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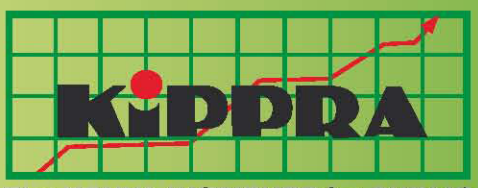

The KENYA INSTITUTE for PUBLIC POLICY RESEARCH and ANALYSIS

Health Professionals in Kenya: Estimation of Minimum County Requirements

Rose Ngara-Muraya and David Muthaka

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THE KENYA INSTITUTE FOR PUBLIC POLICY RESEARCH AND ANALYSIS (KIPPRA)

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Kenya Institute for Public Policy
Research and Analysis

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Abstract

This study forms part of the baseline information for use by counties as they take up the functions of providing public health care. The study objectives therefore includes determining the minimum number of health professionals required by various counties so that they can perform effectively. To achieve this objective involved computing the minimum number of health professionals required based on the projected population in 2013 and analyzing the supply gap per county.

The study uses Kenya's human resources norms and standards for health service delivery, together with the 2009 Kenya Population and Housing Census to estimate the minimum number of health professionals required per county in Kenya. The study uses the already existing norms and standards. The basis for these norms and standards is that the mix of inputs at the different healthcare facility levels should be coordinated.

The study found that health professionals' requirements increase progressively at the various levels. About 508,301 health professionals of different cadres are the minimum requirement nationally at the different levels, with about 429,520 being Community-Owned Resource Persons required at level 1. About 111,321 of these are required in the Rift Valley, which has the largest requirements of the majority of cadres of health professionals, given that it has the largest catchment population, while North Eastern requires only about 25,706.

Thus, some facilities are facing very serious shortfalls in some designated health professionals, therefore needing urgent intervention of the government. There is need to establish the optimum skill mix of health professionals per population levels, expand training of health professionals, and address the issue of adequate numbers in the various health professions. Accurate data would help inform strategies for appropriate and cost-effective combination of staff and roles.

Abbreviations and Acronyms

AHWO	African Health Workforce Observatory
AMHF	Africa Mental Health Foundation
CDF	Constituency Development Fund
CDCP	Centre for Disease Control and Prevention
CHEW	Community Health Extension Workers
CO	Clinical Officer
COHO	Community Oral Health Officer
CORW	Community-Owned Resource Persons
AIDS	Acquired Immuno-Deficiency Syndrome
HMIS	Health Management Information System
HRH	Human Resources for Health
HRM/QM	Human Resources Management/Quality Management
HW	Health Worker
IOM	International Organization for Migration
IPAR	Institute of Policy Analysis and Research
JLI	Joint Learning Initiative
KDHS	Kenya Demographic and Health Survey
KHWIS	Kenya Health Workforce Information System
MOH	Medical Officer of Health
MOMS	Ministry of Medical Services
MOPHS	Ministry of Public Health and Sanitation
NHS	National Health System
NHSSP	National Health Sector Strategic Plan
OECD	Organization for Economic Cooperation and Development
ORC	Opinion Research Corporation
PEPFAR	Partnership to Fight HIV/AIDS in Kenya
RCN	Registered Community Nurses

GoK	Government of Kenya
SSA	Sub-Saharan Africa
UN	United Nations
WHO	World Health Organization

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1. Introduction

1.1 Background

The Constitution of Kenya has created a devolved system of government, where some functions previously performed by the central government will be taken over by the county government. In the health sector, county governments will, amongst other things, provide primary health care services, referred to as county health services. In the formative stages of the county governments, a lot of data and information is required to guide the mobilization, planning and funding of health requirements. The county governments will take some time to collect and collate this county-based data and information to use with respect to health professionals for health service delivery and planning. Norms and standards for health service delivery developed by the Ministry of Health gave an indication of minimum requirements of human resources for health as well as facilities. However, these were using provincial and district regions, which have now been scrapped with the introduction of the new system of county governments. A gap in data by county on health professionals has been identified, and this paper seeks to fill this gap by providing an indication of the requirements of health professionals per county.

The Ministry of Health developed the norms and standards to guide the efficient, equitable, effective and sustainable delivery of the Kenya Essential Package for Health–KEPH (Government of Kenya, 2006b). The basis of the norms and standards especially for health professionals is the assumption of a positive relationship between densities of physicians, among other key health personnels, and healthcare utilization. Health service delivery standards relate to the expectations of each level of care and human resources needed to meet these expectations. Though useful for planning, the norms and standards have not been effectively enforced in the various different levels, resulting in vastly different capacities across the system, particularly as regards human resources.

Key to efficient health services delivery is the availability of adequate health professionals distributed across all regions according to need. Many studies have been carried out on human resources for health, with most of them focusing on the total numbers available within a country and the effects of mal-distribution. For instance, Wibulpolprasert and Pengpaibon (2003) underscore five different types of mal-distribution of human resources for health: between countries, regions of same country, professions (skill mix/over-specialization), institutions, and gender. The mal-distribution may be due to social inequity or health systems management problems, which can be solved by directing resources to disfavoured

areas, reforming medical curriculum, bonding local graduates to deter emigration and brain drain soon after graduation, financial strategies and incentives, personnel management, increased supply and replacement strategies as well as social strategies.

1.2 Motivation and Context

Inadequacy of health professionals in Kenya is a problem which has persisted partially due to mal-distribution across the country. Norms and standards for health service delivery have been in use since 2006. They give an indication of minimum requirements of human resources for health as well as facilities, and information which has been analyzed to assess the minimum required numbers of health professionals by province. These provinces and districts have now been scrapped with the introduction of the new system of county governments. In the formative stages, counties will need to establish their resource requirement. This study seeks to form part of a baseline for use by counties as they take up the functions of providing public health care. Thus, the objective of this study includes determining the minimum number of health professionals required by the counties. This will involve computing the minimum number of health professionals required based on the projected population in 2013, and analyzing the supply gap per county. The study seeks to answer the following questions: (i) How many health professionals are currently serving in each of the 47 counties? (ii) What is each county's minimum requirement for health professionals? (iii) What is the health professionals supply gap for each county? and (iv) How can the counties fill the identified gaps to achieve minimum requirements?

Two things to note about this study: (i) the focus is health professionals and not human resources for health. The latter encompasses other professionals working in the health sector, including health management, as well as health support workers; (ii) It focuses on minimum requirements for health professionals in public facilities only, without any due consideration to private service providers. However, the study recognizes the fact that the private sector employs about 50 per cent of health professionals (Government of Kenya-GoK, 2009). However, many private health establishments are based in urban areas. This leaves the government facilities serving most of the counties, which are predominantly rural. Due to complexity of projecting county population, 2009 data has been used. Current data on human resources in place is also a challenge; hence data used may not reflect the exact situation on the ground.

However, even with the said scope and limitation, the outcome of this study will assist the county governments in planning health care delivery by identifying

the minimum number of health professionals that they should be working with. It will also suggest ways of filling the gap between the actual numbers currently available and the minimum required.

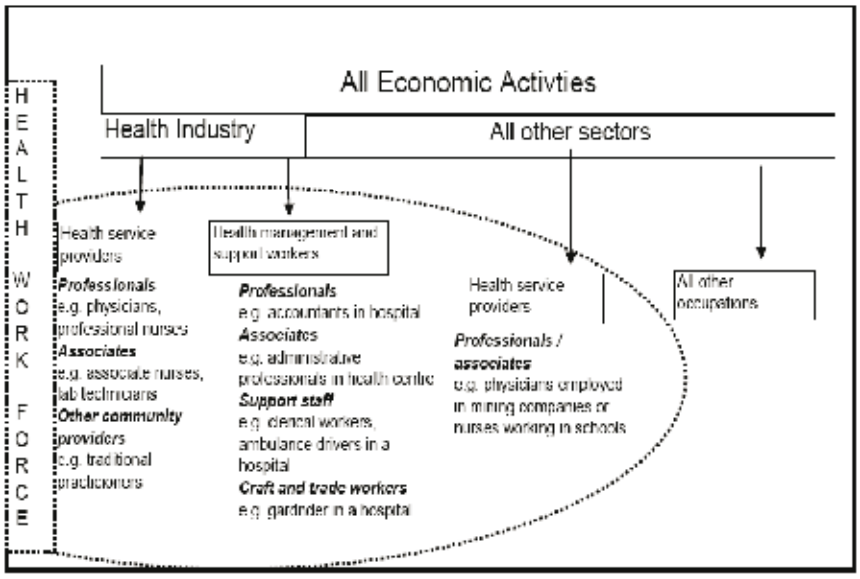
2. Related Literature

2.1 Global Perspective and Health Workers Classification

There is a difference between health professionals and health workers. The World Health Organization (WHO) defines health workers as people engaged in the promotion, protection or improvement of the population's health. To understand who health professionals are, consider the classification of various cadres of health workers provided by the International Standard Classification of Occupations (ISCO) for which the International Labour Organization is responsible. The use of ISCO provides a coherent framework for categorizing occupation types and level of training according to shared characteristics (Diallo *et al.* 2003). ISCO occupations are essentially organized according to two dimensions: skill level and specialization or subject matter.

Apart from health service providers, there are many non-health trained workers in health industries, such as managers, computing professionals, trade people, clerical and service workers, who provide administrative/managerial and infrastructure support, as well as welfare professionals for whom there is some overlap with health workers (United Nations, 2006). Figure 2.1 summarizes this framework.

Figure 2.1: Health workforce classification



Source: Dal Poz et al. (2006)

This system of counting, therefore, allows us to distinguish between two types of health workers: health service providers and health management and support staff. The former includes professional and associate professionals as well as other less qualified health cadres engaged in the delivery of health services, whether personal or non-personal, while the latter are people who help the health system function but do not provide health services directly to the population.

The attainment of various health goals such as health MDGs requires inputs that are necessary to ensure efficient and effective delivery of health services (Government of Kenya, 2006b). Human resources are crucial to the health sector because provision of health services is labour-intensive (Stordeur and Leonard, 2010), and quality depends critically on the size, skills, and commitment of the health workforce, which is also associated with immunization coverage, outreach of primary care and infant, child and maternal survival (World Health Organization-WHO, 2006).

Various countries have in the past tried to estimate the adequacy of their health professionals. However, due to deficiencies of methodologies or inadequate implementation of policies, some countries such as Belgium, Canada, United States of America (USA), United Kingdom (UK) and France often find themselves balancing between periods of surplus and those of shortages (Stordeur and Leonard, 2010).

2.2 Comparative Analysis of Selected African Countries

Sub-Saharan Africa has 25 per cent of the global disease burden but only 3 per cent of the health workforce (WHO, 2006b). Table 2.1 shows how Kenya compared in availability of health professionals with peer countries within the SSA region in 2000 and growth for various years. Although the data is dated, the relativity has not changed by much.

Between 2000 and 2011, Kenya's density of physicians almost doubled, while nurses grew by about 20 per cent. Density of physicians in South Africa grew by nearly 40 per cent in the same period. Some countries such as Tanzania and Zimbabwe had a decline of physicians but a sizable increase in nurses as the decade progressed. WHO recommends a minimum of 36 doctors and 356 nurses per 100,000 populations. Only Mauritius and South Africa satisfy this recommendation for doctors, while none of the listed countries satisfies the recommended level of nurse density.

As Stordeur and Leonard (2010) note, policy planners worldwide are struggling with the question of the appropriate numbers of health professionals given population needs and trends in health service utilization. A comprehensive

Table 2.1: Physicians and nurses working in selected African countries

Country	*Population	Physicians		Physicians/ 100,000 pop		Nurses		Nurses/ 100,000 Pop.	
	2000	2000	Number(yr)**	2000	2006***	2000	Number(yr)****	2000	Number(yr)*****
Angola	13,926,373	881	2,956(09)	6	8	13,155	29,592(09)	94	170(09)
Botswana	1,757,925	530	591(06)	30	40	3,556	5,006(06)	202	280(10)
DRC	49,626,200	5,647	5827(04)	11	11	16,969	28,789(04)	34	..
Kenya	31,253,701	3,855	7,549(11)	12	14	26,267	32,941(11)	84	80(11)
Lesotho	1,963,878	114	89(03)	6	5	1,266	1,123(03)	64	..
Madagascar	15,364,272	1,428	3,150(07)	9	29	3,088	3,585 (04)	20	..
Malawi	11,228,756	200	265(09)	2	2	1,871	4,812(09)	17	30(10)
Mauritius	1,186,873	960	1,303(04)	81	106	2,629	4,438(04)	222	..
Mozambique	18,200,656	435	548(08)	2	3	3,664	6,214(08)	20	30(10)
Namibia	1,895,839	466	774(07)	25	30	2,654	5,750(07)	140	280(10)
S. Africa	44,000,000	27,551	38,236(11)	63	77	90,986	184,459(04)	207	..
Swaziland	1,010,787	133	173(09)	13	16	3,345	1626(09)	331	160(09)
Tanzania	34,038,161	1,264	300(06)	4	2	26,023	37,625(05)	76	20(10)
Uganda	24,213,120	2,429	3,361(05)	10	8	9,851	6,720(06)	41	130(10)
Zambia	10,201,562	670	836(10)	7	12	10,987	7,461(10)	108	80(10)
Zimbabwe	12,509,477	1,530	827(09)	12	16	11,640	16,668(09)	73	130(10)

*Source: Mwaniki and Dulo (2008); *World Bank Population data; **World Health Organization; *** Africapedia; ****WHO; and ***** World Bank*

WHO report has highlighted a worldwide shortage of almost 4.3 million doctors, midwives, nurses and support workers, with 1.5 million needed for Africa alone, where 36 of the 57 countries with severe shortages are located (WHO, 2006 and 2013). Kenya is 36th in SSA and 57th globally in terms of human resources for health shortages, with only 1.69 health workers per 1,000 people, which is nearly 30 per cent below the WHO recommendation of 2.3 per 1,000 population (Government of Kenya, 2011). It takes an adequate, qualified, skilled, competent, well distributed and managed health workforce for a health system to operate effectively.

