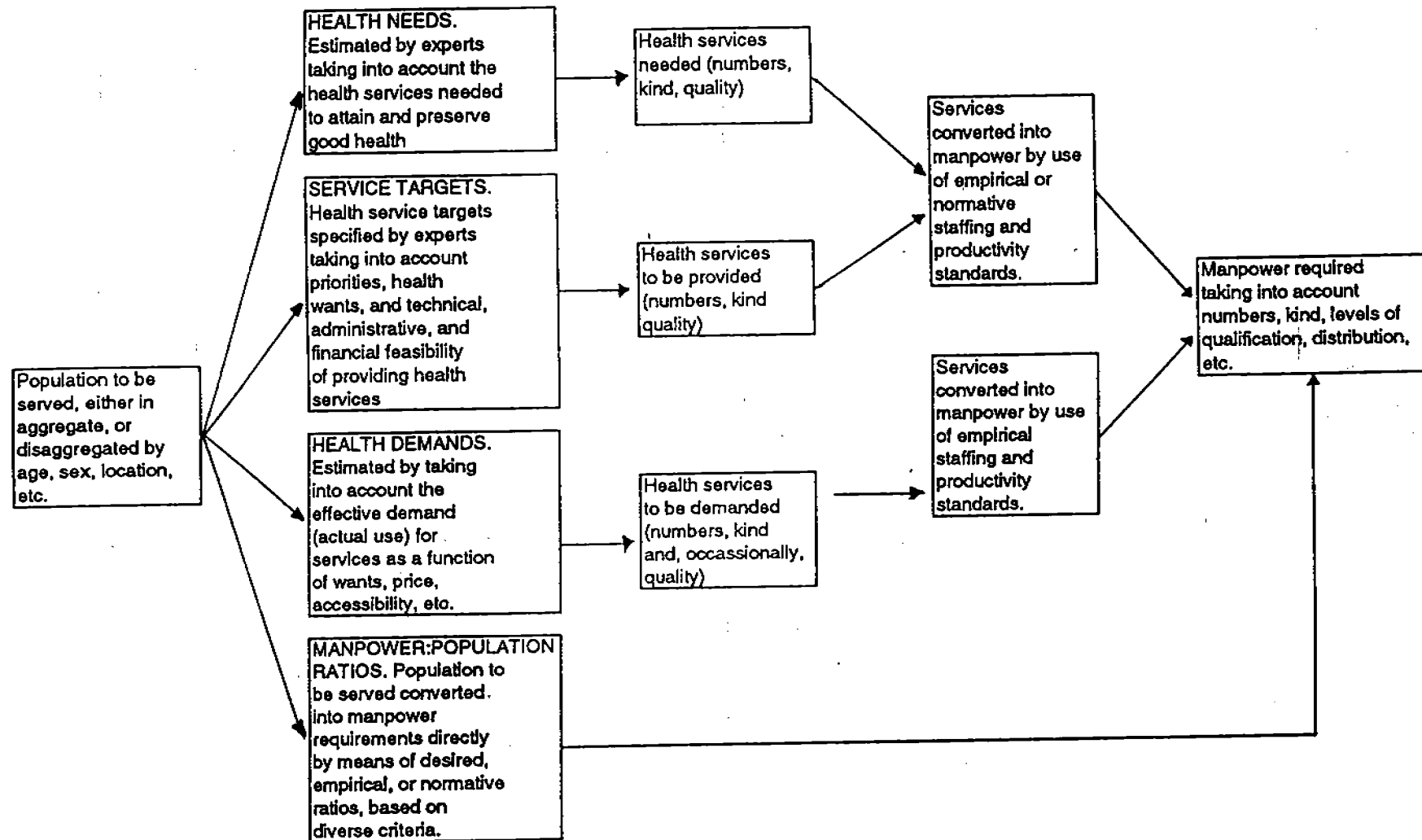
The performance of each of the separate markets in the medical care sector influences each of the other markets. On the demand side, initial demands by households (or patients) are expressed by going to a physician. The physician as a decision maker selects one or more of several settings (hospital, rural health unit, private clinic, home) which is based on the relative prices of each setting, the relative cost of each to the physician, and the efficacy of each in treatment. On the other hand, the demand for institutional care is determined by patient demand factors, physician considerations, the relative price and the quality of care obtained in the different institutional settings.

The demand for a particular health manpower category depends upon factors relating to the patient's demand for the institutional settings in which that manpower group is employed, the wages of the group, and the relationship of their wages to those of other health workers. Meanwhile, the demand for a health professional education is determined by the expected income and wages that might be earned and by non-economic motivating factors.

In addition to health or economic demand, Hall (1980) describes three other methods of estimating demand for health manpower, namely: health needs, service targets, and manpower to population ratio. The definitions are shown in the Figure I.1; comparative advantages can be found in Appendix A.

On the supply side, the markets work as follows. The supply of health professional educational institutions and the demands for such education determine the number of graduates and the tuition rate to be charged. The continuing flow of health graduates plus the existing

Figure 1.1 - Schematic Representation of Four Methods of Estimating Manpower Requirements



stock comprise the supply of health manpower. The supply of each group of manpower, considered in connection with the demand for such group, configures incomes, wages, and participation rates. The outcomes of the health manpower markets will affect the supply of services offered in different institutional settings. Theoretically, the cost of providing care in given institutional setting will rise as the wages for a given manpower group rise and as more members of that manpower category are used to provide care. The amount of care provided is determined by the costs of providing care together with the demands for care in each institutional setting. This is the outcome of the institutional markets.

Methods for characterizing workforce supply and developing projections are discussed in Hall (1978). He argues that detailed information obtained from a sample of health professionals is more helpful than a superficial profile of an entire health manpower category. He considers estimation of manpower losses over time based on cohorts of graduates the best method, but suggests an approximation based on other countries' experience if data are lacking. The likely output of medical and allied health schools, intra- and extra-school attrition and immigration of foreign health professionals have to be factored in to project increments to stock.

Smith, Reinhardt and Andreano (1979) cautions against too much reliance on exogenously determined point estimates of health workforce requirements for policy actions. Delegations and partial substitutions that do occur between health professions make estimates and forecasts of supply and requirements especially tenuous. A parametric model that can work out forecasts by simply putting in assumptions, even if arbitrary, about the various parameters involved is suggested for policy-making. Hall (1978) agrees with this perspective, acknowledging that predictions are bound to be proved wrong such that the test of a good workforce projection is not how close it is to reality but whether the actions resulting from the projections are ultimately beneficial.

The choice of method that would properly apply to the conditions in a particular country should be determined by the extent of government involvement in health care planning and delivery, the past experience in health manpower production and utilization, the quality of data and planning capabilities and the degree to which assessment results will be consonant with the socio-economic and political realities in a country. Stevenson (1988), putting it another way, contends that the usual choice is not which single method to use but what combination of methods would be appropriate.

Further on methodology, Chorny (1973) assesses several mathematical models being used in health manpower planning and how they apply in the Latin American context. The Feldstein-Kelman Model computes demand based on the production of five services: hospital days, nursing home days, visits to the doctor's offices, visits to the outpatient clinics, and home care. Stock is estimated taking into account graduations, migrations and variations in personnel activity rates. Using Markov chains, the Navarro Model postulates that individuals can be positioned in a state-of-care continuum and calculate the probability of an individual passing from one state to another. Demand is calculated based on the type of services for a particular state of health, the number of persons in this state, and manpower productivity. Despite the logic of the



model, however, the author is not convinced it is practicable in developing countries because of the high level of research technology required. He prescribes replacing technological sophistication with "intellectual boldness" in research in this field.

Reyes and Picazo (1990) analyzed secondary data on the stock of and requirements for physicians, dentists, nurses and midwives in the Philippines. The discussions focus on health manpower stock as of 1987, supply forecast until year 2000, estimates and methodologies for estimation of needs and demand for health manpower, supply and needs comparison, and critical issues on health manpower productivity. Reyes and Picazo paint a scenario of acute maldistribution of health manpower and project a surplus of physicians and a shortage of dentists by the year 2000.

Prior to this study, Sanchez (1988) came up with a profile of medical schools and an analysis of the health system as a whole. He stresses the need for national planning for health manpower development in response to the problems of inefficiency and ineffectiveness in both medical education and practice, migration to other countries and economic crisis. Due to the failure to formulate relevant plans and policies on manpower, Sanchez points out, the ultimate outcome is severe geographic maldistribution. Majority of the Filipino people, especially those in far-flung areas, remain medically unserved or underserved despite too many medical schools and medical graduates. This can also be attributed to the wastage of manpower brought about by over-specialization and overtraining of physicians in health centers for the not-so-complex tasks required of them. Medical education follows the American trend towards specialization which seems inappropriate to the socio-cultural and economic structure of the Philippines.

#### *D. General Framework of the Study*

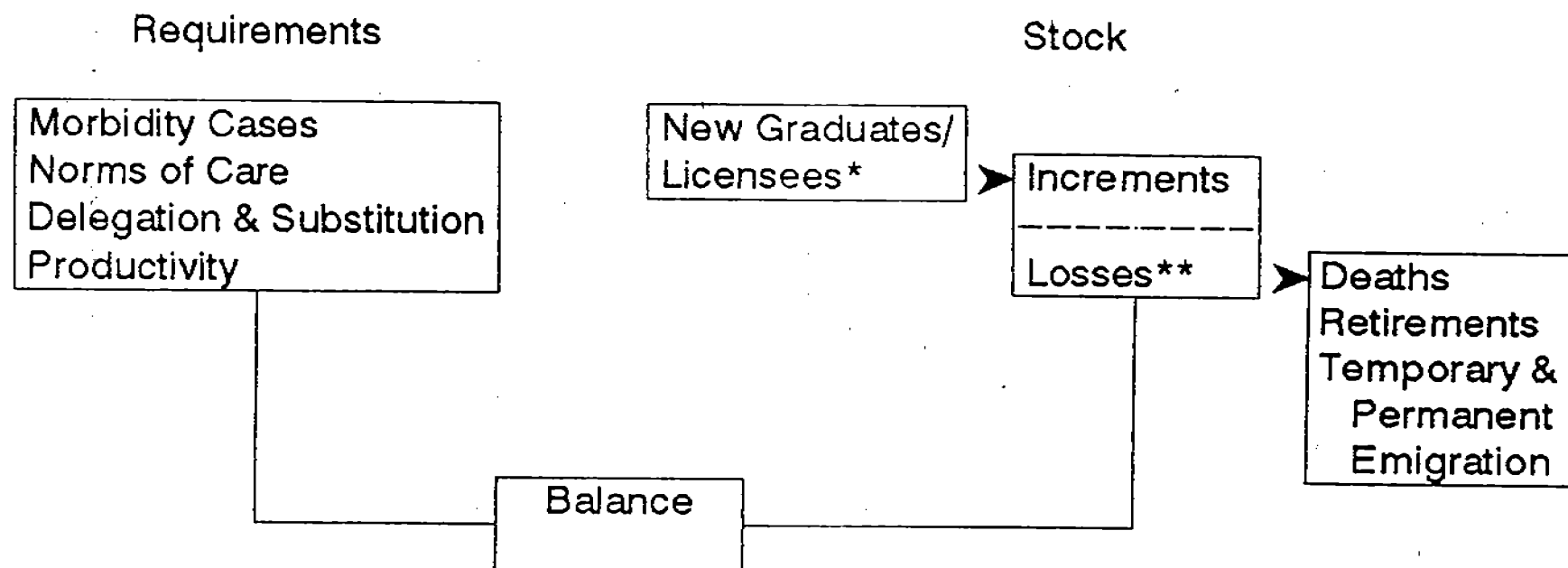
Of Hall's categorization of health manpower requirement estimation methods, this study finds the *health needs method* the most relevant and practicable considering present data inadequacies. The method is complemented by standard manpower-to-population ratios.

Using the needs method, the study is more concerned with expert opinion on kinds, amount and quality of services required to maintain a healthy population. In this way, it is not able to consider what services people can and will pay for, information needed to make economically realistic projections.

Demand here would be largely represented by need or requirement for health manpower and supply by stock, as presented in Figure I.2.

The requirement for health manpower depends largely on the patient's need for treatment or the morbidity cases. It is also affected by the amount of care that health workers can render, and the substitutability and complementarity of the services. In both developed and developing countries, these last two factors figure prominently in health manpower planning as they can account for substantial adjustments in demand, reaching critical levels as they do in certain

Figure 1.2. Stock of and Requirements for Health Manpower



\*Unaccounted for by the study are workers transferring from jobs elsewhere in and outside the health sector, and those coming from other countries.

\*\*Unaccounted for are early retirements, and transfers to other jobs in and outside the health sector.

places. For instance, in rural Philippines, it is the midwife who actually heads rural health units and makes actual decisions on deliveries. In physician-scarce areas such as Bicol, midwives and doctors have been found to be medical substitutes (Gonzalez, 1990).

The institutional setting (hospital, rural health unit, private clinic, puericulture center, home) is assumed to depend on the locational choice of the health workers. The locational decision of health practitioners is affected by socio-economic factors such as income, presence of hospitals, GDP level of the area, among others.

On the supply side, the stock of health manpower is determined by the continuing flow of medical/health graduates. The outflow from the stock is determined by the natural attrition of death and retirement, transferees to the other professions, international migration, among others.

Health manpower balance refers to the equilibrium point where the requirement for health manpower matches the stock. Any exogenous changes in the factors which determine both requirement and stock will consequently affect the health manpower demand-supply and result in either shortage or surplus.

Among the major issues which affect the health manpower demand-supply are the changes in health financing schemes, such as expansion of Medicare coverage to include outpatient and obstetrical care, pooling of community-based funds, and wider population coverage by health maintenance organizations. All will have ripple effects on the demand side or supply side of the health labor market. For that matter, government interventions that give rise to demands for consumer protection and reduction of substantial information asymmetries (Weisbrod, 1991) will influence the way the medical care markets work. They will affect public investment decisions on the construction of community hospitals, likely increase the demand for both major and auxiliary manpower categories and subsequently raise both the wages and number of health professionals, and influence the final price and quantity of medical care.

Other issues include the heavy international outflows of medical workers in search of greener pastures, if not for professional advancement, and the barriers to entry which limit the increment to the total stock of health manpower.

#### E. *Accounting Framework of the Stock and Flow of Health Manpower*

The total stock at time  $t$ ,  $TS_t$ , of health manpower refers to the cumulative ever-registrants or the cumulative number of new licensees registered with the Philippine Regulation Commission (PRC). Thus,  $TS_t$  is determined by adding the number of new licensees at time  $t$ ,  $NL_t$  to the total stock at time  $t-1$ ,  $TS_{t-1}$ :

$$TS = TS_{t-1} + NL_t \quad (1)$$

The main source of new licensees at time  $t$  is the output of graduates at time  $t-m$ , where  $m$  stands for the number of years from the time of graduation until the time a license is obtained. For the dentists, nurses, medical technologists and pharmacists, it is assumed that they obtain a license a year after their graduation. In the case of doctors, it is assumed that they obtain a license two years after their graduation, factoring in the one-year internship requirement. The midwives' case is quite different: since licensure requires a legal age of 21 years, midwives who are assumed to have graduated at the age 18 wait out about three years before taking the licensure examination.<sup>2</sup>

Let  $L_t$  be defined as the licensing rate at time  $t$  which is the ratio of the number of new licensees at time  $t$ ,  $NL_t$ , to the number of graduates at time  $t-m$ ,  $G_{t-m}$ :

$$L_t = NL_t / G_{t-m} \quad (2)$$

However, this rate may not reflect the exact percentage of "fresh" graduates who pass the licensure examination since not all of the graduates at time  $t$  will take the examination after  $m$  years. Moreover, there are other sources of new licensees such as the retakers and those who take the board examination more than  $m$  years after their graduation.

Meanwhile, the number of graduates at  $t-m$  is determined mainly by the number of freshmen enrollees at  $t-m-n$ ,  $F_{t-m-n}$ , where  $n$  stands for the number of years per course. The four-year courses include Medicine Proper, Dentistry Proper, Nursing, Medical Technology and Pharmacy. Midwifery takes 2 years.

The survival rate at time  $t-m$ ,  $S_{t-m}$ , is defined as the ratio of the number of graduates at time  $t-m$  to the number of first year enrollees at time  $t-m-n$ :

$$S_{t-m} = G_{t-m} / F_{t-m-n} \quad (3)$$

This attrition rate, which aims to convert student entrants into graduates, may not accurately indicate the survival rate in its true sense, since there are transferees from other courses and delayed graduation owing to leave of absence, repetition of courses a required thesis. These probably offset the number of dropouts or transferees to other courses.

From Eqs. 2 and 3, the number of new licensees can be expressed as follows:

$$NL_t = L_t S_{t-m} F_{t-m-n} \quad (4)$$

Losses from the total stock can be attributed to natural attrition, e.g. deaths (D) and retirement (R), and to international outflows in terms of permanent emigration (PE) and temporary emigration (i.e., OCWs).

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<sup>2</sup> However, this prerequisite was relaxed starting 1992.

The net increment,  $NI_t$ , can be defined as the sum of the number of new licensees and the attrition from the total stock at the current year.

$$NI_t = NL_t - (D_t + R_t + OCW_t + PE_t) \quad (5)$$

Given the previous-year net stock,  $NS_{t-1}$ , the net increment,  $NI_t$ , is added to it to obtain the net stock at the current year,  $NS_t$ :

$$NS_t = NS_{t-1} + NI_t \quad (6)$$

or, in summary,

$$NS_t = NS_{t-1} + (L_t S_{t-m} F_{t-m-n}) - (D_t + R_t + OCW_t + PE_t) \quad (7)$$

After taking into account the increment to and decrement from the total stock, the net stock represents the professionally active force in a particular health manpower category which serves the domestic need for health providers at a current year.

This workforce flow of health manpower abstracts from other sources of increment (such as transferees from jobs elsewhere in the health sector and from other occupations, people returning to the workforce and immigrants) and other sources of losses (such as transferees to other jobs within the health sector and to other occupations, temporary losses occasioned by extended vacation and early retirement or withdrawals). This is made necessary by difficulties in estimation. Data are fragmentary and informed guesses are unavailable.

From Eq. 7, it can be deduced that changes in the trend of enrollees, graduates, new licensees, and international outflows would eventually affect the level of net stock.

The sources of data, estimation of stock and requirement, methodology in projecting the stock for year 2000 and sensitivity analysis are presented in Appendix B.

#### F. *Accounting Framework for Health Manpower Requirements*

This study adopted a model formulated by the Graduate Medical Education National Advisory Committee (GMENAC) in determining the health manpower requirements of US-based physicians. The adopted model will henceforth be called the modified GMENAC model. The basic steps in the operation of this model include (a) the development of assumptions, and (b) the convening of a modified Delphi panel to review the data and make necessary adjustments in the manpower estimates or to synthesize new "data outputs" for use in the model. The modified Delphi technique of utilizing expert opinion is an integral part of the model, and is quite useful in settings where "hard data" are unavailable.

The modified GMENAC model is a needs based model or an epidemiology based model, which means that the manpower requirements are related to the epidemiology of disease - the incidence, distribution, and control of disease in a population.

The model begins with empirical data on morbidity cases,  $M$  which represent the "true need" of the population for health services. This "need" is adjusted by multiplying the percentage requiring care,  $RC$  which is affected by changes in technology, treatment modalities, patient preferences, and other factors that affect the epidemiology of disease. The product of the total adjusted needs and the norms of care,  $NC$  (e.g., annual visits for each condition) shows the total service requirement,  $TSR$ , for all diseases, conditions and well-care by the target population.

$$TSR_t = ( M_t RC_t NC_t ) \quad (8)$$

where  $t$  = year

The next step is to subtract from the  $TSR$  those services,  $DS$ , that should be delegated to various categories of health workers who complement the work of the health manpower category under study. The difference is the total service requirement net of delegation/substitution,  $TSR^*$ , or the total units of care that require specific services by said health provider.

$$TSR^*_t = TSR_t - DS_t \quad (9)$$

To obtain the total number of full-time equivalent (FTE) health personnel for patient care, the total service requirement net of delegation/substitution is divided by the average productivity,  $AP$  (e.g., office visits per year).

$$FTE_t = TSR^*_t / AP_t \quad (10)$$

The final step is to add the percentage of health providers for nonpatient care activities or  $NPC$  which usually includes research, teaching and administration to the  $FTE$ . The sum is the actual number of health manpower ("head counts") or  $MR$  required to provide all the services needed by the population and the health system in a certain period  $t$ .

$$MR_t = FTE_t + NPC_t \quad (11)$$

In summary,

$$MR_t = \left( \frac{ ( M_t RC_t NC_t ) - DS_t }{ AP_t } \right) + NPC_t \quad (12)$$

From Eq. 12, forecast requirements for the year 2000 can be determined by the projections in the values of the variables in the model.

This framework is further elucidated in Chapter 3.

The health manpower balance is achieved when the net stock of health workers matches the requirements for health workers. That is,

$$NS_t = MR_t \quad (13)$$

Imbalance exists when there are mismatches. Distortions in the health manpower balance occur when there are exogenous changes in the determinants of the net stock and the manpower requirement.

#### G. *Organization of the Study*

The study is divided into four main chapters: (1) the supply side which is the profile, stock and flow of health manpower; (2) the demand side which is the current and projected requirements for health manpower; (3) the analyses of health manpower imbalance; and (4) other major issues.

The Chapter II presents the profile of health manpower, the framework and the assumptions used in determining the current and future stock estimates and the workforce flow per category taking into account education, licensure, migration, shifts to other professions and deaths which result in increments/decrements in stock.

The Chapter III discusses the demand for health manpower as need or requirement and explains the methodologies adopted in computing the requirements for the five types of health manpower. It also shows current and future requirements using such methodologies.

The Chapter IV analyzes health manpower imbalance by comparing stock with requirements and tackles imbalance in terms of number, type, function, and distribution. The comparison with Asian countries is also presented.

Chapter V further elaborates on other major issues affecting the supply of health manpower in the country. These are the impact of a major health financing scheme on the supply of medical worker, barriers to entry, and the extent and determinants of international migration.

Chapter VI presents the summary of findings and conclusions, while Chapter VII discusses the policy recommendations.

## II. PROFILE, STOCK AND FLOW OF HEALTH MANPOWER

This chapter presents the profile, stock and flow of six health manpower categories - physicians, dentists, nurses, midwives, medical technologists and pharmacists.

The profile elements are age, sex, marital status, employment status, nationality, work

setting (e.g., hospital, school or industrial sector including primary, secondary and tertiary sector), location of work (whether in urban or rural area), income and regional distribution. The data for this section were taken from the subsample for health professionals from the 1990 Census of Population and Housing (CPH) of the National Statistics Office (NSO).<sup>3</sup>

The derivation of the estimates for the stock and flow of health manpower is discussed in Chapter 1 and in Appendix B. The limitations of the estimates can be attributed to the methodologies used and insufficient data.

### *A. Selected Health Manpower Categories*

#### *A.1. Physicians*

##### *A.1.1. Introduction*

*Education.* The degree of Doctor of Medicine is earned after four years of intensive training in a medical school. A bachelor's degree is an entry requirement. After graduation, another year of training as an intern in an approved hospital is required before the doctor is allowed to take the licensing examination for medical practice. The young physician may decide to practice right after licensure which is at least nine years after high school or to become a specialist, the training of which takes another three to five years depending on the specialty (Sanchez, 1988).

*Functions.* A physician physically examines any person, and diagnoses, treats, operates or prescribes medication for human disease, injury, deformity, physical, mental, psychical ailment (real or imaginary) regardless of the nature of the remedy or the treatment administered, prescribed or recommended (Section 10 of RA 2382 as amended by RA 4224, June 20, 1959).

##### *A.1.2. Profile of Physicians*

Table II.1, based on census data, shows the profile of the current stock of physicians. The majority of physicians (59.3 percent) are relatively young with ages less than 40 years. This implies that most of the physicians have had little experience gained through years of practice. About 30 percent are single while 67 percent are married.

Female physicians comprise about 48.8 percent of the population of physicians. According to Sanchez (1985), the proportion of women doctors rose from 2.5 percent before 1930 to 18 percent in 1950, to 30 percent in 1970 and to 40 percent in 1980. This trend suggests that women are becoming increasingly interested in this profession which was previously the domain

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<sup>3</sup> The 1990 CPH had the following sample sizes of health manpower: Doctors (3,182); Dentists (1,735); Nurses (6,240); Midwives (3,323); Medical Technologists (1,086); and Pharmacists (978).



Table II.1. Profile of Physicians, 1990

AGE STRUCTURE			MARITAL STATUS		
	Number	%		Number	%
< 25	83	2.6	Single	954	30.0
25 - 29	659	20.7	Married	2,143	67.3
30 - 34	708	22.3	Widowed	62	1.9
35 - 39	435	13.7	Separated	22	0.7
40 - 49	557	17.5	Others	1	0.0
50 - 59	433	13.6	Unknown	0	0.0
60 and up	307	9.6			
Total	3,182	100.0	Total	3,182	100.0
GENDER			NATIONALITY		
	Number	%		Number	%
Male	1,629	51.2	Filipino	3,150	99.0
Female	1,553	48.8	Non-Filipino	32	1.0
Total	3,182	100.0	Total	3,182	100.0
EMPLOYMENT STATUS			LOCATION OF WORK		
	Number	%		Number	%
Employed	3,074	96.6	Urban	2,943	92.5
Unemployed	108	3.4	Rural	239	7.5
Total	3,182	100.0	Total	3,182	100.0
WORK SETTING					
	Number	%		Number	%
Hospitals'			Industries		
Private	2,064	64.9	Primary	1	0.0
Public	705	22.2	Secondary	23	0.7
Schools			Tertiary	36	1.1
Private	13	0.4	Public Admin	159	5.0
Public	17	0.5	Others	164	5.2
			Total	3,182	100.0

Source of basic data: 1990 CPH, NSO

'Includes clinics and laboratories

of men.

The employment rate is 96.6 percent. This means that only about 1,094 are seeking employment. Ninety-nine percent of the physicians are Filipinos (the Census includes non-Filipino nationals).

In terms of work setting, an estimated 64.84 percent and 22.15 percent of the active supply of physicians are located in private and public hospitals, clinics and laboratories, respectively. About 5 percent are connected with public administration and less than 1 percent are in each of the other work settings. An estimated 92.5 percent are situated in urban areas.

Table II.2 reveals that the regional distribution of the total supply of active physicians is  
Table II.2. Regional Distribution of Physicians

Region	(Sample Data) Total Physicians		DOH Personnel (Actual Data)		
	Number	%	Hospital	Field Serv	Total
NCR	1,354	42.55	601	67	668
CAR	66	2.07	255	76	331
1	117	3.68	412	150	562
2	56	1.76	278	110	388
3	304	9.55	558	252	810
4	336	10.56	659	343	1,002
5	106	3.33	352	220	572
6	177	5.56	477	163	640
7	220	6.91	187	155	342
8	77	2.42	345	125	470
9	61	1.92	257	80	337
10	110	3.46	341	139	480
11	131	4.12	343	101	444
12	67	2.11	182	100	282
Total	3,182	100.0	5,247	2,081	7,328

Sources of basic data: 1990 CPH, NSO and MAS-DOH

skewed towards the National Capital Region. Nearly half of the physicians, i.e., 42.55 percent are located in the NCR. Higher percentages are noticeable in Regions 5 and 6 while other regions' percentages of physicians range from 2 percent to 6 percent.

Looking at the DOH personnel, the hospital-based physicians number 5,247 which accounts for 72 percent of all DOH physicians. Field service doctors, such as those detailed in rural health units (RHUs) comprise a low percentage of 28 percent. This trend is visible across the regions but more pronounced in Metro Manila.

### A.1.3. Stock and Workforce Flow of Physicians

#### A.1.3.1. Production of Physicians

*Student Admissions.* Inputs to the production of medical professionals are determined by the number of student admissions or of freshmen enrollment. The latter is mainly affected by the quota of enrollment imposed by the Association of Philippine Medical Colleges for each school and the National Medical Admissions Test (NMAT) administered by the Board of Medical

Education<sup>4</sup>. Passing the NMAT is a requirement for admission to medical school which aims to ensure that only those who are qualified are accepted for medical studies. Although there are 26 medical schools in the country, admission gets competitive with the heavy turnout of freshmen applicants. Table II.3 shows the quota per school imposed by the APMC which total to a ceiling

Table II.3. APMC Quota Imposed on the Freshmen Enrollment

Schools	Quota	Schools	Quota
Lyceum Northwestern FOD Med .....	160	Remedios T. Romualdez Med'l Foundn ...	100
Virgen Milagrosa Educ'l Inst .....	160	U.P. Leyte (Inst of Health Science) ...	NA
Angeles University Foundation ....	150	Xavier University .....	100
DLSU-Emilio Aguinaldo Col of Med..	200	Davao Medical School Foundation .....	160
Perp'l Help College of Med .....	176	Mindanao State University .....	100
AGO Medical and Educ'l Center ....	160	Fatima Med Science Found .....	176
Iloilo Doctor's Coll of Med .....	160	Far Eastern University .....	360
West Visayas State University ....	160	Manila Central University .....	210
Cebu Doctors College of Med .....	160	Pamantasan ng Lungsod ng Mla .....	110
Cebu Institute of Medicine .....	260	UE Ramon Magsaysay Mem Med .....	360
Southwestern University .....	210	University of the Phil - Mla .....	NA
University of Visayas .....	160	University of Santo Tomas .....	420
Divine Word Univ. of Tacloban ....	60	St. Louis University .....	160
Total .....		4,432	

Source: DECS

of 4,432 first year students per year. The quota has been imposed mainly to control the number of students who are accommodated on the basis of the existing facilities and faculty of the schools. Table II.4, on the other hand, shows the percentage of NMAT passers as against the

Table II.4. NMAT Examinees, SY 1986-87 to SY 1990-1991

School Year	First time			Second time			Third time			Total Examinees		
	Passed	Failed	Total	Passed	Failed	Total	Passed	Failed	Total	Passed	Failed	Total
1986-87	3,256	2,305	5,561	388	531	919				3,644	2,836	6,480
	58.6%	41.4%		42.2%	57.8%					56.2%	43.8%	
1987-88	2,534	3,205	5,739	633	952	1,585	81	262	343	3,248	4,419	7,667
	44.2%	55.8%		39.9%	60.1%		23.6%	76.4%		42.4%	57.6%	
1988-89	2,897	2,722	5,619	622	790	1,412	311	434	745	3,830	3,946	7,776
	51.6%	48.4%		44.1%	55.9%		41.7%	58.3%		49.3%	50.7%	
1989-90	2,509	2,171	4,680	324	726	1,050	82	322	404	2,915	3,219	6,134
	53.6%	46.4%		30.9%	69.1%		20.3%	79.7%		47.5%	52.5%	
1990-91	2,821	2,568	5,389	431	767	1,198	128	256	384	3,380	3,591	6,971
	52.3%	47.7%		36.0%	64.0%		33.3%	66.7%		48.5%	51.5%	
Total	14,017	12,971	26,988	2,398	3,766	6,164	602	1,274	1,876	17,017	18,011	35,028
Average	51.9%	48.1%		38.9%	61.1%		32.1%	67.9%		48.6%	51.4%	

Source: Center for Educational Measurement

total examinees. On the average, NMAT passers comprised 48.6 percent of the total examinees per school year. As can be observed from the table, majority of the first time examinees (51.9 percent) passed the examination. The exam passers who took the examination for the second time and third time registered a passing rate of only 38.9 percent and 32.1 percent, respectively. This dwindling rate of passers indicates, in one respect, that NMAT is an effective screening

<sup>4</sup> Other major factor affecting the number of enrollees is the high cost of medical education wherein only those with relatively higher income levels could afford.

device in medical school.

In both cases, the school quota and the NMAT aim to ensure the production of good quality medical professionals.

**Student Attrition.** Table II.5 shows the trends of medical enrollees, graduates and new licensees. Student attrition by year level is also presented.

Table II.5. Physicians: Trends for Enrollees, Graduates and New Licensees

School Year	Enrollees				Graduates		New Lic.	Yearly Enrollment Attrition/Addition				Surv'l Rate	Licensing Rate
	1	2	3	4	2sem	Total		1-2	2-3	3-4	4-2sg	1-TG	
1982-83	2,878												
1983-84	3,071	2,829						98.3					
1984-85	3,228	3,080	2,725					100.3	96.3				
1985-86	4,197	4,015	3,998	2,948	2,185	2,322		124.4	129.8	108.2	74.1	80.7	
1986-87	2,843	2,344	2,393	1,939	2,166	2,351		55.8	59.6	48.5	111.7	76.6	
1987-88			2,451	2,056	1,817	2,026	2,553		104.6	85.9	88.4	62.8	109.9
1988-89				1,279	1,621	1,894	2,789			52.2	126.7	45.1	118.6
1989-90							3,911						193.0
1991							1,415						74.7
Average:												66.3	124.2

Sources of data: MIS of DECS Bureau of Higher Education and PRC

As mentioned earlier, the NMAT and freshmen enrollment quota affect the enrollment level. Comparing the quota with the enrollment shown in Table II.5, it can be deduced that the enrollment quota had been observed. However, the number of students who passed the NMAT is not consistent with the number of enrollees in the same school year, likely because a number of previously admitted registrants put off matriculation for sometime.

In Table II.5, freshmen enrollment shows a declining trend, starting from its peak in SY 1985-86.

The yearly attrition shows an erratic pattern. An attrition per year of less than 100 percent implies that losses from the production of medical graduates can be attributed to the number of dropouts, failures or transferees to other courses. An attrition of more than 100 percent indicates additional students who are transferees from other related courses or those who are able to make up for their failures.

The enrollment level, as pointed out in studies dealing with health manpower production, is largely determined by various economic forces. One is the effective demand in the local market especially in the urban areas and second is the heavy influence of the foreign labor market on our system as many enter medical education in the hope of migrating to developed countries.

As observed from Table II.5, the number of graduates in the second semester differs from the total number of graduates in the same school year. This difference is due to the graduation of irregular students.

The average survival rate is 66.3 percent. However, this may not reflect the number of first year students who have actually graduated on schedule since there may be a considerable number of delayed graduates.

*Percentage of New Licensees to Total Graduates.* The licensing examination ensures that only those who are competent are allowed to practice the profession. The licensing rate<sup>5</sup> averaged 124.15 percent which is too high; but again, this may be due to a number of retakers and other examinees who took the tests a few years after their internship. The growth of new licensees is significantly affected by the rate of the yearly student attrition. The trend in the number of licensees from 1988 to 1990 "follows" the trend in the number of enrollees from SY 1982-1983 to SY 1984-1985. Note, however, that the licensing rate in 1991 dropped drastically to 74.7 percent from 3,911 in 1990 to 1,415 in 1989-1990, representing a 64 percent reduction. This decrease in the number of new licensees can be traced back to the sharp drop in the number of first year enrollees from 4,197 in SY 1985-86 to only 2,843 in SY 1986-87 (a 32 percent reduction), clearly showing the sensitivity of the number of new licensees to student attrition.

Aside from the APMC quota, the NMAT, and the licensure examination, the next hurdle a medical professional will squarely face is the competitive environment for job application in hospitals (particularly tertiary hospitals). As opposed to other work settings for doctors, hospitals pay better and offer good training ground owing to their advanced facilities and technologies.

#### A.1.3.2. International Outflows

The licensing rate determine the annual increment to the total stock of medical professionals. However, there are leakages from the stock. Crucial leakages are not due to natural attrition caused by deaths and retirement, but to international outflows associated with permanent and temporary emigration as in the case of overseas contract workers (OCWs).

*Permanent Emigration.* In the 1980's, the number of permanent emigrants reached 32,000 (UNESCO, 1987) primarily as a result of the mass outflow in the 1960s and 1970s.<sup>6</sup> Many left for medical training<sup>7</sup>, largely in the United States and Canada, and eventually decided to stay and practice their profession there. The outflow was a function mainly of the differential between

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<sup>5</sup> Licensing rate = ratio of the number of new licensees to the number of graduates (refer to Accounting Framework of the stock and flow of health manpower in Chapter I).

<sup>6</sup> Sanchez (1988) estimated about 2,000 permanent emigrants. Abella (1980) estimated 28.06 percent of the total stock or about 16,000 physicians who emigrated.

<sup>7</sup> The US Exchange Visitors Program in medicine was established to help foreign countries in training their doctors to become qualified scientists. The initial result showed that many Filipino specialists in various medical disciplines returned home. The returnees strengthened the faculty of the existing medical schools and of newly established schools in the 1990s. They also organized the professional societies for the different specialties and the corresponding specialty boards. However, the program gradually became the precursor of the phenomenon of "brain drain" (Sanchez, 1988).

home wages and wages in the country of destination. The US Immigration Act of 1965, which relaxed restrictions on race and country of origin and placed greater emphasis on skill, also greatly facilitated the outflow of medical workers. In recent years, however, immigration to the United States and Canada has been severely curtailed because of new restrictions in these countries. A few manage to leave through "unofficial" channels (UNESCO, 1987). There are reports told of doctors taking up nursing in response to the big market for nurses in the USA. The annual outflow of permanent emigrants for the period 1988-1991 is shown in Table II.6 where USA is the major recipient of migrants followed by Australia and Canada. The number of emigrants to other countries is relatively small. Between 1988 and 1991, permanent emigrants ranged from 269 to 350.

*Overseas Contract Workers (OCWs).* Economic development in the oil-exporting Middle East countries created a large gap between the rapid rate of growth and the growth of labor to sustain and fuel expansion. The shortage of labor demand for labor included medical workers.

The opening of a large labor market in the Gulf region has changed international outflow trends. When the USA closed its door to physicians from foreign countries, Filipino doctors began to seek employment as OCWs and/or training in countries in the Middle East.

Abella (1980) estimated that 3.38 percent of the total stock of physicians sought temporary employment abroad as OCWs in the late 70s. Using the total stock in 1990, the number of OCWs was estimated at 2,000.

Table II.6 provides the annual data on "contract" migration for the period 1988-1992. The table shows that there are more new hires for the kingdom of Saudi Arabia compared to other countries. In 1992, there were 63 physicians on contract work. However, the actual number may

Table II.6. Physicians: International Outflow

	USA	Canada	Austr.	KSA	Others	Total
<i>Permanent Emigrants</i>						
1988	244	12	38		6	300
1989	219	24	20		6	269
1990	245	46	45		1	337
1991	277	39	30		4	350
<i>Overseas Contract Workers (OCWs)</i>						
1988				27	14	41
1989	1			23	16	40
1990	1			35	14	50
1992				53	10	63

Note : - Data on OCWs are only new hirees which are approximately half of the total number of processed contract workers (See Appendix B)  
 - 1991 data on OCWs are not available

Sources: Permanent Emigrants - Commission on Filipinos Overseas  
 OCWs - Philippine Overseas Employment Administration

be more than double this number.

#### A.1.4 Projections

##### A.1.4.1 Increment to the Total Stock

Based on the historical trend, the number of freshmen enrollees will reach 3,688 by SY 1998-1999 from 2,878 in SY 1982-1983 (see Table II.7). Given this enrollment trend and

Table II.7. Increment to the Total Stock of Physicians

School Year	Freshmen Enrollment (A)	Year	New Licensees (B)	Previous-Year Total Stock (C)	Current-Year Total Stock (B+C)
1982 - 83	2,878	1988	2,553	55,217	57,770
1983 - 84	3,071	1989	2,789	57,770	60,559
1984 - 85	3,228	1990	3,911	60,559	64,470
1985 - 86	4,197	1991	1,415	64,470	65,885
1986 - 87	2,843	1992	2,305	65,885	68,190
1987 - 88	2,949	1993	2,391	68,190	70,581
1988 - 89	3,054	1994	2,476	70,581	73,057
1989 - 90	3,160	1995	2,562	73,057	75,619
1990 - 91	3,265	1996	2,648	75,619	78,266
1991 - 92	3,371	1997	2,733	78,266	81,000
1992 - 93	3,477	1998	2,819	81,000	83,818
1993 - 94	3,582	1999	2,904	83,818	86,723
1994 - 95	3,688	2000	2,990	86,723	89,713

Sources of Data:

Enrollment:	1982-1990	-	DECS
	1991-1995	-	projected values using historical trend
New Licensees:	1988-1991	-	PRC
	1992-2000	-	projected values using the enrollment data, the average survival rate (S) and the average rate of new licensees (L): $(B = A \cdot S \cdot L)$
Total Stock:	1987	-	PRC

assuming fixed survival rate of 66 percent and a 124 percent, the number of new licensees will register 2,990 in the year 2000. Note that different survival rates of new licensees will definitely alter this projected number of new licensees.

As an observation, any change in the student attrition will have an impact of less than 6 years on the level of new licensees. Improvements in the curriculum or increases in enrollment may improve the rate of new licensees. However, it will take a longer time for it to cause an impact on the number of new licensees.

In 1987, there were 55,217 physicians registered with the PRC. Counting the number of new licensees as the annual increment to the previous-year total stock, the total stock in the year 2000 will reach 89,713 physicians.

#### A.1.4.2 Decrement from the Total Stock

The estimated initial net stock for physicians in 1987 ranges from 7,486 to 31,219 with 19,352 as the median value (see Table II.8 and Appendix B). The stock was estimated using low,

Table II.8. Estimated Stock of Physicians, 1987

	Low Assumptions	Medium Assumptions	High Assumptions
Total Stock (1986)	53,497	53,497	53,497
Add: New Licensees (1987)	1,720	1,720	1,720
Total Stock (1987)	55,217	55,217	55,217
Less: Retirees	5,623	5,623	5,623
Dead	6,509	6,509	6,509
OCWs	5,599	3,733	1,866
Permanent Emigrants	30,000	20,000	10,000
Net Stock (1987)	7,486	19,352	31,219

Source: See Appendix B

medium, and high assumptions.

The assumptions used are as follows:

(a) The total stock of physicians in 1986 was 53,497, according to the PRC data. Adding the number of new licensees in 1987 of 1,720, the total stock in 1987 was 55,217 under the medium assumption.

(b) The number of retirees was a straightforward calculation while the number of deaths was computed using unabridged life tables for the Philippines based on the 1980 and 1990 Censuses.

(c) Using the estimate of Sanchez (1988), the number of permanent emigrants registered 20,000 under the medium assumption. The value under the low assumption is 30,000 which is close to the estimate made by UNESCO (1987).

(d) OCWs make up 3.38 percent of the total stock according to Abella (1980). Assuming that the percentage has doubled in the late 80s, the number of OCWs is estimated at 3,733 in 1987 under the medium assumption. The estimate made by Abella falls under the high assumption.

The projected supply for physicians is shown in Table II.9.



Table II.9. PROJECTED SUPPLY OF PHYSICIANS: 1988-2000

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
<b>a. Low Assumption</b>													
Previous-Year Net Stock	7,486	9,012	10,635	13,378	13,344	13,458	14,204	15,153	16,124	17,085	17,891	18,539	19,339
Add: New Licensees	2,553	2,789	3,911	1,415	2,305	2,391	2,476	2,562	2,648	2,733	2,819	2,904	2,990
Less: Retirees	113	268	131	425	586	983	1,040	1,081	1,140	1,106	1,229	612	742
Dead	345	366	393	408	420	423	426	430	433	439	445	458	465
OCWs	450	404	506	525	1,023	191	29	65	81	324	425	899	999
Permanent Emigrants	119	131	138	92	162	48	33	15	33	59	72	138	153
Current-Year Net Stock	9,012	10,635	13,378	13,344	13,458	14,204	15,153	16,124	17,085	17,891	18,539	19,339	19,970
<b>b. Medium Assumption</b>													
Previous-Year Net Stock	19,352	21,068	22,869	25,827	25,998	26,507	27,333	28,302	29,300	30,299	31,232	32,046	33,191
Add: New Licensees	2,553	2,789	3,911	1,415	2,305	2,391	2,476	2,562	2,648	2,733	2,819	2,904	2,990
Less: Retirees	113	268	131	425	586	983	1,040	1,081	1,140	1,106	1,229	612	742
Dead	345	366	393	408	420	423	426	430	433	439	445	458	465
OCWs	300	269	337	350	682	127	19	43	54	216	283	599	666
Permanent Emigrants	79	87	92	61	108	32	22	10	22	39	48	92	102
Current-Year Net Stock	21,068	22,869	25,827	25,998	26,507	27,333	28,302	29,300	30,298	31,232	32,046	33,191	34,206
<b>c. High Assumption</b>													
Previous-Year Net Stock	31,219	33,124	35,103	38,276	38,652	39,556	40,462	41,451	42,476	43,513	44,573	45,553	47,043
Add: New Licensees	2,553	2,789	3,911	1,415	2,305	2,391	2,476	2,562	2,648	2,733	2,819	2,904	2,990
Less: Retirees	113	268	131	425	586	983	1,040	1,081	1,140	1,106	1,229	612	742
Dead	345	366	393	408	420	423	426	430	433	439	445	458	465
OCWs	150	135	169	175	341	84	10	22	27	106	142	300	333
Permanent Emigrants	40	44	46	31	54	16	11	5	11	20	24	46	51
Current-Year Net Stock	33,124	35,103	38,276	38,652	39,556	40,462	41,451	42,476	43,513	44,573	45,553	47,043	48,442

The sensitivity analysis results show that the net stock is sensitive to the fluctuations in the international outflows (see Appendix B). This implies that controlling the international outflows will eventually increase the number of physicians serving the population in the domestic setting.

#### A.1.5. Specialization

After a one-year internship, graduates of medical science can take the licensing examination and upon passing the examination, can do general practice or opt to take a graduate medical education or residency which leads to a clinical specialization. The objective of this phase of their education is to equip them with the basic competencies in their respective fields. Residency is a responsibility of the hospital or a department of the hospital. Accreditation of training programs and certification of the specialist are done by the appropriate specialty society and its accrediting board.

Residency training ranges from two to five years. Non-surgical residencies are usually shorter than surgical disciplines. Post-residency fellowships leading to subspecialty certification usually last one to two years. Some residency programs are multitrack and lead to subspecialties like neurosurgery and urology (Sanchez, 1988).

Some of the existing residency programs and their duration are shown in Table II.10.

Table II.11 presents the head counts of specialists by region which were obtained from several sources such as the Philippine Medical Care Commission (PMCC), Philippine Society of Pathologists, Philippine Society of Ophthalmologists, Philippine Urological Association, Philippine Society of Nephrology, Philippine College of Radiology, Philippine College of Chest Physicians, Philippine Heart Association and Philippine Pediatric Society.

However, these figures seem smaller than the total number of specialists since about 50-70 percent are neither members of any medical associations nor PMCC-accredited medical professionals. On the other hand, these figures are useful in indicating the regional distribution of specialists and the distribution of physicians among specialties.

Across the regions, the data confirm what has been known all along: that the higher the urbanization level of an area, the greater the tendency of manpower to converge to this area. An extreme concentration of health specialists is observed in the National Capital Region compared to other regions. As regards areas of specialization, there are more physicians who specialize in obstetrics-gynecology, internal medicine, surgery and pediatrics than in other fields.

Table II.10. Residency Training in Years

	Graduate Medical Education Years						
	0	1	2	3	4	5	6
FAMILY MEDICINE							
INTERNAL MEDICINE							
SUBSPECIALTIES							
Allergy							
Pulmonary							
Diabetes							
Endocrinology							
Gastroenterology							
Cardiology							
Hematology							
Oncology							
Infectious Disease							
Nuclear Medicine							
Nephrology							
Rheumatism							
PEDIATRICS							
RADIOLOGY							
REHABILITATIVE MED.							
NEUROLOGY							
PSYCHIATRY							
PATHOLOGY							
Anatomy							
Clinical							
GENERAL SURGERY							
Plastic & Reconstructive							
Orthopedic							
Pediatric							
Thoracic							
Urologic							
Neurosurgery							
ANESTHESIA							
OBSTETRICS							
OPHTHALMOLOGY							
OTORHINOLARYNGO							

Table II.11. Physicians, By Specialty and By Region (actual distribution of specialists).

	NCR	CAR	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
TOTAL	6,189	443	590	357	1,244	1,469	567	914	1,128	425	350	232	857	412	15,682
GENERAL PRACTICE	1,925	307	410	297	839	982	432	608	620	358	292	503	592	345	8,590
SPECIALTIES	4,264	136	180	60	405	487	135	306	508	67	58	154	265	67	7,092
OB-GYN	709	17	30	7	88	86	20	46	80	11	9	25	54	13	1,195
INTERNAL MED	564	19	22	6	41	59	14	41	77	14	9	22	42	6	936
CARDIOLOGY	311	6	11	3	21	27	20	20	26	3	4	9	23	1	485
NEPHROLOGY	35	15	0	0	1	1	0	4	7	1	0	1	3	0	68
PULMONARY MED	361	7	6	5	11	20	4	14	12	1	2	4	1	2	452
ONCOLOGY	4	0	0	0	0	0	0	0	1	0	0	0	0	0	5
HEMATOLOGY	1	0	0	0	0	1	0	0	0	0	0	0	0	0	2
NUCLEAR MED	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
GASTROENTEROLOGY	5	0	0	0	0	1	0	0	1	0	0	0	0	0	7
PEDIATRICS	644	13	27	9	67	86	19	39	82	10	8	22	32	9	1,067
SURGERY	586	29	44	7	87	94	29	59	87	17	9	28	56	19	1,151
ORTHO SURGERY	30	0	1	0	1	2	0	0	1	0	0	0	0	2	37
NEURO-SURGERY	11	1	0	0	0	1	0	0	0	0	0	0	0	0	13
PLASTIC SURGERY	4	0	0	0	0	0	0	1	0	0	0	0	0	0	5
ANESTHESIOLOGY	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
ENT	227	8	9	5	32	34	5	18	25	0	4	11	15	2	395
OPHTHALMOLOGY	201	4	12	3	15	18	7	9	20	0	3	10	7	4	313
FAMILY MED	59	1	2	5	11	25	7	13	35	3	5	14	13	2	195
RADIOLOGY	155	5	3	6	11	17	3	13	18	3	4	1	10	5	254
UROLOGY	105	6	1	12	7	3	5	6	0	0	3	3	1	1	152
PATHOLOGY	194	8	6	2	6	4	2	14	26	4	1	2	4	1	274
REHAB MEDICINE	17	0	0	0	0	0	1	3	2	0	0	2	0	0	25
NEUROLOGY	16	1	0	0	1	0	0	1	0	0	0	0	0	0	19
DERMATOLOGY	13	0	0	0	0	0	0	2	1	0	0	0	0	0	16
OCUL/L/IND'L MED	11	1	0	0	0	3	0	3	0	0	0	0	0	0	18
PSYCHIATRY	1	0	1	0	0	0	0	1	1	0	0	0	0	0	4
ORTHOPEDICS	0	1	0	0	0	0	1	0	0	0	0	0	0	0	2

Sources: PHCC and other medical societies, 1991-1992

## A.2. Dentists

Dentistry consists of a two-year pre-dental course and a four-year dentistry proper curriculum after which the graduate prepares to take the licensure examination. A dentist performs any operation or part of an operation upon the mouth, jaws, teeth, and surrounding tissues; prescribes drugs or medicine for the treatment of oral diseases and lesions; or corrects malpositions of the teeth (section 14 of RA 4419, June 19, 1965).<sup>8</sup> The field dentist (primary health care) has the following specific tasks: oral examinations, oral prophylaxis, fluoride utilization, fit and fissure sealant, permanent or temporary filling, gum treatment and extraction.

### A.2.1. Profile and Stock

As shown in Table II.12, 69 percent of dentists are below 40 years of age. Majority or 63.3 percent of those actively working are female. Also, 56 percent are married. In this health manpower category, 4.6 percent are unemployed and only 0.5 percent are non-Filipinos.

In terms of work setting, 73.89 percent of dentists can be found in private hospitals, clinics and laboratories; 9.86 percent in public providers; 3.92 percent in public administration and 7.61 percent in undefined business areas. As much as 91.3 percent of dentists are in urban areas.

<sup>8</sup> The mechanical construction of artificial dentures or fixtures and other oral devices is beyond the legislated functions of a dentist.

Table II.12. Profile of Dentists, 1990

AGE STRUCTURE			MARITAL STATUS		
	Number	%		Number	%
< 25	201	11.6	Single	692	39.9
25 - 29	536	30.9	Married	973	56.1
30 - 34	308	17.8	Widowed	53	3.1
35 - 39	149	8.6	Separated	14	0.8
40 - 49	146	8.4	Others	2	0.1
50 - 59	233	13.4	Unknown	1	0.1
60 and up	162	9.3			
Total	1,735	100.0	Total	1,735	100.0
GENDER			NATIONALITY		
	Number	%		Number	%
Male	637	36.7	Filipino	1,726	99.5
Female	1,098	63.3	Non-Filipino	9	0.5
Total	1,735	100.0	Total	1,735	100.0
EMPLOYMENT STATUS			LOCATION OF WORK		
	Number	%		Number	%
Employed	1,655	95.4	Urban	1,584	91.3
Unemployed	80	4.6	Rural	151	8.7
Total	1,735	100.0	Total	1,735	100.0
WORK SETTING					
	Number	%		Number	%
Hospitals			Industries		
Private	1,282	73.9	Primary	1	0.1
Public	171	9.9	Secondary	11	0.6
Schools			Tertiary	11	0.6
Private	15	0.9	Public Admin	68	3.9
Public	31	1.8	Others	145	8.4
			Total	1,735	100.0

Source of basic data: 1990 CPH, NSO

Table II.13 shows that among the regions, NCR has the largest number of dentists representing 46.51 percent of the total number. Regions 5 and 6 have observable high percentages of dentists. Other regions have percentages of dentists ranging from 2 percent to percent.

Among the DOH personnel, there are more field health service dentists (80 percent) than hospital-based professionals. A similar trend prevails across the regions.

Table II.13. Regional Distribution of Dentists

Region	(Sample Data) Total Dentists		DOH Personnel (Actual Data)		
	Number	%	Hospital	Field Serv	Total
NCR	807	46.51	4	426	430
CAR	36	2.07	17	25	42
1	74	4.27	15	59	74
2	31	1.79	26	39	65
3	186	10.72	33	74	107
4	245	14.12	30	128	158
5	60	3.46	23	64	87
6	47	2.71	28	56	84
7	71	4.09	17	52	69
8	30	1.73	36	58	94
9	20	1.15	18	40	58
10	46	2.65	17	75	92
11	51	2.94	19	89	108
12	31	1.79	16	39	55
Total	1,735	100.0	299	1,224	1,523

Sources of basic data: 1990 CPH, NSO and MAS-DOH

## A.2.2 Workforce Flow of Dentists

## A.2.2.1 Production of Dentists

*Student Attrition.* Table II.14 tracks down the number of enrollees, graduates and new

Table II.14. Dentists: Trends for Enrollees, Graduates and New Licensees

School Year	Enrollees				Graduates		New Licensees	Yearly Enrollment Attrition/Addition				Survival Rate 1-TO	Rate of Licensg
	1	2	3	4	2sem	Total		1-2	2-3	3-4	4-2nd		
1982-83	2966							92.0					
1983-84	3219	2729						97.9	88.8				
1984-85	3377	3151	2,421					117.9	110.1	141.2	38.4	66.5	
1985-86	4562	3980	3,468	3,421	1,312	1,972		87.3	86.5	112.4	33.2	54.2	63.1
1986-87	4457	3993	3,443	3,899	1,293	1,745	1,245	52.4	52.6	70.5	33.4	34.6	62.5
1987-88		2337	2,096	2,427	811	1,167	1,090		91.7	131.9	48.8	41.8	181.9
1988-89			2,143	2,764	1,348	1,909	2,123			56.0	38.4	40.3	66.4
1989-90				1,201	461	1,796	1,267						119.7
1991							2,150						
Average:												46.2	91.7

Sources of data: MIS - Bureau of Higher Education of DECS and PRC

licensees in the dental field across the school years, from SY 1982-1983 to SY 1991. Like Table II.5 for physicians, this table illustrates the progression of enrollees into graduates, and finally into licensees. Some, of course, fall by the wayside. The yearly attrition of dental students from first year to fourth year ranges from 52 percent to 132 percent. The fluctuations in number of students following regular schedule are caused by inflows and outflows of students from the dentistry course. Second semester graduates averaged at 30.1 percent of all fourth year students. This means that about 62 percent of graduating students failed to graduate in that semester. The survival rate averaged 46.2 percent.

*Percentage of New Licensees to Total Graduates.* The licensing rate averaged 91.7 percent. This includes the number of "fresh" graduates plus the number of retakers who have

passed the licensure examination.

#### A.2.2.2 International Outflows

Just as the number of new licensees (which is dependent on the number of graduates and enrollees) defines the inflow to the total stock of dentists, so does the number of permanent emigrants and OCWs determine the outflows from the stock of dentists.

*Permanent Emigration.* Dentists were among the medical workers who went with the wave of emigrants in the 60s and 70s. An estimated 1,764 dentists are presently residing abroad. The annual data for the 1988-91 period are shown in Table II.15. It could be observed that most of the emigrants settled in the USA, Canada and Australia.

Table II.15. Dentists: International Outflows

	USA	Canada	Austrl.	S. Arabia	Others	Total
<i>Permanent Emigrants</i>						
1988	122	16	42		2	182
1989	150	28	21		3	202
1990	137	27	27		5	196
1991	133	30	29		4	196
<i>Overseas Contract Workers</i>						
1988				27	3	30
1989				21		21
1990				25	5	30
1992				14	3	17

Note : - Data on OCWs are only new hirees which are approximately half of the total number of processed contract workers (See Appendix B)  
 - 1991 data on OCWs are not available  
 Sources: OCWs - Philippine Overseas Employment Administration  
 Permanent Emigrants - Commission on Filipinos Overseas

*Overseas Contract Workers.* The annual data on dental OCWs are shown in Table II.15. Although the data are limited to the number of new hires, it could be observed that Saudi Arabia is the recipient of dentists who seek temporary employment in the Middle East.

#### A.2.3 Projections

##### A.2.3.1 Increment to the Total Stock

The historical trend indicates that the number of freshmen enrollees in dental schools will reach 3,835 in the SY 1994-1995 (see Table II.16). Given this enrollment trend and

Table II.16. Increment to the Total Stock of Dentists

School Year	Freshmen Enrollment (A)	Year	New Licensees (B)	Previous-Year Total Stock (C)	Current-Year Total Stock (B+C)
1982 - 83	2,966	1987	1,245	22,534	23,779
1983 - 84	3,219	1988	1,090	23,779	24,869
1984 - 85	3,377	1989	2,123	24,869	26,992
1985 - 86	4,562	1990	1,267	26,992	28,259
1986 - 87	4,457	1991	2,150	28,259	30,409
1987 - 88	2,844	1992	1,205	30,409	31,614
1988 - 89	2,967	1993	1,258	31,614	32,872
1989 - 90	3,091	1994	1,310	32,872	34,182
1990 - 91	3,215	1995	1,363	34,182	35,545
1991 - 92	3,339	1996	1,415	35,545	36,960
1992 - 93	3,463	1997	1,468	36,960	38,428
1993 - 94	3,587	1998	1,520	38,428	39,948
1994 - 95	3,711	1999	1,573	39,948	41,521
1995 - 96	3,835	2000	1,625	41,521	43,147

## Sources of Data:

Enrollment:	1982-1990 -	DECS
	1991-1995 -	projected values using historical trend
New Licensees:	1988-1991 -	PRC
	1992-2000 -	projected values using the enrollment data, the average survival rate (S) and the average licensing rate (L): $(B = A \cdot S \cdot L)$
Total Stock:	1987 -	PRC

assuming a fixed survival rate of 46 percent and a licensing rate of 92 percent, the number of new licensees will register 1,625 in the year 2000. Note that different levels of survival rates and rates of new licensees will alter this projected number of new licensees.

