

**DATA INTEGRITY AND EVIDENCE-INFORMED GUIDANCE ASSOCIATED WITH
THE IMPLEMENTATION OF A HEALTH MANAGEMENT INFORMATION SYSTEM
AT KENYATTA NATIONAL HOSPITAL**

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Article Received: 31 March 2024 | | Article Revised: 20 April 2024 | | Article Accepted: 12 May 2024

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DOI: <https://zenodo.org/doi/10.5281/zenodo.11424152>

ABSTRACT

Objective: The main objective for carrying out the project was to ascertain the factors associated with the implementation of a health management information system at Kenyatta national hospital. The objective of this study was to determine Data Integrity and Evidence-informed guidance associated with the implementation of a Health Management Information System at Kenyatta National Hospital.

Design setting: The investigation deployed an analytical cross-sectional study.

Subjects or participants: A sample total of 263 respondents was calculated using the Krecie and Morgan formula for the quantitative study. A strict inclusion criterion was followed to select the respondents from all trained health personnel in Kenyatta National Hospital. The study utilized an interview schedule. Data were analyzed using SPSS version 21 while qualitative data was analyzed on themes developed. Data presentation was in form of quantitative statistics such as frequency distribution, percentages, and tables. Qualitative results were presented in verbatim form.

Results: The results depicted that the hospital uses HMIS in its day-to-day activities/roles in delivering health care services, (p-value 0.006 and OR 6.844). The sex of the study population showed a significant association and also agreed strongly that there was an effective and fair distribution of computers in the hospital (OR 3.67). The study observed that the age of the study population strongly agreed and had a statistically significant association with the fact that there was proper HMIS advocacy by the management in KNH, p-value 0.05.

Conclusion: Modern medicine's best practice holds that health information systems empower the patient by putting them in the center of their own healthcare story.

KEYWORDS: Health Systems, Health Information, Interoperability, Automation, Integration.

INTRODUCTION

In June 2021, the World Health Organization launched a new multiyear initiative on measuring the effectiveness and the social, health and economic impact of Health Systems, public health and social measures during health emergencies. The initiative aims at strengthening the HIMS global evidence base to provide actionable and evidence-informed guidance on such measures for decision-makers and apply a multidisciplinary and multiple-methods approach promoting randomized trials and observational research.

The envisage is: the next big thing globally is information. It is the wellspring of literally everything and thus the saying ‘‘INFORMATION IS POWER’’ Any continent, country, or organization that is considered a superpower is arguably among the best if not the best in handling information. Healthcare is no exclusion on information demands. The best hospitals in the world have practices and a culture of nurturing data/information Healthcare data is the impetus to improve patient outcomes, predict outbreaks of epidemics, gain valuable insights, avoid preventable diseases, reduce the cost of healthcare delivery and improve the quality of life in general. The factions would arise from the extent of access to healthcare data considering patient’s rights, privacy and confidentiality.^[1]

A study by Omambia *et al.*,^[2] indicated that the prerequisite for EMR/EHR is to understand the Organization needs and existing practices, then phase wise implementation will produce good results. Nevertheless, the organizational culture and administrative system continue to resist change. EMR/EHR implementation success depends on the requirements of the individual organization and their readiness to the adoption. While the integration of information and other health services expectations cannot be ignored, there are many bottlenecks which affect its adoption. Majority of healthcare organizations have actually abandoned their newly acquired systems innovations and decided to go back to their antiquated systems.^[3]

The^[4], notes that interoperability of the health management Information is systems. For better and more effective interventions in dealing with tropical and infectious diseases we need improved and quality health systems. HIMS serve a critical function in healthcare, including areas of public health, administration, research and education. Expectedly there are significant limitations to all healthcare administrative and public health data. Often this relates to the breadth of data collected, which is frequently determined by the expected HIMS.

In conformity with^[5], Health information technology (HIT) is in general increasingly viewed as the most promising tool for improving the overall quality, safety and efficiency of the health delivery system. The dire need to improve healthcare delivery, uptake of services and quality of care globally has led to competition to stimulate innovation and integration of precision diagnostic technologies making definitive health assessment directly to health consumers. Health information technology makes it possible for health care providers to better manage patient care through secure use and sharing of health information.