Scheffler *et al.* (2009) estimated the healthcare professional situation in Sub-Saharan Africa (SSA) by 2015. Their study used a forecasting model to estimate the need, supply, and shortage of doctors, nurses and midwives in 39 African countries, and found that 31 countries will experience a need-based shortage of about 800,000 doctors, nurses, and mid wives, which they compare with the WHO estimates of need-based shortages of 818,000 health professionals in the region. They also noted that, besides shortages, African countries face skill-mix imbalances. Skill mix of health workers has been identified as a possible solution to overall shortages, and that shifting to less-trained workers can be cost-effective in some circumstances. However, establishing an appropriate optimal worker mix is a major challenge to health system managers and policy makers.

Stordeur and Leonard (2010) argue that medical supply planning goes beyond issues of manpower size to desired skill-mixes, availability and accessibility level of medical services, quality control and accountability of health care providers, regulatory measures shaping the demand for health care, and financing of the health system. They argue that without such a broad perspective, medical supply planning becomes a demographic exercise where the population-age structure determines service needs and the quantity of care provided.

Table 2.2: Number of employees in government facilities by cadre (2006)

Cadre	Number	Total workforce in %	Staff not mapped	% total
Doctors	1,203	3.4	76	0.2
Clinical officers	2,186	6.1	26	0.1
Public Health Officer	4,259	11.9	64	0.2
Registered nurses	3,482	9.8	41	0.1
Enrolled nurses	12,664	35.5	84	0.2
Others	11,849	33.3	159	0.4
Total workforce	35,643	100	450	1.2

Source: Government of Kenya (2006a)

Table 2.3: Registered health personnel and number per 100,000 population

Category	2008		2009		2010		2011	
	Total	Per 100,000	Total	Per 100,000	Total	Per 100,000	Total	Per 100,000
Doctors	6,623	17	6,897	17	7,129	18	7549	19
Dentists	974	3	1,004	3	898	2	930	2
Registered Nurses	14,073	37	15,947	40	29,678	75	32941	83
BSc. Nurses		2		2		2		3
Pharmacist	2,860	7	2,921	7	3,097	8	3205	8
Enrolled Nurses		83		81		86		87
Health Institutions	6,190		6,696		7,111		8,006	

Source: Kenya National Bureau of Statistics (2012)

2.3 Kenyan Scenario

Health services provision in Kenya is relatively urban-based, with a large percentage of health professionals based in urban areas. The country is not different from other developing countries which, according to Kinoti and Livesley (2004), have 23 per cent of doctors and 38 per cent of nurses working in the rural areas, and 1 doctor serving 500 people in Nairobi compared to 160,000 in Turkana District.

Table 2.2 reflects the outcome of a mapping conducted in 2006 on the staff in government hospitals. It shows staff composition, with nurses (registered and enrolled) comprising over 40 per cent of the total workforce compared to doctors, who make up only 3.4 per cent of the workforce.

Table 2.3 shows registered medical personnel numbers and distribution per 100,000 population from 2008 to 2011. The number of nurses per 100,000 population is increasing, with a large leap between 2009 and 2010. However, the increase in the number of physicians is very small and negative for dentists between 2009 and 2010.

The Government of Kenya (2009) highlights the core human resource challenges facing the health sector in Kenya to include "policy and institutional arrangements, human resources planning, recruitment and placement, performance management and appraisal, reward and motivation, capacity building, and employee welfare".

According to Government of Kenya (2009), Kenya was going to lose more than 50 per cent of its health workforce to retirement and other attrition attributes

by 2020 had the retirement age not been adjusted to 60 years. This was coupled with recruitment of an additional 1,500 health workers per year approved by the government and another 3,000 contract workers who are likely to be absorbed at the end of their contract. Although doctors working in public facilities increased by 43 per cent between 2004 and 2008, nurses declined by over 20 per cent, while clinical officers declined by about 3 per cent. An increase of 14,000–21,000 health workers was proposed within the 2009–2012 plan period, 85 per cent being health professionals (Government of Kenya, 2009).

Even as the country grapples with shortages of human resources for health, the situation has not been easy to monitor due to poor information management. Available reports show that the Ministry of Health lacks accurate data on human resource, and so do medical training institutions (Rogers, 2008). However, there have been initiatives to manage health workforce data in Kenya. For instance, the Kenya Health Workforce Information System (KHWIS) is a computer-based database management system initiated between 2002 and 2005 to replace the paper system. It started with a database for nurses but has now been extended to other health professionals so as to help monitor supply and demand. In 2012, the programme matured and the database became accessible online by all in the government system, and training on its usage was cascaded from the headquarters to the provinces, and to the counties. This system will help the counties in their needs identification and will be essential in monitoring their workforce since staff are listed by facility. The system is linked/harmonized with regulatory bodies such as the Nurses Council of Kenya (NCK) and the Integrated Payroll and Personnel Database-IPPD (Njenga, 2012). The Funzo Kenya USAID five year training programme for human resources for health (2012–2017) is expected to give the health workforce a huge skills boost (USAID, 2012).

Before the devolved system of government, engagement of health workers was being done by the government through the Public Service Commission (PSC), while deployment was being done by the Ministry of Medical Services (MoMS) and Ministry of Public Health and Sanitation (MoPHS). Training, registration and enrolment, licensing, code of conduct regulations and enforcement were under the regulatory bodies, which include the Medical Practitioners and Dentists Board, Nursing Council of Kenya, Pharmacy and Poisons Board, Clinical Officers Council and Medical Laboratory Technologists and Technicians Board. Distribution was done according to provincial and district health management committees, but major disparities existed especially among regions mostly due to poor retention strategies. About 200 doctors and 600 nurses leave the service every year in addition to scores of laboratory technician and public health officers, citing poor remuneration and working environment (AHWO, 2009).

2.4 Health Personnel Distribution, Decentralization and Imbalances

Health personnel distribution entails the number of health workers per unit of the population. For significant progress on global health goals, a health worker/ population ratio of 2.5/1,000 is required, yet Africa has slightly less than 1.0 health worker/1,000 population (Kinoti *et al.*, 2006). Mal-distribution of health workers entails imbalances in health services provision, with areas of shortage receiving substandard health service provision. Health workforce imbalances range from profession/specialty imbalances, geographical, institutional and services imbalances to gender imbalances. These arise when market failure within a country leads to divergence between supply and demand (Zurn et al., 2004).

A constant health policy concern worldwide is inequitable geographical, gender and occupational distribution of health workers, which affect performance of the health systems (Gravelle and Sutton, 2001; Gupta et al., 2003; Chen et al., 2004, Djibuti et al., 2008). For example, Munga and Maestad (2009) revealed that there were significant inequalities in health workers per capita and skill mix in Tanzania. Health professionals have a tendency to prefer urban to rural areas in service delivery, mostly because urban areas present other opportunities such as training, career development, schools, spouse employment, better housing, power, water, roads among other services that are not readily available in rural areas (Serneels et al., 2007).

The health sector in Kenya suffers from skewed distribution of the available health personnel, with some rural dispensaries being unmanned, while some facilities in urban areas are overstaffed (Government of Kenya, 2006). This situation has further been aggravated by additional dispensaries constructed under the Constituency Development Fund (CDF), with over 1,000 dispensaries constructed since the inception of the fund. While these are expected to greatly increase access to health services, they pose special challenges in staffing and medical supplies (Government of Kenya, 2008). Ndetei et al (2008) attest that rural to urban migration of health workers is a serious problem as international migration, and it stems from economic, social, professional and security factors. The distribution policy of Kenya's health workers is discussed under methodology. It shows that distribution is done per level of facility, where level 1 has CHEW; level 2, nurses; level 3, clinical officers; level 4, medical officer; level 5, specialists; and level 6 serves as tertiary, mostly for training.

Decentralization of health services provision should lead to improved allocative efficiency in services mix and expenditure as well as quality, accountability, transparency and equity. It entails transferring planning, management,

resource allocation and decision-making power and responsibility from the central government to local users (Government of Kenya, 2010a). Centralized bureaucracies are connected with wasteful resource use, while local authorities are deemed to have better control of usage and increased accountability, hence management of health services. Political rather than health sector concerns determine how power is transferred from the centre, yet the sector needs are dependent on epidemiological and technological transitions, varying disease prevalence, service providers and patient expectations (Rigoli and Dussault, 2003; Kolehmainen-Aitken, 2004). For example, Sousa *et al.* (2006) observe how substantial health workers distribution inequalities exist in Brazil due to adapted decentralization strategy, with greater disease burden areas having fewer health workers.

Implementation of decentralization in Kenya has been done starting with management decision-making using the Health Sector Services Fund (HSSF), while the central government retains the policy functions. Planning and financial management have therefore been devolved to the counties. This includes decentralization of continuing education to enhance skills of already existing health workers.

2.5 Closing the Gap

Derksen and Whelan (2009) recognize that the USA suffers from a long term shortage of nurses, standing at 400,000 in 2009, and estimated to reach 1 million by 2020 when physicians will also be short by 200,000. They also recognize that the inadequacy is worsened by the mal-distribution of the available workforce. To fill the gap, the health care training programme has to be enhanced, particularly through funding, which will ensure expanded faculty capacity to take in more applicants for training.

Mal-distribution, notes Derksen and Whelan (2009), is highly correlated with where the training takes place. Given that most of the training takes place in urban settings, it is only natural for those that qualify to desire similar work environments. Majority of medical trainees, especially doctors, are from urban well-to-do families, and are unlikely to provide primary care in low income neighbourhoods and rural settings. Nurse training is also academic institution-based, yet hospitals receive training funds that these academic institutions do not receive. Relocating training facilities to the rural settings is one way of addressing the mal-distribution problem. Provision of scholarships to those willing to practice in areas of scarcity should be coupled with giving training institutions an incentive

to set up training residence in these areas (Derksen and Whelan, 2009; McKeag *et al.*, 2007).

Notable here is the fact that the gap can be closed by training more professionals as well as encouraging those already qualified to relocate to areas of scarcity. Unfortunately, most SSA countries have either one or no medical school, offering insufficient training opportunities (Africa's Health Workforce Crisis, 2004). Education and training rationalizes any profession. Strategies for upgrading human resources for health include investments in education, training of health workers and curriculum development. Education and training directly impact on the size of the health workforce within a country or region. Despite progress in development of effective training methodologies for health workers in Africa and other developing countries, challenges continue to hamper its success. These include high costs, poor country-level coordination, inequitable access, interrupted services, and skills and knowledge reinforcement, all of which aggravate crisis in human resources for health and impede effective training scale-up to address health worker shortages. Training initiatives must be preceded by performance gaps assessment, coupled with an understanding of other factors besides skills that health workers need to perform well (Gaye and Nelson, 2009).

Studies carried out in various countries show how issues of inadequacy of health workforce are dealt with, as in the case of Mozambique, after repatriating Portuguese medical doctors in mid-1970s and the collapse of the socialist block (Russia and Cuba), whcih led to the country facing a threat of having hospitals without specialized medical doctors. Through "poor"-to-"poor" cooperation, a pool funded by Switzerland, The Netherlands and Norway was created in 1996, which increased national medical specialists in Maputo, and later redistributed through financial incentives (Vio, 2006).

Qualified health professionals are limited in many developing countries, leaving substitute health workers to perform medical procedures, given that clinical officers are often used as a substitute for doctors, achieving similar outcomes. For example, clinical officers who perform major emergency surgery such as obstetric operations save maternal and neonatal lives in Malawi (Chilopora *et al.*, 2007). Such substitutes are cost-effective, making them suitable for African health systems especially in rural communities. They provide surgery, ophthalmology, orthopedics, radiology, dermatology, anesthesiology and dentistry (Dovlo, 2004). In Mozambican 'técnico de cirurgia', they get training and effectively assist their health system's medical officers (Cumbi *et al.*, 2007). Another successful case is Micronesia (Keni, 2006) where indigenous people are trained in basic health science to provide health services to local communities. Building the capacity and using substitute cadres to deal with expanding demand for health services,

especially due to HIV/AIDS, can fill part of the gap, but this requires eliminating doubts in abilities as well as professional territorialism (Dovlo, 2004).

Adequacy and capacity of health professionals goes beyond ideal numbers to include a well motivated human resource base, whose retention strategies must be entrenched in human resources for health management. Motivation in the work place is "an individual's degree of willingness to exert and maintain an effort towards organizational goals" (Franco et al., 2002), while performance is a combination of available, competent, productive and responsive staff (Bloom *et al.*, 2001). Large numbers of demotivated health workers cannot provide good health services. Poor performance leads to lower care standards as patients and the community are either mistreated or untreated (Dieleman and Harnmeijer, 2006).

Allowing dual practice can also help narrow the gap. However, public sector health workers are often labeled as unproductive, poorly motivated, inefficient, client-unfriendly, absent, corrupt, among other things, because they often employ dual practice; that is, combining salaried public-sector work with a fee-for-service private work (Ferrinho *et al.*, 2004). They practice predatory behaviour, lowering the quality of care they provide in the public sector to win patients into their private practice. Public-to-private brain drain and resource misuse (vehicles, equipment, time, etc) ensue. The practice can be encouraged but with tighter controls and closer regulation of the practitioners, including increased risks to damaged professional reputations for breaching regulations (Jumpa et al., 2007) and improved working conditions that culminate to financial pressure.

