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Cloud Computing Information Sharing Capability Influence on Quality of Healthcare Management of Chronic Diseases

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ABSTRACT

Over the decades the management of healthcare has been an increasing burden on individuals as well as governments across the globe. Prior research has shown that chronic diseases account for 60 percent of all deaths worldwide. Besides the health consequences, long term costs associated with the treatment of chronic ailments and their negative effects on productivity are taking devastating tolls on the economic situations of individuals, families and countries. Consequently, research on improving the management of chronic diseases has been a top priority agenda for governments, researchers, and practitioners. This paper aims to contribute to this agenda by proposing that cloud computing can play a significant role in improving the management of chronic diseases.

The study used a descriptive approach with a questionnaire-based survey which was used to collect data from 10 hospitals in Nairobi and its environments. The target population was doctors and management staff of the hospitals. Purposeful sampling plan was deployed where a sample of 10 doctors and 10 management staff from each hospital were selected. Within each hospital random sampling of 10 participants from the doctor's strata and 10 management staff was conducted. Relevant hypotheses were derived and tested by linear regression analysis.

The findings revealed that sharing of information using cloud computing has a significant effect on the access to healthcare in the management of chronic diseases. The research was conducted in 10 hospitals of Nairobi which may limit the generalizability of the findings. Practical implications— The findings offer healthcare providers, medics and healthcare professionals with a better understanding of what contribution information sharing using cloud computing brings to the improvement of access to healthcare and particularly the management of chronic diseases. The research contributes to the application of new technology cloud computing in the healthcare industry through the use of information sharing to improve access and quality of the management of chronic diseases. The findings also help Healthcare facilities consider their cloud computing technologies usage when aiming to improve access and quality of their disease management using cloud computing.

Keywords: *Cloud computing, healthcare, Chronic Diseases, Management, Disease, Nairobi*

1. INTRODUCTION

1.1 The Enigma of Chronic Diseases

Health is a state of complete physical, mental and social well-being hence not merely the absence of disease or infirmity [1]. The health of a people is fundamental to the attainment of peace and security and is dependent upon the fullest co-operation of individuals and states hence the enjoyment of the highest attainable standards of health is one of the fundamental rights of every human being. Chronic disease is a long-lasting condition that can be controlled but not cured [2]. Chronic diseases are on the rise in the country and are a leading cause of morbidity and disability. In 2005, an estimated 35 million people worldwide died from chronic diseases; this is double the number of deaths from all infectious diseases. A while back, road accidents, malaria and hygiene related illnesses topped the charts but now the likes of HIV/AIDS, diabetes, hypertension, chronic breathing conditions and cancer have taken over. Chronic diseases are responsible for up to 50% of disease burden in many developing countries [2].

The global status report by [2] on non-communicable diseases indicates that chronic diseases are the leading cause of death globally, killing more people each year than all other causes combined. Statistical

information shows that nearly 80% of NCD deaths occur in low- and middle-income countries and much of the human and social impacts caused each year by these diseases could be averted through well-understood, cost-effective and feasible interventions [3].

Chronic conditions like cancer, diabetes, mental disorders, cardiovascular and respiratory diseases account for 36 out of the 57 million deaths annually. These diseases are mainly caused by four behavioral risk factors that are pervasive aspects of economic transition, rapid urbanization and 21st-century lifestyles: tobacco misuse, unhealthy diet, insufficient physical activity and the harmful use of alcohol. A sad fact is that they are the most significant causes of illness and death of the working age populations in developing countries and worse still, financing the prevention and treatment of NCDs accounts for less than 1% of official development assistance (ODA) for health [3]

According to Stuart [4], the enormous burden currently posed by chronic diseases is in low-resource countries and the realistic prospect that this burden will continue to increase, provides compelling reasons to rapidly address chronic illnesses from both a public health perspective and the impact on individual lives. The prevalence of chronic disease has significant implications

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on health care costs, accounting for three quarters of total national health care expenditures and nearly all growth in Medicare expenditures can be traced to the one half of beneficiaries suffering from multiple chronic diseases [5].

