THE INTERNATIONAL JOURNAL OF HUMANITIES & SOCIAL STUDIES

Effect of Access to Healthcare due to Rural Electrification on the Household Wellbeing among Proprietors of Micro and Small Enterprises in Kenya

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Abstract:
Kenya's Medium-Term Plan III (2018-2022) promises that the health sector will pay special attention to the 'Big Four' initiatives with particular focus on the achievement of Universal Health Coverage by implementing programmeslike rural electrification that increase access to quality healthcare services. Kenya's electricity demand for rural electrification has been steadily rising in the recent past. Households in Kenya are willing and able to pay for improved energy services based on renewable energy resources at reasonable rates. It's against this background that this study sought to investigate the effect of access to healthcare due to rural electrification on household wellbeing among proprietors of micro and small enterprises in Kenya. The study adopted a cross-sectional descriptive survey design. The target population for this study comprised172,554 proprietorsofmicro and small enterprises registered in Kenya by 2015. The study used multistage sampling involving systematic and simple random sampling procedures due to the large target population involved. Primary data from proprietors of rural micro and small enterprises in eight counties namely; Kakamega, Bungoma, Nakuru, Busia, Bomet, Siaya, Kericho and Kirinyaga forming a sample size of 418 was used. The data collection instrument was pilot tested on 5% of the sample size. Pearson correlation analysis showed that there was a moderate positive relationship between access to healthcare due to rural electrification and household wellbeing among proprietors of micro and small enterprises. Regression analysis results revealed that access to healthcare contribute significantly to household wellbeing. It was concluded that there was a statistical significant relationship between access to healthcare and household wellbeing among proprietors of micro and small enterprises. It is recommended that the Kenyan government should promote universal access to electricity in all health facilities to a higher level on the political agenda, supporting these commitments with strategic plans, clear policies and dedicated establishments.

Keywords: *Access to healthcare, rural electrification, household wellbeing, micro enterprises, small scale enterprises, Kenya*

1. Background to the Study

Wellbeing is a state of fulfillment of basic human needs and rights as a crucial requirement before people can flourish and live well (Tinkler&Hicks, 2013). People from diverse cultures appear to emphasize different elements of happiness and have distinct beliefs about wellbeing. Americans, for example, may associate happiness with excitement while, in contrast, Japanese people are more likely to associate happiness with peace and calm (Oishi, 2018). The World Happiness Report 2016-2018 list reveals that developed countries are the happiest occupying the top 10 positions whereas poor countries have the lowest average happiness index occupying the bottom 10 countries on the list (Helliwell, Layard& Sachs, 2019). In contrast, according to the Gallup-Healthways Wellbeing Index, the global wellbeing map is dynamic and changing in favor of growing economies. For the Gallup-Healthways Wellbeing Index the highest 10 wellbeing countries include developing and Latin America economies while the lowest 10 wellbeing countries are largely poor nations (Gallup-Healthways, 2015).

There has been much economic growth around the globe, but it has been criticized for not being sufficiently 'inclusive' (Gupta, Pouw&Ros-Tonen, 2015) and it has not resulted in a markedly more equitable distribution of household wellbeing on a global scale (Bourguignon, 2015). The connection between energy and household wellbeing is established by the fact that the poor in developing countries constitute the bulk of the estimated 2.7 billion people relying on traditional biomass (wood, coal, charcoal, or animal waste) and kerosene for meeting their basic energy needs and the vast majority of the 1.4 billion without access to grid electricity (IEA, 2011; GEA, 2012). The relationship reveals a vicious cycle in which people who lack access to cleaner and affordable energy are often trapped in a re-enforcing cycle of deprivation, lower incomes and the means to improve their living conditions (GEA, 2012).

Countries with the highest levels of poverty and lower levels of household wellbeing tend to have lower access to modern energy services - a problem that is most pronounced in sub-Saharan Africa and South Asia (IEA, 2017). Improvement in rural electrification is manifest, with the global rural electrification proportion increasing from 63 percent in 2000 to 73 percent in 2014 (World Bank, 2017). In 2014, 1.06 billion people still lived without access to electricity - approximately 15 percent of the global population and almost 3.04 billion people still relied on traditional biomass and kerosene for cooking and heating which is an indication of low level of wellbeing (IEA, 2017). This, for instance explains why wellbeing has become a policy concern in a range of nations, including the United Kingdom, Bhutan, the United Arab Emirates, and France, as well as at international organizations such as the United Nations and the OECD (Sachs, 2018; Tay, Chan&Diener, 2014). Countries that enjoy the highest levels of wellbeing are those that are closest to reaching the 17 SDGs – those that have the highest social capital, the most inclusive and equitable economies, and policies that effectively protect and promote the natural environment (Global Council for Happiness and Wellbeing, 2019).

Electricity access seems to have a notable impact on some key health service indicators, such as reducing indoor pollution, prolonging night-time service provision, attracting and retaining skilled health workers, and providing faster emergency response, including for childbirth deliveries (Sustainable Energy for All, 2013).Healthcare facilities must be strategically located, offer uniquely affordable services, universally acceptable, adequately available and evenly distributed in order to enhance access to healthcare services and increase the level of household wellbeing. Rural electrification makes healthcare facilities to be strategically available reducing the distance travelled to seek medical services (Noor, Amin, Gething, Atkinson, Hay & Snow, 2006). Healthcare expansion to the community level as a result of electrification enhances access to healthcare (WHO, 2015) which may enhance household wellbeing.