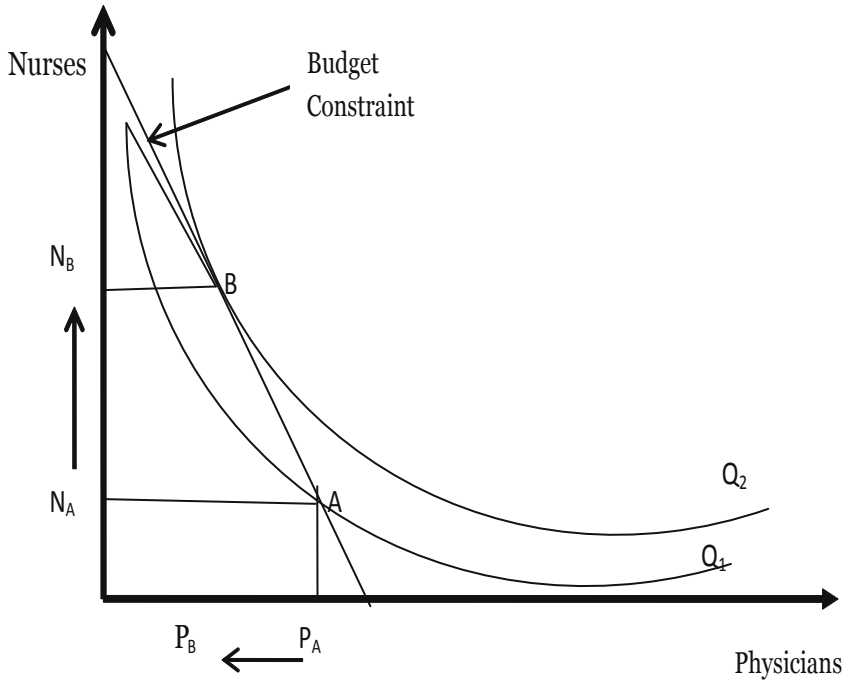
3. Analytical Framework and Methodological Note

3.1 Theoretical Framework

Generally, we know that health professionals enter the health production function as an input to health. However, the inputs of health professionals enter into people's health through provision of healthcare. We recognize here that health itself is influenced by, among other things, individual characteristics including genetics, food and nutrition, environmental factors, and healthcare. Even in healthcare provision, there are various factors that come into play, including health facilities, drugs, laboratory services and other healthcare inputs even before the impact of the healthcare professional is felt. Thus, since the goal of any health care system is to improve the health of the healthcare consumers, this becomes the role of the health professionals.

Fulton *et al.* (2011) present an economic framework based on skill mix and task-shifting, in which they argue that when the skill mix and each cadre's activities and tasks are not well matched to local health care needs, then health care services become less accessible or less affordable. Therefore, Fulton *et al.* describe an optimal skill mix as a combination of health workers that produce a given level of health care services at a particular quality for the lowest cost.

Figure 3.1: Skill mix isoquants and budget constraint



Source: Adapted from Fulton et al. (2011)

Borrowing the concept of skill mix from Fulton *et al.* (2011), we note that there are many combinations of health worker skill-mixes that could produce a health care service in a particular setting as shown in the Figure 3.1.

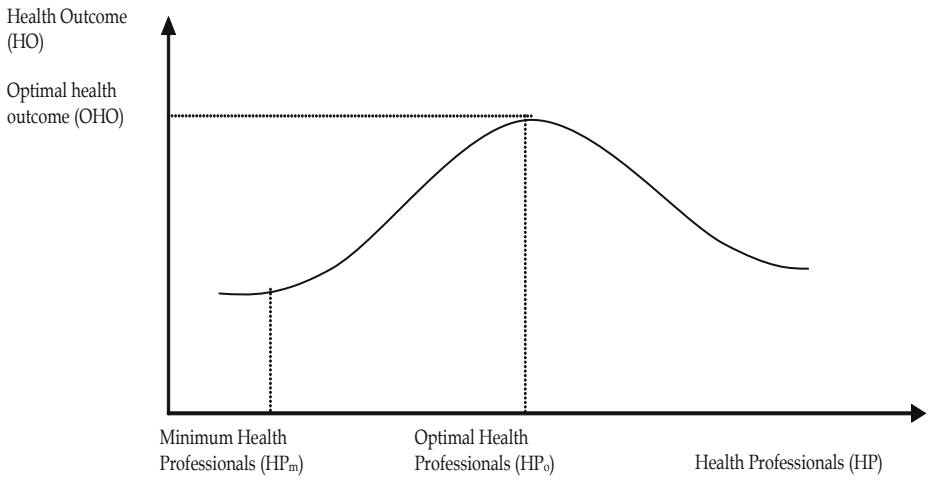
To produce a given health care service for a given level of quality, Fulton *et al.* (2010) assume a scenario in which two health worker types are available (physicians and nurses) as represented by the horizontal and vertical axis, respectively, in Figure 3.1. Q_1 and Q_2 are isoquants that represent different quantities of health care service produced by different mixes of physicians and nurses ($Q_2 > Q_1$). The budget line represents a fixed budget constraint along which total staffing costs are equal. It also represents a trade-off between nurses and physicians.

As described by Fulton *et al.* (2010), the figure shows an inefficient combination/ skill mix of nurses and physicians (Point A) and an efficient combination (Point B). Point A is inefficient because the service provider could reduce the number of physicians from P_A to P_B and simultaneously increase the number of nurses from N_A to N_B without increasing costs and still produce a higher quantity of health care services ($Q_2 > Q_1$). Point B, therefore, represents the productively efficient mix of workers because it is the point where the budget constraint is tangent to the isoquant, and the quantity of services at a given quality are maximized.

The above framework assists in pointing out whether a country is operating at the productively-efficient mix. For instance, Fulton *et al.* (2010) note that in 2003, the ratio of nurses to doctors was 8 to 1 in Africa and 1.5 to 1 in western Pacific countries, while other countries such as Brazil (4.04), Bangladesh (0.96) and India (0.83) had a higher physician-to-nurse ratio, which is greater than the global average (0.43). However, it is accepted that a productively efficient mix would vary across countries because of the different health care services provided and the influence of other factors like a country's health system, payment scheme, workforce training, wage rates and management culture.

Thus, when the Kenyan government came up with norms and standards for health service delivery, the assumption was that the human resource mix and other inputs will produce optimal health outcomes. This is the same assumption extended in this study. Among the health inputs that produce the health capital (measured by health outcomes) are health professionals. Therefore, health capital is taken as a function of health professionals as well as other health and non-health related goods and services. A combination of these inputs into the health production function will therefore make a county realize its optimal health outcome as shown in Figure 3.2.

Figure 3.2: Optimal health outcomes



Source: Author's Conceptualization

However, the norms and standards developed by the Ministry of Health in Kenya do not relate to the optimal levels. They set the minimum levels of health professionals that a facility should have. Given that facilities are established through regional considerations (that is in the past, a district could only have one district hospital and several health centres and dispensaries), the number of health professionals in a region are determined through the facilities established. For regions/counties to enjoy almost the same level of health outcomes, there should be some minimal inputs in terms of health professionals that should be in place. After the initial minimum number of health professionals (HP_m), the county can continue engaging more and more health professionals until the optimal point (HP_o) where any other increase of that number yields diminishing returns. This point will be determined by the demographic structure and disease burden of the county. Currently, the counties could be having less human resources than anticipated by the norms and standards.

To reach the optimal point, a county will have to consider the most cost-effective way of producing optimal health outcomes. A county would want to increase its health professionals but consider the least cost model. For instance, Fulton *et al.* (2011) have estimated the skill mix options required for countries to achieve the MDGs by 2015. Their study argues that the optimal mix of health workers is obtained 'when the marginal product divided by the workers' wage is equal across all health workers'. This means that an additional health professional should be able to increase the productivity of the health sector at minimal cost. The marginal product can be measured, for example, by the additional vaccinations due to an

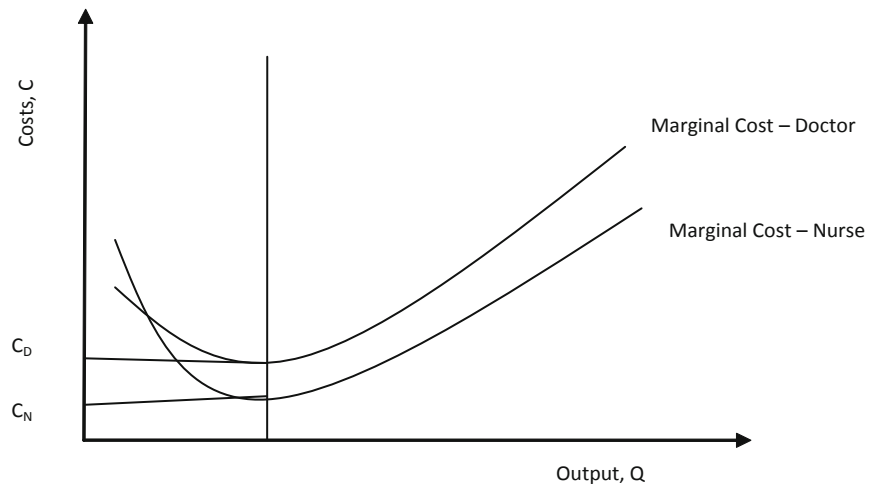
additional worker. Therefore, the mix would consider whether it would be cost effective to add more doctors for the same number of vaccinations; or it would be better to get more nurses or physicians for similar number of vaccinations.

The concept of marginal product follows the law of diminishing returns as shown in Figure 3.3. If output is measured by the number of vaccinations and inputs by the health professionals, then we can increase the workers up to the point where an additional worker leads to an increase in costs in the health sector, but no increase in number of vaccinations.

Therefore, this concept in the health sector implies that if the number of additional vaccinations given per dollar wage was higher from hiring an additional nurse versus an additional doctor, then more nurses should be hired. As more nurses are hired, the additional number of vaccinations given is likely to decrease eventually (because of diminishing returns), but the total wage bill will increase because of the increased demand for nurses. From Figure 3.3, looking at both the slopes and the levels of output (Y) and cost (C), an additional nurse produces more optimal output (Y_N) than an additional doctor (Y_D) and at a relatively lower wage (cost-C_N).

Based on the above framework, it is possible to estimate the optimal number of health professionals required in order to deliver outlined health goals. For instance, the framework can be used to estimate the required health professionals to enable a country realize MDGs. Two methods have been used in literature: a need-based model, and an economic-based model. A need-based model calculates the shortage of health professionals as the difference between need and supply. On the other hand, an economic-based model estimates the shortage based on

Figure 3.3: Health workers' marginal product



economic demand and supply. Therefore, both models estimate an optimal level of the health professionals.

3.2 Empirical Literature

Stordeur and Leonard (2010) carried out a study in Belgium where they examined the challenges in physician supply planning. Their study recognizes that planning human resources for health is a complex process. This is because it involves determining the numbers, mix and distribution of health providers required at some point in the future. It is assumed that there is a positive relationship between physician densities and health care utilization.

Stordeur and Leonard (2010) note correctly that reliable planning for HRH is crucial because it involves projecting the required workforce to meet future health service demand and the development of strategies to meet those requirements. Their study echoes what has been observed elsewhere that currently, there is a worldwide need to establish the appropriate numbers of health professionals given health needs and trends in health service utilization and production.

In their study, Stordeur and Leonard (2010) first reviewed relevant legal texts in Belgium to assess policies and institutional mechanisms in relation to workforce supply. Secondly, they interviewed some stakeholders for insights on specific aspects of HRH policy; and finally, they benchmarked Belgium status against some of its neighbours that display diverse educational policies and regulations. Their projections for Belgium health professionals were based on various measures. For instance, although the official figure reported for medical density was 42.2 per 10,000 inhabitants, Stordeur and Leonard (2010) found that in reality, this figure ranged between 23.8 and 28.1. Firstly, their analysis found that only a proportion of registered physicians were practicing. Secondly, about 20 to 30 per cent of the practicing physicians worked in other fields. Third, there was attrition in a number of practicing physicians due to old age, and women physicians taking career breaks. Fourth, in Belgium, the Ministry of Public Health fixed the number of practice licenses available to trainees every year. Thus, lack of consideration of these factors had estimated the official figure at 42 per 10,000 instead of 23-38 per 10,000.

When Rosenquist (1994) projected the future supply and demand of radiologists in the United States, he appreciated the fact that the task was important but difficult. This was because of the existence of incomplete data and erroneous conclusions due to future unpredictable changes. Nevertheless, Rosenquist considered the number of radiologists presently in training, the number of residents entering diagnostic radiology each year, and the annual attrition of radiologists through

either death or retirement. He developed a different equation to calculate the number of radiologists practicing in future years as:

$$S_N = (1+R)^N S_0 + I\frac{(1+R)^N - 1}{R}$$

where S_N = the number of radiologists in a future number of years (N),

R = Attrition rate of radiologists,

N = The number of years in the future,

S_0 = The present number of radiologists, and

I = the number of entering radiologists each year.

The above equation produced different estimates for different scenarios for the supply of the radiologists that considered maintaining of current output of radiologists at 900 per year; attrition, so that output per year is reduced by 25 per cent to 675; and a 50 per cent reduction of output to 450 per year.

Rosenquist (1994) considered several factors likely to affect the increase or decrease in radiologic services. The study found that the following factors increased demand for radiologic services: population increase (6%); aging population (1%); universal health insurance (3%); women working part-time (0.6%); and increasing complexity of examinations (6%). On the other hand, the factors that are likely to decrease demand included health care reforms (17%), and efficiency of radiology services (6%). The findings revealed that the most important factor influencing the projected reduced need for radiologists is the decrease in demand for radiologic services resulting from anticipated change to a managed care system, which is estimated to decrease demand by 17 per cent. This brings out health care reform as an important factor to consider during projections for health professionals. Population growth, demographic changes, and growth in percentage of women radiologists would together increase demand for radiologists by 18.5 per cent.