Chronic disease management requires daily oversight and treatment adjustment. This management is difficult within the current ambulatory care system, which is designed to provide acute and episodic care across disparate health facilities. For example, in addition to a family doctor, patients with diabetes, for example, often require care from a variety of specialists, including but not limited to nephrologists, podiatrists, and ophthalmologists. These specialists may order a number of tests, prescribe several medications or refer the patient to additional specialists. Without timely communication of information, including tests results and medications prescribed and improved coordination between entities in the fragmented “community of providers,” the continuity of care for a chronically ill patient will remain less than optimal. Generally, improved access to a patient’s records and knowledge of medical best practices through health IT applications can help medics spend less time looking for information and more time focused on caring for patients [5].

A good case of the burden of chronic diseases is the American continent. The study by [6] reveals how seemingly benign elements of American life style is making millions of children chronically disabled, ill, or dysfunctional. Children are being diagnosed with sicknesses such as asthma, autism, allergies, and Attention Deficit Hyperactivity Disorder (ADHD) at a stunning rate. The etiology of autism continues to confound mainstream medicine, yet parents, medical researchers and healthcare practitioners dedicated to unraveling the mystery are beginning to put the pieces of the puzzle into place. They have found that environmental factors that cause autism are the same ones causing epidemics of Attention Deficit Hyperactivity Disorder (ADHD), youth asthma, diabetes, gastrointestinal disorders, and numerous other chronic diseases. Even though the specific path physiology of each individual child’s sickness differs, all of them have the same rudimentary underlying causes. No doubt the cases emanate from a blizzard of environmental influences including toxic or nutritionally anemic diets, decades of pharmaceutical over-usage, excessive exposure to environmental toxins, specific American cultural habits and lifestyles, and surprisingly excessive or improperly administered vaccines [6]. How can this epidemic be reversed and how can more children and adults be prevented from becoming victims of such illness? The fact that the answer to this question is not in the horizon, makes the search for effective management of chronic diseases acute and urgent for rescuers and practitioners.

This study is therefore an investigation on how features of cloud computing like information sharing can be exploited to help improve the management of chronic disease in healthcare facilities.

1.2 Cloud Computing Technology

Cloud computing may be defined as a panache of computing where massively scalable information technology-enabled capabilities are delivered as a service to external customers using Internet technologies [7].

Cloud computing offers numerous benefits including pay-for-use, fast deployment, lower costs, rapid provisioning, scalability, rapid elasticity, low-cost disaster recovery and data storage solutions, ubiquitous network access, real time detection of system tampering, on-demand security controls, and rapid re-constitution of services [8]. Cloud computing essentially stores all of its applications and databases in the data centers which are positioned at different locations. Unfortunately, due to this movement of application software, data and services are not trust worthy because it give rise to several security challenges. These challenges include accessibility vulnerabilities, web application vulnerabilities, virtualization vulnerabilities, and privacy and control concerns a rising from third party shaving physical control of data. Other matters related to credential and identity management, tampering, data verification, integrity, data loss, confidentiality and theft, issues related to authentication of the respondent device or devices and internet protocol (IP) spoofing[8].

E-health, which is the use of advanced information communication technology to improve the provision of affordable quality health care, is an emerging phenomenon in the management of diseases. African Air Rescue (AAR) tabled a report in the Kenya National E-health conference displaying a health care dilemma of quality, cost and access show casing how ICT tools can be used in health management [9]. When it comes to innovations in the field of information technology with a sole aim of managing chronic diseases, health information technology by Dixon & Samarth [5] come very close. This is a project initiated and ran by the AHRQ National Resource Center for Health Information Technology and involves the use of electronic information applications such as electronic health records (EHR) and clinical-decision support (CDS) systems, to capture, store, and manage clinical data over time. Briefly, the modules combine and perform the following functions: Clinical-decision support (CDS) systems: These systems provide alerts, reminders, and customized data entry forms to help providers interpret clinical results, document a patient’s health status and prescribe medications. Nevertheless Dixon [5] never addressed how cloud technology can be used for management of diseases.