Besides improving the direct functionality of health facilities, access to electricity is equally instrumental in attracting and retaining skilled health workers, especially in rural areas (World Health Organization, 2015). Recorded cases show that health workers choose to even quit employment when they are assigned to work in remote rural areas where energy is a problem (IEA, 2014). Poor energy infrastructure can affect the quality of service: for example, reduced operating hours resulting in an un-served population, reduced capacity for lab tests, night-time safety concerns and decline in staff morale (USAID, 2012).

According to International Energy Agency (2013), 33.6 million people (80 per cent of a population of 42 million) in Kenya lacked access to electricity in 2011. This means that Kenya had the seventh highest deficit in access to electricity in the world. Electricity consumption per capita was 155kWh per year in 2011, as compared to an average 219kWh in all low-income countries, 535kWh in sub-Saharan Africa and a world average of 3,045kWh. Generation capacity as of March 2014 was 1,810MW (Republic of Kenya, 2014). In Kenya, the electrification gap is larger in rural areas, where only 7 per cent of the population has access, as compared to an urban electrification rate of 58 per cent (International Energy Agency, 2013).

Electrification rates in Kenya remained very low averaging 5.5 percent and 22.3 percent for households and businesses respectively (Lee, Miguel &Wolfam, 2016). Electricity access in healthcare facilities increased by 1.5% annually in Kenya between 2004 and 2010, and by 4% annually in Rwanda between 2001 and 2007 (Adair-Rohani, Zukor, Bonjour, Wilburn, Kuesel, Hebert, &Fletchera, 2013). According to the Kenya National Bureau of Statistics, the number of customers connected under the rural electrification programme rose by 4.9 per cent to 1,332.1 thousand customers in 2017/18 from 1,269.5 thousand customers during 2016/17 financial year. The increase was mainly drawn from domestic consumers and small-scale enterprises. Consequently, revenue realized grew by 14.2 per cent from KSh 10,376 million in 2016/17 to KSh. 11,846 million in 2017/18 (Republic of Kenya, 2019). Surprisingly, according to World Bank (2017), Kenya is leading the way in the East African region on how to balance a rapidly growing electrification program with consumer affordability in a financially sustainable manner.

1.1. Statement of the Problem

Kenya's Medium-Term Plan III (2018-2022) promises that the health sector will pay special attention to the 'Big Four' initiatives with particular focus on the achievement of Universal Health Coverage by implementing programmes that increase access to quality healthcare services and offer financial protection to people when accessing healthcare (Republic of Kenya, 2018). According to the Kenya National Bureau of Statistics, electricity demand for rural electrification rose by 3.6 per cent in 2018. The number of customers connected under the rural electrification drawn from domestic consumers and small-scale enterprises programme rose by 4.9 per cent in 2017/18. Consequently, revenue realized grew by 14.2 per cent during the same period (Republic of Kenya, 2019). Khandker, Hussain, Rubabaand Douglas (2012) agree that the role and intent of electrification programs is not only to provide access to electricity but also to improve the overall wellbeing of people. According to World Happiness and Wellbeing Report 2019, Kenya was ranked position 121 globally with a relatively dismal performance index of 4.509 on a scale of 1-10 (Helliwell, Layard& Sachs, 2019). Similarly, poverty rates in Kenya remain relatively high compared to other lower middle-income countries indicating that household wellbeing has equally remained low (World Bank, 2018).

Tegene, Berhe and Teklemariam (2015) found a positive and significant relationship between rural electrification and poverty reduction especially through enhanced access to healthcare, education and on the development of both on-farm and off-farm commercial activities inEthiopia. Similarly, a study by Bezerra, Callegari, Ribas, Lucena, Portugal-Perreira, Koberle, Sziko and Schaeffer (2017) revealed that rural electrification had a positive influence on all dimensions of Human Development Index (HDI) in Brazil. Households in Kenya are willing and able to pay, on average, about Ksh. 37 per kWh (US$0.35 per kWh) for improved energy services based on renewable energy resources (Kirubi, Jacobson, Kammen&, Mills, 2009). In view of the foregoing, it is acknowledged that rural electrification enhances access to

healthcare that consequently improves wellbeing of the rural poor. This study therefore sought to establish whether the same trends are also realizable in Kenya.

1.2. Objective of the Study

The objective of this study was to investigate the effect of access to healthcare due to rural electrification on the household wellbeing among proprietors of micro and small enterprises in Kenya.

1.3. Research Hypothesis

This study was guided by the null hypothesis that access to healthcare due to rural electrification has no effect on the household wellbeing amongproprietors of micro and small enterprises in Kenya.

2. Literature Review

The theoretical anchoring for this study is the social exclusion theory. The idea of social exclusion focuses attention on the processes (Room, 1995) by which a disadvantage occurs. Sen (2000) contends that social exclusion needs to be scrutinized in relation to its efficacy in providing new insights in understanding the nature of wellbeing and identifying causes of poverty. Social exclusion is a broader concept than poverty, encompassing not only low material means but the inability to access social services like healthcare and education (Duffy, 1995). Todman (2004) explains that social exclusion is a consequence of the discriminatory decisions and actions undertaken by a society's political and economic elite who, by acting in their own self-interest exclude the other members of society, for instance, inadequate access to healthcare in rural areas.