Rosenquist (1994), therefore, presented a formula that could project the numbers for any specific cadre of health professionals. However, the study highlights several limitations that could inform future predictions of cadres of health professionals. First, the assumption is that the existing ratio of health professionals – in this case, radiologists – for the population is appropriate. Second, the effect of technology affects future projection of the supply of health professionals. Third, changes in population, sometimes, have unexpected shifts.

In Africa, Muula *et al.* (2007) estimated the human resource requirements for highly active antiretroviral therapy (HAART) scale-up in Malawi. Like other studies in this area, Muula *et al.* (2007) appreciated the importance of clinical human resources estimation needed for informing planning and distribution of health professionals.

They used data on total number of patients on the HAART programme in Malawi and the numbers of registered health professionals in that country. Muula et al. (2007) used the norms established for Africa for the number of health care professionals required to provide HAART. Thus, they calculated the numbers of health professionals that would be required to provide care to 95,674 patients on HAART using the following formula:

$(\alpha * \beta) / \kappa$

where

α = the number of health professionals required for 1,000 patients,

β = total number of patients on HAART, and

K = 1,000 patients

Thus, Muula et al. (2007) take the norm for provision of HAART to 1,000 patients to be 1-2 physicians of clinical officers, 2-7 nurses, and 1-3 pharmacy staff. Using the number of health professionals within a professional category, they estimated the number of health professionals required for the delivery of HAART from the total health professionals' pool in Malawi.

The Malawian study considered the issue of full-time equivalents (FTE) of doctors with the argument that at initiation of a programme such as HAART, the number of FTE doctors tends to be high. However, after the first year of implementation, the FTE of doctors is likely to reduce. This is because doctors would gain experience, and patients (in the HAART programme) would have been stabilized on treatment, resulting in a reduced patient-clinician consultation time. Even outside HAART, doctors operating in specific regions would tend to know the disease structures and prevalence in such areas, hence become more efficient in their diagnosis. Experience would in general reduce the FTE of doctors.

Muula et al. (2007) therefore found that the human resource requirement for HAART was about 31.1 per cent of all clinicians or 189.7 FTE. The main finding showed that Malawi was using fewer human resources than would be expected or experienced in other settings. Whereas our study estimates the health professionals required by cadre and not necessarily for a particular ailment such as HIV/AIDS, it will borrow the idea of norms as used in Muula *et al.* (2007).

Like some of the studies reviewed here, Scheffler *et al.* (2008) used personnel norms established by WHO to estimate country shortages (or surpluses) of health professionals. Thus, the study assumed that each country needed 2.28 doctors, nurses, and mid-wives per 1,000 of the population. The WHO personnel threshold has been strengthened by other studies that have found either similar thresholds, or positive relationships between health worker density and health outcomes.

The study by Scheffler *et al.* (2008) presents some methodologies for forecasting the global shortage of physicians using a need-based and an economics-based approach. The need-based model was used to determine the number of physicians per capita required to achieve 80 per cent coverage of live births by a skilled health care attendant, whereas the economic model was used to identify the number of physicians per capita that are likely to be demanded, given each country's economic growth. The study extrapolated the future supply of physicians using the historical rate of increase in physicians per capita for each country and compared this with the estimates from the two models.

Scheffler *et al.* (2008) estimated the following regression model to identify a level of physician density below which virtually no country would be able to achieve 80 per cent coverage of live births as per the MDG 8. The equation run for each country between 1980 and 2001 is given as follows:

L_n (physicians per 1000 $population_t$) = $\alpha_o + \alpha_1 * year_t + \varepsilon_t$

where α_o and α_1 are unknown parameters to be estimated from the model and ε_t is the error term. The model assumes that current trends in the growth of physician numbers will continue for each country, and that skill mixes remain unchanged. Thus, Scheffler *et al.* (2008) estimated the baseline supply projections to the year 2015 using the historical growth rate of physician densities in each country.

Scheffler *et al.* (2008) used the following equation for the needs-based estimates for all countries *i* at time *t*:

Sin^{-1} (%$coverage_{it}$) = $\beta_o + \beta_1 * ln$ (physicians per 1000 $population_{it}$) + $\mu_i + \eta_t + \delta_{it}$

where μ_i and η_t reflect country and time fixed effects, respectively; δ_{it} is the error term; and β_o, β_1 are unknown parameters to be estimated from the model. The model estimates the number of physicians that would be needed in each country to attain the MDG of 80 per cent coverage of live births.

Scheffler *et al.* (2008) used a different model for the demand-based estimates, which utilize gross national income (GNI) per capita as the predictor of demand for physicians per 1,000 population, while country fixed effects account for the unobservable heterogeneity across countries, weighed by population size. The equation used for the estimation is of the following form, for country *i* at time *t*:

$ln(physicians\ per\ 1{,}000\ population_{it}) = \gamma_o + \gamma_1 * ln\ (GNI\ per\ capita_{it-5}) + \gamma_2 * income\ level_i + \mu_1 + \zeta_{it}$

where γ_o, and γ_1 are unknown parameters to be estimated; μ_1 is a vector of country fixed effects; and ζ_{it} is the error term. GNI per capita is lagged five years to account for time required for economic growth to affect health care spending and, in turn, influence changes in the health care system.

From the estimation of the above models, Scheffler *et al.* (2008) found that 45 countries (majority from Africa) will have a human resource shortage in 2015 according to the need-based approach. Results from the demand based model showed that 37 countries are likely to experience a shortage in 2015. Countries projected to experience demand-based shortages are those likely to experience strong economic growth in the near future. However, some countries will have both a need-based and demand-based shortage. This is because even with a critical need for more physicians, and projected economic growth that will demand a larger physician workforce, the human resource supply will not increase sufficiently by 2015, since such countries do not have the required capacity to train the numbers that will be demanded by 2015. For instance, the study estimated that Kenya would need 24,000 physicians by 2015, while its economy will demand 7,600 physicians, yet the supply is projected at 6,100 physicians.

However, Scheffler *et al.*'s (2008) criterion only reflected one aspect of health care delivery; meaning that different numbers of physicians would be required to meet alternative normative criteria for health services. Secondly, their projections of demand and supply rely on trends in either economic growth or physicians per capita, variables that are affected by policy changes. Finally, their demand projections are also affected by other factors other than economic growth, meaning the demand models would continuously require refining.

3.3 Methodology

This study uses Kenya's human resources norms and standards for health service delivery (Government of Kenya, 2006b) together with the 2009 Kenya Population and Housing Census (Government of Kenya, 2010) to estimate the minimum number of health professionals required per county in Kenya.

The norms of human resources for health are derived using a two-step approach:

(i) To qualify the expected types of staff cadres needed at each level based on the services that need to be provided as detailed in Kenya Essential Package for Health (KEPH); and

(ii) To quantify the numbers of the different identified staff cadres needed at every level based on the following two different methods:

(a) Determining the expected workload based on the activities to be performed. Workload is a function of the expected activities to be carried out at each level, and the time it takes to carry out the activities. This provides the total time needed for each activity of service delivery, within a given period (one year). This is then correlated with the available time the respective staff cadre has to carry out the

activities over the same period to determine the total number of staff needed for the activity. Expected activities are based on expected services to be delivered, while time taken for each activity is based on World Health Organization (WHO) standards.

(b) Rules of thumb

3.3.1 Health workers distribution policy

The human resources for health requirement correlates with the health system in place and the norms and standards that the government has put in place. The current health care systems include public, private-for-profit and private-not-for-profit (usually faith-based or NGOs) health institutions. While public health system is financed from the budget, private-not-for-profit facilities are partially from user fees, donor/partners funds, and some government seconded staff, while private system is privately-funded.

There are 6 levels of facilities in Kenya's health system. Before the realignment of ministries, the Ministry of Public Health and Sanitation (MoPHS) handled levels 1-3, while the Ministry of Medical Services (MoMS) handled levels 4-6. According to Government of Kenya (2006b), the staff requirement is rationalized over the levels such that two Registered Comprehensive Nurses (RCN) serve 5,000 people each at the level 2 facility. At higher levels:

> "A nurse is available for each ten inpatient beds; at least two nurses are available per operating theatre table; three nurses are needed every 24 hours (eight-hour shifts); a nurse is not responsible for more than 1,000 inpatients annually (ten inpatients for every three nurses, each covering an eight-hour shift)" (Government of Kenya, 2006b).

These levels and the services offered at the various levels are as follows:

Level 1: Community level, which is the foundation of service delivery. Activities focus on ensuring that individuals, households and communities carry out appropriate healthy behaviours, and recognize signs and symptoms of conditions that need to be managed at other levels of the system. This level has community health workers but no facilities, since the workers go to the community. The community health workers (CHWs) are organized into units that are attached to a dispensary in the community. The CHWs are supervised by community health extension workers (CHEWs), who are attached to level 2 facilities.

Level 2: Dispensaries, which are the interface between the community and the physical health system. It is expected to organize and coordinate structured, permanent dialogue and interaction with the community and its structures by ensuring provision of preventive and some curative services. Basically, a

dispensary provides preventive health care services and is manned by enrolled nurses, with a maximum of three per facility.

Level 3: Health centres that provide the services similar to those provided by level 2, but with additional services such as inpatient care, and minor surgeries but limited to outpatients. They are manned by clinical officers, who are supported by enrolled nurses.

Level 4: Sub-district and district hospitals, which focus on appropriate curative care. The facilities constitute the principal referral level for all KEPH interventions. The functions include provision of level 2 and 3 services with the inclusion of services such as referral level outpatient care, inpatient services and emergency obstetric care. Normally, level 4 are managed by a medical officer. Whereas there are all cadres of health professionals, the concentration of physicians is higher because it is a referral level.

Level 5: Provincial hospitals where the whole broader spectrum of specialized referral curative services are offered, to ensure that a wide scope of potential health needs of the communities are addressed at a point where they have access. Level 5 also includes training facilities for cadres of health workers who function at primary care level; this being basically nursing staff and clinical officers. Level 5 is a referral level from the district and is highly concentrated with medical specialists.

Level 6 are the national referral hospitals. Presently, Kenya has Kenyatta National Hospital and Moi Teaching and Referral Hospital, which serve the whole country mainly in respect of major referral cases. Table 3.1 presents the norms for key service delivery cadres at every level.

Table 3.1: Norms for key service delivery cadres, by level of care

Health care delivery	Definition	Catchment population	Service delivery staff	Minimum health workers
Level 1 unit	Community	5,000	CORPs	50
Level 2 unit	Dispensary	10,000	RCNs	2
			CHEW	2
Level 3 unit	Health centre	30,000	CO	2
			EN	14
			COHO	1
			Lab Technician	1
			Pharmaceutical Technologists	1
Level 4 unit	District hospital	100,000	MO	6
			CO	5
			EN	60
			Dentist	1
			Pharmacist	1
			Radiographer	1
			Dental Technologist	1
			Lab Technologist	1
Level 5 unit	Provincial hospital	1,000,000	Physicians	3
			Obstetricians/ Gynaecologists	4
			Paediatricians	3
			Surgeons	3
			Psychiatrists	1
			Opthalmologists	2
			ENT Specialist	1
			Dermatologist	1
			Anaesthetists	3
			Pathologist	1
			Radiologist	1
			Orthopaedic Surgeon	1
			Physiotherapist	1
			Occupational Therapist	1
			Orthopaedic Technologist	1
			Social Worker	1
			MO(ICU)	1
			EN (ICU)	12
			Clinical Pharmacist	1
Level 6 unit	National hospitals	40,000,000		

Source: Government of Kenya (2006)

4. Status of Human Resources for Health in Kenya

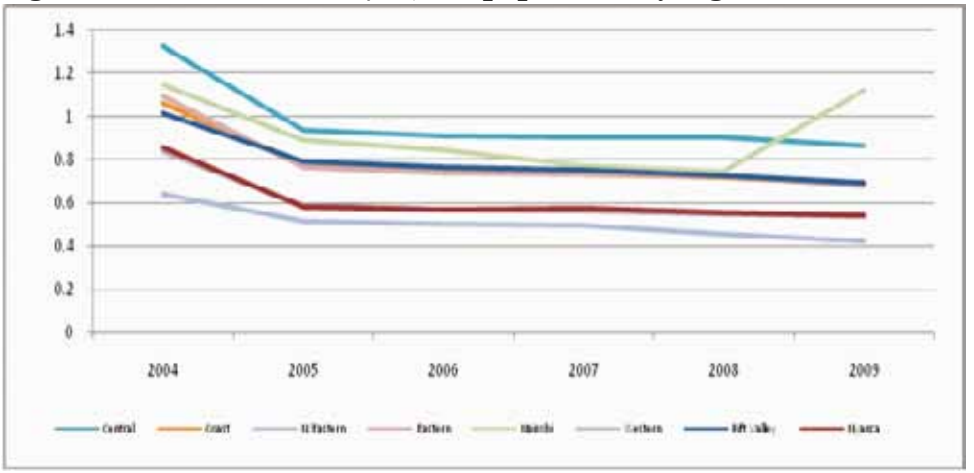
Health workers comprise personnel responsible for direct health care services as well as administrative personnel. This paper recognizes the important role played by the administrative personnel, especially in operation and maintenance of health facilities. However, the study lays emphasis mainly on non-administrative health professionals, with a greater focus on physicians, nurses and clinical officers in Kenya, and the minimum requirements of the county governments.