With the popularity of cloud computing, the healthcare industry may be in for a disruptive form of innovation because a lot of hospitals, patients, doctors and other medics are already using, interacting or moving towards the clouds [10]. When there is already widespread use of cloud computing in the healthcare sector, patients, the public, and other stake holders can expect several benefits including cost and time savings as

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there won't be a need to take duplicate medical tests. Moreover, images can be accessed instantaneously, provided there is robust internet connection. Hospitals and clinics need not invest on hardware and maintenance because these concerns are already taken care of by the cloud computing providers.

The end result is a more efficient and improved health care management. Thus there is dearth empirical evidence on the effect of cloud technology on management of chronic diseases, thus this research will envision filling this research gap which other scholars have not addressed. The government of Kenya, in an effort to try and combat health problems as part of attaining the stated Millennium development goals MDGs is in conjunction with international partners to work towards finalizing the development of an efficient Health Management Information System (HMIS), [11]

2. PROBLEM STATEMENT

Over the decades the management of healthcare has been an increasing burden on individuals as well as governments across the globe. Prior research has shown that chronic diseases account for 60 percent of all deaths worldwide [12]. Besides the health consequences, long term costs associated with the treatment of chronic ailments and the negative effects on productivity are taking devastating tolls on the economic situations of individuals, families and countries [12]. Consequently, research on improving the management of chronic diseases has been a top priority agenda for governments, researchers, and practitioners. This paper aims to contribute to this agenda by proposing that cloud computing can play a significant role in improving the management of chronic diseases.

Chronic diseases account for 60 percent of all deaths worldwide [12]. Besides the health consequences, long-term costs associated with the treatment of chronic ailments and the negative effects on productivity are taking devastating tolls on the economic situations of individuals, families and countries [12]. Chronic disease infections are impeding the achievement of the set Millennium Development Goals (MDGs) [13]. Broadly, they are a hindrance to economic growth and an underestimated cause of poverty causing nearly a billion days of disability worldwide.

Improved access to a patient's records and knowledge of medical best practices through health IT applications can help medics spend less time looking for information and more time focused on caring for patients.

The growth and dominance of chronic diseases has significant implications on health care costs accounting for over a half of the total national health care expenditures and nearly all growth in Medicare expenditures can be traced to individuals suffering from multiple chronic diseases. Chronic disease management requires daily oversight and treatment adjustment and this is difficult within the current ambulatory care system,

which is designed to provide acute and episodic care across scarce health facilities. Thus by introduction of cloud technology this problem can be solved. The use of EMRs enables easy sharing of a patient's information. [14].

According to Rodriguez, health systems can be strengthened through ICT thereby bringing forth greater equity, solidarity, quality of life and health ultimately contributing to poverty reduction [15]. Majority of the western world have efficiently adopted the cloud technology to support their health systems with a view to control chronic diseases. This has gone a long way reducing related costs and deaths, allowed for co-location and easier management of medical information. As per researchers in the United States of America, Hospitals in Texas that used computers to keep track of patient records and manage health care had lower complications, costs and deaths reduced by 15%. If this were to happen in all hospitals in the U.S. they would save over 100,000 lives annually [16]

There have been some local studies done on application of technology by way of hosted medical records for management of chronic diseases. According to [14] developing countries have a serious chronic disease burden. Moreover, due to their strained budgets there is an acute need for new ways of delivering health care. It is against the backdrop of the above information that the study was designed; to ascertain the actual effect of cloud technology on management of chronic diseases in Kenya. According to the researcher's knowledge, in Kenyan context, there has been very little study done to be significant. There is scarce empirical evidence on the effect of cloud technology on management of chronic diseases, thus this research envisioned filling this research gap.

3. LITERATURE REVIEW

There are broadly three layers of Cloud computing, [17]; [18]. The First one is Software as a Service (SaaS). It is the highest level of abstraction on the Cloud and the applications are delivered over the World Wide Web as a service. This layer of Cloud service offers a wide range of applications from productivity (e.g. office-type) applications to enterprise applications such as e-mail hosting, supply chain management or enterprise resource planning. The second layer is Platform as a Service (PaaS). It is the next level of abstraction, which not only does the technical abstraction but essential application infrastructure services such as computation, messaging, connectivity, access control, etc. In the traditional in-house computing model, a group of network, database and system management experts are needed to keep everything up and running. With Cloud computing, these services are now provided remotely by Cloud providers under this layer. The third layer is Infrastructure as a Service (IaaS).