Social inclusion on the other hand has been defined as a process in which those at risk of poverty and social exclusion gain the opportunities and resources that are needed to fully participate in societal activities (Frazer &Marlier, 2013). Social inclusion has also been referred to as the endpoint of overcoming social exclusion, where social exclusion is characterized by the involuntary exclusion of individuals and groups from society's political, economic and societal processes, which prevents their full participation in the society in which they live (UNDESA, 2010). Social inclusion has further been seen as a foundation for shared prosperity that characterizes the process of improving abilities, opportunities and dignity of the poor through access to services such as healthcare (World Bank, 2013). In this study, access to healthcare due to rural electrification, has been treated as a key means to tackle social exclusion, poverty and inequality that may finally enhance wellbeing of proprietors of MSEs. Spatial inclusion has been defined as a goal of connecting people to assets and goods regardless of their location and is argued to be critical for poverty eradication, inclusive growth and improved wellbeing (AfDB*et al*., 2014).

According to World Health Organization, access to healthcare is the degree to which healthcare services are available to as many people as possible. Health facility expansion to the community level as a result of electrification enhances access to healthcare (WHO, 2015). Rural electrification makes health facilities to be strategically available reducing the distance travelled to seek medical services. These facilities must be strategically located, offer uniquely affordable services, universally acceptable, adequately available and evenly distributed to easily access healthcare services (Noor *et al*., 2006).Availability of utility services such as electricity and water is imperative for the functioning of a health facility, and is an important determinant of effective delivery of essential health services (WHO, 2015).According to Energypedia (2014), if the cold chain is inoperable when supplies arrive, vaccines, blood, and other medicines may go to waste. If a clinic is without lights, patients arriving at night may be forced to wait until morning to receive care.

In Cuba, 170 rural clinics provided with electricity saw improvements in both quality of life and infant mortality (GVEP, 2013). The systems provided included lights, a vaccine refrigerator, and other key pieces of equipment including electrocardiographs and x-ray machines. The use of radiant warmers for newborn care, cold chain storage for vaccines, and night-time deliveries are all dependent on the availability of reliable power. A publication by the World Health Organization and the World Bank maintains that besides improving the direct functionality of health facilities, access to electricity is equally instrumental in attracting and retaining skilled health workers, especially in rural areas (WHO, 2015). In Tanzania for instance, there are health facilities with no single health worker and one of the contributing factors is the unavailability of energy. Recorded cases show that health workers choose to even quit employment when they are assigned to work in remote rural areas where energy is a problem (IEA, 2014).

From the few studies that have been done, it can be seen that electricity may have a significant impact on some key health service indicators such as: prolonging night-time service provision; attracting and retaining skilled health workers to a facility; and providing faster emergency response, including childbirth emergencies (WHO, 2015). Poor energy infrastructure can affect the quality of service: for example, reduced operating hours resulting in an un-served population, reduced capacity for lab tests, night-time safety concerns and decline in staff morale (USAID, 2012). A project in Columbia provided electricity for four rural communities to provide health care services by powering vaccine refrigeration, lighting, communications, and medical appliances. Services were noted to have improved with increased vaccine coverage, more rapid malaria diagnosis and improved lighting for night visits. Opening hours were increased in Bangladeshi and Kenyan clinics with electricity. In the case of Bangladesh this was 7.1 hours with electricity and 6.1 without, and in Kenya, 15.1 hours with electricity and 11.0 without (GVEP, 2013). Impact assessment for rural health facilities electrification for Uganda, found that the use of electricity at health clinics enhances the delivery of medical services through the provision of quality light for use during treatment of night time emergencies, emergency deliveries and for security purposes (Energypedia, 2014).

The powering of emergency medical equipment, storage of blood and vaccines, and performing of basic health procedures, especially after dark, are all contingent on reliable electricity supplies (Van Leeuwen, 2014). The provisions of

reliable, secure and affordable energy services are central to addressing many of today's global development challenges including poverty, inequality, climate change, food security, health and education as well as wealth creation and economic development (Brazilian, Nussbaumer, Rogner, Brew-Hammond, Foster, Pachauri&Williams, 2011). Furthermore, electricity can improve food quality and nutrition through cooking and refrigeration (World Bank, 2015).

Suhlrie, Bartram, Burns, Joca, Tomaro and Rehfuess (2018) carried out a data assessment on the role of energy among health facilities in Malawi. Based on extensive literature searches and iterative discussions within the research team, they developed a conceptual framework that was used to explore how characteristics of electricity supply affect distinct energy uses in health facilities (e.g., lighting), and how functional or non-functional lighting affects the provision of night-time care services in Malawi. The study applied descriptive statistics and conducted logistic and multinomial regressions using data from the Service Provision Assessment (SPA) of the Demographic and Health Surveys (DHS) for all health facilities in Malawi in 2013/2014. The conceptual framework depicted the pathways from different energy types and their characteristics, through to distinct energy uses in health facilities (e.g., medical devices) and health-relevant service outputs (e.g., safe medical equipment). The study revealed that the outputs can improve outcomes for patients (e.g., infection control), facilities (e.g., efficiency) and staff (e.g., working conditions) at facilities level and, ultimately, contribute to better population health outcomes.

Chen, Chindarkar and Xiao (2019) examine the effect of JyotigramYojana (JGY), a rural electrification program providing 24-hour electricity to rural non-agricultural users in Gujarat, India, on core components of health systems including health facilities, health information, and health services utilization. The study matched data from the District Level Household and Facility Survey (DLHS-II and DLHS-III) and administrative data from electricity distribution companies on JGY implementation. They then apply a difference-in-differences framework to address potential bias in JGY implementation by comparing the sample from Gujarat (treatment group) with that from Maharashtra (control group). The study found that JGY implementation significantly improved the operational capacity of health facilities, in particular primary health centers (PHCs), by increasing the availability and functionality of a wide range of essential devices and equipment. JGY also significantly increased access to health information through television. Further, JGY increased utilization of health services; in particular, it increased the probability of children receiving critical vaccinations and pregnant women receiving antenatal care. The study concluded that reliable electricity can be an effective tool in improving core components of health systems.