In a review of performance between 1994 and 2010, there has been a general decline in the number of health workers per 10,000 population (Government of Kenya, 2010b). This may be due to population growing at a faster rate than the number of health workers. From 2005, the whole country had less than one doctor per 10,000 population. A rising trend was observed in Nairobi in 2008-2009 (Figure 4.1), which could be explained by, among other factors, a displacement of people, including heath workers, from the countryside following the post-election violence of 2007/08.

Growth in numbers but no change in distribution over time

Although Nairobi is the second smallest province in terms of population, it has the highest proportion of doctors, with the most populated Rift Valley Province coming second, while Central Province has the third highest proportion albeit being the fifth in population size. Western Province, which has a slightly larger population than Central Province, has nearly half the number of doctors. North Eastern has the least, just as it is the least populated. Rift Valley leads with the supply of the other professionals besides doctors. However, it is worthwhile to

Figure 4.1: Health workers/10,000 population by region



Source: Government of Kenya (2010b)

note that Nairobi houses the largest referral hospital, Kenyatta National Hospital (KNH), which absorbs and houses quite a large proportion of the doctors, while Rift Valley houses Moi Teaching and Referral Hospital. Both have employed 42 per cent of Kenya's doctors, and 13 per cent of all nurses (Luoma *et al.*, 2010). Both of these referral hospitals are national in service delivery.

Appropriation of doctors, clinical officers and nurses per 100,000 population is reflective of the health professionals distribution. Using some historical 2003/04 data, Table 4.1 presents the ratio of key health personnel by region per 100,000 population. Appendix Table A1 is an expanded version of Table 4.1 with more cadres. Nairobi Province had a total of 233 doctors working down to 9 doctors per 100,000 population, while North Eastern Province had only 19 doctors working down to 1 doctor per 100,000 population in 2004. The remaining provinces had 2 to 4 doctors per 100,000 population. In terms of nurses, Central Province with 72 nurses per 100,000 population had the best, followed by Eastern Province with 55 nurses per 100,000 population. The ratio for clinical officers was almost uniform, averaging 6 per 100,000 population. North Eastern Province was the most disadvantaged with only 27 nurses per 100,000 population, while Nairobi had 33 nurses per 100,000 population (GoK, 2004). Comparatively, in 2009, OECD countries had an average of 8.4 nurses per 1,000 population, which translates to 840 nurses per 100,000 population (OECD, 2011).

Table 4.1: Distribution of key health personnel by province in 2003/4

	Central	Coast	Eastern	Nairobi	North Eastern	Nyanza	Rift Valley	Western	Total
Population (000)	3,919	2,807	5,180,	2,657	1,236	4,868	8,078	3,954	32,698
Doctors	143	114	170	233	19	101	220	80	1,080
D/P Ratio (000)	27.4	24.6	30.5	11.4	65.0	48.2	36.7	49.4	30.3
Per 100,000 people	4	4	3	9	1	2	3	2	3
Clinical Officers	275	215	330	118	76	280	640	214	2148
CO/P Ratio (000)	14.2	13.3	15.7	22.5	16.3	17.4	12.6	18.5	15.2
Per 100,000 people	7	7	6	4	6	6	8	5	6
Nurses	2,838	1,457	2,849	886	342	1,907	3,959	1,777	16,015
N/P Ratio	1,404	1,963	1,760	2,859	3,741	2,515	2,003	2,225	2,045
Per 100,000 people	72	51	55	33	27	39	49	45	49

Source: Government of Kenya (2004)

D/P Ratio = Doctor to Population Ratio; N/P Ratio = Nurse to Population Ratio; CO/P Ratio = Clinical Officers to Population Ratio.

Table 4.2: Percentage share of national cadres by province

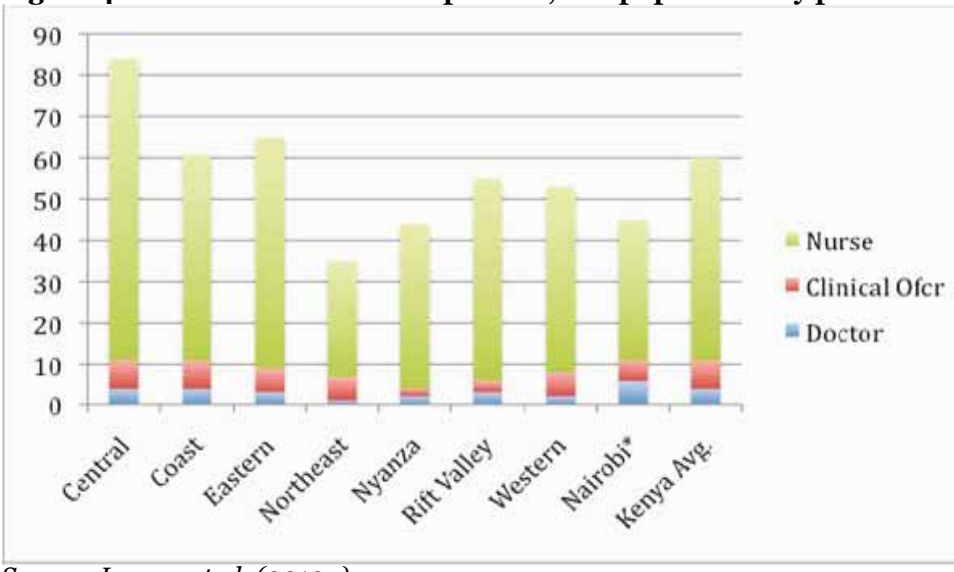
	Central	Coast	Eastern	Nairobi	North Eastern	Nyanza	Rift Valley	Western
Population	11 (12)	9 (8)	15 (16)	8 (8)	6 (4)	14 (15)	26 (25)	11 (12)
Clinical Officers	12	11	15	7	5	14	27	11
Dental Specialists	17	13	12	25	1	8	18	6
Enrolled Nurses	16	9	18	5	3	14	25	11
Doctors	14	8	11	32	2	9	18	6
Registered Nurses	16	11	15	10	2	14	23	8
Pharm. Tech.	9	10	17	15	5	10	26	9
Pharmacist	11	9	14	30	2	10	16	7
Total	15 (16)	9 (9)	16 (17)	9 (9)	3 (2)	13 (12)	25 (25)	10 (10)

Source: Government of Kenya (2010a)

Table 4.2 has the percentage distribution of various cadres of health professionals Kenya had at the end of the last decade. Shown in bold within parenthesis in first and last row are the 2004 percentages for comparison purposes.

The proportion of population for Central, Eastern, Nyanza and Western provinces declined between 2004 and 2010, while that of Coast, North Eastern and Rift Valley provinces increased. If population was the only factor that determines distribution of medical personnel, then Central and North Eastern have highly divergent figures, with Central getting more than its rightful share by 4 percentage points and North Eastern having less by 3 percentage points. Coast Province has

Figure 4.2: Health care workers per 100,000 population by province



Source: Luoma et al. (2010a)

the same for both, while the other provinces are either over- or under-served by 1 percentage point.

Figure 4.2 shows the three key cadres–physicians, clinical officers and nurses–on the same axis to reflect the skill mix by province. Clearly, Central Province had more nurses per population followed by Eastern and Coast Provinces. Nairobi, Western, Nyanza and North Eastern provinces are all below the national average. However, in Nairobi data as shown in Figure 4.2, local government facilities staff are included (Luoma *et al.*, 2010), which causes a significant understatement.

Nationally, registered and enrolled nurses are the largest group as they constitute 45.7 per cent of the Ministry's workforce followed by public health technicians and public health officers at 14.4 per cent and 11.9 per cent, respectively. Doctors and clinical officers together constitute only around 9.0 per cent. The proportion of doctor to clinical officer is 1:2, while that of doctor to nurses is 1:15.

Besides population size, the demand for the professionals is an equally important determining factor with respect to distribution of health personnel. This should go according to the disease burden, which raises the need for health services, hence pushing the demand for health professionals up.

Although the ratio/mix should be determined mostly by epidemiological factors in a country, OECD countries have an average of 3 nurses per doctor (OECD, 2011). Pakistan and Mexico have more doctors than nurses (Baldwin *et al.*, n.d.). The Kenya ratio is way out of this range, due to mostly shortage of doctors. To cope with the shortage, lower level staff perform tasks beyond their

Table 4.3: Number of health professionals by cadre

Year/Type	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011*
Doctors	4,740	4,813	5,016	5,446	5,889	6,271	6,623	6,800	7,129	7,549
Dentists	761	772	841	871	898	931	974	859	898	930
Clinical Officers	4,778	4,804	4,953	5,059	5,285	5,797	5,035	7,816	8,598	9,793
Pharmacists	1,866	1,881	2,570	2,637	2,697	2,775	2,860	2,921	3,097	3205
Reg. Nurses	9,753	9,869	10,210	10,657	10,905	12,198	14,073	26,988	29,678	32,941
Enrolled Nurses	29,094	30,212	30,562	31,895	31,917	31,917	31,917	34,032	34,282	34,576
Pharm Tech	1,399	1,405	1,620	1,656	1,680	1,680	1,815	1,950	2,233	2,409
Public H Officers	1,174	1,216	1,314	1,388	1,457	1,682	6,960	7,192	7,429	7,584
Public Health Tech.	5,484	5,627	5,861	5,938	5,969	5,969	5,969	5,969	5,969	5,969
BSc. Nursing							657	863	988	1,130
Total	59,049	60,599	62,947	65,547	66,697	69,220	76,883	95,390	100,301	55,732

Source: Government of Kenya (Various), Economic Survey)

Table 4.4: Number of interns joining the ministry annually after graduation

	2005	2006	2007	2008	2009	2010
Medical Officers	233	249	273	406	364	334
Dental Officers	26	26	38	34	46	18
Pharmacists	88	73	67	120	123	84

Source: AHWO (2008)

level of expected competency such as minor surgeries, dispensing medicine and taking X-rays (Government of Kenya, 2004). This is practised not only in Kenya.

> "In response to shortages of doctors and to ensure proper access to care, some countries have developed more advanced roles for nurses. Evaluations of nurse practitioners from the United States, Canada and the United Kingdom show that advanced practice nurses can improve access to services and reduce waiting times, while delivering the same quality of care as doctors for a range of patients, including those with minor illnesses and those requiring routine follow-up." (OECD, 2011)

Changes in number of health professionals by cadre

Table 4.3 shows the growth of medical personnel by type for the period 2002 to 2011. There was a gradual increase in number of doctors, although the rate of increase varied over time. Dentists also increased steadily, but a decline was observed between 2001 and 2002, and 2008 and 2009. Registered nurses increased at an average rate of 4 per cent, although the growth rate was lowest in 2000/01 and 2002/03 at less than 2 per cent and highest in 2006/07 at 11.8 per cent. From 2006 to 2008, there was no increase in enrolled nurses. This is a reflection of the fact that the course started to be upgraded to more advanced registered nurses, hence many public institutions have been phasing it out.

Table 4.4 shows the number of interns joining the ministry annually after graduation. When compared with the numbers in Table 4.3, it is notable that only a small proportion joins the ministry each year after graduation. The larger proportion join faith-based organizations (FBOs) and private hospitals, while others join private practice or move to other countries.

4.1 Minimum Health Professionals Requirements

4.1.1 National level requirements

Against WHO recommended minimum staffing levels of 36 doctors and 356 nurses per 100,000 populations, Kenya's average ratios were at 19 and 170, respectively by 2011 (Table 2.3 and Government of Kenya, 2012), which is about half of the recommended level. The norms and standards together with 2013

Table 4.5: Minimum number of health professionals required in 2013

Health care delivery level	Definition	Number of facilities required (Units)	Medical service delivery staff	Minimum health professionals for 2013
Level 1 unit	Community	8,590	Community Owned Resource Persons (CORP)	429,520
Level 2 unit	Dispensary	4,295	Registered Community Nurses	8,590
			Community Health Extension Workers (CHEW)	8,590
Level 3 unit	Health centre	1,431	Clinical Officers (CO)	2,863
			Enrolled Nurses (EN)	20,045
			Community Oral Health Officer (COHO)	1,431
			Lab Technician	1,431
			Pharm Tech	1,431
Level 4 unit	District hosp.	430	Medical Officers	2,577
			Clinical Officers	2,148
			Enrolled Nurses	25,771
			Dentists	430
			Pharmacists	430
			Radiographers	430
			Dental Technologist	430
			Lab Technologist	430
Level 5 unit	Provincial hosp.	43	Physicians	129
			Obstetricians/ Gynecologists	171
			Paediatricians	129
			Surgeons	129
			Psychiatrists	43
			Opthalmologists	86
			ENT specialist	43
			Dermatologist	43
			Anaesthetists	129
			Pathologist	43
			Radiologist	43
			Orthopaedic Surgeon	43
			Physiotherapist	43
			Occupational Therapist	43
			Orthopaedic Technologist	43
			Social Worker	43
			MO(ICU)	43
			EN (ICU)	515
			Clinical Pharmacist	43