Any changes in the number of enrollees and student attrition in a particular year will definitely affect the number of new licensees 5 years hence.

In 1987, the PRC had a total of 23,779 registered dentists. Adding the new licensees the previous-year total stock in a cumulative fashion, the total stock in the year 2000 will reach 43,147 dentists.

## A.2.3.2 Decrement from the Total Stock

The estimated initial net stock for dentists in 1987 varied from 11,684 (low assumption), and 14,300 (medium assumption). (see Appendix B).

In arriving at these figures, the following assumptions were used:



(a) Based on the PRC data, the total stock of dentists in 1986 was 22,534. Adding the number of new licensees in 1987 of 1,245, the total stock in 1987 was 23,779 under the medium assumption.

(b) The number of retirees was a straightforward calculation while the number of deaths was computed using the life table.

(c) According to the 1990 NSO survey, 2.70 percent of the total stock, or 642 dentists, were OCWs. Under the medium assumption, the number of dentists would be twice this figure, or 1,284.

(d) About 1.42 percent of the total stock in 1969 (Gupta, 1973) was the percentage assumed to have become ten times higher in the late 80s. The number of dentists was estimated at 4,300 in 1987.

Table II.17. Estimated Stocks of Dentists, 1987

	Low Assumption	Medium Assumption	High Assumption
Total Stock (1986)	22,534	22,534	22,534
Add: New Licensees (1987)	1,245	1,245	1,245
-----	-----	-----	-----
Total Stock (1987)	24,402	23,779	23,157
Less: Retirees	1,734	1,734	1,734
Dead	2,514	2,514	2,514
OCWs	1,926	1,284	642
Permanent Emigrants	5,921	3,947	1,974
-----	-----	-----	-----
Net Stock (1987)	11,684	14,300	16,915
=====	=====	=====	=====

It is difficult to establish how reliable the estimates of total stock of permanent emigrants and OCWs are, due to the inadequacy of data.

The projected supply for dentists for the period 1988-2000 is presented in Table II.18.

### A.3. Nurses

The International Council of Nurses defines a professional nurse as a person who has completed a basic nursing education program and is licensed in his or her country or state to practice professional nursing. The country's Nursing Law (RA 4704) specifies the main functions of a four-year-course graduate nursing professional, thus: to undertake nursing care and supervision of all sorts of patients, involving the management of care and observation of symptoms of physical and mental conditions and needs.

#### A.3.1 Profile and Stock

Table II.19 shows that 57 percent of the nurses are married and about 41 percent are

Table II.18. PROJECTED SUPPLY OF DENTISTS: 1988-2000

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
a. Low Assumption													
Previous-Year Net Stock	11,684	12,272	13,865	14,572	16,143	16,777	17,384	18,149	18,970	19,786	20,684	21,594	22,492
Add: New Licensees	1,090	2,123	1,267	2,150	1,205	1,258	1,310	1,363	1,415	1,468	1,520	1,573	1,625
Less: Retirees	14	19	37	72	124	173	173	144	167	70	54	63	55
Dead	128	139	147	154	158	158	159	161	162	170	180	190	198
OCWs	87	69	83	59	42	47	26	21	29	42	51	60	69
Permanent Emigrants	273	303	294	294	248	273	188	216	242	288	326	362	405
Current-Year Net Stock	12,272	13,865	14,572	16,143	16,777	17,384	18,149	18,970	19,786	20,684	21,594	22,492	23,390
b. Medium Assumption													
Previous-Year Net Stock	14,300	15,008	16,725	17,557	19,246	19,976	20,690	21,526	22,426	23,332	24,340	25,375	26,414
Add: New Licensees	1,090	2,123	1,267	2,150	1,205	1,258	1,310	1,363	1,415	1,468	1,520	1,573	1,625
Less: Retirees	14	19	37	72	124	173	173	144	167	70	54	63	55
Dead	128	139	147	154	158	158	159	161	162	170	180	190	198
OCWs	58	46	55	39	28	31	17	14	19	28	34	40	46
Permanent Emigrants	182	202	196	196	165	182	125	144	161	192	217	241	270
Current-Year Net Stock	15,008	16,725	17,557	19,246	19,976	20,690	21,526	22,426	23,332	24,340	25,375	26,414	27,470
c. High Assumption													
Previous-Year Net Stock	16,915	17,743	19,584	20,542	22,348	23,175	23,995	24,902	25,881	26,877	27,995	29,156	30,335
Add: New Licensees	1,090	2,123	1,267	2,150	1,205	1,258	1,310	1,363	1,415	1,468	1,520	1,573	1,625
Less: Retirees	14	19	37	72	124	173	173	144	167	70	54	63	55
Dead	128	139	147	154	158	158	159	161	162	170	180	190	198
OCWs	29	23	28	20	14	16	9	7	10	14	17	20	23
Permanent Emigrants	91	101	98	98	83	91	63	72	81	96	109	121	135
Current-Year Net Stock	17,743	19,584	20,542	22,348	23,175	23,995	24,902	25,881	26,877	27,995	29,156	30,335	31,549

Table II.19. Profile of Nurses, 1990

AGE STRUCTURE			MARITAL STATUS		
	Number	%		Number	%
< 25	1,379	22.1	Single	2,531	40.6
25 - 29	1,033	16.6	Married	3,555	57.0
30 - 34	2,003	32.1	Widowed	85	1.4
35 - 39	1,068	17.1	Separated	56	0.9
40 - 49	475	7.6	Others	11	0.2
50 - 59	222	3.6	Unknown	2	0.0
60 and up	60	1.0			
Total	6,240	100.0	Total	6,240	100.0
GENDER			NATIONALITY		
	Number	%		Number	%
Male	568	9.1	Filipino	6,209	99.5
Female	5,672	90.9	Non-Filipino	31	0.5
Total	6,240	100.0	Total	6,240	100.0
EMPLOYMENT STATUS			LOCATION OF WORK		
	Number	%		Number	%
Employed	5,916	94.8	Urban	5,192	83.2
Unemployed	324	5.2	Rural	1,048	16.8
Total	6,240	100.0	Total	6,240	100.0
WORK SETTING					
	Number	%		Number	%
Hospitals			Industries		
Private	3,080	49.4	Primary	13	0.2
Public	1,792	28.7	Secondary	88	1.4
Schools			Tertiary	54	0.9
Private	90	1.4	Public Admin	315	5.0
Public	126	2.0	Others	682	10.9
			Total	6,240	100.0

Source of basic data: 1990 CPH, NSO

single, with an average age of 31.7 years old, of which 90.9 percent are female. Ninety four point eight percent are employed while 5.2 percent are unemployed. Majority are Filipinos and only 0.5 percent are non-Filipinos.

Most of the nurses work in hospitals, clinics and laboratories. About 49.36 percent and 28.72 percent, are found respectively in private and public hospitals, clinics and laboratories; 5 percent in public administration and about 9.31 percent in undefined jobs.

Eighty three point two percent (83.2%) work in urban areas while 16.8 percent manage the nursing care needs of the rural population.

Table II.20 depicts the maldistribution of nurses among the regions. One third of the

Table II.20. Regional Distribution of Nurses

Region	(Sample Data)		DOH Personnel (Actual Data)		
	Number	%	Hospital	Field Serv	Total
NCR	1,959	31.39	85	547	632
CAR	215	3.45	411	147	558
1	400	6.41	475	190	665
2	177	2.84	453	123	576
3	511	8.19	744	263	1,007
4	830	13.30	908	352	1,260
5	233	3.73	482	274	756
6	573	9.18	742	214	956
7	386	6.19	347	286	633
8	166	2.66	605	209	814
9	190	3.04	381	204	585
10	201	3.22	502	215	717
11	251	4.02	373	150	523
12	148	2.37	251	184	435
Total	6,240	100.0	6,759	3,358	10,117

Sources of basic data: 1990 CPH, NSO and MAS-DOH.

nurses are found in the National Capital Region. Regions 6 and 9 host, respectively, 13.3 percent and 9.18 percent of the nurses.

Among the DOH nurses, 67 percent are hospital-based. Only 33 percent are working in community health centers or RHUs. The same pattern of distribution can be observed among the regions. An exception is Metro Manila where only 85 nurses out of 632, work in hospitals.

### A.3.2 Workforce Flow of Nurses

#### A.3.2.1 Production of Nurses

*Student Attrition.* The number of enrollees, graduates and new licensees across school years is shown in Table II.21. The yearly attrition rate ranges from 65 percent to 133 percent. This rather wide range indicates the erratic pattern of movement of students to and from the

Table II.21. Nurses: Trends of Enrollees, Graduates and New Licensees

School Year	Enrollees				Graduates		New Lic.	Yearly Enrollment Attrition/Addition				Surv'1 Rate 1-TG	Licen-sing Rate
	1	2	3	4	2sem	Total		1-2	2-3	3-4	4-2seG		
1982-83	5,535												
1983-84	7,663	5,707						103.1					
1984-85	11,156	7,748	4,689					101.1	82.2				
1985-86	23,383	15,328	8,612	6,045	4,573	6,261		132.5	111.2	128.9	75.6	113.1	
1986-87	20,546	15,151	7,688	6,231	7,130	10,139	3,877	64.8	50.2	72.4	114.4	132.3	61.9
1987-88		15,597	10,170	6,458	6,425	8,492	4,910	75.9	67.1	84.0	99.5	73.4	48.4
1988-89			12,917	8,922	8,176	8,563	4,355		82.8	87.7	91.6	36.6	51.3
1989-90				9,157	8,727	12,050	9,100			70.9	95.3	58.6	106.3
1991							9,165						76.1
Average:												66.24	69.0

Sources of data: MIS - Bureau of Higher Education of DECS and PRC

nursing course. The survival rate averages at 66 percent, which means that 40 percent of the freshmen enrollees were not able to graduate.

*Percentage of New Licensees to Total Graduates.* The licensing rate, 69 percent, is quite low, which may reflect the poor quality of nursing schools in the production of nursing graduates.

#### A.3.2.2 International Outflow

*Permanent Emigrants.* Little is known about contemporary international migration of nurses, and reliable secondary source materials on nurse migration are difficult if not impossible to obtain. In 1990, 40,440 nurses permanently migrated abroad. As shown in Table II.22, the United States is the major destination of migrant Filipino nurses, receiving an average 84 percent of the total migrants, with Canada and Australia as next in line.

Table II.22. Nurses: International Outflow

	USA	Canada	Austrl.	Saudi A.	Others	Total
Permanent Emigrants						
1988	1067	45	103		24	1239
1989	1012	89	60		41	1202
1990	1123	114	60		29	1326
1991	908	138	67		21	1134
Overseas Contract Workers						
1988	2086			2547	395	5028
1989	2545			2445	434	5424
1990	2941			3325	581	6847
1992	1165			2356	547	4068

Note : - Data on overseas contract workers are only new hires which are approximately half of the total number of processed contract workers (See Appendix B)  
- 1991 data on OCWs are not available

Sources: Permanent Emigrants - Phil. Overseas Employment Administration  
OCWs - Commission on Filipinos Overseas

*Overseas Contract Workers.* Contract migration of nurses in the 1960s and 1970s was directed mainly to the United States. From 1976 onwards, however, the flow has been towards the Middle East.

The demand for Filipino nurses dominates the overall international demand in the health sector. Nurses capture about 75 percent of the market.<sup>9</sup> They also capture a 6-7 percent share of the total landbased Filipino worker deployment.

Saudi Arabia is obviously the most important importer of nurses, having received more than 50 percent of the number of OCWs. The United States ranks second in absorbing Filipino

<sup>9</sup> Overseas Employment Info Series, Vol 5, No. 1, 1992

nurses, next to Saudi Arabia.

In 1987, POEA recorded a deployment of 25,940 nurses. Eighty-seven percent (87%) of these nurses went to the Middle East, 11 percent to the Americas, 0.7 percent to Europe, 0.3 percent to Asia, .06 percent to the Trust Territories and 0.02 percent to Oceania.

Although the Philippine Nursing Act of 1991 requires nurses who graduate from state colleges or universities to render, after being issued the necessary board licenses, at least one year of nursing service in the Philippines before they are allowed to leave for overseas jobs, the government's liberal labor export policy facilitates the mass exodus of Filipino Medical workers for high paying overseas employment, creating an acute nursing shortage in the local service.

The shortage is compounded by a number of factors. One, it is the good, experienced and highly specialized ones who are lost to other countries, leaving the nursing sector skill-deficient. Two, the replacement of experienced nurses who leave for overseas employment takes time since new graduates and relatively inexperienced nurses could not be trained as fast as emigrants leave. Three, it is the critical areas such as intensive care units which are impaired when the outflow is particularly massive.

### A.3.3 Projections

#### A.3.3.1 Increment to the Total Stock

In the school year 1995-1996, the number of freshmen enrollees will reach 46,095. The number of new licensees will reach 21,075 in 2000 assuming a fixed survival rate of 66 percent and licensing rate of 69 percent. Different survival and licensing rates will yield different

Table II.23. Increment to the Total Stock of Nurses

School Year	Freshmen Enrollment (A)	Year	New Licensees (B) */	Previous-Year Total Stock (C)	Current-Year Total Stock (B+C)
1982 - 83	5,535	1987	3,877	151,870	155,747
1983 - 84	7,663	1988	4,910	155,747	160,657
1984 - 85	11,565	1989	4,355	160,657	165,012
1985 - 86	23,383	1990	9,100	165,012	174,112
1986 - 87	20,546	1991	9,165	174,112	183,277
1987 - 88	19,514	1992	8,922	183,277	192,199
1988 - 89	24,043	1993	10,993	192,199	203,192
1989 - 90	27,193	1994	12,433	203,192	215,625
1990 - 91	30,344	1995	13,873	215,625	229,499
1991 - 92	33,494	1996	15,314	229,499	244,812
1992 - 93	36,644	1997	16,754	244,812	261,567
1993 - 94	39,794	1998	18,195	261,567	279,761
1994 - 95	42,945	1999	19,635	279,761	299,396
1995 - 96	46,095	2000	21,075	299,396	320,471

Sources of Data:

Enrollment: 1982-1990 - DECS

1991-1995 - projected values using historical trend

\*/ New Licensees:

1988-1991 - PRC

1992-2000 - projected values using the enrollment data, the average survival rate (S) and the average rate of new

licensees (L):  $(B = A \cdot S \cdot L)$

Total Stock: 1987 - PRC

numbers of new licensees.

Changes in the school's or government's policy on enrollment, or changes in student attrition, would affect the number of new licensees five years after the change is instituted. The time lag is explained by the same fact that it takes four years to train nurses.

In 1987, the PRC had a tally of 155,747 registered nurses. Adding to this initial stock the subsequent number of new licensees and repeating the process for every year, the total stock in the year 2000 will be 320,471 nurses.

#### A.3.3.2 Decrement from the Total Stock

The estimated initial net stock for nurses in 1987 ranges from 50,597 to 113,216 nurses. The median value is 81,907 (see Appendix B). These correspond to the low, high and medium assumptions, respectively.

Supporting these estimates are the following assumptions:

(a) The total stock of nurses in 1986 was 151,870, according to the PRC data. Adding the number of new licensees in 1987 of 3,877, the total stock in 1987 was 155,747 under the medium assumption.

(b) The number of retirees was a straightforward calculation while the number of deaths was computed using the life table.

(c) In 1987, the POEA recorded a deployment abroad of 25,940 nurses.

(d) Permanent emigrants as a proportion of the total stock of nurses stood at 23.55 percent, according to Abella (1980). Assuming this to be constant throughout the years, the number of permanent emigrants is about 36,678 in 1987.

(e) On the basis of the above information, the net stock of nurses in 1987 was estimated at 81,907 under the medium assumption.

Table II.24. Estimated Stocks of Nurses, 1987

	Low Assumptions	Medium Assumptions	High Assumptions
Total Stock (1986)	151,870	151,870	151,870
Add: New Licensees (1987)	3,877	3,877	3,877
Total Stock (1987)	157,686	155,747	153,809
Less: Retirees	4,412	4,412	4,412
Dead	6,810	6,810	6,810
OCWs	38,910	25,940	12,970
Permanent Emigrants	55,018	36,678	18,339
Net Stock (1987)	50,597	81,907	113,216

The projected net stocks for the period 1988-2000 are presented in Table II.25.

As observed, the net stock is dwindling due to the increasing international outflows.

Table II.25. PROJECTED SUPPLY OF NURSES: 1988-2000

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
<b>a. Low Assumption</b>													
Previous-Year Net Stock	50,597	43,848	34,582	28,915	27,145	22,413	18,789	17,851	17,173	17,329	18,060	19,332	21,033
Add: New Licensees	4,910	4,355	9,100	9,165	8,922	10,993	12,433	13,873	15,314	16,754	18,195	19,635	21,075
Less: Retirees	159	45	185	148	105	299	66	372	405	404	297	759	876
Dead	522	553	592	634	678	723	774	824	876	932	992	1,050	1,108
OCWs	9,741	11,839	12,644	9,019	11,217	11,588	10,966	11,261	11,776	12,377	13,100	13,503	14,288
Permanent Emigrants	1,239	1,202	1,326	1,134	1,654	2,027	1,745	1,894	2,101	2,310	2,534	2,622	2,830
Current-Year Net Stock	43,848	34,562	28,915	27,145	22,413	18,769	17,851	17,173	17,329	18,060	19,332	21,033	23,206
<b>b. Medium Assumption</b>													
Previous-Year Net Stock	81,907	75,156	65,872	60,225	58,455	53,723	50,079	48,961	48,483	48,639	49,370	50,642	52,343
Add: New Licensees	4,910	4,355	9,100	9,165	8,922	10,993	12,433	13,873	15,314	16,754	18,195	19,635	21,075
Less: Retirees	159	45	185	148	105	299	66	372	405	404	297	759	876
Dead	522	553	592	634	678	723	774	824	876	932	992	1,050	1,108
OCWs	9,741	11,839	12,644	9,019	11,217	11,588	10,966	11,261	11,776	12,377	13,100	13,503	14,288
Permanent Emigrants	1,239	1,202	1,326	1,134	1,654	2,027	1,745	1,894	2,101	2,310	2,534	2,622	2,830
Current-Year Net Stock	75,156	65,872	60,225	58,455	53,723	50,079	48,961	48,483	48,639	49,370	50,642	52,343	54,516
<b>c. High Assumption</b>													
Previous-Year Net Stock	113,216	106,465	97,181	91,534	89,764	85,032	81,388	80,270	79,792	79,948	80,679	81,951	83,652
Add: New Licensees	4,910	4,355	9,100	9,165	8,922	10,993	12,433	13,873	15,314	16,754	18,195	19,635	21,075
Less: Retirees	159	45	185	148	105	299	66	372	405	404	297	759	876
Dead	522	553	592	634	678	723	774	824	876	932	992	1,050	1,108
OCWs	9,741	11,839	12,644	9,019	11,217	11,588	10,966	11,261	11,776	12,377	13,100	13,503	14,288
Permanent Emigrants	1,239	1,202	1,326	1,134	1,654	2,027	1,745	1,894	2,101	2,310	2,534	2,622	2,830
Current-Year Net Stock	106,465	97,181	91,534	89,764	85,032	81,388	80,270	79,792	79,948	80,679	81,951	83,652	85,825



According to the POEA's information series on international market prospects of nurses, the demand for Filipino nurses in the United States will continue beyond the year 2000 since wages are expected to increase. The current recession in the Western countries has however slowed down the demand for foreign medical workers in the United States, although the Boston University School of Nursing quoted a shortage of 370,000 nurses by the year 2000. Moreover, demand by Middle East employers for Filipino nurses will also continue to grow in the coming years, with Saudi Arabia as the key market.

#### A.4 Midwives

Midwifery is a two-year curriculum which requires a license to practice. A midwife performs services requiring an understanding of the principles and applications of procedures and techniques applicable to the care of normal child-bearing women from the beginning of pregnancy until the end of puericulture and the care of their normal infants during the neonatal period (Section 24, RA 2644, June 18, 1960). A rural health midwife performs clinic services of consultation, treatment and referrals; provides maternal and child health, nutrition and family planning services in the community and is responsible for case-finding, collection of specimen, examination and treatment, and referral in the control of communicable and diarrheal diseases, dental care and other unit programs.

##### A.4.1 Profile and Stock

Some 88 percent of the stock of midwives are at the age of 40 years below (see Table II.26). Majority of the midwives are female; male midwives comprise only 1 percent. The employment rate was 93.3 percent. Almost all of the midwives are Filipinos.

By place of work, 42.37 percent and 34.58 percent can be found, respectively, in private and public hospitals, clinics and laboratories; 12.37 percent are in public administration and 7.61 percent are employed in jobs of undefined nature. About 65.9 percent are working in urban areas while 34.1 percent are working in rural areas.

In terms of regional distribution, 16.58 percent of the midwives work in the NCR, which is a much smaller proportion compared with the other health workers (refer to Table II.27). About the same percentage work in Region 4. Region 3 accounts for 12.79 percent of midwives. Percentages of midwives in other regions range from 3 percent to 7 percent.

The DOH midwives total 12,408. Ninety-seven percent of government midwives are community-based; only 414 are working in the hospitals. Larger numbers of community-based midwives are found in the NCR and Regions 3 and 4.

##### A.4.2 Workforce Flow of Midwives

###### A.4.2.1 Production of Midwives

*Student Attrition.* The number of enrollees, graduates and new licensees across school years are presented in Table II.28. The yearly attrition rate ranges from 44 percent to 113 percent. The survival rate is, on the average, 54.7 percent. This lower rate shows that a number of students transfer to the nursing course, or drop out.

*Percentage of New Licensees to Total Graduates.* The licensing rate stood at 74 percent

Table II.26. Profile of Midwives, 1990

AGE STRUCTURE			MARITAL STATUS		
	Number	%		Number	%
< 25	846	25.5	Single	1,233	37.1
25 - 29	497	15.0	Married	1,969	59.3
30 - 34	830	25.0	Widowed	81	2.4
35 - 39	547	16.5	Separated	37	1.1
40 - 49	308	9.3	Others	2	0.1
50 - 59	258	7.8	Unknown	1	0.0
60 and up	37	1.1			
Total	3,323	100.0	Total	3,323	100.0
GENDER			NATIONALITY		
	Number	%		Number	%
Male	33	1.0	Filipino	3,316	99.8
Female	3,290	99.0	Non-Filipino	7	0.2
Total	3,323	100.0	Total	3,323	100.0
EMPLOYMENT STATUS			LOCATION OF WORK		
	Number	%		Number	%
Employed	3,100	93.3	Urban	2,190	65.9
Unemployed	223	6.7	Rural	1,133	34.1
Total	3,323	100.0	Total	3,323	100.0
WORK SETTING					
	Number	%		Number	%
Hospitals			Industries		
Private	1,408	42.4	Primary	6	0.2
Public	1,149	34.6	Secondary	6	0.2
Schools			Tertiary	7	0.2
Private	12	0.4	Public Admin	411	12.4
Public	18	0.5	Others	306	9.2
			Total	3,323	100.0

Source of basic data: 1990 CPH, NSO

in 1991.

## A.4.2.2 International Outflow

*Permanent Emigrants.* Table II.29 provides information on the annual flow of permanent emigrants for the period 1988-1991. The trend is increasing. The USA is still the biggest recipient of midwives.

*Overseas Contract Workers.* The annual data on overseas contract workers is also shown in Table II.29. Saudi Arabia employed more midwives from the Philippines than any other country in 1990.

## A.4.3 Projections

Table II.27. Regional Distribution of Midwives

Region	(Sample Data) Total Midwives		DOH Personnel (Actual Data)		
	Number	%	Hospital	Field Serv	Total
NCR	551	16.58	1	1,050	1,051
CAR	86	2.59	101	449	550
1	230	6.92	18	806	824
2	120	3.61	16	540	556
3	425	12.79	22	1,154	1,176
4	534	16.07	13	1,442	1,455
5	219	6.59	15	775	790
6	234	7.04	30	964	994
7	189	5.69	12	934	946
8	95	2.86	8	805	813
9	94	2.83	7	709	716
10	180	5.42	58	947	1,005
11	214	6.44	8	669	677
12	152	4.57	105	750	855
Total	3,323	100.0	414	11,994	12,408

Sources of basic data: 1990 CPH, NSO and MAS-DOH

Table II.28. Midwives: Trends of Enrollees, Graduates and New Licensees

School Year	Enrollment		Graduates		New Licensees	Enrollment Attrition		Surv'l Rate 1-TG	Licen-sing Rate
	1	2	2sem	Total		1-2	2-2sc		
1983 - 84	7,288								
1984 - 85	9,212	5,389				73.9			
1985 - 86	17,905	10,439	4,720	5,551		113.3	45.2	60.3	
1986 - 87	12,381	7,827	6,231	7,440		43.7	79.6	41.6	
1987 - 88		7,849	5,865	6,727		63.4	74.7	54.3	
1988 - 89				8,221	3,527		77.1	63.5	63.5
1989 - 90					4,471			60.0	60.1
1991					6,681				99.3
Average:								54.7	74.4

Sources of data: MIS - Bureau of Higher Education of DECS and PRC

## A.4.3.1 Increment to the Total Stock

Table II.30 presents the projections for the number of freshmen enrollees in midwifery and the number of new licensees. The freshmen enrollment will increase to 22,214 in the school year 1995-96. The number of new licensees is projected to reach 9,054 in 2000 and the total stock is expected to reach 228,185 in 2000.

## A.4.3.2 Decrement from the Total Stock

The estimated initial net stock of midwives ranges from 39,577 to 104,504 with 72,041 as the median value using low, high and medium assumptions, respectively.

These are estimates using the following assumptions:

(a) Based on the PRC data, the total stock of midwives in 1986 was 146,226. Adding the number of new licensees in 1987 of 2,306, the total stock in 1987 was 148,532 under the medium assumption.

Table II.29. Midwives: International Outflow

	USA	Canada	Austrl.	Saudi A.	Others	Total
<b>Permanent Emigrants</b>						
1988	45	2	20		9	76
1989	47	10	7		14	78
1990	56	9	8		12	85
1991	63	11	13		19	106
<b>Overseas Contract Workers</b>						
1988				133	0	133
1989				77	1	78
1990				64	6	70
1992				101	173	274

Note: - Data on overseas contract workers are only new hires which are approximately half of the total number of processed contract workers (See Appendix B)  
 - 1991 data on OCWs are not available  
 Sources: Permanent Emigrants - Commission on Filipinos Overseas  
 OCWs - Phil. Overseas Employment Administration

Table II.30. Increment to the Total Stock of Midwives

School Year	Freshmen Enrollment (A)	Year	New Licensees (B)	Previous-Year Total Stock (C)	Current-Year Total Stock (B+C)
1982 - 83	5,852	1987	2,306	146,226	148,532
1983 - 84	7,288	1988	2,925	148,532	151,457
1984 - 85	9,212	1989	3,527	151,457	154,984
1985 - 86	17,905	1990	4,471	154,984	159,455
1986 - 87	12,381	1991	6,681	159,455	166,136
1987 - 88	12,948	1992	5,277	166,136	171,413
1988 - 89	14,802	1993	6,033	171,413	177,446
1989 - 90	13,356	1994	5,443	177,446	182,889
1990 - 91	14,832	1995	6,045	182,889	188,934
1991 - 92	16,309	1996	6,647	188,934	195,581
1992 - 93	17,785	1997	7,249	195,581	202,830
1993 - 94	19,262	1998	7,850	202,830	210,680
1994 - 95	20,738	1999	8,452	210,680	219,132
1995 - 96	22,214	2000	9,054	219,132	228,185

Sources of Data:

Enrollment: 1982-1990 - DECS

1991-1995 - projected values using historical trend

New Licensees: 1988-1991 - PRC

1992-2000 - projected values using the enrollment data, the average survival rate (S) and the average rate of new licensees (L):  $(B = A \cdot S \cdot L)$

Total Stock: 1987 - PRC

(b) The number of retirees was a straightforward calculation while the number of deaths

was computed using the life table.

(c) Using the estimate of IMAP (1991), the number of permanent emigrants registered 20,000 under the medium assumption. The value under the high assumption was 10,000 which was close to the estimate of Gupta's (1973) figure of 10 times higher than the 1969 rate of 0.54 percent or approximately 8,000 in 1987.

(d) OCWs as a proportion of the total stock was estimated to be 10 percent of the total deployment in 1987, taking into account the midwives who registered at the POEA as domestic helpers. This figure is about 44,927 midwives.

Table II.31. Estimated Stocks of Midwives, 1987

	Low Assumptions	Medium Assumptions	High Assumptions
Total Stock (1986)	146,226	146,226	146,226
Add: New Licensees (1987)	2,306	2,306	2,306
Total Stock (1987)	149,685	148,532	147,379
Less: Retirees	4,230	4,230	4,230
Dead	7,334	7,334	7,334
OCWs	67,391	44,927	22,464
Permanent Emigrants	30,000	20,000	10,000
Net Stock (1987)	39,577	72,041	104,504

The projected net stocks for the period 1988-2000 are shown in Table II.32.

## A.5 Medical Technologists

As a licensed professional and a graduate of a four-year dental curriculum, a medical technologist performs various medical laboratory procedures in aid of the physician in the diagnosis, study and treatment of disease and in the promotion of health in general. In the examination of tissues, secretions and excretions of the human body, he employs chemical, microscopic, bacteriologic, hematologic, serologic, immunologic, parasitologic, mycologic, microbiologic, histopathologic, cytotechnological and nuclear techniques. Other functions include blood banking, clinical research, preparations and standardization of reagents, clinical laboratory quality control and collection and preservation of specimen.

### A.5.1 Profile and Stock

Eighty-three percent of medical technologists are 40 years and below. Most are single; only 46 percent are married (see Table II.33), with females comprising 74.4 percent of the population. About 99.7 percent are employed; only 0.2 percent are non-Filipino nationals.

By place of work, 49.54 percent and 26.24 percent of medical technologists can be found, respectively, in private and public hospitals, clinics and laboratories; 7.83 percent are in public administration and about 10 percent have undefined jobs.

Table II.32. PROJECTED SUPPLY OF MIDWIVES: 1988-2000

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
<b>a. Low Assumption</b>													
Previous-Year Net Stock	39,577	40,262	41,279	42,748	46,011	47,839	50,016	51,920	54,068	56,622	59,324	62,285	65,331
Add: New Licensees	2,925	3,527	4,471	6,681	5,277	6,033	5,443	6,045	6,647	7,249	7,850	8,452	9,054
Less: Retirees	211	84	182	173	246	204	138	301	137	494	618	1,080	1,147
Dead	609	646	694	742	792	840	881	930	970	1,018	1,067	1,140	1,201
OCWs	1,307	1,653	1,998	2,345	2,253	2,833	2,354	2,490	2,782	2,835	2,893	2,873	3,153
Permanent Emigrants	114	117	128	159	158	180	167	176	195	200	212	213	225
Current-Year Net Stock	40,262	41,279	42,748	46,011	47,839	50,016	51,920	54,068	56,622	59,324	62,285	65,331	68,659
<b>b. Medium Assumption</b>													
Previous-Year Net Stock	72,041	73,199	74,806	76,984	81,081	83,713	86,827	89,571	92,608	96,157	99,871	103,900	108,008
Add: New Licensees	2,925	3,527	4,471	6,681	5,277	6,033	5,443	6,045	6,647	7,249	7,850	8,452	9,054
Less: Retirees	211	84	182	173	246	204	138	301	137	494	618	1,080	1,147
Dead	609	646	694	742	792	840	881	930	970	1,018	1,067	1,140	1,201
OCWs	871	1,102	1,332	1,563	1,502	1,755	1,569	1,660	1,861	1,890	1,995	1,982	2,102
Permanent Emigrants	76	78	85	106	105	120	111	117	130	133	141	142	150
Current-Year Net Stock	73,199	74,806	76,984	81,081	83,713	86,827	89,571	92,608	96,157	99,871	103,900	108,008	112,482
<b>c. High Assumption</b>													
Previous-Year Net Stock	104,504	106,136	108,333	111,219	116,151	119,586	123,638	127,222	131,147	135,692	140,417	145,514	150,884
Add: New Licensees	2,925	3,527	4,471	6,681	5,277	6,033	5,443	6,045	6,647	7,249	7,850	8,452	9,054
Less: Retirees	211	84	182	173	246	204	138	301	137	494	618	1,080	1,147
Dead	609	646	694	742	792	840	881	930	970	1,018	1,067	1,140	1,201
OCWs	436	551	666	782	751	878	785	830	931	945	998	991	1,051
Permanent Emigrants	38	39	43	53	53	60	58	59	65	67	71	71	75
Current-Year Net Stock	106,136	108,333	111,219	116,151	119,586	123,638	127,222	131,147	135,692	140,417	145,514	150,684	156,264

Table II.33. Profile of Medical Technologists, 1990

AGE STRUCTURE			MARITAL STATUS		
	Number	%		Number	%
< 25	299	27.5	Single	568	52.3
25 - 29	247	22.7	Married	499	45.9
30 - 34	171	15.7	Widowed	10	0.9
35 - 39	184	16.9	Separated	8	0.7
40 - 49	150	13.8	Others	1	0.1
50 - 59	31	2.9	Unknown	0	0.0
60 and up	4	0.4			
Total	1,086	100.0	Total	1,086	100.0
GENDER			NATIONALITY		
	Number	%		Number	%
Male	278	25.6	Filipino	1,084	99.8
Female	808	74.4	Non-Filipino	2	0.2
Total	1,086	100.0	Total	1,086	100.0
EMPLOYMENT STATUS			LOCATION OF WORK		
	Number	%		Number	%
Employed	1,041	95.9	Urban	945	87.0
Unemployed	45	4.1	Rural	141	13.0
Total	1,086	100.0	Total	1,086	100.0
WORK SETTING					
	Number	%		Number	%
Hospitals			Industries		
Private	538	49.5	Primary	3	0.3
Public	285	26.2	Secondary	29	2.7
Schools			Tertiary	20	1.8
Private	4	0.4	Public Admin	85	7.8
Public	8	0.7	Others	114	10.5
			Total	1,086	100.0

Source of basic data: 1990 CPH, NSO

Of the total number, about 87 percent are working in urban areas and 13 percent work in rural areas.

Table II.34 shows the regional distribution of medical technologists. More than one-third are located in the NCR. Higher percentages are noticeable in Regions 5 and 6 while the other regions' percentages of physicians range from 2 percent to 5 percent.

About 54 percent of DOH medical technologists are based in the hospitals. This pattern is not consistent among the regions. Some regions have a larger proportion of community-based medical technologists while some, a higher proportion of hospital-based personnel.

#### A.5.2 Workforce Flow of Medical Technologists

##### A.5.2.1 Production of Medical Technologists

Table II.34. Regional Distribution of Medical Technologists

Region	Total Med Technologists		DOH Personnel		
	Number	%	Hospital	Field Serv	Total
NCR	398	36.65	10	109	119
CAR	26	2.39	39	19	58
1	45	4.14	45	1	46
2	33	3.04	48	28	76
3	116	10.68	59	92	151
4	134	12.34	93	67	160
5	38	3.50	57	123	180
6	72	6.63	72	17	89
7	61	5.62	44	82	126
8	25	2.30	56	76	132
9	17	1.57	55	57	112
10	44	4.05	67	93	160
11	56	5.16	43	32	75
12	21	1.93	29	54	83
Total	1,086	100.0	717	850	1,567

Sources of basic data: 1990 CPH, NSO and MAS-DOH

*Student Attrition.* Table II.35 presents the trends for enrollees, graduates and new licensees. The yearly attrition of students ranges from 45 percent to 130 percent. The survival rate stands at 43 percent which is explained by a high number of student transferees to the school of medicine.

Table II.35. Med'l Technologists: Trends of Enrollees, Graduates and New Licensees

School Year	Enrollees				Graduates		New Licensees	Yearly Enrollment Attrition/Addition				Survival Rate 1-TG	Licensing Rate
	1	2	3	4	2sem	Total		1-2	2-3	3-4	4-2seG		
1982 - 83	13,325												
1983 - 84	16,031	4,338						130.5					
1984 - 85	14,714	3,576	3,398					59.3	78.3				
1985 - 86	16,391	4,793	4,685	2,339	11,138	2,040		101.7	121.0	68.8	48.7	61.4	
1986 - 87	18,547	7,270	4,854	2,219	11,306	2,288	1,362	113.8	101.3	47.4	58.9	37.9	66.8
1987 - 88		3,849	5,678	2,864	11,485	2,318	1,406	45.0	78.1	59.0	51.9	49.2	61.5
1988 - 89			4,866	2,713	12,017	3,157	1,980		126.4	47.8	74.3	49.4	85.4
1989 - 90				2,169	11,267	2,734	1,816			44.6	58.4	32.0	57.5
1990 - 91							1,509						55.2
Average:												43.2	64.4

Sources of data: MIS - Bureau of Higher Education of DECS and PRC

*Percentage of New Licensees to Graduates.* The ratio of new licensees to the number of graduates is 64.4 percent.

#### A.5.2.2 International Outflow

*Permanent Emigrants.* The annual data from 1988 to 1992 on the international outflow of medical technologists are shown in the following table. The USA is consistently the recipient of permanent emigrants while Saudi Arabia is the largest importer of contract migrants or OCWs. In 1991, the number of emigrants was 235.



Table II.36. Medical Technologists: International Outflow

	USA	Canada	Austrl.	Saudi A.	Others	Total
<b>Permanent Emigrants</b>						
1988	140	62	24		2	228
1989	121	67	3		3	194
1990	186	52	20		10	268
1991	171	26	26		12	235
<b>Overseas Contract Workers</b>						
1988	0			46	0	46
1989	11			22	1	34
1990	36			39	3	78
1992	49			36	116	201

Note: - Data on overseas contract workers are only new hirees which are approximately half of the total number of processed contract workers (See Appendix B)  
 - 1991 data on OCWs are not available

Sources: Permanent emigrants - Commission on Filipinos Overseas  
 OCWs - Phil. Overseas Employment Administration

*Overseas Contract Workers.* The table below also presents the number of OCWs from 1988 to 1992.

### A.5.3 Projections

#### A.5.3.1 Increment to the Total Stock

Table II.37 provides the projections for freshmen enrollment and the number of new licensees. In school year 1995-1996, the freshmen enrollment is projected at 6,953. At a fixed survival rate of 43 percent and rate of licensing of 64 percent, the number of new licensees in 2000 is projected at 1,935. With the annual increment of the number of new licensees, the total stock will rise to 47,218 in 2000.

#### A.5.3.2 Decrement from the Total Stock

Table II.38 presents the estimated initial net stock of medical technologists in 1987. The net stock ranged from 12,804 to 21,735 medical technologists. Under the medium assumption, the net stock in 1987 was estimated at 17,270.

The assumptions used in deriving these figures are as follows:

(a) The total stock of medical technologists in 1986 was 25,703, according to the PRC data. Adding the number of new licensees in 1987 of 1,362, the total stock in 1987 was 27,065 under the medium assumption.

(b) The number of retirees was a straightforward calculation while the number of deaths was computed using the life table.

Table II.37. Increment to the Total Stock of Medical Technologists

School Year	Freshmen Enrollment (A)	Year	New Licensees (B) */	Previous-Year Total Stock (C)	Current-Year Total Stock (B+C)
1982 - 83	3,325	1987	1,362	25,703	27,065
1983 - 84	6,031	1988	1,406	27,065	28,471
1984 - 85	4,714	1989	1,980	28,471	30,451
1985 - 86	6,391	1990	1,816	30,451	32,267
1986 - 87	8,547	1991	1,509	32,267	33,776
1987 - 88	4,415	1992	1,229	33,776	35,005
1988 - 89	4,018	1993	1,118	35,005	36,123
1989 - 90	4,438	1994	1,235	36,123	37,358
1990 - 91	4,857	1995	1,352	37,358	38,710
1991 - 92	5,276	1996	1,468	38,710	40,178
1992 - 93	5,695	1997	1,585	40,178	41,763
1993 - 94	6,115	1998	1,702	41,763	43,465
1994 - 95	6,534	1999	1,818	43,465	45,283
1995 - 96	6,953	2000	1,935	45,283	47,218

## Sources of Data:

Enrollment: 1982-1990 - DECS

1991-1995 - projected values using historical trend

\*/ New Licensees: 1988-1991 - PRC

1992-2000 - projected values using the enrollment data, the average survival rate (S) and the average rate of new licensees (L):  $(B = A \cdot S \cdot L)$ 

Total Stock: 1987 - PRC

Table II.38. Estimated Stocks of Medical Technologists

	Low Assumptions	Medium Assumptions	High Assumptions
Total Stock (1986)	25,703	25,703	25,703
Add: New Licensees (1987)	1,362	1,362	1,362
Total Stock (1987)	27,746	27,065	26,384
Less: Retirees	0	0	0
Dead	864	864	864
OCWs	4,466	2,977	1,489
Permanent Emigrants	8,931	5,954	2,977
Net Stock (1987)	12,804	17,270	21,735

(c) According to the 1990 Census, OCWs comprised 11 percent of the total stock, or 2,977 using the 1987 total stock. Assuming that the rate of permanent emigration is twice the rate of contract migration, permanent emigrants stood at 5,954 medical technologists in 1987. PAMET puts the number medical technologists who are out of the country for work at 6,000

The projected net stocks for the period 1988-2000 are presented in Table II.39.

Table II.39. PROJECTED SUPPLY OF MEDICAL TECHNOLOGISTS: 1988-2000

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	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
a. Low Assumption													
Previous-Year Net Stock	12,804	13,637	15,109	16,193	16,966	17,701	18,391	19,247	20,173	21,168	22,228	23,357	24,553
Add: New Licensees	1,406	1,980	1,818	1,509	1,229	1,118	1,235	1,352	1,468	1,585	1,702	1,818	1,935
Less: Retirees	0	0	0	0	0	0	0	0	0	0	0	0	0
Dead	98	106	114	122	131	140	151	161	173	186	199	214	229
OCWs	134	111	218	261	83	48	18	33	47	59	71	81	82
Permanent Emigrants	342	291	402	353	281	240	210	233	255	279	303	327	353
Current-Year Net Stock	13,637	15,109	16,193	16,966	17,701	18,391	19,247	20,173	21,166	22,228	23,357	24,553	25,815
b. Medium Assumption													
Previous-Year Net Stock	17,270	18,261	19,867	21,157	22,135	22,991	23,777	24,709	25,723	26,817	27,991	29,245	30,577
Add: New Licensees	1,406	1,980	1,818	1,509	1,229	1,118	1,235	1,352	1,468	1,585	1,702	1,818	1,935
Less: Retirees	0	0	0	0	0	0	0	0	0	0	0	0	0
Dead	98	106	114	122	131	140	151	161	173	186	199	214	229
OCWs	89	74	144	174	55	32	12	22	31	39	47	54	61
Permanent Emigrants	228	194	268	235	187	160	140	155	170	186	202	218	235
Current-Year Net Stock	18,261	19,867	21,157	22,135	22,991	23,777	24,709	25,723	26,817	27,991	29,245	30,577	31,987
c. High Assumption													
Previous-Year Net Stock	21,735	22,885	24,625	26,121	27,303	28,280	29,162	30,170	31,273	32,467	33,754	35,132	36,600
Add: New Licensees	1,406	1,980	1,818	1,509	1,229	1,118	1,235	1,352	1,468	1,585	1,702	1,818	1,935
Less: Retirees	0	0	0	0	0	0	0	0	0	0	0	0	0
Dead	98	106	114	122	131	140	151	161	173	186	199	214	229
OCWs	45	37	72	87	28	16	6	11	18	20	24	27	31
Permanent Emigrants	114	97	134	118	94	80	70	78	85	93	101	109	118
Current-Year Net Stock	22,885	24,625	26,121	27,303	28,280	29,162	30,170	31,273	32,467	33,754	35,132	36,600	38,158

## A.6 Pharmacists

A pharmacist, a graduate of a four-year course, prepares or manufactures, analyzes, assays, preserves, stores, distributes or sells any medicine, drug, chemicals, cosmetics, pharmaceuticals, devices, or contrivances used; or renders pharmaceutical service in any office or drug and cosmetic establishment where scientific, technological or professional knowledge of Pharmacy is applied; or conducts scientific pharmaceutical research for biological and bacteriological testings and examinations; or engages in teaching (section 23, RA 5921, June 21, 1969).

### A.6.1 Profile and Stock

As shown in Table II.40, 64 percent of pharmacists are 40 years old and younger. Of the total active population of pharmacists, the male pharmacists comprise only 6.3 percent. About 58 percent are married. Employment rate is 96.1 percent. Less than 1 percent are non-Filipino pharmacists.

Around 12.58 percent and 6.44 percent, respectively, work in private and public hospitals, clinics and laboratories. More than half of the pharmacists or about 59.14 percent work in drug stores and medical supplies. About 5.42 percent work in manufacturing industries while 6.85 percent have miscellaneous jobs.

About 90 percent work in urban areas while only 10 percent work in rural areas.

Table II.41. Regional Distribution of Pharmacists

Region	Total Pharmacists		DOH Personnel		
	Number	%	Hospital	Field Serv	Total
NCR	353	36.09	3	21	24
CAR	13	1.33	24	8	32
1	31	3.17	33		33
2	29	2.97	34	6	40
3	77	7.87	48	8	56
4	118	12.07	74		74
5	26	2.66	45	1	46
6	57	5.83	52		52
7	56	5.73	30		30
8	23	2.35	46	2	48
9	33	3.37	29	1	30
10	53	5.42	27	7	34
11	79	8.08	34	6	40
12	30	3.07	20	3	23
Total	978	100.0	499	63	562

Sources of basic data: 1990 CPH, NSO and MAS-DOH

About 36 percent of the pharmacists are located in the National Capital Region. Higher percentages are found in Regions 5 and 6 while the other regions' percentages of pharmacists range from 2 percent to 8 percent.

Of the DOH personnel, an average of 89 percent work in hospitals. All the regions,

Table II.40. Profile of Pharmacists, 1990

AGE STRUCTURE			MARITAL STATUS		
	Number	%		Number	%
< 25	159	16.3	Single	363	37.1
25 - 29	183	18.7	Married	568	58.1
30 - 34	165	16.9	Widowed	35	3.6
35 - 39	118	12.1	Separated	11	1.1
40 - 49	111	11.3	Others	1	0.1
50 - 59	146	14.9	Unknown	0	0.0
60 and up	96	9.8			
Total	978	100.0	Total	978	100.0
GENDER			NATIONALITY		
	Number	%		Number	%
Male	62	6.3	Filipino	972	99.4
Female	916	93.7	Non-Filipino	6	0.6
Total	978	100.0	Total	978	100.0
EMPLOYMENT STATUS			LOCATION OF WORK		
	Number	%		Number	%
Employed	940	96.1	Urban	880	90.0
Unemployed	38	3.9	Rural	98	10.0
Total	978	100.0	Total	978	100.0
WORK SETTING					
	Number	%		Number	%
Hospitals			Industries		
Private	123	12.6	Primary	2	0.2
Public	63	6.4	Secondary	54	5.5
Schools			Tertiary	632	64.6
Private	2	0.2	Public Admin	22	2.2
Public	2	0.2	Others	78	8.0
			Total	978	100.0

Source of basic data: 1990 CPH, NSO

except NCR, had more DOH personnel working in hospitals.

## A.6.2 Workforce Flow of Pharmacists

## A.6.2.1 Production of Pharmacists

**Student Attrition.** The growth in the number of enrollees, graduates and new licensees are shown in Table II.42. The yearly attrition rate ranges from 60 percent to 106 percent. The

Table II.42. Pharmacists: Trends of Enrollees, Graduates and New Licensees

School Year	Enrollees				Graduates		New Licensees	Yearly Enrollment Attrition/Addition				Survival Rate 1-70	Licensing Rate
	1	2	3	4	2aem	Total		1-2	2-3	3-4	4-2aG		
1982 - 83	11,125												
1983 - 84	11,160	903						80.3					
1984 - 85	11,547	942	822					81.2	91.0				
1985 - 86	11,634	1,214	1,002	755	496	669		78.5	106.4	91.8	65.7	59.5	
1986 - 87	11,970	1,225	968	714	558	709	648	75.0	79.7	71.3	78.2	61.1	96.9
1987 - 88		1,463	1,102	848	753	1,316	239	74.3	90.0	87.6	88.8	85.1	33.7
1988 - 89			881	736	631	814	1,032		60.2	66.8	85.7	49.8	78.4
1989 - 90				803	639	1,020	848			91.1	79.6	51.8	104.2
1990 - 91							1,359						133.2
Average:												60.9	91.1

Sources of data: MIS - Bureau of Higher Education of DECS and PRC

survival rate is about 79.8 percent.

**Percentage of New Licensees to Total Graduates.** The percentage of new licensees to total graduates is, on the average, 91 percent.

#### A.6.2.2 International Outflow

**Permanent Emigrants.** The annual international outflows are shown in Table II.43. The USA has relatively more migrant Filipino pharmacists on a permanent basis.

Table II.43. Pharmacists: International Outflow

	USA	Canada	Austrl.	Saudi A.	Others	Total
Permanent Emigrants						
1988	75	3	8		3	89
1989	96	4	6		0	106
1990	82	10	7		0	99
1991	122	6	8		3	139
Overseas Contract Workers						
1988	0			24	13	37
1989	0			33	20	53
1990	1			61	8	70

Note: - Data on overseas contract workers are only new hires which are approximately half of the total number of processed contract workers (See Appendix B)  
- 1991 data on OCWs are not available

Sources: Permanent emigrants - Commission on Filipinos Overseas  
OCWs - Phil. Overseas Employment Administration

**Overseas Contract Workers.** Saudi Arabia, on the other hand, imported more OCWs relative to other destination countries.

### A.6.3 Projections

#### A.6.3.1 Increment to the Total Stock

Table II.44 shows projections for freshmen enrollment and the number of new licensees. In school year 1995-1996, freshmen enrollment is projected at 2,106. At a fixed survival rate of 60 percent and licensing rate of 91 percent, the number of new licensees in 2000 will reach 1,169. The total stock will reach 39,320 in 2000.

Table II.44. Increment to the Total Stock of Pharmacists

School Year	Freshmen Enrollment (A)	Year	New Licensees (B)	Previous-Year Total Stock (C)	Current-Year Total Stock (B+C)
1982 - 83	1,125	1987	648	26,845	27,493
1983 - 84	1,160	1988	239	27,493	27,732
1984 - 85	1,547	1989	1,032	27,732	28,764
1985 - 86	1,634	1990	848	28,764	29,612
1986 - 87	1,970	1991	1,359	29,612	30,971
1987 - 88	1,491	1992	827	30,971	31,798
1988 - 89	1,419	1993	787	31,798	32,586
1989 - 90	1,361	1994	755	32,586	33,341
1990 - 91	1,485	1995	824	33,341	34,165
1991 - 92	1,610	1996	893	34,165	35,058
1992 - 93	1,734	1997	962	35,058	36,020
1993 - 94	1,858	1998	1,031	36,020	37,051
1994 - 95	1,982	1999	1,100	37,051	38,151
1995 - 96	2,106	2000	1,169	38,151	39,320

Sources of Data:

Enrollment: 1982-1990 - DECS

1991-1995 - projected values using historical trend

New Licensees: 1988-1991 - PRC

1992-2000 - projected values using the enrollment data, the average survival rate (S) and the average licensing rate (L):  $(B = A \cdot S \cdot L)$

#### A.6.3.2 Decrement from the Total Stock

The estimated initial net stock of Pharmacists ranges from 13,715 (low assumption) to 18,865 (high assumption) with 16,290 as the median value. The following assumptions were used to obtain these estimates.

(a) A total of 27,493 pharmacists were registered with the PRC in 1986. Adding the number of new licensees in 1987 of 648, the total stock in 1987 was 28,141 under the medium assumption.

(b) The number of retirees was a straightforward calculation while the number of deaths was computed using the life table.

(c) Based on the 1990 NSO survey, the OCWs accounted for 4.10 percent of the total stock or 1,154 pharmacists.

(d) The number of permanent emigrants was about 1.42 percent of the total stock in 1969 (Gupta, 1973). This is assumed to be ten times higher in the late 80s which was estimated at 3,996 in 1987.

Table II.45. Estimated Stocks of Pharmacists

	Low Assumption	Medium Assumption	High Assumption
Total Stock (1986)	27,493	27,493	27,493
Add: New Licensees (1987)	648	648	648
Total Stock (1987)	28,465	28,141	27,817
Less: Retirees	3,562	3,562	3,562
Dead	3,139	3,139	3,139
OCWs	1,731	1,154	577
Permanent Emigrants	5,994	3,996	1,998
Net Stock (1987)	13,715	16,290	18,865

The projected net stocks for the period 1988-2000 are presented in Table II.46.

## B. Summary

Table II.47 provides the summary of the figures under the profile, stock and flow of selected health manpower categories.

Table II.47. Summary Table of the Profile, Stock and Flow of Selected Health Manpower

	Physicians	Dentists	Nurses	Midwives	Med Tech	Pharmacists
Profile and Stock						
Age : less 40 years (%)	59.3	68.9	87.9	82.0	82.8	64.0
Marital : Married (%)	67.3	56.1	57.0	59.3	45.9	58.1
Gender : Female (%)	48.8	63.3	90.9	99.0	74.4	93.7
Unemployment Rate (%)	3.4	4.6	5.2	6.7	4.1	3.9
Hospital/clinic-based (%)	87.1	83.8	78.1	77.0	75.7	19.0
Rural-based (%)	7.5	8.7	16.8	34.1	13.0	10.0
Regional : Total						
NCR (%)	42.6	46.5	31.4	16.6	36.7	36.1
Regional : DOH personnel						
NCR (%)	4.9	4.2	3.6	6.6	1.3	0.3
Flow of Health manpower						
Production:						
Range of yearly attrition	48.5	33.2	67.1	41.6	44.6	59.3
Survival Rate (Average)	133.4	131.9	132.5	113.3	130.5	106.4
Range: min	65.3	46.2	66.2	54.7	43.2	60.9
max	45.1	34.6	36.6	41.6	32.0	49.8
Licensign Rate (Avg)	80.7	66.5	132.3	63.5	61.4	61.1
Range: min	124.1	91.7	69.0	74.4	64.4	91.1
max	74.7	62.5	48.4	60.1	55.2	33.7
International Outflows:						
Permanent Emigrants	25.4	6.2	23.2	1.7	11.4	5.0
OCWs	3.3	2.8	36.6	30.3	10.2	4.9



Table II.46. PROJECTED SUPPLY OF PHARMACISTS: 1988-2000

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
<b>a. Low Assumption</b>													
Previous-Year Net Stock	13,715	13,445	13,878	14,118	14,821	14,885	14,420	14,408	13,812	13,811	13,798	13,783	13,868
Add: New Licensees	239	1,032	848	1,359	827	787	755	824	893	962	1,031	1,100	1,169
Less: Retirees	129	120	114	112	297	962	348	1,057	620	569	569	569	569
Dead	139	146	152	161	166	158	183	153	151	151	199	150	150
OCWs	108	174	194	174	150	68	129	58	113	129	138	150	162
Permanent Emigrants	134	159	149	209	150	65	129	53	111	128	138	149	161
Current-Year Net Stock	13,445	13,878	14,118	14,821	14,885	14,420	14,408	13,812	13,811	13,798	13,783	13,868	13,993
<b>b. Medium Assumption</b>													
Previous-Year Net Stock	16,290	16,100	16,644	16,998	17,829	17,993	17,572	17,644	17,186	17,159	17,230	17,309	17,491
Add: New Licensees	239	1,032	848	1,359	827	787	755	824	893	962	1,031	1,100	1,169
Less: Retirees	129	120	114	112	297	962	348	1,057	620	569	569	569	569
Dead	139	146	152	161	166	158	183	153	151	151	199	150	150
OCWs	72	118	129	116	100	45	86	37	75	86	92	100	108
Permanent Emigrants	89	108	99	139	100	43	86	35	74	85	82	99	107
Current-Year Net Stock	16,100	16,644	16,998	17,829	17,993	17,572	17,644	17,186	17,159	17,230	17,309	17,491	17,728
<b>c. High Assumption</b>													
Previous-Year Net Stock	18,865	18,758	19,411	19,879	20,837	21,101	20,724	20,882	20,460	20,508	20,664	20,835	21,117
Add: New Licensees	239	1,032	848	1,359	827	787	755	824	893	962	1,031	1,100	1,169
Less: Retirees	129	120	114	112	297	962	348	1,057	620	569	569	569	569
Dead	139	146	152	161	166	158	183	153	151	151	199	150	150
OCWs	36	58	65	58	50	23	43	19	38	43	46	50	54
Permanent Emigrants	45	53	50	70	50	22	43	18	37	43	46	50	54
Current-Year Net Stock	18,758	19,411	19,879	20,837	21,101	20,724	20,882	20,460	20,508	20,664	20,835	21,117	21,459

Under the profile and stock portion, most of the health professionals in all categories are very young with ages of 40 years and below. The youngest group is that of nurses and the relatively older group is that of physicians. These figures suggest that more and more nurses, midwives and other medical professionals in the health delivery system are becoming less and less experienced. In terms of marital status, most of the medical professionals in all the health manpower categories, except medical technologists, are married. As observed, the number of female medical workers are larger than male medical workers. Females are still dominant in nursing, midwifery and pharmacy which are traditionally their domain. In the fields of medicine, dentistry and medical technology which are previously the domain of men, the proportion of female health professionals is increasing.

Midwives have the highest unemployment rate relative to other health professionals. Most of those employed are located in the hospitals, except for the pharmacists where the majority are found in drugstores and pharmaceutical companies. Most of those employed are nowhere to be found in the rural areas. A heavy concentration of health professionals in the urban areas is conspicuous.

The regional distribution of medical workers is skewed towards the NCR. About 30 to 40 percent are NCR-based, except for midwives.

DOH-employed health workers are a small number, particularly dentists, medical technologists and pharmacists. Public sector physicians are only 23 percent of the total number while government pharmacists are only 2.9 percent.

Majority of physicians, nurses and pharmacists are hospital-based while most of the DOH dentists and midwives are found in community health centers.

As regards the flow of health manpower, the irregular patterns of the yearly attrition depict fluctuations attributed to the movement of students into and from the particular health program. These erratic trends "follow" closely the rate of survival of students (rates range from 32 percent to 132 percent). On the other hand, the licensing rate ranges from 34 percent to 193 percent which suggests a good number of re-takers and non-passers.

International migration poses a threat on the net supply of health professionals. The volume of outflow is larger, particularly among nurses, doctors and midwives. The impact is immediate on the net supply of health workers.