This is the lowest layer in Cloud computing. IaaS provides abstract IT infrastructure resources such as storage and memory as services. A Cloud service

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provider manages the physical infrastructure; provisions virtualized infrastructure of operating systems to the end-user. The consumer here is given complete ownership of the virtual image which one can configure according to the requirements. Products offered through this layer include the remote delivery and support (via World Wide Web) of a full computer infrastructure (e.g. virtual servers, storage devices, etc.).

3.1 Costs Reduction

By adopting cloud computing, users can buy computing literally recording the purchase as an operating expense rather than a capital investment [19]. One of the greatest advantages of the cloud is the flexibility it offers. A production system can be backed up on demand and in literally minutes a mirror of the same system can be restarted. This allows for easy testing and refining of a system without worry of taking it down. It's a great way to try out new plug-ins for projects. It doesn't require buying new servers and it can be done rapidly.

A small elastic compute cloud (EC2) instance does not offer a lot of computational resources. There is not a lot of RAM, disk space or processing power. If demand rises, it is possible to scale this server up without interrupting the service for longer than a few minutes. Amazon offers Auto Scaling and Elastic Load Balancing services, which allow computing capacity to be grown or shrunk in a way that is transparent to users. With the scalability and expandability of cloud computing, we can prevent server sprawl and over-provisioning IT infrastructure which are issues frequently seen in traditional way of deploying and scaling computing servers [20].

For businesspeople, cloud computing services offer more for less: plenty of computing power, without the costs of maintaining expensive IT infrastructure. Instead of licensing software, users tap into a service when it's needed for as long as it's needed. All that is required is a broadband Internet connection, a phone or personal computer with a browser. As with cable TV or a phone service, organizations pay by the kind and amount of services used, plus any additional fees. At the other end of the Internet connection are supersized data centers containing tens of thousands of servers hosting web applications. So with cloud services, the major burdens and expenses of IT power become someone else's problem. By obviating the need for large investments in IT, cloud computing makes it easier for small, agile competitors to enter data-intensive markets. Some big companies are finding cloud computing to be surprisingly cheap. For example, Eli Lilly paid Amazon Web Services only \$89 to analyze data on a drug under development. To do the job themselves, its researchers would have had to buy or redeploy 25 servers. Add the savings from eliminating the cost of servers, software licenses, maintenance fees, data center space, electricity and IT labor, and the benefits of replacing a large up-front capital expense with a low, pay-for-use operating expense and the financial appeal of cloud computing is obvious.

Cost flexibility is a key reason many companies consider adopting cloud services. More than 31 percent of executives surveyed cited cloud services' potential to reduce fixed IT costs and shift to a more variable "pay as you go" cost structure as a top benefit. Cloud services can help an organization reduce fixed IT costs by enabling a shift from capital expenses to operational expenses. With cloud applications, there is no longer a need to build hardware, install software or pay dedicated software license fees. The organization pays for what it needs when it needs it. This pay-per-use model provides greater flexibility, promotes more rapid innovation and is an alternative to capital expenditures. Cloud technology led to reduced total cost of ownership through shared infrastructure. Cloud computing depends on service providers also known as Cloud providers for various low level management and service levels of their multi-tenant applications, platforms, and infrastructures. This also leads to minimal capital expenditure (Capex) through pay-as-you-use-model. It implies that the reduction of the TCO by optimally using the hardware and software licenses [21]; [17]; [18].

3.2 Information Sharing and Management

The World Health Organization defines e-health as the use of information communication technology in the efficient provision and management of health care.