Source: Authors' computations

Table 4.6: Regional human resources requirements

Minimum number of health professionals required by province											
Health care delivery	**Service delivery staff**	**Kenya 2009**	**Kenya 2013**	**Nairobi**	**Central**	**Coast**	**Eastern**	**N. Eastern**	**Nyanza**	**R. Valley**	**Western**
2013 Population		38,610, 097	42,951, 928	3,491, 289	4,876, 708	3,699, 248	6,305, 522	2,570, 609	6,054, 761	11,132, 104	4,821, 687
Level 1 unit	CORPS	386,101	429,519	34,913	48,767	36,992	63,055	25,706	60,548	111,321	48,217
Level 2 unit	RCN	7,722	8590	698	975	740	1,261	514	1211	2226	964
	CHEW	7,722	8590	698	975	740	1,261	514	1211	2,226	964
Level 3 unit	CO	2,574	2863	233	325	247	420	171	404	742	321
	EN	18,019	20044	1629	2276	1726	2943	1,200	2826	5,195	2250
	COHO	1,287	1432	116	163	123	210	86	202	371	161
	Lab Technician	1,287	1432	116	163	123	210	86	202	371	161
	Pharm Tech	1,287	1432	116	163	123	210	86	202	371	161
Level 4 unit	Medical Officer	2,317	2577	209	293	222	378	154	363	668	289
	Clinical Officer	1,930	2148	175	244	185	315	129	303	557	241
	EN	23,165	6013	489	683	518	883	360	848	1,558	675
	Dentist	385	430	35	49	37	63	26	61	111	48
	Pharmacist	385	430	35	49	37	63	26	61	111	48
	Radiographer	385	430	35	49	37	63	26	61	111	48
	Dental Technologist	385	430	35	49	37	63	26	61	111	48
	Lab Technologist	385	430	35	49	37	63	26	61	111	48
Level 5 unit	Physicians	115	129	10	15	11	19	8	18	33	14
	Obstetr/Gynaecologists	115	172	14	20	15	25	10	24	45	19
	Paediatricians	115	129	10	15	11	19	8	18	33	14
	Surgeons	115	129	10	15	11	19	8	18	33	14
	Psychiatrists	37	43	3	5	4	6	3	6	11	5
	Opthalmologists	78	86	7	10	7	13	5	12	22	10
	ENT specialist	37	43	3	5	4	6	3	6	11	5

	Dermatologist	37	43	3	5	4	6	3	6	11	5
	Anaesthetists	115	129	10	15	11	19	8	18	33	14
	Pathologist	37	43	3	5	4	6	3	6	11	5
	Radiologist	37	43	3	5	4	6	3	6	11	5
	Orthopaedic Surgeon	37	43	3	5	4	6	3	6	11	5
	Physiotherapist	37	43	3	5	4	6	3	6	11	5
	Occupational Therapist	37	43	3	5	4	6	3	6	11	5
	Orthopaedic Technologist	37	43	3	5	4	6	3	6	11	5
	Social Worker	37	43	3	5	4	6	3	6	11	5
	MO(ICU)	37	43	3	5	4	6	3	6	11	5
	EN (ICU)	464	515	42	59	44	76	31	73	134	58
	Clinical Pharmacist	37	43	3	5	4	6	3	6	11	5
Total		456,937	488,592	39,715	55,474	42,080	71,727	29,242	68,875	126,631	54,848

projected population data (using an average annual population growth rate of 2.7) were used to estimate the minimum number of health professionals required in Kenya. The results are presented in Tables 4.5 to 4.8.

Table 4.5 shows that Kenya requires 429,520 CORPs to serve 8,590 community units (level 1); 8,590 Registered Community Nurses to serve in 4,295 dispensaries (level 2); 2,863 Clinical Officers to serve in 1,431 health centres (level 3); and 2,577 medical officers to serve in 430 district hospitals (level 4). This is based on the norms and standards that define the minimum resources for each level rather than the optimal number (Government of Kenya, 2006b).

4.2 Regional Level Requirements

The norms, standards and projected 2013 population data was used to estimate the minimum number of professionals required in Kenya (Table 4.6). The table shows that Rift Valley requires the largest number of health professionals in majority of the cadres, given that it has the largest catchment population, requiring 111,321 CORPs compared to North Eastern province that requires 25,706.

Table 4.7: Minimum nurses and doctors requirements

Enrolled Nurses	**Numbers per 1,000,000 Pop**
Level 4 (100,000 pop.) @ 60	600
Level 5 (1,000,000 pop.)	12 for ICU
Category of Doctors	Numbers
Physicians	3
Obstetricians/ Gynaecologists	4
Paediatricians	3
Surgeons	3
Psychiatrists	1
Opthalmologists	2
ENT specialist	1
Dermatologist	1
Anaesthetists	3
Pathologist	1
Radiologist	1
Orthopedic Surgeon	1
Dentists 1 per 100,000	10
MO @ 6 per 100,000	60
MO(ICU)	1
Total	95

Source: Compiled from other tables in document

4.3 County Level Requirements and Gap

Using the norms and standards, the estimated minimum requirements of health professionals required in counties is computed and presented in Table 4.8. The data is approximated using doctors and nurses norms and standards requirements for levels 3 (30,000 population), 4 (100,000 population) and 5 (1,000,000 population). At level 3, 14 nurses are required for each unit. At level 4, six medical officers and one dentist are required for each unit of 100,000, hence 60 and 10 for one million, respectively. Each level 5 unit has all the requirements for level 3 and 4 in addition to the requirements for doctors as listed in Table 4.7, which shows 95 doctors and 612 nurses are required for every 1 million population.

Only doctors and nurses are accommodated in Table 4.8, with the summaries obtained from Appendix Table A1 to A11. Table 4.8 shows the gap between minimum requirements and what was in place in 2010/11. Although the situation on the ground is bound to have changed with respect to health professionals, counties can be able to work with these minimum requirements compared with the current situation. Appendix Tables A1 to A11 show what each county presently requires for all health care workers.

Clearly, as shown in Table 4.8, majority of the counties have a deficiency of both doctors and nurses, with more professionals needed than those in place in some cases. Uasin Gichu, Nyeri and Mombasa have more than the minimum requirements for both nurses and doctors. Laikipia, Kiambu, Kisumu and Busia also have more than the minimum number of nurses required. Nairobi shows the largest nurse deficit. It should be noted that the minimum requirement estimation has been done without cognizance of private and faith-based facilities, yet these also offer services at the county level.

Table 4.8: County population, number of doctors and nurses in place and minimum requirement in 2009

	S/ No. County	Population 2009	Pop. per Doctor	Approx. No. of Drs 2010/11*	Pop. per Nurse	Approx No. of nurses 2010/11*	Projected Pop. 2013*	Drs: Minim required**	Gap Doctors	Nurses Minim required **	Gap nurses
1	Baringo	555,561	278,000	2	4,115	135	618,036	59	-57	378	-243
2	Bomet	724,186	103,000	7	4,210	172	805,623	77	-70	493	-321
3	Bungoma	1,630,934	45,000	36	3,315	492	1,814,338	172	-136	1110	-618
4	Busia	488,075	31,000	16	1,148	425	542,961	52	-36	332	93
5	Elgeyo Marakwet	369,998	62,000	6	2,434	152	411,605	39	-33	252	-100
6	Embu	516,212	13,000	40	1,060	487	574,262	55	-15	351	136
7	Garissa	623,060	52,000	12	2,316	269	693,125	66	-54	424	-155
8	Homa Bay	963,794	44,000	22	1,949	495	1,072,176	102	-80	656	-162
9	Isiolo	143,294	143,000	1	3,115	46	159,408	15	-14	98	-52

10	Kajiado	687,312	76,000	9	7,723	89	764,602	73	-64	468	-379
11	Kakamega	1,660,651	69,000	24	3,122	532	1,847,397	176	-152	1131	-599
12	Kericho	758,339	15,000	51	1,823	416	843,617	80	-29	516	-100
13	Kiambu	1,623,282	15,000	108	1,466	1,107	1,805,825	172	-64	1105	2
14	Kilifi	1,109,735	48,000	23	2,655	418	1,234,528	117	-94	756	-338
15	Kirinyaga	528,054	31,000	17	1,100	480	587,435	56	-39	360	121
16	Kisii	1,152,282	378,000	3	5,703	202	1,281,860	122	-118	784	-582
17	Kisumu	968,909	15,000	65	1,433	676	1,077,866	102	-37	660	16
18	Kitui	1,012,709	26,000	39	1,770	572	1,126,591	107	-68	689	-117
19	Kwale	649,931	46,000	14	3,080	211	723,018	69	-55	442	-231
20	Laikipia	399,227	21,000	19	1,446	276	444,121	42	-23	272	4
21	Lamu	101,539	no data		no data		112,957	11		69	-69
22	Machakos	1,098,584	27,000	41	1,688	651	1,222,123	116	-75	748	-97
23	Makueni	884,527	37,000	24	1,970	449	983,995	93	-69	602	-153
24	Mandera	1,025,756	256,000	4	14,051	73	1,141,106	108	-104	698	-625
25	Marsabit	291,166	321,000	1	1,967	148	323,909	31	-30	198	-50
26	Meru	1,356,301	38,000	36	1,609	843	1,508,821	143	-107	923	-80
27	Migori	1,028,579	24,000	43	1,478	696	1,144,246	109	-86	700	-4
28	Mombasa	939,370	7,000	134	1,381	680	1,045,005	99	35	640	41
29	Murang'a	942,581	17,000	55	1,609	586	1,048,577	100	-45	642	-56
30	Nairobi	3,138,369	23,000	136	2,797	1,122	3,491,289	332	-196	2137	-1015
31	Nakuru	1,603,325	32000	50	2,146	747	1,783,624	169	-119	1092	-344
32	Nandi	752,965	94,000	8	3,137	240	837,638	80	-72	513	-273
33	Narok	850,920	41,000	21	3,128	272	946,609	90	-69	579	-307
34	Nyamira	598,252	100,000	6	2,498	239	665,527	63	-57	407	-168
35	Nyandarua	596,268	22,000	27	1,117	534	663,320	63	-36	406	128
36	Nyeri	693,558	5,000	139	654	1,060	771,551	73	66	472	588
37	Samburu	223,947	25,000	9	1,037	216	249,131	24	-15	152	63
38	Siaya	842,304	44,000	19	1,815	464	937,024	89	-70	573	-109
39	Taita Taveta	284,657	71,000	4	2,612	109	316,668	30	-26	194	-85
40	Tana River	240,075	48,000	5	5,108	47	267,072	25	-20	163	-116
41	Tharaka-Nithi	365,330	21,000	17	1,773	206	406,413	39	-22	249	-43
42	Trans Nzoia	818,757	273,000	3	6,110	134	910,829	87	-84	557	-423
43	Turkana	855,399	285,000	3	14,748	58	951,591	90	-87	582	-524
44	Uasin Gishu	894,179	4,000	224	706	1267	994,732	94	130	609	658
45	Vihiga	554,622	185,000	3	3,990	139	616,991	59	-56	378	-239
46	Wajir	661,941	132,000	5	4,163	159	736,378	70	-65	451	-292
47	West Pokot	512,690	73,000	7	1,979	259	570,344	54	-47	349	-90
	Total			**1,537**		**19,051**	**43,075,866**	**4,092**	**-2562**	**26362**	**-7312**

5. Summary, Conclusions and Recommendations

5.1 Summary and Conclusions

Norms and standards that guide the efficient, effective and sustainable delivery of the Kenya Essential Package for Health were developed and they define the quantities of human resource inputs needed to deliver the package. The basis for these norms and standards is that the mix of inputs at the different levels should be coordinated. This has, however, not been the case since facilities across the country are of different sizes with differing investments and offering widely varied services, hence poor rationalization/inequitable distribution of health services across the country. Devolution of central government services to county governments is expected to alleviate this imbalance.

The new health system has 6 levels, with level 1 being the community health units, while level 6 is national referral and training facilities. About 7,722 level 1 facilities were required nationally in 2009, increasing to 8,590 in 2013, each handling a population of about 5,000 community members. At this level, preventive and promotive health care is carried out by CHEWs. The minimum facilities requirement for the different levels include: 3,861 facilities for level 2 in 2009, reaching 4,295 in 2013; 1,287 facilities for level 3 in 2009, increasing to 1,431 in 2013; 386 facilities for level 4 and 39 facilities for level 5 in 2009, increasing to 430 and 43, respectively, in 2013. Facilities in place by 2009 were level 2=3,363; level 3=721; and level 4=488. The difference shows a shortfall of 498 in level 2, 566 in level 3, and an excess of 102 in level 4. Level 5 offers specialized referral curative services as well as training facilities for health workers.

Health professionals' requirements increased progressively at the various levels. Each higher level has components of all the levels below it and offers increasingly more complex and extensive health services, therefore requiring workers with higher levels of training and specialization. About 508,301 health professionals of different cadres are the minimum requirement nationally at the different levels, with about 429,520 being CORPs required at level 1. About 111,321 of these CORPs are required in Rift Valley, which has the largest requirements of the majority of cadres of health professionals, given that it has the largest catchment population, while North Eastern requires only about 25,706.

5.2 Recommendations

Some designations of health professionals are facing a serious shortfall. They will require urgent government interventions that include enhanced training coverage, especially now that public health care will be the duty of county governments.

Further research is recommended to assess the optimum requirement for the counties, which will be an improvement from this minimum requirements assessment. This should be done with the current population data and projected over the county's plan period to ensure that counties are prepared with the health professionals required at every stage in the development process. Of particular importance is measuring the optimum skill mix of the health workforce to offer a means of assessing the combination of categories of personnel at certain population levels. Possible imbalances would thus be identified as well as disparity in the numbers of the various health professions. These statistics can help inform strategies for appropriate and cost-effective combination of staff and roles.

Attracting, retaining and motivating health professionals

Counties have to own their human resources for health and take charge of growth of numbers as well as county-specific retention incentives. Modalities will initially revolve around offering county-specific packages that will attract health professionals. Such packages must be both financial and non-financial, so as to motivate the professionals to perform by offering effective and efficient health care services. The non-financial packages should include a conducive work environment; housing; schooling for the children; amenities such as water, power and other basics; as well as hardship allowances for counties that may be unattractive due to their relative location within the country. Financial incentives should include loans to buy land and develop residential houses. This guarantees that the family gets rooted in the county, making translocation harder.

