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Vol. 1 | Implications of Social Service Delivery on Development in Africa

## Infrastructure and Healthcare Service Delivery in Tiaty Sub-County, Baringo County, Kenya

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### Abstract

*Quality service delivery as defined by International Organization for Standardization (ISO) is a relative concept and in most cases where inherent characteristic of a service meets the requirements of a patient, the delivery can be rated as high in quality. In service industries like hospitals for example, the experience of patients plays a crucial role in rating, assessment, and ranking of quality of services offered in these facilities. In Kenya, like most developing countries in Africa, premature deaths and preventable diseases still inflict a high toll in communities. Inadequacy in access to basic health services is affecting distinct regions, areas, communities, and social groups in these countries. The objective of the study was to establish the extent to which poor infrastructure affects healthcare service delivery in Tiaty sub-County. A descriptive survey research design was used for this study. The target population of the study was the employees and patients who visit the healthcare institutions in Tiaty sub-County. The study used a stratified random sampling technique to select a sample of 126 respondents. The questionnaire was the selected research instrument for the study. Quantitative data collected was analyzed by the use of descriptive statistics using SPSS (Version 21) and presented through percentages, means, standard deviations and frequencies. The study concludes that road networks, power coverage, healthcare facilities, and water and telecommunication, positively affect the healthcare service delivery in Tiaty sub-County. The study recommends that the government ensure the construction of roads in every sub-county in the country to increase the road networks and promote the distribution of power.*

**Keyword:** Infrastructure, Healthcare Service Delivery, Road Networks, Power Coverage, Healthcare Facilities, Water and Telecommunication and Healthcare Service Delivery

## Introduction

### *1.1. Background of the Study*

Social services are a range of public services provided by government, private, and non-profit organizations. These public services aim to create more effective organizations, build stronger communities, and promote equality and opportunity. Social services include the benefits and facilities such as education, food subsidies, health care, police services, fire service, job training, subsidized housing, adoption, community management, policy research, and lobbying. Infrastructure refers to the fundamental facilities and systems serving a country, city, or area (O'Sullivan, Arthur, Sheffrin & Steven 2003), including the services and facilities necessary for its economy to function. It typically characterizes technical structures such as roads, bridges, tunnels, water supply, sewers, electrical grids, telecommunications, and so forth, and can be defined as "the physical components of interrelated systems providing commodities and services essential to enable, sustain, or enhance societal living conditions (Fulmer & Jeffrey 2009). Quality in health service is dependent on newer technology, effective medication, and qualified staff-to-patient ratio, effectiveness, affordability and efficiency of service delivery. While technical quality in the health sector is defined primarily on the basis of technical accuracy and effectiveness of the medical diagnoses and procedures or the conformance to professional specifications. Functional quality is the manner in which health service is actually delivered to patients.

In Malaysia, the number of public primary care facilities (currently 802 centres and over 2000 small community clinics) and dental clinics were expanded steadily in earlier decades, particularly to reach people in under-served rural areas. Secondary care is offered in smaller public hospitals, and more complex tertiary care in regional and national hospitals (including university teaching hospitals run by the Ministry of Higher Education). Growth has slowed in recent years however, and public services in urban areas have not kept pace with rapid urbanization, while the population ratio of hospital beds has declined slightly. Private clinics and hospitals in urban areas have grown rapidly over the last decade. The supply of health professionals remains seriously below the required number, although the government has increased the number of training places (Chee & Barraclough, 2007b). On provision of services, national health policies stress public health and health promotion comprising 'a wellness' as well as a 'disease' perspective. The Ministry of Health has developed an extensive network of public primary care centres and dental services especially for children, but these services are under strain and have staff shortages, so patients often encounter long waits. Primary care exerts only a limited gatekeeper function since people can bypass a referral from a general practitioner and for a small additional fee (if in the public sector) can go directly to specialists and hospitals (Van Doorslaer et al, 2006; 2007).