3. Research Design

Kothari and Garg (2014) define research design as the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure. This study was conducted using a cross sectional survey research design. Houser (2011) reiterates that a cross-sectional survey design provides in-depth information about the characteristics of subjects within a particular field of study. The study is anchored on a critical realist approach philosophy. Critical realism focuses on a complex view of ontology which investigates the properties that societies and people possess that might make them possible objects of knowledge (Bhaskah, 1979). It argues that research should be able to make generalized claims but that the subjectivities of individuals and the meanings instilled within action are central to understanding the external world (Prowse, 2010). It therefore provides a solid epistemological basis for a reflexive wellbeing research of this type.

3.1. Target Population

Population refers to all the items under consideration in any field of inquiry (Kothari andGarg, 2014). The target population for this study was172,554rural registered micro and small enterprises inKakamega, Bungoma, Nakuru, Busia, Bomet, Siaya, Kericho and Kirinyaga Counties (Republic of Kenya, 2016). The decision to use the above-named counties for this study was based on their contribution to national poverty as shown in Table 1

County	Total Population	Contribution (%)	Rank (Highest to lowest)
Kakamega	1,644,328	4.77	1
Bungoma	1,359,983	3.79	5
Nakuru	1,562,625	3.08	10
Busia	735,294	2.61	15
Bomet	721,873	2.18	20
Siaya	833,230	1.87	25
Kericho	737,942	1.71	30
Kirinyaga	520,585	0.79	45

Table 1: Contribution to National Poverty by County
Source: Republic of Kenya (2014)

3.2. Sampling Frame

Sekaran and Bougie (2011) defines sampling frame as a physical representation of all the elements in the universe/population from which the sample is drawn. The sampling frame for this study consisted of172,554 micro and smallenterprises registered in Kakamega, Bungoma, Nakuru, Busia, Bomet, Siaya, Kericho and Kirinyaga Counties by 2015(Republic of Kenya, 2016) making a total of 172,554 in number as shown in Table 2

County	Total Registered MSEs.	Total Registered Rural MSEs.
Kakamega	52,470	30,957
Bungoma	17,149	10,118
Nakuru	117,254	69,180
Busia	27,748	16,371
Bomet	14,000	8,260
Siaya	14,114	8,327
Kericho	19,522	11,518
Kirinyaga	30,209	17,823
Total	292,466	172,554

Table 2: Population Sampling Frame
Source: Republic of Kenya (2016)

3.3. Sample and Sampling Technique

The study adopted multistage sampling technique to select the sample size. In the first stage, systematic sampling was used to arrive at the choice of the eight counties based on their contribution to national poverty and county ranking as shown in Table 1. In the second stage, simple random sampling technique using random numbers was used to select the individual proprietors of MSEs from each of the counties involved in the study. This fulfilled the requirements of efficiency, representativeness, reliability and flexibility taking care of systematic bias that may result from non-respondents (Kothari, 2012).

Since thetarget population(172,554) is more than 10,000, Mason, Lind andMarchal (1999) explains that the sample size may be computed by the following formula;

$n = \frac{z^2pq}{d^2}$ ..... Equation 1

Where;
n is the desired sample size when population is greater than 10,000.
z is the standard normal deviate at 95% confidence level (z = 1.96).
*p*is the proportion in target population estimated to have characteristic being measured (p = 0.5).
*d*isthe level of statistical significance set (d = 0.05).
Substituting the values into equation 1, the estimated sample size for infinite population was obtained as follows:

$n = (1.96)^2 (0.5)^2 \div (0.05)^2$
$= 3.8416 \times 0.25 \div 0.0025$
$= 384.16$

Correcting for finite population, the following formula was used (Naing, *et.al.* 2006)

$n^1 = n/ (1+n/N)$ ..... Equation 2

Where:
n^1 = sample size for finite population
N = the target population = 172,554
n = calculated sample size from infinite population = 384.16
Substituting these values into equation 2:

$n^1 = 384.16/ (1+384.16/172,554)$
$= 384.16/1.00223$
$= 383.3$

The calculated sample size was therefore 384.

The proportionate sample sizes for each stratum are computed on the basis of the size of the stratum and the target population. In view of the above explanation concerning the sample size, it is ensured that the sample size for each stratum (for our case each county) is the larger value as proportionately computed from the formula above or 30, being the minimum sample size as per the central limit theorem or the total of the particular stratum for a population size below 30. The sample for each county is then divided by the number of rural wards in the county. This study therefore used a sample population of 418 respondents for data collection as shown in Table 3.

County	Total Reg. Rural MSEs	Proportionality	Sample
Kakamega	30,957	17.94	69
Bungoma	10,118	5.86	30
Nakuru	69,180	40.09	153
Busia	16,371	9.49	37
Bomet	8,260	4.79	30
Siaya	8,327	4.83	30
Kericho	11,518	6.68	30
Kirinyaga	17,823	10.32	39
Total	172,554	100	418

Table 3: Sample Population per County

3.4. Data Collection Instruments

Data collection instrument refers to the device used to collect data such as a paper questionnaire or computer assisted interviewing system (Sekara&Bougie, 2010). The main instrument for data collection was a structured questionnaire with a fixed set of choices designed with alternative answers expressed in a Likert scale style.