In observing the current situation of the health professionals discussed in this Chapter, the following questions are raised in relation to future increments and losses in the stock:

- (a) Given the existing or planned educational capacity, how many new graduates will be produced in future years?
- (b) What internal factors (such as student losses) could be modified so as to improve the output efficiency of educational institutions, and what are the maximum enrollment levels possible in those institutions if it becomes necessary to increase the manpower supply?
- (c) What exogenous factors limit school enrollments and effective output? Example of such factors are insufficient supply of qualified applicants and lack of coordination between production (educational programs) and national health

## III.

planning. Or what external factors will increase school enrollment?

- (d) Is the international outflow of medical workers beneficial or a disadvantage? What outflow levels could be tolerated? What appropriate policies ought to be adopted to regulate international migration of health manpower?
- (e) What government policy or combination of policies should be pursued to control the flow of health manpower, taking into account the fact that regulation on the inflow side (e.g., enrollment, licensing, etc) has long-run effects and regulation on the outflow side has an immediate impact on the net supply of medical workers? Finally, the absorptive capacity of the market of the health professionals should be seriously studied.
- (f) Is coordination between the DOH and the DECS on the inflow side, and between the DOH and the DFA and other concerned institutions on the outflow side critical?

### III. REQUIREMENT FOR HEALTH MANPOWER

Health manpower needs are estimated in this study using two techniques which are basically normative in approach. One is the standard manpower to population ratios and the other is the Modified GMENAC Requirements Model, a biologic or health needs approach.

A major shortcoming, however, of estimating or forecasting health manpower requirements based on the health needs approach is not being able to account for the changes in price and income. Since the projections are based mainly on health experts' judgment of the ideal medical services that the population ought to have, prices and incomes which may affect the consumption of health services are not considered. The model assumes that the population actually needs and can afford such a professionally determined quantity of health services.

A third approach, the economic demand approach, more realistically estimates and projects health manpower needs according to the total amount of health services a population will seek and can afford at a certain time. Although it is appropriate to combine both needs and demand approaches in the Philippines, where both government and private sectors are actively involved in the providing health services, the demand approach is not used in this study due to data constraints.

#### A. Standard Requirements

This section presents standard requirements for health personnel per certain population sizes.

##### A.1. Standard health manpower/population ratios

This ratio method identifies a suitable proportion of health manpower to a specific population size. Standard health personnel to population ratios have been developed in the Philippines for hospitals, primary level of health care, school health, occupational health and safety, and medical specialty.

*Hospital.* The Hospital Operations and Management Services (HOMS) of the Department of Health has been utilizing the standard personnel requirements for hospitals in determining the number of health personnel per hospital according to bed capacity. Table III.1 provides the total personnel requirements for all health professionals, including medical specialists, dentists, nurses, midwives (or nursing aides), medical technologists and pharmacists. Here, the number of health personnel depends largely on the bed capacity of hospitals.

*Primary Health Care.* The standard staffing pattern used by the DOH for each municipal health unit (RHU) used by the DOH is shown in Table III.2. The ratio set for doctors and nurses is 1:20,000 adopted from the 1974 operations research study funded by WHO. On the other hand, the ratio set for midwives is 1:3000 as concluded in the 1988 DOH workshop on Philippine Health Development Project III.<sup>10</sup>

<sup>10</sup> The 1974 study proposes a 1:5,000 midwife to population ratio. However, this was reduced to 1:30,000 in 1988 to take into account the heavier workload of midwives relative to physicians and nurses, as well as the added responsibilities (Reyes and Picazo, 1990). Moreover, the Cebu Provincial Health Office proposes another ratio which take into account an area's accessibility (Mercado, 1988).

Table III.1 - Standard Personnel Requirements for Hospitals

	Bed Capacity										
	<25	25	50	100	150	200	250	300	350	400	500
Physicians (All)	2	4	8	39	50	83	86	115	122	161	161
Chief of Clinic				1	1	1	1	1	1	1	1
Surgeons				2	3	5	5	6	6	9	9
EBENT				2	2	2	2	2	2	2	2
Orthopedics						2	2	3	3	3	3
Urology										2	2
Internal Medicine				2	3	5	5	6	6	9	9
Psychiatrists						1	1	2	2	2	2
Neurologists										2	2
Ob-Gyn				3	3	4	5	5	5	7	7
Pediatricians				3	3	4	4	5	5	7	7
Anesthesia				2	2	3	4	5	5	7	7
Pathologists				2	2	2	3	5	5	5	5
Radiology				2	2	3	3	5	5	5	5
OPD/GPs				1	1	2	3	3	3	3	3
Other Medical Specialists						1	1	1	2	2	2
Res Physicians	2	4	8	19	28	48	47	66	72	95	95
Dentists	0	1	1	3	3	5	6	6	9	9	9
Nurses	5	7	15	38	61	81	108	127	149	170	190
Midwives/NA	2	4	11	17	32	39	55	68	80	90	103
Med Tech	1	1	1	2	2	3	3	4	5	5	5
Pharmacists	0	1	2	4	4	5	6	6	9	9	9

Source: DOH - Hospital Operations and Management Services

Table III.2 - Standard Health Manpower Requirements for Public Health, School Health and Industrial/Occupational Health

	Public Health (RHU)	School Health	Industrial/Occupational Health and Safety		
	Ratio to Pop	Ratio to Students	51-200	Firm Size 201-300	300-up
Physicians	1:20,000	1:10,000	None	Part-time	Full-Time
Dentists	1:20,000	1: 5,000	None	Part-time	Full-Time
Nurses	1:20,000	1: 5,000	Full-Time	Full-Time	Full-Time
Midwives	1: 3,000				

Sources: DOH, DECS and DOLE

**School Health.** The Department of Education, Culture and Sports (DECS) in 1986 issued a memorandum which stipulates the minimum standard staffing of school health centers: one physician for every 10,000 students, and a nurse and a dentist for every 5,000 students. The standard ratio per student population which is lower than the one provided in RA 124 requires private schools with 300 students or more to employ full time or part-time physician. This law which took effect in June 14, 1947 has never been followed, however.

**Occupational/Industrial Health and Safety.** Article 157, Book 4 of the Philippine Labor Code requires firms to provide health personnel according to their number of employees. Thus, firms with 51 to 200 employees are required to have one full-time nurse. Those with employees of 201 to 301 are required to have one full-time nurse, one part-time physician and a dentist while those with 301 or more employees must have a full-time physician, dentist and nurse. Small-scale firms with 50 or less employees are provided with special regulations by the Secretary of Labor.



Using the population, the number of students and employees (of firms with 15 or more employees), Table III.4 presents the standard requirements for physicians, dentists, nurses and

Table III.4 - Health manpower Standard Requirements By Work Setting, 1990

	Public Health	School Health (Priv't & Public)	Ind/Occup Health (All Establishments)
Physicians	3,074	1,579	1,222
Dentists	3,074	3,159	1,222
Nurses	3,074	3,159	6,634
Midwives	20,493		

Source: DOH, DECS, DOLE and NSO

midwives in community health services, schools and industrial establishments.

## B. The GMENAC Requirements Model

Earlier works on health manpower requirements made use of the simple task and time utilization technique which basically considers the time spent by health personnel for specific patient care tasks. This study employs a more detailed health manpower forecasting model, the US Graduate Medical Education National Advisory Council (GMENAC) Model which derives the requirements from subjective normative standards based on the projected morbidity of the population at risk and some experts' opinion on the proper utilization of services deployed against this morbidity.

The modified GMENAC requirements model used in this study seeks to capture what each health manpower category does or should be doing, identify unmet needs of underserved populations, highlight preventive and well-person care and services, and determines unduplicated counts of each type of manpower required to deliver specific services.

The two key features of the model are:

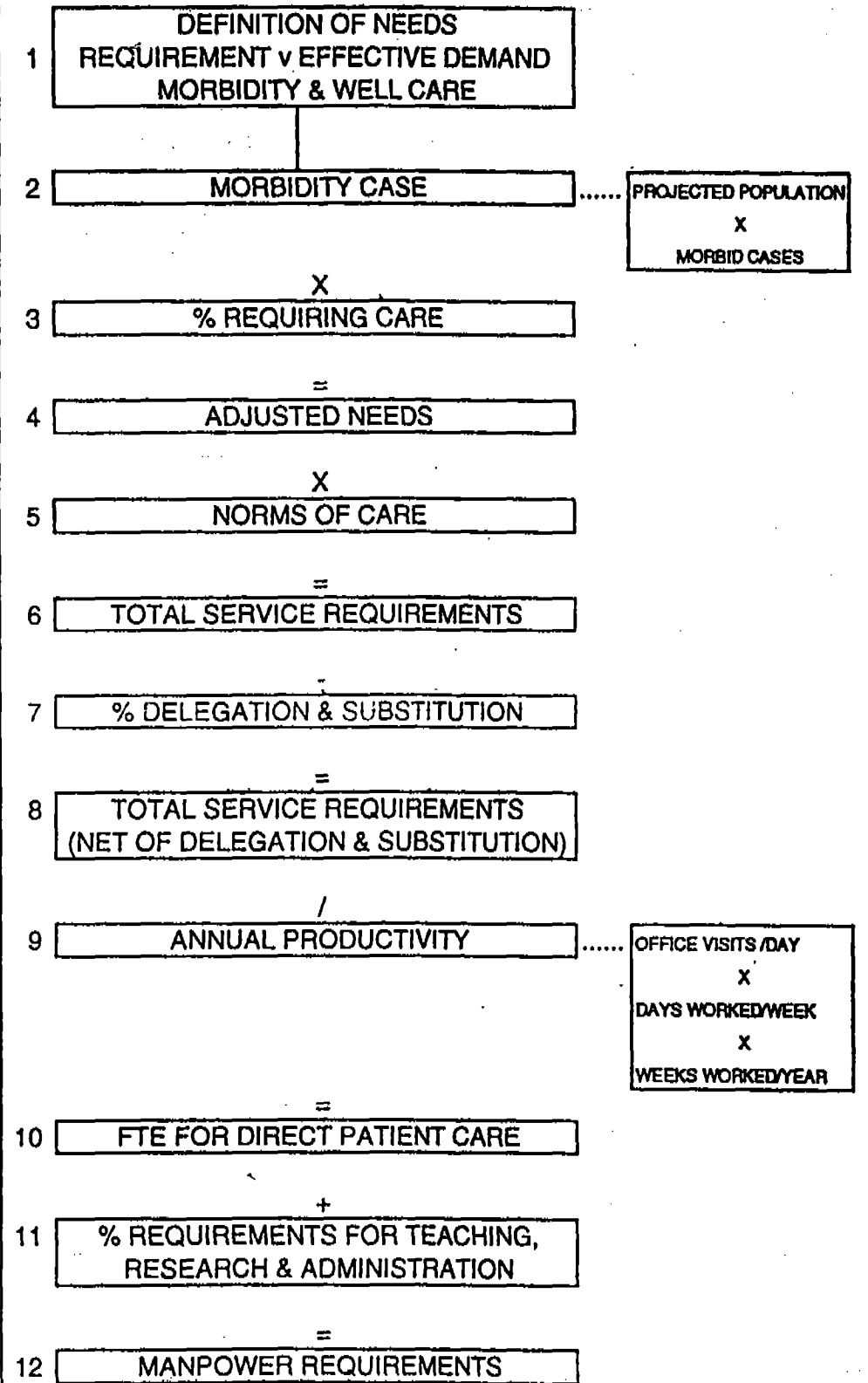
- (1) the manpower requirements are related to the incidence and prevalence of disease; and
- (2) an adjustment process for the manpower requirements estimates is developed based on what the panel of experts believes is achievable, reasonable and likely to be employed or utilized.

The model takes into account other important factors which determine the total manpower requirement such as percentage of morbidity cases requiring care, delegation and substitution, norms of care, full time equivalent and percentage required for non-patient care, i.e., teaching, research and administration.

### B.1 Operational Procedure

The model, Figure III.1, begins with defining clearly the need for health services (See Box 1). "True needs" is represented by all of health care needs, including preventive and administrative services required by the entire population. Need includes disability or morbidity and well care.

# THE GMENAC\* MODEL



\*GRADUATE MEDICAL EDUCATION NATIONAL ADVISORY COMMITTEE

Figure III.1



**Morbidity Cases.** This represents the data source on the national prevalence and incidence estimates for specific diseases, conditions or practices (Box 2). The percentage of the morbid cases to the population in a specified base year is multiplied by the projected population at a future year.

**Adjusted Needs.** Data on morbidity and mortality were sourced from the 1987 Health Statistics, 1989 National Health Survey, specialty journals and special purpose studies and presented to the panel for validation. Adjustments were then made on the data with the percentage requiring care (Box 3) determined by the panel themselves. These adjusted needs (Box 4) symbolizes the adjusted expected prevalence in future time of each disease.

**Norms of Care.** For each disease, condition, preventive or administrative service, the model requires that norms of care and service intensities requirements be developed (Box 5). The panel of experts make estimates of the average number of visits required per year to provide adequate medical care for each disease, condition or practice. Norms of care is the product of frequency of consultation per year and duration of consultation (hours) per year. Each type of manpower requires different bases for developing the norms of care. For doctors, inpatient and outpatient care are considered; for dentists, the patient's age; and for indirect patient care, laboratory needs.

**Total Service Requirements.** The total adjusted needs (cases per population, Box 4) and norms of care (annual visits for each condition, Box 5) comprise the total service requirements for all diseases, conditions and well care by the target population (Box 6). The prevalence or incidence conditions or operative procedure are expressed as thousands or millions of operations, deliveries, or hospital-day visits, encounters between the patient population and health manpower required to provide adequate medical care to the entire population in the future time.

**Delegation and Substitution.** Having obtained the total service requirements by each type of manpower for the entire population needing care in the future time, the model next subtracted from the total services those services that should be delegated to or provided by the various categories of health providers who complement the work of each type of manpower. The experts were asked to specify for each disease or condition the percentage of total visits that should be delegated (Box 7). The difference is the total units of care that require specific services by each type of manpower (Box 8).

**Full-Time-Equivalent.** The total number of full-time-equivalent (FTE) required to provide all of the medical care services needed by the population was obtained by dividing the net of substitution and delegation (Box 8) to the annual physician productivity (office visits per day, days worked per week and weeks worked per year). A modified Delphi process was used again and respondents were asked to estimate how the average health manpower will distribute his/her time among direct and indirect patient care activities. The units may be expressed in thousands of office visits that can be handled per year, number of operative procedures performed per year or other units unique to the worked outputs and others. The result is the total number of manpower required for patient care (Box 10).

**Manpower Requirements.** The total manpower required to provide all the services needed by the population and the health care system in a specified future year was finally obtained by adding to the total number of manpower for patient care, the percentage requirement for non-patient care activities (Box 11) and any other demands that have not been captured elsewhere in the model. Adjustments include teaching, research, and administration activities, community programming and planning for which a percentage add-on was developed by the panel of experts.

## B.2 Scope and Limitations

The requirements for the different health manpower categories are computed using low, medium and high assumptions. While the medium assumption serves as the baseline projection as it takes into account purely professional judgment, the low and high assumptions serve as alternative projections based on potential changes or policies that could affect manpower requirements. Both public and private perspectives are considered in the projections.

Requirement for physicians is computed per specialty. Not all specialties though are included in the model due to time constraints. Hence, related specialties are classified based on the types of diseases one handles or on similar tasks or units of output one chooses and considers as a major specialty. Major specialties like surgery, cardiology, pulmonology, etc. use the modified GMENAC model while other specialties such as nuclear medicine and occupational/industrial medicine, etc. which are considered residuals are estimated on the basis of either standard manpower to population ratio, laboratory needs or linkage to institutions employing them.

For types of manpower where the modified GMENAC model does not apply as in the case of medical technologists and pharmacists, other methods were adopted since these health professionals are not directly involved in patient care. Medical technologists are laboratory-based, hence, requirement is based on the utilization rate of laboratory services of hospitals and rural health care while the need for pharmacists is derived from the DOH-required number of pharmacists per hospital type and the number of pharmaceutical establishments. On the other hand, the methodology for computing the requirement for nurses follows the framework of the modified GMENAC Model. However, it is not based on morbidity cases but on the number of patients received in the hospital, clinic or rural health unit.

Although the use of modified Delphi panel and solicitation of experts opinion contributed to the projection of health manpower requirements, there is a possibility that not every one of the experts represents the real world and that the panel has not reached a robust consensus on the norms of care.

Specific norms of care for the different manpower categories adopted from the Reyes and Picazo study were first presented to a panel of practicing medical experts, who made corresponding modifications based presumably on their own experience and observations on initial iteration. More iterations followed but not on a panel as large as the first - usually on a one-on-one interview basis. Although the study tried to apply a rigorous Delphi method, it was not able to get as much respondents as to short of constitute a representative survey of practice norms, relying as it did on the fact that the few Metro Manila-based respondents from which information were obtained were top experts in their field and would know better the prevailing norms throughout the country.

The sources of morbidity information are the 1989 Philippine Health Statistics, 1987 National Health Survey, the 1991 DOH Annual Report, different journals published by specialty associations and some special purpose studies. Under-reporting seems apparent especially on the morbidity cases of the 1989 Philippine Health Statistics. The crude estimate of the morbidity cases poses a severe problem in computing the requirements. Incidence and prevalence of morbidity were presented to the experts for validation. Morbidity data are either used as is or adjusted according to the experts' estimates.

Health manpower requirements are estimated using medium population projections for the year 1992 and 2000 based on the 1980 Census of Population and Housing.

### **B.3 Requirement Estimates for Physicians and Specialists**

Requirements for physicians are largely influenced by the various tasks being performed in each specialty. Thus it is imperative to consider the levels of care, i.e. promotive/ preventive, restorative, rehabilitative and palliative care in each specialty in order to have a vivid picture of the amount of work concentration, delegation and substitution. The computation of physicians' requirements per specialty also gives an idea of how much is being coordinated with other specialties. Intra-referral in the medical system is necessary in complicated conditions which need to be diagnosed by several specialists.

#### *B.3.1 General Practitioners*

The renewed commitment of government to primary health care has once more placed general practitioners at the forefront of health activities targeting the greater mass of the population. Non-specialized physicians assume an even greater role now that health thrusts include traditional medicine and resource-infused community practice. The epidemiological shift, notwithstanding, activities like food and micro-nutrient supplementation, vaccination and information, education and communication (IEC) campaigns must be sustained to protect the gains achieved in the fight against communicable and infectious diseases.

Private-sector general practitioners also share responsibilities with community physicians mostly in the areas of curative and rehabilitative care which includes prescribing medicines and treatment procedures, referral to other levels of care, monitoring signs of deterioration or improvements, and counselling patients.

The assumptions underlying the estimations are given as follows:

1. Morbidity Cases - Data on morbidity cases from the 1989 Philippine Health Statistics were considered underreported thus, not adopted by the experts. The adjusted morbidity case is 180 percent for medium assumption and 230 percent for high assumption. This is based on the morbidity estimates made by the experts: bronchitis - 55 percent, tuberculosis - 45 percent, cardiovascular diseases - 20 percent, respiratory diseases - 20 percent, accidents - 20 percent, undiscovered diseases - 10 percent, and other communicable diseases - 10 percent. The study done by Reyes and Picazo (1990) on health manpower used 43.1 percent morbid population. This data is used in developing the morbidity cases for low assumption requirement.

The percentage requiring care from the general practitioners is 60 percent.

2. Norms of Care - The average treatment for bronchitis, tuberculosis, cardiovascular, respiratory, ordinary diseases requires 5, 4, 6, 6, 6 visits respectively per year to provide sufficient medical care. The average time needed for each visit is 10, 10, 15, 15, 15 minutes respectively allowing travel time to and from the patient's location. Given this information, it is assumed that the average number of visits required per year is 5 with a mean duration of 15 minutes.
3. Delegation and Substitution - No percentage of total services should be delegated in the

case of general practitioners since their work is usually under minimal, intermediate and not intensive care and does not require hospital services most of the time. However, because of limited public manpower resources constraints it is assumed that 25 percent of the total service requirements are delegated to the ancillary medical workers under medium and high assumptions.

**Physician Productivity** - It is assumed that the general practitioners provide 10 hours per day to patient care, 6 working days per week and 53 weeks per year. Hence, the average annual productivity is 2,760.

**Requirement for Non-Patient Care** - It is assumed that 30 percent of the total number of services will be added for non-patient care activities such as teaching, administration, research, community health programming and planning.

Applying these assumptions, the total number of general practitioners required to provide all the services needed by the population for 1992 stands at 9,784 (low assumption); 30,645 (medium assumption); and 39,158 (high assumption). By the year 2000, the requirement estimates are 8,570 (low assumption); 45,840 (medium assumption); and 61,120 (high assumption).

### *B.3.2 Cardiologists*

The demand for cardiologists becomes apparent since heart disease has become the most common cause of disability and death in the country. The 1989 Philippine Health Statistics indicates that heart diseases ranked eighth among the top ten leading causes of morbidity with a total of 98,813 cases or 164.4 per 100,000 population. Major diseases of the heart were responsible for an estimated 44,856 deaths or 74.6 per population, or about 13.8 percent of the total deaths in 1989.

#### **Assumptions:**

1. **Morbidity Cases** - The 1989 Philippine Health Statistics which indicates the causes of morbidity was presented to the panel. Based on their assessment, data on the heart disease profile was not accurate since not all cases from all over the country were reported. Adjustments were made on morbidity cases and the estimated prevalence of cardiovascular diseases is 10 percent of the population in 1992 and 2000. This implies that 6.4 million are expected to seek consultation in 1992 and 7.5 million in 2000. The most common heart diseases expected to prevail are congenital heart disease, coronary artery disease, hypertensive heart disease, rheumatic heart disease and valvular diseases. No estimates were given on the prevalence of each sub-disease such that only the total morbid population under cardiovascular diseases was considered.

Cases of cardiovascular diseases are likely to remain the same or deteriorate depending on the status of the economy. While primary and secondary prevention programs are being implemented by both public and private agencies in combatting these diseases, more efforts must be exerted particularly in promoting a healthy lifestyle. The DOH in partnership with Local Government Units and other sectors has set its objectives in improving the health status of the Filipinos. A 20 percent reduction in cases is being targeted by the year 2000. This means that the adjusted morbidity case of 10 percent given by the panel will decrease to 8 percent morbid population or 6 million.

The assumption is that 70 percent of all cases of cardiovascular diseases will be handled by cardiologists while the remaining 30 percent will be attended to by general practitioners and other specialists.

2. **Norms of Care** - Cardiovascular diseases apply both to in-patient and outpatient care. Lower and higher values are adopted in computing the norms of care. It is assumed that an average of 2 visits are required both for in-patient and outpatient care. For outpatient care, initial and follow-up consultations are considered while for in-patient care, surgical operations and non-surgical operations like daily patient rounds are taken into account.

It is assumed that for 1992 and 2000, the minimum and maximum time required for outpatient are 15 and 30 minutes, respectively. The minimum and maximum time required for in-patient non-surgical are 5 and 10 minutes, while a minimum of 55 minutes and a maximum of 5 hours are required for surgical operation.

In the absence of accurate data on the number of outpatients and in-patients under cardiovascular diseases, it is assumed that only 30 percent of the total morbidity cases will be considered outpatient, 70 percent for in-patient with a breakdown of 49 percent for in-patient (non-surgical) and 21 percent for surgical operations. Hence, the computed norms of care for 1992 and 2000 are .61 and 2.56 hours, respectively.

The computed total service requirements for cardiovascular diseases by 1992 are 2.7 million (medium assumption), and 11 million (high assumption), 3 million (medium assumption) and 13 million (high 2 assumption) in 2000 (without policy change) and 10 million (high 2 assumption) in 2000 (with policy change).

3. **Delegation and Substitution** - An internal medicine practitioner specializing in cardiology appears to have the capacity of absorbing auxiliary personnel. It is assumed that five percent of the total services under the care of cardiologists are delegated to the nurses. The main activities delegated to nurses are taking blood pressure and pulse rate, injections and giving of medication.
4. **Physician Productivity** - Cardiologists are expected to devote an average of nine hours of patient care per day. Usually, they spent 2 to 3 hours in clinic, 2 hours for regular patient rounds, and 1 to 4 hours for surgical operations. It is assumed that they work 6 1/2 day per week and 53 weeks per year. No official holiday is accounted for in the working days since cardiologists are obliged to see their patients especially those with chronic condition.
5. **Requirement for Non-Patient Care** - It is assumed that only 5 percent of the total number of services will be added for non-patient care activities such as teaching, administration and research. Cardiologists concentrate more in practicing their specialty for patient care rather than devoting themselves to non-patient care activities.

Applying these medium assumptions, the computed requirements for cardiologists are 907 for 1992 and 1,062 for 2000. Using the maximum norms of care, the estimated requirements for 1992 are 3,786 and for 2000, 4,432 (without policy changes) or 3,545 (with policy changes). If only 50 percent is assumed for the percentage requiring care from cardiologists, only 648 is required for the year 1992 as the low assumption.

### *B.3.3 Pediatricians*

The health and well-being of children, their development, treatment and care are among the responsibilities of pediatricians.

1. **Morbidity Cases** - The practice of pediatrics is not limited to one organ unlike other specialties (Ophthalmology, Gynecology, and others), nor with just one disease or system as in Cardiology, Hematology and Gastroenterology. Pediatrics may be considered as the whole of Medicine applied to an individual. It is concerned with the physical, emotional and social health of children, including all factors affecting their welfare from conception to adolescence. At present, the age periods included in Pediatrics as recommended by the WHO start from zero to twenty years and 364 days old.

The NSO projected population of ages zero to 21 in 1992 and 2000 is used as the basis for computing the morbidity cases. In 1992, the projected population is 33,668,376 and 36,438,662 for 2000. This pediatric age coverage constitutes about 52 percent and 48 percent of the population in 1992 and 2000, respectively.

The 1989 NHS as adopted by the panel reveals that the top leading causes of morbidity in zero to 21 years old are bronchitis, diarrhea, influenza, pneumonia, and measles. In this study, all the 23 notifiable diseases were accounted for the pediatric age. In variance to the computation of other specialties, each disease was applied to compute the need for pediatricians. There are 23 estimated requirements using the same values for percentage requiring care, adjusted needs, norms of care, percentage delegation and substitution, full-time-equivalent and percentage requirement for non-patient care activities. All these 23 computed requirements were summed up to get the total requirements for pediatricians.

Some of the services of pediatricians include the following: pre- and post-natal care of infants; diagnosis and treatment of disorders of growth and development; preventive care through periodic examinations and immunizations; anticipatory guidance and counselling; diagnosis and treatment of illness and injury; diagnosis, treatment and rehabilitation of patients with abnormalities both physical and mental, congenital and acquired; consultations; concurrent care; consecutive care; screening tests for vision; hearing and intellectual development; psychiatric and psychological services, both diagnostic and therapeutic; and other services. While these services require 100 percent total care from pediatricians, the general practitioners also serve this clientele. It is assumed that only 50 percent requires care from pediatricians while the other 50 percent obtains its care from general and family physicians.

2. **Norms of Care** - To provide proper health care for the pediatric age group, babies of ages zero to 12 months after birth, the perinatal period from the 28th week of gestation to the first six days after birth, the neonatal period-the first month after birth require an average of 9 visits per year. The early infants (1-2 years old) require an average of 3 visits per year, and the toddlers or later infants, pre- school children, school children and adolescence require one visit per year. This gives a total average of 13 consultations required from pediatricians.

Based on experienced clinician, the normal consultation for this pediatric age group is ten minutes. Hence, the norms of care requires two hours.

3. **Delegation and Substitution** - The services of pediatricians have become broader in scope in terms of preventive, curative, promotive and rehabilitative care for the individual, family and community. While they tend to devote themselves to more specialized care, the role of nurses, midwives and physician assistants becomes apparent as they contribute substantially to primary care. It is assumed that 37 percent of the total service requirements for pediatricians is delegated to the ancillary medical workers. The activities delegated to these non-physician workers include routine immunization, intravenous immunization, diagnosis, early management of ailments, health education and disease prevention.
4. **Physician Productivity** - It is assumed that pediatricians provide eight hours per day to patient care taking into account the out-patient, in-patient care activities, 6 1/2 working days per week and 53 weeks per year with no sick and personal leave. Hence, the average number of visits that can be handled per year is 2,756.
5. **Requirement for Non-Patient Care** - Training, teaching, research, administrative activities have made remarkable progress in the field of Pediatrics. It is assumed that 10 percent of the total number of services will be added for these non-patient care activities.

Applying these medium assumptions, the total number of pediatricians required to provide all the services needed by the pediatric age group is 648 in 1992 and 701 in year 2000.

#### *B.3.4 Ophthalmologists*

The need for eye health care covers an entire continuum of services which are for sight conservation, promotion, and restoration. Health personnel who are trained to provide eye care include physicians who specialize in ophthalmology, physicians in general, nurses, optometrists and opticians. Ophthalmologists are essentially concerned with the examining, studying and analyzing ocular functions, and correcting their defects.

Applying the medium assumptions, the total number of ophthalmologists required to provide all the services needed by the population is 1,384 in 1992 and 1,258 in 2000.

1. **Morbidity Cases** - The 1987 Institute of Ophthalmology-UP Manila Blindness Survey Group claims that the ocular morbidity rate in the Philippines is 77/100,000 population. The leading causes of ocular morbidity among Filipinos are error of refraction, infections of the conjuction, eyelids, corneas, cataracts, glaucoma, squints and diseases of the retina and optic nerves as shown in Table III.5. This reference data was adopted for ophthalmologists for the years 1992 and 2000. The expected cases of ocular morbidity are 49,479 in 1992 and 57,992 by the year 2000.

Also, the survey demonstrated a binocular blindness prevalence rate of 1.07 percent and a monocular blindness of 0.06 percent of the total population. Applying these percentages to the 1992 and 2000 projected population, the expected cases of blindness are 1,073,125 and 1,256,241 respectively. Adjustments were made in estimating the blindness prevalence rate of 1.67 percent for the years 1992 and 2000 when the cataract blindness backlog was considered. It is assumed that 10.5 percent or 112,710 patients with bilateral cataracts of the total number of blind Filipinos have been operated for 1992. This means that the blindness prevalence rate has decreased from 1.67 percent to 1.49 percent for 1992. For the year 2000, the rate will fall from 1.67 percent to 1.12

Table III.5 - Leading Causes of Ocular Morbidities in the Philippines

Anatomic/Etiologic	UP-PGH <sup>1</sup> 1970	Mangubat <sup>2</sup> 1970	Olivar <sup>3</sup> 1973	IO Survey <sup>4</sup> 1987
Errors of Refraction	30.00%	28.30%	52.10%	6.31%
Conjunctiva: Infections	22.50%	24.00%	15.00%	6.26%
Cataracts	8.90%	11.00%	15.49%	4.56%
Eyelids, e.g. Infections	9.40%	2.60%	1.68%	
Cornea, e.g. Infectious, scars	6.29%	6.52%	4.48%	1.15%
Glaucoma	1.20%	3.43%	3.78%	0.16%
Squints	0.90%	0.70%	0.63%	0.49%
Retina/Optic Nerve Diseases	1.10%	1.80%	2.45%	1.99%

<sup>1</sup>Eye Clinic Patients: N = 17,155 Cases

<sup>2</sup>Eye patients seen in various rural eye clinics conducted by the PSO

<sup>3</sup>Eye patients seen in a rural eye clinic in Ilocos Region: N = 1,426 cases

<sup>4</sup>Nationwide, population-based survey; ocular morbidity rate of 77/100,000 population.

Source: Salceda, "Controversy between two O's" in the UP Bagumbayan, 1992

percent when 33 percent of the bilateral cataract patients will have been operated on.

2. **Percentage Requiring Care** - Data on blindness and ocular morbidity in the general population indicate that only 37 percent of the eye diseases and disorders need the expertise of ophthalmologists. This data was used to assume that only 37 percent of the total cases requires direct care from ophthalmologists. In the absence of ophthalmologists, people with eye problems are better served by the general medical professionals. The survey conducted by the Institute of Ophthalmology indicates that 92 percent of the general medical practitioners in 75 provinces were consulted by patients for their eye problems and that 83 percent of these practitioners were competent enough to treat eye problems. (Salceda, S. & Tan, R: Non-Ophthalmic Physicians and Eye Care). Hence, the computed adjusted need is 18,307 cases for 1992 and 21,431 for 2000.
3. **Norms of Care** - The treatment of various eye problems requires regular visits. In this study, it is assumed that an average of 10 visits are required per episode of acute and chronic condition per year. The diagnostic treatment and follow-up consultation last an average of 30 and 15 minutes, respectively. Surgical operations require an average of 4 hours. However, only 37 percent of the total morbidity cases requires surgical services. From the weighted average of the time needed for eye problem treatment, it is assumed that the duration of consultation is one hour and seventy six minutes. Hence, the computed norms of care is 1.764 hours.
4. **Delegation and Substitution** - The delegation and substitution as percent of the total services for ophthalmologists is assumed 10 percent for ocular morbidities and 30 percent for blindness prevalence. Nurses in the rural health units provide basic eye care services to those suffering from common eye diseases and initiate referrals for more complicated



cases. The role of nurses in the private sector is purely assistive in eye clinics and in the operating rooms. Midwives on the other hand instill the Crede prophylaxis (silver nitrate solution) into the eyes of the newly born babies to prevent Ophthalmic Neonatorum. Barangay Health Aides are being trained to conduct eye health education, recognize Bitot's spots and administer Vitamin A capsules, apply tetracyclines for infections of the conjunctiva as well as remove foreign bodies in the conjunctiva. (Salceda, 1989)

5. **Physician Productivity** - It is assumed that the ophthalmologists provide 11 hours per day to patient care taking into account the out-patient, in-patient care activities, 6 working days per week and 53 weeks per year with no sick and personal leave. Hence, the average number of visits that can be handled per year is 3,432.

The average number of outpatients and in-patients treated per working day per ophthalmologists is equivalent to 10-12 patients in urban areas and 80-100 patients in rural areas.

6. **Requirement for Non-Patient Care** - It is assumed that 25 percent of the total number of services will be added for non-patient care activities such as teaching, administration, research, community programming and planning. There is also the need for managing eye health and diseases problems, training of other health personnel for public health ophthalmology and continuing education for basic eye care services.

#### Low and High Assumption (1992)

There is no exact data on the number of visits required per episode of acute and chronic condition per year. It is assumed that 8 and 12 aside from 10 (medium assumption) are possible values for the frequency of consultation. This assumption results in changes in the norms of care of 14.11 (low assumption) and 21.17 (high assumption). As a consequence, the requirement for ophthalmologists decline to 1,108 using low assumption of 14.11 norms of care and increases to 1,661 using high assumption of 21.17 norms of care for 1992.

#### Low Assumption (2000)

A nationwide program that draws the support from the public and private sectors, communities, families and individuals on proper eye care, and recognizing the early signs and symptoms of eye diseases, will eventually reduce the rate of blindness. Moreover, the projected ocular morbidity rate will drop from 77 to 50 per 100,000 population in the year 2000 as determined by the experts. This means that the expected cases would be 37,612. Otherwise, the assumed 77 per 100,000 ocular morbidity will remain in 2000.

Given that the other parameters remain constant, the consequence of a decrease in the number of morbidity cases will cause a drop in the requirement for ophthalmologists from 138 to 89 under ocular morbidity.

If 40 percent or 87,936 patients with bilateral cataracts of the total number of blind Filipinos will be operated on by the year 2000, the blindness prevalence rate will decrease from the medium assumption of 1.12 percent to 1 percent. As a result, a minimal change will occur for the requirements for ophthalmologists from 1,258 to 1,092.

### High Assumption (2000)

The requirement estimates by the year 2000 under high assumption is 1,392 if the assumed bilateral cataracts backlog is 25 percent.

### B.3.5 Surgeons

The promotive and preventive care being handled by surgeons are generally similar to those provided by general practitioners and other specialists in terms of giving instructions on well-care, e.g. anti-smoking to prevent lung cancer. Surgeons perform the entire diagnosis and treatment components of diseases which are surgical in nature like cancer of the mouth and cancer of the breast. Rehabilitative care by surgeons refers to the post-operation treatment needed by the patient. Also stressed in this specialty is the palliative care which also applies to other specialties handling diseases with no known cure. Their function here is to alleviate the condition of the patient as much as possible.

Current requirement estimates for surgeons are 317 (low), 377 (medium), 952 (high). Future requirement estimates are 334 (low), 743 (medium) and 1,115 (high) for year 2000.

#### Assumptions:

1. Morbidity Cases - The top three morbidity cases under the care of surgeons are cardiovascular diseases, cancer and accidents. Morbidity figures for cardiovascular diseases and accidents were taken from the 1989 Philippine Health Statistics while cancer cases were obtained from accurate population-based cancer registries. Given all these data, the proportion of the population needing surgeons registered .01.

Cardiovascular diseases and accidents are expected to be reduced by around 15 per cent if there will be significant improvement in the delivery of health services particularly at the promotive/preventive care level such as programs on nutrition and immunization. For cancer cases, there will be a 5 per cent increase if the current situation prevails and only marginal attention is given to cancer.

2. Percent Requiring Care - The diagnosis of a disease which requires operation or surgery is usually done by a specific internal specialist so that oftentimes a surgeon attends to the patient only during surgery. The post-surgery care is likewise taken cared of by the same specialist. Therefore, 20 percent of the cases are treated by the surgeon and the rest by another specialist.
3. Norms of Care - Surgery requires only one visit or treatment per year. The surgeon spends an average of two to three hours in the operating room.
4. Delegation and Substitution - Surgeons delegate much of their tasks to nurses who usually devote 90 percent of their tasks in preventive care, 80 percent in rehabilitative and 95 percent in palliative care. Since surgeons attend mainly to operations spending between two and three hours in the operating room, these delegations are deemed not significant and therefore will not be considered in determining the requirement.
5. Annual Productivity - Out-patient or office visits to surgeons are minimal compared with other specialties. In a day they spend three hours in the operating room, work 5 to 6 days

a week and 46 weeks a year.

6. Requirement for Non-Patient Care - Based on professional judgment, half of the requirement for surgeons should go to non-patient care. Teaching requires 30 percent, research needs 10 percent and administration needs another 10 percent. These figures are applicable until the year 2000.

### *B.3.6 Obstetrician-Gynecologists*

For obstetrician-gynecologists, preventive and promotive care means taking care of reproductive and non-reproductive women. Restorative care is given during post-natal while rehabilitative care refers to instructions on birth-spacing and family planning.

Requirement estimates for 1992 are 2,991 (low), 5,598 (medium), 6,928 (high). Future requirements are 3,636 (low), 6,800 (medium), 8,420 (high).

#### **Assumptions:**

1. Morbidity Cases - The ratios of women's morbidity cases to the total reproductive female population (15 to 49 years) are taken. These morbidity cases are expected to decline by 15 percent if better screening is done for high-risk pregnancy and more facilities, trained personnel and referral system are made available.
2. Percent Requiring Care - This is assumed to be 90 per cent. For the year 2000 it may be lower given improvements in obstetrical and gynecological services and facilities. There will be a decline in the number of morbidity cases if progress is made on obstetrical and gynecological services and facilities.
3. Delegation and Substitution - There is actually no delegation and substitution of tasks to other medical personnel in the entire treatment of ob-gyne conditions. Based on experts' opinion, their presence and supervision are required in each type of care. Even in normal delivery, an ob-gyne must be present to give the nurses and midwives the necessary instructions.
4. Norms of Care - Care for pregnancy with complications of hemorrhage, hypertension and infections needs an average time of 4.2 hours. Patients have to make three or four office visits every month for more or less 4 consecutive months in a year to get adequate medical care. Ob-gynes spend an average of 30 minutes per visit. Pre-natal check-ups consume 20 minutes of their time, curative consumes 40 minutes and birth delivery both caesarian and normal consumes 30 minutes.
5. Annual Productivity - An ob-gyne is on call for 24 hours especially for birth attendance. He has six working days and 46 working weeks in a year.
6. Requirement for Non-Patient Care - Of the total requirement for this specialty, 70 percent is assumed to be devoted to non-patient care.

### 5.3.7 Pulmonologists/Chest Specialists

For 1992, requirement projections for pulmonologists are 216 (low), 545 (medium), 954 (high). For 2000, the requirements are 240 (low), 558 (medium), 1,197 (high).

Pulmonologists or chest specialists give instructions on proper sanitation and protection against pollution in the environment as their preventive/promotive function. Medical treatment for therapy of respiratory diseases and thoracic surgery or operation of the lungs and the diaphragm (thorax) are considered as restorative care while the use of spirometry to expand the lungs and the use of the IPPV machine are referred to as rehabilitative/habilitative care.

#### Assumptions:

1. Morbidity Cases - Bronchitis, pneumonia, tuberculosis and cancer of the lungs are cases requiring chest specialists. Three estimates are considered in developing the morbidity case: .023 (low), .40 (medium), .70 (high). If there will be no improvement in the present environmental condition an increase of five percent is expected in the future. On the other hand, if significant progress is made, morbidity cases will decline by five percent.
2. Norms of Care - Treatment of bronchitis and pneumonia requires six visits for a duration of five minutes. Tuberculosis requires two to three visits for five minutes while lung cancer needs one to two visits but its operation or surgery takes two to three hours. In severe cases such as advanced lung cancer, visits become less frequent as the patient's condition becomes terminal.
3. Delegation and Substitution - Thirty percent of preventive and promotive tasks of pulmonologists such as lecturing on well-care can be delegated to nurses and interns. Pulmonary therapists take 15 percent restorative care which, however, is considered as 100 percent delegated since chest specialists' tasks are primarily curative. Furthermore, preventive and promotive care under this specialty is being done by other physicians and other health personnel.
4. Annual Productivity - The average time a pulmonologist works per day is ten hours. He works six days a week for 46 weeks in a year.
5. Requirement for Non-Patient Care - Of the total requirement for this specialty, 60 percent should be devoted to non-patient care.

### B.3.8 Psychiatrists

Current requirement estimates for psychiatrists are 3,766 (low), 4,184 (medium), 5,230 (high). Future requirements (2000) are 4,408 (low), 4,898 (medium), 6,123 (high).

#### Assumptions:

1. Morbidity Cases - About two percent of the population needs psychiatric treatment. These are patients suffering from mental illness such as schizophrenia, paranoia and those brought about by prohibited drugs. Preventive care for mental illness is being undertaken at the primary health care level so that psychiatrists will perform mainly restorative and rehabilitative care. It is estimated that half of the mentally sick population are treated as

in-patients.

2. Delegation and Substitution - The percentage delegated to nurses and other specialists is 15 percent. This applies to both out-patients and in-patients.
3. Norms of Care - In-patients are confined in a hospital, clinic or rehabilitation center for two to four weeks. Psychiatrists visit them twice a week with 30 to 40 minutes per visit. For out-patients, treatment requires two to three consultations every month, each consultation lasting for about 20 minutes.
4. Annual Productivity - A psychiatrist works around ten hours a day for at least five days in 45 weeks a year.

### *B.3.9 Infectious Disease Specialists*

As a tropical country the Philippines has a significant need for this specialty. Control of communicable disease, prevention of complication and reduction of fatalities are important considerations in dealing with communicable diseases.

#### *Assumptions:*

1. Morbidity Cases - In developing the morbidity case estimates, this study considered the following: typhoid, diarrhea, tuberculosis, leprosy, diphtheria, whooping cough, tetanus, acute polio, varicella, measles, infectious hepatitis, malaria, syphilis, gonococcal infection, pneumonia, influenza, and AIDS/HIV. The number of cases was taken from the 1989 Philippine Health Statistics.

Different percentages of requiring care were adopted for each disease. For instance, 80 percent is assumed under acute poliomyelitis, gonococcal infection, typhoid, and 100 percent for leprosy, malaria, and AIDS/HIV. The assumed loading assignment could vary since other specialties and the general practitioners as well handle infectious diseases.

2. Norms of Care - Each type of infectious disease requires various norms of care. The treatment of malaria needs 30 days stay in hospitals and the assumed frequency of consultation is 14 with a mean duration of 40 minutes. (See Table for other type of disease)
3. Delegation and Substitution - Ten percent is delegated to ancillary medical workers both for in-patient and outpatient.
4. Percentage Requirement for Non-Patient Care - Medical doctors specializing in infectious diseases are continually doing research for the control of communicable diseases. The assumed percentage for research, teaching, administration, and community programming is 23 percent.

The computed requirements under this specialty for 1992 are 1,533 (medium assumption), 2,040 (high assumption). Future requirement estimates are 1,559 (medium assumption), 2,387 (high assumption).

### *B.3.10 E.E.N.T.*

Doctors under this specialty deal with preventive, restorative and habilitative care of patients with diseases of the eye, ears, nose and throat. Part of their preventive and promotive care are prophylactic management, training of rural health units personnel, practicing as general practitioners in rural areas. Restorative and rehabilitative care include anatomical medical or surgical management, follow-ups and post-medical surgical management, and sub-specialty training for complete management.

Requirement estimates for EENT specialists for 1992 are 846 (low), 1,410 (medium), and 2,961 (high). The computed requirement by the year 2000 are 990 (low), 1,651 (medium) and 3,466 (high).

1. Morbidity Cases - No data on the morbidity cases under E.E.N.T is available. Of the total population, 10 percent is assumed morbid in low and medium assumptions, and 70 percent for high assumption. Intra-referrals in this specialty is common since there are other specialists with more or less similar concerns like ophthalmologists and internists. E.E.N.T doctors on the other hand also practice as general practitioners. The percentage requiring care therefore poses as an important indicator of the requirement for this specialty. The assumed percentage requiring care are 30 percent for low, 50 percent for medium, and 15 percent for high.
2. Norms of Care - The weighted average of the norms of care is 1.51 taking into account the surgical operations, check-ups, and diagnosis. The computed frequency of consultation is 4.60 with a mean duration of 20 minutes.
3. Delegation and Substitution - A minimal percentage of 5 percent is delegated to non-EENT doctors. The specific task delegated especially to nurses is screening.
4. Annual Productivity - E.E.N.T. doctors spend, on the average, 11 hours a day, six days a week, and 52 weeks a year.
5. Requirement for Non-Patient Care - Only 5 percent of the total requirement is assumed for non-patient care.

### *B.3.11 Dermatologists*

Current requirement projections for this specialty are 263 (low), 526 (medium) and 1,052 (high) while future requirements are 308 (low), 615 (medium) and 1,231 (high).

#### *Assumptions:*

1. Morbidity Cases - The Jose Reyes Memorial Hospital, known to specialize in skin diseases, reported more than 60,000 old and new cases for 1992. There are wide variations in the norms of care for the treatment of skin diseases since they range from mild to severe cases.
2. Percent Requiring Care - A 90 percent requiring care is assumed; ten percent is provided by other specialties.

3. Norms of Care - A skin disease needs an average of 8 consultations for treatment with 15 minutes or .25 hours per consultation.
4. Annual Productivity - A dermatologist works ten hours per day in 5.5 days a week and 46 weeks a year.
5. Percent Required for Teaching Research and Administration - 15 percent of the total requirement for this specialty is needed for non-patient care.

### *B.3.12 Rehabilitation Medicine Specialists*

Rehabilitation medicine or physical medicine and rehabilitation refers to those processes that are designed to enable persons with acute illness or those who have undergone surgery to revitalize their impaired functions. Physicians under this specialty, along with the physiatrists, occupational and physical therapists, speech pathologists and specialists in other disciplines address the physical, social, vocational and psychological functions of individuals in averting further deterioration of many of the less severely disabled and totally dependent category. Hence, the need for rehabilitation is vital to restore the individual to the highest possible level of physical, economic, social, and emotional self-reliance.

#### **Assumptions:**

1. Morbidity Case - In January 1993, the Philippine Medical Association reported 4.2 million disabled Filipinos for whom age, extent of disability, or personal desires preclude a need of rehabilitation service for total care. This specialty covers patients with strokes, spinal cord injury, closed head trauma, neurologic disorders, peripheral vascular disease, musculoskeletal problems, metabolic diseases, diseases of the muscular and neuromuscular systems, cerebral palsy, poliomyelitis, cancer, paraplegia or quadriplegia, pulmonary problems, problems of children and geriatric medicine. No information was available as to the specific number of incidence for each case. What seems useful so far in developing the morbidity case is the data given by the Philippine Medical Association. Of the 4.2 million disabled Filipinos, it is assumed that 40 percent are neurologic disorders; 30 percent are orthopedic cases; 15 percent have cardio-pulmonary problems while 15 percent belong to other types of conditions. Low and high assumptions made use of five and seven percent morbid population, respectively.
2. Norms of Care - Rehabilitative patients require constant visit depending on the severity of the case. It is assumed that the average patient's condition requires 3 visits with each visit lasting 40 minutes.
3. Delegation and Substitution - The assumed delegation and substitution as percent of the total medical care services under Rehabilitation Medicine is zero. The treatment of patients requires a team approach where each concerned health workers such as occupational therapists, physical therapists, rehabilitation nurses and other health aides perform distinct functions.
4. Annual Productivity - Physicians under rehabilitation medicine usually spend 12 hours per day for direct patient care, six days a week, and 53 weeks per year.
5. Percent Requirement for Teaching, Research and Administration - Non-patient care by this

specialty needs 23 percent of the total requirement.

Applying these assumptions, the requirement estimates for 1992 are 2,071 (low), 2,708 (medium), and 2,900 (high). For the year 2000, the requirements are 2,425 (low), 3,170 (medium), and 3,395 (high).

### **B.3.13 Total Physician Requirement**

Over-all current requirement estimates for physicians are 23,171 (low), 50,038 (medium) and 69,161 (high). For the year 2000, estimates are projected at 24,142 (low), 68,450 (medium) and 100,211 (high).

General practitioners account for the largest share in the total physician requirements. The present thrust of the government on primary health care or promotive/preventive care suggests the increasing need for general practitioners.

Among all the specialties, ob-gynecology ranks first followed by psychiatry, rehabilitation medicine, infectious diseases and ophthalmology. The reason is that psychiatrists spend more time with patients for diagnosis and treatment while the rest either have big percentage of morbidity cases or big percentage requiring care. Those with the least shares in the total physician requirements are pulmonology, surgery and dermatology. This is due to the wide practice of intra-referral to other specialties and delegation to health auxiliaries. It should be noted that most surgeons are tied to a major specialty, e.g. thoracic surgeons are also chest specialists, neuro-surgeons are neurologists, pediatric surgeons are pediatricians, etc. Physicians who are highly specialized have lower requirements than those with general or broader scope of work like ob-gynecology, EENT, and occupational medicine. In the case of pediatrics, albeit a broader specialty, the requirement is low due to delegation and substitution and the assumed low morbidity cases.

### **B.4 Requirements for Dentists**

No community in the Philippines is free from dental diseases according to the Dental Health Department of the Department of Health. Only five percent or less are free of tooth decay. While dental diseases are viewed only as indirect threats to life and seen only as prostrate illness, dental disease tops all other diseases in morbidity. The role of dentists becomes indispensable in providing dental care.

Health instructions for self-care, dental health education, oral hygiene instructions, scaling and fluoride utilization are just some of the activities under dental preventive care. Mouth examination, applying anesthesia, cutting of tissue, insertion of filling materials, x-ray taking and simple extractions fall under restorative care. The treatment of cleft palate, complicated periodontal diseases, abnormal soft tissue growth, abnormal bone condition, enamel aberration, pulpitis, periapical diseases and missing teeth comprise rehabilitative and habilitative care.

Current projection requirements for dentists are 86,732 (low), 91,551 (medium) and 97,180 (high). Future estimates (2000) are 33,844 (low), 78,969 (medium) and 112,387 (high). These estimates are based on the following assumptions:

1. Morbidity Case - The Second National Monitoring Evaluation Dental Survey (1987) done



by Dental Health Service of DOH serves as the reference data on dental diseases. The survey indicates that nationwide, the percentage of 5,770 sample examined with active dental caries on temporary and/or permanent teeth for all ages stands 93.9 percent, 89.5 of those examined had one or more permanent tooth decays for filling, missing, filled and decayed indicated for extraction; 58.3 percent had missing teeth; 23.3 percent had no healthy sextant; one of every 14 subjects examined was found to have deep pockets in one or more sextant; 16.8 percent were denture wearers; 63.3 were in need of denture repair; 10.2 percent were affected by fluorosis; 41.3 percent required orthodontic treatment; 38 percent were in need of periodontal treatment. Data on the proportion of population with dental needs were presented to experts for validation. The total morbid population, however, had been adjusted to 98 percent following professional judgment. The following assumptions were considered: each person has at least one missing tooth; a child loses at least one permanent/temporary tooth before age six. A hundred percent requiring care was also assumed.

2. Norms of Care - Dental treatment requires around four (4) visits or consultations in a year with a mean duration of 30 minutes or .5 hours per consultation. Pre-adolescents usually require one visit; adolescents, four visits; and, adults, six visits in a year with a span of 30 minutes per visit.
3. Delegation and Substitution - For the 1992 baseline or medium projection which is based on experts' opinion, five percent of dentists' tasks are considered delegated to dental aides or auxiliaries. Low and high projections, on the other hand, are placed at 10 and 3 percent, respectively which slightly diverge from that of the medium assumption. For the year 2000, a high percentage of delegation pegged at 70 percent is assumed for the low projection in view of the successful implementation of the dental health program focusing on preventive care and training of dental aides. For the high projection, insignificant delegation is assumed as represented by zero.
4. Annual Productivity - A dentist spends on the average five hours a day, 5.5 days per week and 48 weeks per year.
5. Percent Required for Teaching, Research and Administration - For non-patient care, only one percent of the current total requirement for dentists is needed. This figure is also used in the low projection. For the high projection, five percent is considered. All future projections likewise made use of one percent.

## **B.5 Requirements for Nurses**

Nurses work in diverse fields of health care. The total manpower requirement is summed up for the fields of hospital service, public health, school health, industrial and occupational health, education and the smaller sectors of military nursing, private duty nursing, clinic nursing and independent nursing practice.

### **B.5.1 Hospital**

Nursing care varies with the type of hospital, (whether primary, secondary and tertiary hospital), and with the classification of patients (whether out-patient or in-patient and whether under minimal, moderate or intensive care).

### B.5.1.1 In-Patients

The computation of the requirement for hospital-based nurses who take care of in-patients follows to some degree the framework of the modified GMENAC model. Among other modifications is the use of bed capacity. Assumptions on full bed capacity and less than full capacity, as determined by the bed occupancy rate are used. That is, the number of in-patients is represented by the total bed capacity of a hospital or by its bed occupancy rate.

Two scenarios were considered in projecting the total hospital beds for the year 2000: (1) without change, in which growth rate was determined by the historical trend of the number of hospital beds, and (2) with change, in which growth rate is 50 percent lower than that of the first scenario assuming that there would be less demand for hospital beds as a result of the government's effort in improving the primary health care.

Table III.6 - Number of In-patients per day based on the number of Bed Capacity

Type of Hospital	1990		2000	
	Number of Hospitals	Bed Capacity	Bed Capacity W/o Change	Bed Capacity W/ Change
Primary	800	14,632	16,355	15,494
Secondary	672	23,055	25,769	24,412
Tertiary	261	49,446	55,267	52,356
Total	1,733	87,133	97,391	92,262

Sources of basic data: 1991 Statistical Yearbook and Philippine Hospital Association

According to the 1990 SEAMIC Health Statistics, the bed occupancy rate for all hospitals was 45.5 percent in 1987. However, this figure seemed to have been underestimated because the Philippine health care is perceived to be insufficient to serve the rural population. Thus occupancy rate should be relatively higher. In this case, we adopted the 73 percent occupancy rate of DOH hospitals in 1991 for the first scenario and assumed a 60 percent occupancy rate for the year 2000. These assumptions attempt to capture the DOH vision on the effectiveness of government and of the private sector's priority strategies on primary health care and preventive and promotive programs for a healthier population.

*Patient classification.* In most patient classification systems, patients are divided into three categories on the basis of their dependency needs and the level of personnel required to satisfy those needs. These are: minimal care, intermediate or moderate care, and intensive care (which include total care). Patients in the minimal care category are capable of performing the activities of daily living as long as the nurse provides the necessary equipment and supplies, e.g., meal trays. A patient in the intermediate care category may be able to feed, bathe, and dress himself without help but requires some help in special treatments or certain aspects of personal care, e.g., wound debridement. Lastly, a bed-ridden patient who lacks strength or mobility necessitates nursing assistance in feeding, for instance, can be said to require total care while a critically ill patient who is in constant danger of death can be said to require intensive care.

The total number of patients receiving minimal, moderate or intensive care varies with

Table III.7 - Percentage of Patients in Various Level of Care per Type of Hospital

Type of Hospital	Percentage of Patients in Various Level of Care			
	Minimal Care	Moderate Care	Intensive Care	Total
Primary	70	25	5	100
Secondary	65	30	5	100
Tertiary	30	45	25	100

the type of hospitals where they are confined (see Table III.7). In primary hospitals, 70 percent of the patients receive minimal care while in tertiary hospitals, 30 percent of the patients receive minimal care. On the other hand, a lower percentage of patients under intensive care can be found in primary hospitals but a higher percentage of patients receiving intensive care are found in tertiary hospitals.

*Norms of care.* The number of nursing care hours needed per patient per day per levels of care is defined as the number of visits within 24 hours times the duration per visit (in hours). As shown in Table III.8, the patients under intensive care require more nursing care hours than those under minimal care.

Table III.8 - Number of Nursing Care Hours needed per Patient per Day per Levels of Care

Levels of Care	Number of Nursing Care Hours Needed Per Patient Per Day
Level I - Minimal Care	1.5
Level II - Moderate Care	3.0
Level III - Intensive Care	4.5

*Full-time equivalent.* The number of working hours and full-times depends on RA 5901 known as Forty Hour Per Week Law. This law states that personnel working in agencies located in one million population and in hospitals with one hundred bed capacity and over are entitled to work forty hours per week. But those who work with lesser bed capacity will have to work forty eight hours per week.

The following table shows the derivation of the total working hours/year for those working for 40 and 48 hours per week.

The percentage distribution of hospitals with less than 100 beds and with 100 beds or

Table III.9 - Total Number of Working Days, Non-Working Days & Working Hours of Nursing Personnel Per Year

Rights/Privileges Given Each Personnel	Working Hours Per Week	
	40 hrs	48 hrs
1. Days of Vacation Leave	15	15
2. Days of Sick Leave	15	15
3. Legal Holidays	10	10
4. Special Holidays	2	2
5. Continuing Education	3	3
6. Off Duties R.A. 5901	104	52
Total non-working days/yr	149	97
Total working days/year	216	268
Total working hours/year	1,728	2,144

more in primary, secondary and tertiary hospitals are as follows:

	Primary	Secondary	Tertiary
less than 100 beds	99.12	96.73	29.50
100 beds or more	0.88	3.27	70.50

*Relievers needed.* The number of nursing personnel needed to staff the various units/departments should be sufficient even when some of the personnel complement are off-duty, absent, on vacation or sick leave, or on legal holiday off.

Each employee is entitled to 15 days vacation leave, 5 days sick leave and 12 days holiday off per year. They also enjoy 3 days for attending continuing education programs. Their total number of absences is 45 days per year and the actual relief needed for each is 45 days/365 days or 0.123 per year.