The health system of Bangladesh is a pluralistic system with four key actors that define the structure and function of the system: government, private sector, non-governmental organizations (NGOs) and donor agencies. The Government or public sector is the first key actor which by constitution is responsible not only for policy and regulation but for provision of comprehensive health services, including financing and employment of health staff. The Ministry of Health and Family Welfare, through the two Directorates General of Health Services (DGHS) and Family Planning (DGFP), manages a dual system of general health and family planning services through district hospitals. Upazila Health Complexes (with 10 to 50 beds) at sub-district level and Union Health. However, there is now one bed for every 1699 number of people, which is still inadequate. Meanwhile, to bring health facilities closer to the doorstep of the population, there is a community clinic for every 6000 number of people (n=12 527) which provides primary health care services (Paul & Goel, 2010). In the public sector, the Central Medical Store is responsible for procurement and supply of medical and surgical equipment and products, including drugs.

Two governmental bodies oversee health care infrastructure and delivery in Ghana – the Ministry of Health (MOH) and Ghana Health Services (GHS). Until 1996, the MOH oversaw the direct provision of health service delivery in Ghana. Today, health service delivery is provided by GHS. The goal of MOH is, "to improve the health status of all people living in Ghana through effective and efficient policy formulation, resource mobilization, monitoring and regulation of delivery of health care by different health agencies" (www.moh-ghana.org). MOH works on policy formation, the monitoring and evaluation of health service delivery throughout the country, resource allocation for health services, and the regulation of health services delivery. MOH also develops the framework for the regulations of food, drugs, and health service delivery.

The health sector in Ghana is in transition from a mainly government managed public sector to one managed by a greater diversity of health services providers. The public sector faces many challenges in terms of financing and the resulting diminishing quality of basic services. The National Health Insurance Service (NHIS) is a national service that finances the sector but while effective, it faces serious challenges for financial sustainability and efficiency. In response to the continuing demand and willingness from the middle class and elite to pay competitive fees for quality health services, opportunities for international investors in the health sector will continue to emerge, for example, the construction of hospitals and diagnostic centres and laboratories.

The South African Government is under increasing pressure to advance programmes and incentives that will drive the maintenance, upgrading and construction of housing and healthcare infrastructure within the country. Funding and administration constraints have hampered service delivery in the past, and are likely to encourage an increase in public-private sector interaction in future years, as the government seeks private sector participation in key infrastructure development. New analysis from Frost & Sullivan (<http://www.environmental.frost.com>), *African Infrastructure Tracker: South Africa's Social Infrastructure*, finds that South Africa's social infrastructure sector is expected to grow as the government seeks to meet significant demand for service delivery, while the population increases. The government is increasingly shifting focus toward the promotion of public-private partnerships in order to speed up delivery processes and reduce funding pressures. "Massive demand, driven by the effects of apartheid and a growing population, has intensified the need for the South African Government to implement social infrastructure development programmes," notes Frost & Sullivan's Environmental and Building Technologies Research Analyst James Milne. The provision of low-cost housing forms a crucial part of social service delivery in the country, while a lack of consistent maintenance of basic public healthcare infrastructure has led to a gap between levels of supply and demand. The government is currently attempting to resolve this issue by encouraging public-private partnerships, and the implementation of large scale infrastructure repair and maintenance programmes. The Government has set the goal of eliminating the backlog by 2030, indicating that significant opportunities will exist for private companies to enter the market, through partnering with the government, at all stages of the value chain (Frost & Sullivan, 2012).

Tiaty sub-County is a largely arid land and covers 44% of Baringo's 11,000 Km Sq. With a total of seven wards: Kolowa, Tirioko, Churo/Amaya, Ribkwo, Tangulbei/Korossi, Silale, and Loiyamorok. The sub-county is 4,540.48 Kms Sq. and has a population of 133,189 according to the 2009 Census. Baringo County Government has since 2013 invested a huge chunk of its resources in the area in a bid to bridge the gap, noting that the area has previously been marginalized. To increase access to healthcare services, the County Government has established a total of 21 health facilities and is in the process of constructing corresponding infrastructure like staff quarters. Upon completion of all the facilities, some of which are in the finishing stages, the number of hospitals will increase from 15 to 36 in the next three years. The County Government has invested in water supply through the funding of a water project per ward, in each financial year. Since inception, some water projects have been the target of expansion in subsequent financial years. Additionally, numerous pan dams have been excavated in the area. Oighony Irrigation Scheme is in the sub-County. In collaboration with Japan International Cooperation Agency (JICA) and the National Government, Tiaty sub-County is a beneficiary of 30 boreholes, with an additional ten being funded exclusively by the County Government of Baringo (Tam, 2005).