This is to say that the term e-Health means ensuring that the right health information is provided to the right person at the right place and time in a secure, electronic form to support the delivery of quality and efficient healthcare. E-health should be viewed as both the essential infrastructure underpinning information exchange between all participants in the Kenyan health care system and as a key enabler of improved health for all Kenyans. An important factor to the achievement of this will be an ICT driven health information management system which more effectively responds to the healthcare needs of individuals and communities. The two key terms in question bring about the scenario of having hosted medical records. We can examine this as having a patient's medical history recorded, stored and regularly updated on a database server linked by a computer network service. This enables health service providers make easy and quick references to a patient's health records electronically using a computer or any other device with internet access so as to make the necessary therapy plans [14]. Cloud technology has multi-tenancy drives value. Multi-tenancy means that a single instance of particular software runs on a server and it can serve multiple clients (tenants) simultaneously. By implementing a multi-tenant architecture, each software application is configured to virtually partition its data and each client works with a customized pre-configured virtual application instance. This kind of architecture has several advantages – for example, a single instance to maintain including troubleshooting, fixing, and upgrading. By doing this, the Cloud service provider is able to manage its resources efficiently. Please note that designing the multi-tenant architecture may be more

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expensive to begin with but the long-term benefits outweigh the up-front costs that may be higher initially [17].

The cloud concept has significant implications as a virtual communication and a collaboration medium. While it may not be highly interactive in a physical sense, it has strong potential for social interactivity. As academics, what we are most interested in is its potential for storage and sharing of intellectual work in the form of digital scholarship to other members of the professional community such that they can, in turn, collaborate in a scholarly environment intellectual openness, research, disseminate, peer-review, critique, publish and further build up on it. The role of research cannot be overemphasized because it has to be incorporated into practice in order to move away from the traditional higher education scholarship to the new practice through the development of SoTL (scholarship of teaching and learning). CC is quite useful for collaborative research through new forms of peer review, social networking and open access to information with links to real time data will be the rule, not an exception.

The goal of utilizing this type of tool is the achievement of “virtual communities” of educators, researchers and practitioners on the Internet working in small collaborative groups which may help to promote a more reflective meta cognitive approach in tackling problems and advancing the practices through research. More than ever before, there is an urgent need for more and better research through increased active collaboration among teachers in order to optimize their roles and expertise. This is critical in order to adopt the ideals of the scholarship of teaching and learning (SoTL). In order to succeed in research projects and to develop quality work through interactive processes, the role of active collaboration with colleagues and experts in the field at its various stages of development cannot be overemphasized. Collecting and analyzing data, authoring, publishing and archiving information are all integral to the everyday work of researchers – with collaboration, search and discovery augmenting the entire process (Microsoft External Research Fact Sheet, 2009), [22].

Technology-supported collaborative platforms could be used to more effectively promote research activities by sharing evolving data and ideas, to reflect on others' views and to refine one's own ideas at different stages in research projects through scholarly communications such as setting research theme, discussion and collaboration, data storage/preservation, presentation and publication / dissemination. The cloud computing provides an easy user-friendly environment/platform for this type of collaboration. It is flexible enough to serve as dynamic research environment as the data evolves, as new concepts and new relationships emerge. From a research perspective, it is a great platform for research-based higher education institutions to capture their research output and the

relationships between the various entities to be dynamically stored, dynamically navigated and dynamically visualized. They are beneficial in reaching out and engaging the community as well as in spearheading academic-industrial collaboration. Several US colleges, universities, and K-12 school districts are already reaping the benefits of switching to a cloud-computing model [17].

They are several IT based systems for sharing health information: Health information exchange (HIE); these technologies enable the sharing of information across organizational boundaries so all providers in a community can access a patient's information to provide better care when the patient receives treatment from them. Tele-health; these applications use telecom technologies to deliver health-related services and information that support patient care, administrative activities and health education. Hospital information systems; these systems help providers manage patient information and track success in treating chronic diseases; examples include laboratory and pharmacy information systems.

Cloud technology facilitates external collaboration with partners and customers, which can lead to improvements in productivity and increased innovation. Cloud-based platforms can bring together disparate groups of people who can collaborate and share resources, information and processes. Health Hiway shows how a cloud-enabled business model can enable ecosystem connectivity. A cloud-based health information network, Health Hiway enables the exchange of information and transactions among healthcare providers, employers, payers, practitioners, third-party administrators and patients in India. By connecting more than 1,100 hospitals and 10,000 doctors, the company's software-as-a-service solution facilitates better collaboration and information sharing, helping deliver improved care at a low cost, particularly important in growing markets, such as India [17].