In relation to International health concerns majority of the National referral systems in developed countries among them Canada, United States of America and the United Kingdom have had to budget for huge amounts of money for an impetus towards Health Management Information System (HMIS) adoption whereas developing countries are still lagging behind and struggling to make do with the old traditional healthcare setups. Health systems are the core foundations of how countries respond to new disease threats and improving health of the people. The iterative nature of the process cannot be further overemphasized; any changes in mission, operations, functions, or information and data

needs must be assessed to reveal their impact on analyses already completed, since these changes could have a profound effect on the system to be acquired.^[6]

However, as sophisticated as the healthcare system is today, there are lurking threats that have enclaved health data and information handling. One of the glaring issues currently plaguing the healthcare industry is the privacy and security surrounding healthcare data. Various studies allow for healthcare data to be captured and gathered. Throughout the process, it's critical to manage consent, ensure privacy and protect access to patient healthcare data. Today, passwords and passcodes are the only barriers to accessing sensitive systems and data; however, a good digital identity system will move us beyond this limitation so that consumers of health data can do more online, the concept is a new frontier in value creation for individuals and institutions around the world. A good digital identity is something that should be portable, simple to use and accepted everywhere, much like a credit card or mobile phone. It should be trustworthy and cost-effective for accessing healthcare and other services consequently, will provide users with more choice, control and convenience.^[7]

According to^[2], embracing modern innovations in healthcare technology is one among very many ways of improving efficiency and reducing losses within healthcare organizations. The integration of information and health services envisaged benefits cannot be disputed, still, there are many challenges that affect and determine its effectual adoption. In fact, the majority of organizations have abandoned their newly acquired systems only to go back to their old manual systems. Health management information systems can be the impetus for managing complex healthcare challenges and addressing growing information needs. A vital approach to the design and implementation of any HIT and health program is to identify the various stakeholders who need to be involved and find mechanisms for including and incorporating their perspectives and concerns while simultaneously finding ways to mobilize their skills, expertise and resources.

In accordance with^[8], digital health, or the use of digital technologies for health, has become a salient field of practice for employing routine and innovative forms of information and communications technology (ICT) to address health needs. Development (USAID) and the World Health Organization (WHO) advocated the “use of the digital revolution to scale up health interventions and engage civil society”. The World Health Assembly Resolution on Digital Health demonstrated a collective recognition of the value of digital technologies to contribute to advancing universal health coverage (UHC) and other health aims of the Sustainable Development Goals (SDGs).

As assessed by the Kenya Health policy^[9] definition of the Country's long term intent in health through strengthening of health information, the target of the policy is to attain a level and distribution of health at a level commensurate with that of a middle income country, with specific impact targets of attaining a 16% improvement in life expectancy; a 50% reduction in annual mortality from all causes; and a 25% reduction in time spent in ill health.

MATERIALS AND METHODS

The study was conducted at Kenyatta National Hospital in Nairobi County, Kenya. KNH is a National referral facility at the apex of the healthcare sector in Kenya both as a facility and a training center. As per the time of the study, the facility had 50 wards 22 outpatient clinics, 24 theatres (16 specialized) and an Accident and Emergency department it has a bed capacity of 1800 beds out of which 209 beds are for the private wing. The Hospital was built to fulfill the role of being a National Referral and Teaching Hospital, as well as to provide a medical research environment. The study

utilized a Cross-sectional research design. Cross-sectional studies portray an accurate profile of persons, events, or situations at that particular time. It allows the collection of a large amount of data from a sizable population in a highly economical way. As per the healthcare tiers in Kenya, KNH is at the apex of which is the National Teaching and Referral Hospital and thus was purposefully selected. These allowed the study to collect data that was analyzed quantitatively and quantitatively using descriptive and inferential statistics.^[10] These details corroborated the Cross-sectional survey as deemed the best strategy to fulfill the objectives of the study. The research design explored a case study of KNH. There were 4,490 accredited healthcare service delivery officers at Kenyatta National Hospital who would have in one way or another been involved in implementing the HMIS. The study included all the 4,490 accredited healthcare service delivery officers in the three levels of management; top/managerial, middle/ and operational levels at Kenyatta National Hospital who would have in one way or another been involved in implementing the HMIS. All other persons not involved in the HMIS implementation were excluded. KNH has got 46 departments in total. From the organogram respondents were sampled based on their relevance and phases of HMIS implementation, thus there were three cadres of respondents. Since a sample was selected from the KNH located in Nairobi, it was expected that selecting one healthcare worker/respondent was the same as selecting the other. In the determination of the target population to be surveyed, a qualitative and quantitative sample size was determined. Therefore, according to the Krecie and Morgan formula, three factors served as the basis for appropriate determination of the sample size.^[11] These factors were the projected frequency of the preferred respondent characteristic (p) from which an approximated 87.5% of the health professional officers surveyed were expected to persuade that the research was viable. The other factors used were the preferred level of confidence (t) which was set at 95% (gives a standard value of 1.96) and the acceptable margin of error (m) set at 4% (which gives a standard value of 0.04). Given the three factors, the sample size was thus calculated using the formula:

Total number of health workers = 4,490

19 departments are directly involved with HMIS

$$N = \{t^2 \times p(1-p) \times 1\} / m^2$$

$$= 1.96^2 \times 0.875(1-0.875) / 0.04^2$$

$= 0.420175 / 0.0016 = 262.609375$ and thus, 263 respondents at the operational level and thus 14 respondents in each stratum/department. In qualitative sampling, snowball sampling was utilized where there was a very small population size characteristically at the top level of management. As indicated by^[12], in this type of sampling, the investigator asked the initial subject to identify another or the next potential subject who meets the criteria of the research study. A questionnaire and key informant interview schedule were used as data collection tools. The data collection method was through the use of questioning and interviewing. The data collection technique involved structured and unstructured questions combined with a key informant interview. Before processing the quantitative data which in reference to^[12] is data that can easily be measured or quantified, the data collected from the field was cleaned, edited, coded then entered into a computer software and analyzed using SPSS version 21. Qualitative data which cannot be represented by a numerical statistic was done through qualitative content analysis. The study proposal was submitted to the Kenyatta National Hospital/University of Nairobi ethical review committee for ethical approval. Subsequent approval was vindicated upon meeting the warranted KNH/UoN ERC threshold in addition to participants being approached and didactically taken through the study to purposely fathom before agreeing and authenticating by signing an informed consent form.

RESULTS

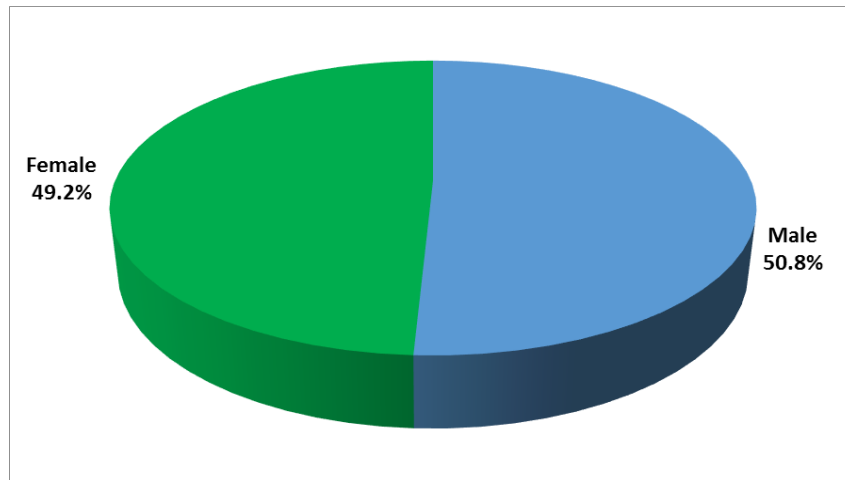


Figure 1: Sex distribution among the study population.

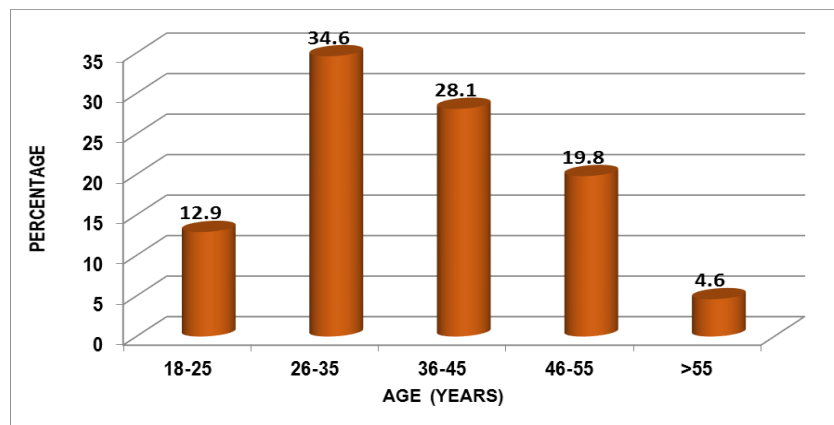


Figure 2: Age distribution among the study population.