To determine the total number of relievers needed, the computed number of nursing personnel is multiplied by 0.123.

*Delegation/Substitution.* The delegation or substitution of nursing care of professional nurses to non-professional nurses varies among patients. For minimal care patients, 45 percent of the nursing care hours of professional nurses are delegated to non-professionals. However, only 25 percent is delegated when patients are under intensive care (see Table below).

Table III.10 - The Ratio of Professional Nurse to Non-Professional Nursing Personnel in Various Levels of Care

Levels of Care	Ratio of Professional Nurses to Non-Professionals
Level I - Minimal Care Patients	55-45
Level II - Moderate Care Patients	60-40
Level III - Intensive Care Patients	75-25

### B.5.1.2 Out-patients

The average percentage of in-patients and out-patients per year is given in the table below.

Table III.11 - Average percentage of in-patients and out-patients per year

In-patients	25.0
Out-patients	75.0
Total	100.0%

Based on the study conducted by Azurin (1988), the ratio of in-patients to out-patients was 21.8 : 79.2 in 1985. For the 1990 data, a 25 : 75 ratio was assumed.

Table III.12 - Average number of Outpatients per day based on bed capacity

Type of Hospital	1990		2000	
	Number of Hospitals	Out-Patients	Number of Out-Patients (W/o change)	(W/Change)
Primary	754	43,896	49,065	46,482
Secondary	685	69,165	77,307	73,236
Tertiary	294	148,338	165,801	157,068
Total	1,733	261,399	292,173	276,786

Using this ratio, the number of outpatients of primary hospitals is computed at 75 percent of (number of bed hospitals over 25 percent of which are inpatients). A similar computation is used with the number of outpatients in secondary and tertiary hospitals.

*Relievers.* The computation is similar to that of the in-patient nurses.

*Delegation.* In the out-patient department, the percentage of the services of a professional nurse delegated to non-professional nurse is about 80 percent.

### **B.5.2 Public health**

At present, there are 1,535 municipalities and 41,293 barangay units (Galang, 1991). On the average, each municipality has 27 barangay units.

In 1990, there were 2,295 rural health units (RHUs) and 10,151 barangay health stations (BHS). Each municipality has 1 or 2 RHUs with each RHU having an average number of 4 BHSs. As it is, there would be about 6 barangays sharing one BHS.

According to the 1991 DOH annual report, there were 3,358 nurses in the field services nationwide with 1 or 2 nurses per RHU serving 4 BHS and about 1 or 2 nurses serving 24 barangays.

Assuming that there is one nurse serving two barangays, the total number of nurses required would be 20,647.

### **B.5.3 School health**

In 1990, there were 3,837 pre-schools, 34,382 elementary schools, 5,518 secondary schools and 1,755 tertiary schools. Assuming one nurse per school (regardless of the number of students), the total number of nurses required for schools is 45,492. However, since school nurses have dual roles - health education and health services - the percentage requiring nursing care for the school population would only be about 50 percent. Hence, the number of nurses for school health centers would be half the total number of schools.

### **B.5.4 Industrial/Occupational health**

Article 157, Book 4 of the Labor Code requires firms to have one full-time professional nurse for firms with 50 or more workers. For firms with less than 50 workers, the Secretary of Labor shall provide the appropriate regulations on health services.

In 1990, there were 4,822 manufacturing firms (with 10 or more workers). Following the Labor Code requirement, the industrial/occupational nurses requirement would sum up to 4,822.

Requirements for all nursing areas are summed up in the table below. Low and medium estimates are based on 45 and 73 percent bed occupancy rates in hospitals while high estimates are based on total bed capacity. Assumptions for the other service areas are similar across the

Table III.13 - Total nursing requirements

	Year 1990						Year 2000					
				Without Change			With Change					
	Case I High	Case II Medium	Case III Low	Case I High	Case II Medium	Case III Low	Case I High	Case II Medium	Case III Low			
Hospitals	42,560	31,069	19,365	47,570	34,726	21,645	45,065	27,039	20,505			
Public Health	20,647	20,647	20,647	20,647	20,647	20,647	20,647	20,647	20,647			
School Health	22,746	22,746	22,746	26,781	26,781	26,781	26,781	26,781	26,781			
Occupational	4,822	4,822	4,822	4,822	4,822	4,822	4,822	4,822	4,822			
Others	18,155	15,857	13,516	19,964	17,395	14,779	19,463	15,858	14,551			
Total	108,929	95,140	81,095	119,783	104,370	88,672	116,777	95,146	87,304			

range.

### B.6 Requirements for Midwives

Midwives concentrate their services in three areas, namely: maternal, child and community/primary health care. The 1992 projected population was divided into these three types of services. Under the maternal care, the projected population for female child-bearing age (15-49 years old) is 16 million in 1992 and 19 million in 2000. For child care (0 to nine months) the projected population is 1.76 million in 1992 and 1.74 million in 2000. The remainder (1 to 60 years old excluding 0 to nine and child-bearing population groups), projected at 46.1 million (1992) and 53.5 million (2000) are also beneficiaries of primary health care.

The total requirement estimates for midwives are 16,410 (low), 17,619 (medium) and 19,821 (high). Projections for the year 2000 are 16,154 (low), 16,604 (medium) and 23,055 (high).

#### Assumptions:

1. **Morbidity Case** - In computing the morbidity case under maternal care, the pregnancy rate (3.5 percent of the total population) adopted by the DOH was used. Morbidity cases under maternal care, child care and primary health care used in the current projections are 14 percent, 100 percent and 130 percent, respectively. Future low and medium projections for maternal care are assumed at 11 percent and 13 percent, respectively, showing a slight improvement in morbidity case on account of an effective family planning program while primary health care has 100 percent (decrease of 30 percent) for low and medium projections taking into account the government's thrust on primary health.
2. **Norms of Care** - The assumed norms of care for maternal handling of midwives is 7 hours. Pre-natal cases require 4 visits with 20 minutes (.33 hours) attendance, delivery cases require an average of 120 minutes (2 hours), post-natal cases require 2 visits with 15 minutes (.25 hours) attendance. Under child care, 4 visits a year are considered with

.25 hours or 15 minutes per consultation. For primary health care, communicable diseases are used to determine the norms of care as 3 visits a year with .5 hours or 30 minutes of attendance by midwives.

Delegation and Substitution - Medium projection for 1992 assumes 20 percent delegation of midwives' job to Barangay health workers. Maternal care and primary health care under the low projection however assumes a higher percentage (21 and 40 percent respectively) in view of the 20,000 traditional birth attendants and 400,000 traditional health workers who are being trained to attend to some health needs of the populace. The high projections, on the other hand, assume relatively less delegation (5 percent).

4. Annual Productivity - A midwife spends, on the average, 8 hours a day, 6 days a week and 43 weeks a year.
5. Percent Required for Teaching, Research and Administration - Non-patient care by midwives needs only 5 percent of their total requirement.

### **B.7 Medical Technologists**

To estimate the need for medical technologists, the utilization rate of laboratory services in hospitals and rural health units (RHUs) was derived based on the given number of hospital beds and the DOH laboratory services (see Appendix C, Table B18). It is assumed that hospital beds reflect the number of laboratory facilities of hospitals. It is further assumed that the utilization rate is constant for a changing population. The estimated demand for laboratory services is then converted into the manpower required to produce by means of the number of services which could be produced by medical technologists annually. Data on the number of services were taken from the 1989 Philippine Health Statistics (DOH hospital services) and the 1991 Annual Report of the DOH (public health services). An adjustment of 25 percent on the Philippine Health Statistics data was done to correct for under-reporting. Services not included in the DOH report such as those in clinics, etc. are estimated at 20 percent.

A total of 23,399 medical technologists is required by the present population. The projected need by the year 2000 is 27,998.

### **B.8 Pharmacists**

While provisions on pharmacy manpower is supposed to be a component of a rational drug use policy, germinal activities of the country's National Drug Policy Program have not so far included an agenda for pharmacy manpower production and utilization that would effectively respond to the people's needs. This makes estimation of requirement for pharmacists doubly difficult since, as Gallagher (1987) maintained, "there is no absolute criteria of need, in a practical sense." Ideally, the methodology should estimate requirement for pharmacists based on



the list of vital and essential drugs in the national formulary. With expert opinion on current epidemiological and clinico-pharmacological issues and empirical evidence on the morbidities and therapeutic needs of the population, the volume of essential drugs needed by the population and, correspondingly, the quantity and quality of pharmacists needed to prepare and dispense the formulations will be estimated. Inadequate data, however, prevents this study from using this method.

Alternatively albeit rather crudely, this study makes estimates based on a range of low, medium and high assumptions. For the medium estimates, it is assumed that at least one pharmacist, as mandated by law, is needed per drugstore. At least one pharmacist is also considered for all other pharmaceutical establishments (manufacturer, distributor, etc.). The DOH minimum staffing requirement per hospital which is set per certain categories of bed capacity is similarly taken into account. The total requirements for public and private hospitals are computed based on a report by the Philippine Hospital Association in 1991 (see Table B.17). For the low estimates, requirement per manufacturer is similar to the medium estimate, while 25 percent less pharmacists for drugstores and 50 percent less for non-Rx and Chinese drug outlets are assumed. These reductions are considered delegatable to the sales personnel specially in small drugstores. With delegation to nurses, hospitals are assumed to cope with 11 percent vacancy in pharmacy. For the high estimates, the bigger manufacturers and drugstores are assumed to need more than one pharmacist each; the top 20 manufacturers need at least three pharmacists while two pharmacists are considered for Mercury Drug, the biggest chain of drugstore.

Based on the above premises, the total requirement for pharmacists in 1992 is at least 8,999, on the average 11,382 and at most 11,922. Projected requirements for the year 2000 are 10,534 (low), 13,324 (medium) and 13,956 (high).

### C. Summary

Table III.14 summarizes the requirement estimates of health manpower categories. The computations of each requirement are contained in Appendix C.

Among the six categories of health manpower, nurses have the highest requirement in the country followed by physicians and dentists while medical technologists and pharmacists have the lowest. By the year 2000, the population will remain in dire need of dentists, nurses, midwives and physicians than any of the other health providers. The rate of morbidity and the degree of delegation and substitution to health auxiliaries and/or other categories of manpower largely determine the requirements.

The modified GMENAC requirements model essentially sheds light on the roles of midwives and physicians particularly ob-gynecologists. In the hospitals, midwives mainly serve as nursing aides to ob-gynecologists. In barangays, midwives function almost as physicians in the absence or scarcity of such health provider especially in far-flung rural areas. Both address

Table III.14 - Summary of Requirement Estimates for  
Health Manpower, 1992 & 2000

Health Manpower Category	1992			2000		
	Low	Medium	High	Low	Medium	High
All Physicians	23,172	50,038	69,161	24,142	68,450	100,211
General/Family Practice	9,784	30,645	39,158	8,570	45,840	61,120
Specialties Modeled	13,388	19,393	30,003	15,572	22,610	39,091
Cardiology	648	907	3,786	849	1,062	3,545
Pediatrics	617	648	1,702	668	701	6,756
Ophthalmology	1,108	1,384	1,661	1,092	1,258	1,392
Surgeons	317	377	952	334	743	1,115
Obstetrics-Gynecology	2,991	5,598	6,928	3,626	6,900	8,420
Pulmonology	216	545	954	240	558	1,197
Psychiatry	2,259	2,510	3,138	2,645	2,939	3,674
Infectious Diseases	1,191	1,533	2,040	1,394	1,559	2,387
E.E.N.T	846	1,410	2,961	990	1,651	3,466
Dermatology	263	526	1,052	308	615	1,231
Rehabilitation Medicine	2,071	2,708	2,900	2,425	3,170	3,395
Specialties Not Modeled	781	1,247	1,929	860	1,454	2,513
Dentists	86,732	91,551	97,180	33,844	78,696	112,387
Nurses	81,095	95,140	108,929	87,304	104,370	116,777
Midwives	30,139	35,924	40,415	31,598	36,830	48,046
Medical Technologists	21,612	22,749	23,562	25,859	27,220	28,192
Pharmacists	8,999	11,382	11,922	10,534	13,324	13,956

the need for maternal care but apparently each caters to a specific clientele. Midwives mostly attend to pregnant women belonging to the low income class while ob-gynecologists attend to those belonging to the middle to upper income brackets. It is during complications that an ob-gynecologist is consulted for treatment by women of low socio-economic status.

The present thrust of the government on primary health care or promotive/preventive care increases the need for general practitioners. Thus, physicians need more nurses and more midwives to respond to this demand.

Most midwives are made to reside in a community where they are assigned. The Department of Health provides residence health station on call for 24 hours. Midwives are thus considered quite productive compared to other health personnel. Delegation and substitution with barangay health volunteers and "hilots" or traditional birth attendants (TBAs), who are commonly perceived by rural folks as the more pragmatic choice for obstetric and gynecological care, play an important role in midwives' requirement now that regular trainings are being conducted by the health department for them.

#### **IV. HEALTH MANPOWER IMBALANCE ANALYSIS**

Defining health manpower imbalance is difficult because of the complex and multi-faceted nature of the concept of balance as applied to health occupations (Mejia, 1987).

In the most general sense, health manpower imbalance refers to the discrepancy between numbers, functions, distribution and quality of health workers, on the one hand, and, on the other, the country's needs for their services and ability to employ, support and maintain them.

The supply of health manpower may be inadequate in one or several ways relative to a specified health purpose or target, according to objective or subjective norms of care or standards.

The following sections A and B, respectively, compare the existing supply/stock of the health manpower estimated in Chapter 2 with the (a) standard health manpower requirements, and (b) requirements of manpower derived from a normative qualification of needs for health manpower using the modified GMENAC model discussed in Chapter 3.

Section C discusses the distributional imbalance of health manpower in terms of geographical distribution using the population/health manpower ratio as the indicator. Factors which determine the regional distribution of health manpower are examined. Finally, section D gives a comparison of population/health manpower ratios in selected Asian countries.

The succeeding analyses of health manpower may be more indicative than conclusive, because of the difficulties in quantifying both present and future stock and manpower requirements.

##### **A. Stock v. Standard Requirements**

To determine the imbalance, this section compares the standard requirement for health personnel by work setting to the estimated "actual" stock of health manpower.

Table IV.1 presents the total standard requirements by place of work such as hospitals, rural health units (RHUs), schools and industries, and the actual stock by work setting. The actual stock of health manpower by work setting in 1990 and 2000 is derived by multiplying the Census percentage distribution per work setting to the computed net stock of health manpower under the medium assumptions in Chapter 2. The percentage distribution per work setting is assumed to be constant, that is, the same in 1990 and 2000. The projected values of the standard requirements for the year 2000 are estimated using the historical trend of the number of hospitals,

Table IV.1. Health Manpower Standard Requirements By Work Setting Vs. Estimated Actual

	Hospitals (Prv't & Public)		Public Health		School Health (Prv't & Public)		Ind/Occpl Health (All Establishments)	
	Standard	Actual	Standard	Actual	Standard	Actual	Standard	Actual
Physicians								
1990	18,911	28,021	3,074	2,615	1,579	304	1,222	607
2000	24,735	30,475	3,761	3,285	1,726	315	1,692	660
Dentists								
1990	1,527	18,391	3,074	1,224	3,159	582	1,222	291
2000	1,993	23,850	3,761	3,353	3,452	768	1,692	377
Nurses								
1990	25,565	44,214	3,074	3,358	3,159	1,960	6,634	1,407
2000	33,371	21,133	3,761	4,099	3,452	920	9,181	672
Midwives								
1990	13,325	74,316	20,493	11,994				
2000	17,394	99,466	25,075	12,867				
Med Technologists								
1990	2,071	18,288						
2000	2,703	24,271						
Pharmacists								
1990	1,928	3,652						
2000	2,474	3,692						

number of students and number of establishments with 51 or more employees.<sup>12</sup>

The actual figures of health workers under a hospital setting include those working in private clinics and laboratories while standard figures are limited to those working in hospital. The difference between actual and standard figures may indicate the number of health workers involved in private practice.

The table reveals that the number of RHU personnel is less than the standard requirement

<sup>12</sup> Actual data and projections for the year 2000 using historical trend:

	1990	2000
# of students		
Pre-School	321,459	444,698
Elementary	10,284,861	10,952,231
Secondary	3,961,639	4,254,561
Tertiary	1,347,715	1,607,920
Total	15,915,674	17,259,411
# of hospitals	1,773	2,262
# of establishments with employees of 51 and more	6,634	9,181

Source of basic data: NSCB Statistical Yearbook

mentioned earlier, except in the case of nurses. However, questions could be raised on whether this number of nurses really meets the actual needs of the rural population considering that the standard ratios used need to be updated. Assuming that these ratios are underestimated, then the gap between the actual number of public health workers and the standard requirements is actually wider.

The table also indicates that the actual number of school health workers falls short of the standard school health personnel requirement. This gap will be aggravated if RA 124 requirements for physicians were to be adopted.

In the industrial/occupational health sector, discrepancies are also observed. Actual figures are far below the standard requirements.

From the foregoing findings, it could be deduced that health manpower shortage exists in the following work settings: public health, school health, and industrial/occupational health and safety. However, these findings may or may not reflect the overall shortage since surpluses might be prevailing in other areas of work.

Table IV.2. Current and Projected Number of Medical Specialists

Specialists	1990			2000		
	PMA Recommended (Total)	DOH Hospital Requirements	Actual (PMCC-accred) (Total)	PMA Recommended (Total)	DOH Hospital Requirements	Actual (PMCC-accred) (Total)
Surgeons	6,148	762	2,010	7,522	995	2,187
EENT	4,099	426	658	5,015	556	716
Urologists	1,025	40	253	1,254	52	276
Internal Med	2,049	762	3,260	2,507	995	3,546
Ob-Gyn	3,074	795	1,992	3,761	1,038	2,167
Pediatricians	2,049	780	1,778	2,507	1,018	1,935
Pathologists	615	531	457	752	693	497
Radiologists	1,025	557	253	1,254	727	461

Sources of basic data: PMA, PMCC and DOH-HOMS

Table IV.2 compares the health manpower requirements based on PMA recommendations and on standard hospital personnel needs to the estimated number of medical specialists. The actual figures were estimated using the data from the PMCC and other medical societies and it is assumed that PMCC-accreditation or membership of specialists to medical societies is about 60 percent of the total population of specialists.

Table IV.2 indicates that there exists a shortage of specialists in almost all areas of specialization, whether one looks at PMA or DOH recommendations. The gap between the standard requirements and the actual stock of specialists will continue to widen through the year 2000 unless measures are undertaken to alleviate the foreseen shortages. Only in the case of Internists is a surplus apparent.

## B. Stock vs. "GMENAC" Requirements

Chapters 2 and 3 deal with the measurement and projection of the stock/supply and requirements of health manpower, respectively. The net stock, defined as those currently active professionally or seeking employment, is determined by the increment to and losses from the total

stock. The requirements are derived using the modified GMENAC model which seeks to determine, based on expert opinion, the amount and quality levels of services required to attain and maintain a healthy population. Service targets are then converted into manpower requirements in conjunction with staffing and productivity levels.

This section determines the mismatch between the stock and requirements.

Table IV.3 presents the estimates of stock and requirements of health manpower including specialists in 1992 and in the year 2000.

Shortage of medical professionals is seen in the group of physicians, dentists, nurses and medical technologists while excess stock of medical professionals is observed in the group of midwives and pharmacists.

Shortage of dentists is quite severe as their stock is consistently only less than half of their total requirements in low, medium and high projections. On the other hand, the table indicates a huge surplus of midwives.

Oversupply of midwives and pharmacists, and shortage of physicians, dentists, nurses and medical technologists will persist despite certain positive changes or developments. Projections show that it may be alleviated but not totally remedied. The oversupply of midwives can be partly explained by the fact that DOH serves to be their primary clientele. However, the considerable production of midwives cannot be absorbed by DOH's limited capacity.

With physicians, there is a shortage in supply of both general practitioners and specialists. Most specialists are in short supply except for those in the field of pulmonology, pediatrics, surgery, and infectious diseases. These imbalances are projected to become worse by the year 2000: the numbers will increase for all those with already excessive supply; on the other hand, there will be less for most of those experiencing scarcity.

Health manpower imbalance in the Philippines is due to political, social and economic predisposing factors. In terms of production there is a real shortage of physicians but with nurses an artificial need has been created by the flight of a large portion of this health manpower group to other countries. The country has been actually producing nurses for export specifically to developed countries such as the United States, Canada and the Middle East either as permanent immigrants or overseas contract workers.

In urbanized areas in the country, the opening of medical schools in the country has been primarily a response to market forces by the private sector. On the other hand, in the provinces, medical schools, hospitals and facilities are put up and closed not because of needs but due to political reasons.

Shortage of specialists may be attributed to pressures from elites in the medical profession who prevent the number of specialists from increasing by setting very high qualification standards in specialty associations (Sanchez, 1988).

This section describes the health manpower imbalance per category while previous section describes the health manpower imbalance per category with reference to the place of work. Both results are complementary and consistent. They are complementary in the sense that one result discusses the overall imbalance of health manpower while the other result discusses the health manpower imbalance per work setting. They are consistent, since the shortages of physicians,

Table IV.3 - Supply and Requirement for Health Manpower, 1992 &amp; 2000

		Supply		Requirement		Balance				Supply		Requirement		Balance	
		1992	2000	1992	2000	1992	2000			1992	2000	1992	2000	1992	2000
<b>Physicians</b>															
	High	39,558	48,442	69,161	100,211	(29,605)	(51,769)								
	Medium	26,507	34,206	50,038	68,450	(23,531)	(34,244)								
	Low	13,458	19,970	23,172	24,142	(9,714)	(4,172)								
<b>General/Family Practice</b>															
	High	21,667	26,535	39,158	61,120	(17,491)	(34,585)								
	Medium	14,520	18,737	30,645	45,840	(16,125)	(27,103)								
	Low	7,372	10,939	9,784	8,570	(2,412)	2,368								
<b>Specialties Modeled</b>															
	High	17,889	21,907	30,003	39,091	(12,114)	(17,184)								
	Medium	11,987	15,469	19,393	22,610	(7,405)	(7,140)								
	Low	6,088	9,031	13,388	15,572	(7,302)	(6,541)								
<b>Cardiology</b>															
	High	1,223	1,498	3,786	3,545	(2,563)	(2,047)								
	Medium	820	1,058	907	1,082	(87)	(4)								
	Low	416	618	648	849	(232)	(231)								
<b>Pediatrics</b>															
	High	2,691	3,296	1,702	6,756	989	(3,460)								
	Medium	1,803	2,327	648	701	1,155	1,628								
	Low	916	1,359	617	668	299	691								
<b>Ophthalmology</b>															
	High	790	967	1,661	1,392	(871)	(425)								
	Medium	529	683	1,384	1,258	(855)	(575)								
	Low	269	399	1,108	1,092	(839)	(693)								
<b>Surgeons</b>															
	High	2,903	3,555	952	1,115	1,951	2,440								
	Medium	1,945	2,511	377	743	1,568	1,768								
	Low	988	1,466	317	334	671	1,132								
<b>Obstetrics-Gynecology</b>															
	High	3,014	3,691	6,928	8,420	(3,914)	(4,729)								
	Medium	2,020	2,607	5,598	6,900	(3,578)	(4,293)								
	Low	1,025	1,522	2,991	3,628	(1,966)	(2,104)								
<b>Pulmonology</b>															
	High	1,140	1,396	954	1,197	186	199								
	Medium	784	986	545	558	219	428								
	Low	388	576	216	240	172	338								
<b>Psychiatry</b>															
	High	10	12	3,138	3,674	(3,128)	(3,662)								
	Medium	7	9	2,510	2,939	(2,503)	(2,930)								
	Low	3	5	2,259	2,645	(2,256)	(2,640)								
<b>Infectious Diseases</b>															
	High	3,867	4,735	2,040	2,387	1,827	2,348								
	Medium	2,591	3,344	1,533	1,559	1,058	1,785								
	Low	1,316	1,952	1,191	1,394	125	558								
<b>E.E.N.T</b>															
	High	998	1,220	2,981	3,486	(1,985)	(2,246)								
	Medium	668	862	1,410	1,651	(742)	(789)								
	Low	339	503	846	990	(507)	(487)								
<b>Dermatology</b>															
	High	40	49	1,052	1,231	(1,012)	(1,182)								
	Medium	27	35	526	615	(499)	(580)								
	Low	14	20	263	308	(249)	(288)								
<b>Rehabilitation Medicine</b>															
	High	63	77	2,900	3,395	(2,837)	(3,318)								
	Medium	42	55	2,708	3,170	(2,666)	(3,115)								
	Low	21	32	2,071	2,425	(2,050)	(2,393)								
<b>Specialties Not Modeled</b>															
	High	1,150	1,409	1,929	2,513	(779)	(1,105)								
	Medium	771	995	1,247	1,454	(476)	(459)								
	Low	392	581	781	860	(390)	(279)								
<b>Dentists</b>															
	High	23,175	31,549	97,180	112,387	(74,005)	(80,838)								
	Medium	19,976	27,470	91,551	78,896	(71,575)	(51,226)								
	Low	16,777	23,390	86,732	33,844	(69,955)	(10,454)								
<b>Nurses</b>															
	High	85,032	85,825	108,929	116,777	(23,897)	(30,952)								
	Medium	53,723	54,516	95,140	104,370	(41,417)	(49,854)								
	Low	22,413	23,208	81,095	87,304	(58,882)	(64,090)								
<b>Midwives</b>															
	High	119,588	156,264	40,416	48,046	79,171	108,218								
	Medium	83,713	112,462	35,924	36,830	47,789	75,632								
	Low	47,839	68,659	30,139	31,598	17,700	37,061								
<b>Medical Technologists</b>															
	High	28,280	36,158	23,562	26,192	4,718	9,968								
	Medium	22,991	31,967	27,749	27,220	(4,758)	4,767								
	Low	17,701	25,815	21,612	25,859	(3,911)	(44)								
<b>Pharmacists</b>															
	High	21,101	21,459	11,922	13,956	9,179	7,503								
	Medium	17,993	17,726	11,382	13,324	6,611	4,402								
	Low	14,885	13,993	8,999	10,534	5,886	3,459								



dentists and nurses in the public health sector, schools and industries reflect the overall shortage of these health manpower categories. With this, it could be inferred that there are either shortages of health manpower in other work settings not considered in this study, or surpluses in other work settings but which are more than offset by the shortages of the above mentioned health manpower categories. In the case of midwives, there is a shortage in the public health sector but there is an overall surplus.

### C. Distributional Imbalances

Unequal distribution of resources is universal and neither new nor unique to the health sector. Indeed, as long as wide variations in levels of development and life style continue, urban sectors will continue to capture a hugely disproportionate share of the annual growth in health sector labor resources.

The underlying causes of inequalities are for the most part self-evident. Many are linked to wide and growing differences between urban and rural living standards that are both antecedent to and consequent upon migration from the rural areas to the towns. Among the major factors are the better and more varied opportunities open to urban residents for education, health care, housing, transport, cultural and recreational activities, jobs and income. It is little wonder that health professionals tend to favor the way of life convenient for themselves and thus contribute to the overall problem.

#### C.1 Work Setting

It was pointed out in Chapter 2 that health workers, such as physicians, dentists, nurses, midwives and medical technologists are concentrated in the hospitals/clinics/laboratories. They account for, on the average, eighty percent (80%) of their respective stock. In the case of pharmacists, only 19 percent work in hospitals, clinics and laboratories but about sixty-five percent (65%) of them are employed in drugstores and pharmaceutical companies.

The high number of health workers in the hospitals reveals their preference against working in public health units (e.g., rural health units and barangay health units) and even in school-based. The level of technology or the number of advanced facilities which health manpower would like to take advantage of and the prestige they would earn as hospital-based personnel than as rural-based health workers seem to influence their decision to choose urban institutional settings.

#### C.2 Location of Work

On the average, about 89 percent of the respective net stock of physicians, dentists, nurses, medical technologists and pharmacists are located in urban areas while about 66 percent of midwives are in urban areas (see Table IV.4a).

As a result of this maldistribution, the population served per health manpower in the rural areas is greater than that in the urban areas (see Table IV.4b). One physician serves a population of only 1,099 in urban areas while in rural areas, a physician serves a population of 18,190 as against the average of 2,349 per physician. A similar pattern could be observed in the case of the other health workers. This reinforces earlier analyses that urban areas offer better facilities which are attractive to health workers.

Table IV.4a. Urban-Rural Percentage Distribution of Selected Health manpower, 1990

Region	Physicians	Dentists	Nurses	Midwives	MedTech.	Pharmacist
Urban	92.5	91.3	83.2	65.9	87.0	90.0
Rural	7.5	8.7	16.8	34.1	13.0	10.0
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

Source: 1990 Census

Table IV.4b. Ratio of Population to Health manpower, 1990

Region	Physicians	Dentists	Nurses	Midwives	MedTech.	Pharmacist
Urban	1,099	1,637	524	517	1,426	1,716
Rural	18,190	23,067	3,482	1,342	12,811	20,729
AVERAGE	2,349	3,456	1,008	788	2,868	3,570

Sources of Basic Data: Computed health manpower stock from Chapter 2, NSCB Statistical Yearbook and 1990 Census

### C.3 Regional Distribution

As pointed out earlier, the NCR captures most of the health professionals as against other regions (see Table IV.5a and Figure IV.1). Higher percentage shares are also observed in

Table IV.5a. Regional Distribution of Health manpower (in Percent)

Region	Physicians	Dentists	Nurses	Midwives	MedTech.	Pharmacists
NCR	42.55	46.51	31.39	16.58	36.65	36.09
CAR	2.07	2.07	3.45	2.59	2.39	1.33
1	3.68	4.27	6.41	6.92	4.14	3.17
2	1.76	1.79	2.84	3.61	3.04	2.97
3	9.55	10.72	8.19	12.79	10.68	7.87
4	10.56	14.12	13.30	16.07	12.34	12.07
5	3.33	3.46	3.73	6.59	3.50	2.66
6	5.56	2.71	9.18	7.04	6.63	5.83
7	6.91	4.09	6.19	5.69	5.62	5.73
8	2.42	1.73	2.66	2.86	2.30	2.35
9	1.92	1.15	3.04	2.83	1.57	3.37
10	3.46	2.65	3.22	5.42	4.05	5.42
11	4.12	2.94	4.02	6.44	5.16	8.08
12	2.11	1.79	2.37	4.57	1.93	3.07
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00

Source: 1990 Census

Regions 3 and 4. This maldistribution is more evident as we relate the number of population to the number of health manpower (see Table IV.5b). As with the case of physicians, one physician

Figure IV.1 – Regional Distribution

# POPULATION/HEALTH MANPOWER RATIO

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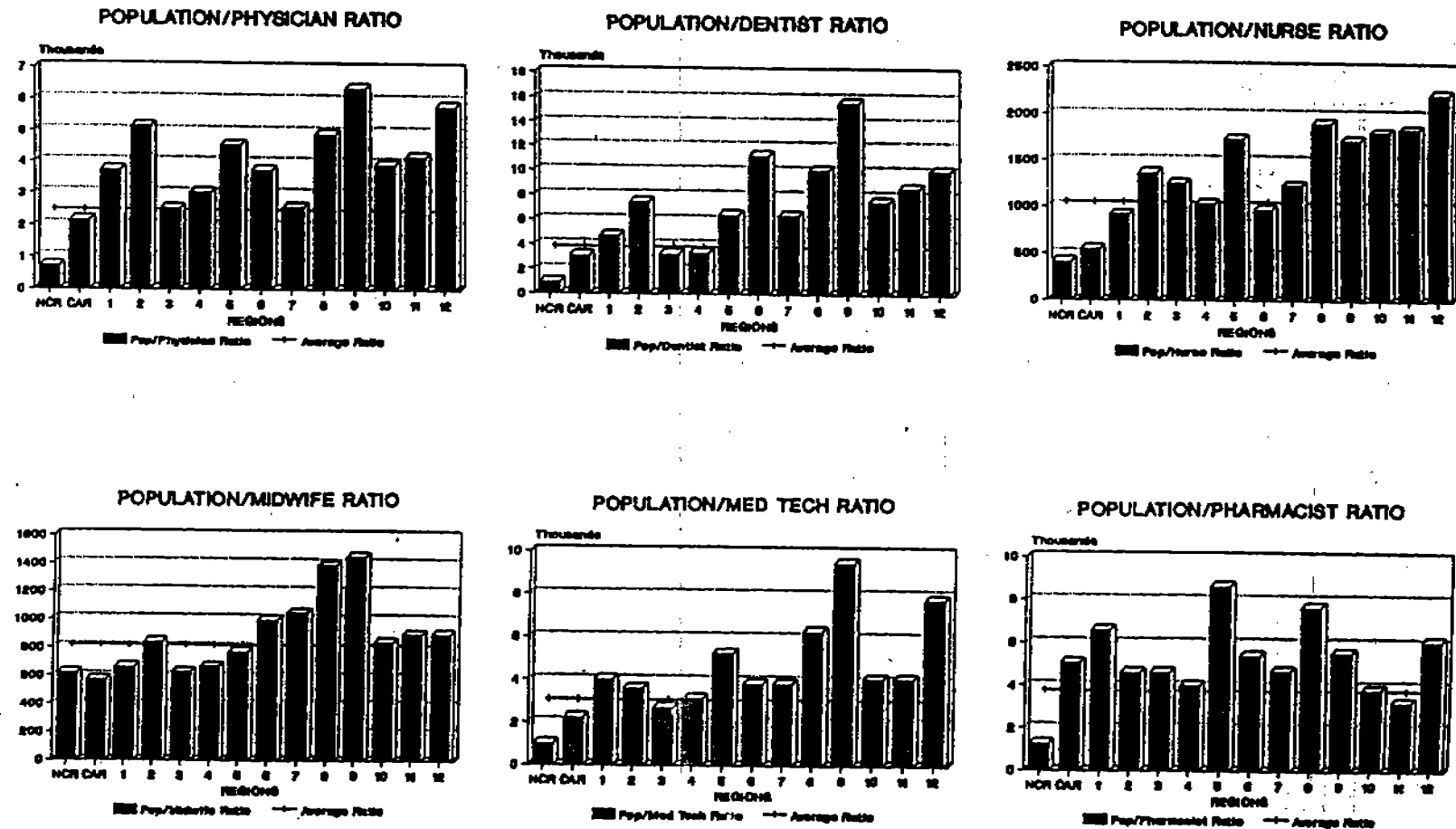


Table IV.5b. Ratio of Population to Health manpower, 1990

Region	Physicians	Dentists	Nurses	Midwives	MedTech.	Pharmacist
NCR	722	971	419	621	1,023	1,293
CAR	2,144	3,153	552	575	2,266	5,069
1	3,736	4,737	920	667	4,054	6,590
2	5,150	7,449	1,369	842	3,640	4,637
3	2,513	3,294	1,257	630	2,743	4,634
4	3,031	3,334	1,032	668	3,166	4,029
5	4,546	6,437	1,741	771	5,280	8,648
6	3,755	11,333	975	995	3,844	5,441
7	2,574	6,396	1,232	1,049	3,863	4,716
8	4,888	10,058	1,907	1,388	6,278	7,648
9	6,371	15,646	1,725	1,450	9,510	5,515
10	3,928	7,544	1,810	841	4,096	3,810
11	4,189	8,635	1,841	899	4,083	3,245
12	5,819	10,090	2,222	901	7,766	6,077
AVERAGE	2,349	3,456	1,008	788	2,868	3,570

serves 722 persons in Metro Manila compare that with 6,371 per physician in Region 9. Among the regions, Region 9 exhibits the lowest number of health human resources. The shortage is more pronounced in the number of dentists.

The maldistribution of health manpower is highlighted further in Table IV.6 which indicates that 271 municipalities are without doctors and nurses (DOH, 1993). At present, the

Table IV.6. Number of municipalities per region  
physicians and nurses, 1992

Region	Municipalities w/o physicians and nurses (A)	Total number of municipalities (B)	Percent (A/B)*100
NCR	0	13	0%
CAR	0	75	0%
1	37	122	30%
2	26	93	28%
3	4	116	3%
4	34	213	16%
5	15	112	13%
6	7	123	6%
7	4	123	3%
8	25	139	18%
9	38	99	38%
10	26	116	22%
11	11	84	13%
12	44	104	42%
Total	271	1,532	18%

Source: DOH, 1993

Department of Health's Project 271, which provides a generous package of benefits for physicians

willing to be assigned in these areas, has mustered several takers. On the average, 18 percent of the total number of municipalities have no physicians and nurses.

In view of these observations, attempts are made at identifying the factors affecting the regional location of health professionals. The literature on locational decisions of health manpower based on the experience of Western countries suggests that among the factors that affect physician location are physician income in the area, the number of physicians practicing in the area, per capita income, population and its age composition, and educational level. The area's economic activities, cultural and recreational resources, number of hospitals and hospital beds, presence of medical schools and training facilities, and types of supportive institutions (Cooper et al, 1972). The factors being considered in this study are population, real GDP, real GDP per capita, number of schools, number of hospital beds, number of hospitals. Generally, it is expected that regions with high GDP or GDP per capita, high number of schools offering health programs, high number of hospital beds as well as hospitals attract health personnel. Per capita GDP indicates the ability of patients to pay the services that will be rendered by the health personnel. As indicator of the average income level of the population, it is, likewise, reflective of the income level of the health personnel. According to Fuche (1986), income or GDP level which serves as a substitute for the level of cultural, educational, social and recreational opportunities a country has to offer also attracts health personnel. Specifically, medical schools draw health personnel-to-be and its affiliated hospitals attract interns and residents. Hospitals and hospital beds are proxy in a more general sense for the whole range of medical facilities. These pecuniary and non-pecuniary elements influence a health personnel to settle in a region.

Correlation analysis is utilized to determine the association of these factors on the regional location of health professionals.<sup>13</sup> The results of these correlation analyses provide some insights on the nature of location decisions of health professionals and the possible steps in minimizing regional maldistribution of health manpower.

Regional location for all health professional categories is positively and highly correlated with the regional population, real GDP or real GDP per capita, number of schools offering the health programs within the region, and number of hospital beds. However, the number of

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<sup>13</sup> Regression analysis, which accounts for all variables being considered, is not feasible due to the multicollinearity of factors and the limited number of cases (the number of regions, which is 14). In lieu of regression, correlations between the regional number of health professionals and the following variables are considered:

rdoc, rden, etc.	-	regional number of corresponding health professionals as rdoc for physicians
pop	-	population
gdp	-	real GDP (1985=100)
gdpcap	-	real GDP per capita
sdoc, sden, etc.	-	regional number of corresponding schools such as sdoc for medical schools or snur nursing schools
beds	-	regional number of hospital beds (private and public)
hosp	-	regional number of hospitals (private and public)

hospitals is found to be uncorrelated with the regional number of medical workers. What actually matters is the bed capacity of the hospitals and not the number of hospitals. To illustrate, primary hospitals are numerous across the regions, representing 46 percent of the total hospitals in the country, but in terms of bed capacity, tertiary hospitals and secondary hospitals have more hospitals beds. Moreover, the number of hospital beds is indicative of the hospital personnel requirements, as pointed out in the previous section.

The number of schools and the number of hospital beds are correlated with the level of GDP or GDP per capita. That is, developed regions (as measured in terms of GDP per capita) provide better facilities such as schools and big hospitals (secondary or tertiary hospitals with large number of hospital beds as opposed to primary hospitals) and have cultural, educational, social and recreational opportunities, among others, which are attractive to medical workers.

Table IV.7. Correlation Results: Locational Decision Factors

Sample range: 1 - 14

Number of observations: 14 regions

	CORRELATION					
	Physicians	Dentists	Nurses	Midwives	Med Tech	Pharmacists
POP	0.7039729	0.7159894	0.7792425	0.9454700	0.7577636	0.7414895
GDP	0.9735412	0.9720111	0.9734289	0.8477255	0.9860027	0.9889845
GDPCAP	0.9461924	0.9325373	0.9126579	0.7028077	0.9454709	0.9605537
SCHOOLS <sup>14</sup>	0.8384733	0.8476173	0.9577142	0.7346945	0.8638707	0.8444672
BEDS	0.9841570	0.9847363	0.9732719	0.8201263	0.9882501	0.9936167
HOSP	0.3517055	0.4055082	0.3800080	0.7566420	0.4217750	0.4455589

	CORRELATION					
	Population	GDP	GDP/cap	Schools	Beds	Hospitals
GDP	0.8190796					
GDPCAP	0.6440696	0.9520397				
SCHOOLS <sup>15</sup>	0.5640742	0.7859960	0.7554003			
BEDS	0.7734575	0.9923048	0.9517472	0.8120117		
HOSP	0.7319330	0.5128562	0.4026957	0.0958916	0.4885836	

Correlation analysis is also used to relate the morbidity cases to the regional number of health professionals which attempts to determine whether the presence of health professionals corresponds to the need for their health services. The need for physicians, nurses, medical technologists and pharmacists per region can be represented by the regional incidences of leading morbidities including bronchitis, influenza, diarrheal diseases, pneumonias, all forms of TB, accidents, malaria, heart diseases, measles and malignant neoplasms. These morbidity cases are correlated with the regional number of medical workers, such as physicians, nurses, medical technologists and pharmacists. The number of live births which serves as the indicator of the need for midwives is positively correlated with the number of midwives and the regional number of persons needing dental attention with the number of dentists.

<sup>14</sup> The schools here refer to the schools offering the six health programs under study.

<sup>15</sup> The schools here are medical schools only. The results, however, reflect the same pattern with those of schools offering dentistry, nursing, midwifery, medical technology and pharmacy.

The correlation results in Table IV.8 reveal that the regional number of physicians, dentists, nurses, medical technologists and pharmacists are not correlated with the number of morbidity cases. On the other hand, the number of midwives present in the regions is correlated with the number of live births per region. It should be noted that the distribution of midwives across the regions is relatively more equal compared with the other health workers. As with the dentists, the distribution is not correlated with the dental care needs of the population.

These results indicate the gap between the regional need for the health services of physicians, dentists, nurses, medical technologists and pharmacists and the number of medical workers. The locational decision of these medical professionals may be explained by the income level of the region (that is, a large number of health manpower are located in areas with higher GDP per capita and scarce health manpower resources are found in less developed regions), the number of hospital beds (this denotes health workers' preference toward working in hospitals offering better facilities which could be found in relatively developed areas) and the number of schools offering health related courses.

Table IV.8. Correlations Analyses Results: Morbidity Cases

=====						
SMPL range: 1 - 14						
Number of observations: 14						
=====						
	Physicians	Dentists	CORRELATION			
			Nurses	Midwives	MedTech	Pharmacists
-----						
MORBID	-0.1975450		-0.1968514		-0.1608122	-0.0827677
DENTAL		-0.2006788				
BIRTHS				0.8703077		
=====						

#### D. Asian Comparison

Though Asian countries may have, to some degree, similar socio-cultural conditions, variables determining the trends in the health professions differ.

This section attempts to compare the Philippine trend of health human resources with that of a number of Asian countries, namely Indonesia, Japan, Malaysia, Singapore and Thailand. The general concept which underlies this comparative analysis is that the principal health manpower problems are comparable to Asian countries as a result of economic and social circumstances.

This section will first discuss trends in the growth of population/health personnel ratios for the period 1975 to 1990 and then relate the health personnel per 10,000 population to some health indicators in 1988.

Experiences of developed countries from other available sources are also cited for reference since it is known that basic health needs of these countries are less compared to those of developing countries and that medical densities are just the opposite. Nonetheless, experiences of other least developed countries are also cited.

### **D.1 Trends of population per health worker**

Asian trends of population served per health worker or population/health personnel ratio are shown in Table IV.9. The lower population/health personnel ratio indicates the greater accessibility of the population to health care services; however, this does not imply that there is no health manpower imbalance nor that the supply is adequate. Furthermore, the decreasing trend of this ratio is a reflection of the fact that the number of health personnel is growing faster than the population they serve.

Among the Asian countries, Japan has the lowest population/health personnel ratios, except in the case of midwives. For physicians, the ratio reached 583 per physician in 1990. Singapore with a ratio of 761 per physician ranks second to Japan. The Philippines ranks third with a ratio of 3,380 per physician in 1990. According to the 1991 WHO annual statistics, in the USA and Norway, there are 419 and 503 persons per physician, respectively, in 1988 while in some countries like Nepal and Uganda, there are 25,682 and 24,876 persons per physician, respectively. These figures convey that the people in the Philippines have relatively greater access to physicians compared to citizens of other developing countries. On the other hand, Japan's figure and that of Singapore are closer to the ratios of the other developed countries and may serve as benchmarks for comparison.

The Philippines ranks next to Japan in its ratios for dentists and pharmacists (with a little difference vis-a-vis that of Singapore); and has the lowest ratio for midwives. Among the Asian countries, Indonesia has the largest ratio for all health manpower categories.

As regards the trends of the ratios over time, declining trends can be observed for population/physician and population/dentist ratios in all the countries. For nurses, the trends are decreasing except in the Philippines and Indonesia. This trend reflects the international outflow of nurses from these countries. The Philippines faces competition from Indonesia in sending nurses to the US; as in 1988, thousands of nurses went to the US (POEA Info Series, 1990). The case of midwives is quite different: Japan and Singapore had increasing trends, that is, the population growth surpassed the growth of the number of midwives; Thailand's ratio is consistently declining while in the Philippines and Indonesia, a shift from declining to increasing trends can be observed. In the case of pharmacists, while the other Asian countries had improved ratios (or declining trend), the Philippines has an increasing trend.

### **D.2 Relationship between health personnel to population ratio and health indicators**

The disparity or similarities among these countries could also be determined by relating health personnel per 10,000 population to the trend of the following health indicators: GDP per capita, birth rates per 1,000, mortality rates per 1,000 and life expectancy. High health personnel/population ratios are associated with high GDP per capita, and countries with high health personnel/population ratios have also low life expectancies, low mortality rates and low birth rates.

Figures IV.2 to IV.5 show the association of health personnel to the health indicators.

Figure IV.2 shows that there is close (positive) association between GDP per capita and the number of doctors, dentists and nurses per 10,000 population. As explained earlier, GDP per capita indicates the pecuniary and non-pecuniary considerations for health workers and countries like the Philippines, Indonesia, Thailand and Malaysia and in these countries such



Figure IV.2. Relationship Between Health Manpower and GDP per Capita

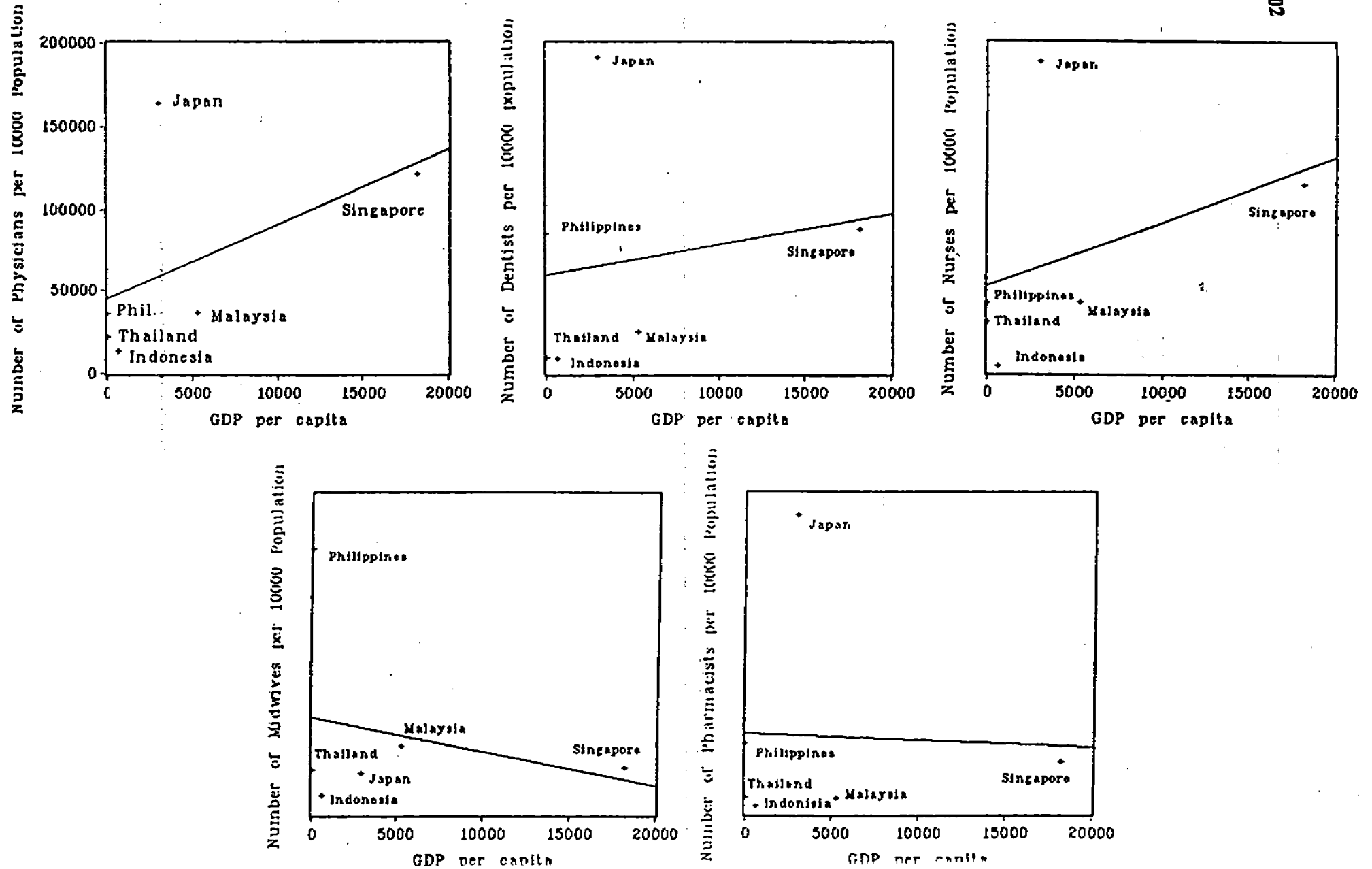


Table IV.9. Asian Comparison: Population per Health manpower

Year	Phils.	Indonesia	Japan	Malaysia	Singapore	Thailand
Population per physician						
1975	3,184	15,763	842	4,316	1,418	8,272
1980	3,005	11,322	748	3,577	1,215	6,772
1985	2,794	8,221	649	3,179	988	5,977
1990	2,380	7,028	583	2,524	761	4,356
Population per dentist						
1975	5,007	138,300	2,560	27,483	5,489	63,497
1980	4,511	87,091	2,179	19,971	4,948	39,778
1985	4,004	38,565	1,859	15,082	4,305	35,631
1990	3,502	31,769	1,672	11,684	3,512	31,071
Population per nurse						
1975	1,106	13,241	309		399	2,180
1980	824	7,247	240	897	318	2,516
1985	745	5,355	196	746	310	1,337
1990	1,021	6,320	166	737	284	930
Population per midwife						
1975	913	12,174	4,173	3,159	2,473	6,535
1980	879	8,888	4,515	2,759	3,081	5,364
1985	834	3,181	4,960	2,363	4,000	6,700
1990	799	10,657	5,482	3,202	5,156	4,820
Population per pharmacist						
1975	2,665	70,655	1,183	46,124	7,986	21,641
1980	2,989	48,589	1,006	28,279	6,522	17,547
1985	3,304	38,285	909	18,624	5,963	15,314
1990	3,617	33,468	826	13,861	4,612	14,324

## Sources of Basic Data:

Philippine Data: Computed health manpower stock under medium assumption and NSCB Statistical Yearbook

Other Asian Data: SEAMIC Statistical Yearbook, 1990

advantages are relatively less.

Figures IV.3 and IV.4 show that the number of health personnel has close negative relationship with the birth rates and death rates of the country (except for midwives). Figure IV.5 shows the negative association of the number of health personnel with the life expectancy age.

The results reveal that Philippines, Indonesia, Thailand and Malaysia generally have comparable trends in health personnel and health conditions while Singapore and Japan have a similar pattern. Economic considerations determine the density of health personnel in these countries.

Figure IV.3. Relationship Between Health Manpower and Birth Rate

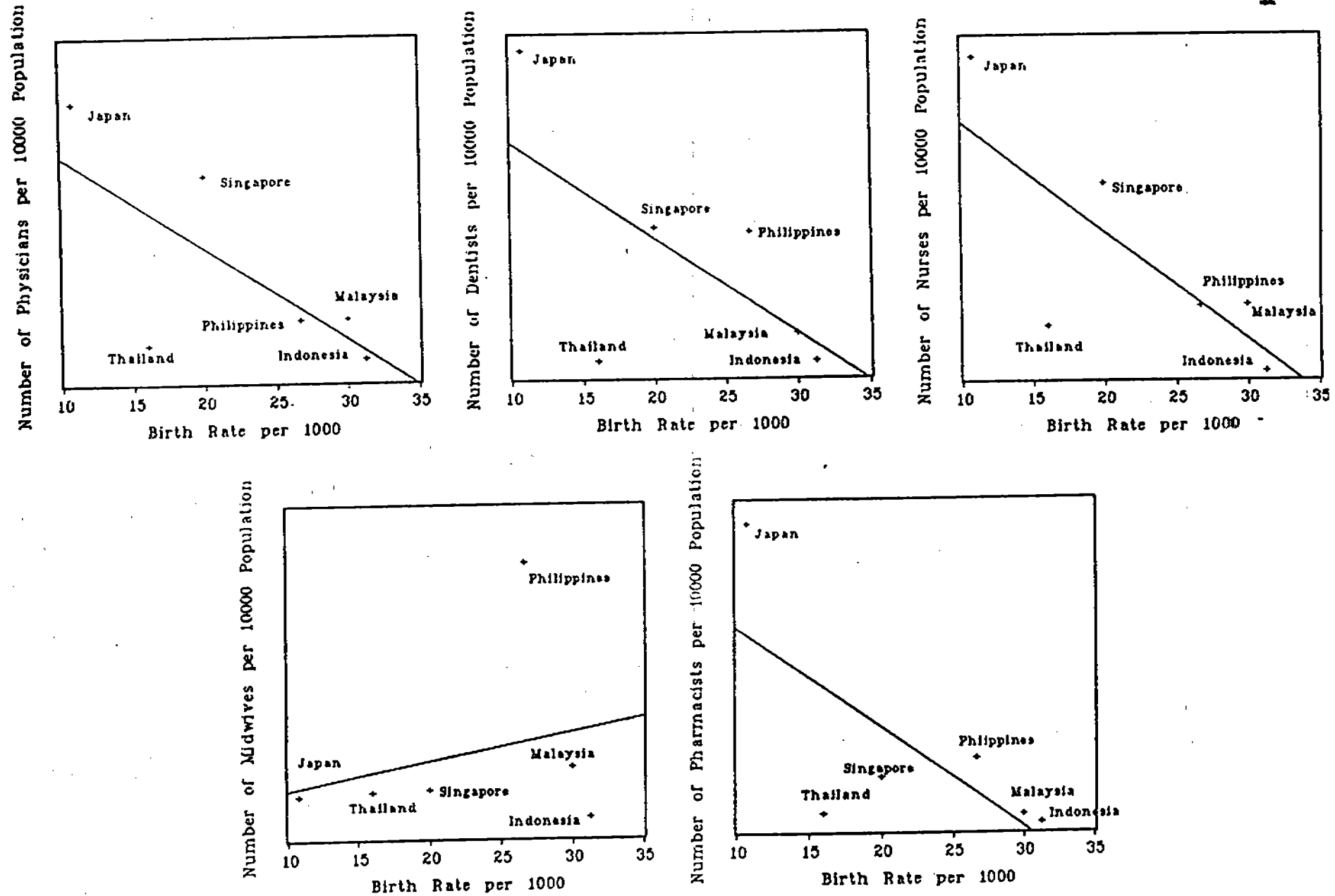


Figure IV.4. Relationship Between Health Manpower and Death Rate

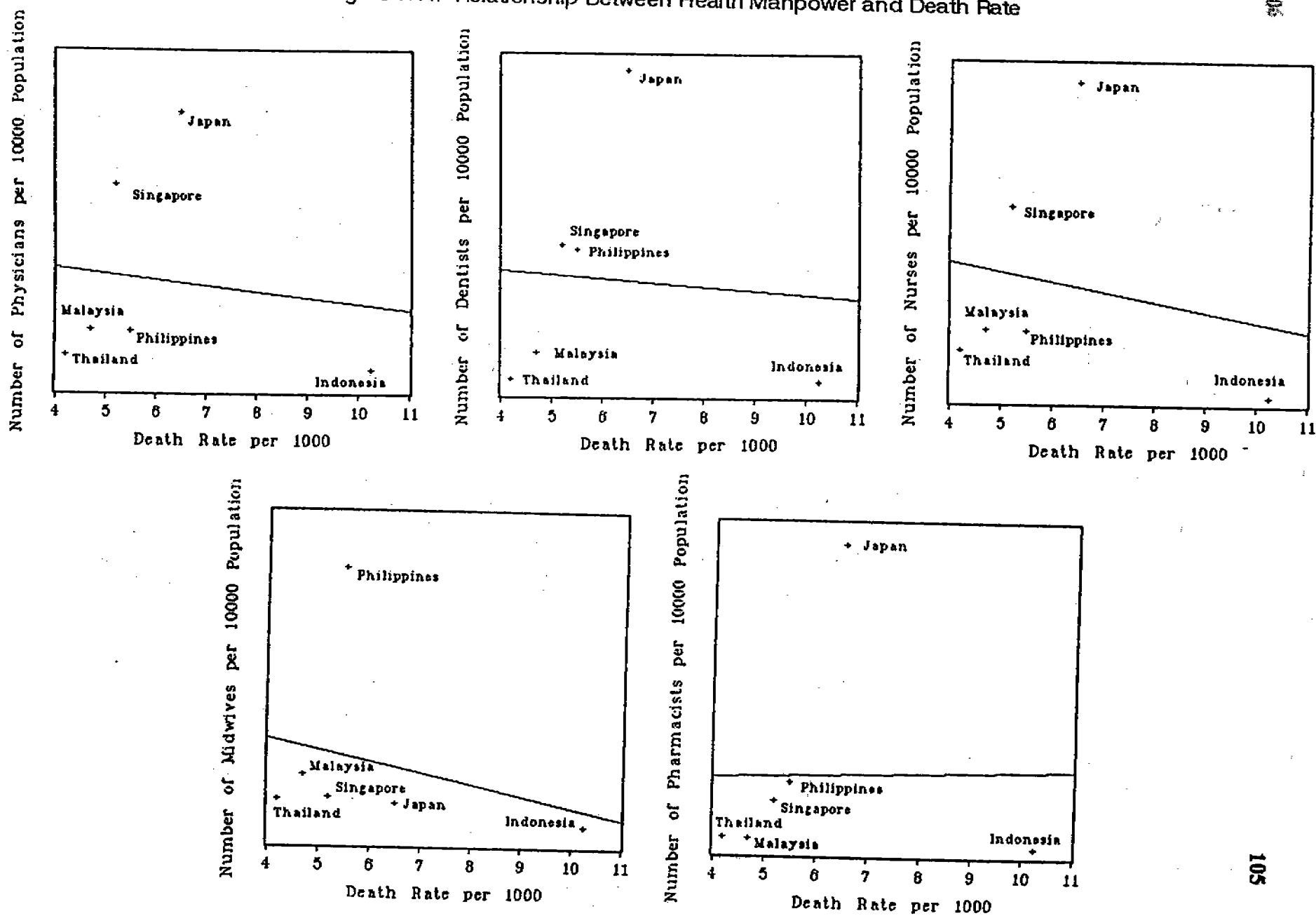
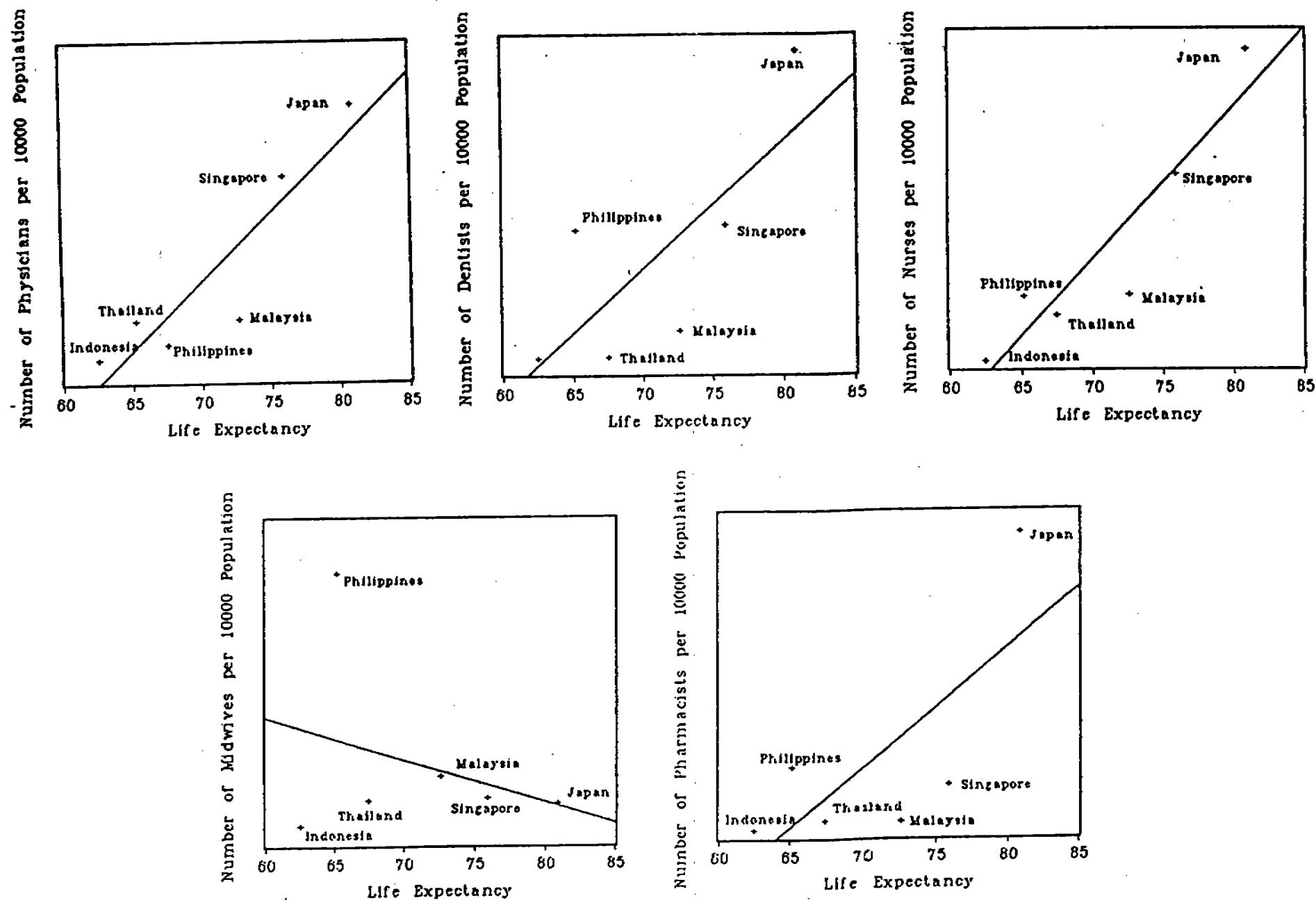


Figure IV.5. Relationship Between Health Manpower and Life Expectancy



## V. OTHER MAJOR ISSUES

### A. The Impact of Health Care Financing Schemes on the Supply of Medical Manpower

Among the many factors affecting the supply of and requirements for health manpower are health financing schemes like the Medicare and combined financing and delivery schemes mostly taking the form of health maintenance organizations (HMOs). Introduction of or changes in health financing schemes, such as expansion of Medicare coverage to include outpatient and obstetrical care, or pooling of community-based funds, or wider introduction of health maintenance organizations, will have ripple effects on the demand for or supply of health manpower. For that matter, government interventions that give rise to demands for consumer protection and reduction of substantial information asymmetries (see Weisbrod, 1991) will influence the way the medical care markets work. They will affect public investment decisions on construction of community hospitals, quite likely increase the demand for both major and auxiliary manpower categories and subsequently raise both the wages and number of health professionals, and influence the final price and quantity of medical care.