Rural practice

Most counties have a mix of urban and rural settings. To encourage health professionals to work in the poor, rural and remote areas, a premium should be added to the basic pay. Additionally, rural facilities should strive to provide good working conditions, including housing and solar power where there is no electricity supply, and boreholes where there is water scarcity. Such health facilities should be established near schools, which are manned by teaching staff with good/attractive credentials.

Counties are also encouraged to, individually or in coalitions invest in medical schools in the rural areas. Scholarships should also be provided to students from low income and rural areas, to encourage them to serve their people and others from similar backgrounds. This will orient the graduates to serve in the rural areas and reduce the urban attraction of medical practitioners and health professionals. This will also improve health service provision in under-served neighbourhoods and rural areas.

Ratio of professionals and coping with inadequacy

Counties must constantly monitor health professionals and put in place sustenance strategies. Each county should aspire to reach and maintain the WHO recommended ratio of doctors to nurses and clinical officers, as well as other cadres. It is, however, notable that attaining these standards may pose a challenge given the pre-existing imbalances. Capacity of lower cadre staff can be developed, such that they can deal with issues requiring higher cadre, but just as effectively. For example, clinical officers may be trained to handle some cases that doctors could handle. In dispensaries, CORPs could also be trained to handle some minor medical procedures such as cleaning and dressing wounds, and other first aid cases such that they can assist in case of nurse shortages. Additionally, local people can be trained to handle some minor medical procedures. Poor neighbouring counties can also develop cooperation strategies of sharing rare professionals, who can be facilitated to serve across counties on need basis.

County brain drain

Counties must identify county-specific push and pull factors so as to promote pull and counter push factors. Push factors such as harsh working conditions, de-motivation, and lack of opportunities for professional and personal growth must be addressed. Having a clear progression process, identifying scholarships and transparently stipulating how these must be earned, allowing for study leave and bonding conditions are some of the professional growth issues that a county can be clear about to attract professionals. Each county should identify its attractive aspects and use them as selling points to attract health professionals to its medical facilities. A clean environment, good road network and a reliable and efficient transport system, good schools, housing facilities, constant supply of clean water and power, are among the key selling points that a county can use.

Dual practice

Much as dual practice can be a hindrance due to misappropriation of public resources in private practice, counties can make the practice resource-saving by allowing a transparent system and spelling out stringent punitive measures for any misconduct. A success case of dual practice is Canada, where policies guiding the practice ensure efficiency. Such guidelines include controlled charges in private practice, which are often levied on the government health insurance agency. A county-specific regulations body can register and license practitioners within the county, monitor their conduct and implement disciplinary action to any arising cases. Performance contacts in the public practice is one guiding principle that can ensure efficient time allocation between private and public practice that a physician must meet certain measurable outputs per given timelines.

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Appendix

Table A1: Distribution of health professionals by province and designation (2004)

Cadres	Central	Coast	Eastern	Nairobi	North Eastern	Nyanza	Rift Valley	Western	Total
Doctors	143	114	170	233	19	101	220	80	1,080
Clinical Officers	275	215	330	118	76	280	640	214	2,148
Registered Nurses	594	386	569	257	93	413	814	295	3,421
Enrolled Nurses	2,244	1,071	2,280	629	249	1494	3,145	1,482	12,594
Public Health	634	337	656	220	113	495	1,342	366	4,163
Administration	240	144	304	245	22	329	388	125	1,797
Accounts	0	1	1	48	0	0	3	0	53
Med Engineering	46	40	61	28	11	40	83	28	337
Technologist Diploma	250	192	266	183	43	209	476	165	1,784
Lithographers	0	0	0	1	0	0	0	0	1
Nutrition	60	28	40	43	9	24	117	26	347
Orthopedic	73	25	51	29	9	31	88	19	325
Personnel	2	2	0	40	1	1	4	2	52
Secretarial	29	22	34	97	1	12	27	13	235
Procurement	12	7	12	35	1	8	10	4	89
Social Welfare	1	0	2	10	0	2	5	4	24
Boiler	1	0	0	0	0	0	0	0	1
Building	29	8	18	36	0	14	19	12	136
Chemist	0	1	0	9	0	4	0	0	14
Dental Technology	61	36	53	61	5	27	84	23	350
Economic Planning	0	6	0	13	0	0	0	0	19
Finance Admin.	0	0	0	0	1	0	0	0	1
Health Administration	2	2	5	4	0	2	5	3	23
Health Records Information	88	50	78	65	9	47	143	41	521
House Keeping	38	6	17	33	2	14	11	6	127
Inspectors	0	1	2	4	2	1	3	1	14
Librarian	0	0	1	4	0	0	0	0	5
Painting	0	0	0	7	0	0	0	1	8
Pharm. Technologist	45	37	69	128	19	37	96	29	460
Physiotherapist	120	82	124	61	10	79	143	63	682
Radiation	47	28	49	32	9	43	74	22	304
Scientist/ Researchers	0	0	0	7	0	4	2	0	13
Others	612	314	726	421	74	650	707	339	3,843
Radiophycists I/II/III	1	0	0	13	0	0	1	0	15
Total	5,647	3,155	5,918	3,115	777	4,361	8,650	3,363	34,986
% Cadre	16	9	17	9	2	12	25	10	100
Population	3,918,538	2,806,649	5,180,139	2,656,997	1,235,592	4,868,010	8,077,517	3,954,081	32,697,523
% Population	12	8	16	8	4	15	25	12	100

Source: Government of Kenya (2004)

Table A2: Employee distribution by designation and gender (2004)

	Designation	Women	Men	Total	% Women
1	Doctors	275	805	1,080	25.5
2	Clinical Officers	729	1,419	2,148	35.5
3	Registered Nurses	2,371	1,050	3,421	69.3
4	Enrolled Nurses	9,834	2,758	12,592	78.1
5	Public Health Officers	1,151	3,011	4,162	27.6
6	Administration	752	1,045	1,797	41.8
7	Accounts	11	42	53	20.7
8	Health Administration	2	21	23	8.7
9	Med. Engineering	61	276	337	18.1
10	Technologist Diploma	640	1,145	1,785	35.8
11	Lithographers	0	1	1	0
12	Nutrition	279	68	347	80.4
13	Orthopedic	169	156	325	52.0
14	Personnel	14	38	52	26.9
15	Secretarial	229	6	235	97.4
16	Procurement	16	73	89	18.0
16	Social Welfare	12	12	24	50
18	Boiler	0	1	1	0
19	Building	45	91	136	33.1
20	Health Records Information	180	341	521	34.5
21	House Keeping	90	37	127	70.9
22	Inspectors	1	13	14	7.1
23	Librarians	2	3	5	40
24	Painting	1	7	8	14.2
25	Pharm. Technologist	145	315	460	31.0
26	Physiotherapist	204	478	682	29.9
27	Radiation protection Board	77	227	304	25.3
28	Radiophycists I/II/III	0	15	15	0
29	Scientist Researchers	4	9	13	30.8
30	Others	1,929	1,914	3,843	50.2
	Total	19,353	15,633	34,986	55.3

Source: The report on the Performance Status 2003 and 2004: Health Management Information System (Human Recourse Mapping 2004)

Table A3: Minimum number of health facilities* required per county

Serial No.	County	2013 Projected Population	Level 2: Dispensary	Level 3: Health Centre	Level 5: Provincial hospitals
1	Baringo	618,036	62	21	0.6
2	Bomet	805,623	81	27	0.8
3	Bungoma	1,814,338	181	60	1.8
4	Busia	542,961	54	18	0.5
5	Elgeyo Marakwet	411,605	41	14	0.4
6	Embu	574,262	57	19	0.6
7	Garissa	693,125	69	23	0.7
8	Homa Bay	1,072,176	107	36	1.1
9	Isiolo	159,408	16	5	0.2
10	Kajiado	764,602	76	25	0.8
11	Kakamega	1,847,397	185	62	1.8
12	Kericho	843,617	84	28	0.8
13	Kiambu	1,805,825	181	60	1.8
14	Kilifi	1,234,528	123	41	1.2
15	Kirinyaga	587,435	59	20	0.6
16	Kisii	1,281,860	128	43	1.3
17	Kisumu	1,077,866	108	36	1.1
18	Kitui	1,126,591	113	38	1.1
19	Kwale	723,018	72	24	0.7
20	Laikipia	444,121	44	15	0.4
21	Lamu	112,957	11	4	0.1
22	Machakos	1,222,123	122	41	1.2
23	Makueni	983,995	98	33	1.0
24	Mandera	1,141,106	114	38	1.1
25	Marsabit	323,909	32	11	0.3
26	Meru	1,508,821	151	50	1.5
27	Migori	1,144,246	114	38	1.1
28	Mombasa	1,045,005	105	35	1.0
29	Murang'a	1,048,577	105	35	1.0
30	Nairobi	3,491,289	349	116	3.5
31	Nakuru	1,783,624	178	59	1.8
32	Nandi	837,638	84	28	0.8
33	Narok	946,609	95	32	0.9
34	Nyamira	665,527	67	22	0.7
35	Nyandarua	663,320	66	22	0.7
36	Nyeri	771,551	77	26	0.8
37	Samburu	249,131	25	8	0.2
38	Siaya	937,024	94	31	0.9
39	Taita Taveta	316,668	32	11	0.3

40	Tana River	267,072	27	9	0.3
41	Tharaka Nithi	406,413	41	14	0.4
42	Trans Nzoia	910,829	91	30	0.9
43	Turkana	951,591	95	32	1.0
44	Uasin Gishu	994,732	99	33	1.0
45	Vihiga*	616,991	62	21	0.6
46	Wajir	736,378	74	25	0.7
47	West Pokot	570,344	57	19	0.6
	Total	43,075,866	4,308	1,436	43.1

*Community level has no physical health facility

Table A5: Minimum number of health professionals required in North Eastern by county

Health care delivery	Definition	Service delivery staff	Number of minimum HR required		
			Garissa	Mandera	Wajir
			693,125	1,141,106	736,378
Level 1 unit	Community	CORPs	6,931	11,411	7,364
Level 2 unit	Dispensary	RCNs	139	228	147
		CHEW	139	228	147
Level 3 unit	Health centre	CO	46	76	49
		EN	323	533	344
		COHO	23	38	25
		Lab Technician	23	38	25
		Pharm Tech	23	38	25
Level 4 unit	District hospital	MO	42	68	44
		CO	35	57	37
		EN	416	685	442
		Dentist	7	11	7
		Pharmacist	7	11	7
		Radiographer	7	11	7
		Dental Technologist	7	11	7
		Lab. Technologist	7	11	7
Level 5 unit	Provincial hospitals	Physicians	2	3	2

		Obstetricians/ Gynaecologists	3	5	3
		Paediatricians	2	3	2
		Surgeons	2	3	2
		Psychiatrists	1	1	1
		Ophthalmologists	1	2	1
		ENT specialist	1	1	1
		Dermatologist	1	1	1
		Anaesthetist	2	3	2
		Pathologist	1	1	1
		Radiologist	1	1	1
		Orthopaedic Surgeon	1	1	1
		Physiotherapist	1	1	1
		Occupational Therapist	1	1	1
		Orthopaedic Technologist	1	1	1
		Social Worker	1	1	1
		MO(ICU)	1	1	1
		EN (ICU)	8	14	9
		Clinical Pharmacist	1	1	1

Table A6: Minimum number of health professionals required in Western region by county

Health care delivery	**Definition**	**Service delivery staff**	**Number of minimum HR required**			
			Bungoma	Busia	Kakamega	Vihiga
Population			1,814,338	542,961	1,847,397	616,991
Level 1 unit	Community	CORPs	18,143	5,430	18,474	6,170
Level 2 unit	Dispensary	RCNs	363	109	369	123
		CHEW	363	109	369	123
Level 3 unit	Health centre	CO	121	36	123	41
		EN	847	253	862	288
		COHO	60	18	62	21
		Lab. Technician	60	18	62	21
		Pharm. Tech.	60	18	62	21
Level 4 unit	District hospital	MO	109	33	111	37
		CO	91	27	92	31
		EN	254	76	259	86
		Dentist	18	5	18	6
		Pharmacist	18	5	18	6
		Radiographer	18	5	18	6

		Dental Technologist	18	5	18	6
		Lab Technologist	18	5	18	6
Level 5 unit	Provincial hospitals	Physicians	5	2	6	2
		Obstet/ Gynaecologists	7	2	7	2
		Paediatricians	5	2	6	2
		Surgeons	5	2	6	2
		Psychiatrists	2	1	2	1
		Opthalmologists	4	1	4	1
		ENT specialist	2	1	2	1
		Dermatologist	2	1	2	1
		Anaesthetists	5	2	6	2
		Pathologist	2	1	2	1
		Radiologist	2	1	2	1
		Orthopaedic Surgeon	2	1	2	1
		Physiotherapist	2	1	2	1
		Occupational Therapist	2	1	2	1
		Orthopaedic Technologist	2	1	2	1
		Social Worker	2	1	2	1
		MO(ICU)	2	1	2	1
		EN (ICU)	22	7	22	7
		Clinical Pharmacist	2	1	2	1
			20,639	**6,176**	**21,015**	**7,018**

Table A7: Minimum number of health professionals required in Rift Valley by county

Health care delivery	**Service delivery staff**	**Number of minimum HR required**						
		Baringo	Bomet	Elgeyo Marakwet	Kajiado	Kericho	Laikipia	Nakuru
		618,036	805,623	411,606	764,603	843,617	44,4121	1,783,624
Level 1 unit	CORPs	6,180	8,056	4,116	7,646	8,436	4,441	17,836
Level 2 unit	RCNs	124	161	82	153	169	89	357
	CHEW	124	161	82	153	169	89	357