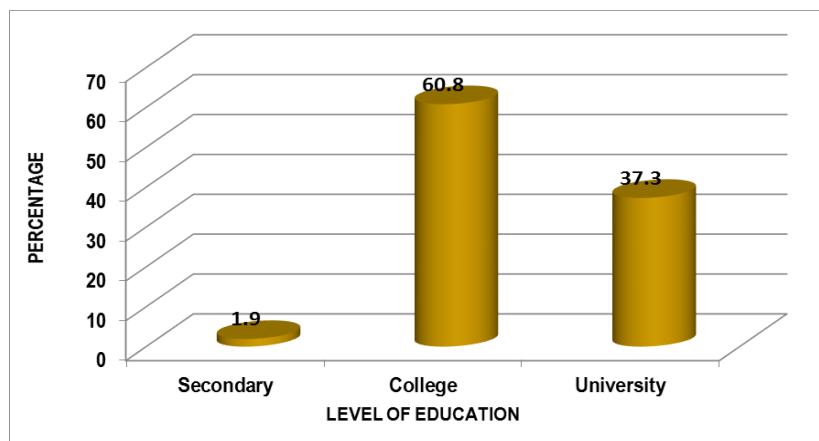


Figure 3: Education distribution among the study population.

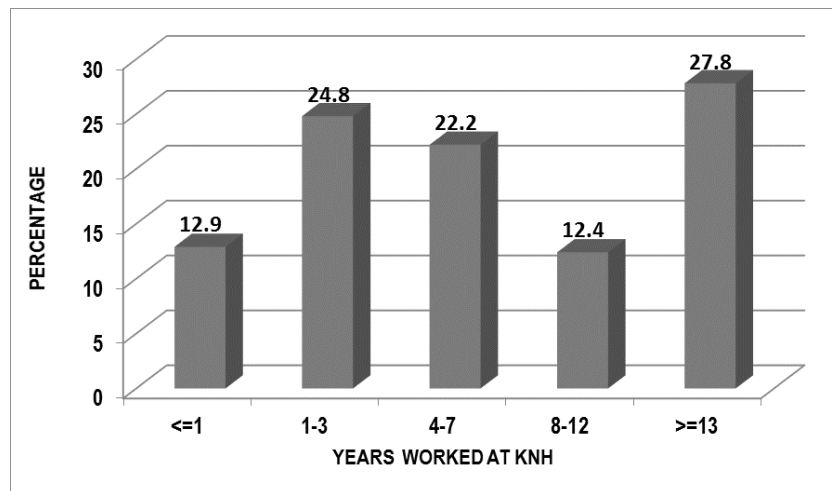


Figure 4: Duration of work among the participants.

A total of 263 respondents participated in the study. The ratio of males to females was 1:1 as indicated in Figure 1, 133(50.6%) and females 129(49.4%) thus gender balanced. A greater number of the respondents were aged between 26-35, 91(34.6%), followed closely by the age bracket 36-45, 74(28.1%), the minority were aged 55 and above, 12(4.6%) as shown in Figure 2. In Kenyatta, as depicted by Figure 3, more than half of the respondent's education level was college, 160(60.8%) with very few at secondary, 5(1.9%). There seemed a symmetry in years worked at KNH with respondents who had worked for more than 13 years, 74(27.8%) being the highest followed closely by respondents who had worked 1-3 years, 66(24.8%) and least being less than 1, 34(12.8%) and 8-12 years, 33(12.4%) respectively as indicated in Figure 4. A larger number of the respondents were at the Middle/technical level of management, 139(53.1%) followed by the operational level, 110(42%) and a minimum number were at the top level of management, 13(5%).

A larger part of the respondents, (81.1%) agreed that KNH utilizes HMIS in their daily activities towards service delivery as indicated in Table 1 below. A fair number (18.8%) were uncertain about the full implementation of HMIS, (40.6%) felt HMIS was not fully implemented while an equal percentage (40.6%) felt there was full HMIS implementation. The majority of the subjects (58.7%) felt the institution had adopted changes into a more integrated process of management, whereas, a small number (14.6%) were contrary to the idea.