3.3 Dependent Variable: Efficiency and Access to Healthcare

Cloud computing is especially well suited for sporadic, seasonal or temporary work, for finishing tasks at lightning speed, processing vast amounts of data, for software development and testing projects. Faster time-to-market with on demand, elastic IT services. Cloud computing lowers IT expenditure in two fundamental ways – it leverages a “virtual suite” of pre-integrated Cloud-based applications and infrastructure and simplifies the complexity of traditional IT services. Cloud computing also reduces infrastructure management, monitoring of costs and optimizes resource utilization by provision on demand [18]. From a business point of view, firms are increasingly attempting to integrate business processes into their existing Information Systems applications and build internet-based technologies for transacting business with trading partners [23]. In high-tech industries, ubiquitous data transformation practices have become one of the key aspects for improving

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operation efficiency. To enhance competitive advantage, developing cloud computing capability is an important undertaking because it is not only rapidly changing the way that enterprises buy, sell and deal with customers, but it is also becoming a more integral part of enterprises' business tactics [24]. Cloud computing diffusion becomes a significant research topic because it enables firms to execute data transactions along value chain activities (e.g. including manufacturing, finance, distribution, sales, customer service, information sharing and collaboration with trading partners) [25]; [24].

Conceptual Framework

The conceptual framework is shown in Figure 1 below.

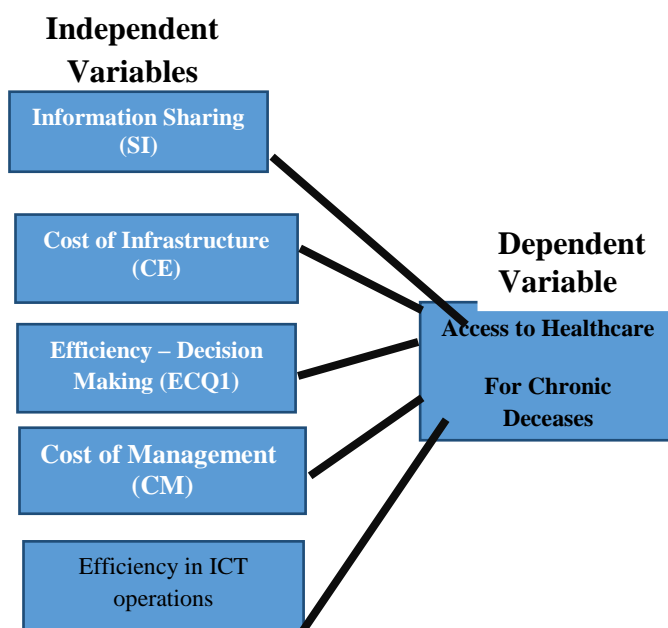


Figure 1: Conceptual Framework

In this study we propose the following hypothesis:

- H₁:** Information Sharing (SI) dimension of cloud computing has a positive effect on improved access to healthcare for chronic diseases
- H₂:** Cost of Infrastructure (CE) of cloud computing has a positive effect on improved access to healthcare for chronic diseases
- H₃:** Cost of Management (CM) dimension of cloud computing has a positive effect on improved access to healthcare for chronic diseases
- H₄:** Efficiency – Decision Making (ECQ1) dimension of cloud computing has a positive effect on improved access to healthcare for chronic diseases
- H₅:** Efficiency- IT (CE2) dimension of cloud computing has a positive effect on improved access to healthcare for chronic diseases.

4. METHODOLOGY

According to Burke, a research design is the arrangement of circumstances for collection and analysis of data in a way that aims to combine both relevance to their search purpose and economy in procedure [26].

In addition to the fact that this research philosophy is positivist, the relevance, purpose and economy of the methodology adopted was descriptive research design.

This design used a cross-sectional approach taking on a survey method that used a questionnaire for data collection.

The target population consisted of the major hospitals in Nairobi and its environments from which the actual sample of hospitals was selected.

The sample unit is a single member of the population, which in this study are the doctors and management staff. In this study, rather than use random sampling approach in selecting the hospitals, a purposive sampling technique was applied to select the participating hospitals. In addition, random sampling was used to select participating individuals in selected hospitals. Wherever possible, items used for the development of constructs were adapted from preceding research in order to ensure the content validity of the scale to be used was attained [27].