Tiaty sub-County is largely Arid and Semi-Arid Land (ASAL) with huge populations of livestock. Several government interventions have been rolled off in the area including livestock breed upgrade by use of bull breeding services. The County Government has so far given farmers 8 pedigree Sahiwal Bulls and over 50 Gala Bucks and Doper Rams for this purpose. The vast sub-County has also been the target of comprehensive livestock vaccination exercises, establishment of cattle dips (3 per ward in the last 3 years), livestock sale yards, and an abattoir in Loruk. Tiaty is Baringo's powerhouse in livestock production and the government intends to assist farmers to increase production so as to support its meat value chain development plans. Roads in the area have also received a facelift with new roads being constructed to open up the sub-county for trade and ease of access of important services like healthcare. Major Roads that have been upgraded include Tangulbei-Mukutani, Chesirimion-Kashokon, Chemolingot-Kosetei-Katikit, Nginyang-Mengmenti-Nalekat, Loruk-Barpello (the only tarmacked road in the sub-County) roads, among others (Reinartz, 2004). Interior parts of the sub-County have no passable road network to aid in transport, therefore limiting healthcare service accessibility by majority of the residents. More so, distribution of healthcare services calls for proper road network. Faith based organizations

including East Pokot Medical Project and Tangelubei divisional medical programmes have mobile healthcare services to reach out to the most interior parts of the sub-County. World Vision offers temporary medical and feeding services to the residents. The Government of Kenya through the Beyond Zero campaign and the County Government of Baringo have initiated mobile health care services to women and children. However, these services do not extend to the most interior parts of the sub-County. When need arises, the government collaborates with faith based organizations and NGO's to deliver essential health care services to the people of Tiaty sub-County.

### ***1.2 Statement of the Problem***

Although transport, electricity, healthcare facilities, water and telecommunication are supportive services in healthcare delivery, lack of these services is reason why people do not use healthcare services, especially services requiring a referral. Problems with transport, electricity, healthcare facilities, water and telecommunication also affect the ability of staff to deliver health services. The distance from the neighboring communities to the district hospital is far and with a deplorable road network, it makes it unattractive for private transport users to use the roads in case of emergency. Limited transport, lack of electricity, inadequate healthcare facilities in the county hospital makes it difficult when there are many emergency cases from the lower level to the higher level. Health services are often not accessed by the very poor and by women in particular. Key obstacles are healthcare charges, long distances to facilities, inadequate and unaffordable transport systems, poor quality of care, poor governance, and lack of accountability mechanisms (Dean and Lang, 2008).

Access to appropriate, affordable and timely transport affects women's ability to receive preventative and emergency obstetric care that is essential for their survival. The World Health Organization estimates that 75 per cent of maternal deaths can be prevented through timely access to child-birth related care (WHO 2001A). The transport sector therefore plays an important role in achieving the fifth millennium development goal 5 - to reduce maternal mortality by 75 per cent by 2015. Distance, poor roads, and lack of ambulances and other means of transport delays the management of life threatening complications. Obstetric emergencies are especially difficult to predict when they occur during a home delivery; hence, getting the mother to a hospital is critical. Distribution of healthcare facilities in Tiaty sub-County is also poor, with only one sub-County hospital in existence, which is also poorly equipped. The health centers (approximately four) and the dispensaries, cannot meet the needs of the sub-County residents.

The public sector health facilities lack medical equipment and instruments with many of the lower-level facility laboratories being ill-equipped and having inadequate emergency response facilities and other clinical diagnostic equipment. Supply of drugs is also inadequate and the supply chain is frequently disrupted. The sub-County lacks educated and trained healthcare personnel. Due to the poor infrastructure, insecurity and overall difficult environment to work in, there is a high turnover of healthcare workers and other healthcare providers are not interested in working in the area. The study sought to fill the research gap by assessing the extent in which poor infrastructure affects healthcare service delivery in Tiaty sub-County.