Out of the 264 respondents, 20 (7.6%) strongly agreed, 88(33.3%) agreed, 87(33%) disagreed, 20(7.6%) strongly disagreed and 49(18.6%) were uncertain about HMIS being fully implemented and supported by the hospital. The proportion of participants who strongly agreed 12(4.5%), agreed 116(43.9%), disagreed 53(20.1%), strongly disagreed 17(6.4%) and those that were uncertain 66(25%) about HMIS being harmonized and standardized in the hospital. The proportion of participants who strongly agreed 14(5.3%), agreed 141(53.4%) disagreed 31(11.7%), strongly disagreed 7(2.7%) and those that were uncertain 71(26.9%) about HMIS being integrated with the hospital management process. The proportion of participants who strongly agreed 28(10.6%), agreed 108(40.9%), disagreed 44 (16.7%), strongly disagreed 12(4.5%) and those that were uncertain 72(27.3%) about HMIS advocacy by the management as indicated in Table 1.

Table 1: Frequency table for the Perceived organisational support for the implementation of HMIS.

	Strongly Disagree n (%)	Disagree n (%)	Uncertain n (%)	Agree n (%)	Strongly agree n (%)	Total n (%)
HMIS fully implementation supported by the hospital	20(7.6)	87(33.0)	49(18.6)	88(33.3)	20(7.6)	264(100%)
HMIS harmonized and standardized in hospital	17(6.4)	53(20.1)	66(25.0)	116(43.9)	12(4.5)	264(100%)
HMIS integrated with the hospital management process.	7(2.7)	31(11.7)	71(26.9)	141(53.4)	14(5.3)	264(100%)
HMIS advocacy by the management	12(4.5)	44(16.7)	72(27.3)	108(40.9)	28(10.6)	264(100%)

There were different organizational factors influencing the implementation of the health management information system at the Kenyatta National hospital that the study set out to look at, X^2 test of association was used to test for association between independent variables and dependent variables. and the following were among the factors that had statistical significance. There was a significant association between age and management support of trainings in HMIS (X^2 df 16, $P = 0.014$), age and HMIS fully implemented (X^2 df 16, $P = 0.000$), age and HMIS (X^2 df 16, $P = 0.000$), age and Cost of ICT in HMIS (X^2 df 16, $P = 0.000$), age and Computers use in data management (X^2 df 16, $P = 0.001$), age and Resistance to change (X^2 df 16, $P = 0.012$) sex and efficiency in Healthcare Services (X^2 df 4, $P = 0.029$), Highest education level and use of Computers in data management (X^2 df 8, $P = 0.003$) as indicated in table 2 below.

Table 2: Chi-square test values for organizational factors influencing the implementation of the Health Management Information System at the Kenyatta National Hospital (C.I is 95%).

Variables	Age		sex		Highest education level	
	P value	df	P value	df	P value	df
KNH uses HMIS in their day-to-day activities/roles in	0.135	8	0.598	4	0.125	8
KNH management supports trainings in HMIS	0.014	16	0.463	4	0.577	8
HMIS has been fully implemented by the hospital	0.000	16	0.094	4	0.124	8
HMIS advocacy by the management in KNH	0.000	16	0.962	4	0.604	8
Cost of ICT equipment in the implementation of HMIS	0.000	16	0.514	4	0.227	8
More computers should be added	0.193	16	0.516	4	0.272	8
Use of Computers in Data Management	0.001	16	0.291	4	0.003	8
Efficiency in Healthcare Services	0.119	16	0.029	4	0.762	8
Fear of Change	0.126	16	0.285	4	0.079	8
Resistance to change	0.012	16	0.252	4	0.407	8