Feldstein (1988) also mentions that physicians may move to areas where there is better insurance coverage in addition to higher rate of illness, or higher income, all would increase demand for physician services.

Health care financing schemes create positive externalities in the form of provider services and in the process induce demand for medical manpower.

The impact of health insurance packages like the Medicare on utilization and, thus, on manpower requirement, is seen to depend critically on the price and income elasticities of demand while organizational changes at provider level which assuredly affect productivity are expected to be brought about by the growth of HMOs. There is an expected shift from solo and small-partnership types of medical practice to large-scale group practice parallel to the growth in HMO clientele size. In the United States, for example, a white paper of the Nixon administration suggests a reduction of 40 percent in physician per population under the HMO mode.

HMOs arrived in the Philippine health scene not so long ago; 21 (Gorra, 1993) were counted only recently, and mostly for-profit. Population coverage of existing HMOs is about 0.81 to 0.97 percent (Solon et al., 1992); a quantum-leaping enrolment growth is not foreseeable during the decade considering present access and affordability levels. It can be assumed that any increase in coverage would not affect in a discernible way the manpower supply-demand picture.

Medicare, the national health insurance, has long been in place to have altered the picture to whatever extent. Its introduction in 1972 has caused the outlying regions as a whole to make rapid gains in the provision of medical services (Almario et al. 1993). It has had a marked effect in distributing private-sector health resources to encourage the growth of small hospitals outside Metro Manila (Griffin et al. 1985). Theoretically, this ought to induce the demand for health providers.

As a risk-sharing social insurance where the user pays for coverage rather than for direct medical services, Medicare relieves providers of the need to take into account the consumer's ability to pay, thus creating incentives for more medical care. The effect is a consequent increase in the provision of medical goods, such as in-patient care, curative care and pharmaceuticals. In

turn, this variety of services lead to the growth of hospital-based medical manpower, such as physicians, nurses, pharmacists and laboratory-based technicians such as medical technologists.

Regression results suggest that Medicare does have impact on the supply of medical manpower based in hospitals such as doctors, nurses, medical technologists and pharmacists. The study looked at the number of health manpower as a function of medical fees or charges, number of Medicare claims, provider setting (private or public), provider type (primary, secondary or tertiary), and provider location (urban or rural). The results of the least squares estimation (refer to Appendix D for details) roughly indicate that medical charges and the number of medical claims are positively associated with the supply of medical manpower in hospitals. Whether the hospital is private or government has no effect on the number of physicians entering or shifting to the hospital services market. Public hospitals have a positive significant effect on the number of nurses and medical technologists. On the type of institutional setting, the existence of tertiary providers has a positive effect on the supply of physicians while primary providers have significant impact on the supply of hospital-based nurses and medical technologists. Finally, the urban location of a provider positively affects the hospital's supply of doctors and medical technologists.

### **B. Barriers to Entry**

Due to unavailability of data of other health professions, this section discusses entry barriers only in the medical profession.

Feldstein (1988) mentions three entry barriers to the physician market. These are licensure, graduation from an approved medical school and continual increases in training. He hypothesizes that such barriers exist for the purpose of increasing the quality and competence of practicing physicians. He rationalizes that these barriers serve to protect the public or the consumer of health services from the uncertainty of the provider's training. Furthermore, it does not only mean protecting the patient from incompetent physicians but protecting others from bearing the costs of incompetency as in the case of "a physician causing an epidemic."

The first barrier to entry in the medical profession is licensure which requires an examination. Examination is said to be a weak entry barrier since a person may try to pass the examination many times and the number of people taking the exam is limited. It is deemed more effective if the cost of taking the exam is raised to the point that not everyone would be willing to take the cost especially if there is uncertainty in passing the exam.

The second barrier then is the imposition of an educational requirement and a limit on the number of institutions that could provide such an education.

The third barrier is the longer training time for a student to become a physician. This results in increased cost to the student and higher foregone income, and reduced rate of return to prospective physician. This entry barrier suggests that steps to improve the quality of physician services are independent of demands by consumers for better quality. Instead, it is related to the income considerations of the medical profession.

Another hypothesis which attempts to explain the reasons for entry restrictions to becoming a physician is to provide physicians with a monopoly and to increase their incomes.

Given these two hypotheses to explain the reasons for entry barriers: to increase physician

incomes or to provide protection to consumers, one should look into the consistency of policies with regard to the assurance of quality or the achievement of monopoly power.

As seen in Chapter 2, a number of barriers to entry in the medical profession in the country conspire to partly bring about the present imbalance between stock and requirements for health manpower. These barriers, from the point of view of the medical profession in the Philippines, are only screening devices to ensure competent physicians. Among these are the NMAT and other entrance examinations for other health programs, admissions quota and accreditation of medical schools, licensure, the increasing duration of specialization/trainings and board certification.

For physicians, the NMAT is the first major entry barrier. With annual passing rate standing at an average of 49 percent for the period 1986-1991, more than half of students apparently willing and able to invest in medical education are winnowed out. The second barrier is the APMC and enforced quota on freshmen admissions. Data, however, show that only 63 percent of the total quota for all schools are met if all NMAT passers were enrolled. The country's medical educational institutions are capable of training about 1,600 more students annually but the NMAT prevents this from happening.

Academic stringencies further whittle down the number of prospective physicians throughout the four years of medical schooling. Medical school requirements as they have been for the past several years have barred around 44 percent of freshmen enrollees from getting a medical degree. The number of graduates hovered at 2,100 plus in the second half of the previous decade.

Of these graduates, nearly a quarter (23%) are eliminated by the PRC through the board exams, another major entry barrier. For general practitioners, no more entry barriers can be encountered from this point on, but for those pursuing specialty trainings, the increasing duration of such trainings assume the nature of entry barriers.

Despite all these entry barriers, medical schools have not lacked for enrollees. One hypothesis which explains student motivation is the prospect of earning better, not to mention the prestige aspect. It is common knowledge that many doctors earn higher incomes than other medical workers, except perhaps dentists. Table V.1 shows the differences in the compensation of DOH health personnel. There is no available data on health personnel's "true" income since, as many health manpower surveys have found out, most of them would not divulge their true earnings. In lieu of income, we are using available data on compensation of DOH personnel for comparison purposes among the health manpower categories. The high differentials may be attributed to the restrictive practices of the medical profession, aimed at limiting entry to the profession and thereby maintaining their incomes at levels over and above those that would be obtained in a competitive labor market for their services.

We have attempted to estimate the internal rates of return of medical education. These rates can be used to assess whether the high incomes earned by medical professionals can be justified by the lengthy period of investment in human capital which was identified as one of the entry barriers. When viewing medical education as an investment, one calculates the rate of return by estimating the cost of that investment and the expected higher financial return. Thus, one can compare its profitability with alternative investments, education and otherwise. The costs of purchasing medical education are the direct outlays, such as tuition, laboratory, and book fees, and the income a student has foregone had he or she gone to work immediately after college. These opportunity costs of the student's time are the more significant costs of securing a



Table V.1 - Compensation of DOH Health Personnel, 1992

POSITION	PAY GRADE	COMPENSATION (IN PESOS)
<b>PHYSICIANS</b>		
Rural Health Physician	20	6,798
Medical Officer III	18	5,670
Medical Officer IV	20	6,798
Medical Officer V	22	8,250
Medical Officer VI	24	10,135
Medical Officer VII	25	11,385
Chief of Hospital I	24	10,135
Chief of Hospital III	26	12,650
Medical Specialist I	21	7,478
Medical Specialist II	22	8,250
Medical Specialist III	23	9,131
Chief of Sanitarium III	26	12,650
Chief of Sanitarium IV	26	12,650
Chief of Medical Professional Sta	25	11,385
Provincial Health Officer I	25	11,385
Provincial Health Officer II	26	12,650
City Health Officer I	24	10,135
City Health Officer II	25	11,385
<b>NURSES</b>		
Nurse I	10	3,102
Nurse II	14	4,091
Nurse III	16	4,786
Nurse IV	18	5,670
Nurse V	20	6,798
Nurse VI	22	8,250
Nurse VII	24	10,135
<b>DENTISTS</b>		
Dentist I	13	3,800
Dentist II	16	4,786
Dentist III	19	6,199
Dentist IV	22	8,250
Dentist V	24	10,135
<b>PHARMACISTS</b>		
Pharmacists I	10	3,102
Pharmacist III	14	4,091
Pharmacist IV	18	5,670
<b>MEDICAL TECHNOLOGISTS</b>		
Medical Technologist I	11	3,309
Medical Technologist II	15	4,418
Medical Technologist III	18	5,670
<b>MIDWIVES</b>		
Midwife I	6	2,473
Midwife II	8	2,752
Midwife III	11	3,309
Midwife IV	13	3,800

Source: DOH

professional education. The higher return of investment in medical education is the higher income that a physician will earn compared with the income from an alternative occupation. The comparison between these higher return and the cost required to receive them is the rate of return to medical education.

In the absence of a complete costing of education from the DECS and affiliated hospitals for training, estimates of the rates of return to medical schooling were computed in this study by regressing the earnings of physicians against the number of years of schooling and training, and the number of years of medical practice. The coefficients of these two independent variables determine the private rate of return to the private cost of foregoing labor market participation in order to attend school, and the private rate of return to the earned years of practice, respectively.

The regression results indicate that for every additional year of medical schooling, there is a 7.6 percent marginal increment in the physician's earnings. Likewise, for every additional year of practice, there is a 4.2 percent marginal increment in the earnings (Refer to Appendix D).

However, the results are not conclusive on whether the reasons for entry restrictions are for monopoly incomes of the physicians or for ensuring competent practitioners, but indicative of the marginal increments in the physician's earnings for every one year of schooling or practice.

### C. Extent and Determinants of Health Manpower Outflow

#### C.1 Extent

Among the types of health manpower, doctors and nurses have been the major emigrants to other countries mainly to the United States and the Middle East. In the past, the country lost a significant number of physicians to the United States. By 1970, around 45 percent of Filipino doctors had left the country, however, in the mid-70s this declined due to the restrictions of the United States to Filipino physicians. This caused emigration to decline to 400 yearly between 1980 to 1985. Another phenomenon further evolved from this curtailment. Physicians, in order to enter the United States took up nursing while previously, it was the nurses who took up medical education for advancement (Sanchez, 1988). Based on data from the CFO and the POEA presented earlier, the outflow of physicians to the United States declined further to an average of 300 every year from 1988 to 1991.

Nonetheless, physicians and nurses have shifted their sights to the Middle East as contract workers but unlike those leaving for the United States most of whom intend to stay there permanently, those who leave for the Middle East return to the Philippines upon expiration of their contracts.

A study by Corcuera (as cited in Reyes and Picazo, 1990), revealed that, in general, physicians who left the country for contract work in the Middle East and Africa had lower qualifications relative to practitioners in the country. By contrast, permanent emigrants, both physicians and nurses, in developed countries such as the United States and Canada are those with high quality of training and education such that the better, experienced and highly specialized ones are being lost to other countries. Apparently, the loss is not only in number; the loss is much-felt-in quality.

As a response to the closure of United States to Filipino doctors, a consortium of hospitals has been established to provide an alternative to specialized training and to match local

limitations and resources. With respect to nurses, the replacement of better ones who emigrated is quite a concern. New and inexperienced ones could not be trained as fast as the rate of loss. The government does not have sufficient fund to continuously train nurses while private hospitals do not normally appropriate budget for training (UNESCO, 1987).

The following section attempts to determine the factors which influence the decision of health personnel to migrate.

## C.2. Determinants

Many factors influence the migration of health professionals to other countries. These are, among others: (1) differences between countries as regards the rate, the level and the pattern of social and economic development, (2) differences between countries in terms of quantity and quality of health services available or the size and structure of the health labour force, (3) in relation to the country's absorptive capacity: there is overproduction for the donor countries and underproduction for the recipient countries, and (4) the relevance of education and training programs.

Many theories have been put forth as to the causes of migration. Perhaps the most convincing theory is that migration is the result of the interplay of various forces: political, social, economic, legal, historical, cultural, educational, etc., operating at both ends of the migratory axis. Traditionally, these forces have been classified as "push" forces, i.e., those operating in the donor country; and "pull" forces, i.e., those operating in the recipient country. Both sets of forces are assumed to operate in unison in order to trigger migration.

In addition to the push and pull forces, certain basic facilitating forces need to be present to make migration possible. Moreover, there must not be legal or other constraints that impede migration.

However, Mueller (1982) observed that personal attributes of potential migrants have consequently been given little role in the migration decision, which includes the destination choice as well as the choice to move, and personally relevant measures of economic factors that have not been typically used. In order to consider this observation, an economic theory of migration that is based upon an analysis of a consumer maximizing his lifetime expected utility (e.g., income) over space has been adopted. Factors identified to be of theoretical importance in the potential migrant's decision are personal attributes, among others. It is assumed that a certain health worker is thought to be maximizing his income and is assumed to migrate if the wage abroad is higher than the wage at home and the marginal utility over income at home. The utility model is then specified as a linear function of the personal characteristics of the health manpower such as age, gender, marital status and education. The probit results show that nurses have higher propensities to migrate than other medical professionals (refer to Appendix D).

## VI. SUMMARY OF FINDINGS

### PROFILE, STOCK AND FLOW OF HEALTH MANPOWER

1. *General Profile.* Most of the health professionals in all categories are very young with the average age of less than 40 years. The youngest group is that of nurses and the relatively older group is that of physicians. Moreover, females remain dominant figures in nursing, midwifery and pharmacy which have traditionally been their domain. They are also increasingly gaining in numbers in the fields of medicine, dentistry and medical technology which are previously the domain of men.

2. *Production of Health Manpower:* Increment to the Total Stock. Addition to the total stock is determined by the number of new licensees which is also determined by the number of freshmen enrollment, the survival rate and rate of new licensees. The irregular yearly attrition depicts the fluctuations attributed to the inflows and outflows of students into and from the particular health program. These erratic trends are reflected in the survival rates of students which range from 32 percent to 132 percent. On the other hand, the rate of new licensees ranges from 34 percent to 193 percent; the wide range reflects the number of re-takers and non-takers.

3. *International Outflows:* Losses from the Total Stock. Leakages from the domestic stock of medical workers are the international outflows either in the form of permanent emigration or temporary emigration as overseas contract workers (OCWs). Among the medical professionals, physicians and nurses have heavy international outflows. In particular, the nurses' rate of outflow outpaces other medical workers.

### REQUIREMENTS FOR HEALTH MANPOWER

4. *Standard Requirements.* At present, there is no available standard ratio for each of the health manpower to total population. What are available are standard ratios per work setting/place, such as community health centers, hospitals, schools and industrial firms. However, the parameters used in arriving at these ratios still need to be reviewed and updated.

5. *Modified GMENAC Requirement.* Among the six categories of health manpower, nurses have the highest requirement in the country followed by physicians and dentists while medical technologists and pharmacists have the lowest. By the year 2000, the population will remain in dire need of physicians, dentists, nurses and medical technologists than that of any other health providers. The morbidity incidence, the percentage of such requiring care and the degree of delegation and substitution to health auxiliaries and other categories of manpower largely determine the requirements.

### HEALTH MANPOWER IMBALANCE ANALYSIS

6. *Stock vs. Standard Requirements.* The comparative analyses of the computed stock of the health manpower per work setting with the standard requirements per work setting show that health manpower shortage exists in the following work settings: rural health units (RHUs), school health and industrial/occupational health. On the other hand, the result for hospitals is not conclusive.

In comparing the PMA-recommended number of specialists with that of the PMCC data (roughly representing the actual number of specialists), it can be said that there is shortage in almost all areas of specialization except that of internal medicine.

*7. Stock vs. Modified GMENAC Requirements.* The foregoing findings reveal that health manpower imbalance exists in all health manpower categories being considered. There is no overall shortage nor overall surplus. Shortage and surplus situations coexist across all the health manpower categories, such that shortage of medical professionals is observed in the group of physicians, dentists, nurses and medical technologists while excess supply is noticed in the practice of midwifery and pharmacy.

The practice of medicine can be categorized into two groups: the general practitioners (GPs) and the specialists. Comparing the requirement for these groups, the need for both of these categories exceeds their supply. Among the specialties, the fields of pulmonology, surgery, pediatrics, infectious diseases have excess supply. These market situations will likely persist until the year 2000.

*8. Distributional Imbalance.* Health workers are concentrated in hospitals/clinics registering an average of 80 percent, except for pharmacists where 65 percent are employed in drugstores and pharmaceutical companies. Moreover, on the average, about 89 percent of health professionals work in the urban areas, but for midwives only 66 percent do so. In terms of regional distribution, the number of health professionals is skewed towards the NCR, except for midwives. This imbalance is more conspicuous using the population/medical worker ratio.

The correlation results reveal that regional population, real GDP or GDP per capita, number of "medical" schools and the number of hospital beds are positively correlated with the number of health workers in the regions. These variables, then, can influence the locational choice of health workers. However, the number of hospitals is not significantly associated with the number of health professionals in the regions.

Exceptions can be observed with midwives. The number of midwives is positively associated with the number of hospitals.

To determine whether the number of medical workers in the region actually corresponds to service their needs, the correlation results show that the number of physicians, nurses, medical technologists and pharmacists are not related to the morbidity cases. The population needing dental care is also not correlated with the number of dentists in the regions. On the other hand, the number of midwives is highly and positively correlated with the regional birth rates. Thus, the existing regional distribution of medical workers, except that of midwives, does not approximate the regional needs for health services which these medical workers can provide.

*9. Asian Comparison.* As regards the population/health manpower ratio, most Asian countries have declining ratios which imply that the number of medical workers are coping with the growing needs of the population. This observation includes the Philippines except the figure for nurses which reflects the heavy international outflow of this health manpower category.

To further compare the Asian trends, the number of health manpower is compared with the health indicators. The results show that the number of health workers (except midwives) are positively associated with the level of GDP per capita and life expectancy, and negatively related to birth rate and death rate.

## OTHER MAJOR ISSUES

*10. Impact of Medicare on the supply of medical manpower.* It was found that Medicare charges are positively associated with supply of medical manpower. That is, the higher the fees, the higher the financial returns to medical workers (especially doctors) and more persons are induced to join the medical professions.

*11. Barriers to entry.* In entering the medical profession, a medical student faces several layers of barriers, such as NMAT, licensure, etc., although these may be thought of as screening devices. A concrete example of entry barrier is the high cost of education. However, this high investment guarantees higher earnings relative to other health professionals. The regression result shows that the private rate of return for schooling in lieu of earning income outside the school is 7.6 percent which is significant at 1 percent level. Also, additional years of practice assure additional earnings.

*12. Extent and determinants of migration.* Among the health workers, the nurses have the heaviest international outflow followed by physicians. The main factor for migration is essentially economic (they earn more abroad than at home). The probit results reveal that one chooses to get a degree in nursing or a degree in any of the allied health courses in order to go abroad and "earn dollars".

## VII. CORRECTING HEALTH MANPOWER IMBALANCE: POLICY CHOICES

This section briefly examines alternative public policies that can be adopted to correct either shortages or surpluses of health manpower. Changes in the supply of, and requirements for, various health professions may be effected by a number of policy instruments. In cases of shortfalls in requirements (the normative definition of a shortage), the traditional position is to argue for government *subsidies* to increase the number of health workers. Other options exist, however, to enlarge the supply of health professional services. *Legal restrictions* can be altered to allow the number of health professionals to grow. A more "upstream" factor, *barriers to entry*, can be lifted to increase the production of various health manpower categories.

Demand for a given health profession can also be influenced by *wage incentives* relative to the wages of other professional groups. Narrowing wage differentials are quite important where there are exogenous factors affecting local supply (e.g., the presence of a large labor market for health professionals in the US and the Gulf Region). In this case, wages between source and destination regions need to be compared. Of course, outright *regulations*, in the form of emigration quotas and selective travel ban, can be imposed by the government to retard the international flow of health professionals.

Surpluses are more easily taken care of in the long run through the workings of the market. But some regulatory measures are helpful. The rate of return to a particular health professional education can be allowed to fall by imposing *ceilings on charges or fees* or by increasing the cost of professional practice through *taxation*. How these policy choices affect the various health manpower categories is explored below.

**Physicians** — Overall, there is a shortage of physicians in the country. In short supply are general practitioners and most specialists. The handful of exceptions include those in the area of pulmonology, infectious diseases, surgery, and pediatrics. Emigrants and contract workers contribute to the low supply of physicians. The current geographic maldistribution of physicians—a pattern that is likely to persist unless other incentives are put in place—would exacerbate the shortage, with urban areas disproportionately getting a lion's share of the limited supply of doctors.

A long-term shortage of physicians will not resolve itself; government intervention is necessary. To increase the number of persons entering the medical profession, subsidies can be provided to offset training costs, but not in the way government is inefficiently doing it. In the current setup, heavy public subsidies go to state medical schools, representing a clear wastage of resources since even those who are willing and able to pay for medical training costs are able to "capture" a substantial part of the subsidies. Such inefficiency can be avoided if government subsidies in, UP Manila, for example, and other state-owned schools are transformed into academic grants that support grants-in-aid, loans or other forms of financial assistance to low-income students. The financial assistance can be repaid or amortized on a delayed basis, that is, when the medical graduate starts practicing his profession. Private schools (and private firms as well) can be encouraged to offer full or partial scholarships to poor students. In general, targeted subsidies decrease public costs and reduce leakages of highly-trained personnel to the profit sector (with high opportunity costs to the public health system). If the health education market responds, lowering the costs of education would increase the number of applicants to the profession. The caveat here is that the subsidized professionals ought to fairly distribute themselves geographically to achieve increases in physician services. Otherwise, if the increased

number of physicians with subsidized education induces a decline in the productivity of existing physicians (which could conceivably happen if doctors squeeze themselves competitively in urban areas), then the social costs of the subsidies might outweigh the expected benefits.

The production of physicians can also be raised by lifting barriers imposed on entering the medical profession so that more students could be admitted, and by easing restrictions on who is permitted to practice. For example, it might be important to encourage APMC to lift the enrollment quota to make medical schools accessible to more applicants. Another relevant measure is to transform the NMAT into a classification exam which could be used by the school simply to rank students on the basis of their capabilities but not to deny anyone admission to medical school. The time required to produce physicians can also be reduced through academic innovations. For example, UP has begun, on an experimental basis, a 6-year MD track which abbreviates both undergraduate and medical proper schedules by combining some courses and eliminating some. Licensure could also be relaxed in certain cases, as long as professional competence and quality of services could be guaranteed through other means. The real danger lies not in easing restrictions but in transforming screening devices such as examinations into proxy entry and practice barriers. While there is a need to provide safeguards against medical malpractice, in the end consumer protection would be best served by overseeing the quality of care provided. It is the end indicators of quality of care—health outcomes—which should be more closely monitored, more than process indicators such as licensing standards. The government still needs to address the issue of consumer protection squarely, but it should allow more elbow room as far as entry and practice requirements are concerned, to enable the market to allocate medical manpower and services more efficiently, and prevent a long-term shortage.

In the public sector, relatively lower wages result in inadequate supply of doctors, particularly in rural areas. The government is forced to use auxiliary personnel to augment medical services in far-flung areas. The likely consequences of a general shortage includes rationing of physician services, often in the form of long queues to see a doctor (with high time costs), and a possible deterioration in quality (patients are given less time for consulting doctors). The "culprit" is the wage gap—doctors will not gravitate to rural areas unless the prices paid for their services rise or exceed those given to urban-based suppliers. To alleviate this shortage situation, physicians may be offered higher remuneration. The Department of Health's current program of luring new medical practitioners into municipalities without doctors by offering a package of wage incentives fall under this scheme. At the same time, programs like this help rectify the regional maldistribution of physicians by encouraging medical professionals and other health workers to start their practice in these areas. A possible tradeoff is that if the market for general practitioners responds favorably to the increase in wages for rural practice, the production of specialists might decline (GPs may be discouraged from specializing if the GPs' income exceeds that of specialists). This requires further research.

For relatively higher-paid physicians working in urban hospitals, the point of comparison is not necessarily the urban-rural wage gap but the foreign-domestic wage differential. Income augmentation measures tolerated or encouraged by the government, such as putting up private clinics in tertiary or secondary hospitals, can stabilize the local supply of physicians and reduce the flow of migrant or "contract" doctors from the country.

For categories of specialists whose supply is predicted to increase faster than the need for their services, no government intervention would probably be needed, since the excess supply normally causes in the long run a decline in the rate of return to such specialists. A low rate of return lowers the number of prospective qualified applicants to some residency training programs.



**Dentists** — The long-term need for dentists will not be satisfied by the projected number of dentists.

As in the case of physicians, it may be necessary to regulate the international migration of dentists by closing the foreign-domestic wage differential. Increasing the wages of public sector dentists or providing them other forms of incentives (e.g., subsidizing the purchase of dental equipment) will likely increase the supply of dentists, including those in rural health units. The use of in-kind incentives (dental equipment) would be especially attractive to dentists, who, unlike general practitioners, are unable to function effectively without expensive, in-place medical instruments.

To augment possible shortages in dental services, an important policy measure to pursue is the development of submarkets within dentistry. A great deal of delegation and substitution should occur among dental workers. The preventive functions of dentists can gradually be turned over to dental aides or to barangay health workers through periodic training. The Philippine Dental Association itself favors this policy shift. If there are no barriers to movement between dental subcategories, and if training costs are not substantial, substitution could take place without serious difficulties. Delegation of functions would at the same time increase the efficiency of dentists, who would be relieved of minor duties and be able to focus on the more specialized aspects of dental care.

**Nurses** — The production of nurses more than offsets the domestic need for nurses. However, because of the heavy international outflow, the number of nurses locally available is insufficient to meet the domestic need.

Here, it is not simply a question of easing entry barriers since nursing schools have their hands full accommodating student applicants. At issue is whether some nursing school restrictions ought to be put in place to contain the heavy flow of nursing migration to foreign destinations, especially the US and the Middle East. For example, the local curriculum for nursing has slowly undergone changes and is now geared more toward satisfying international employment requirements, often at the expense of the local need for nursing services. Government can assist nursing schools in at least keeping a two-track nursing curriculum, one oriented toward the foreign market and the other oriented toward domestic, especially rural, requirements. While such an "entry" measure could only be temporary, a more permanent solution would be to narrow the foreign-domestic wage gap. It should help alleviate the domestic requirement for more nurses.

A much more important factor to consider is how the local practice of nursing could be made relatively attractive by offsetting the benefits (in terms of higher wages) offered by employers abroad. Because long-run shortages do not work themselves out, government intervention is clearly needed to increase the wages of registered nurses, in order to bridge the high foreign-domestic wage differential. As wages rise, an increase in the number of non-migrant nurses is expected, which in turn should fill vacancies in rural health units located in regions outside Metro Manila and other major cities. Nursing graduates could be offered higher pay and other material incentives in the same way that new physicians are being promised incentive packages if they stay in rural areas. In fact, attracting nurses to be mainstays in rural health units could relieve the government of the burden of searching for new doctors to man RHUs. With lower wage levels relative to physicians, nurses could substitute for doctors in non-hospital settings. But first, there should be an increase in the responsibilities delegated to RHU nurses for tasks now performed by doctors which will approximate the level of nursing care provided

in hospitals. Since nurses are usually trained for hospital-based care (where considerable substitution has taken place), a lot of delegation at the RHU level will make rural jobs more interesting and appealing to nurses in terms of their career. Apart from the offer of higher wages, this ought to increase the participation rate of nurses locally.

**Midwives** — There are more than enough midwives to service the population needing maternal and child care.

Since surpluses seem to work themselves out in the long run, the oversupply of midwives may not be a serious problem. The rate of return for getting a midwifery degree would fall as more midwives join the scramble for jobs in the market for midwives. Many midwives are currently unemployed, with some known to have taken supplemental jobs as governess. Yet an innovative way to solve the oversupply problem, and at the same time achieve a breakthrough in the local nursing undersupply dilemma, is to train midwives to become nurses. That would be equivalent to creating a submarket within nursing. Opening a new track, licensed practical nurses, to accommodate midwives who wish to pursue nursing, would alleviate the long-term shortage of nurses. There are a number of steps which government could take in this regard: (a) rid the midwifery curriculum of unnecessary courses and replace them by nursing-related subjects; (b) credit years of experience to take the place of some units in nursing; and consequently, (c) increase the course work for midwifery to make it academically equivalent to a "practical" nursing degree. The risk associated with upgrading midwives to the level of nurses is that the same emigration incentives now open to the latter would also begin to be attractive to midwives. But this could be offset by the same solution outlined above: bridge the foreign-domestic wage gap by offering higher pay scales to midwives-turned-nurses.

Yet another important policy recourse is for government and the private medical sector to encourage pregnant women to allow midwives to have a more serious role in the delivery of newborns. The present practice, especially among middle-class women, is to entrust childbirth completely to obstetrician-gynecologists. The net effect is to maintain inefficiencies in child delivery by overburdening obstetricians and decreasing the productivity of midwives. Giving midwives primary responsibility for child delivery will permit obstetrician-gynecologists to concentrate on the more complicated aspects of childbirth as well as on prenatal and postnatal diseases and hygiene. Whether this would require changes in training, e.g., a stricter monitoring by licensed midwives of the curriculum requirement of completing 20 deliveries would be a matter that should be discussed with both the midwives' and obstetricians' associations.

**Medical Technologists** — The need for medical technologists exceeds what the health sector can supply in the long run.

Low salaries and poor amenities contribute to the difficulty of increasing the supply of laboratory technicians such as medical technologists which in turn make the job of staffing laboratories formidable. The way ahead is for government to adopt wage incentives for medical technologists, like those being adopted now for new public doctors, to boost the production of health professionals in that sector.

The government could also assist in eliminating inefficiencies in the administrative setup in medical facilities by giving medical technologists bigger responsibilities. The law requiring that laboratories be managed by a resident pathologist has high time costs for the pathologist's professional practice. Allowing medical technologists to be promoted to a laboratory chief would

ease this administrative problem. At the same time, it would increase career inducements for medical technologists and thus lure more persons into the medical technology profession.

The basic question, however, is whether government could, and should, increase budgetary outlays for infrastructure (i.e., laboratory facilities) in primary hospitals and rural health units. On a cost-effectiveness basis, too many government resources are already being spent on high-cost, hospital-based, and laboratory-dependent care, instead of on basic health interventions such as immunization, maternal and child care, and health education. To spend more on facilities, including laboratories, seems to be a wasteful way to augment publicly provided health services.

Yet spending on hospitals and laboratory facilities is required because they are still a necessary part of the entire health referral structure. In this case, the necessary reform seems to be in redirecting the resources tied up in hospitals to lower levels of the health system. Within this context, it would be easier to justify the need for more laboratories in rural health units and primary hospitals in underserved areas. "Decentralizing" laboratory work also means rural doctors would have quicker access to laboratory findings vital to diagnosing patients' conditions; backlogs in centralized laboratories would be resolved simultaneously. Since supply-side problems are often associated with the highly-centralized locations of hospitals and facilities, rechanneling some resources for the provision of laboratories in rural areas would create more job opportunities for laboratory technicians, which in turn should increase the supply of medical technologists--provided this policy move is linked to a package of incentives that include higher wages and better amenities.

**Pharmacists** — There is a surplus of pharmacists in the country.

Most of the employed pharmacists are overconcentrated in the pharmaceutical industry, which is not in a position to absorb more pharmacists. In the long-run, the oversupply will resolve itself through an eventual lowering of the rate of return to a pharmacy education, which in turn would discourage new entrants to the pharmacy profession. In the short run it may still be necessary to adopt a job creation policy for unemployed and underemployed pharmacists. The public sector has a big responsibility in this regard, within the context of expanding publicly provided health services.

The government often responds to the need for more health services, given budgetary constraints, by cutting back on critical inputs, such as research and development. Because these inputs are frequently a tiny portion of total costs, they are cut excessively. Yet the adverse effects of cost-cutting is a poorly-run R & D, especially in the area of drug research. Ironically, the small financial savings made by the government from the cutbacks are easily dissipated "downstream" through the accelerating expenditures on costly medicine, especially brand-name drugs. Yet a low-cost but adequately funded drug research could easily cut down costly expenses down the line. This is where pharmacists could be tapped to help.

The role of pharmacists can be expanded to include making breakthroughs in drug research. Government-sponsored pharmaceutical research is needed in (a) determining the bioequivalence of herbal medicine with the standard drugs, and (b) developing new indigenous drugs. In addition, pharmacists could be given the responsibility of launching and sustaining information campaigns on generic drugs (currently the obligation of doctors who, at any rate, do not have the incentives to be participants in generic drug dispensing). Since the DOH has taken initiatives in expanding the market for herbal and indigenous medicine and generic drugs, the

expansion of both R & D and information drives would be a logical course to follow. Low-cost interventions such as opening new research centers would not only solve the supply-side dilemma of underfunded recurrent costs; it would also be a job generation vehicle for pharmacists.

**Concluding remarks:** Since the need to disperse the services of doctors, dentists, nurses, midwives, medical technologists and pharmacists to rural regions is a common thread in the above analysis, it is unwise to proceed in a piecemeal fashion in considering the deployment of various health professionals. To provide better care for the poor, organized medical teams consisting of physicians, nurses, midwives, dentists and even medical technologists and pharmacists should be considered as a cost-effective alternative to fragmented services by individual health professionals. Basic publicly funded health services are more closely and appropriately integrated through a team approach that considers, among others, substitution and delegation possibilities among health professionals. Integration at the local level improves incentives for health service innovations, increases accountability for the staff, ensures that local health choices correspond to local needs, and advances the development of health management capabilities at the community level. It is vitally important to encourage staff to be retained as close as possible to the point of service delivery through a package of income incentives that applies to various health workers. Needless to say, even as the health sector continues to search for ways to sustain and improve the health manpower balance, the combination of government intervention and market incentives must be maintained in a way that motivates health professionals and allocates them to different institutional settings efficiently and equitably.

Table VII.1 - Summary of Policy Recommendations

HEALTH MANPOWER CATEGORY	FINDINGS (Shortage/Surplus)	POLICY RECOMMENDATIONS	
		Supply	Demand
A. Physicians			
GPs	Shortage	<ol style="list-style-type: none"> <li>1. Increase freshman enrollment by <ul style="list-style-type: none"> <li>o Lifting entrance restrictions</li> <li>o Giving subsidies or grants directly to low-income students and not to schools</li> </ul> </li> <li>2. Limit international outflow by <ul style="list-style-type: none"> <li>o Reducing wage differentials between home and foreign countries (e.g., increasing SSL rates)</li> <li>o Increasing legal restrictions</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>1. Reduce morbidity cases by <ul style="list-style-type: none"> <li>o Increasing public health care intervention (with the collaboration of the private sector)</li> </ul> </li> <li>2. Increase percentage of delegation/substitution by <ul style="list-style-type: none"> <li>o Promoting medical team practice</li> <li>o Lifting legal restrictions</li> </ul> </li> </ol>
Specialists	Surplus	<ol style="list-style-type: none"> <li>1. Increase freshman enrollment by <ul style="list-style-type: none"> <li>o Increasing entry restrictions</li> <li>o Increasing VAT</li> <li>o Imposing ceilings on medical fees</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>1. Increase non-patient care activity which include research by <ul style="list-style-type: none"> <li>o Providing subsidies for research</li> </ul> </li> </ol>
	Shortage	<ol style="list-style-type: none"> <li>1. Increase freshman enrollment by <ul style="list-style-type: none"> <li>o Lifting entrance restrictions</li> <li>o Giving subsidies or grants directly to low-income students and not to schools</li> </ul> </li> <li>2. Limit international outflow by <ul style="list-style-type: none"> <li>o Reducing wage differentials between home and foreign countries (e.g., increasing SSL rates)</li> <li>o Increasing legal restrictions</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>1. Reduce morbidity cases by <ul style="list-style-type: none"> <li>o Increasing preventive care (DOH-IEC)</li> <li>o Utilizing HMO (including nutrients package)</li> </ul> </li> <li>2. Increase percentage of delegation/substitution by <ul style="list-style-type: none"> <li>o Minimizing legal restrictions</li> </ul> </li> </ol>
B. Dentists	Shortage	<ol style="list-style-type: none"> <li>1. Increase freshman enrollment by <ul style="list-style-type: none"> <li>o Giving subsidies or grants directly to low-income students and not to schools</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>1. Increase percentage of delegation/substitution by <ul style="list-style-type: none"> <li>o Delegating preventive and restorative functions to dental aides</li> </ul> </li> </ol>
C. Nurses	Shortage	<ol style="list-style-type: none"> <li>1. Control international outflow by <ul style="list-style-type: none"> <li>o Reducing wage differentials between home and foreign countries (e.g., increasing SSL rates)</li> <li>o Increasing legal restrictions</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>1. Increase percentage of delegation/substitution by <ul style="list-style-type: none"> <li>o Delegating nurse's functions to nursing aides</li> </ul> </li> <li>2. Increase non-patient care activities which include research by <ul style="list-style-type: none"> <li>o Providing subsidies for research</li> </ul> </li> </ol>
D. Midwives	Surplus	<ol style="list-style-type: none"> <li>1. Increase freshman enrollment by <ul style="list-style-type: none"> <li>o Encouraging midwives to become a nurse</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>1. Be recipients of delegated functions</li> <li>2. Increase non-patient care activities such as: maternal care, family planning, etc.</li> </ol>
E. Medical	Shortage	<ol style="list-style-type: none"> <li>1. Encourage freshman enrollment by <ul style="list-style-type: none"> <li>o Providing incentives (e.g., "mobile" laboratory in RHUs)</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>1. Increase percentage of delegation/substitution by <ul style="list-style-type: none"> <li>o Delegating preventive and restorative functions to medical technicians or aides</li> </ul> </li> </ol>
F. Pharmacists	Surplus		<ol style="list-style-type: none"> <li>1. Increase functions which include generic promotion, herbal medicine, drug research, etc.</li> </ol>

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## **Appendices**

Appendix A

Comparison of Health Manpower Estimation Methods

<i>Name and description of the method's principal variants</i>	<i>Potential advantages</i>	<i>Potential disadvantages</i>	<i>Prerequisites and appropriate country situations</i>
<p>Economic demand (or "effective economic demand"): This method concerns the measurement and projection of what health services people are willing and able to pay for, irrespective of the quality of the specific services obtained or of their need for them. The services demanded tend to be curative in nature and to be provided predominantly through the private sector, with or without the intervention of third party reimbursement mechanisms. The method consists of correlating the receipt of services with selected economic and other variables, and then of projecting the changes likely to occur regarding these variables in order to derive the impact of these changes on the demand for services, and ultimately on health manpower requirements. Variants include:</p> <ol style="list-style-type: none"> <li>1. Constant utilization rates for a changing population</li> <li>2. Population and income</li> <li>3. Trend in expenditures</li> <li>4. Job vacancies</li> <li>5. Relative earnings</li> <li>6. Rate of return</li> </ol>	<p>Helps describe dynamics and determinants of health services utilization</p> <p>Tends to produce economically realistic projections</p> <p>Allows for disaggregation of various components of demand</p> <p>Probably provides a good estimate of the minimum growth in demand and ensures that the level of future satisfaction at least equals present satisfaction</p> <p>Some variants of this approach are quite simple</p> <p>May provide useful information for comparing returns from training for health occupations with those of other sectors</p>	<p>May be complicated, costly and require sophisticated data</p> <p>Ignores many political and societal reasons for improving the distribution of health services</p> <p>Does not necessarily take into account the quality of services or their relevance to the health problems of the country</p> <p>May neglect consideration of ways to improve manpower productivity</p> <p>Hard to interpret to health sector authorities and to the public</p>	<p>Requires sophisticated data and technical expertise in some cases</p> <p>Of greatest use in countries with: large private sector; relatively limited and/or passive government involvement in the provision of health services; relatively small urban-rural, rich-poor, and other imbalances in the utilization rate of services</p> <p>Can usefully complement other methods of manpower estimation</p>
<p>Health needs (or, biologic needs): This method seeks to determine, based on expert opinion and taking into account available technology, what kinds, amounts, and quality levels of services are required to attain and maintain a healthy population. Service targets are then converted into manpower requirements by means of staffing and productivity standards. Considerations of service costs and distribution are of secondary importance.</p>	<p>Appealing logic of method</p> <p>Permits allocation of resources where they will have greatest effect on health; can focus on ways to improve utilization</p> <p>Fulfills health ethic of providing services according to need and not to social or economic conditions of consumers</p> <p>Provides ultimate or maximum goal for the provision of services</p> <p>Particularly suited to high priority categorical programs</p>	<p>Complicated, costly, and requires sophisticated data</p> <p>Logic of method may require excessively detailed planning and frequent updating of standards in accord with developing technology</p> <p>Continued wide divergence among experts on "best" methods to treat many disease conditions</p> <p>Apt to result in costly projections of service requirements, far in excess of ability to provide them</p> <p>Presupposes tight governmental control over health services delivery system and high level of health consciousness in the population</p>	<p>Requires sophisticated data and technical expertise</p> <p>Of greatest use in countries with: relatively large public sector; active government commitment to improving and shaping health services delivery; tight government control over health system; high level of health consciousness of people</p> <p>Useful in defined public health or other categorical health programs</p>

cont.

<i>Name and description of the method's principal variants</i>	<i>Potential advantages</i>	<i>Potential disadvantages</i>	<i>Prerequisites and appropriate country situations</i>
<p>Health manpower:population ratios (ratio method): This method involves the identification of a suitable health manpower:population ratio for a future point in time and then the application of this ratio to the projected population to derive manpower requirements. Many different methods have been used to derive the desired ratios. These include:</p> <ol style="list-style-type: none"> <li>1. International comparisons</li> <li>2. Maintaining the current situation</li> <li>3. Use of "recognized" standards</li> <li>4. Adoption of the ratio currently observed in a favored portion of the country</li> <li>5. Construction of a model using one of the other methods, conversion of the requirements into a ratio, and adoption of this as the standard</li> <li>6. Extrapolation of past ratio trend lines</li> </ol>	<p>Easy to use and interpret</p> <p>Data requirements usually modest and not very sensitive to errors within the validity of the underlying assumptions</p> <p>If current situation is judged adequate, maintenance of status quo is a defensible policy</p>	<p>Easy to select unrealistic ratios resulting in major errors in economic and manpower policies</p> <p>Tends to be used with single occupational categories with risk of ignoring potential improvements in utilization through changed interpersonnel ratios</p> <p>Some methods of selecting a ratio cannot help but show a manpower shortage</p> <p>Provides little insight into the dynamics of demand</p> <p>With primary emphasis on manpower, little attention may be given to services (kind, quality, volume, frequency, distribution, and relevance)</p>	<p>Realism and candor, even more than with the other methods</p> <p>Of greatest use in countries with: public or private sectors; reasonably adequate health services delivery system, and health situation; limited planning resources; passive or active health policies, though the latter requires fairly strong control over the health system</p>
<p>Service targets approach (normative approach): This method emphasizes the development of detailed standards for the provision of different kinds of services, standards which are then used to derive targets for the production of these services. Manpower staffing and productivity standards are then used to convert service targets into the manpower required to attain them. Various methods can be used to develop the service standards, including those used in manpower:population ratio methods. Other techniques for developing standards include:</p> <ol style="list-style-type: none"> <li>1. Task and functional analysis</li> <li>2. Empirical experience</li> <li>3. Professional judgment</li> <li>4. Internationally recommended standards</li> <li>5. International comparisons</li> </ol>	<p>Permits a disaggregated approach in which the most suitable methods and standards are used for each component activity of the sector</p> <p>With primary emphasis on "services," not "manpower," attention is naturally directed toward productivity, interpersonnel ratios and efficient resource utilization</p> <p>Facilitates closer adjustment of delivery to needs and demands</p> <p>Relatively easy to interpret rationale to others</p> <p>Cost estimation relatively easy</p>	<p>Method is prone to having standards based more on desires than on reality, leading to major policy errors</p> <p>The logic of the method invites excessively detailed planning for segments of the sector not subject to tight control</p>	<p>Modest data and planning capability requirements</p> <p>Of greatest use in countries with: dominant public sector; activist government policies toward development and provision of health services; adequate governmental control over health services delivery system</p> <p>Can be readily used in conjunction with other methods</p>

Source: Hornby, Shipp and Hall, 1980

## Appendix B

### INITIAL NET STOCK ESTIMATION AND PROJECTION, AND DATA SOURCES

Enrollees and Graduates. These are available from the individual school records at the DECS.

Total Stock. This is defined as the cumulative ever- registrants. The data is derived from the number of new licensees per year taken from the Professional Regulations Commission (PRC).

New Licensees. The earliest data of the annual number of licensees per category that are being considered are as follows:<sup>1</sup>

Doctors:	1902	Midwives:	1961
Dentists:	1903	Med Techs:	1971
Nurses:	1919	Pharmacists:	1913

Retirees. A physician is assumed to start service at age 27; a dentist at age 24; a nurse at age 21; a midwife at age 21, a medical technologist at age 22; and a pharmacist at age 21. All are assumed to retire at age 65. For instance, a physician who passed the licensure examination and entered the service in 1952 is presumed retired in the year 1990. Using the given age of medical technologist at 22 to start service and the starting year of licensure examination of medical technologists in 1970, there are no retirees in this profession from 1990 to 2000.

Dead. The number of deaths prior to age 65 is computed using the gender-differentiated rates of mortality for the Philippines. Partial life tables for each health profession commenced at the average age at licensing with the annual number (radix) of licensees, which diminishes through application of single-year death rates. This method assumes that health professionals experience the same mortality rates as the general population.

Permanent Emigrants. The Commission on Filipinos Overseas (CFOs) had provided the annual data for the 1988-1991 period.

Overseas Contract Workers (OCWs) or temporary emigrants. The Philippine Overseas Employees Administration (POEA) had furnished the annual data on the number of new hirees for the 1988-1992 period. Data on the number of OCWs which include both new hirees and re-hirees are not available. To take into account the rehires, the pattern (i.e., ratio) of the rehires and new hires to the total landbased processed OCWs for the period 1988- 91 is considered and assumed to have a similar pattern with that of the healthmanpower category. The

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3 A year before these years indicate the start of licensure examination for each category.

following data were utilized:

Number of processed contract workers (Landbased)			
	New hires	rehires	total
1988	197,125 51.62%	184,767 48.38%	381,892
1989	186,919 45.82%	221,055 54.18%	407,974
1990	253,753 54.15%	214,838 45.85%	468,591
1991	335,524 60.51%	218,952 39.49%	554,476
Source of basic data: POEA			

With the ratio of new hirees to the total number of processed contract workers, the total number of processed contract workers can be estimated.

Moreover, there are no data available on deployment level of health manpower categories. In lieu, the data on the number of processed contract workers were utilized. These data would approximate the number of deployed contract workers.

#### CALCULATING THE INITIAL NET STOCK, NS.

In estimating the initial net stock of healthmanpower in 1987, three types of assumptions are considered: low, medium and high.

The net stock under the medium assumption will serve as the baseline estimates. The low assumption would yield the minimum value of net stock while the high assumption will give the maximum value of the net stock of health workers. The estimates at low and high assumptions are 50% and -50%, respectively of the values of the variables considered under the medium assumption. That is, the number of OCWs (or temporary emigrants) and permanent emigrants is 1.5%, under the low assumption and 0.5%, under the high assumption of their corresponding number under the medium assumption.

Only changes in the number of OCWs and permanent emigrants are measured in the sensitivity analysis since these variables can be directly controlled while the variables on deaths and retirement are beyond control. Besides data on OCWs and permanent emigrants are not sufficient and maybe underreported.

Note that stock of temporary migrants (includes the re-hirees and new hirees) are not stock of net migrants because it does not exclude the number of returnees from abroad. Data on net migrants are not available at the POEA nor at the CFO. In the projections, it is assumed that the overseas contracts are renewed. This assumption would somehow offset the fact that migrations are underreported or that the POEA or CFO cannot provide the exact number of migrants.

On the other hand, changes in the number of new licensees reflect the changes in the enrollment policies of the schools and the DECS in previous years, or in the schools' standards as indicated by the attrition rates and survival rates. Prevailing attractions of the courses as they offer better employment opportunities abroad, i.e., the opening of the US market for health workers (Sanchez, 1988) can also cause an increase in the enrollment of students to these courses and hence affect the change of the number of new licensees. This may be treated separately on the Section discussing entry barriers and determinants of migration from the sensitivity analysis in this section which is focused on the changes of the number of OCWs and permanent emigrants.

### 1. Physicians

The total stock of Physicians in 1986 was 53,497, according to the PRC data. Adding the number of new licensees in 1987 of 1,720, the total stock in 1987 was 55,217 under the medium assumption.

The number of retirees was a straight forward calculation while the number of deaths was computed using the lifetime table.

Using the estimate of Sanchez (1988), the number of permanent emigrants registered 20,000 under the medium assumption. The value under the low assumption is 30,000 which will capture the estimate of the UNESCO (1987).

The percentage of the OCWs to the total stock is estimated at 3.38%, according to Abella (1980). Assuming that this has doubled in the late 80s, the number of OCWs is estimated at 3,733 in 1987 under the medium assumption. Abella's rate is captured under the high assumption.

Using these values, the net stock ranges from 7,486 to 31,219 with median at 19,352.

	Low Assumptions	Medium Assumptions	High Assumptions
Total Stock (1986)	53,497	53,497	53,497
Add: New Licensees (1987)	1,720	1,720	1,720
Total Stock (1987)	55,217	55,217	55,217
Less: Retirees	5,623	5,623	5,623
Dead	6,509	6,509	6,509
OCWs	5,599	3,733	1,866
Permanent Emigrants	30,000	20,000	10,000
Net Stock (1987)	7,486	19,352	31,219

### Dentists

Based on the PRC data, the total stock of dentists in 1986 was 22,534. Adding the number of new licensees in 1987 of 1,245, the total stock in 1987 was 23,779 under the medium

assumption.

The number of retirees was a straight forward calculation while the number of deaths was computed using the lifetime table.

According to the 1990 NSO survey, the number of OCWs is estimated at 2.70% of the total stock or 642 dentists. A medium assumption would be twice this figure numbering 1,284.

The number of permanent emigrants is about 1.42% of the total stock in 1969 (Gupta, 1973). This is assumed to be ten times higher in the late 80s which is estimated at 14,300 in 1987.

Using these values, the net stock ranges from 11,684 to 16,915 with 14,300 as the median value.

		Low	Medium	High
		Assumptions	Assumptions	Assumptions
Total	Total Stock (1986)	22,534	22,534	22,534
comp Add:	New Licensees (1987)	1,245	1,245	1,245
		-----	-----	-----
	Total Stock (1987)	23,779	23,779	23,779
Less:	Retirees	1,734	1,734	1,734
	Dead	2,514	2,514	2,514
	OCWs	1,926	1,284	642
	Permanent Emigrants	5,921	3,947	1,974
		-----	-----	-----
	Net Stock (1987)	11,684	14,300	16,915

### 3. Nurses

The

The total stock of nurses in 1986 was 151,870, according to the PRC data. Adding the number of new licensees in 1987 of 3,877, the total stock in 1987 was 155,747 under the medium assumption.

The number of retirees was a straight forward calculation while the number of deaths was computed using the lifetime table.

In 1987, the POEA registered a deployment of 25,940 nurses.

The percentage of the permanent emigrants to the total stock of nurses stood at 23.55%, according to Abella (1980). Using the same percentage of outflow of the total stock of nurses in 1987, the number of permanent emigrants is about 36,678.

Using these pieces of information, the net stock of nurses in 1987 is estimated at 81,907 under the medium assumption.

The net stock ranges from 50,597 to 113,216 nurses.



	Low Assumptions	Medium Assumptions	High Assumptions
Total Stock (1986)	151,870	151,870	151,870
Add: New Licensees (1987)	3,877	3,877	3,877
Total Stock (1987)	155,747	155,747	155,747
Less: Retirees	4,412	4,412	4,412
Dead	6,810	6,810	6,810
OCWs	38,910	25,940	12,970
Permanent Emigrants	55,018	36,678	18,339
Net Stock (1987)	50,597	81,907	113,216

#### 4. Midwives

Based on the PRC data, the total stock of midwives in 1986 was 146,226. Adding the number of new licensees in 1987 of 2,306, the total stock in 1987 was 148,532 under the medium assumption.

The number of retirees was a straight forward calculation while the number of deaths was computed using the lifetime table.

Using the estimate of IMAP (1991), the number of permanent emigrants registered 20,000 under the medium assumption. The value under the high assumption is 10,000 which will capture the estimate of Gupta's (1973) figure of 10 times higher than the 1969 rate of 0.54% which is approximately 8,000 in 1987.

The percentage of the OCWs to the total stock is estimated at 10% of the total deployment in 1987 to take into account the midwives who registered at the POEA as domestic helpers. This figure is about 44,927 midwives.

Using these base information, the net stock ranges from 39,577 to 104,504 with 72,041 as the median value.

	Low Assumptions	Medium Assumptions	High Assumptions
Total Stock (1986)	146,226	146,226	146,226
Add: New Licensees (1987)	2,306	2,306	2,306
Total Stock (1987)	148,532	148,532	148,532
Less: Retirees	4,230	4,230	4,230
Dead	7,334	7,334	7,334
OCWs	67,391	44,927	22,464
Permanent Emigrants	30,000	20,000	10,000
Net Stock (1987)	39,577	72,041	104,504

## 5. Medical Technologists

The total stock of medical technologists in 1986 was 25,703, according to the PRC data. Adding the number of new licensees in 1987 of 1,362, the total stock in 1987 was 27,065 under the medium assumption.

The number of retirees was a straight forward calculation while the number of deaths was computed using the lifetime table.

According to the 1990 NSO survey, the number of OCWs is estimated at 11% of the total stock or 2,977 using the 1987 total stock. Assuming that the rate of permanent emigration is twice the rate of OCWs, permanent emigrants stood at 5,954 medical technologists in 1987. PAMET estimated 6,000 medical technologists who were out of the country for work.

Using these pieces of information, the net stock of medical technologists in 1987 is estimated at 17,270 under the medium assumption.

The net stock ranges from 12,804 to 17,270 medical technologists.