### ***1.3 Study Objectives***

The paper was guided by the following objectives

- i. To determine the effect of road networks on healthcare service delivery in Tiaty sub-County.
- ii. To examine the effect of power coverage on healthcare service delivery in Tiaty sub-County.
- iii. To find out the effect of healthcare facilities on healthcare service delivery in Tiaty sub-County.
- iv. To establish the effect of water and telecommunication on healthcare service delivery in Tiaty sub-County

## **Literature Review**

### ***Road networks***

Transport infrastructure and services have significantly improved the livelihoods of poor people living in rural areas. Transport facilitates the timely and affordable delivery of basic health, education, water and sanitation services, it connects communities to markets and information, and can empower vulnerable groups. The organization of health services can

add to or alleviate all these impacts, as well as make it more or less difficult for patients, relatives and healthcare providers to travel to and between healthcare settings. The provision of transport services (including issues such as car parking) have major cost implications, as does addressing the health issues associated with transport. Transport issues are an integral element in meeting a range of health service aims, including those set out in national service frameworks and other policy documents, and in the health service environmental standards. There are significant inequalities in the impact of transport on the health of individuals and communities; both directly (e.g. through the social distribution of child pedestrian deaths) and indirectly (e.g. through the influence of planning decisions to accommodate car access).

Hall et al., (2006) conducted a study in the Eastern Cape province of South Africa with a view to understanding the impacts of transport on healthcare service delivery. Their findings demonstrated not only the need for improved transport services in the delivery of health, but also the importance of using the right type of vehicles. Their study also revealed that during the rainy season, it was exceedingly difficult for delivery vehicles laden with drug supplies to access health facilities largely because of poor road infrastructure running along hilly, often broken and generally difficult terrain that characterize the province. In wet weather, these roads become muddy and slippery. In fact, health transport problems are indeed most severe in the wet season for most rural areas not only in South Africa but also in other developing countries (Gray & Suleman 1999). This severity is felt much more keenly in emergency cases.

In a study done by Mobility and Health (2008) in Namibia, it was demonstrated that transport for emergency cases comes at a higher cost for people living in rural and largely marginalized areas. Very often, patients get too exhausted or die while waiting for ambulances, which take over three hours on average to report at the scene after a callout. In South Africa, there is a huge backlog in terms of the provision of emergency medical services (EMS) especially in the public health sector. This situation is exacerbated by the short supply of specially designed and equipped vehicles as well as well-trained staff or paramedics – the hallmark of EMS. Small wonder then that organizations such as the Southern African Rural Poverty Network (SARPN) have clamored for the generation of a *National EMS Strategic Plan* (as part of a concerted effort to achieve the Millennium Development Goals) using the 2010 FIFA Soccer World Cup as a fillip (SARPN, 2007).

Lack of adequate and affordable transport services particularly in remote rural and marginalized areas, undergirded by sound transportation infrastructure, are obstacles to achieving meaningful service delivery. Clearly, without proper transport infrastructure and services, healthcare facilities in these areas will remain under-serviced in terms of maintaining adequate levels of medical supplies and retaining medical staff as well as eliciting confidence and therefore regular utilization of the facilities by locals (Mashiri *et al*, 2007b; Mashiri *et al*, 2008). As part of the overarching framework of the *National Transport Policy* for South Africa, it is envisaged that policies in the transport sector will be outward looking, shaped by the needs of society in general (South Africa Department of Transport, 1996). Among those needs is transport for health service delivery.

A study conducted in the village of Vanathavillu in the north-western Province of Sri Lanka by Wettasinghe and Pannila (2002) illustrates that even where rural communities are better served with intermediate and motorized transport and a paved road, transport of those who are too ill to travel by bus is prohibitively costly. Added to this is the problem of gaining access to medical staff once the health outlet has been reached. Due to the low ratio of health workers to the population they serve, villagers need to travel early and queue for many hours if they are to have any chance of being seen by qualified medical staff. There is inadequate literature on the effect of road networks on delivery of healthcare services in Tiaty sub-County.