DISCUSSION

This study produced several observations, primarily on the Data Integrity and Evidence-informed guidance associated with implementing a Health Management Information System at Kenyatta National Hospital. It was agreed that organizations need to target resource mobilization, research and development, and access to essential medicines and vaccines, health workforce, international health regulations and statistical capacity-building, WHO stated that a qualified health workforce that is available, equitably distributed and accessible by the population is essential for a well-functioning health system.^[8] These findings agreed with the study findings that the integration of HIMS had a positive influence on the day to day affairs of KNH. The respondents reflected that adequate staff training and sufficient time spent by different experts in the field helped to ensure the appropriate design of the new system. It was safe to say that the study highlighted that KNH's leadership and governance had developed changes in its structure into a more integrated process of management, especially when it comes to how products and services are adopted and

implemented in the hospital. Making sure there is an all-inclusive consultative process across all cadre. The Information system development and implementation activities that were conducted in anticipation from manual to electronic at KNH include; Planning, designing, training of system users, revision of indicators, preparation of guidelines, staff training, benchmarking, self-assessment of the organization, evaluation of manual systems, conducting group discussions, integration of data collection process, disease surveillance, patient identification, deployment of trained staff, procurement of computers, installation and commissioning. The key informant's interview also pointed out that training of users to have skills and knowledge on how to use the system and to avoid resistance and good software, preparation of guidelines since they literally explain everything related to the system. The implementation phase was important as it determined how well the process rolled out, and self-assessment.^[2] The PDCA cycle was effective and it brought about emphasis on continuous feedback that identifies major errors on the ongoing process.

The majority of those interviewed were of the opinion that HMIS had improved services by effecting efficiency in services delivery especially in accident and emergency department, in the wards and reception areas, generally efficiency in information handling, it had helped to identify patients in the system, and there was reduction in costs. One respondent observed;

“For sure the HMIS had reduced the patient waiting time during registration, increased effectiveness in communication, charging of services, ordering of drugs online, discharging of patient, ease of records retrieval, reduced errors.....”

However, a few respondents were of the view that, HMIS had not improved efficiency to a larger extent since a lot of things were still done manually, no proper training, the system is not fully implemented.

The components considered to be key elements were; Hardware, software, users, data collection, storage and its management, integration, then use of funsoft software, patient bio-data, the networks and internet, the processes and basically everyone working in the system. Some of the respondents were uncertain since their interaction with HMIS was limited. The needs analysis helped KNH management to identify the needs for implementing HMIS. Development of data capturing system using computers during patient's registration. The pilot studies were important as they involved various departments and the involvement of other stakeholders. However, some respondents were uncertain of what they thought was critical during the adoption and implementation of HISM at KNHS. According to^[13], a people centered approach means that, data should empower people or help their effort to actively participate in the development of a health management information system, from the design phase all the way to the implementation of the system. The^[14], indicates that governance and leadership of countries is vital on how the health systems perform. This is in tandem with the study results that indicated there is a need to strengthen the health system through enhancing and in syncing systems and human systems.

CONCLUSION

Modern medicine's best practice holds that health information systems empower the patient by putting them in the center of their own healthcare story. There are numerous benefits to improving how health data is processed specially, in regard to improving the delivery of healthcare services. These benefits are only possible if data is collected and processed in a manner that protects and preserves the data subject's rights, particularly as it relates to their personal health information. It is important, therefore, to ensure that the systems in use adhere to the data protection standards mandated in the Data Protection Acts. The healthcare system should be designed in such a way that it provides controls

in a user-friendly manner. Authorized personnel for example an end-user must have full control over his/her collected data at any moment and can be traced to identify the end user for accountability i.e., to whom it can be or cannot be shared. At any moment, the user should be given the possibility to know and control who has his data, what data have been collected, and for what purposes they will be used for the legitimate initial purpose. With effective management of health information, healthcare providers, researchers, policymakers and other stakeholders will make evidence-informed decisions toward implementing better healthcare practices and innovations across the healthcare continuum.

Declarations

- 1. Ethics approval and consent to participate-** All methods were carried out in accordance with relevant guidelines and regulations. Approval was warranted by the KNH/UoN ERC and informed consent was obtained from all subjects and/or their legal guardian(s).
- 2. Consent for Publication-** Not applicable
- 3. Availability of data and materials-** Under authors ownership
- 4. Competing Interests-** Not applicable
- 5. Funding-** Not applicable
- 6. Authors' Contributions-** Salim Omambia Matagi is the sole author and is responsible for ideation, writing, images and submission.
- 7. Acknowledgements-** I would like to acknowledge Kenya Medical Training College, KEMRI Graduate School/Jomo Kenyatta University of Agriculture in Kenya, and Nagasaki University in Japan for their moral support.
- 8. Authors' Information-** Not applicable

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