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Implementation of Advanced Medical Devices on the Performance of Healthcare Facilities in Kenya

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Abstract
The purpose of the study was to determine the effect of implementing advanced medical devices (AMDs) on the performance of healthcare facilities in Kenya. Specifically, the research focused on understanding the effects of planning and resourcing, installation and maintenance, and utilisation of AMDs on healthcare facility performance. The target population was Level 6 hospitals in Nairobi with a sample size of 337 composed of hospital management, biomedical engineers, and medical staff, and 83% response rate. Pearson Correlation analysis revealed a positive and significant relationship between planning and resourcing of AMDs and healthcare facility performance ($r = 0.785$, $p < 0.05$), installation and maintenance of AMDs ($r = 0.746$, $p < 0.05$), and AMDs utilisation ($r = 0.781$, $p < 0.05$). Regression analysis showed a significant positive effect of planning and resourcing on performance ($\beta = 0.304$, $p < 0.05$), installation and maintenance ($\beta = 0.299$, $p < 0.05$) and AMDs utilisation ($\beta = 0.354$, $p < 0.05$). The study concluded that the implementation of AMDs significantly enhances healthcare performance. To maximise the benefits of AMDs, the study recommends that healthcare facilities improve resource allocation, secure adequate funding for AMDs initiatives, and provide regular training. Additionally, establishing clear utilisation protocols, streamlined maintenance processes, and engaging biomedical engineers should be prioritised.

Introduction

The integration of advanced medical devices (AMDs) has revolutionised healthcare worldwide, transforming diagnostic accuracy, surgical precision, treatment efficacy, and patient monitoring (World Health Organisation [WHO], 2023). The increasing adoption of AMDs has prompted extensive research into their impact on healthcare facility performance. Studies have consistently demonstrated a strong correlation between AMDs and improved patient outcomes, reduced healthcare costs, and streamlined clinical workflows, particularly in areas like imaging diagnostics and robotic-assisted surgery (Smith et al., 2022). Research by Brown et al. (2021) emphasises the potential for AMDs to improve equitable access to quality care, particularly in underserved regions. Healthcare performance encompasses several key aspects, including operational efficiency, financial sustainability, clinical outcomes, and patient safety (Donabedian, 1988). High-performing healthcare systems are characterised by their ability to promptly meet patient needs, provide accurate diagnoses, administer effective treatments, and manage resources efficiently. These elements are crucial to determining a healthcare facility's overall success and its capacity to contribute to improved public health outcomes.

As healthcare continues to evolve, the integration of innovative technologies has become a significant driver of enhanced performance. Advanced medical devices (AMDs), electronic medical records

(EMRs), and telemedicine platforms are transforming the delivery of healthcare, particularly by improving diagnostic accuracy, reducing operational errors, and streamlining clinical workflows (Smith et al., 2022). These innovations not only support better decision-making and patient care but also help facilities manage costs and resources more effectively, making them integral to improving healthcare performance in both high-resource and resource-constrained settings (Brown et al., 2021). At the intersection of AMDs and healthcare access, telemedicine and telemonitoring emerge as promising tools for managing chronic diseases, especially in low and middle-income countries (LMICs) (WHO, 2023). These technologies provide avenues for improved care delivery in resource-limited settings, enhancing patient engagement and disease management (Abdalla et al., 2020).

The integration of AMDs with telemedicine and telemonitoring offers even greater promise, particularly for chronic disease management in LMICs (Akter et al., 2020). Telemedicine can function with basic tools, such as smartphones, but when combined with AMDs, its effectiveness is significantly enhanced. Smith et al. (2022) underscore this synergy, noting how AMDs can automatically collect and transmit health data, enabling real-time monitoring and remote adjustments by healthcare providers. This integration has transformative potential for addressing the healthcare challenges in resource-constrained environments, where continuous care is often limited. As healthcare technology evolves, artificial intelligence (AI) is increasingly influencing the development and deployment of AMDs. AI has the potential to improve diagnosis, treatment, and resource allocation, but ethical considerations such as justice, transparency, and accountability must be addressed to ensure responsible implementation (Nguyen et al., 2021). Balancing these ethical concerns with innovation is essential to maintaining public trust while optimising healthcare delivery (WHO, 2023).

In Kenya, the healthcare system faces challenges like limited resources, inadequate infrastructure, and workforce shortages (Desai et al., 2020). Despite these constraints, advancements in medical technology, particularly AMDs, present opportunities to improve patient outcomes and healthcare delivery (Majeed et al., 2021). However, realising the full potential of AMDs in Kenya depends on effective management practices, sufficient training, and optimised workflows. Careful consideration of cost-effectiveness, infrastructure development, and human resource training, coupled with addressing specific challenges faced by different technologies, will enable Kenya to harness the full power of AMDs to improve healthcare access and patient outcomes.