### *Power coverage*

Access to electricity is critical to healthcare delivery and to the overarching goal of universal health coverage. Data on electricity access in healthcare facilities are rarely collected and have never been reported systematically in a multi-country study. From a health and development perspective, ensuring universal access to modern energy services in health facilities in developing countries is an essential requirement for improving health and well-being. However, evidence about energy access in healthcare facilities in developing regions is lacking. In 2012, the United Nations (UN) Secretary-General launched the “Sustainable Energy for All” (SE4All) initiative, which aims to achieve universal access to clean and modern energy sources in households and community settings by 2030. The initiative also aims to double the global rate of energy efficiency and use of renewable energy. SE4All notes that healthcare facilities are a special focus on its community energy

access agenda. Work has already begun to define measurable access targets for electricity—one of the most widely used forms of energy in health services (Bello, 2004).

There are certain appliances providing a range of services in health facilities that cannot be operated without energy. These include medical refrigerators, sterilizers, lamps, cookers, suction machines for deliveries, incubators, microscopes, centrifuges, mixers, X-Ray viewers, etc. Many rural health facilities in East Africa are limited in their ability to deliver quality health services, partly due to a lack of appropriate, affordable, and accessible energy services. Some of the relationships are quite direct and relate to the provision of services at a clinic or a health centre. Others, such as consequences of labour intensive farming and poor access to clean water, are more indirect, or fall outside of what is strictly considered the domain of the health sector, and yet these relationships also have an impact on the health of the population (Ajayi & Tokon, 2009).

Hospitals and clinics located near an electricity grid connection have traditionally relied on grid power as a primary energy source. Yet power failures or outages during periods of peak demand are a problem even in grid-connected cities and regions. This forces clinics to rely on expensive backup generators, or to remain without power. In off-grid settings, stand-alone diesel-powered generators have been the most common solution, backed up mostly by kerosene lamps, candles or flashlights. Generators, however, are expensive to operate due to the increasingly high cost of fuel and its transport and storage. As equipment maintenance also may not be locally available, the unreliability of generators is thus a major issue. In a recent WHO survey of data from six large sub-Saharan African countries, less than 30 percent of stand-alone diesel generators were functional and with fuel available on the day of the survey (Adesina and Jim, 2008).

Generators also produce significant waste heat, which is essentially wasted energy. Small on-site diesel generators tend to be particularly inefficient. They produce high proportions of health-harmful particulate matter (PM) and CO<sub>2</sub> emissions per Kwh of power generation, contributing to air pollution exposures, as well as to climate change. Conventional thermal grid power generation is also an energy-inefficient process, generating significant waste heat during power production and thermal losses during transformation and long-distance transmission. More than two-thirds of input energy may thus be wasted in a conventional coal or oil-fired power plant. Finally, grid power access does not alleviate the need for on-site generators, because all health facilities that offer emergency care, childbirth management or surgical procedures also require backup power. Regulatory or accreditation requirements typically make on-site power mandatory for such facilities (Bello, 2004).

### *Healthcare facilities*

A healthy county is a productive county. In order to accord high quality and reliable health and therefore improved productivity for its residents, Baringo County Government has since 2013 invested heavily on the health sector. Kabarnet Referral Hospital is being upgraded to level five, complete with renal unit and CT scan, new X-Ray unit, and oxygen plant. Maternity and general wards have also been refurbished in order to accommodate more patients. Eldama Ravine Hospital hosts a new 32-bed modern maternity, built courtesy of a partnership between Baringo County Government and Waitrose Foundation. Infrastructure development is crucial to the provision of services in hospitals. The County Government has established new health facilities especially in the far flung remote areas of Baringo County by renovating and upgrading existing ones and constructing staff quarters in health centres across the county.

Many countries in sub-Saharan Africa are unable to provide well-equipped wards and adequate quality and coverage of health services because of economic factors and scarce resources. This has prompted many countries to advocate for decentralization as a key factor to drive health sector reforms with a view of maximizing the use of available resources in improving access and quality of healthcare service provision. Providing quality service has significant impact on customer satisfaction (Swanson & Davis, 2003), customer retention (Yeas et al., 2004) and growth of organization (So Hail, 2003). However, the poor state of customer service in some public health facilities in Kenya has resulted in high turnover and weak morale among staff, making it difficult to guarantee 24-hour coverage, and resulting in problems with patients care as well as increased cost of operations due to inefficiencies (Owino & Korir, 1997) hence, prompting some patients to look for an alternative provider and speak ill of the services provided, which affects potential clients and curbs the growth of the hospital (Tam, 2005).