	Low Assumptions	Medium Assumptions	High Assumptions
Total Stock (1986)	25,703	25,703	25,703
Add: New Licensees (1987)	1,362	1,362	1,362
Total Stock (1987)	27,065	27,065	27,065
Less: Retirees	0	0	0
Dead	864	864	864
OCWs	4,466	2,977	1,489
Permanent Emigrants	8,931	5,954	2,977
Net Stock (1987)	12,804	17,270	21,735

## 6. Pharmacists

A total of 27,493 pharmacists were registered with the PRC in 1986. Adding the number of new licensees in 1987 of 648, the total stock in 1987 was 28,141 under the medium assumption.

The number of retirees was a straight forward calculation while the number of deaths was computed using the lifetime table.

Based on the 1990 NSO survey, the OCWs accounted for 4.10% of the total stock or 1,154 pharmacists.

The number of permanent emigrants is about 1.42% of the total stock in 1969 (Gupta, 1973). This is assumed to be ten times higher in the late 80s which is estimated at 3,996 in 1987.

Using these values, the net stock ranges from 14,039 to 18,541 with 16,290 as the median value.

	Low Assumption	Medium Assumption	High Assumption
Total Stock (1986)	27,493	27,493	27,493
Add: New Licensees (1987)	972	648	324
Total Stock (1987)	28,465	28,141	27,817
Less: Retirees	3,562	3,562	3,562
Dead	3,139	3,139	3,139
OCWs	1,731	1,154	577
Permanent Emigrants	5,994	3,996	1,998
Net Stock (1987)	14,039	16,290	18,541

The studies of Abella and Gupta are cited in the UNESCO study (1987) entitled: "Migration of Talent: Causes and Consequences of Brain Drain".

#### METHODOLOGY FOR THE YEAR 2000 PROJECTIONS

1. The future number of first year enrollees is estimated using historical trend.
2. The number of new licensees until year 2000 is determined with the following formula given in Chapter 1:

$$NL_t = L_t S_t F_{t-10-n}$$

Fixed rates of L and S are assumed using the average rate of new licensees and survival rate determined in Chapter 2.

3. Projected number of deaths is calculated using the lifetime table while retirement by assuming the age of 65 as retireable age.
4. The initial net stocks (1987) of the healthmanpower categories are computed (see previous section)
5. To determine the future percentage distribution of emigrants, OCWs and net stock to the total stock net of deaths and retirees, the following method is used:

5.1 Given:

$$\text{Net Stock}_t = \text{Total Stock net of deaths and retirees}_t - \text{cumulative number of \{emigrant + OCWs\}_t}$$

or,

Total stock net of deaths & retirees<sub>t</sub> = emigrants<sub>t</sub> + OCWs<sub>t</sub> + Net Stock<sub>t</sub>

5.2 Starting off from the above equation, the percentage distribution of stock of emigrants, stock of OCWs and "net stock" to the total cumulative number of retirees and dead is calculated applying the Markov model, such as:

Let  $X_T$  - Total Stock net of retirees and dead  
 $x_1$  - Stock of permanent emigrants as % of  $X_T$   
 $x_2$  - Stock of OCWs as % of  $X_T$   
 $x_3$  - "net stock" as % of  $X_T$

Thus,

$$x^t = \sum_{i=1}^3 x_i^t = 100\% \quad \text{and} \quad x^t = x^t - \sum_{i=1}^2 x_i^t$$

Estimating future percentage distribution using Markov chain:

$$x^{t+1} = x^t P$$

or  $x^z = x^0 P^z$

where

$$x = [x_i]$$

$$= [x_1 \ x_2 \ x_3]$$

$$P = [p_{ij}]$$

$$= \begin{bmatrix} p_{11} & p_{12} & p_{13} \\ p_{21} & p_{22} & p_{23} \\ p_{31} & p_{32} & p_{33} \end{bmatrix}$$

$z$  = some future year from the base year  $t = 0$

$P$  = probability matrix

5.3 From the results and given the projected total stock presented in Chapter 2, the annual data on the number of emigrants, OCWs and the "net stock" can be easily computed.

## **Appendix C**

Table B1

**ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR GENERAL PRACTITIONERS  
USING MODIFIED GMENAC MODEL**

	1992			2000		
	Low Assumption	Medium Assumption	High Assumption	Low Assumption	Medium Assumption	High Assumption
POPULATION	64,259,000	64,259,000	64,259,000	75,224,000	75,224,000	75,224,000
MORBIDITY CASE	27,695,629	115,666,200	147,795,700	32,346,320	173,015,200	173,015,200
MORBIDITY CASE (%)	0.43	1.80	2.30	0.43	2.30	2.30
% REQUIRING CARE	0.60	0.60	0.60	0.60	0.60	0.60
ADJUSTED NEEDS	16,617,377	69,399,720	88,677,420	19,407,792	103,809,120	103,809,120
NORMS OF CARE	1.25	1.25	1.25	1.25	1.25	1.25
FREQUENCY OF CONSULTATION	5	5	5	5	5	5
DURATION OF CONSULTATION (MIN)	15	15	15	15	15	15
(HRS.)	0.25	0.25	0.25	0.25	0.25	0.25
TOTAL SERVICE REQUIREMENTS (TSR)	20,771,722	86,749,650	110,846,775	24,259,740	129,761,400	129,761,400
% DELEGATION & SUBSTITUTION	0	0.25	0.25	0.25	0.25	0
NUMBER FOR DEL. & SUBS.	0	21,687,413	27,711,694	6,064,935	32,440,350	0
TSR (NET OF DELEGATION & SUBST.)	20,771,722	65,062,238	83,135,081	18,194,805	97,321,050	129,761,400
ANNUAL PRODUCTIVITY	2,760	2,760	2,760	2,760	2,760	2,760
OFFICE VISITS (HRS.)/DAY	10	10	10	10	10	10
DAYS WORKED/WEEK	6	6	6	6	6	6
WEEKS WORKED/YEAR	46	46	46	46	46	46
FTE PHYSICIAN REQUIRED FOR DIRECT	7,526	23,573	30,121	6,592	35,261	47,015
PATIENT CARE						
% REQ FOR T, R, A	0.30	0.30	0.30	0.30	0.30	0.30
NUMBER FOR T, R, A	2,258	7,072	9,036	1,978	10,578	14,105
MANPOWER REQUIREMENTS	9,784	30,645	39,158	8,570	45,840	61,120

Table B2

**ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR CARDIOLOGISTS  
USING MODIFIED GMENAC MODEL**

	1992			2000			
	Low Assumption	Medium Assumption	High Assumption	Low Assumption	Medium Assumption	High 1 Assumption	High 2 Assumption
POPULATION	64,259,000	64,259,000	64,259,000	75,224,000	75,224,000	75,224,000	75,224,000
MORBIDITY CASE	6,425,900	6,425,900	6,425,900	6,017,920	7,522,400	6,017,920	7,522,400
MORBIDITY CASE (%)	0.10	0.10	0.10	0.08	0.10	0.08	0.10
% REQUIRING CARE	0.50	0.70	0.70	0.70	0.70	0.70	0.70
ADJUSTED NEEDS	3,212,950	4,498,130	4,498,130	4,212,544	5,265,680	4,212,544	5,265,680
NORMS OF CARE	0.61	0.61	2.57	0.61	0.61	2.57	2.57
FREQUENCY OF CONSULTATION	2	2	2	2	2	2	2
outpatients	2	2	2	2	2	2	2
inpatients	3	3	3	3	3	3	3
surgical	1	1	1	1	1	1	1
DURATION OF CONSULTATION (HRS)	0.31	0.31	1.28	0.31	0.31	1.28	1.28
outpatients	0.25	0.25	0.50	0.25	0.25	0.50	0.50
inpatients	0.08	0.08	0.17	0.08	0.08	0.17	0.17
surgical	0.92	0.92	5	0.92	0.92	5	5
TOTAL SERVICE REQUIREMENTS (TSR)	1,975,322	2,765,450	11,544,900	2,589,872	3,237,340	10,811,915	13,514,894
% DELEGATION & SUBSTITUTION	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	98,766	138,273	577,245	129,494	161,867	540,596	675,745
TSR (NET OF DELEGATION & SUBST.)	1,876,556	2,627,178	10,967,655	2,460,378	3,075,473	10,271,320	12,839,150
ANNUAL PRODUCTIVITY	3,042	3,042	3,042	3,042	3,042	3,042	3,042
OFFICE VISITS (HRS.)/DAY	9	9	9	9	9	9	9
DAYS WORKED/WEEK	6.5	6.5	6.5	6.5	6.5	6.5	6.5
WEEKS WORKED/YEAR	52	52	52	52	52	52	52
FTE PHYSICIAN REQUIRED FOR	617	864	3,605	809	1,011	3,377	4,221
FOR DIRECT PATIENT CARE							
% REQ FOR T, R, A	0.05	0.05	0.05	0.05	0.05	0.05	0.05
NUMBER REQ FOR T, R, A	31	43	180	40	51	169	211
MANPOWER REQUIREMENTS	648	907	3,786	849	1,062	3,545	4,432

Table B3a

## ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR PEDIATRICS USING MODIFIED GMENAC MODEL

1992  
Low Assumption

	TYPHOID***	DIARRHEAS	TB	LEPROSY	DIPHTHERIA	WHOOPING COUGH	TETANUS	ACUTE POLIO	VARICELLA	MEASLES	H-FEVER
POPULATION *	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376
MORBIDITY CASE	7,506	624,346	38,416	1,347	640	10,067	2,289	337	14,006	66,764	2,087
MORBIDITY CASE (%)	0.0002	0.0185	0.0011	0.000040	0.000019	0.0003	0.0001	0.000010	0.0004	0.0020	0.0001
% REQUIRING CARE	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
ADJUSTED NEEDS	3,754	312,173	19,208	674	320	5,033	1,144	168	7,003	33,382	1,044
NORMS OF CARE :	2	2	2	2	2	2	2	2	2	2	2
FREQUENCY OF CONSULTATION**	13	13	13	13	13	13	13	13	13	13	13
DURATION OF CONSULTATION (MIN)	10	10	10	10	10	10	10	10	10	10	10
(HRS.)	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
TOTAL SERVICE REQUIREMENTS	8,124	676,376	41,817	1,459	693	10,906	2,480	365	15,173	72,328	2,261
% DELEGATION & SUBSTITUTION (0.40)	3,253	270,550	16,647	584	277	4,362	992	146	6,069	28,631	804
TSR (NET OF DELEGATION & SUBSTITUTION)	4,880	405,826	24,970	875	416	6,544	1,488	219	9,104	43,697	1,357
ANNUAL PRODUCTIVITY	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756
OFFICE VISITS (HRS./DAY)	8	8	8	8	8	8	8	8	8	8	8
DAYS WORKED/WEEK	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
WEEKS WORKED/YEAR	53	53	53	53	53	53	53	53	53	53	53
FTE PHYSICIAN REQUIRED FOR DIRECT PATIENT CARE	2	147	8	0	0	2	1	0	3	16	0
% REQ FOR T, R, A	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	0	15	1	0	0	0	0	0	0	2	0
MANPOWER REQUIREMENTS	2	162	10	0	0	3	1	0	4	17	1

	INFECTIOUS HEPATITIS	MALARIA	SYPHILIS	GONOCOCCAL INFECTION	SCHISTO- SOMIASIS	FILARIASIS	MALIGNANT NEOPLASMS	DISEASES OF THE HEART	BRONCHITIS	PNEUMONIAS	INFLUENZA	ACCIDENTS
POPULATION *	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376
MORBIDITY CASE	8,148	56,597	34	3,737	15,252	83	3,502	11,652	781,377	203,896	485,767	50,526
MORBIDITY CASE (%)	0.0002	0.0017	0.000001	0.0001	0.0005	0.000002	0.0001	0.0004	0.0226	0.0061	0.0144	0.0018
% REQUIRING CARE	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
ADJUSTED NEEDS	4,074	28,299	17	1,869	7,626	41	1,751	5,976	390,689	101,948	242,883	25,763
NORMS OF CARE	2	2	2	2	2	2	2	2	2	2	2	2
FREQUENCY OF CONSULTATION**	13	13	13	13	13	13	13	13	13	13	13	13
DURATION OF CONSULTATION (MIN)	10	10	10	10	10	10	10	10	10	10	10	10
(HRS.)	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
TOTAL SERVICE REQUIREMENTS	8,827	61,313	37	4,048	10,523	90	3,794	12,948	824,825	220,887	629,248	64,486
% DELEGATION & SUBSTITUTION (0.40)	3,631	24,526	15	1,619	6,609	36	1,618	5,179	329,830	89,356	210,499	25,795
TSR	6,296	39,788	22	2,429	9,914	54	2,276	7,769	494,995	132,532	318,749	38,692
ANNUAL PRODUCTIVITY	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756
OFFICE VISITS/DAY	8	8	8	8	8	8	8	8	8	8	8	8
DAYS WORKED/WEEK	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
WEEKS WORKED/YEAR	53	53	53	53	53	53	53	53	53	53	53	53
FTE PHYSICIAN REQUIRED FOR DIRECT CARE	2	13	0	1	4	0	1	3	180	49	112	14
% REQ FOR T, R, A	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	0	1	0	0	0	0	0	0	18	5	11	1
MANPOWER REQUIREMENTS	2	16	0	1	4	0	1	3	198	53	123	15
TOTAL	617											

\* Population projection - 0-21 yrs old

\*\* 0-12 months old requires 9 visits/year, below 2 yrs old requires 3 visits/yr; 2 yrs old &amp; above requires 1 visit/year; diarrheal cases - 2 visits per episode, 6 episodes per year

\*\*\*Includes paratyphoid fever and other salmonella infections



Table B3b

## ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR PEDIATRICS USING MODIFIED GMENAC MODEL

1992  
Medium Assumption

	TYPHOID***	DIARRHEAS	TB	LEPROSY	DIPHTHERIA	WHOOPING COUGH	TETANUS	ACUTE POLIO- MYELITIS	VARICELLA	MEASLES	H-FEVER
POPULATION *	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378
MORBIDITY CASE	7,508	624,346	38,418	1,347	640	10,067	2,289	337	14,006	66,764	2,087
MORBIDITY CASE (%)	0.0002	0.0185	0.0011	0.000040	0.000019	0.0003	0.0001	0.000010	0.0004	0.0020	0.0001
% REQUIRING CARE	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
ADJUSTED NEEDS*	3,754	312,173	19,208	674	320	5,034	1,145	169	7,003	33,382	1,044
NORMS OF CARE	2	2	2	2	2	2	2	2	2	2	2
FREQUENCY OF CONSULTATION**	13	13	13	13	13	13	13	13	13	13	13
DURATION OF CONSULTATION (MIN)	10	10	10	10	10	10	10	10	10	10	10
(HRS.)	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
TOTAL SERVICE REQUIREMENTS	8,134	678,375	41,617	1,459	693	10,906	2,480	365	15,173	72,328	2,261
% DELEGATION & SUBSTITUTION (0.37)	3,009	250,259	15,398	540	257	4,035	918	135	5,614	26,781	837
TSR	5,124	428,116	26,219	919	437	6,871	1,562	230	9,559	45,546	1,424
ANNUAL PRODUCTIVITY	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756
OFFICE VISITS (HRS) /DAY	8	8	8	8	8	8	8	8	8	8	8
DAYS WORKED/WEEK	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
WEEKS WORKED/YEAR	53	53	53	53	53	53	53	53	53	53	53
FTE PHYSICIAN REQUIRED FOR DIRECT	2	155	10	0	0	2	1	0	3	17	1
PATIENT CARE											
% REQ FOR T, R, A	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
MANPOWER REQUIREMENTS	2	170	10	0	0	3	1	0	4	18	1

	INFECTIOUS HEPATITIS	MALARIA	SYPHILIS	GONOCOCCAL INFECTION	SCHISTO- SOMIASIS	FILARIASIS	MALIGNANT NEOPLASMS	DISEASES OF THE HEART	BRONCHITIS	PNEUMONIAS	INFLUENZA	ACCIDENTS
POPULATION *	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378
MORBIDITY CASE	8,148	58,597	34	3,737	15,252	83	3,502	11,952	781,377	203,896	485,767	59,626
MORBIDITY CASE (%)	0.0002	0.0017	0.000001	0.0001	0.0005	0.000002	0.0001	0.0004	0.0226	0.0061	0.0144	0.0018
% REQUIRING CARE	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
ADJUSTED NEEDS	4,074	29,299	17	1,869	7,626	42	1,751	5,976	390,689	101,948	242,884	29,783
NORMS OF CARE	2	2	2	2	2	2	2	2	2	2	2	2
FREQUENCY OF CONSULTATION**	13	13	13	13	13	13	13	13	13	13	13	13
DURATION OF CONSULTATION (MIN)	10	10	10	10	10	10	10	10	10	10	10	10
(HRS.)	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
TOTAL SERVICE REQUIREMENTS	6,827	81,313	37	4,048	16,623	60	3,794	12,948	824,825	220,887	526,243	64,487
% DELEGATION & SUBSTITUTION (0.37)	3,268	22,688	14	1,488	6,114	33	1,404	4,791	305,185	81,728	194,712	23,890
TSR	3,561	38,627	23	2,561	10,409	27	2,390	8,157	519,640	139,159	331,531	40,597
ANNUAL PRODUCTIVITY	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756
OFFICE VISITS/DAY	8	8	8	8	8	8	8	8	8	8	8	8
DAYS WORKED/WEEK	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
WEEKS WORKED/YEAR	53	53	53	53	53	53	53	53	53	53	53	53
FTE PHYSICIAN REQUIRED FOR DIRECT	2	14	0	1	4	0	1	3	189	50	120	15
CARE												
% REQ FOR T, R, A	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
MANPOWER REQUIREMENTS	2	15	0	1	4	0	1	3	207	56	132	16
TOTAL	649											

\* Population projection - 0-21 yrs old

\*\* 0-12 months old requires 9 visits/year, below 2 yrs old requires 3 visits/yr; 2 yrs old &amp; above requires 1 visit/year; diarrheal cases - 2 visits per episode, 6 episodes per year

\*\*\* Includes paratyphoid fever and other salmonella infections

Table B3a

## ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR PEDIATRICS USING MODIFIED GMENAC MODEL

1992  
Low Assumption

	TYPHOID***	DIARRHEAS	TB	LEPROSY	DIPHTHERIA	WHOOPING COUGH	TETANUS	ACUTE POLIO	VARICELLA	MEASLES	H-FEVER
POPULATION *	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376
MORBIDITY CASE	7,506	624,346	38,416	1,347	640	10,067	2,289	337	14,006	66,764	2,087
MORBIDITY CASE (%)	0.0002	0.0185	0.0011	0.000040	0.000019	0.0003	0.0001	0.000010	0.0004	0.0020	0.0001
% REQUIRING CARE	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
ADJUSTED NEEDS	3,754	312,173	19,208	674	320	5,033	1,144	168	7,003	33,382	1,044
NORMS OF CARE :	2	2	2	2	2	2	2	2	2	2	2
FREQUENCY OF CONSULTATION**	13	13	13	13	13	13	13	13	13	13	13
DURATION OF CONSULTATION (MIN)	10	10	10	10	10	10	10	10	10	10	10
(HRS.)	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
TOTAL SERVICE REQUIREMENTS	8,124	676,376	41,817	1,459	693	10,906	2,480	365	15,173	72,328	2,261
% DELEGATION & SUBSTITUTION (0.40)	3,253	270,550	16,647	584	277	4,362	992	146	6,069	28,631	804
TSR (NET OF DELEGATION & SUBSTITUTION)	4,880	405,826	24,970	875	416	6,544	1,488	219	9,104	43,697	1,357
ANNUAL PRODUCTIVITY	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756
OFFICE VISITS (HRS./DAY)	8	8	8	8	8	8	8	8	8	8	8
DAYS WORKED/WEEK	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
WEEKS WORKED/YEAR	53	53	53	53	53	53	53	53	53	53	53
FTE PHYSICIAN REQUIRED FOR DIRECT PATIENT CARE	2	147	8	0	0	2	1	0	3	16	0
% REQ FOR T, R, A	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	0	15	1	0	0	0	0	0	0	2	0
MANPOWER REQUIREMENTS	2	162	10	0	0	3	1	0	4	17	1

	INFECTIOUS HEPATITIS	MALARIA	SYPHILIS	GONOCOCCAL INFECTION	SCHISTO- SOMIASIS	FILARIASIS	MALIGNANT NEOPLASMS	DISEASES OF THE HEART	BRONCHITIS	PNEUMONIAS	INFLUENZA	ACCIDENTS
POPULATION *	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376
MORBIDITY CASE	8,148	56,597	34	3,737	15,252	83	3,502	11,652	781,377	203,896	485,767	50,526
MORBIDITY CASE (%)	0.0002	0.0017	0.000001	0.0001	0.0005	0.000002	0.0001	0.0004	0.0226	0.0061	0.0144	0.0018
% REQUIRING CARE	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
ADJUSTED NEEDS	4,074	28,299	17	1,869	7,626	41	1,751	5,976	390,689	101,948	242,883	25,763
NORMS OF CARE	2	2	2	2	2	2	2	2	2	2	2	2
FREQUENCY OF CONSULTATION**	13	13	13	13	13	13	13	13	13	13	13	13
DURATION OF CONSULTATION (MIN)	10	10	10	10	10	10	10	10	10	10	10	10
(HRS.)	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
TOTAL SERVICE REQUIREMENTS	8,827	61,313	37	4,048	10,523	90	3,794	12,948	824,825	220,887	629,248	64,486
% DELEGATION & SUBSTITUTION (0.40)	3,631	24,526	15	1,619	6,609	36	1,618	5,179	329,830	89,356	210,499	25,795
TSR	6,296	39,788	22	2,429	9,914	54	2,276	7,769	494,995	132,532	318,749	38,692
ANNUAL PRODUCTIVITY	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756
OFFICE VISITS/DAY	8	8	8	8	8	8	8	8	8	8	8	8
DAYS WORKED/WEEK	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
WEEKS WORKED/YEAR	53	53	53	53	53	53	53	53	53	53	53	53
FTE PHYSICIAN REQUIRED FOR DIRECT CARE	2	13	0	1	4	0	1	3	180	49	112	14
% REQ FOR T, R, A	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	0	1	0	0	0	0	0	0	18	5	11	1
MANPOWER REQUIREMENTS	2	16	0	1	4	0	1	3	198	53	123	15
TOTAL	617											

\* Population projection - 0-21 yrs old

\*\* 0-12 months old requires 9 visits/year, below 2 yrs old requires 3 visits/yr; 2 yrs old &amp; above requires 1 visit/year; diarrheal cases - 2 visits per episode, 8 episodes per year

\*\*\*Includes paratyphoid fever and other salmonella infections

Table B3b

## ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR PEDIATRICS USING MODIFIED GMENAC MODEL

1992  
Medium Assumption

	TYPHOID***	DIARRHEAS	TB	LEPROSY	DIPHTHERIA	WHOOPING COUGH	TETANUS	ACUTE POLIO- MYELITIS	VARICELLA	MEASLES	H-FEVER
POPULATION *	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378
MORBIDITY CASE	7,508	624,346	38,418	1,347	640	10,067	2,289	337	14,006	66,764	2,087
MORBIDITY CASE (%)	0.0002	0.0185	0.0011	0.000040	0.000019	0.0003	0.0001	0.000010	0.0004	0.0020	0.0001
% REQUIRING CARE	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
ADJUSTED NEEDS*	3,754	312,173	19,208	674	320	5,034	1,145	169	7,003	33,382	1,044
NORMS OF CARE	2	2	2	2	2	2	2	2	2	2	2
FREQUENCY OF CONSULTATION**	13	13	13	13	13	13	13	13	13	13	13
DURATION OF CONSULTATION (MIN)	10	10	10	10	10	10	10	10	10	10	10
(HRS.)	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
TOTAL SERVICE REQUIREMENTS	8,134	678,375	41,617	1,459	693	10,906	2,480	365	15,173	72,328	2,261
% DELEGATION & SUBSTITUTION (0.37)	3,009	250,259	15,398	540	257	4,035	918	135	5,614	26,781	837
TSR	5,124	428,116	26,219	919	437	6,871	1,562	230	9,559	45,546	1,424
ANNUAL PRODUCTIVITY	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756
OFFICE VISITS (HRS) /DAY	8	8	8	8	8	8	8	8	8	8	8
DAYS WORKED/WEEK	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
WEEKS WORKED/YEAR	53	53	53	53	53	53	53	53	53	53	53
FTE PHYSICIAN REQUIRED FOR DIRECT	2	155	10	0	0	2	1	0	3	17	1
PATIENT CARE											
% REQ FOR T, R, A	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
MANPOWER REQUIREMENTS	2	170	10	0	0	3	1	0	4	18	1

	INFECTIOUS HEPATITIS	MALARIA	SYPHILIS	GONOCOCCAL INFECTION	SCHISTO- SOMIASIS	FILARIASIS	MALIGNANT NEOPLASMS	DISEASES OF THE HEART	BRONCHITIS	PNEUMONIAS	INFLUENZA	ACCIDENTS
POPULATION *	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378	33,668,378
MORBIDITY CASE	8,148	58,597	34	3,737	15,252	83	3,502	11,952	781,377	203,896	485,767	59,626
MORBIDITY CASE (%)	0.0002	0.0017	0.000001	0.0001	0.0005	0.000002	0.0001	0.0004	0.0226	0.0061	0.0144	0.0018
% REQUIRING CARE	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
ADJUSTED NEEDS	4,074	29,299	17	1,869	7,626	42	1,751	5,976	390,689	101,948	242,884	29,783
NORMS OF CARE	2	2	2	2	2	2	2	2	2	2	2	2
FREQUENCY OF CONSULTATION**	13	13	13	13	13	13	13	13	13	13	13	13
DURATION OF CONSULTATION (MIN)	10	10	10	10	10	10	10	10	10	10	10	10
(HRS.)	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
TOTAL SERVICE REQUIREMENTS	6,827	81,313	37	4,048	16,623	60	3,794	12,948	824,825	220,887	526,243	64,487
% DELEGATION & SUBSTITUTION (0.37)	3,268	22,688	14	1,488	6,114	33	1,404	4,791	305,185	81,728	194,712	23,890
TSR	3,561	38,627	23	2,561	10,409	27	2,390	8,157	519,640	139,159	331,531	40,593
ANNUAL PRODUCTIVITY	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756
OFFICE VISITS/DAY	8	8	8	8	8	8	8	8	8	8	8	8
DAYS WORKED/WEEK	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
WEEKS WORKED/YEAR	53	53	53	53	53	53	53	53	53	53	53	53
FTE PHYSICIAN REQUIRED FOR DIRECT	2	14	0	1	4	0	1	3	189	50	120	15
CARE												
% REQ FOR T, R, A	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
MANPOWER REQUIREMENTS	2	15	0	1	4	0	1	3	207	56	132	16
TOTAL	649											

\* Population projection - 0-21 yrs old

\*\* 0-12 months old requires 9 visits/year, below 2 yrs old requires 3 visits/yr; 2 yrs old &amp; above requires 1 visit/year; diarrheal cases - 2 visits per episode, 6 episodes per year

\*\*\* Includes paratyphoid fever and other salmonella infections

Table B30

## ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR PEDIATRICS USING MODIFIED GMENAC MODEL

1992 High Assumption											
	TYPHOID***	DIARRHEAS	TB	LEPROSY	DIPHTHERIA	WHOOPING COUGH	TETANUS	ACUTE POLIO- MYELITIS	VARICELLA	MEASLES	H-FEVER
POPULATION *	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376
MORBIDITY CASE	176,850	792,088	206,758	169,689	168,982	176,409	170,631	168,679	182,348	235,106	170,429
MORBIDITY CASE (%)	0.0052	0.0235	0.0061	0.005040	0.005018	0.0053	0.0051	0.005010	0.0054	0.0070	0.0051
% REQUIRING CARE	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
ADJUSTED NEEDS	87,925	396,344	103,379	84,844	84,491	89,204	85,315	84,338	91,174	117,553	85,214
NORMS OF CARE *	2	2	2	2	2	2	2	2	2	2	2
FREQUENCY OF CONSULTATION**	13	13	13	13	13	13	13	13	13	13	13
DURATION OF CONSULTATION (MIN)	10	10	10	10	10	10	10	10	10	10	10
(HRS.)	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
TOTAL SERVICE REQUIREMENTS	190,604	856,746	223,008	183,630	183,064	193,276	184,850	182,735	197,644	264,696	184,631
% DELEGATION & SUBSTITUTION (0.37)	70.486	317,798	82,875	68,017	67,734	71,512	66,395	67,612	73,091	94,238	68,314
TSR (NET OF DELEGATION & SUBSTITUTION)	120,018	541,009	141,112	115,613	115,330	121,764	118,455	115,123	124,452	160,460	116,318
ANNUAL PRODUCTIVITY	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756
OFFICE VISITS (HRS./DAY)	8	8	8	8	8	8	8	8	8	8	8
DAYS WORKED/WEEK	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
WEEKS WORKED/YEAR	53	53	53	53	53	53	53	53	53	53	53
FTE PHYSICIAN REQUIRED FOR DIRECT PATIENT CARE *	44	196	51	42	42	44	42	42	45	58	42
% REQ FOR T, R, A	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	4	20	5	4	4	4	4	4	5	6	4
MANPOWER REQUIREMENTS	48	216	56	46	46	49	46	48	60	64	46

	INFECTIOUS HEPATITIS	MALARIA	SYPHILIS	GONOCOCCAL INFECTION	SCHISTO- SOMIASIS	FILARIASIS	MALIGNANT NEOPLASMS	DISEASES OF THE HEART	BRONCHITIS	PNEUMONIAS	INFLUENZA	ACCIDENTS
POPULATION *	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376
MORBIDITY CASE	178,490	224,839	166,376	172,079	183,594	166,425	171,844	180,294	926,719	372,238	654,109	227,866
MORBIDITY CASE (%)	0.0052	0.0067	0.005001	0.0051	0.0055	0.005002	0.0051	0.0054	0.0276	0.0111	0.0194	0.0068
% REQUIRING CARE	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
ADJUSTED NEEDS	88,245	112,469	84,188	86,039	91,797	84,212	85,922	90,147	464,859	186,119	327,054	113,634
NORMS OF CARE *	2	2	2	2	2	2	2	2	2	2	2	2
FREQUENCY OF CONSULTATION**	13	13	13	13	13	13	13	13	13	13	13	13
DURATION OF CONSULTATION (MIN)	10	10	10	10	10	10	10	10	10	10	10	10
(HRS.)	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
TOTAL SERVICE REQUIREMENTS	191,197	243,684	182,407	186,419	198,893	182,460	186,184	195,318	1,007,195	403,259	706,816	246,857
% DELEGATION & SUBSTITUTION (0.37)	70.743	90,183	67,491	68,976	73,591	67,610	66,661	72,268	372,662	149,205	262,189	91,237
TSR	120,454	153,521	114,917	117,444	125,303	114,850	117,523	123,051	634,533	254,052	444,622	155,620
ANNUAL PRODUCTIVITY	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756
OFFICE VISITS/DAY	8	8	8	8	8	8	8	8	8	8	8	8
DAYS WORKED/WEEK	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
WEEKS WORKED/YEAR	53	53	53	53	53	53	53	53	53	53	53	53
FTE PHYSICIAN REQUIRED FOR DIRECT CARE *	44	56	42	43	45	42	43	45	230	92	162	56
% REQ FOR T, R, A	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	4	9	4	4	5	4	4	4	23	9	16	6
MANPOWER REQUIREMENTS	48	61	46	47	50	46	47	49	253	101	178	62
TOTAL	1,702											

\* Population projection - 0-21 yrs old

\*\* 0-12 months old requires 9 visits/year, below 2 yrs old requires 3 visits/yr; 2 yrs old &amp; above requires 1 visit/year; diarrheal cases - 2 visits per episode, 6 episodes per year

\*\*\* Includes typhoid fever and other salmonella infections

Table B3a

## ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR PEDIATRICS USING MODIFIED GMENAC MODEL

2000  
Low Assumption

	TYPHOID***	DIARRHEAS	TB	LEPROSY	DIPHTHERIA	WHOOPING COUGH	TETANUS	ACUTE POLIO	VARICELLA	MEASLES	H-FEVER
POPULATION*	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662
MORBIDITY CASE	8,126	676,719	41,677	1,458	692	10,895	2,478	394	15,158	72,258	2,259
MORBIDITY CASE (%)	0.0002	0.018544	0.001141	0.00004	0.0000190	0.000299	0.000068	0.000010	0.000418	0.001983	0.000062
% REQUIRING CARE	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
ADJUSTED NEEDS	4,063	337,859	20,788	729	346	5,448	1,239	192	7,579	36,129	1,130
NORMS OF CARE	2	2	2	2	2	2	2	2	2	2	2
FREQUENCY OF CONSULTATION**	13	13	13	13	13	13	13	13	13	13	13
DURATION OF CONSULTATION (MIN)	10	10	10	10	10	10	10	10	10	10	10
(HRS.)	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
TOTAL SERVICE REQUIREMENTS	8,603	732,028	45,041	1,679	760	11,603	2,884	395	18,422	79,279	2,447
% DELEGATION & SUBSTITUTION (0.40)	3,621	292,811	18,018	632	300	4,721	1,074	168	6,569	31,312	979
TSR	5,282	439,217	27,025	947	450	7,082	1,811	227	9,853	48,068	1,468
ANNUAL PRODUCTIVITY	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756
OFFICE VISITS/DAY	8	8	8	8	8	8	8	8	8	8	8
DAYS WORKED/WEEK	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
WEEKS WORKED/YEAR	53	53	53	53	53	53	53	53	53	53	53
FTE PHYSICIAN REQUIRED FOR DIRECT PATIENT CARE	2	159	10	0	0	3	1	0	4	17	1
% REQ FOR T, R, A	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	0	16	1	0	0	0	0	0	0	2	0
MANPOWER REQUIREMENTS	2	175	11	0	0	3	1	0	4	19	1

	INFECTIOUS HEPATITIS	MALARIA	SYPHILIS	GONOCOCCAL INFECTION	SCHISTO- SOMIASIS	FILARIASIS	MALIGNANT NEOPLASMS	DISEASES OF THE HEART	BRONCHITIS	PNEUMONIAS	INFLUENZA	ACCIDENTS
POPULATION*	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662
MORBIDITY CASE	8,818	61,253	38	4,045	16,507	91	3,790	12,836	824,024	220,673	525,737	64,424
MORBIDITY CASE (%)	0.000242	0.001681	0.000001	0.000111	0.000453	0.0000025	0.000104	0.000355	0.022814	0.006056	0.014428	0.001788
% REQUIRING CARE	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
ADJUSTED NEEDS	4,409	30,627	18	2,022	8,253	46	1,895	6,468	412,012	110,336	262,869	32,212
NORMS OF CARE	2	2	2	2	2	2	2	2	2	2	2	2
FREQUENCY OF CONSULTATION**	13	13	13	13	13	13	13	13	13	13	13	13
DURATION OF CONSULTATION (MIN)	10	10	10	10	10	10	10	10	10	10	10	10
(HRS.)	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
TOTAL SERVICE REQUIREMENTS	9,553	65,358	39	4,362	17,882	99	4,106	14,014	892,693	239,092	689,646	69,792
% DELEGATION & SUBSTITUTION (0.40)	3,821	26,543	16	1,763	7,183	39	1,642	5,605	357,077	95,626	277,619	27,917
TSR	5,732	38,815	24	2,629	10,729	60	2,463	8,408	535,616	143,437	341,728	41,875
ANNUAL PRODUCTIVITY	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756
OFFICE VISITS/DAY	8	8	8	8	8	8	8	8	8	8	8	8
DAYS WORKED/WEEK	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
WEEKS WORKED/YEAR	53	53	53	53	53	53	53	53	53	53	53	53
FTE PHYSICIAN REQUIRED FOR DIRECT PATIENT CARE	2	14	0	1	4	0	1	3	194	52	124	15
% REQ FOR T, R, A	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	0	1	0	0	0	0	0	0	19	6	12	2
MANPOWER REQUIREMENTS	2	16	0	1	4	0	1	3	214	67	136	17
TOTAL	668											

\* Population projection - 0-21 yrs old

\*\* 0-12 months old requires 9 visits/year, below 2 yrs old requires 3 visits/yr; 2 yrs old &amp; above requires 1 visit/year; diarrheal cases - 2 visits per episode, 6 episodes per year

\*\*\*Includes paratyphoid fever and other salmonella infections

Table B3b

## ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR PEDIATRICS USING MODIFIED OMENAC MODEL

2000 Medium Assumption											
	TYPHOID***	DIARRHEAS	TB	LEPROSY	DIPHTHERIA	WHOOPING COUGH	TETANUS	ACUTE POLIO- MYELITIS	VARICELLA	MEASLES	H-FEVER
POPULATION *	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662
MORBIDITY CASE	8,128	675,719	41,577	1,458	692	10,895	2,478	364	15,158	72,258	2,259
MORBIDITY CASE (%)	0.0002	0.018544	0.001141	0.00004	0.0000190	0.000299	0.000068	0.000010	0.000416	0.001993	0.000062
% REQUIRING CARE	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
ADJUSTED NEEDS	4,063	337,859	20,788	729	346	5,448	1,239	182	7,579	36,129	1,130
NORMS OF CARE	2	2	2	2	2	2	2	2	2	2	2
FREQUENCY OF CONSULTATION**	13	13	13	13	13	13	13	13	13	13	13
DURATION OF CONSULTATION (MIN)	10	10	10	10	10	10	10	10	10	10	10
(HRS.)	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
TOTAL SERVICE REQUIREMENTS	8,603	732,028	45,041	1,579	750	11,603	2,684	395	10,422	79,279	2,447
% DELEGATION & SUBSTITUTION (0.37)	3,257	270,851	16,665	584	278	4,367	993	146	6,076	28,963	908
TSR	5,346	461,178	28,376	995	472	7,236	1,691	249	10,346	48,316	1,542
ANNUAL PRODUCTIVITY	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756
OFFICE VISITS/DAY	8	8	8	8	8	8	8	8	8	8	8
DAYS WORKED/WEEK	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
WEEKS WORKED/YEAR	53	53	53	53	53	53	53	53	53	53	53
FTE PHYSICIAN REQUIRED FOR DIRECT PATIENT CARE	2	167	10	0	0	3	1	0	4	18	1
% REQ FOR T, R, A	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
MANPOWER REQUIREMENTS	2	164	11	0	0	3	1	0	4	20	1

	INFECTIOUS HEPATITIS	MALARIA	SYPHILIS	GONOCOCCAL INFECTION	SCHISTO- SOMIASIS	FILARIASIS	MALIGNANT NEOPLASMS	DISEASES OF THE HEART	BRONCHITIS	PNEUMONIAS	INFLUENZA	ACCIDENTS
POPULATION *	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662
MORBIDITY CASE	8,818	61,233	36	4,045	16,507	91	3,790	12,836	824,024	220,873	526,737	64,424
MORBIDITY CASE (%)	0.000242	0.001681	0.000001	0.000111	0.000453	0.0000025	0.000104	0.000355	0.022614	0.006056	0.014428	0.001768
% REQUIRING CARE	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
ADJUSTED NEEDS	4,409	30,627	18	2,022	8,253	46	1,895	6,468	412,012	110,336	262,969	32,212
NORMS OF CARE	2	2	2	2	2	2	2	2	2	2	2	2
FREQUENCY OF CONSULTATION**	13	13	13	13	13	13	13	13	13	13	13	13
DURATION OF CONSULTATION (MIN)	10	10	10	10	10	10	10	10	10	10	10	10
(HRS.)	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
TOTAL SERVICE REQUIREMENTS	9,563	66,358	39	4,392	17,892	99	4,106	14,014	692,893	239,092	689,848	89,792
% DELEGATION & SUBSTITUTION (0.37)	3,636	24,652	16	1,621	6,616	37	1,519	5,165	330,296	88,453	210,733	28,623
TSR	6,018	41,696	25	2,761	11,266	62	2,586	8,829	362,596	150,639	479,115	61,169
ANNUAL PRODUCTIVITY	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756
OFFICE VISITS/DAY	8	8	8	8	8	8	8	8	8	8	8	8
DAYS WORKED/WEEK	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
WEEKS WORKED/YEAR	53	53	53	53	53	53	53	53	53	53	53	53
FTE PHYSICIAN REQUIRED FOR DIRECT PATIENT CARE	2	15	0	1	4	0	1	3	204	63	130	19
% REQ FOR T, R, A	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
MANPOWER REQUIREMENTS	2	17	0	1	4	0	1	4	224	60	143	18
TOTAL	791											

\* Population projection - 0-21 yrs old

\*\* 0-12 months old requires 9 visits/year, below 2 yrs old requires 3 visits/year; 2 yrs old &amp; above requires 1 visit/year; diarrheal cases - 2 visits per episode, 6 episodes per year

\*\*\*Includes paratyphoid fever and other salmonella infections

Table B3c

## ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR PEDIATRICS USING MODIFIED OMENAC MODEL

	2000 High Assumption										
	TYPHOID***	DIARRHEAS	TB	LEPROSY	DIPHTHERIA	WHOOPING COUGH	TETANUS	ACUTE POLIO- MYELITIS	VARICELLA	MEASLES	H-FEVER
POPULATION *	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662
MORBIDITY CASE	180,310	857,912	223,770	183,651	182,886	183,088	184,671	182,558	187,352	254,451	184,453
MORBIDITY CASE (%)	0.0052	0.023544	0.006141	0.00504	0.0050180	0.005299	0.005068	0.005010	0.005418	0.006993	0.005092
% REQUIRING CARE	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
ADJUSTED NEEDS	95,160	428,956	111,885	91,828	91,443	96,644	92,336	91,279	98,676	127,229	92,228
NORMS OF CARE	2	2	2	2	2	2	2	2	2	2	2
FREQUENCY OF CONSULTATION**	13	13	13	13	13	13	13	13	13	13	13
DURATION OF CONSULTATION (MIN)	10	10	10	10	10	10	10	10	10	10	10
(HRS.)	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
TOTAL SERVICE REQUIREMENTS	206,179	929,405	242,417	198,955	198,126	209,179	200,060	197,771	213,798	275,655	199,824
% DELEGATION & SUBSTITUTION (0.37)	78,286	343,880	89,894	73,813	73,307	77,396	74,022	73,175	79,105	101,693	73,935
TSR	128,893	685,525	152,723	125,342	124,818	131,783	126,038	124,596	134,693	173,963	125,889
ANNUAL PRODUCTIVITY	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756
OFFICE VISITS/DAY	6	6	6	6	6	6	6	6	6	6	6
DAYS WORKED/WEEK	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
WEEKS WORKED/YEAR	53	53	53	53	53	53	53	53	53	53	53
FTE PHYSICIAN REQUIRED FOR DIRECT PATIENT CARE	47	212	85	45	45	48	46	45	49	63	48
% REQ FOR T, R, A	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	6	21	6	5	5	5	6	6	5	6	6
MANPOWER REQUIREMENTS	52	234	81	50	50	53	50	50	54	69	50

	INFECTIOUS HEPATITIS	MALARIA	SYPHILIS	GONOCOCCAL INFECTION	SCHISTO- SOMIASIS	FILARIASIS	MALIGNANT NEOPLASMS	DISEASES OF THE HEART	BRONCHITIS	PNEUMONIAS	INFLUENZA	ACCIDENTS
POPULATION *	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662
MORBIDITY CASE	191,011	1,883,186	1,821,970	1,825,978	1,838,440	1,822,024	1,825,723	1,834,869	2,845,957	2,042,009	2,247,870	1,886,357
MORBIDITY CASE (%)	0.005242	0.051681	0.050001	0.050111	0.050453	0.0500025	0.050104	0.050355	0.072614	0.056096	0.064428	0.051768
% REQUIRING CARE	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
ADJUSTED NEEDS	95,606	841,693	810,885	812,989	819,220	811,012	812,861	817,434	1,322,979	1,021,303	1,173,835	943,178
NORMS OF CARE	2	2	2	2	2	2	2	2	2	2	2	2
FREQUENCY OF CONSULTATION**	13	13	13	13	13	13	13	13	13	13	13	13
DURATION OF CONSULTATION (MIN)	10	10	10	10	10	10	10	10	10	10	10	10
(HRS.)	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
TOTAL SERVICE REQUIREMENTS	208,929	2,040,119	1,973,800	1,978,143	1,991,643	1,973,890	1,977,866	1,987,775	2,866,453	2,212,623	2,543,309	2,043,663
% DELEGATION & SUBSTITUTION (0.37)	78,564	754,844	730,306	731,013	736,906	730,328	731,811	735,477	1,060,586	815,744	941,024	766,118
TSR	130,365	1,285,275	1,243,494	1,246,230	1,254,735	1,243,562	1,246,056	1,252,298	1,805,866	1,396,879	1,602,285	1,287,439
ANNUAL PRODUCTIVITY	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756
OFFICE VISITS/DAY	6	6	6	6	6	6	6	6	6	6	6	6
DAYS WORKED/WEEK	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
WEEKS WORKED/YEAR	53	53	53	53	53	53	53	53	53	53	53	53
FTE PHYSICIAN REQUIRED FOR DIRECT PATIENT CARE	47	466	451	452	455	451	452	454	655	606	691	487
% REQ FOR T, R, A	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	6	47	45	45	46	45	45	45	66	61	66	47
MANPOWER REQUIREMENTS	52	513	496	497	501	496	497	500	721	656	640	514
Total	9,796											

\* Population projection - 0-21 yrs old

\*\* 0-12 months old requires 9 visits/year, below 2 yrs old requires 3 visits/yr; 2 yrs old &amp; above requires 1 visit/year; diarrheal cases - 2 visits per episode, 6 episodes per year

\*\*\*Includes typhoid fever and other salmonella

Table B4a

ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR OPHTHALMOLOGISTS  
USING MODIFIED GMENAC MODEL  
1992

	Low Assumption		Medium Assumption		High Assumption	
	OCULAR MORBIDITIES	BLINDNESS PREVALENCE (Binocular/ Monocular) with backlog 10.5%	OCULAR MORBIDITIES	BLINDNESS PREVALENCE (Binocular/ Monocular) with backlog 10.5%	OCULAR MORBIDITIES	BLINDNESS PREVALENCE (Binocular/ Monocular) with backlog 10.5%
POPULATION	64,259,000	64,259,000	64,259,000	64,259,000	64,259,000	64,259,000
MORBIDITY CASE	49,479	960,415	49,479	960,415	49,479	960,415
MORBIDITY CASE (%)	0.0007700	0.0149	0.0007700	0.0149	0.0007700	0.0149
% REQUIRING CARE	0.37	0.37	0.37	0.37	0.37	0.37
ADJUSTED NEEDS	18,307	355,354	18,307	355,354	18,307	355,354
NORMS OF CARE	14.11	14.11	17.64	17.64	21.17	21.17
FREQUENCY OF CONSULTATION	8	8	10	10	12	12
DURATION OF CONSULTATION (MIN.)	105.84	105.84	105.84	105.84	105.84	105.84
(HRS.)	1.764	1.764	1.764	1.764	1.764	1.764
TOTAL SERVICE REQUIREMENTS (TSR)	258,354	5,014,749	322,942	6,268,437	387,531	7,522,124
% DELEGATION & SUBSTITUTION	0.10	0.30	0.10	0.30	0.10	0.30
	25,835	1,504,425	32,294	1,880,531	38,753	2,256,637
TSR (NET OF DELEGATION & SUBST.)	232,518	3,510,325	290,648	4,387,906	348,778	5,265,487
ANNUAL PRODUCTIVITY	3,432	3,432	3,432	3,432	3,432	3,432
OFFICE VISITS (HRS.)/DAY	11	11	11	11	11	11
DAYS WORKED/WEEK	6	6	6	6	6	6
WEEKS WORKED/YEAR	52	52	52	52	52	52
FTE PHYSICIAN REQUIRED FOR DIRECT	68	1,023	85	1,279	102	1,534
PATIENT CARE						
% REQ FOR T, R, A	0.25	0.00	0.25	0.00	0.25	0.00
	17	0	21	0	25	0
MANPOWER REQUIREMENTS	85	1,023	106	1,279	127	1,534
TOTAL	1,108		1,384		1,661	



Table B4b

**ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR OPHTHALMOLOGISTS  
USING MODIFIED GMENAC MODEL  
2000**

	Low Assumption		Medium Assumption		High Assumption	
	OCULAR MORBIDITIES	BLINDNESS PREVALENCE (Binocular/ Monocular) with backlog 40%	OCULAR MORBIDITIES	BLINDNESS PREVALENCE (Binocular/ Monocular) with backlog 33%	OCULAR MORBIDITIES	BLINDNESS PREVALENCE (Binocular/ Monocular) with backlog 25%
POPULATION	75,224,000	75,224,000	75,224,000	75,224,000	75,224,000	75,224,000
MORBIDITY CASE	37,612	753,745	57,922	841,681	57,922	942,181
MORBIDITY CASE (%)	0.000500	0.0100	0.0007700	0.0112	0.0007700	0.0125
% REQUIRING CARE	0.37	0.37	0.37	0.37	0.37	0.37
ADJUSTED NEEDS	13,916	278,886	21,431	311,422	21,431	348,607
NORMS OF CARE	17.64	17.64	17.64	17.64	17.64	17.64
FREQUENCY OF CONSULTATION	10	10	10	10	10	10
DURATION OF CONSULTATION (MIN)	105.84	105.84	105.84	105.84	105.84	105.84
(HRS.)	1.764	1.764	1.764	1.764	1.764	1.764
TOTAL SERVICE REQUIREMENTS (TSR)	245,486	4,919,543	378,048	5,493,484	378,048	6,149,427
% DELEGATION & SUBSTITUTION	0	0.30	0	0.30	0	0.30
		1,475,863		1,648,045		1,844,828
TSR (NET OF DELEGATION & SUBST.)	245,486	3,443,680	378,048	3,845,438	378,048	4,304,599
ANNUAL PRODUCTIVITY	3,432	3,432	3,432	3,432	3,432	3,432
OFFICE VISITS (HRS.)/DAY	11	11	11	11	11	11
DAYS WORKED/WEEK	6	6	6	6	6	6
WEEKS WORKED/YEAR	52	52	52	52	52	52
FTE PHYSICIAN REQUIRED FOR DIRECT PATIENT CARE	72	1,003	110	1,120	110	1,254
% REQ FOR T, R, A	0.25	0.00	0.25	0.00	0.25	0.00
	18	0	28	0	28	0
MANPOWER REQUIREMENTS	89	1,003	138	1,120	138	1,254
TOTAL	1,092		1,258		1,392	

Table B30

## ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR PEDIATRICS USING MODIFIED GMENAC MODEL

1992 High Assumption											
	TYPHOID***	DIARRHEAS	TB	LEPROSY	DIPHTHERIA	WHOOPING COUGH	TETANUS	ACUTE POLIO- MYELITIS	VARICELLA	MEASLES	H-FEVER
POPULATION*	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376
MORBIDITY CASE	176,850	792,088	206,758	169,689	168,982	176,409	170,631	168,679	182,348	235,106	170,429
MORBIDITY CASE (%)	0.0052	0.0235	0.0061	0.005040	0.005018	0.0053	0.0051	0.005010	0.0054	0.0070	0.0051
% REQUIRING CARE	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
ADJUSTED NEEDS	87,925	396,344	103,379	84,844	84,491	89,204	85,315	84,338	91,174	117,553	85,214
NORMS OF CARE	2	2	2	2	2	2	2	2	2	2	2
FREQUENCY OF CONSULTATION**	13	13	13	13	13	13	13	13	13	13	13
DURATION OF CONSULTATION (MIN)	10	10	10	10	10	10	10	10	10	10	10
(HRS.)	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
TOTAL SERVICE REQUIREMENTS	190,604	856,746	223,088	183,630	183,064	193,276	184,850	182,735	197,644	264,896	184,631
% DELEGATION & SUBSTITUTION (0.37)	70.486	317,798	82,875	68,017	67,734	71,512	66,395	67,612	73,091	94,238	68,314
TSR (NET OF DELEGATION & SUBSTITUTION)	120,018	541,009	141,112	115,613	115,330	121,764	118,455	115,123	124,452	160,460	116,318
ANNUAL PRODUCTIVITY	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756
OFFICE VISITS (HRS./DAY)	8	8	8	8	8	8	8	8	8	8	8
DAYS WORKED/WEEK	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
WEEKS WORKED/YEAR	53	53	53	53	53	53	53	53	53	53	53
FTE PHYSICIAN REQUIRED FOR DIRECT PATIENT CARE	44	196	51	42	42	44	42	42	45	58	42
% REQ FOR T, R, A	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	4	20	5	4	4	4	4	4	5	6	4
MANPOWER REQUIREMENTS	48	216	56	46	46	49	46	48	60	64	46

	INFECTIOUS HEPATITIS	MALARIA	SYPHILIS	GONOCOCCAL INFECTION	SCHISTO- SOMIASIS	FILARIASIS	MALIGNANT NEOPLASMS	DISEASES OF THE HEART	BRONCHITIS	PNEUMONIAS	INFLUENZA	ACCIDENTS
POPULATION*	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376	33,668,376
MORBIDITY CASE	178,490	224,839	166,376	172,079	183,594	166,425	171,644	180,294	926,719	372,238	654,109	227,866
MORBIDITY CASE (%)	0.0052	0.0067	0.005001	0.0051	0.0055	0.005002	0.0051	0.0054	0.0276	0.0111	0.0194	0.0068
% REQUIRING CARE	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
ADJUSTED NEEDS	88,245	112,469	84,188	86,039	91,797	84,212	85,922	90,147	464,859	186,119	327,054	113,634
NORMS OF CARE	2	2	2	2	2	2	2	2	2	2	2	2
FREQUENCY OF CONSULTATION**	13	13	13	13	13	13	13	13	13	13	13	13
DURATION OF CONSULTATION (MIN)	10	10	10	10	10	10	10	10	10	10	10	10
(HRS.)	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
TOTAL SERVICE REQUIREMENTS	191,197	243,684	182,407	186,419	198,893	182,460	186,184	195,318	1,007,195	403,259	706,816	246,857
% DELEGATION & SUBSTITUTION (0.37)	70.743	90,183	67,491	68,976	73,591	67,610	66,661	72,268	372,662	149,205	262,189	91,237
TSR	120,454	153,521	114,917	117,444	125,303	114,850	117,523	123,051	634,533	254,052	444,622	155,620
ANNUAL PRODUCTIVITY	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756
OFFICE VISITS/DAY	8	8	8	8	8	8	8	8	8	8	8	8
DAYS WORKED/WEEK	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
WEEKS WORKED/YEAR	53	53	53	53	53	53	53	53	53	53	53	53
FTE PHYSICIAN REQUIRED FOR DIRECT CARE	44	56	42	43	45	42	43	45	230	92	162	56
% REQ FOR T, R, A	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	4	9	4	4	5	4	4	4	23	9	16	6
MANPOWER REQUIREMENTS	48	61	46	47	50	46	47	49	253	101	178	62
TOTAL	1,702											

\* Population projection - 0-21 yrs old

\*\* 0-12 months old requires 9 visits/year, below 2 yrs old requires 3 visits/yr; 2 yrs old &amp; above requires 1 visit/year; diarrheal cases - 2 visits per episode, 6 episodes per year

\*\*\* Includes typhoid fever and other salmonella infections

Table B3a

## ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR PEDIATRICS USING MODIFIED GMENAC MODEL

2000  
Low Assumption

	TYPHOID***	DIARRHEAS	TB	LEPROSY	DIPHTHERIA	WHOOPING COUGH	TETANUS	ACUTE POLIO	VARICELLA	MEASLES	H-FEVER
POPULATION*	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662
MORBIDITY CASE	8,126	676,719	41,677	1,458	692	10,895	2,478	394	15,158	72,258	2,259
MORBIDITY CASE (%)	0.0002	0.018544	0.001141	0.00004	0.0000190	0.000299	0.000068	0.000010	0.000418	0.001983	0.000062
% REQUIRING CARE	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
ADJUSTED NEEDS	4,063	337,859	20,788	729	346	5,448	1,239	192	7,579	36,129	1,130
NORMS OF CARE	2	2	2	2	2	2	2	2	2	2	2
FREQUENCY OF CONSULTATION**	13	13	13	13	13	13	13	13	13	13	13
DURATION OF CONSULTATION (MIN)	10	10	10	10	10	10	10	10	10	10	10
(HRS.)	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
TOTAL SERVICE REQUIREMENTS	8,603	732,028	45,041	1,679	760	11,603	2,884	395	18,422	79,279	2,447
% DELEGATION & SUBSTITUTION (0.40)	3,621	292,811	18,018	632	300	4,721	1,074	168	6,569	31,312	979
TSR	5,282	439,217	27,025	947	450	7,082	1,811	227	9,853	48,068	1,468
ANNUAL PRODUCTIVITY	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756
OFFICE VISITS/DAY	8	8	8	8	8	8	8	8	8	8	8
DAYS WORKED/WEEK	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
WEEKS WORKED/YEAR	53	53	53	53	53	53	53	53	53	53	53
FTE PHYSICIAN REQUIRED FOR DIRECT PATIENT CARE	2	159	10	0	0	3	1	0	4	17	1
% REQ FOR T, R, A	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	0	16	1	0	0	0	0	0	0	2	0
MANPOWER REQUIREMENTS	2	175	11	0	0	3	1	0	4	19	1

	INFECTIOUS HEPATITIS	MALARIA	SYPHILIS	GONOCOCCAL INFECTION	SCHISTO- SOMIASIS	FILARIASIS	MALIGNANT NEOPLASMS	DISEASES OF THE HEART	BRONCHITIS	PNEUMONIAS	INFLUENZA	ACCIDENTS
POPULATION*	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662
MORBIDITY CASE	8,818	61,253	38	4,045	16,507	91	3,790	12,836	824,024	220,673	525,737	64,424
MORBIDITY CASE (%)	0.000242	0.001681	0.000001	0.000111	0.000453	0.0000025	0.000104	0.000355	0.022814	0.006056	0.014428	0.001788
% REQUIRING CARE	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
ADJUSTED NEEDS	4,409	30,627	18	2,022	8,253	46	1,895	6,468	412,012	110,336	262,869	32,212
NORMS OF CARE	2	2	2	2	2	2	2	2	2	2	2	2
FREQUENCY OF CONSULTATION**	13	13	13	13	13	13	13	13	13	13	13	13
DURATION OF CONSULTATION (MIN)	10	10	10	10	10	10	10	10	10	10	10	10
(HRS.)	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
TOTAL SERVICE REQUIREMENTS	9,553	65,358	39	4,362	17,882	99	4,106	14,014	892,693	239,092	689,646	69,792
% DELEGATION & SUBSTITUTION (0.40)	3,821	26,543	16	1,763	7,183	39	1,642	5,605	357,077	95,626	277,619	27,917
TSR	5,732	38,815	24	2,629	10,729	60	2,463	8,408	535,616	143,437	341,728	41,875
ANNUAL PRODUCTIVITY	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756
OFFICE VISITS/DAY	8	8	8	8	8	8	8	8	8	8	8	8
DAYS WORKED/WEEK	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
WEEKS WORKED/YEAR	53	53	53	53	53	53	53	53	53	53	53	53
FTE PHYSICIAN REQUIRED FOR DIRECT PATIENT CARE	2	14	0	1	4	0	1	3	194	52	124	15
% REQ FOR T, R, A	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	0	1	0	0	0	0	0	0	19	6	12	2
MANPOWER REQUIREMENTS	2	16	0	1	4	0	1	3	214	67	136	17
TOTAL	668											