3.5. Data Collection Procedure

Data collection is the process of gathering and measuring information on targeted variables in an established systematic fashion that enables one to answer relevant questions, test hypotheses, and evaluate outcomes (Sekara&Bougie, 2010). Research assistants in each of the eight counties were contacted by the researcher and introduced to the questionnaire. A period of four weeks was given for the research assistants to allow respondents to answer the questions. Post-paid envelops with the researcher's postal address were left so that once the questionnaires werefilled, they could be posted. Contact mobile number and email address of the researcher was given to the respondents for any clarification. Follow up telephone calls were made after two weeks and at the end of the four weeks to find out if the questionnaires had been posted and to thank them for participating in the research.

4. Results

4.1. Reliability Test Results

The reliability for opinion items were computed separately for the two subscales in the MSEs proprietors' questionnaires, as shown in Table4. The Cronbach's alpha revealed that the instruments had adequate reliability for the study.

Scale	No. Items	Cronbach's alpha	Conclusion
Access to Healthcare	10	0.882	Reliable
Household Wellbeing	8	0.865	Reliable

Table 4: Cronbach's Alpha Results

The subscale access to healthcare composed of 10 items had good internal consistency, α = .882, all the items of this subscale were worth of retention. Deleting any of the items in this subscale would not result to an increase in Cronbach's alpha. This implies that deleting any of the items would not cause improvement in the internal consistency. Similarly, the internal consistency of items in the questionnaire for household wellbeing was adequate enough for the study. Both the subscales had Cronbach's alpha of greater than 0.7, which is adequate (Pallant, 2007).

4.1.1. Validity Test Results

Although pilot study was done to improve external validity of the instruments, internal validity of the constructs was tested by subjecting the survey data to suitability tests using the Kaiser-Meyer-Oklin measure of sampling adequacy (KMO Index) and the Bartlett's Test of Sphericity. This is a prerequisite condition for a factor analysis. Before the extraction of factors, the suitability of the questionnaire data set for factor analysis was assessed for each sub-scale. The results of the Kaiser-Meyer-Oklin measure of sampling adequacy (KMO Index) and the Bartlett's Test for Sphericity for each subscale of the questionnaire are presented in Table 5.

Subscale	Kaiser-Meyer-Olkin(KMO index)	Bartlett's Test for Sphericity		
		Approx. Chi-Square	Df	Sig.
Access to Healthcare	.891	1177.124	45	.000
Household Wellbeing	.899	910.693	28	.000

Table 5: KMO and Bartlett's Test

Kaiser (1974) asserts that the Kaiser-Meyer-Oklin measure of sampling adequacy index ranging> .6 is of adequate internal validity and is considered suitable for factor analysis. The Bartlett's Test for Sphericity on the other hand relates to the significance of the study and indicates the validity of responses obtained in relation to the problem that the study seeks to address. Creswell (2014) observes that Bartlett's Test of Sphericity test statistic should be less than .05. As presented in Table 5, the value of Bartlett's test for Sphericity is significant (p<.001, p=.000) for both the subscales of the questionnaire. In addition, the Kaiser-Meyer-hold Olkin indexes are all > .6 which is a sufficient threshold for internal validity. Creswell (2014) asserts that if the Bartlett's test for Sphericity is significant, and if the Kaiser-Meyer-Olkin measure is greater than .6, then factorability is assumed and hence use of factor analysis is attainable. Thus, based on the results, it was appropriate to proceed with factor analysis on assumption of adequate internal validity, which is an indication that both the subscales had suitable data.

4.1.2. Access to Healthcare and Wellbeing

The study sought to investigate the effect of access to healthcare due to rural electrification on household wellbeing among proprietors of micro and small enterprises in Kenya. To achieve this objective, access to healthcare was assessed through three main measures namely service time, service quality and service cost. Ten constructs that underlie

the three measures were subjected to factor analysis. Overall, effect of access to healthcare on household wellbeing was analyzed through descriptive statistics, factor analysis, correlation analysis and regression analysis.

Table 6 shows the statistical results for access to healthcare based on 10 opinion statements. The proprietors of micro and small enterprises rated the items using: 1=strongly disagree, 2=disagree, 3=neither agree nor disagree, 4=agree and 5=strongly agree. The Likert scale responses were converted to continuous scale data by computing the percentages in each item.

Opinion Statement	**Strongly Agree**	**Agree**	**Neither Agree nor Disagree**	**Disagree**	**Strongly Disagree**
1. Electricity provides quality lighting at night for performing medical operations.	64.5%	24.8%	7.8%	0.3%	2.6%
2. Availability of electricity enables health centers to operate for longer hours.	38.1%	51.8%	6.8%	1.0%	2.3%
3. Availability of electricity enables faster medical emergency response especially at night.	44.3%	42.0%	9.1%	2.3%	2.3%
4. Access to electricity helps to attract more qualified medical staff to work in health facilities.	43.6%	46.5%	6.3%	1.9%	1.7%
5. Use of electricity in health facilities reduces the cost of energy leading to reduced cost of healthcare services.	23.5%	49.8%	15.3%	8.5%	2.9%
6. Electricity enables storage of vaccines and medicines requiring refrigeration.	44.3%	44.6%	7.8%	1.3%	2.0%
7. Use of electricity-dependent medical equipment after electrification reduces costs previously incurred on referrals.	35.8%	45.0%	12.3%	4.9%	2.0%
N = 307					

Table 6: Access to Healthcare

Table 6 reveals that rural electrification had a considerable effect on access to healthcare resulting to improved wellbeing of households. For instance,90 percent of the respondents agreed that access to electricity helped to attract more qualified medical staff to work in local hospitals. One of the recommendations made by World Health Organization to assist in attraction and retention of healthcare workers in rural areas is to improve living conditions for health workers and their families and invest in infrastructure and services such as electricity as this has a significant influence on a health worker's decision to relocate to or remain in rural areas (WHO, 2010). Similarly, World Health Organization (2015) also report that health facilities with electricity may be better positioned to attract and retain skilled health workers, especially in rural areas. In Tanzania there are health facilities with no single health worker and one of the contributing factors is the unavailability of electricity. Surprisingly, health workers choose to even quit employment when they are assigned to work in remote rural areas where electricity is a problem (IEA, 2014).