In Ghana's healthcare sector, the attention of health service providers is being drawn to the need to be cautious about how the customer/patient is dealt with. The provision of service is a very challenging task (Collier, 1987) especially in the healthcare sector. Every country needs a good health care system and it is important to recognize that a healthy population

is better disposed to achieving the productivity needed to increase and sustain continued growth of the country's economy (Andaleeb, 2000).

In Nigeria the Minister for Health, Prof. Onyebuchi Chukwu said that Nigerians go abroad for treatment due to lack of standard medical facilities in the country. Chukwu spoke on the investment opportunities in the Nigeria health sector at a seminar organized by the Institute of Directors in Lagos. He encouraged business men to invest in the tertiary healthcare services, saying that through private-public partnership arrangements, the government intended to transform some health centres. In his remarks, he reiterated that the phenomenal increase in medical tourism by Nigerians, which is hinged on a number of factors: lack of appropriate and modern facilities in their tertiary centre; inadequate human capacity development and no modern technological advancement; incessant work disruption occasioned by workers' strikes; lack of information on facilities and services available in the country; the propensity to patronize foreign goods and services; as well as unethical commercialization of the referral system. He disclosed that the Federal Government had embarked on a rescue mission of upgrading tertiary health care services. Presently, there are 10 of these centres that have been upgraded, while 2 are nearing completion.

In America healthcare facilities are becoming increasingly outdated hence, capital is needed to sustain and improve these facilities. In the absence of improved facilities healthcare providers will need to locate and develop new facilities. Currently, the funding for most healthcare facilities does not provide sufficient monies for capital improvements and certainly not for acquisition of or development of new facilities. Rural healthcare facilities have struggled over the past several years with many of these facilities closing and leaving rural communities underserved (Koenig & Peterman, 2009).

#### *Water and telecommunication*

Improving the quality, accessibility, and efficiency of healthcare for citizens is considered the aim of Information Communication and Technologies (ICT) for health. ICT for health is considered the application of ICT across a range of functions that are affecting the health sector. Controlling escalation of costs and improving the healthcare of citizens is what every nation seeks to achieve. In 2010 alone, the size of ICT enabled healthcare services was estimated to be about \$ 3.1 billion worldwide, and out of this, 80 per cent were in developed countries (Rudowski, 2009). Consultations which are done online by patients and doctors using websites and emails, distance referrals, emergency evacuations, and advance transmission of images and data of patients from ambulances, is known to reduce lead times of intervention in emergency wards of most hospitals. This level of ICT in health has not been reached in developing countries by most professional and community users.

North America and Europe for example apply ICT in healthcare service delivery in the advanced stage. In fact, the use of technology in delivery of health services has been described in various ways including telemedicine, tele-nursing, tele-homecare and many others. The use of ICT in delivery of healthcare services is attributed to well-developed technological infrastructure. Studies have been conducted on how e-health has been achieved through the application of technologies. A significant contribution to technical solutions in social context and in relation to individual needs is therefore needed in research and in the practice of health-enabling and ambient-assistive technologies (Koch *et al.*, 2009). Tele-health systems such as online and mobile tools have already opened up the possibility for reducing hospitalization and increasing home care (Venter *et al.*, 2012). Studies associated with tele-nursing have indicated an increased benefit of using technology in the nursing care delivery system in USA. The benefits of using the tele-nursing technologies range from improved diagnosis and consultations to the development of career options and professional nurses (Hebda & Czar, 2013). Most importantly, tele-nursing have led to improved patients' clinical and healthcare outcomes. Each of the benefit areas are related to the patients' safety concerns (Hebda and Czar, 2013). Tele-nursing is becoming an attractive and exceptional area in the professionals nursing practice where practitioners are required to develop skills in using the technologies in the patient care delivery system.

Expectations in health have risen due to the advancement of ICT (Dury, 2005). ICT impacts on almost every aspect of the healthcare sector. Information management and communication especially in public health sector is important and can be improved by available systems (Olukunle, 2009). The emergence of electronic health, which is ICT-supported health provision, has reduced the cost of healthcare thereby increasing efficiency by data management and transfer, disease management, and quality transfer of knowledge (Oladosu *et al.*, 2009).