\* Population projection - 0-21 yrs old

\*\* 0-12 months old requires 9 visits/year, below 2 yrs old requires 3 visits/yr; 2 yrs old &amp; above requires 1 visit/year; diarrheal cases - 2 visits per episode, 6 episodes per year

\*\*\*Includes paratyphoid fever and other salmonella infections

Table B3b

## ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR PEDIATRICS USING MODIFIED OMENAC MODEL

2000 Medium Assumption											
	TYPHOID***	DIARRHEAS	TB	LEPROSY	DIPHTHERIA	WHOOPING COUGH	TETANUS	ACUTE POLIO- MYELITIS	VARICELLA	MEASLES	H-FEVER
POPULATION *	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662
MORBIDITY CASE	8,128	675,719	41,577	1,458	692	10,895	2,478	364	15,158	72,258	2,259
MORBIDITY CASE (%)	0.0002	0.018544	0.001141	0.00004	0.0000190	0.000299	0.000068	0.000010	0.000416	0.001993	0.000062
% REQUIRING CARE	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
ADJUSTED NEEDS	4,063	337,859	20,788	729	346	5,448	1,239	182	7,579	36,129	1,130
NORMS OF CARE	2	2	2	2	2	2	2	2	2	2	2
FREQUENCY OF CONSULTATION**	13	13	13	13	13	13	13	13	13	13	13
DURATION OF CONSULTATION (MIN)	10	10	10	10	10	10	10	10	10	10	10
(HRS.)	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
TOTAL SERVICE REQUIREMENTS	8,603	732,028	45,041	1,579	750	11,603	2,684	395	10,422	79,279	2,447
% DELEGATION & SUBSTITUTION (0.37)	3,257	270,851	16,665	584	278	4,367	993	146	6,076	28,963	908
TSR	5,346	461,178	28,376	995	472	7,236	1,691	249	10,346	48,316	1,542
ANNUAL PRODUCTIVITY	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756
OFFICE VISITS/DAY	8	8	8	8	8	8	8	8	8	8	8
DAYS WORKED/WEEK	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
WEEKS WORKED/YEAR	53	53	53	53	53	53	53	53	53	53	53
FTE PHYSICIAN REQUIRED FOR DIRECT PATIENT CARE	2	167	10	0	0	3	1	0	4	18	1
% REQ FOR T, R, A	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
MANPOWER REQUIREMENTS	2	164	11	0	0	3	1	0	4	20	1

	INFECTIOUS HEPATITIS	MALARIA	SYPHILIS	GONOCOCCAL INFECTION	SCHISTO- SOMIASIS	FILARIASIS	MALIGNANT NEOPLASMS	DISEASES OF THE HEART	BRONCHITIS	PNEUMONIAS	INFLUENZA	ACCIDENTS
POPULATION *	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662
MORBIDITY CASE	8,818	61,233	36	4,045	16,507	91	3,790	12,836	824,024	220,873	526,737	64,424
MORBIDITY CASE (%)	0.000242	0.001681	0.000001	0.000111	0.000453	0.0000025	0.000104	0.000355	0.022614	0.006056	0.014428	0.001768
% REQUIRING CARE	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
ADJUSTED NEEDS	4,409	30,627	18	2,022	8,253	46	1,895	6,468	412,012	110,336	262,969	32,212
NORMS OF CARE	2	2	2	2	2	2	2	2	2	2	2	2
FREQUENCY OF CONSULTATION**	13	13	13	13	13	13	13	13	13	13	13	13
DURATION OF CONSULTATION (MIN)	10	10	10	10	10	10	10	10	10	10	10	10
(HRS.)	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
TOTAL SERVICE REQUIREMENTS	9,563	66,358	39	4,392	17,892	99	4,106	14,014	692,893	239,092	689,848	89,792
% DELEGATION & SUBSTITUTION (0.37)	3,636	24,652	16	1,621	6,616	37	1,519	5,165	330,295	89,453	210,733	28,623
TSR	6,018	41,696	25	2,761	11,266	62	2,586	8,829	362,598	150,009	359,215	43,969
ANNUAL PRODUCTIVITY	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756
OFFICE VISITS/DAY	8	8	8	8	8	8	8	8	8	8	8	8
DAYS WORKED/WEEK	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
WEEKS WORKED/YEAR	53	53	53	53	53	53	53	53	53	53	53	53
FTE PHYSICIAN REQUIRED FOR DIRECT PATIENT CARE	2	15	0	1	4	0	1	3	204	63	130	19
% REQ FOR T, R, A	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
MANPOWER REQUIREMENTS	2	17	0	1	4	0	1	4	224	60	143	19
TOTAL	791											

\* Population projection - 0-21 yrs old

\*\* 0-12 months old requires 9 visits/year, below 2 yrs old requires 3 visits/year; 2 yrs old &amp; above requires 1 visit/year; diarrheal cases - 2 visits per episode, 6 episodes per year

\*\*\*Includes paratyphoid fever and other salmonella infections

Table B3c

## ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR PEDIATRICS USING MODIFIED OMENAC MODEL

	2000 High Assumption										
	TYPHOID***	DIARRHEAS	TB	LEPROSY	DIPHTHERIA	WHOOPING COUGH	TETANUS	ACUTE POLIO- MYELITIS	VARICELLA	MEASLES	H-FEVER
POPULATION *	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662
MORBIDITY CASE	180,310	857,912	223,770	183,651	182,886	183,088	184,671	182,558	187,352	254,451	184,453
MORBIDITY CASE (%)	0.0052	0.023544	0.006141	0.00504	0.0050180	0.005299	0.005068	0.005010	0.005418	0.006993	0.005092
% REQUIRING CARE	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
ADJUSTED NEEDS	95,160	428,956	111,885	91,828	91,443	98,644	92,336	91,279	98,676	127,229	92,228
NORMS OF CARE	2	2	2	2	2	2	2	2	2	2	2
FREQUENCY OF CONSULTATION**	13	13	13	13	13	13	13	13	13	13	13
DURATION OF CONSULTATION (MIN)	10	10	10	10	10	10	10	10	10	10	10
(HRS.)	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
TOTAL SERVICE REQUIREMENTS	206,179	929,405	242,417	198,955	198,126	209,179	200,060	197,771	213,798	275,655	199,824
% DELEGATION & SUBSTITUTION (0.37)	78.286	343,880	89,894	73,813	73,307	77,396	74,022	73,175	79,105	101,693	73,935
TSR	128,893	685,525	152,723	125,342	124,818	131,783	126,038	124,596	134,693	173,663	125,889
ANNUAL PRODUCTIVITY	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756
OFFICE VISITS/DAY	6	6	6	6	6	6	6	6	6	6	6
DAYS WORKED/WEEK	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
WEEKS WORKED/YEAR	53	53	53	53	53	53	53	53	53	53	53
FTE PHYSICIAN REQUIRED FOR DIRECT PATIENT CARE	47	212	55	45	45	48	46	45	49	63	48
% REQ FOR T, R, A	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	6	21	6	5	5	5	6	5	5	6	6
MANPOWER REQUIREMENTS	52	234	61	50	50	53	50	50	64	69	50

	INFECTIOUS HEPATITIS	MALARIA	SYPHILIS	GONOCOCCAL INFECTION	SCHISTO- SOMIASIS	FILARIASIS	MALIGNANT NEOPLASMS	DISEASES OF THE HEART	BRONCHITIS	PNEUMONIAS	INFLUENZA	ACCIDENTS
POPULATION *	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662	36,438,662
MORBIDITY CASE	191,011	1,883,186	1,821,970	1,825,978	1,838,440	1,822,024	1,825,723	1,834,869	2,845,957	2,042,009	2,247,870	1,889,357
MORBIDITY CASE (%)	0.005242	0.051681	0.050001	0.050111	0.050453	0.0500025	0.050104	0.050355	0.072614	0.056096	0.064428	0.051768
% REQUIRING CARE	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
ADJUSTED NEEDS	95,606	841,693	810,885	812,989	819,220	811,012	812,861	817,434	1,322,979	1,021,303	1,173,835	943,178
NORMS OF CARE	2	2	2	2	2	2	2	2	2	2	2	2
FREQUENCY OF CONSULTATION**	13	13	13	13	13	13	13	13	13	13	13	13
DURATION OF CONSULTATION (MIN)	10	10	10	10	10	10	10	10	10	10	10	10
(HRS.)	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
TOTAL SERVICE REQUIREMENTS	208,929	2,040,119	1,973,800	1,978,143	1,991,643	1,973,880	1,977,866	1,987,775	2,866,453	2,212,623	2,543,309	2,043,663
% DELEGATION & SUBSTITUTION (0.37)	78.564	754,844	730,306	731,013	736,906	730,328	731,811	735,477	1,060,586	815,744	941,024	766,118
TSR	130,365	1,285,275	1,243,494	1,246,230	1,254,735	1,243,552	1,246,056	1,252,298	1,805,866	1,396,879	1,602,285	1,287,439
ANNUAL PRODUCTIVITY	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756	2,756
OFFICE VISITS/DAY	6	6	6	6	6	6	6	6	6	6	6	6
DAYS WORKED/WEEK	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
WEEKS WORKED/YEAR	53	53	53	53	53	53	53	53	53	53	53	53
FTE PHYSICIAN REQUIRED FOR DIRECT PATIENT CARE	47	466	451	452	455	451	452	454	655	606	691	487
% REQ FOR T, R, A	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	6	47	45	45	46	45	45	45	66	61	66	47
MANPOWER REQUIREMENTS	52	513	496	497	501	496	497	500	721	656	640	514
Total	9,796											

\* Population projection - 0-21 yrs old

\*\* 0-12 months old requires 9 visits/year, below 2 yrs old requires 3 visits/yr; 2 yrs old &amp; above requires 1 visit/year; diarrheal cases - 2 visits per episode, 6 episodes per year

\*\*\*Includes typhoid fever and other salmonella

Table B4a

ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR OPHTHALMOLOGISTS  
USING MODIFIED GMENAC MODEL  
1992

	Low Assumption		Medium Assumption		High Assumption	
	OCULAR MORBIDITIES	BLINDNESS PREVALENCE (Binocular/ Monocular) with backlog 10.5%	OCULAR MORBIDITIES	BLINDNESS PREVALENCE (Binocular/ Monocular) with backlog 10.5%	OCULAR MORBIDITIES	BLINDNESS PREVALENCE (Binocular/ Monocular) with backlog 10.5%
POPULATION	64,259,000	64,259,000	64,259,000	64,259,000	64,259,000	64,259,000
MORBIDITY CASE	49,479	960,415	49,479	960,415	49,479	960,415
MORBIDITY CASE (%)	0.0007700	0.0149	0.0007700	0.0149	0.0007700	0.0149
% REQUIRING CARE	0.37	0.37	0.37	0.37	0.37	0.37
ADJUSTED NEEDS	18,307	355,354	18,307	355,354	18,307	355,354
NORMS OF CARE	14.11	14.11	17.64	17.64	21.17	21.17
FREQUENCY OF CONSULTATION	8	8	10	10	12	12
DURATION OF CONSULTATION (MIN.)	105.84	105.84	105.84	105.84	105.84	105.84
(HRS.)	1.764	1.764	1.764	1.764	1.764	1.764
TOTAL SERVICE REQUIREMENTS (TSR)	258,354	5,014,749	322,942	6,268,437	387,531	7,522,124
% DELEGATION & SUBSTITUTION	0.10	0.30	0.10	0.30	0.10	0.30
	25,835	1,504,425	32,294	1,880,531	38,753	2,256,637
TSR (NET OF DELEGATION & SUBST.)	232,518	3,510,325	290,648	4,387,906	348,778	5,265,487
ANNUAL PRODUCTIVITY	3,432	3,432	3,432	3,432	3,432	3,432
OFFICE VISITS (HRS.)/DAY	11	11	11	11	11	11
DAYS WORKED/WEEK	6	6	6	6	6	6
WEEKS WORKED/YEAR	52	52	52	52	52	52
FTE PHYSICIAN REQUIRED FOR DIRECT	68	1,023	85	1,279	102	1,534
PATIENT CARE						
% REQ FOR T, R, A	0.25	0.00	0.25	0.00	0.25	0.00
	17	0	21	0	25	0
MANPOWER REQUIREMENTS	85	1,023	106	1,279	127	1,534
TOTAL	1,108		1,384		1,661	

Table B4b

**ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR OPHTHALMOLOGISTS  
USING MODIFIED GMENAC MODEL  
2000**

	Low Assumption		Medium Assumption		High Assumption	
	OCULAR MORBIDITIES	BLINDNESS PREVALENCE (Binocular/ Monocular) with backlog 40%	OCULAR MORBIDITIES	BLINDNESS PREVALENCE (Binocular/ Monocular) with backlog 33%	OCULAR MORBIDITIES	BLINDNESS PREVALENCE (Binocular/ Monocular) with backlog 25%
POPULATION	75,224,000	75,224,000	75,224,000	75,224,000	75,224,000	75,224,000
MORBIDITY CASE	37,612	753,745	57,922	841,681	57,922	942,181
MORBIDITY CASE (%)	0.000500	0.0100	0.0007700	0.0112	0.0007700	0.0125
% REQUIRING CARE	0.37	0.37	0.37	0.37	0.37	0.37
ADJUSTED NEEDS	13,916	278,886	21,431	311,422	21,431	348,607
NORMS OF CARE	17.64	17.64	17.64	17.64	17.64	17.64
FREQUENCY OF CONSULTATION	10	10	10	10	10	10
DURATION OF CONSULTATION (MIN)	105.84	105.84	105.84	105.84	105.84	105.84
(HRS.)	1.764	1.764	1.764	1.764	1.764	1.764
TOTAL SERVICE REQUIREMENTS (TSR)	245,486	4,919,543	378,048	5,493,484	378,048	6,149,427
% DELEGATION & SUBSTITUTION	0	0.30	0	0.30	0	0.30
		1,475,863		1,648,045		1,844,828
TSR (NET OF DELEGATION & SUBST.)	245,486	3,443,680	378,048	3,845,438	378,048	4,304,599
ANNUAL PRODUCTIVITY	3,432	3,432	3,432	3,432	3,432	3,432
OFFICE VISITS (HRS.)/DAY	11	11	11	11	11	11
DAYS WORKED/WEEK	6	6	6	6	6	6
WEEKS WORKED/YEAR	52	52	52	52	52	52
FTE PHYSICIAN REQUIRED FOR DIRECT PATIENT CARE	72	1,003	110	1,120	110	1,254
% REQ FOR T, R, A	0.25	0.00	0.25	0.00	0.25	0.00
	18	0	28	0	28	0
MANPOWER REQUIREMENTS	89	1,003	138	1,120	138	1,254
TOTAL	1,092		1,258		1,392	

Table B:

## ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR SURGEONS USING MODIFIED GMENAC MODEL

	1992			2000		
	Low Assumption	Medium Assumption	High Assumption	Low Assumption	Medium Assumption	High Assumption
POPULATION	64,259,000	64,259,000	64,259,000	75,224,000	75,224,000	75,224,000
MORBIDITY CASE	321,295	381,920	963,885	338,508	752,240	1,128,360
MORBIDITY CASE (%)	0.005	0.01	0.015	0.0045	0.0100	0.0150
% REQUIRING CARE	0.20	0.20	0.20	0.20	0.20	0.20
ADJUSTED NEEDS	64,259	76,384	192,777	67,702	150,448	225,672
NORMS OF CARE	2.50	2.50	2.50	2.50	2.50	2.50
FREQUENCY OF CONSULTATION	1	1	1	1	1	1
DURATION OF CONSULTATION (MIN)	150.00	150.00	150.00	150.00	150.00	150.00
(HRS.)	2.50	2.50	2.50	2.50	2.50	2.50
TOTAL SERVICE REQUIREMENTS (TSR)	160,648	190,960	481,943	169,254	376,120	564,180
% DELEGATION & SUBSTITUTION	0.000	0.000	0.000	0.000	0.000	0.000
	0	0	0	0	0	0
TSR (NET OF DELEGATION & SUBST.)	160,648	190,960	481,943	169,254	376,120	564,180
ANNUAL PRODUCTIVITY	759	759	759	759	759	759
OFFICE VISITS (HRS.)/DAY	3	3	3	3	3	3
DAYS WORKED/WEEK	5.50	5.50	5.50	5.50	5.50	5.50
WEEKS WORKED/YEAR	46	46	46	46	46	46
FTE PHYSICIAN REQUIRED FOR DIRECT PATIENT CARE	212	252	635	223	496	743
% REQ FOR T, R, A	0.50	0.50	0.50	0.50	0.50	0.50
	106	126	317	111	248	372
MANPOWER REQUIREMENTS	317	377	952	334	743	1,115



Table B6a

## ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR OBSTETRICIAN-GYNECOLOGISTS USING MODIFIED GMENAC MODEL

1992

	Low Assumption		Medium Assumption		High Assumption	
	Delivery	Pregnant and non-pregnant women w/ diseases	Delivery	Pregnant and non-pregnant women w/ diseases	Delivery	Pregnant and non-pregnant women w/ diseases
POPULATION (female-15 to 49 years of age)*		16,362,821		16,362,821		16,362,821
MORBIDITY CASES	2,249,065	3,272,564	2,249,065	3,272,564	2,249,065	3,272,564
MORBIDITY CASE (%)		0.20		0.20		0.20
PERCENTAGE REQUIRING CARE	0.10	0.20	0.13	0.40	0.15	0.50
ADJUSTED NEEDS	224,907	654,513	292,378	1,309,026	337,360	1,636,282
NORMS OF CARE	7.00	10.67	7.00	10.67	7.00	10.67
FREQUENCY OF CONSULTATION	6	16	6	16	6	16
DURATION OF CONSULTATION (MIN)	70	40	70	40	70	40
HRS	1.17	0.67	1.17	0.67	1.17	0.67
TOTAL SERVICE REQUIREMENTS (TSR)	1,574,346	6,981,470	2,046,649	13,962,941	2,361,518	17,453,676
% DELEGATION AND SUBSTITUTION	0.05	0.05	0.05	0.05	0.05	0.05
TSR (NET OF DELEGATION & SUBST.)	78,717	349,074	102,332	698,147	118,076	872,684
	1,495,628	6,632,397	1,944,317	13,264,794	2,243,442	16,580,992
ANNUAL PRODUCTIVITY	2,760	2,760	2,760	2,760	2,760	2,760
OFFICE VISITS (HRS.)/DAY	10	10	10	10	10	10
DAYS WORKED/WEEK	6	6	6	6	6	6
WEEKS WORKED/YEAR	46	46	46	46	46	46
FTE PHYSICIAN REQUIRED FOR DIRECT PATIENT CARE	29	128	37	253	43	316
% REQ FOR T, R, A	0.30	0.30	0.30	0.30	0.30	0.30
	9	38	11	76	13	95
MANPOWER REQUIREMENTS	550	2,441	716	4,882	826	6,102
	2,991		5,598		6,928	

\* The female population of child bearing age (15-49 years) is based on the NSO population projections, 1992 and 2000 using the medium assumption-moderate fertility and moderate mortality decline using 1980 census of population and housing (CPH).

Table B6b

## ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR OBSTETRICIAN-GYNECOLOGISTS USING MODIFIED GMENAC MODEL

2000

	Low Assumption		Medium Assumption		High Assumption	
	Delivery	Pregnant and non-pregnant women w/ diseases	Delivery	Pregnant and non-pregnant women w/ diseases	Delivery	Pregnant and non-pregnant women w/ diseases
POPULATION (female-15 to 49 years of age)*		19,985,426		19,985,426		19,985,426
MORBIDITY CASES	2632840	3,997,085	2632840	3,997,085	2632840	3,997,085
MORBIDITY CASE (%)		0.20		0.20		0.20
PERCENTAGE REQUIRING CARE	0.10	0.20	0.13	0.40	0.15	0.50
ADJUSTED NEEDS	263,284	799,417	342,269	1,598,834	394,926	1,998,543
NORMS OF CARE	7.00	10.67	7.00	10.67	7.00	10.67
FREQUENCY OF CONSULTATION	6	16	6	16	6	16
DURATION OF CONSULTATION (MIN)	70	40	70	40	70	40
HRS	1.17	0.67	1.17	0.67	1.17	0.67
TOTAL SERVICE REQUIREMENTS (TSR)	1,842,988	8,527,115	2,395,884	17,054,230	2,764,482	21,317,788
% DELEGATION AND SUBSTITUTION	0.05	0.05	0.05	0.05	0.05	0.05
TSR (NET OF DELEGATION & SUBST.)	92,149	426,356	119,794	852,712	138,224	1,065,889
	1,750,839	8,100,759	2,276,090	16,201,519	2,626,258	20,251,898
ANNUAL PRODUCTIVITY	2,760	2,760	2,760	2,760	2,760	2,760
OFFICE VISITS (HRS.)/DAY	10	10	10	10	10	10
DAYS WORKED/WEEK	6	6	6	6	6	6
WEEKS WORKED/YEAR	46	46	46	46	46	46
FTE PHYSICIAN REQUIRED FOR DIRE	33	154	43	309	50	386
PATIENT CARE	634	2,935	825	5,870	952	7,338
% REQ FOR T, R, A	0.30	0.30	0.30	0.30	0.30	0.30
	10	46	13	93	15	118
MANPOWER REQUIREMENTS	644	2,981	838	5,963	967	7,454
	3,626		6,800		8,420	

\* The female population of child bearing age (15-49 years) is based on the NSO population projections, 1992 and 2000 using the medium assumption-moderate fertility and moderate mortality decline using 1980 Census of Population and Housing (CPH).

Table B7

**ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR PULMONOLOGIST/CHEST SPECIALIST  
USING MODIFIED GMENAC MODEL**

	1992			2000		
	Low Assumption	Medium Assumption	High Assumption	Low Assumption	Medium Assumption	High Assumption
POPULATION	64,259,000	64,259,000	64,259,000	75,224,000	75,224,000	75,224,000
MORBIDITY CASE	1,453,851	25,703,600	44,981,300	1,616,835	26,328,400	56,418,000
MORBIDITY CASE (%)	0.02262	0.40000	0.70000	0.02149	0.35000	0.75000
% REQUIRING CARE	0.70	0.10	0.10	0.70	0.10	0.10
ADJUSTED NEEDS	1,017,695	2,570,360	4,498,130	1,131,784	2,632,840	5,641,800
NORMS OF CARE	0.492	0.492	0.492	0.492	0.492	0.492
FREQUENCY OF CONSULTATION						
bronchitis	6	6	6	6	6	6
pneumonia	6	6	6	6	6	6
tuberculosis	3	3	3	3	3	3
cancer of the lungs	2	2	2	2	2	2
DURATION OF CONSULTATION (HRS)						
bronchitis	0.083	0.083	0.083	0.083	0.083	0.083
pneumonia	0.083	0.083	0.083	0.083	0.083	0.083
tuberculosis	0.083	0.083	0.083	0.083	0.083	0.083
cancer of the lungs	2.500	2.500	2.500	2.500	2.500	2.500
TOTAL SERVICE REQUIREMENTS	500,634	1,264,436	2,212,763	556,758	1,295,172	2,775,368
% DELEGATION & SUBSTITUTION	0.150	0.150	0.150	0.150	0.150	0.150
	75,095	189,665	331,914	83,514	194,278	418,305
TSR (NET OF DELEGATION & SUBS.)	425,539	1,074,771	1,880,849	473,244	1,100,898	2,359,063
ANNUAL PRODUCTIVITY	2,760	2,760	2,760	2,760	2,760	2,760
OFFICE VISITS (HRS.)/DAY	10	10	10	10	10	10
DAYS WORKED/WEEK	6	6	6	6	6	6
WEEKS WORKED/YEAR	46	46	46	46	46	46
FTE PHYSICIAN REQUIRED FOR	154	389	681	171	399	855
DIRECT PATIENT CARE						
% REQ FOR T, R, A	0.40	0.40	0.40	0.40	0.40	0.40
	62	156	273	69	160	342
MANPOWER REQUIREMENTS	216	545	954	240	558	1,197

Table B8

**ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR PYSCHIATRISTS  
USING MODIFIED GMENAC MODEL**

	1992			2000		
	Low Assumption	Medium Assumption	High Assumption	Low Assumption	Medium Assumption	High Assumption
POPULATION (2000)	64,259,000	64,259,000	64,259,000	75,224,000	75,224,000	75,224,000
MORBIDITY CASE	1,156,662	1,285,180	1,606,475	1,354,032	1,504,480	1,880,600
MORBIDITY CASE (%)	0.018	0.020	0.025	0.018	0.020	0.025
% REQUIRING CARE	0.85	0.85	0.85	0.85	0.85	0.85
ADJUSTED NEEDS	983,163	1,092,403	1,365,504	1,150,927	1,278,808	1,598,510
NORMS OF CARE	2.73	2.73	2.73	2.73	2.73	2.73
FREQUENCY OF CONSULTATION	6	6	6	6	6	6
DURATION OF CONSULTATION (MIN (HRS.))	27.30 0.455	27.30 0.455	27.30 0.455	27.30 0.455	27.30 0.455	27.30 0.455
TOTAL SERVICE REQUIREMENTS	2,684,034	2,982,260	3,727,825	3,142,031	3,491,146	4,363,932
% DELEGATION & SUBSTITUTION	0.15	0.15	0.15	0.15	0.15	0.15
	402,605	447,339	559,174	471,305	523,672	654,590
TSR (NET OF DELEGATION & SUBST	2,281,429	2,534,921	3,168,651	2,670,727	2,967,474	3,709,342
ANNUAL PRODUCTIVITY	1,035	1,035	1,035	1,035	1,035	1,035
OFFICE VISITS (HRS.)/DAY	4.5	4.5	4.5	4.5	4.5	4.5
DAYS WORKED/WEEK	5	5	5	5	5	5
WEEKS WORKED/YEAR	46	46	46	46	46	46
FTE PHYSICIAN REQUIRED FOR	2,204	2,449	3,061	2,580	2,867	3,584
DIRECT PATIENT CARE						
% REQ FOR T, R, A	0.025	0.025	0.025	0.025	0.025	0.025
NUMBER REQ FOR T,R,A	55	61	77	65	72	90
MANPOWER REQUIREMENTS	2,259	2,510	3,138	2,645	2,939	3,674

Table B9a  
ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR MEDICAL DOCTORS-INFECTIOUS DISEASES USING MODIFIED GMENAC MODEL  
1992

	LOW ASSUMPTION									
	TYPHOID*	DIARRHEAS	TB ALL FORMS	LEPROSY	DIPHTHERIA	WHOOPING COUGH	TETANUS	ACUTE POLIO	VARICELLA	MEASLES
POPULATION	64,259,000	64,259,000	64,259,000	64,259,000	64,259,000	64,259,000	64,259,000	64,259,000	64,259,000	64,259,000
MORBIDITY CASE	17,794	741,733	206,508	4,228	1,297	9,468	3,102	335	16,831	68,498
MORBIDITY CASE (%)	0.0003	0.0115	0.0032	0.0001	0.000020	0.0001	0.00005	0.000005	0.0003	0.0011
% REQUIRING CARE	0.80	0.20	0.50	1	1	0.80	1	0.80	1	0.80
ADJUSTED NEEDS	14,235	148,347	103,254	4,228	1,297	7,573	3,102	268	16,831	54,797
NORMS OF CARE	2	1	2	7	2	2	2	2	2	2
FREQUENCY OF CONSULTATION	3	2	3	10	3	3	3	3	3	3
DURATION OF CONSULTATION (MIN)	40	40	40	40	40	40	40	40	40	40
(HRS.)	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
TOTAL SERVICE REQUIREMENTS	28,470	197,795	206,508	28,187	2,594	15,148	6,204	538	33,862	109,594
% DELEGATION & SUBSTITUTION (30%)	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
	8,541	59,339	61,952	8,456	778	4,544	1,861	161	10,159	32,878
TSR	19,929	138,457	144,556	19,731	1,816	10,602	4,343	376	23,703	76,716
ANNUAL PRODUCTIVITY	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880
OFFICE VISITS (HRS./DAY)	10	10	10	10	10	10	10	10	10	10
DAYS WORKED/WEEK	6	6	6	6	6	6	6	6	6	6
WEEKS WORKED/YEAR	48	48	48	48	48	48	48	48	48	48
FTE FOR DIRECT PATIENT CARE	7	48	50	7	1	4	2	0	8	27
% REQ FOR T, R, A	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
	2	11	12	2	0	1	0	0	2	6
MANPOWER REQUIREMENTS	9	59	62	8	1	5	2	0	10	33

\*Includes typhoid fever and other salmonella infections

	INFECTIOUS HEPATITIS	MALARIA	SYPHILIS	GONOCOCCAL INFECTION	PNEUMONIA	INFLUENZA	AIDS/HIV
POPULATION	64,259,000	64,259,000	64,259,000	64,259,000	64,259,000	64,259,000	64,259,000
MORBIDITY CASE	14,761	125,114	99	6,428	232,058	773,802	38,800
MORBIDITY CASE (%)	0.0002	0.0019	0.000002	0.0001	0.0038	0.0120	0.0006
% REQUIRING CARE	0.80	1	0.80	0.80	0.80	0.80	1.00
ADJUSTED NEEDS	11,809	125,114	79	5,141	185,645	619,042	38,800
NORMS OF CARE	2	9	2	2	5	2	1
FREQUENCY OF CONSULTATION	3	14	3	3	7	3	2
DURATION OF CONSULTATION (MIN)	40	40	40	40	40	40	40
(HRS.)	0.67	0.67	0.67	0.67	0.67	0.67	0.67
TOTAL SERVICE REQUIREMENTS	23,618	1,167,731	158	10,281	868,342	1,238,083	48,067
% DELEGATION & SUBSTITUTION (30%)	0.30	0.30	0.30	0.30	0.30	0.30	0.30
	7,085	350,319	48	3,084	259,903	371,425	14,720
TSR	16,532	817,411	111	7,197	608,440	866,658	34,347
ANNUAL PRODUCTIVITY	2,880	2,880	2,880	2,880	2,880	2,880	2,880
OFFICE VISITS (HRS./DAY)	10	10	10	10	10	10	10
DAYS WORKED/WEEK	6	6	6	6	6	6	6
WEEKS WORKED/YEAR	48	48	48	48	48	48	48
FTE FOR DIRECT PATIENT CARE	6	284	0	2	211	301	12
% REQ FOR T, R, A	0.23	0.23	0.23	0.23	0.23	0.23	0.23
	1	65	0	1	48	69	3
MANPOWER REQUIREMENTS	7	349	0	3	259	370	15
TOTAL	1,191						

Table B9b  
ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR MEDICAL DOCTORS-INFECTIOUS DISEASES USING MODIFIED GMENAC MODEL  
1992

MEDIUM ASSUMPTION

	TYPHOID*	DIARRHEAS	TB ALL FORMS	LEPROSY	DIPHTHERIA	WHOOPING COUGH	TETANUS	ACUTE POLIO	VARICELLA
POPULATION	64,259,000	64,259,000	64,259,000	64,259,000	64,259,000	64,259,000	64,259,000	64,259,000	64,259,000
MORBIDITY CASE	17,794	741,733	206,508	4,228	1,297	9,466	3,102	335	18,931
MORBIDITY CASE (%)	0.0003	0.0115	0.0032	0.0001	0.000020	0.0001	0.00005	0.000005	0.0003
% REQUIRING CARE	0.80	0.20	0.50	1	1	0.80	1	0.80	1
ADJUSTED NEEDS	14,235	148,347	103,254	4,228	1,297	7,573	3,102	268	18,931
NORMS OF CARE	2	1	2	7	2	2	2	2	2
FREQUENCY OF CONSULTATION	3	2	3	10	3	3	3	3	3
DURATION OF CONSULTATION (MIN (HRS.))	40 0.67	40 0.67	40 0.67	40 0.67	40 0.67	40 0.67	40 0.67	40 0.67	40 0.67
TOTAL SERVICE REQUIREMENTS	28,470	197,795	206,508	28,187	2,594	15,146	6,204	638	33,862
% DELEGATION & SUBSTITUTION	2,847	19,780	20,651	2,819	259	1,515	620	64	3,396
TSR	25,623	178,016	185,857	25,368	2,335	13,631	5,584	462	30,476
ANNUAL PRODUCTIVITY	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880
OFFICE VISITS (HRS.) / DAY	10	10	10	10	10	10	10	10	10
DAYS WORKED / WEEK	6	6	6	6	6	6	6	6	6
WEEKS WORKED / YEAR	48	48	48	48	48	48	48	48	48
FTE FOR DIRECT PATIENT CARE	9	62	65	9	1	5	2	0	11
% REQ FOR T, R, A	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
	2	14	15	2	0	1	0	0	2
MANPOWER REQUIREMENTS	11	76	79	11	1	6	2	0	13

\*Includes typhoid fever and other salmonella infections

	MEASLES	INFECTIOUS HEPATITIS	MALARIA	SYPHILIS	GONOCOCCAL INFECTION	PNEUMONIA	INFLUENZA	AIDS/HIV
POPULATION	64,259,000	64,259,000	64,259,000	64,259,000	64,259,000	64,259,000	64,259,000	64,259,000
MORBIDITY CASE	68,498	14,761	125,114	99	8,635	232,058	773,602	36,800
MORBIDITY CASE (%)	0.0011	0.0002	0.0019	0.000002		0.0036	0.0120	0.0006
% REQUIRING CARE	0.80	0.80	1	0.80	0.80	0.80	0.80	1.00
ADJUSTED NEEDS	54,797	11,809	125,114	79	6,908	185,645	619,042	36,800
NORMS OF CARE	2	2	9	2	2	6	2	1
FREQUENCY OF CONSULTATION	3	3	14	3	3	7	3	2
DURATION OF CONSULTATION (MIN (HRS.))	40 0.67	40 0.67	40 0.67	40 0.67	40 0.67	40 0.67	40 0.67	40 0.67
TOTAL SERVICE REQUIREMENTS	109,594	23,618	1,187,731	158	13,816	866,342	1,238,083	49,067
% DELEGATION & SUBSTITUTION	10,959	2,382	118,773	16	1,382	86,634	123,808	4,907
TSR	98,634	21,236	1,050,958	143	12,434	779,708	1,114,275	44,160
ANNUAL PRODUCTIVITY	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880
OFFICE VISITS (HRS.) / DAY	10	10	10	10	10	10	10	10
DAYS WORKED / WEEK	6	6	6	6	6	6	6	6
WEEKS WORKED / YEAR	48	48	48	48	48	48	48	48
FTE FOR DIRECT PATIENT CARE	34	7	385	0	4	271	387	15
% REQ FOR T, R, A	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
	8	2	84	0	1	62	89	4
MANPOWER REQUIREMENTS	42	9	449	0	5	333	476	18
TOTAL	1533							

Table B9c  
ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR MEDICAL DOCTORS-INFECTIOUS DISEASES USING MODIFIED GMENAC MODEL  
1992

	HIGH ASSUMPTION									
	TYPHOID*	DIARRHEAS	UBERCULOSIS ALL FORMS	LEPROSY	DIPHTHERIA	WHOOPING COUGH	TETANUS	ACUTE POLIO	VARICELLA	MEASLES
POPULATION	84,259,000	84,259,000	84,259,000	84,259,000	84,259,000	84,259,000	84,259,000	84,259,000	84,259,000	84,259,000
MORBIDITY CASE	49,923	773,883	238,837	36,357	33,428	41,595	35,232	32,465	49,060	100,828
MORBIDITY CASE (%)	0.0008	0.0120	0.0037	0.0008	0.000520	0.0008	0.00055	0.000505	0.0008	0.0018
% REQUIRING CARE	0.80	0.20	0.50	1	1	0.80	1	0.80	1	0.80
ADJUSTED NEEDS	39,839	154,773	119,318	36,357	33,428	33,278	35,232	25,972	49,060	80,500
NORMS OF CARE	2	1	2	7	2	2	2	2	2	2
FREQUENCY OF CONSULTATION	3	2	3	10	3	3	3	3	3	3
DURATION OF CONSULTATION (MIN)	40	40	40	40	40	40	40	40	40	40
(HRS.)	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
TOTAL SERVICE REQUIREMENTS	79,878	206,363	238,837	242,383	66,853	66,553	70,463	51,943	98,121	181,001
% DELEGATION & SUBSTITUTION (10%)	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	7,988	20,636	23,884	24,238	6,685	6,655	7,046	5,194	9,812	18,100
TSR	71,890	185,727	214,774	218,145	60,168	59,898	63,417	46,749	88,309	144,901
ANNUAL PRODUCTIVITY	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880
OFFICE VISITS (HRS./DAY)	10	10	10	10	10	10	10	10	10	10
DAYS WORKED/WEEK	6	6	6	6	6	6	6	6	6	6
WEEKS WORKED/YEAR	48	48	48	48	48	48	48	48	48	48
FTE FOR DIRECT PATIENT CARE	25	64	75	76	21	21	22	18	31	50
% REQ FOR T, R, A	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
	8	15	17	17	5	5	5	4	7	12
MANPOWER REQUIREMENTS	31	79	92	93	26	26	27	20	38	62

\*Includes typhoid fever and other salmonella infections

	INFECTIOUS HEPATITIS	MALARIA	SYPHILIS	GONOCOCCA INFECTION	PNEUMONIA	INFLUENZA	AIDS/HIV
POPULATION	84,259,000	84,259,000	84,259,000	84,259,000	84,259,000	84,259,000	84,259,000
MORBIDITY CASE	46,890	157,244	32,228	38,555	264,186	805,932	68,929
MORBIDITY CASE (%)	0.0007	0.0024	0.000502	0.0008	0.0041	0.0125	0.0011
% REQUIRING CARE	0.80	1	0.80	0.80	0.80	0.80	1.00
ADJUSTED NEEDS	37,512	157,244	25,783	30,844	211,348	644,745	68,929
NORMS OF CARE	2	9	2	2	5	2	1
FREQUENCY OF CONSULTATION	3	14	3	3	7	3	2
DURATION OF CONSULTATION (MIN)	40	40	40	40	40	40	40
(HRS.)	0.67	0.67	0.67	0.67	0.67	0.67	0.67
TOTAL SERVICE REQUIREMENTS	75,025	1,467,806	51,568	61,689	986,293	1,289,490	91,906
% DELEGATION & SUBSTITUTION (10%)	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	7,502	146,781	5,157	6,169	98,629	128,949	9,191
TSR	67,522	1,320,845	46,409	55,520	887,663	1,160,541	82,715
ANNUAL PRODUCTIVITY	2,880	2,880	2,880	2,880	2,880	2,880	2,880
OFFICE VISITS (HRS./DAY)	10	10	10	10	10	10	10
DAYS WORKED/WEEK	6	6	6	6	6	6	6
WEEKS WORKED/YEAR	48	48	48	48	48	48	48
FTE FOR DIRECT PATIENT CARE	23	459	16	19	308	403	29
% REQ FOR T, R, A	0.23	0.23	0.23	0.23	0.23	0.23	0.23
	5	105	4	4	71	93	7
MANPOWER REQUIREMENTS	29	564	20	24	379	496	35
TOTAL	2040						

Table B9a

ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR MEDICAL DOCTORS-INFECTIOUS DISEASES USING MODIFIED GMENAC MODEL  
2000

LOW ASSUMPTION

	TYPHOID*	DIARRHEAS	TB ALL FORMS	LEPROSY	DIPHTHERIA	WHOOPING COUGH	TETANUS	ACUTE POLIO	VARICELLA	MEASLES
POPULATION	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853
MORBIDITY CASE	20,830	888,299	241,748	4,949	1,518	11,081	3,831	392	19,820	80,184
MORBIDITY CASE (%)	0.0003	0.0115	0.0032	0.0001	0.000020	0.0001	0.00005	0.000005	0.0003	0.0011
% REQUIRING CARE	0.80	0.20	0.50	1	1	0.80	1	0.80	1	0.80
ADJUSTED NEEDS	16,664	173,660	120,873	4,949	1,518	8,885	3,831	314	19,820	64,147
NORMS OF CARE	2	1	2	7	2	2	2	2	2	2
FREQUENCY OF CONSULTATION	3	2	3	10	3	3	3	3	3	3
DURATION OF CONSULTATION (MIN) (HRS.)	40	40	40	40	40	40	40	40	40	40
	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
TOTAL SERVICE REQUIREMENTS	33,328	231,548	241,748	32,896	3,037	17,730	7,283	827	39,640	128,294
% DELEGATION & SUBSTITUTION (30%)	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
	9,999	69,464	72,524	9,899	911	5,319	2,179	188	11,892	38,488
TSR	23,330	162,082	169,222	23,097	2,126	12,411	5,084	439	27,748	89,806
ANNUAL PRODUCTIVITY	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880
OFFICE VISITS (HRS./DAY)	10	10	10	10	10	10	10	10	10	10
DAYS WORKED/WEEK	6	6	6	6	6	6	6	6	6	6
WEEKS WORKED/YEAR	48	48	48	48	48	48	48	48	48	48
FTE FOR DIRECT PATIENT CARE	8	56	69	8	1	4	2	0	10	31
% REQ FOR T, R, A	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
	2	13	14	2	0	1	0	0	2	7
MANPOWER REQUIREMENTS	10	68	72	10	1	5	2	0	12	38

\*Includes typhoid fever and other salmonella infections

	INFECTIOUS HEPATITIS	MALARIA	SYPHILIS	GONOCOCCAL INFECTION	PNEUMONIA	INFLUENZA	AIDS/HIV
POPULATION	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853
MORBIDITY CASE	17,280	146,483	118	7,522	271,853	805,840	43,079
MORBIDITY CASE (%)	0.0002	0.0019	0.000002	0.0001	0.0036	0.0120	0.0006
% REQUIRING CARE	0.80	1	0.80	0.80	0.80	0.80	1.00
ADJUSTED NEEDS	13,824	146,483	83	6,018	217,322	724,672	43,079
NORMS OF CARE	2	9	2	2	5	2	1
FREQUENCY OF CONSULTATION	3	14	3	3	7	3	2
DURATION OF CONSULTATION (MIN) (HRS.)	40	40	40	40	40	40	40
	0.67	0.67	0.67	0.67	0.67	0.67	0.67
TOTAL SERVICE REQUIREMENTS	27,848	1,366,987	185	12,036	1,014,171	1,448,344	67,439
% DELEGATION & SUBSTITUTION (30%)	0.30	0.30	0.30	0.30	0.30	0.30	0.30
	8,294	410,096	56	3,611	304,251	434,803	17,232
TSR	19,353	956,891	130	8,425	709,920	1,014,541	40,207
ANNUAL PRODUCTIVITY	2,880	2,880	2,880	2,880	2,880	2,880	2,880
OFFICE VISITS (HRS./DAY)	10	10	10	10	10	10	10
DAYS WORKED/WEEK	6	6	6	6	6	6	6
WEEKS WORKED/YEAR	48	48	48	48	48	48	48
FTE FOR DIRECT PATIENT CARE	7	332	0	3	246	352	14
% REQ FOR T, R, A	0.23	0.23	0.23	0.23	0.23	0.23	0.23
	2	76	0	1	57	81	3
MANPOWER REQUIREMENTS	8	409	0	4	303	433	17
TOTAL	1,394						



Table B9b  
ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR MEDICAL DOCTORS-INFECTIOUS DISEASES USING MODIFIED GMENAC MODEL  
2000

MEDIUM ASSUMPTION

	TYPHOID*	DIARRHEAS	TB ALL FORMS	LEPROSY	DIPHTHERIA	WHOOPING COUGH	TETANUS	ACUTE POLIO	VARICELLA	MEASLES
POPULATION	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853
MORBIDITY CASE	15,045	744,718	203,104	7,522	1,279	7,522	3,009	301	15,045	67,701
MORBIDITY CASE (%)	0.0002	0.0099	0.0027	0.0001	0.000017	0.0001	0.00004	0.000004	0.0002	0.0009
% REQUIRING CARE	0.80	0.20	0.50	1	1	0.80	1	0.80	1	0.80
ADJUSTED NEEDS	12,038	148,943	101,552	7,522	1,279	6,018	3,009	241	15,045	54,181
NORMS OF CARE	2	1	2	7	2	2	2	2	2	2
FREQUENCY OF CONSULTATION	3	2	3	10	3	3	3	3	3	3
DURATION OF CONSULTATION (MIN (HRS.))	40 0.67	40 0.67	40 0.67	40 0.67	40 0.67	40 0.67	40 0.67	40 0.67	40 0.67	40 0.67
TOTAL SERVICE REQUIREMENTS	24,072	198,591	203,104	50,149	2,558	12,038	6,018	481	30,090	108,322
% DELEGATION & SUBSTITUTION	2,407	19,859	20,310	5,015	258	1,204	602	48	3,009	10,832
TSR	21,664	178,732	182,794	45,134	2,302	10,832	5,416	433	27,081	97,490
ANNUAL PRODUCTIVITY	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880
OFFICE VISITS (HRS./DAY	10	10	10	10	10	10	10	10	10	10
DAYS WORKED/WEEK	6	6	6	6	6	6	6	6	6	6
WEEKS WORKED/YEAR	48	48	48	48	48	48	48	48	48	48
FTE FOR DIRECT PATIENT CARE	8	82	63	18	1	4	2	0	8	34
% REQ FOR T, R, A	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
	2	19	19	5	0	1	1	0	3	8
MANPOWER REQUIREMENTS	10	81	82	20	1	5	2	0	12	42

\*Includes typhoid fever and other salmonella infections

	INFECTIOUS HEPATITIS	MALARIA	SYPHILIS	GONOCOCCAL INFECTION	PNEUMONIA	INFLUENZA	AIDS/HIV
POPULATION	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853
MORBIDITY CASE	15,045	127,881	75	8,635	233,194	774,808	37,612
MORBIDITY CASE (%)	0.0002	0.0017	0.000001	0.000115	0.00310	0.0103	0.0005
% REQUIRING CARE	0.80	1	0.80	0.80	0.80	0.80	1.00
ADJUSTED NEEDS	12,038	127,881	60	6,908	188,555	619,845	37,612
NORMS OF CARE	2	9	2	2	6	2	1
FREQUENCY OF CONSULTATION	3	14	3	3	7	3	2
DURATION OF CONSULTATION (MIN (HRS.))	40 0.67	40 0.67	40 0.67	40 0.67	40 0.67	40 0.67	40 0.67
TOTAL SERVICE REQUIREMENTS	24,072	1,193,552	120	13,818	870,591	1,239,889	50,149
% DELEGATION & SUBSTITUTION	2,407	119,355	12	1,382	87,059	123,889	5,015
TSR	21,664	1,074,197	108	12,434	783,532	1,115,720	45,134
ANNUAL PRODUCTIVITY	2,880	2,880	2,880	2,880	2,880	2,880	2,880
OFFICE VISITS (HRS./DAY	10	10	10	10	10	10	10
DAYS WORKED/WEEK	6	6	6	6	6	6	6
WEEKS WORKED/YEAR	48	48	48	48	48	48	48
FTE FOR DIRECT PATIENT CARE	8	373	0	4	272	397	18
% REQ FOR T, R, A	0.23	0.23	0.23	0.23	0.23	0.23	0.23
	2	88	0	1	63	89	4
MANPOWER REQUIREMENTS	9	459	0	5	335	477	19
TOTAL	1659						

**Table B9c**  
**ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR MEDICAL DOCTORS-INFECTIOUS DISEASES USING MODIFIED GMENAC MODEL**  
**2000**

	HIGH ASSUMPTION									
	TYPHOID*	DIARRHEAS	UBERCULOSIS ALL FORMS	LEPROSY	DIPHTHERIA	WHOOPING COUGH	TETANUS	ACUTE POLIO	VARICELLA	MEASLES
POPULATION	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853
MORBIDITY CASE	58,442	905,911	279,357	42,561	39,130	48,693	41,243	38,004	67,432	117,796
MORBIDITY CASE (%)	0.0008	0.0120	0.0037	0.0006	0.000520	0.0006	0.00055	0.000505	0.0008	0.0016
% REQUIRING CARE	0.80	0.20	0.50	1	1	0.80	1	0.80	1	0.80
ADJUSTED NEEDS	46,754	181,182	139,679	42,561	39,130	38,955	41,243	30,403	57,432	94,237
NORMS OF CARE	2	1	2	7	2	2	2	2	2	2
FREQUENCY OF CONSULTATION	3	2	3	10	3	3	3	3	3	3
DURATION OF CONSULTATION (MIN)	40	40	40	40	40	40	40	40	40	40
(HRS.)	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
TOTAL SERVICE REQUIREMENTS	93,508	241,576	279,357	283,742	76,260	77,909	82,486	60,807	114,864	188,473
% DELEGATION & SUBSTITUTION (10%)	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	9,351	24,158	27,936	28,374	7,828	7,791	8,249	6,081	11,486	18,847
TSR	84,157	217,419	251,422	255,368	70,434	70,118	74,238	54,726	103,378	169,626
ANNUAL PRODUCTIVITY	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880
OFFICE VISITS (HRS./DAY	10	10	10	10	10	10	10	10	10	10
DAYS WORKED/WEEK	6	6	6	6	6	6	6	6	6	6
WEEKS WORKED/YEAR	48	48	48	48	48	48	48	48	48	48
FTE FOR DIRECT PATIENT CARE	29	75	87	89	24	24	26	19	36	59
% REQ FOR T, R, A	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
	7	17	20	20	6	6	6	4	6	14
MANPOWER REQUIREMENTS	36	93	107	109	30	30	32	23	44	72

\*Includes typhoid fever and other salmonella infections

	INFECTIOUS HEPATITIS	MALARIA	SYPHILIS	BONOCOCCA INFECTION	PNEUMONIA	INFLUENZA	AIDS/HIV
POPULATION	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853	75,223,853
MORBIDITY CASE	54,892	184,075	37,728	45,134	309,265	943,452	80,691
MORBIDITY CASE (%)	0.0007	0.0024	0.000502	0.0006	0.0041	0.0125	0.0011
% REQUIRING CARE	0.80	1	0.80	0.80	0.80	0.80	1.00
ADJUSTED NEEDS	43,913	184,075	30,182	36,107	247,412	754,761	80,691
NORMS OF CARE	2	9	2	2	5	2	1
FREQUENCY OF CONSULTATION	3	14	3	3	7	3	2
DURATION OF CONSULTATION (MIN)	40	40	40	40	40	40	40
(HRS.)	0.67	0.67	0.67	0.67	0.67	0.67	0.67
TOTAL SERVICE REQUIREMENTS	87,827	1,718,031	80,365	72,215	1,154,589	1,509,523	107,589
% DELEGATION & SUBSTITUTION (10%)	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	8,783	171,803	8,036	7,221	115,459	150,952	10,759
TSR	79,044	1,546,228	54,328	64,993	1,039,130	1,358,571	96,830
ANNUAL PRODUCTIVITY	2,880	2,880	2,880	2,880	2,880	2,880	2,880
OFFICE VISITS (HRS./DAY	10	10	10	10	10	10	10
DAYS WORKED/WEEK	6	6	6	6	6	6	6
WEEKS WORKED/YEAR	48	48	48	48	48	48	48
FTE FOR DIRECT PATIENT CARE	27	537	19	23	361	472	34
% REQ FOR T, R, A	0.23	0.23	0.23	0.23	0.23	0.23	0.23
	6	123	4	5	83	108	8
MANPOWER REQUIREMENTS	34	660	23	28	444	580	41
TOTAL	2387						

Table B10

**ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR EENT SPECIALISTS  
USING MODIFIED GMENAC MODEL**

	1992			2000		
	Low Assumption	Medium Assumption	High Assumption	Low Assumption	Medium Assumption	High Assumption
POPULATION	64,259,000	64,259,000	64,259,000	75,224,000	75,224,000	75,224,000
MORBIDITY CASE	6,425,900	6,425,900	44,981,300	7,522,400	7,522,400	52,656,800
MORBIDITY CASE (%)	0.10	0.10	0.70	0.10	0.10	0.70
% REQUIRING CARE	0.30	0.50	0.15	0.30	0.50	0.15
ADJUSTED NEEDS	1,927,770	3,212,950	6,747,195	2,256,720	3,761,200	7,898,520
NORMS OF CARE	1.51	1.51	1.51	1.51	1.51	1.51
FREQUENCY OF CONSULTATION	4.60	4.60	4.60	4.60	4.60	4.60
DURATION OF CONSULTATION (MIN)	20	20	20	20	20	20
(HRS.)	0.33	0.33	0.33	0.33	0.33	0.33
TOTAL SERVICE REQUIREMENTS (TSR)	2,910,933	4,851,555	10,188,264	3,407,647	5,679,412	11,926,765
% DELEGATION & SUBSTITUTION	0.05	0.05	0.05	0.05	0.05	0.05
	145,547	242,578	509,413	170,382	283,971	596,338
TSR (NET OF DELEGATION & SUBST.)	2,765,386	4,608,977	9,678,851	3,237,265	5,395,441	11,330,427
ANNUAL PRODUCTIVITY	3,432	3,432	3,432	3,432	3,432	3,432
OFFICE VISITS (HRS.)/DAY	11	11	11	11	11	11
DAYS WORKED/WEEK	6	6	6	6	6	6
WEEKS WORKED/YEAR	52	52	52	52	52	52
FTE PHYSICIAN REQUIRED FOR	806	1,343	2,820	943	1,572	3,301
DIRECT PATIENT CARE						
% REQ FOR T, R, A	0.05	0.05	0.05	0.05	0.05	0.05
NUMBER REQ FOR T, R, A	40	67	141	47	79	165
MANPOWER REQUIREMENTS	846	1,410	2,961	990	1,651	3,466

Table B11

## ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR DERMATOLOGISTS USING MODIFIED GMENAC MODEL

	1992			2000		
	Low Assumption	Medium Assumption	High Assumption	Low Assumption	Medium Assumption	High Assumption
POPULATION	64,259,000	64,259,000	64,259,000	75,224,000	75,224,000	75,224,000
MORBIDITY CASE	321,295	642,590	1,285,180	376,120	752,240	1,504,480
MORBIDITY CASE (%)	0.005	0.01	0.02	0.005	0.01	0.02
% REQUIRING CARE	0.90	0.90	0.90	0.90	0.90	0.90
ADJUSTED NEEDS	289,166	578,331	1,156,662	338,508	677,016	1,354,032
NORMS OF CARE	2.00	2.00	2.00	2.00	2.00	2.00
FREQUENCY OF CONSULTATION	8	8	8	8	8	8
DURATION OF CONSULTATION (MIN)	15	15	15	15	15	15
(HRS.)	0.25	0.25	0.25	0.25	0.25	0.25
TOTAL SERVICE REQUIREMENTS	578,331	1,156,662	2,313,324	677,016	1,354,032	2,708,064
% DELEGATION & SUBSTITUTION	0.10	0.10	0.10	0.10	0.10	0.10
	57,833	115,666	231,332	67,702	135,403	270,806
TSR (NET OF DELEGATION & SUBST)	578,331	1,156,662	2,313,324	677,016	1,354,032	2,708,064
ANNUAL PRODUCTIVITY	2,530	2,530	2,530	2,530	2,530	2,530
OFFICE VISITS (HRS.)/DAY	10	10	10	10	10	10
DAYS WORKED/WEEK	5.5	5.5	5.5	5.5	5.5	5.5
WEEKS WORKED/YEAR	46	46	46	46	46	46
MANPOWER FOR PATIENT CARE	229	457	914	268	535	1,070
% REQ FOR T, R, A	0.15	0.15	0.15	0.15	0.15	0.15
NUMBER REQ FOR T,R,A	34	69	137	40	80	161
MANPOWER REQUIREMENTS	263	526	1,052	308	615	1,231

Table B12

**ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR MEDICAL DOCTORS-REHABILITATION MEDICINE  
USING MODIFIED GMENAC MODEL**

	1992			, 2000		
	Low Assumption	Medium Assumption	High Assumption	Low Assumption	Medium Assumption	High Assumption
POPULATION	64,259,000	64,259,000	64,259,000	75,224,000	75,224,000	75,224,000
MORBIDITY CASE	3,212,950	4,200,000	4,498,130	3,761,200	4,916,678	5,265,680
MORBIDITY CASE (%)	0.0500	0.0654	0.0700	0.0500	0.0654	0.0700
% REQUIRING CARE	1.00	1.00	1.00	1.00	1.00	1.00
ADJUSTED NEEDS	3,212,950	4,200,000	4,498,130	3,761,200	4,916,678	5,265,680
NORMS OF CARE	2.00	2.00	2.00	2.00	2.00	2.00
FREQUENCY OF CONSULTATION	3	3	3	3	3	3
DURATION OF CONSULTATION (MIN (HRS.))	40 0.67	40 0.67	40 0.67	40 0.67	40 0.67	40 0.67
TOTAL SERVICE REQUIREMENTS (TSR)	6,425,900	8,400,000	8,996,260	7,522,400	9,833,356	10,531,360
% DELEGATION & SUBSTITUTION	0.00	0.00	0.00	0.00	0.00	0.00
	0	0	0	0	0	0
TSR (NET OF DELEGATION & SUBST.)	6,425,900	8,400,000	8,996,260	7,522,400	9,833,356	10,531,360
ANNUAL PRODUCTIVITY	3,816	3,816	3,816	3,816	3,816	3,816
OFFICE VISITS (HRS.)/DAY	12	12	12	12	12	12
DAYS WORKED/WEEK	6	6	6	6	6	6
WEEKS WORKED/YEAR	53	53	53	53	53	53
FTE PHYSICIAN REQUIRED FOR DIRECT PATIENT CARE	1,684	2,201	2,358	1,971	2,577	2,760
% REQ FOR T, R, A	0.23	0.23	0.23	0.23	0.23	0.23
	387	506	542	453	593	635
MANPOWER REQUIREMENTS	2,071	2,708	2,900	2,425	3,170	3,395

Table B13

ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR DENTISTS  
USING MODIFIED GMENAC MODEL