These findings concur with those of the World Health Organization (2015) that revealed that electricity may have a significant impact on some key health service indicators such as: prolonging night-time service provision; attracting and retaining skilled health workers to a facility; and providing faster emergency response, including for childbirth emergencies and the assertion of Van Leeuwen (2014) that the powering of emergency medical equipment, storage of blood and vaccines, and performing of basic health procedures, especially after dark, are all contingent on reliable electricity supplies.

Factor analysis was used to investigate items with greater significance to access to healthcare and to examine their dimensionality on the variable. Principal Components Method (PCM) approach, which was used as a method of factor analysis, enabled us to identify the common factors and to retain a small number of factors which had the highest influence, as held by Oso and Onen (2009). The extraction of the factors followed the Kaiser criterion where an eigenvalue of 1 or more indicates a unique factor. All the 10items describing access to healthcare were subjected to factor analysis. The results are presented in Table 7

Component	Initial Eigenvalues.			Extraction Sums of Squared Loadings.		Rotation Sums of Squared Loadings			
	Total	Variance (%)	Cumulative (%)	Total	Variance (%)	Cumulative (%)	Total	Variance (%)	Cumulative (%)
1.	3.364	48.063	48.063	3.364	48.063	48.063	2.453	35.045	35.045
2.	1.023	14.618	62.681	1.023	14.618	62.681	1.935	27.636	62.681
3.	.646	9.234	71.915						
4.	.601	8.590	80.505						
5.	.550	7.863	88.368						
6.	.460	6.570	94.937						
7.	.354	5.063	100.000						

Table 7: Total Variance Explained for Access to Healthcare
Extraction Method: Principal Component Analysis

The eigenvalues associated with each linear component (factor) before extraction, after extraction and after rotation are shown in Table 4.6.2. Before extraction, SPSS had identified seven linear components within the data set. The eigenvalues associated with each factor represents the variance explained by that particular linear component and it is displayed in terms of percentage of variance explained. The seven measures of access to healthcare were subjected to factor analysis and six (6) items attracted coefficients of more than 0.4. Therefore, the six (6) statements were retained for analysis. According to Rahn (2010) a factor loading equal to or greater than 0.4 is considered adequate. Using factor analysis, only two factors were identified to have significant influence on explaining characteristics of access to healthcare with cumulative variance of 62.681%. Only these items had an eigenvalue greater than 1 and had significant influence on access to healthcare characteristics, explaining 48.063% and 14.618% totaling to about 62.681% of variance on the variable as shown in Table 7.

The main loadings in the two components were from items on service time, service quality and service cost, all of which measured the degree to which access to healthcare had influenced household wellbeing among proprietors of MSEs. The three initial sub-concepts of service time, service quality and service cost were reduced to form affordable healthcare and quality healthcare. The results demonstrate that enhancing affordable healthcare and quality healthcare forms the main measureofthe effect of access to healthcare due to rural electrification on household wellbeing among proprietors of MSEs in Kenya.

Statement	Affordable Healthcare	Quality Healthcare
1. Electricity provides quality lighting at night for performing medical operations.	.727	.222
2. Availability of electricity enables health centers to operate for longer hours.	.836	.192
3. Availability of electricity enables faster medical emergency response especially at night.	.681	.230
4. Access to electricity helps to attract more qualified medical staff to work in health facilities.	.344	.697
5. Use of electricity in health facilities reduces the cost of energy leading to reduced cost of health services.	.091	.849
6. Electricity enables storage of vaccines and medicines requiring refrigeration.	.748	.186
7. Use of electricity-dependent medical equipment after electrification reduces costs previously incurred on referrals.	.278	.744

Table 8: Rotated Component Matrix for Access to Healthcare
Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 3 iterations

The rotated component matrix (Table 8) shows the factor loadings for each of the retained factors under access to healthcare. The main loadings in component one (1) were mainly from the initial sub-concepts of service time and service cost. Component one (1) was therefore named affordable healthcare. The main loadings in component two (2) were items from the initial sub-concept of service quality. Component two (2) was therefore named quality healthcare. Therefore, the components identified to have the highest influence are; affordable healthcare andquality healthcare. A descriptive

analysis of the two factors of access to healthcare that were identified through rotation was undertaken by estimating the mean of the scales of each factor and the results are presented in Table 9.

Definition	Mean	SD
Timely Response	4.2575	.68983
Quality Healthcare	4.3467	.74554

Table 9: Analysis of the Mean for Access to Healthcare
Key: 1.00-1.80 = Strongly Disagree, 1.81-2.60 = Disagree, 2.61-3.40 = Neither Agree Nor Disagree, 3.41-4.20 = Agree, 4.21-5.0 = Strongly Agree

From Table 9.4, it was observed that quality healthcare owing to rural electrification was the most important issue in access to healthcare as indicated by a mean score of 4.3467, which is equivalent to strongly agree on the ranking scale. It was also noted that affordable healthcare owing to rural electrification was equally an important concern for access to healthcare as indicated by a mean score of 4.2575, which is equivalent to strongly agree on the ranking scale. Poor energy infrastructure can affect the quality of service: for example, reduced operating hours resulting in an un-served population, reduced capacity for laboratory tests, night-time safety concerns and decline in staff morale (USAID, 2012). Electricity can, as a result, work in multiple ways to improve the quality of the service, as well as the ability of health workers to provide certain services in the first place. The majority of the benefits for health tend to either arise by way of extended opening hours or through having equipment that requires electricity (IEG, 2008).