To assess the internal consistency of each construct, the Cronbach's alpha coefficients was computed to enable the results reveal at there is adequate reliability where all values were greater than 0.70 except for one construct. This study used two types of common types of measurement validity namely; convergent validity, and content validity.

The set perspectives of content validity were under taken in the study process. Factor analysis was used to measure if constructs had satisfactory validity and reliability.

5. RESULTS

5.1 Demographics

The sampling frame comprised of ten hospitals in Kenya namely Kenyatta, Nairobi, Aga Khan, Kirwa, Maua Methodist, Laare Nursing Home, Avenue Park, Gur-nanak, St Mary's, and Mater. The response rate was 70% which was equal to 70 complete questionnaires. The demographics comprised of 56% male and 44% female. The age distribution was 20-30 years -20.0%, 30-40 year - 24.3%, 40-50 years -38.6% and above 50 years, -17.1%. The type of Cloud Computing usage was distributed as follows: Software as a Service (SaaS) - 41.4%, Platform as a Service (PaaS) - 24.3% and Infrastructure as a Service (IaaS) -34.3%. Further, the number of years of experience for using cloud computing distribution was as follows: Less than 1 years- 14.3%, 2-5

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years - 50.0%, 5-10 years - 25.7% and Above 10 years - 10.0%.

5.2 Convergent Validity

The factor loadings are displayed in Table 1 to aid in measuring data gathered in the study that was used to find out if the constructs had satisfactory validity and reliability.

The results in the table show construct items that remained after dropping the items that cross-loaded on other factors. As a result the dropped factors were removed from the final analysis. Further since the other items with loadings less than 0.70 had loadings greater than the acceptable threshold of 0.5, they were retained in the analysis. The convergent of the remaining factors into six constructs indicate a satisfactory convergent validity.

The values in bold in Table 1 indicate convergence by having items measuring a particular construct load together for that factor. Further total variance explained by the investigated six factors was 83.949percent. This means that the model focusing on theorized factors explained 83.949 percent of the variance in access to healthcare for chronic diseases

5.3 Descriptive Statistics and Bivariate Correlations

The results revealed that access to Healthcare for Chronic diseases had the highest mean (4.4643) and had a sharing of information enabled by cloud computing had a high correlation to access to Healthcare for Chronic diseases. This association will be further investigated in this paper to be confirmed by regression analysis to establish its significance.

Table 1: Rotated Component Matrix

Component		Loadings
Information Sharing (SI)	S16	0.898
	S17	0.742
	S18	0.871
	S19	0.914
	S20	0.71
	S23	0.696
	S25	0.874
	S26	0.907
Cost of Infrastructure (CE)	CE10	0.955
	CE12	0.927
	CE13	0.921
	CE14	0.843
Efficiency – Decision Making(ECQ1)	CE11a	0.669
	CE11b	0.624
	E28a	0.803
	E28d	0.759
	E28b	0.771
Access to Health Care (AC)	AC1	0.914
	AC2	0.794
Cost of Management (CM)	CM5	0.974
	CM6	0.974
Efficiency- IT (CE2)	E36	0.437
	E29	0.882

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5.4 Construct Reliability

The Cronbach's Alpha for the constructs are shown in Table 2 for the instrument used in the final analysis. It is evident from the Table 2 that the factors loaded into the anticipated theorized components. Table 2 shows after removing the factors that loaded into other factors, and calculating the Cronbach's Alpha reliability coefficients on item analysis. In Table 2 no item was dropped since the Cronbach's Alpha coefficient of reliability was statistically determined for each factor.

The results shown in Table 2 from the analysis indicated acceptable levels of reliability and convergent validity.

Table 2: Cronbach's Alpha^a

Construct Name	Items	Chronbach's Alpha
Cost of Management	2	1.000
Cost of Infrastructure	4	0.869
Information Sharing	8	0.941
Efficiency – Decision Making	5	0.775
Efficiency- IT	2	0.133
Access to Health Care	2	0.905

5.5 Regression Model

Additionally, Component factor analysis using varimaxrotation was conducted on the multi-item construction five Likert Scale. The items that did not load on their constructs were dropped from further analysis. The results of regressing the other variable on access to health care produced the model summary showed in that the R-square value was 0.261 which is an indicator of the "goodness of fit" of the model. It can be thought as a percentage. Thus R-square for this model is 0.261, which means that the predictor variables can explain about 26.1% of the change/variations in access to healthcare due to cloud computing.