Level 3 unit	CO	41	54	27	51	56	30	119
	EN	288	376	192	357	394	207	832
	COHO	21	27	14	25	28	15	59
	Lab Technician	21	27	14	25	28	15	59
	Pharm Tech	21	27	14	25	28	15	59
Level 4 unit	MO	37	48	25	46	51	27	107
	CO	31	40	21	38	42	22	89
	EN	87	113	58	107	118	62	250
	Dentist	6	8	4	8	8	4	18
	Pharmacist	6	8	4	8	8	4	18
	Radiographer	6	8	4	8	8	4	18
	Dental Technologist	6	8	4	8	8	4	18
	Lab Technologist	6	8	4	8	8	4	18
Level 5 unit	Physicians	2	2	1	2	3	1	5
	Obstetricians/ Gynaecologists	2	3	2	3	3	2	7
	Paediatricians	2	2	1	2	3	1	5
	Surgeons	2	2	1	2	3	1	5
	Psychiatrists	1	1	0	1	1	0	2
	Opthalmologists	1	2	1	2	2	1	4
	ENT specialist	1	1	0	1	1	0	2
	Dermatologist	1	1	0	1	1	0	2
	Anaesthetists	2	2	1	2	3	1	5
	Pathologist	1	1	0	1	1	0	2
	Radiologist	1	1	0	1	1	0	2
	Orthopaedic Surgeon	1	1	0	1	1	0	2
	Physiotherapist	1	1	0	1	1	0	2
	Occupational Therapist	1	1	0	1	1	0	2
	Orthopaedic Technologist	1	1	0	1	1	0	2
	Social Worker	1	1	0	1	1	0	2
	MO (ICU)	1	1	0	1	1	0	2
	EN (ICU)	7	10	5	9	10	5	21
	Clinical Pharmacist	1	1	0	1	1	0	2
		7,030	**9,164**	**4,682**	**8,698**	**9,596**	**5,052**	**20,289**

Table A8: Minimum number of health professionals required in Rift Valley by county

Health care delivery	Service delivery staff	Number of minimum HR required						
County		Nandi	Narok	Samburu	Trans Nzoia	Turkana	Uasin Gichu	West Pokot
Population		837,638	946,609	249,131	910,829	951,591	994,732	570,344
Level 1 unit	CORPs	8,376	9,466	2,491	9,108	9,516	9,947	5,703
Level 2 unit	RCNs	168	189	50	182	190	199	114
	CHEW	168	189	50	182	190	199	114
Level 3 unit	CO	56	63	17	61	63	66	38
	EN	391	442	116	425	444	464	266
	COHO	28	32	8	30	32	33	19
	Lab Technician	28	32	8	30	32	33	19
	Pharm Tech	28	32	8	30	32	33	19
Level 4 unit	MO	50	57	15	55	57	60	34
	CO	42	47	12	46	48	50	29
	EN	117	133	35	128	133	139	80
	Dentist	8	9	2	9	10	10	6
	Pharmacist	8	9	2	9	10	10	6
	Radiographer	8	9	2	9	10	10	6
	Dental Technologist	8	9	2	9	10	10	6
	Lab Technologist	8	9	2	9	10	10	6
Level 5 unit	Physicians	3	3	1	3	3	3	2
	Obstetricians/ Gynaecologists	3	4	1	4	4	4	2
	Paediatricians	3	3	1	3	3	3	2
	Surgeons	3	3	1	3	3	3	2
	Psychiatrists	1	1	0	1	1	1	1
	Opthalmologists	2	2	0	2	2	2	1
	ENT specialist	1	1	0	1	1	1	1
	Dermatologist	1	1	0	1	1	1	1
	Anaesthetists	3	3	1	3	3	3	2
	Pathologist	1	1	0	1	1	1	1
	Radiologist	1	1	0	1	1	1	1
	Orthopaedic Surgeon	1	1	0	1	1	1	1
	Physiotherapist	1	1	0	1	1	1	1

	Occupational Therapist	1	1	0	1	1	1	1
	Orthopaedic Technologist	1	1	0	1	1	1	1
	Social Worker	1	1	0	1	1	1	1
	MO (ICU)	1	1	0	1	1	1	1
	EN (ICU)	10	11	3	11	11	12	7
	Clinical Pharmacist	1	1	0	1	1	1	1
		9,528	**10,768**	**2,834**	**10,361**	**10,825**	**11,315**	**6,488**

Table A9: Minimum number of health professionals required in Central region by county

Health care delivery	**Definition**	**Service delivery staff**	**Number of minimum HR required**				
			Kiambu	Kirinyaga	Murang'a	Nyandarwa	Nyeri
			1,805,825	587,435	1,048,577	663,320	771,551
Level 1 unit	Community	CORPs	18,058	5,874	10,486	6,633	7,716
Level 2 unit	Dispensary	RCNs	361	117	210	133	154
		CHEW	361	117	210	133	154
Level 3 unit	Health centre	CO	120	39	70	44	51
		EN	843	274	489	310	360
		COHO	60	20	35	22	26
		Lab Technician	60	20	35	22	26
		Pharm Tech	60	20	35	22	26
Level 4 unit	District hospital	MO	108	35	63	40	46
		CO	90	29	52	33	39
		EN	253	82	147	93	108
		Dentist	18	6	10	7	8
		Pharmacist	18	6	10	7	8
		Radiographer	18	6	10	7	8
		Dental Technologist	18	6	10	7	8
		Lab Technologist	18	6	10	7	8
Level 5 unit	Provincial hospitals	Physicians	5	2	3	2	2
		Obstet/ Gynaecologists	7	2	4	3	3
		Paediatricians	5	2	3	2	2
		Surgeons	5	2	3	2	2
		Psychiatrists	2	1	1	1	1
		Opthalmologists	4	1	2	1	2
		ENT specialist	2	1	1	1	1

		Dermatologist	2	1	1	1	1
		Anaesthetists	5	2	3	2	2
		Pathologist	2	1	1	1	1
		Radiologist	2	1	1	1	1
		Orthopaedic Surgeon	2	1	1	1	1
		Physiotherapist	2	1	1	1	1
		Occupational Therapist	2	1	1	1	1
		Orthopaedic Technologist	2	1	1	1	1
		Social Worker	2	1	1	1	1
		MO(ICU)	2	1	1	1	1
		EN (ICU)	22	7	13	8	9
		Clinical Pharmacist	2	1	1	1	1
			20,542	**6,682**	**11,928**	**7,545**	**8,777**

Table A10: Minimum number of health professionals required in Nyanza by county

Health care delivery	**Definition**	**Service delivery staff**	**Number of minimum HR required**					
			Homa Bay	Kisii	Kisumu	Migori	Nyamira	Siaya
			1,066,610	1,681,386	1,077,866	626,348	665,527	937,024
Level 1 unit	Community	CORPs	10,666	16,814	10,779	6,263	6,655	9,370
Level 2 unit	Dispensary	RCNs	213	336	216	125	133	187
		CHEW	213	336	216	125	133	187
Level 3 unit	Health centre	CO	71	112	72	42	44	62
		EN	498	785	503	292	311	437
		COHO	36	56	36	21	22	31
		Lab Technician	36	56	36	21	22	31
		Pharm Tech	36	56	36	21	22	31
Level 4 unit	District hospital	MO	64	101	65	38	40	56
		CO	53	84	54	31	33	47
		EN	149	235	151	88	93	131
		Dentist	11	17	11	6	7	9
		Pharmacist	11	17	11	6	7	9
		Radiographer	11	17	11	6	7	9
		Dental Technologist	11	17	11	6	7	9
		Lab Technologist	11	17	11	6	7	9
Level 5 unit	Provincial hospitals	Physicians	3	5	3	2	2	3
		Obstetricians/ Gynaecologists	4	7	4	3	3	4
		Paediatricians	3	5	3	2	2	3

		Surgeons	3	5	3	2	2	3
		Psychiatrists	1	2	1	1	1	1
		Opthalmologists	2	3	2	1	1	2
		ENT specialist	1	2	1	1	1	1
		Dermatologist	1	2	1	1	1	1
		Anaesthetists	3	5	3	2	2	3
		Pathologist	1	2	1	1	1	1
		Radiologist	1	2	1	1	1	1
		Orthopaedic Surgeon	1	2	1	1	1	1
		Physiotherapist	1	2	1	1	1	1
		Occupational Therapist	1	2	1	1	1	1
		Orthopaedic Technologist	1	2	1	1	1	1
		Social Worker	1	2	1	1	1	1
		MO(ICU)	1	2	1	1	1	1
		EN (ICU)	13	20	13	8	8	11
		Clinical Pharmacist	1	2	1	1	1	1
			12,133	**19,126**	**12,261**	**7,125**	**7,571**	**10,659**

Table A11: Minimum number of health professionals required in Coast region by county

Health care delivery	**Definition**	**Service delivery staff**	**Number of minimum HR required**					
			Kilifi	Kwale	Lamu	Mombasa	Taita Taveta	Tana River
			1,234,528	723,018	112,957	1,045,005	316,668	267,072
Level 1 unit	Community	CORPs	12,345	7,230	1,130	10,450	3,167	2,671
Level 2 unit	Dispensary	RCN	247	145	23	209	63	53
		CHEW	247	145	23	209	63	53
Level 3 unit	Health centre	CO	82	48	8	70	21	18
		EN	576	337	53	488	148	125
		COHO	41	24	4	35	11	9
		Lab Technician	41	24	4	35	11	9
		Pharm Tech	41	24	4	35	11	9
Level 4 unit	District hospital	Medical Officer	74	43	7	63	19	16
		Clinical Officer	62	36	6	52	16	13
		Enrolled Nurses	173	101	16	146	44	37
		Dentist	12	7	1	10	3	3
		Pharmacist	12	7	1	10	3	3

		Radiographer	12	7	1	10	3	3
		Dental Technologist	12	7	1	10	3	3
		Lab Technologist	12	7	1	10	3	3
Level 5 unit	Provincial hospitals	Physicians	4	2	0	3	1	1
		Obstet/ Gynaecologists	5	3	0	4	1	1
		Paediatricians	4	2	0	3	1	1
		Surgeons	4	2	0	3	1	1
		Psychiatrists	1	1	0	1	0	0
		Opthalmologists	2	1	0	2	1	1
		ENT specialist	1	1	0	1	0	0
		Dermatologist	1	1	0	1	0	0
		Anaesthetists	4	2	0	3	1	1
		Pathologist	1	1	0	1	0	0
		Radiologist	1	1	0	1	0	0
		Orthopaedic Surgeon	1	1	0	1	0	0
		Physiotherapist	1	1	0	1	0	0
		Occupational Therapist	1	1	0	1	0	0
		Orthopaedic Technologist	1	1	0	1	0	0
		Social Worker	1	1	0	1	0	0
		MO(ICU)	1	1	0	1	0	0
		EN (ICU)	15	9	1	13	4	3
		Clinical Pharmacist	1	1	0	1	0	0
			14,043	**8,225**	**1,285**	**11,887**	**3,602**	**3,038**

Table A12: Minimum number of health professionals required in Eastern region by county

Health care delivery	**Service delivery staff**	**Number of Minimum HR required**							
		Embu	Isiolo	Kitui	Machakos	Makueni	Marsabit	Meru	Tharathi Nithi
		574,262	159,408	1,126,591	1,222,123	983,995	323,909	1,508,821	406,413
Level 1 unit	CORPs	5,743	1,594	11,266	12,221	9,840	3,239	15,088	4,064
Level 2 unit	RCNs	115	32	225	244	197	65	302	81
	CHEW	115	32	225	244	197	65	302	81
Level 3 unit	CO	38	11	75	81	66	22	101	27
	EN	268	74	526	570	459	151	704	190

	COHO	19	5	38	41	33	11	50	14
	Lab Technician	19	5	38	41	33	11	50	14
	Pharm Tech	19	5	38	41	33	11	50	14
Level 4 unit	MO	34	10	68	73	59	19	91	24
	CO	29	8	56	61	49	16	75	20
	EN	80	22	158	171	138	45	211	57
	Dentist	6	2	11	12	10	3	15	4
	Pharmacist	6	2	11	12	10	3	15	4
	Radiographer	6	2	11	12	10	3	15	4
	Dental Technologist	6	2	11	12	10	3	15	4
	Lab Technologist	6	2	11	12	10	3	15	4
Level 5 unit	Physicians	2	0	3	4	3	1	5	1
	Obstet/ Gynaecologists	2	1	5	5	4	1	6	2
	Paediatricians	2	0	3	4	3	1	5	1
	Surgeons	2	0	3	4	3	1	5	1
	Psychiatrists	1	0	1	1	1	0	2	0
	Opthalmologists	1	0	2	2	2	1	3	1
	ENT specialist	1	0	1	1	1	0	2	0
	Dermatologist	1	0	1	1	1	0	2	0
	Anaesthetists	2	0	3	4	3	1	5	1
	Pathologist	1	0	1	1	1	0	2	0
	Radiologist	1	0	1	1	1	0	2	0
	Orthopaedic Surgeon	1	0	1	1	1	0	2	0
	Physiotherapist	1	0	1	1	1	0	2	0
	Occupational Therapist	1	0	1	1	1	0	2	0
	Orthopaedic Technologist	1	0	1	1	1	0	2	0
	Social Worker	1	0	1	1	1	0	2	0
	MO(ICU)	1	0	1	1	1	0	2	0
	EN (ICU)	7	2	14	15	12	4	18	5
	Clinical Pharmacist	1	0	1	1	1	0	2	0
		6,532	**1,813**	**12,815**	**13,902**	**11,193**	**3,685**	**17,163**	**4,623**

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