In Africa, South Africa emerges as one of the nations where e-health is widely applied. The success of e-health in South Africa has been attributed to highly developed ICT infrastructure and huge investments in ICT, particularly by the public hospitals, well trained public health personnel, well developed training and health institutions, and belief in the ICT solutions to health problems (Adesina, 2007). Currently, technology plays a critical role in healthcare services delivery in South Africa. However, like most developing countries, innovative approaches to e-health remain significant. One of the successes of such innovations is the application of Cell-life and Mindset health models.

In Kenya, evidence that healthcare professionals have a better access to adequate and reliable knowledge in ICT is little (Gatero, 2011). The country continues to face health threats for example ravaging HIV&AIDS pandemics, the spread of infectious diseases including malaria, soaring levels of infant and maternal mortality, very low levels of life expectancy and further deteriorating healthcare facilities (Gatero, 2011). Notable barriers include few physical access capturing, and slow or unreliable Internet connectivity, very high subscription cost of information materials, inadequate awareness of what is available, lack of relevance of available information that ends up not meeting peoples' needs in terms of scope, style, or format, limited time and incentives to access information, and lack of valued interpretation skills (Bii & Otiike, 2003). Public hospitals in Kenya have not shown robust commitment or willingness to invest in information technology despite its wide application and use. Even though ICT application is gaining popularity within the private sector, the public institutions are yet to embrace the significance of ICT in healthcare service delivery.

## Methodology

A descriptive survey research design was used for this study. The design was chosen simply because it entails investigation in which self-report data is collected from samples with the purpose of describing population on some variable of interest (Osuala 1993). The target population of the study was employees in healthcare institutions and patients who visit the healthcare institutions in Tiaty sub-County.

The study used a stratified random sampling technique to select a sample of 126 employees in healthcare institutions and patients who visit the healthcare institutions in Tiaty sub-County.

The questionnaire was the selected instrument or tool for data collection for the study. The questionnaire was administered to each member of the sample population. The questionnaire was developed with reference to the research objectives aimed at answering the research questions. The researcher administered the questionnaire individually to all respondents of the study. The study carried out a pilot study to pretest and validate the questionnaire. Quantitative data collected was analyzed by the use of descriptive statistics using SPSS (Version, 23) and presented through percentages, means, standard deviations and frequencies. The information was displayed by use of bar charts, graphs and pie charts, and in prose-form.

Content analysis was used to test data that is qualitative in nature or aspects of the data collected from the open-ended questions. The study conducted a correlation analysis to establish the strength of the relationship between the independent and the dependent variable. Multiple regressions were done to determine the effect of infrastructure and health care service delivery in Tiaty sub-County, Baringo County. Data was presented using tables, and pie charts to make them reader-friendly. In addition, a multiple regression was used to measure the quantitative data and analysis was carried out using SPSS.

## Results and Findings

Descriptive and inferential statistics were used to discuss the findings of the study. The study targeted a sample size of 126 respondents from which 110 filled in and returned the questionnaires, reaching a response rate of 87.3%. This response rate was satisfactory and representative to make conclusions for the study. According to Mugenda and Mugenda (2008), a response rate of 50% is adequate for analysis and reporting; a rate of 60% is good and a response rate of 70% and over is excellent. Based on the assertion, the response rate was considered to excellent.

#### 4.1 Correlation Analysis

On the correlation of the study variables, the researcher conducted a Pearson Product Moment correlation. From the findings on the correlation analysis between infrastructure and healthcare service delivery, the study found that there was positive correlation coefficient between healthcare service delivery and road networks as shown by correlation factor of 0.586. The study also found a positive correlation between healthcare service delivery and power coverage as shown by correlation coefficient of 0.612. Association between healthcare service delivery and healthcare facilities was found to have a positive relationship as shown by the correlation coefficient of 0.543. The study also found a positive correlation between healthcare service delivery and water and telecommunication as shown by the correlation coefficient of 0.496.