This is consistent with the findings by World Health Organization (2015) that electricity may have a significant impact on attracting and retaining skilled health workers to a facility and by Noor *et al*. (2006) that rural electrification makes health facilities to be strategically available reducing the distance travelled to seek medical services. This is also in resonance with the findings by Van Leeuwen (2014) that the powering of emergency medical equipment, storage of blood and vaccines, and performing of basic health procedures, especially after dark, are all contingent on reliable electricity supplies and by World Health Organization (2015) that electricity may have a significant impact on some key health service indicators such as: prolonging night-time service provision and providing faster emergency response, including for childbirth emergencies.

APearson Product Moment Correlation Coefficient was computed, with scores on access to healthcare due to rural electrification as independent variable and household wellbeing among proprietors of micro and small enterprises as dependent variable. The scores for both variables, which were collected in form of frequencies, were converted into ratio scaled data by computing mean responses per respondent, where high scale ratings implied high access to healthcareand high household wellbeing and vice versa. The correlation analysis result was shown in SPSS output, as indicated in Table 10.

		Household Wellbeing
Affordable Healthcare	Pearson Correlation	.526**
	Sig. (2-tailed)	.000
	N	307
Quality Healthcare	Pearson Correlation	.530**
	Sig. (2-tailed)	.000
	N	307

Table 10: Access to Healthcare and Wellbeing
***. Correlation is significant at the .01 level (2-tailed)*

The finding showed that there was a moderate positive (r=.526, n=307, p<.05) relationship between affordable healthcare and household wellbeing among proprietors of micro and small enterprises. Prolonged opening hours of healthcare facilities may reduce the costs incurred by the poor in seeking emergency medical services at night. There was also a moderate positive (r=.530, n=307, p<.05) relationship between quality healthcare and household wellbeing among proprietors of micro and small enterprises. Reduced energy costs may translate to reduced cost of healthcare for households of proprietors of MSEs.

To estimate the effect of access to healthcare due to rural electrification on household wellbeing among proprietors of micro and small enterprises, a coefficient of determination was computed. This was done using regression analysis and the results were as shown in Table 11.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.604[a]	.365	.361	.51775

Table 11: Model Summary for Access to Healthcare and Wellbeing
a. Predictors: (Constant), Affordable Healthcare, Quality Healthcare

From Table 11, it can be seen that R-value is 0.604. Therefore, R-value (.604) for access to healthcare suggested that there is a strong influence of access to healthcare on household wellbeing among proprietors of MSEs. It can also be observed that the coefficient of determination, the R-square (R^2) value is 0.365, which represents 36.5% variation of household wellbeing among proprietors of micro and small enterprises owing to access to healthcare. To determine

whether access to healthcare was a significant predictor of household wellbeing among proprietors of micro and small enterprises, Analysis of Variance (ANOVA) was computed as shown in Table 12.

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	46.8	2	23.4	87.291	.000[b]
	Residual	81.493	304	.268		
	Total	128.293	306			

Table 12: ANOVA –Access to Healthcareand Wellbeing
a. Dependent Variable: Household Wellbeing
b. Predictors: (Constant), Affordable Healthcare, Quality Healthcare

From Table 12, it can be noted that access to healthcare was a significant predictor of household wellbeing among proprietors of micro and small enterprises [F (2, 304) = 87.291, p < .05)]. This means that access to healthcare due to rural electrification was a significant predictor of household wellbeing among proprietors of micro and small enterprises. From the results it was clear that access to healthcare explained a significant amount of the variance in the value of household wellbeing among proprietors of micro and small enterprises. To show the strengths of the relationship between access to healthcare and household wellbeing among proprietors of micro and small enterprises, a regression analysis was done. Analysis of the regression model coefficients is shown in Table 13.

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
1		B	Std. Error	Beta		
	(Constant)	.806	.093		8.691	.000
	Affordable healthcare	.321	.051	.342	6.352	.000
	Quality healthcare	.303	.047	.349	6.477	.000

Table 13: Regression Coefficients for Access to Healthcare
a. Dependent Variable: Household wellbeing
Model: Y=0.806+0.342X1+0.349X2

From Table 13, there was a positive beta co-efficient of 0.342 and 0.349 as indicated by the co-efficient matrix with a p-value = .000 <.05 and a constant of 0.806 with a p-value = .000 < .05. Therefore, both the constant, affordable healthcare and quality healthcare contribute significantly to household wellbeing. Consequently, the model can provide the information needed to predict household wellbeing from access to healthcare. The regression equation is presented as follows: $Y=0.806+0.342X_1+0.349X_2$Where Y = household wellbeing, X_2 is affordable healthcare andX_3 is quality healthcare. The findings agree with a study by Youssef, Lannes, Rault and Soucat (2016) that there exists a unidirectional Granger causality from energy consumption to life expectancy in Kenya. As Kenya is growing, the income per capita increases allowing more per capita energy consumption. Energy consumption permits better sanitation, more heating and warm food, less indoor pollution and better medicines conservation.