	1992			2000		
	Low Assumption	Medium Assumption	High Assumption	Low Assumption	Medium Assumption	High Assumption
POPULATION	64,259,000	64,259,000	64,259,000	75,224,000	75,224,000	75,224,000
MORBIDITY CASE	62,973,820	62,973,820	62,973,820	73,719,520	73,719,520	73,719,520
MORBIDITY CASE (%)	0.98	0.98	0.98	0.98	0.98	0.98
% REQUIRING CARE	1.00	1.00	1.00	1.00	1.00	1.00
ADJUSTED NEEDS	62,973,820	62,973,820	62,973,820	73,719,520	73,719,520	73,719,520
NORMS OF CARE	2	2	2	2	2	2
FREQUENCY OF CONSULTATION	4	4	4	4	4	4
DURATION OF CONSULTATION (MIN)	30	30	30	30	30	30
(HRS.)	0.50	0.50	0.50	0.50	0.50	0.50
TOTAL SERVICE REQUIREMENTS (TSR)	125,947,640	125,947,640	125,947,640	147,439,040	147,439,040	147,439,040
% DELEGATION & SUBSTITUTION	0.10	0.05	0.03	0.70	0.30	0.00
	12,594,764	6,297,382	3,778,429	103,207,328	44,231,712	0
TSR (NET OF DELEGATION & SUBST.)	113,352,876	119,650,258	122,169,211	44,231,712	103,207,328	147,439,040
ANNUAL PRODUCTIVITY	1,320	1,320	1,320	1,320	1,320	1,325
OFFICE VISITS (HRS.)/DAY	5	5	5	5	5	5
DAYS WORKED/WEEK	5.5	5.5	5.5	5.5	5.5	5
WEEKS WORKED/YEAR	48	48	48	48	48	53
FTE PHYSICIAN REQUIRED FOR DIRECT	85,873	90,644	92,552	33,509	78,187	111,275
PATIENT CARE						
% REQ FOR T, R, A	0.01	0.01	0.05	0.01	0.01	0.01
	859	906	4,628	335	782	
MANPOWER REQUIREMENTS	86,732	91,551	97,180	33,844	78,969	112,387

Table B.14  
Requirement for Nurses

	Year 1990			Year 2000					
				Without Change			With Change		
	Case I High	Case II Medium	Case III Low	Case I High	Case II Medium	Case III Low	Case I High	Case II Medium	Case III Low
Hospitals	42,560	31,069	19,365	47,570	34,726	21,645	45,065	27,039	20,505
Public Health	20,647	20,647	20,647	20,647	20,647	20,647	20,647	20,647	20,647
School Health	22,746	22,746	22,746	26,781	26,781	26,781	26,781	26,781	26,781
Occupational	4,822	4,822	4,822	4,822	4,822	4,822	4,822	4,822	4,822
Others	18,155	15,857	13,516	19,964	17,395	14,779	19,463	15,858	14,551
Total	108,929	95,140	81,095	119,783	104,370	88,672	116,777	95,146	87,304

# ASSUMPTIONS FOR REQUIREMENT ESTIMATION FOR NURSES

## 1. Hospital based-nurses

### a. Inpatients

	Year 1990			Year 2000		
	W/o Policy Change			With Policy Change		
	Case I (based on bed capa- city) High	Case II (based on occupancy rate) Medium	Case III (based on occupancy rate) Low	Case I (based on bed capa- city) High	Case II (based on occupancy rate) Medium	Case III (based on occupancy rate) Low
Number of bed occupants/day						
Primary	14,832	10,882	8658	16,355	11,838	7442
Secondary	23,055	16,830	10490	25,769	18,811	11725
Tertiary	49,445	36,095	22498	55,267	40,345	25146
Total .....	87,133	63,807	39646	97,391	71,085	44313
Number of bed occupants/year						
Primary	5,340,831	3,898,807	2,430,078	5,989,575	4,357,790	2,718,157
Secondary	8,415,119	6,143,037	3,828,879	9,405,655	6,866,150	4,278,587
Tertiary	18,047,595	13,174,744	8,211,658	20,172,455	14,725,892	9,178,487
Total .....	31,803,545	23,216,588	14,470,613	35,547,715	25,949,832	16,174,210
Note: this should not be taken as the rate of population admitted to the hospitals						
X % of patients by category care						
Primary						
Minimal Care	0.70	0.70	0.70	0.70	0.70	0.70
Intermediate Care	0.25	0.25	0.25	0.25	0.25	0.25
Intensive Care	0.05	0.05	0.05	0.05	0.05	0.05
Secondary						
Minimal Care	0.65	0.65	0.65	0.65	0.65	0.65
Intermediate Care	0.30	0.30	0.30	0.30	0.30	0.30
Intensive Care	0.05	0.05	0.05	0.05	0.05	0.05
Tertiary						
Minimal Care	0.30	0.30	0.30	0.30	0.30	0.30
Intermediate Care	0.45	0.45	0.45	0.45	0.45	0.45
Intensive Care	0.25	0.25	0.25	0.25	0.25	0.25
= # of Patients by category care						
Primary						
Minimal Care	3,471,540	2,534,224	1,579,551	3,860,224	2,832,583	1,765,502
Intermediate Care	1,802,249	1,169,642	729,023	1,790,873	1,307,337	814,847
Intensive Care	267,042	184,840	121,504	298,479	217,889	135,808
Secondary						
Minimal Care	5,469,827	3,992,974	2,488,772	6,113,085	4,462,988	2,781,731
Intermediate Care	2,524,538	1,842,911	1,148,684	2,821,706	2,059,845	1,283,876
Intensive Care	420,756	307,152	191,444	470,284	343,308	213,979
Tertiary						
Minimal Care	5,414,278	3,952,423	2,463,487	6,051,737	4,417,768	2,753,540
Intermediate Care	8,121,418	5,928,835	3,695,245	9,077,805	6,626,651	4,130,310
Intensive Care	4,511,889	3,293,688	2,052,914	5,043,114	3,681,473	2,294,817
Total	31,803,545	23,216,588	14,470,613	35,547,715	25,949,832	16,174,210



**ASSUMPTIONS FOR REQUIREMENT ESTIMATION FOR NURSES (cont.)**

<b>X norms of care (hrs/day)</b>									
Minimal Care	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Intermediate Care	3	3	3	3	3	3	3	3	3
Intensive Care	5	5	5	5	5	5	5	5	5
= Number of nursing care hours needed by a patient within a span of 24 hrs for one year									
<b>Primary</b>									
Minimal Care	5,207,310	3,801,338	2,389,326	5,820,338	4,248,845	2,848,253	5,513,823	3,308,294	2,506,789
Intermediate Care	4,808,748	3,508,928	2,187,070	5,372,618	3,922,011	2,444,541	6,089,683	3,053,810	2,315,808
Intensive Care	1,201,887	877,231	548,768	1,343,154	980,503	611,135	1,272,421	783,452	578,951
SubTotal	11,215,745	8,187,494	5,103,164	12,536,108	9,151,358	5,703,929	11,875,928	7,125,556	5,403,548
<b>Secondary</b>									
Minimal Care	8,204,741	5,989,481	3,733,157	9,170,543	6,894,498	4,172,597	8,887,842	5,212,585	3,952,877
Intermediate Care	7,573,607	5,528,733	3,445,991	8,485,117	6,179,535	3,851,628	8,019,382	4,811,017	3,648,810
Intensive Care	1,893,402	1,382,183	861,498	2,116,279	1,544,884	962,907	2,004,840	1,202,904	912,202
SubTotal	17,671,750	12,900,378	8,040,646	19,751,939	14,418,915	8,987,132	18,711,844	11,227,107	8,513,889
<b>Tertiary</b>									
Minimal Care	8,121,418	5,928,835	3,695,245	9,077,605	6,828,651	4,130,310	8,599,511	5,159,707	3,912,778
Intermediate Care	24,384,253	17,785,905	11,085,735	27,232,814	19,879,954	12,390,930	25,798,534	15,479,120	11,738,333
Intensive Care	20,303,544	14,821,587	9,238,113	22,694,012	18,566,829	10,325,775	21,488,778	12,899,287	9,781,944
SubTotal	52,789,215	38,536,127	24,019,093	59,004,431	43,073,235	26,847,018	55,896,823	33,538,094	25,433,054
<b>Total</b>	<b>81,676,710</b>	<b>59,623,998</b>	<b>37,162,903</b>	<b>91,292,477</b>	<b>68,643,608</b>	<b>41,538,077</b>	<b>86,484,594</b>	<b>51,890,756</b>	<b>39,350,490</b>
divided by total nursing hours per year									
Primary (<100 beds)	2,144	2,144	2,144	2,144	2,144	2,144	2,144	2,144	2,144
Secondary (<100 beds)	2,144	2,144	2,144	2,144	2,144	2,144	2,144	2,144	2,144
(100=>beds)	1,728	1,728	1,728	1,728	1,728	1,728	1,728	1,728	1,728
Tertiary (<100 beds)	2,144	2,144	2,144	2,144	2,144	2,144	2,144	2,144	2,144
(100=>beds)	1,728	1,728	1,728	1,728	1,728	1,728	1,728	1,728	1,728
<b>Equals:</b>									
Primary (<100 beds)	5,231	3,819	2,380	5,847	4,288	2,680	5,539	3,323	2,520
Secondary (<100 beds)	6,594	4,814	3,000	7,370	5,380	3,353	6,982	4,189	3,177
(100=>beds)	2,045	1,493	931	2,288	1,668	1,040	2,168	1,299	985
Subtotal	8,639	6,307	3,931	9,858	7,049	4,394	9,148	5,489	4,162
Tertiary (<100 beds)	4,924	3,595	2,241	5,504	4,018	2,504	5,214	3,129	2,372
(100=>beds)	24,439	17,841	11,120	27,317	19,941	12,428	25,878	15,527	11,775
Subtotal	29,364	21,436	13,361	32,821	23,959	14,934	31,092	18,655	14,147
<b>Total</b>	<b>43,234</b>	<b>31,561</b>	<b>19,872</b>	<b>48,324</b>	<b>35,277</b>	<b>21,988</b>	<b>45,779</b>	<b>27,468</b>	<b>20,830</b>
<b>+ relievers</b>									
(multiply by 0.123/year)	5,318	3,882	2,420	5,944	4,339	2,704	5,631	3,379	2,562
Primary (<100 beds)	643	470	283	719	525	327	681	409	310
Secondary (<100 beds)	611	592	369	907	682	412	859	515	391
(100=>beds)	252	184	114	281	205	128	298	160	121
Subtotal	1,063	776	483	1,188	897	540	1,125	675	512
Tertiary (<100 beds)	808	442	278	677	494	308	641	385	292
(100=>beds)	3,008	2,194	1,368	3,360	2,453	1,529	3,183	1,910	1,448
Subtotal	3,812	2,637	1,643	4,037	2,947	1,837	3,824	2,295	1,740
<b>Total</b>	<b>5,318</b>	<b>3,882</b>	<b>2,420</b>	<b>5,944</b>	<b>4,339</b>	<b>2,704</b>	<b>5,631</b>	<b>3,379</b>	<b>2,562</b>

**ASSUMPTIONS FOR REQUIREMENT ESTIMATION FOR NURSES (cont.)**

<b>= total personnel requirements</b>	<b>48,552</b>	<b>35,443</b>	<b>22,091</b>	<b>54,268</b>	<b>39,616</b>	<b>24,892</b>	<b>51,410</b>	<b>30,846</b>	<b>23,392</b>
Primary	6,875	4,289	2,873	8,568	4,793	2,988	6,220	3,732	2,830
Secondary	9,702	7,082	4,414	10,844	7,918	4,934	10,273	6,184	4,674
Tertiary	32,978	24,072	15,004	38,858	28,908	16,770	34,917	20,950	15,887
<b>Total</b>	<b>48,552</b>	<b>35,443</b>	<b>22,091</b>	<b>54,268</b>	<b>39,616</b>	<b>24,892</b>	<b>51,410</b>	<b>30,846</b>	<b>23,392</b>

minus delegation/substitution to non-nursing professionals

<b>Rates:</b>									
Minimal	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
Primary + Secon + Tert									
Moderate	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Primary + Secon + Tert									
Intensive	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Primary + Secon + Tert									

<b>Primary</b>									
Minimal Care	1,851	1,351	842	2,088	1,510	941	1,959	1,178	892
Intermediate Care	587	429	287	857	479	299	622	373	283
Intensive Care	73	54	33	82	60	37	78	47	35
<b>SubTotal</b>	<b>2,511</b>	<b>1,833</b>	<b>1,143</b>	<b>2,807</b>	<b>2,049</b>	<b>1,277</b>	<b>2,659</b>	<b>1,598</b>	<b>1,210</b>
<b>Secondary</b>									
Minimal Care	2,030	2,072	1,291	3,172	2,316	1,443	3,006	1,803	1,387
Intermediate Care	1,164	850	530	1,301	950	592	1,233	740	561
Intensive Care	121	89	55	136	99	62	128	77	58
<b>SubTotal</b>	<b>4,123</b>	<b>3,010</b>	<b>1,876</b>	<b>4,609</b>	<b>3,364</b>	<b>2,097</b>	<b>4,368</b>	<b>2,620</b>	<b>1,987</b>
<b>Tertiary</b>									
Minimal Care	4,452	3,250	2,028	4,978	3,632	2,284	4,714	2,828	2,145
Intermediate Care	5,938	4,333	2,701	8,634	4,843	3,019	8,285	3,771	2,860
Intensive Care	3,035	2,215	1,381	3,392	2,478	1,543	3,213	1,928	1,462
<b>SubTotal</b>	<b>13,422</b>	<b>9,798</b>	<b>6,107</b>	<b>15,002</b>	<b>10,951</b>	<b>6,826</b>	<b>14,212</b>	<b>8,527</b>	<b>6,468</b>
<b>Total</b>	<b>20,057</b>	<b>14,841</b>	<b>9,128</b>	<b>22,418</b>	<b>16,385</b>	<b>10,200</b>	<b>21,237</b>	<b>12,742</b>	<b>9,663</b>

<b>= Total Nursing personnel for in-patients</b>									
Primary	3,383	2,455	1,530	3,759	2,744	1,710	3,581	2,137	1,620
Secondary	5,578	4,072	2,538	6,235	4,552	2,837	5,907	3,544	2,688
Tertiary	19,554	14,274	8,897	21,858	15,955	9,944	20,705	12,423	9,421
<b>Total</b>	<b>28,498</b>	<b>20,802</b>	<b>12,965</b>	<b>31,850</b>	<b>23,251</b>	<b>14,492</b>	<b>30,173</b>	<b>18,104</b>	<b>13,729</b>

<b>%requirement</b>									
<b>Total</b>	<b>31,345</b>	<b>22,882</b>	<b>14,262</b>	<b>35,035</b>	<b>25,578</b>	<b>15,941</b>	<b>33,190</b>	<b>19,914</b>	<b>15,102</b>

**b. Out-patients**

<b>Number of out-patients/year</b>									
Primary	16,022,493	11,898,420	7,290,234	17,908,725	13,073,389	8,148,470	16,965,609	10,179,365	7,719,352
Secondary	25,245,358	18,429,111	11,486,638	28,217,055	20,598,450	12,838,760	26,731,208	16,038,724	12,162,699
Tertiary	54,142,784	39,524,233	24,634,967	60,517,385	44,177,878	27,535,401	57,330,075	34,398,045	26,085,184
<b>Total</b>	<b>95,410,635</b>	<b>69,849,764</b>	<b>43,411,839</b>	<b>106,643,145</b>	<b>77,849,498</b>	<b>48,522,631</b>	<b>101,026,890</b>	<b>60,616,134</b>	<b>45,967,235</b>

**ASSUMPTIONS FOR REQUIREMENT ESTIMATION FOR NURSES (cont.)**

X norms of care (hr/day)

Primary	1	1	1	1	1	1	1	1	1
Secondary	1	1	1	1	1	1	1	1	1
Tertiary	1	1	1	1	1	1	1	1	1

= Number of nursing care hours needed by a patient within a span of 24 hrs for one year

Primary	18,022,493	11,696,420	7,290,234	17,908,725	13,073,369	8,148,470	16,965,609	10,179,385	7,719,352
Secondary	25,245,358	16,429,111	11,486,638	28,217,055	20,596,450	12,836,760	26,731,206	18,036,724	12,162,699
Tertiary	54,142,784	39,524,233	24,634,967	60,517,385	44,177,676	27,535,401	57,330,075	34,396,045	26,085,184
Total	95,410,635	69,649,764	43,411,839	106,643,145	77,849,496	48,522,631	101,026,890	60,616,134	45,967,235

divided by total nursing hours per year

Primary (<100 beds)	2,144	2,144	2,144	2,144	2,144	2,144	2,144	2,144	2,144
Secondary (<100 beds)	2,144	2,144	2,144	2,144	2,144	2,144	2,144	2,144	2,144
(100-200 beds)	1,728	1,728	1,728	1,728	1,728	1,728	1,728	1,728	1,728
Tertiary (<100 beds)	2,144	2,144	2,144	2,144	2,144	2,144	2,144	2,144	2,144
(100-200 beds)	1,728	1,728	1,728	1,728	1,728	1,728	1,728	1,728	1,728

Equals

Primary (<100 beds)	7,473	5,455	3,400	8,353	6,098	3,801	7,913	4,748	3,600
Secondary (<100 beds)	9,420	6,877	4,286	10,529	7,686	4,781	9,974	5,885	4,538
(100-200 beds)	2,922	2,133	1,329	3,266	2,384	1,486	3,094	1,858	1,408
Subtotal	12,342	9,010	5,616	13,795	10,070	6,277	13,068	7,841	5,946
Tertiary (<100 beds)	5,051	3,667	2,298	5,645	4,121	2,569	5,348	3,209	2,433
(100-200 beds)	25,066	18,298	11,405	29,017	20,453	12,748	26,642	15,925	12,078
Subtotal	30,117	21,965	13,703	33,663	24,574	15,316	31,890	19,134	14,510
Total	49,932	36,450	22,719	55,810	40,741	25,394	52,671	31,723	24,056

+ Relievers

Primary (<100 beds)	819	671	418	1,027	750	467	973	584	443
Secondary (<100 beds)	1,159	846	527	1,295	945	589	1,227	736	558
(100-200 beds)	359	262	164	402	293	183	381	228	173
Subtotal	1,518	1,108	691	1,697	1,239	772	1,607	964	731
Tertiary (<100 beds)	621	453	283	694	507	316	658	395	299
(100-200 beds)	3,063	2,251	1,403	3,446	2,518	1,568	3,265	1,959	1,465
Subtotal	3,704	2,704	1,685	4,140	3,023	1,884	3,922	2,353	1,765
Total	6,142	4,463	2,794	6,865	5,011	3,123	6,503	3,902	2,959

= total Personnel Requirement

Primary	8,392	6,126	3,819	9,380	6,848	4,268	8,886	5,332	4,043
Secondary	13,860	10,116	6,306	15,491	11,309	7,049	14,676	8,805	6,677
Tertiary	33,821	24,689	15,389	37,803	27,596	17,200	35,812	21,487	16,294
Total	56,073	40,934	25,513	62,675	45,753	28,517	59,374	35,624	27,016

minus delegation/substitution to non-nursing professionals (delegation is 80%)

= total number of nurses for out-patients	11,215	8,187	5,103	12,535	9,151	5,703	11,875	7,125	5,403
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(Note: an average of 8508 patients per nurse)

total number of nurses  
for in-patients  
plus  
total number of nurses  
for out-patients  
= Total Nursing personnel  
needed in all hospitals

31,345	22,882	14,282	35,035	25,576	15,941	33,190	19,914	15,102
11,215	8,187	5,103	12,535	9,151	5,703	11,875	7,125	5,403
42,560	31,069	19,385	47,570	34,726	21,645	45,065	27,039	20,505

**Total number of municipalities**  
**Number of barangays: 41293**

[illegible]

## Average Number of

	Number of Schools	Number of Enrollees	Number of Enrollees	Students per School
<b>Pre-s</b>	<b>3837</b>	<b>321459</b>	<b>321459</b>	<b>84</b>
<b>Elementary</b>	<b>34382</b>	<b>10248861</b>	<b>10248861</b>	<b>298</b>
<b>Secondary</b>	<b>5518</b>	<b>3961639</b>	<b>3961639</b>	<b>718</b>
<b>Tertiary</b>	<b>1755</b>	<b>1225315</b>	<b>1225315</b>	<b>698</b>
<b>Total</b>	<b>45492</b>	<b>15757274</b>	<b>15757274</b>	<b>346</b>

<b>Total number of nurses</b>	<b>22746</b>	<b>22746</b>	<b>22746</b>	<b>26,781</b>	<b>26,781</b>	<b>26,781</b>	<b>26,781</b>	<b>26,781</b>	<b>26,781</b>
for 2000: projection of 53,561 enrollees									

**Total number of firms  
(manufacturing)**

[illegible]

Table B15  
ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR MIDWIVES USING MODIFIED GMENAC MODEL  
1992

	Low Assumption			Medium Assumption			High Assumption		
	MATERNAL CARE	CHILD CARE	PRIMARY HEALTH CARE	MATERNAL CARE	CHILD CARE	PRIMARY HEALTH CARE	MATERNAL CARE	CHILD CARE	PRIMARY HEALTH CARE
POPULATION	16,362,281	1,765,341	46,131,378	16,362,281	1,765,341	46,131,378	16,362,281	1,765,341	46,131,378
MORBIDITY CASE	2,249,065	1,765,341	59,970,791	2,249,065	1,765,341	59,970,791	2,249,065	1,765,341	59,970,791
MORBIDITY CASE (%)	0.14	1.00	1.30	0.14	1.00	1.30	0.14	1.00	1.30
% REQUIRING CARE	0.70	0.70	0.60	0.70	0.70	0.60	0.70	0.70	0.60
ADJUSTED NEEDS	1,574,346	1,235,739	35,982,475	1,574,346	1,235,739	35,982,475	1,574,346	1,235,739	35,982,475
NORMS OF CARE	21	1.00	1.50	21	1.00	1.50	21	1.00	1.50
FREQUENCY OF CONSULTATION									
MATERNAL CARE	7			7			7		
PRE-NATAL 4									
DELIVERY 1									
POST-NATAL 2									
CHILD CARE		4			4			4	
COMMUNICABLE DISEASE			3			3			3
OUT-PATIENT 4									
IN-PATIENT 2									
DURATION OF CONSULTATION (M/H)									
MATERNAL CARE	3			3			3		
PRE-NATAL 20 MIN./ .33 HRS.									
DELIVERY 120 MIN./2 HRS.									
POST-NATAL 15 MIN./ .25 HRS.									
CHILD CARE 15 MIN.		0.25			0.25			0.25	
COMMUNICABLE DISEASE 30 M/ .5 H			0.50			0.50			0.50
TOTAL SERVICE REQUIREMENTS	33,061,258	1,235,739	53,973,712	33,061,258	1,235,739	53,973,712	33,061,258	1,235,739	53,973,712
% DELEGATION & SUBSTITUTION	0.21	0.40	0.40	0.20	0.20	0.20	0.10	0.10	0.10
	6,942,884	494,295	21,589,485	6,812,251	247,148	10,794,742	3,308,126	123,574	5,397,371
TSR (NET OF DELEGATION & SUBST)	26,118,392	741,443	32,384,227	26,449,004	988,591	43,178,970	29,755,130	1,112,165	48,576,341
ANNUAL PRODUCTIVITY	2,064	2,064	2,064	2,064	2,064	2,064	2,064	2,064	2,064
OFFICE VISITS (HRS.)/DAY	8	8	8	8	8	8	8	8	8
DAYS WORKED/WEEK	8	8	8	8	8	8	8	8	8
WEEKS WORKED/YEAR	43	43	43	43	43	43	43	43	43
FTE PHYSICIAN REQUIRED FOR	12,654	359	15,690	12,814	479	20,920	14,416	539	23,535
DIRECT PATIENT CARE									
% REQ FOR T, R, A	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	633	18	785	641	24	1,048	721	27	1,177
MANPOWER REQUIREMENTS	13,287	377	16,475	13,455	503	21,968	15,137	566	24,712
TOTAL	30,139			35,924			40,415		

Table B15b  
ASSUMPTIONS FOR REQUIREMENT ESTIMATES FOR MIDWIVES USING MODIFIED GMENAC MODEL  
2000

	Low Assumption			Medium Assumption			High Assumption		
	MATERNAL CARE	CHILD CARE	PRIMARY HEALTH CARE	MATERNAL CARE	CHILD CARE	PRIMARY HEALTH CARE	MATERNAL CARE	CHILD CARE	PRIMARY HEALTH CARE
POPULATION	19,985,426	1,745,358	53,493,216	19,985,426	1,745,358	53,493,216	19,985,426	1,745,358	53,493,216
MORBIDITY CASE	2,797,960	1,745,358	53,493,216	2,797,960	1,745,358	53,493,216	2,797,960	1,745,358	69,641,181
MORBIDITY CASE (%)	0.14	1.00	1.00	0.14	1.00	1.00	0.14	1.00	1.30
% REQUIRING CARE	0.70	0.70	0.60	0.70	0.70	0.60	0.70	0.70	0.60
ADJUSTED NEEDS	1,958,572	1,221,751	32,095,930	1,958,572	1,221,751	32,095,930	1,958,572	1,221,751	41,724,708
NORMS OF CARE	21	1.00	1.50	21	1.00	1.50	21	1.00	1.50
FREQUENCY OF CONSULTATION									
MATERNAL CARE	7			7			7		
PRE-NATAL 4									
DELIVERY 1									
POST-NATAL 2									
CHILD CARE		4			4			4	
COMMUNICABLE DISEASE			3			3			3
OUT-PATIENT 4									
IN-PATIENT 2									
DURATION OF CONSULTATION (M/H)									
MATERNAL CARE	3			3			3		
PRE-NATAL 20 MIN./ .33 HRS.									
DELIVERY 120 MIN./2 HRS.									
POST-NATAL 15 MIN./ .25 HRS.									
CHILD CARE 15 MIN.		0.25			0.25			0.25	
COMMUNICABLE DISEASE 30 M/ .5			0.50			0.50			0.50
TOTAL SERVICE REQUIREMENTS	41,130,007	1,221,751	48,143,894	41,130,007	1,221,751	48,143,894	41,130,007	1,221,751	62,587,063
% DELEGATION & SUBSTITUTION	0.21	0.40	0.40	0.20	0.20	0.20	0.10	0.10	0.10
	8,637,301	488,700	19,257,558	8,226,001	244,350	9,628,779	4,113,001	122,176	8,258,708
TSR (NET OF DELEGATION & SUBST	32,492,705	733,050	28,886,337	32,904,005	977,400	38,515,118	37,017,008	1,099,576	58,328,356
ANNUAL PRODUCTIVITY	2,064	2,064	2,064	2,064	2,064	2,064	2,064	2,064	2,064
OFFICE VISITS (HRS.) / DAY	8	8	8	8	8	8	8	8	8
DAYS WORKED / WEEK	6	6	6	6	6	6	6	6	6
WEEKS WORKED / YEAR	43	43	43	43	43	43	43	43	43
FTE PHYSICIAN REQUIRED FOR DIR	15,743	355	13,995	15,942	474	18,660	17,935	533	27,291
PATIENT CARE									
% REQ FOR T, R, A	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	787	18	700	797	24	933	897	27	1,365
MANPOWER REQUIREMENTS	18,530	373	14,695	16,739	497	19,593	18,831	559	28,355
TOTAL	31,598			36,830			48,046		

**Table B17**

**REQUIREMENT FOR PHARMACISTS**

	Low	Medium	High
<b>Registered Establishments</b>			
Manufacturers	233	233	273
Drugstores	5,413	8,551	9,051
Non-Rx Drug Outlets	17	33	33
Chinese Drugstores	21	42	42
Drug Distributors	628	628	628
Hospital	1,687	1,895	1,895
	<b>1992</b>	<b>8,999</b>	<b>11,382</b>
	<b>2000</b>	<b>10,534</b>	<b>13,324</b>
		<b>11,382</b>	<b>11,922</b>
		<b>13,324</b>	<b>13,956</b>

**Assumptions for Medium Estimates**

1. One pharmacist is needed per pharmaceutical establishment (manufacturer, retail store for Rx and non-Rx drugs, distributor).
2. Hospital requirement is based on DOH minimum staffing requirement.

**Assumptions for Low Estimates**

1. Requirement for pharmacists in manufacturing establishments and drugstores is similar to assumed number for medium estimates.
2. 25% less pharmacists is assumed for drugstores on account of delegation/substitution.
3. 50% less pharmacists is assumed for Chinese and non-Rx drugstores.
4. 11% vacancy (DOH, 1987) is assumed for Chinese and non-Rx drugstores.

**Assumptions for High Estimates**

1. Top 20 manufacturers are assumed to require at least 3 pharmacists.
2. The Mercury Drug chain, the biggest drugstore chain, is assumed to require at least 2 pharmacists per branch.
3. Requirement for hospitals, Chinese and non-Rx drug outlets and drug distributors is similar to assumptions for medium estimates.

Table B18

## REQUIREMENTS FOR MEDICAL TECHNOLOGISTS

	1992			2000		
	Low Assumption	Medium Assumption	High Assumption	Low Assumption	Medium Assumption	High Assumption
Population (In 1000)	64,259,000	64,259,000	64,259,000	75,224,000	75,224,000	75,224,000
Utilization rate	0.55	0.55	0.55	0.55	0.55	0.55
Total Services	34,708,587	34,708,587	34,708,587	41,530,166	41,530,166	41,530,166
Delegation & Substitution	0.05	0	0	0.05	0	0
	1,735,429	0	0	2,076,508	0	0
TSR (NET OF D & S)	32,973,158	34,708,587	34,708,587	39,453,658	41,530,166	41,530,166
FTE	2,136	2,136	2,136	2,136	2,136	2,136
Total manpower requirements (In hospitals and public health)	15,437	16,249	16,249	18,471	19,443	19,443
+ 20% in other areas (private clinics, etc.)	3,087	3,250	3,250	3,694	3,889	3,889
	18,524	19,499	19,499	22,165	23,332	23,332
+ 20% requirement for research and development	3,087	3,250	4,062	3,694	3,889	4,861
TOTAL	21,612	22,749	23,562	25,859	27,220	28,192



## **ASSUMPTIONS FOR REQUIREMENT ESTIMATION FOR MEDICAL TECHNOLOGISTS**

**A. The method will use the utilization rate of laboratory services of hospitals and RHUs.**

**Derivation of the utilization rate:**

### **1. Hospitals**

To determine the hospital laboratory services of non-DOH and private hospitals, the ratio and proportion method is utilized based on the given number of hospital beds and the DOH laboratory services.

**Assumption: Hospital beds, in some degree, reflect the laboratory facilities of hospitals:**

#### **Number of hospital beds (authorized)**

DOH	42,624	0.48
Non-DOH + Private	45,980	0.52
Total	88,604	1.00

**Ratio of DOH hospital beds to private/non-DOH hospitals: 0.93**

According to an article in the April/May 1991 issue of Health Alert, the percentage distribution of households which have used specified health facilities in 1986 (NHS, 1987) shows that the utilization of all households for government and private hospitals and clinics is not significantly different:

Government hospital	32.2%
Private hospital/clinic	34.1%

**Ratio of government hospital to private hospital: 0.94**

This serves to support the method used (ratio and proportion method) in determining the total hospital laboratory services.

It is further assumed that the general utilization rate of hospitals reflect the specific utilization of laboratory facilities of hospitals.

#### **Given 1991 DOH hospital servi**

Urinalysis	2,473,568
Blood	4,029,328
Feces	587,609
Sputum	211,021
Malaria	276,716
Others	2,314,982

	DOH	+	Non-DOH/Private	Total
Urinalysis				
Services	2,473,568		2,668,324	5,141,892
Hospital beds	42,624		45,980	
Blood				
Services	4,029,328		4,346,577	8,375,905
Hospital beds				
Feces				
Services	587,609		633,874	1,221,483
Hospital beds	42,624		45,980	
Sputum				
Services	211,021		227,636	438,657
Hospital beds	42,624		45,980	
Malaria				
Services	276,716		298,503	575,219
Hospital beds	42,624		45,980	
Other services				
Services	2,314,982		2,497,252	4,812,234
Hospital beds	42,624		45,980	
Total hospital services:				20,565,391
Adjusted Total Services (+25% for under-reporting):				25,706,739

## Public Health

### Public health cases, 1991

TB Symptomatics	2,009,865	2,512,331
Malaria	1,879,620	2,349,525
Schistosomiasis	1,389,062	1,736,328
Diarrhea	914,002	1,142,503
Leprosy	377,662	472,078
Sexually Transmitted	631,265	789,081
Total	7,201,476	9,001,845
Total public health services	9,001,845	

Total services rendered by  
hospitals and public health 34,708,584

Population, year 1991 6,868,000

Utilization rate  
(Services/population) 0.55

B. It is further assumed that this utilization rate is constant for a changing population.

C. The estimated annual demand for laboratory services is then converted into manpower requirement, as represented by the total number of full-time equivalent (FTE) needed to provide these services.

8 hours a day	
48 hours a week x 52 weeks/year	= 2,496
Less: holidays + vacation/sick	
leave days (45)	= 360
FTE	= 2,136

## **Appendix D**

### **Regression Results**

#### **A. The Impact of a Major Health Care Financing Scheme on the Supply of Hospital-Based Medical Manpower**

Regression analysis is used to test whether the existence of the Medicare program - the most important health care financing scheme in the country - does indeed affect the supply of medical manpower in hospitals.

To determine the impact of Medicare on the supply, we then look at the number of health manpower as a function of medical fees or charges, number of Medicare claims, provider setting (private or public), provider type (primary, secondary or tertiary), and provider location (urban or rural).

Customary medical fees or charges reflect the costs of compensable Medicare treatment. Medicare does it by charging differentially for primary, secondary and tertiary provider accommodations. It is hypothesized that medical professionals react positively to price. The higher the fees, the higher the financial returns to medical workers (especially doctors), and the more persons are induced to join the medical staff of hospitals. Since Medicare payments are partly a function of the endogenous decisions by the hospital and physician as to length of confinement and the resources deployed in treating each patient, there is great incentive for hospitals to expand health care resources, including the supply of medical manpower. Because demand for many medical services is price inelastic, revenues will increase if fees go up.

The number of Medicare claims is likewise predicted to influence positively the number of doctors and allied medical practitioners within the hospital setting. When providers are able to substantially cover their costs through sheer volume of Medicare-related treatments, the quantity of claims begins to act as an allocative mechanism, and sellers of medical services have a good incentive to provide medical care. Suppliers of medical services increase when the service itself is found to be economically viable. Apart from direct in-patient services provided by doctors and nurses, tests and drugs are included in the Medicare benefit package; hence, the supply of medical technologists and pharmacists will likely increase with higher Medicare claims.

Differences in provider setting affect the supply of medical manpower if supply is reflected in the differential use of public and private hospitals. cursory evidence shows, however, that private hospitals are utilized as much as public hospitals. Even if public hospitals charge less for medical care than the cost of providing it, heavy subsidies almost always make for the difference, signifying an ability to sustain current demand levels. There is thus no difference between the two types in the ability to generate medical resources. Compensation patterns may have demonstrable supply effects, however. Private tertiary hospitals are known to offer higher compensation packages to doctors. Private primary clinics may not have the same inducements, especially if they are established by general practitioners who, as a rule, have lower economic rate of return than specialists in tertiary hospital settings. Public hospitals, on the other hand, have more generous terms for nurses in terms of wages and salaries. If supply is sensitive to prices,

then the presence of public hospitals will impact positively on the stock of nurses in clinics and hospitals. It is unclear, however, whether the presence of private hospitals has any influence on the tally of doctors. No discernible influence is predicted on the supply of medical technologists.

The Medicare program is widely believed to have been responsible for the proliferation of small, primary-type providers and to a lesser extent, secondary clinics. That would mean dependence on a continuous supply of general practitioners and nurses. Specialists would still tend to flock to tertiary providers, however. The latter type would thus still have significant influence on the largely undifferentiated supply of physicians variable. The institutional configuration of primary, secondary, and tertiary hospitals seems to maintain a certain kind of self-selection: it permits medical manpower to self-select themselves into different markets.

One other interesting variable is provider location. Since the urban dummy is a proxy for a host of other indices, including fairly high income levels, comfortable lifestyles, higher educational opportunities, and cultural diversity, it would probably be safe to say that a priori, it is the urban setting which has a positive impact on the levels of hospital-based medical manpower being provided.

#### Data and variable selection

The data have been assembled from the computer files of GSIS on Medicare claims. Information on average Medicare charges, volume of claims, institutional settings (public/private, primary/secondary/tertiary) and location was aggregated at the provider level. A suitable period, from July-December 1991, was selected for estimation purposes. The GSIS records were merged with DOH data on hospital licensing at the provider level, in order to incorporate supply variables (number of doctors, nurses, pharmacists, and medical technologists). The sample yielded 128 observations. Table V.1 lists the descriptive statistics of the variables selected. The variables used serve as potential factors affecting the supply of medical manpower in hospitals.

#### Estimates and discussion

Using ordinary least squares estimation, the results are shown in Table D1.

As predicted, Medicare charges are positively associated with supply of medical manpower in hospitals. The impact of high Medicare fees is to increase the number of physicians, nurses, pharmacists and medical technologists (all t-ratios are significant at the .01 level). This is no surprise, since providers collect significant amounts of revenue through Medicare fees, which in turn steps up the utilization of more health care resources, including human resources. (But it is not always that, necessarily, Medicare increases the number of medical staff; rather it may just induce doctors to increase their productivity. The specification does not capture the 'intensity effect' of Medicare on the existing number of medical staff, longitudinal data on which are not available.) In addition, a hospital's need for labor is a function of its admission of Medicare patients. Hence, as predicted, the number of Medicare claims also tends to expand the supply of doctors, nurses, pharmacists and medical technologists, in a highly significant way. Given the current incentive under the Medicare program to hospitalize rather than to utilize other approaches to health care, there is added inducement to hire more medical workers. But the effect

Table V.1

DEFINITIONS AND DESCRIPTIVE STATISTICS			
	Definition	Mean	Standard Deviation
DEPENDENT VARIABLES			
Doctors	Number of doctors per provider	69.13	74.80
Nurses	Number of nurses per provider	65.45	107.69
Pharms	Number of pharmacists per provider	4.73	8.31
Medtechs	Number of medical technologists per provider	8.74	12.58
INDEPENDENT VARIABLES			
Pripub	Public provider = 1; private provider = 0	0.26	0.44
Type 1	Primary provider = 1; 0 otherwise	0.07	0.26
Claims	Secondary provider = 1; 0 otherwise	0.30	0.46
Charge	Number of Medicare claims per month per provider	277.91	272.42
	Average amount (in pesos) of charges per Medicare recipient	1951.8	981.31
Rurban	Location of provider: urban = 1; rural = 0	0.86	0.35

Table D1

LEAST SQUARES REGRESSION ON SUPPLY OF HEALTH MANPOWER								
DEPENDENT VARIABLE								
NUMBER OF DOCTORS			NUMBER OF NURSES		NUMBER OF PHARMACISTS		NUMBER OF MED TECHS	
INDEPENDENT VARIABLES								
		t-stat		t-stat		t-stat		t-stat
Charge	(5.09)*	0.0354	(4.23)*	0.0461	(2.95)*	0.0021	(3.94)*	0.0048
Claims	(2.06)**	0.0498	(2.97)*	0.1125	(3.87)*	0.0098	(5.02)*	0.0021
Pripub	(-0.13)	-1.5684	(2.03)**	39.3175			(1.59)***	3.4552
Type 1	(1.02)	25.0996	(1.75)**	67.7203			(1.89)**	8.2066
Type 2	(-1.54)***	-26.2237	(0.43)	11.5557			(1.24)	3.6943
Rurban	(1.94)**	32.3818	(1.27)	33.3289	(1.25)	2.4475	(1.97)	5.7879
NUMBER OF OBSERVATIONS: 100								

NUMBER OF OBSERVATIONS: 128

\* Significant at the .01 level using one-tailed test

\*\* Significant at the .05 level

\*\*\* Significant at the .01 level

of Medicare on the number of non-physician medical workers hired may not be as direct as the specification indicates.

Supply of doctors is a bit lower in public hospitals, although not by any significant amount. The fact that a hospital is private or government has no effect on the number of physicians entering or shifting to the hospital services market. It may be that the existence of tertiary providers has significant supply effects, but apparently, the presence of primary-type providers (whose doctors are poorly compensated relative to specialists in tertiary hospitals) is having a confounding effect on the results. The supply of nurses is a different matter. Public hospitals have a highly significant impact on the stock of nurses, and this is probably due to the higher compensation levels for nurses in government-run facilities. Public hospitals likewise positively relate with the supply of medical technologists, which is contrary to the a priori prediction of no-impact. The causal mechanism is unclear in this case, unless compensation levels are also higher for laboratory-based technicians in public hospitals. The supply of pharmacists was not included in this aspect of the regression.

Turning now to another type of institutional setting, secondary providers are seen to slightly influence the supply of hospital doctors while primary providers have a significant impact on the supply of hospital-based nurses and medical technologists. This is somewhat surprising, since arguably, it is the presence of advanced, urban based tertiary hospitals which should lure more people into joining hospital staff. The growth of tertiary facilities has been quite stagnant, however, and it is the larger number of secondary hospitals which has probably been a "second best" haven for an increasing number of doctors. Although the growth of primary providers has been more rapid, they do not have the capacity to absorb a large number of doctors. Again, the results are puzzling for the supply of nurses and medical technologists. Either there are measurement errors or presumably there are behavioral factors operating within the primary hospital setting (e.g., altruism, the need to service the poor) that induce nursing or medical technology. These factors need to be further investigated.

Finally, the urban location of a provider affects the hospital's supply of doctors and medical technologists, which confirms the a priori expectation that a host of "modernizing" factors (e.g., educational opportunities, comfortable lifestyles) are powerful inducements for many to change work settings in medicine and medical technology. Location, however, does not have supply effects as far as nurses and pharmacists are concerned. There is a need to further investigate the locational preferences of these health manpower categories.

If indeed Medicare has been, at least arguably, a driving force in the growth of health care providers, it is apparent that it is as well the impetus for the growth of hospital-based health manpower. The demand for more health workers is derived from the demand facing health care providers. The regression results show that Medicare elements, such as hospital charges, volume of claims and institutional setting, are factors that can strongly influence the supply of health workers.

*Further limitations:* The results should be interpreted as relating only to the increased supply of health manpower to hospitals. The aggregate supply effects are long-term in character and cannot be adequately captured in a least squares estimation using cross-section data. In fact,

it is possible that Medicare may be inducing an increase in the supply of hospital-based health workers at the expense of other provider settings, such as rural health clinics and outpatient clinics. In other words, by influencing the returns to different health manpower in different ways, Medicare might be encouraging only a shift in work settings in the short run, rather than an increase in the aggregate supply.

To test the impact of Medicare on the overall supply of health manpower, an earnings function could be constructed which will determine whether the incomes of physicians and other health workers have increased with the advent of Medicare. A rise in demand for health services due to Medicare would then translate into an increased demand for health manpower. A more "upstream" analysis would test the effects of Medicare on the production of health manpower before and after its institution. A significant increase in levels of enrollment in medical schools after the establishment of Medicare would suggest a positive effect on the aggregate supply of health manpower. These tests, however, are better performed using time-series data, which, unfortunately, are not available.

## B. Barriers to Entry

In the absence of a complete costing of education from the DECS and affiliated hospitals for training, estimates of the rate of return to medical schooling was computed in this study using the following standard approach of estimating a semilogarithmic earnings function adopted.

$$\ln Y = a_0 + a_1 S + a_2 P + a_3 P^2 + U$$

where:

- Y = nominal earnings
- S = years of schooling/training
- P = years of practice
- U = disturbance term
- $a_0$  = logarithm of the no-experience, no schooling earnings level
- $a_1$  = private rate of return to the private cost of foregoing labor market participation in order to attend school
- $a_2$  = private rate of return to the earned years of experience/practice

The above equation was estimated using 295 sample of the 1991 DOH-PIDS Out-Patient Clinic Survey. This provides information on physicians' earnings on clinics, hospitals, honorarium, teaching; years of trainings/residencies; years of practice. The number of actual years of pre-medical schooling and medicine proper is not reported, so the normal years of four and five for pre-medical and medicine proper was adopted respectively. Again the variables chosen serve as possible indicators in estimating the rate of return to medical schooling.

The regression results in Table V.4 show the computed rate of return to medical schooling of 0.0760. The rate of return of garnering years of experience/practice is 0.0422. Both of these coefficients are significant at 1% level of significance.



These results indicate that for every additional year of medical schooling, there is a 7.6 percent marginal increment in the physician's earnings. Likewise, for every additional year of practice, there is a 4.2 percent marginal increment in the earnings.

### C. Determinants of Health Manpower Outflow

Mueller (1982) viewed most economic studies on the determinants of migration to have two major shortcomings. First, while most studies have considered economic conditions in explaining the choice behavior of migrants, few have formalized the behavioral rules of potential migrants. Second, only the mobility studies have been disaggregated. Personal attributes of potential migrants have consequently been given little role in the migration decision, which includes the destination choice as well as the choice to move, and personally relevant measures of economic factors have not typically been used.

In order to meet most of the above shortcomings, an economic theory of migration that is based upon an analysis of a consumer maximizing his lifetime expected utility over space could be adopted. Factors identified to be of theoretical importance in the potential migrant's decision are personal attributes, that relate to unmeasurable nontransport costs of migration, the expected values of economic and amenity attributes, and the variance or degree of information one has concerning the place attributes. Since the optimal choice of a potential migrant with given observable characteristics is indeterminate, only the probability that a potential migrant with given observable attributes will select an alternative with given observable characteristics can be assessed.

To explain the probability of a health manpower's choice to migrate or not given a set of attributes, a probit model has been developed in this study. The said model attempts to consider the importance of personal characteristics in the decision to migrate abstaining from economic, development and locational characteristics.

A certain health manpower is thought to be maximizing his utility over a good, that is, his income. The physician for instance, is assumed to migrate or not when faced with the choice of one of the conditions which serve as hypotheses:

Condition 1.  $W_H + MU_H < W_A$  then migrate

Condition 2.  $W_H + MU_H > W_A$  then not migrate

where:

$W_H$  = wage at home

$W_A$  = wage abroad

$MU_H$  = marginal utility given the wage offers at home and abroad

He/she picks the alternative that maximizes his or her utility. We derive the utility for staying in the Philippines (home) depending on the size of valuation of utility given the wage offers at home and abroad. If the valuation of utility at home is small, then the health manpower only needs small differentials in wage to be able to migrate. The utility model is specified as a linear function of the personal characteristics of the health manpower plus an error term. We assume that personal attributes have zero values for alternatives other than the home country. That is, the effects of personal attributes are specific to the potential migrant's origin utility.

Let:

$$I_i^* = X_i \beta + \varepsilon_i; \quad i = 1, \dots, n$$

where:

$I_i^*$  = represents the utility index, which is determined by an explanatory variable  $X_i$ . The index  $I_i$  is assumed to be a continuous variable which is random and normally distributed. The index will vary by individual and the information being whether the health manpower will migrate or not is not observed.

$$I_i = \begin{cases} 1 & \text{if } I_i^* > 0 \\ 0 & \text{otherwise} \end{cases}$$

$I_i$  can take on only two values, 1 or 0

$W_H + MU_H \leq W_A$  implies  $I_i^* \geq 0$

$W_H + MU_H \geq W_A$  implies  $I_i^* \leq 0$

$X_i$  = value of attributes; personal characteristics, i.e. the values of the explanatory variables; age, gender, marital status, education, occupational status for the  $i$ th individual

$\beta$  = unknown vector of parameters

$\varepsilon_i$  = error term

Functional Form:

$$\begin{aligned} \Pr(I_i = 1) &= \Pr(I_i^* > 0) \\ &= \Pr(X_i \beta + \varepsilon_i > 0) \\ &= \Pr(\varepsilon_i > -X_i \beta) \\ &= \int_{-X_i \beta}^{\infty} f(\varepsilon) d\varepsilon_i \\ &= \Phi(-X_i \beta) \end{aligned}$$

$$\ln L = \sum_{I_i=1} \ln \Phi(-X_i \beta) + \sum_{I_i=0} \ln (1 - \Phi(X_i \beta))$$

where  $i = 1$  refers to those who will migrate and  
 $i = 0$  refers to those who will not migrate

Since the probit model assumes that  $I_i^*$  is a normally distributed random variable,  $I_i$  can be computed from the cumulative normal probability function where  $\epsilon$  is a random variable which is normally distributed with mean zero and unit variance.  $\Pr(I_i = 1)$  represents the probability of an event occurring in the context of the health manpower's choice to migrate. Since this probability is measured by the area under the standard normal curve from  $-\infty$  to  $-X_i \beta$ , the choice to migrate will be more likely to occur the larger the value of the index  $I_i^*$ . To obtain an estimate of the index  $I_i$ , we apply the inverse of the cumulative normal function and take the log linear function. The probability  $\Pr(I_i = 1)$  resulting from the probit model is an estimate of the conditional probability that a health manpower will migrate or not given the personal characteristics and the wages at home and abroad.

#### Probit Model

$$I_i^* = \beta_0 + \beta_1 E_i + \beta_2 A_i + \beta_3 G_i + \beta_4 M_i + \epsilon_i$$

where

$I_i^*$  = utility index

$E_i$  = set of educational attainment dummies {medical/dentistry degree, nursing degree, other allied medical degrees (pharmacy and medtechs)}

$A_i$  = set of age group dummies {20-29, 30-39, 40-49, 50 above (omitted)}

$G_i$  = gender dummy (male = 1; female = 0)

$M_i$  = marital status dummy (never married = 1; others = 0)

$\epsilon_i$  = error term

#### Data Source

The probit results were obtained using a cross-sectional data drawn from the 1988 National Demographic Survey, NSO. Using a subsample of 101 migrant health manpower (part of sample of 1,761 individuals comprising the international migration data) responses to the NDS survey, and an additional 101 non-migrant health manpower which were randomly sampled from 600 individuals comprising non-migrant health personnel. The sample yielded a total of 200 observations. The test for robustness was not applied in this estimation.

#### Estimation Results

The regression coefficients. The results as given tell us the linear relationship between the estimated index  $I_i$  and the personal characteristics variables. The results in Table V.5 suggests that nurses have higher propensities to migrate, followed by pharmacists and medical technologists. Results for physicians and dentists are not significant and have the wrong sign, indicating that these professions are not a determinant of emigration. The effect is that there is

Table V. 5

Estimates of the effect of personal characteristic variables on the health manpower's choice to migrate

INDEPENDENT VARIABLES	COEFFICIENT	STANDARD ERROR	T-RATIO
One (Constant)	(0.602640)	0.31675	(1.903)
Gender	0.919209 E-01	0.243073	0.021
Marital Status	0.466863 E-02	0.217572	0.021
Age			
Twenties	(0.814972) E-01	0.374256	(0.218)
Thirties	0.894469 E-01	0.348153	0.257
Forties	0.701640 E-01	0.416006	0.169
Education			
Medicine/Dentistry	(0.219156)	0.292846	(0.748)
Nursing	1.22440	0.267702	4.574
Others	0.623269	0.323513	1.927

NUMBER OF OBSERVATIONS: 200	
Maximum Likelihood Estimates:	
Log-Likelihood.....	(116.70)
Restricted (Slopes=0) Log-L...	(138.62)
Chi-Squared (8) .....	43.838
Significance Level .....	0.20084 E-07

a probability, conditional on the health worker's being a nurse, to migrate as an optimal choice.

The age variables: twenties, thirties and forties were included since age is commonly associated with stages of the life-cycle affecting mobility. The expectation was that the young are opt to migrate than the old, since the latter are more likely to undergo other social changes, such as starting new households. The age variables are not significant, and "twenties" does not conform to the presumed positive relationship between youth and migration.

The other personal attribute, gender, was considered for the following reason: labor market experiences of women are thought to be different from those of men, in part because of a "crowding" phenomenon, whereby labor market practices limit the scope of occupation open to women (Kahne, 1975). Thus, opportunities "elsewhere" are likely to be less different for women than for men, and women may accordingly be less mobile. However, the results show that gender, as well as, marital status were insignificant.

To allow for nonlinearities (see Table V.6) in the relationship, the square of the variable age was included, which showed an independent effect on the decision to migrate. Education still had a significant effect but with reduced coefficients relative to the previous estimates.

Table V.6

Estimates of the effect of personal characteristic variables on the health manpower's choice to migrate

INDEPENDENT VARIABLES	COEFFICIENT	STANDARD ERROR	T-RATIO
One (Constant)	(3.57089)	1.57720	(2.264)
Gender	0.598198 E-01	0.243182	0.246
Marital Status	0.750862 E-02	0.223046	0.337
Age	0.158380	0.794980 E-01	1.992
AgeSQ	-0.190379 E-01	0.959137 E-03	(1.985)
Education			
Medicine/Dentistry	(0.323294)	0.297674	(1.086)
Nursing	1.16305	0.273236	4.257
Others	0.536746	0.325132	1.651

NUMBER OF OBSERVATIONS: 200	
Maximum Likelihood Estimates:	
Log-Likelihood.....	(114.73)
Restricted (Slopes=0) Log-L...	(138.62)
Chi-Squared (8) .....	47.776
Significance Level .....	0.34377 E-09

## Appendix E

### Other Data

#### Number of Schools

Region	Physicians	Dentists	Nurses	Midwives	MedTech.	Pharmacist
1	2	2	12	17	4	2
2	0	0	1	3	0	0
3	1	0	12	9	1	0
4	2	1	18	23	2	0
5	1	1	11	18	2	0
6	2	1	13	10	4	1
7	4	2	11	7	4	4
8	3	0	2	3	1	0
9	0	0	3	6	1	0
10	1	1	8	15	1	1
11	1	2	6	13	2	1
12	1	0	6	12	1	0
NCR	7	7	37	21	11	9
CAR	1	2	2	5	2	1
TOTAL	26	19	142	162	36	19

Region	Population 1000	Real GDP MILL	GDP/cap	Hosp Beds	Hospitals
1	3,598	18,350	5,100	3,733	97
2	2,372	16,671	7,029	2,161	77
3	6,281	68,392	10,889	7,097	182
4	8,375	101,346	12,101	11,323	237
5	3,962	20,516	5,179	3,940	139
6	5,463	50,071	9,165	4,764	80
7	4,654	46,624	10,019	5,822	91
8	3,095	18,052	5,832	2,761	74
9	3,201	21,198	6,623	2,457	88
10	3,556	38,060	10,702	4,704	144
11	4,516	50,836	11,257	6,433	198
12	3,213	25,299	7,874	3,830	122
NCR	8,034	225,446	28,063	27,173	159
CAR	1,161	11,822	10,182	2,405	65
TOTAL	61,480	712,683	11,592	88,603	1,753

Asian Comparison: Number of Health Manpower

Number of Physicians

Year	Phils.	Indonesia	Japan	Malaysia	Singapore	Thailand
1975	13,212	8,279	132,479	2,757	1,622	5,005
1980	16,080	12,931	156,235	3,858	1,976	6,867
1985	19,570	19,875	186,224	4,939	2,631	8,650
1990	25,827	26,109	213,020	6,893	3,549	12,923

Number of Dentists

Year	Phils.	Indonesia	Japan	Malaysia	Singapore	Thailand
1975	8,402	944	43,586	433	419	652
1980	10,711	1,681	53,602	691	485	1,169
1985	13,654	4,237	64,971	1,041	604	1,451
1990	17,557	5,776	74,286	1,489	769	1,812

Number of Nurses

Year	Phils.	Indonesia	Japan	Malaysia	Singapore	Thailand
1975	38,053	9,856	361,604		5,767	18,993
1980	85,902	20,201	487,169	15,392	7,545	18,483
1985	73,427	30,515	615,057	21,036	8,395	38,683
1990	60,225	29,034	747,410	23,595	9,495	60,527

Number of Midwives

Year	Phils.	Indonesia	Japan	Malaysia	Singapore	Thailand
1975	46,095	10,720	26,742	3,767	930	6,335
1980	54,976	16,472	25,867	5,002	779	8,669
1985	65,569	51,375	24,353	6,643	650	7,716
1990	76,984	17,219	22,656	5,434	524	11,679

Number of Pharmacists

Year	Phils.	Indonesia	Japan	Malaysia	Singapore	Thailand
1975	15,788	1,847	94,362	258	288	1,913
1980	16,162	3,013	116,056	488	368	2,650
1985	16,546	4,268	132,845	843	436	3,376
1990	16,998	5,483	150,294	1,255	585	3,930



## Appendix F

### List of Delphi Panelists and Other Expert-Respondents

#### 1. First Delphi Panel

Health Manpower Seminar-Workshop  
23 September 1992, 8:00 a.m. - 5:00 p.m.  
INNOTECH Building, Diliman, QC

Dr. Fernando Sanchez, Jr.  
Department of Preventive & Community  
Medicine  
UERMMMC

Dr. Marcelino Durante  
Philippine Heart Association

Dr. Norma Crisostomo  
Philippine Society of Anesthesiologists

Ms. Virginia Orais  
Health Manpower Planning Services  
D O H

Dr. Jorge Peralta  
Philippine Society of Pathologists

Ms. Susan Evia  
Philippine Nurses Association

Dr. François Canonne  
World Health Organization

Ms. Amelia Rosales  
Association of Deans of Phil. Colleges of  
Nursing

Dr. Reynaldo de la Cruz  
Philippine Urological Association

Ms. Ma. Linda Buhat  
Nursing Services Administrators

Mr. Nerio Quicoy  
UPLB College of Economics & Management

Dr. Rosie Noche  
Philippine Society of Ophthalmologists

Mrs. Catalina Sanchez  
Philippine Pharmaceutical Association

Ms. Blanche Barbers  
Philippine Dental Association

Ms. Janet Limpiado  
Philippine Institute for Development Studies

Ms. Arlene Lim  
Pharmaceutical & Health Care Association  
of the Philippines

Ms. Arsenia Gavero  
Learning Technology Center, DAP

Ms. Aurma Manlangit  
Project Development Institute, DAP

Dr. Juan Flavier  
Department of Health

Ms. Joy Flavier  
Department of Health

Mrs. Leonila Magcale  
Integrated Midwives Association of the  
Phils. (IMAP)

Mrs. Rosalina Santiago  
IMAP

Dr. Jesus de Jesus  
Philippine College of Chest Physicians

Dr. Elena Cuyegkeng  
Association of Philippine Medical Colleges

## 2. List of Other Experts

Dr. Blanch Barber  
Philippine Dental Association —

Dr. Ledivino Cariño  
Philippine Medical Association

Dr. Adriano Laudico  
Philippine College of Surgeons

Dr. Jeffrey Leonardo  
Fabella Hospital

Ms. Alice dela Gente  
IMAP

Dr. Teresito Ocampo  
Medical City

Dr. Liza Casintahan  
Jose Reyes Hospital

Dr. Alberto Gabriel  
Philippine Society of Microbiology and  
Infectious Diseases

Dr. Marcelino Durante  
Philippine Heart Association

Dr. Jesus de Jesus  
Philippine College of Chest Physicians

Dr. Betty Mancao  
Philippine Medical Rehabilitation Center

Ms. Celia Carlos  
Drugstore Association of the Philippines

Dr. Salvador Salceda  
Philippine Society of Ophthalmology

Dr. Amelia Fernandez  
Philippine Pediatrics Society

Dr. Ponciano M. Bernardo, Jr., M.D.  
Philippine Urological Association

Dr. Jacinto Bautista  
Philippine Academy of Ophthalmology and  
Otolaryngology

Mrs. Florida R. Martinez  
Department of Health National League of  
Nurses

Mrs. Angelita V. Borromeo  
Operating Room Nurses Association of the  
Philippines

Mrs. Edna D. Fineza  
Philippine Orthopedic Nurses Society

Dr. Leda Layo-Danao  
Philippine Nurses Association

Mrs. Rosalinda Cruz  
Philippine Nurses Association

Ms. Eulogia Q. Gonzales  
Philippine Orthopedic Cente