**Table 1** | Correlations Coefficients

		Healthcare service delivery	Road networks	Power coverage	Healthcare facilities	Water and telecommunication
Healthcare service delivery	Pearson Correlation	1	.586**	.612**	.543	.496
	Sig. (2-tailed)		.000	.000	.004	.012
	N	110	110	110	110	110
Road networks	Pearson Correlation	.586**	1	.602**	.310	-.108
	Sig. (2-tailed)	.000		.000	.113	.932
	N	110	110	110	110	110
Power coverage	Pearson Correlation	.612**	.602**	1	.105	-.237
	Sig. (2-tailed)	.000	.000		.597	.170
	N	110	110	110	110	110
Healthcare facilities	Pearson Correlation	.543	.310	.105	1	.738**
	Sig. (2-tailed)	.004	.113	.597		.000
	N	110	110	110	110	110
Water and telecommunication	Pearson Correlation	.496	-.108	-.237	.738**	1
	Sig. (2-tailed)	.012	.932	.170	.000	
	N	75	110	110	110	110

#### 4.2 Regression Analysis

Adjusted R squared is the coefficient of determination which tells us the variation in the dependent variable due to changes in the independent variable. From the findings in the table below the value of adjusted R squared was 0.672 an indication that there was a variation of 67.2% on the healthcare service delivery due to changes in road networks, power coverage, healthcare facilities, water and telecommunication at a 95% confidence interval. This shows that 67.2 % changes in healthcare service delivery could be accounted to changes in road networks, power coverage, healthcare facilities, water, and telecommunication. R is the correlation coefficient which shows the relationship between the study variables. From the findings shown in the table below, there was a strong positive relationship between the study variables as shown by R=0.836.

**Table 2** | Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.836a	0.699	0.672	0.12

From the ANOVA statistics in the table below, the processed data, which is the population parameters, had a significance level of 0%, which shows that the data is ideal for making a conclusion on the population parameters, as the value of significance (p-value) is less than 5%. The F calculated value was greater than the F critical value (2.458 > 0.891) an indication that there were significant difference between healthcare service delivery and road networks, power coverage, healthcare facilities, water, and telecommunications. The significance value was less than 0.05 indicating goodness of fit of the model.

**Table 3** | Analysis of Variance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.654	4	0.414	0.891	.028b
	Residual	48.734	105	0.464		
	<b>Total</b>	<b>50.388</b>	<b>109</b>			

The established regression equation was

$$Y = 1.238 + 0.409 X_1 + 0.321 X_2 + 0.254 X_3 + 0.224 X_4$$

From the above regression equation, it was revealed that holding road networks, power coverage, healthcare facilities, water, and telecommunication to a constant zero, healthcare service delivery would stand at 1.238, a unit increase in staff trainings would lead to increase performance by a factor of 0.305. A unit increase in road networks would lead to an increase in healthcare service delivery by factors of 0.409. A unit increase in power coverage would lead to an increase in healthcare service delivery by a factor of 0.321, and unit increase in healthcare facilities would lead to increase in healthcare service delivery by a factor of 0.224. The study further revealed that holding road networks, power coverage, healthcare facilities, water, and telecommunication were statistically significant to affecting healthcare service delivery, as all the p values (sig) were less than 0.05. The study also found that there was a positive relationship between healthcare service delivery and road networks, power coverage, healthcare facilities, water, and telecommunication.

**Table 4** | Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.238	0.412			
	Road networks	0.409	0.102	0.387	4.010	0.001
	Power coverage	0.321	0.132	0.192	2.432	0.006
	Health care facilities	0.254	0.108	0.163	2.352	0.006
	Water and telecommunication	0.224	0.093	0.121	2.409	0.006

## Conclusion

From the findings, the study concluded that poor infrastructure including lack of proper road network, poor power coverage, inadequate healthcare facilities, poor distribution of water, and poor telecommunication network, negatively influence healthcare service delivery in Tiaty sub-County.

## Recommendations

The study recommends that the government ensure the construction of roads in every ward in the sub-County so as to increase effectiveness and efficiency in healthcare service delivery. This will ensure that the healthcare institutions are easily accessible. The government should promote the distribution of power in the country. This will ensure that power is well distributed all over the country and ensure efficient healthcare service delivery, since the hospitals use power to carry out their activities. The government should ensure that all hospitals are equipped with the relevant facilities to ensure staff delivers their services efficiently. The government should ensure adequate water supply all over the sub-County this can be done by drilling boreholes and also water harvesting during the rainy seasons to ensure that there is adequate water supply throughout the year. The telecommunication industry should also ensure that their services are available all over the sub-County to ensure efficient communication hence promote effective service delivery.

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