According to Table 13, access to healthcare had coefficients of estimate which were significant (p-value = .000 which is less than α = .05). The null hypothesis was thus rejected and it was concluded that access to healthcare had a significant effect on household wellbeing. Consistently, Van Leeuwen (2014)argues that the powering of emergency medical equipment, storage of blood and vaccines, and performing of basic health procedures, especially after dark, are all contingent on reliable electricity supplies. This was also the case with Brazilian*et al*., (2011) who echoes that provision of reliable, secure and affordable energy services are central to addressing many of today's global development challenges including poverty, inequality, climate change, food security, health and education as well as wealth creation and economic development.

This finding is in line with a study by Ramji, Patnaik, Mani, and Dholakia (2017) aimed at investigating the synergy between access to electricity and delivery of healthcare services in India. The findings revealed that power cuts in the evenings significantly reduced service delivery in public health centers. Access to regular electricity also enables access to regular water supply for many health centers. The lack of adequate and quality water supply compromises the ability to provide basic, routine services such as child delivery, and weakens the ability to prevent and control infections (WHO, 2015). Electricity may have a significant impact on prolonging night-time service provision and providing faster emergency response, including for childbirth emergencies (WHO, 2015). Without electricity for refrigeration, health clinics cannot safely administer vaccines or a number of other medicines. Without a constant source of good lighting, which is not achievable using candles or other non-electrified sources, doctors cannot safely perform operations or even adequately examine a patient at night.

An improved health status in the population impacts positively on productivity which has positive implications on, for example, MSEs output (European Commission, 2006). Sickness absenteeism is a major occupational health problem in developing countries where a majority of the working population are engaged inMSEs most of which may be hazardous. This can lead to loss of working hours, a reduction in productivity and even workplace disputes (Tadesse et al, 2015).

Whilst improved healthcare access cannot prevent accidents, it can help access to relevant treatment which we may assume can improve recovery and household wellbeing. The results agree with the findings by Noor *et al*. (2006) that rural electrification may lead to new facilities that are strategically located, offer uniquely affordable services, adequately available and evenly distributed for the poor in rural areas to easily access healthcare services.

In view of the foregoing, rural clinics provided with electricity may lead to improvement in quality of life and reduction in infant mortality. Electricity may also have a significant impact on some key health service indicators in rural areas where a majority of the poor live such as: prolonging night-time service provision; attracting and retaining skilled health workers; and providing faster emergency response, including childbirth emergencies. This is consistent with the findings by Van Leeuwen (2014) that reliable electricity supply in medical facilities has a significant effect on quality of healthcare. The results are alsoin agreement with the assertion byBrazilian*et al*., (2011) thatprovision of reliable, secure and affordable energy are important predictors of poverty reduction and wellbeing.

5. Findings

Descriptive statistics showed that rural electrification had a considerable effect on access to healthcare resulting to improved wellbeing of households. This enhanced both quality healthcare and timely healthcare service. Factor analysis results showed that the first two factors explained most of the variance and were therefore most important. The two factors were affordable healthcare and quality healthcare. The two factors were from items on service time, service quality and service cost, all of which measured the degree to which access to healthcare had influenced household wellbeing among proprietors of Mses. The emergence of affordable healthcare and quality healthcare implies that these services are inadequate in rural areas where a majority of the people are poor and their improvement is likely to enhancewellbeing.This is consistent with the observation by World Health Organization (2015) that electricity may have a significant impact on some key health service indicators such as: prolonging night-time service provision, providing faster emergency response and attracting qualified staff to work in rural health facilities.

According to Pearson correlation analysis, there was a moderate positive correlation betweenboth affordablehealthcare and quality healthcare and household wellbeing among proprietors of micro and small enterprises. Regression analysis revealed thatboth affordable healthcare and quality healthcare contributed significantly to the explanation of household wellbeing. Given that the regression results demonstrated the existence of significant relationship between access to healthcare and household wellbeing, the null hypothesis that access to healthcare due to rural electrification has no effect on the household wellbeing amongproprietors of micro and small enterprises in Kenya was thus rejected and it was concluded that access to healthcare had a significant effect on household wellbeing. This therefore implies that an increase in both affordable healthcare and quality healthcare enhances the level of wellbeing among proprietors of micro and small enterprises. The results agree with the findings by Noor *et al*. (2006) that rural electrification may lead to new facilities that are strategically located, offer uniquely affordable services, adequately available and evenly distributed for the poor in rural areas to easily access healthcare services.

6. Conclusions

The findings revealed that there was a moderate positive relationship between access to healthcare and household wellbeing among proprietors of micro and small enterprises. It was, therefore, concluded that there was indeed a statistical significant relationship between access to healthcare and household wellbeing among proprietors of micro and small enterprises, with increase in access to healthcare resulting to improvement in household wellbeing among proprietors of micro and small enterprises and vice-versa.

7. Recommendations

The study is a justification of the fact that the role of rural electrification on micro and small enterprises in Kenya cannot be underestimated and has contributed to improved household wellbeing in Kenya. In view of the findings of this study, it was concluded that there was a statistical significant relationship between access to healthcare and household wellbeing among proprietors of micro and small enterprises. It is therefore recommended that the Kenyan government should promote universal access to electricity in all health facilities to a higher level on the political agenda, supporting these commitments with strategic plans, clear policies and dedicated establishments. There is need for healthcare providers to take advantage of access to electricity in rural areas to diversify healthcare services including acquisition of electricity powered healthcare equipment and machines.

8. Area for Further Research

Results of this study confirm that household wellbeing among proprietors of MSEs is influenced by access to healthcare due to rural electrification based on data sampled from eight counties. Future research will need to be carried out in the other counties in order to ascertain if the link between access to healthcare due to rural electrification and household wellbeing can be generalized.

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