Further, Table 5, ANOVA, shows that the model can predict Access to health care services using predictor variables. The significance is .001, so we can reject the null hypothesis that "The model has no predictive value." Finally, the most important table is the coefficients shown in Table 3. The significance levels of Sharing Information (SI) is 0.000 which is <0.05. This indicates that we can reject the null hypotheses that CM, CE2, SI, CEQ1, EQ2 do not predict access to healthcare (AC).

The model is given by Access to Health care (SI) = 2.369 - 0.027*CM - 0.066*CE2 + 0.466*SI + 0.097*CEQ1 + 0.074*EQ2 + error.

Table 3: Coefficients^a

Model	Un-standardized Coefficients			Standardized Coefficients	T	Sig.
	B	Std. Error	Beta			
1	(Constant)	2.369	1.031		2.298	.025
	CM	-.027	.096	-.032	-.285	.777
	CE2	-.066	.091	-.080	-.723	.472
	SI	.466	.112	.473	4.159	.000
	CEQ1	.097	.183	.062	.531	.597
	EQ2	.074	.128	.065	.579	.564

a. Dependent Variable: AC

6. DISCUSSION

Experts believe that by 2017, the healthcare cloud computing market will be worth \$5.4 billion [10]. With cloud computing, different doctors can access a patient's health records even if they're miles apart. These physicians need not talk over the phone to request for a transfer of the health records. They will just have to access them in the clouds. Consequently sharing of information in the cloud is one of the greatest benefits to the healthcare sector. This study has confirmed these phenomena from its results. From the results of Table 3, sharing of information has positively influences the access to healthcare for chronic diseases ($\beta = 0.466, p = 0.000$). Consequently, the popularity of cloud computing, in the healthcare industry is likely to be in for a disruptive

innovation because a lot of doctors and even hospitals are already moving towards the clouds [10]. When there is already widespread use of cloud computing in the industry, the public, patients, and even governments can expect cost and time savings due to the improved efficiency such as the fact that there will be no need to take duplicate medical tests and images since this would be accessed instantaneously, provided there would be a robust internet connectivity. Health facilities such as hospitals and clinics will also benefit from cloud computing because there will be no need to invest on hardware and maintenance since these needs will be already taken care of by the cloud computing providers [10]. Unlike [28], this study did not find significant influence of cost reduction benefit due to cloud

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computing influence on access to healthcare, this is consistent with some researchers that argue that the cost may go up, emanating from the use of cloud computing technologies [28].

Currently, cloud computing providers are also providing software and services such as order entries, health records for pharmacy and imaging services. Apart from these elementary services, they also offer non clinical services including cycle management, claims management and billing for hospitals and clinics. The results of this study agree with those of [29]. However, it has been established that cloud computing systems dramatically reduce billing costs and at the same time improve accuracy, workflow efficiency and patient satisfaction. Additionally, it eliminates scheduling problems because at any time, and from anywhere you can access patient and other information and hence the entire practice becomes top of all key patient-related matters

Although researchers such as [8] have raised the concern of security in cloud computing paradigm, there are models such as hybrid and private clouds that are also being offered to deal with compliance and security concerns[8]. Thus there are alternative ways of setting and configuring clouds to be able to meet fundamental healthcare data requirements such as long term preservation, access traceability, data reversibility, confidentiality, authorized users, and security [10].

7. CONCLUSION

This study has established that, sharing information using cloud computing resources and technologies has a significant influence on the access of quality healthcare and particularly, chronic diseases. This can be generalized to mean that the sharing of information annealed by cloud computing has a positive influence on the access of quality healthcare. Thus, cloud computing plays major role in uplifting standards of healthcare services provided by medics, healthcare professionals and facilities. Further research, may investigate and rank the information sharing needs of the various specific services in the provision of healthcare and particularly in the management of chronic diseases. The findings of this study will have benefits to policy makers in the health sector, cloud computing providers, healthcare institutions, medics and healthcare professionals, and researchers in both the cloud computing and service quality spaces.

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