Further research tailored to the Kenyan context is essential to maximise the impact of AMDs in the healthcare system (Majeed et al., 2021). Given Nairobi's position as Kenya's capital and economic hub, investigating the implementation of AMDs on healthcare facilities within urban settings is both significant and timely (Gitahi et al., 2019). While Nairobi has over 60 hospitals, this study focuses on Level 6 facilities—Kenya's most technologically advanced hospitals (Ministry of Health [MOH], 2022). These hospitals, characterised by robust medical device infrastructures, are pivotal in understanding the planning, resourcing, installation, maintenance, and utilisation practices essential for AMD success in Kenya's healthcare system (MOH, 2022).

Theoretical Review

The study adopts an implementation framework anchored on RE-AIM, which is an integrated framework developed to improve the adoption and sustainable implementation of evidence-based interventions in a wide range of health and other settings (Glasgow et al., 1999). RE-AIM: Reach, Effectiveness, Adoption, Implementation, and Maintenance, provides a framework to guide the planning and evaluation of programmes, and was conceptualised two decades ago to address the key failures and delays in translating scientific evidence into practice and policy. Currently, it is one of the most used planning and evaluation frameworks in the field of public health. In contextualising the study's framework, three key parameters have been adopted: planning and resourcing, installation and maintenance, and utilisation.

Empirical Review

Planning and resourcing of AMDs on the performance of healthcare facilities

Implementing advanced medical devices (AMDs) in healthcare facilities requires a comprehensive approach that includes strategic planning, resource allocation, and infrastructure readiness. Møller et al. (2022), in examining the impact of robotic surgery on surgical safety and efficiency, found a strong association with reduced complication rates and shorter hospital stays compared to traditional laparoscopic surgery. The implementation of 3D printing technology for surgical planning and prosthetics has also been shown to improve surgical planning accuracy and reduce surgical time (Ayers et al., 2022). It also enables the creation of customised prosthetics, resulting in faster patient recovery and increased operational efficiency. Gómez et al. (2022) contend that the implementation of tele-neurology consultations in rural hospitals improves access to specialist care and reduces transfer times for patients with neurological emergencies. This improvement in access and reduced transfer times positively impacts performance by facilitating earlier diagnosis and treatment initiation, thereby reducing long-term complications and improving patient outcomes.

Strategic planning is crucial for the effective implementation of AMDs as it ensures that healthcare facilities are well-prepared to adopt and sustain these technologies. Bandyopadhyay et al. (2022) note that successful implementation requires careful planning to achieve long-term success. Orem et al. (2021) further highlight that well-planned stakeholder engagement and continuous needs assessments are critical for sustained device utilisation. Glanz et al. (2023) emphasise that besides the need for adaptable and comprehensive planning, cultural adaptation must be integrated into the planning process to optimise the implementation of AMDs.

Resource allocation and optimisation are fundamental to ensuring that AMDs are not only acquired but are also utilised to their fullest potential within healthcare settings. Steenbekkers et al. (2019) identify exploration of cost-sharing models as an essential component for achieving financial sustainability in telemedicine implementations. Barnett et al. (2022) highlight the importance of context-specific resource allocation to address the high costs associated with medical devices. In addition, infrastructure and workforce readiness are essential for the sustained use of AMDs (Ogwang et al., 2022; Ngugi et al., 2021).

Installation and maintenance of AMDs on the performance of healthcare facilities

The integration of Advanced Medical Devices (AMDs) into healthcare systems offers promising improvements in precision, efficiency, and patient outcomes (Otiso et al., 2022). These devices, such as robotic surgery systems, telemedicine platforms, and AI-powered diagnostics, hold great potential to revolutionise healthcare delivery by enhancing diagnostic accuracy, reducing procedural risks, and shortening recovery times (Akinyi et al., 2023). However, effective installation and maintenance of these devices require careful assessment of the healthcare facility's existing infrastructure and technical capabilities.

Mpeli et al. (2020) point out that improper planning for installation often lead to device underutilisation. On the other hand, Boateng et al. (2019) note that a lack of technical expertise among personnel responsible for device installation often leads to improper installation and safety risks. Ngugi et al. (2022), in assessing the implementation of teleophthalmology in Kenya, emphasise the critical role of reliable technical infrastructure in the successful installation of telemedicine devices. Many of the challenges around installation and management involve budgeting, inadequate planning for installation, and a lack of skilled technicians, all of which contribute to service disruptions.

The maintenance of AMDs is equally essential for ensuring their sustained effectiveness and minimising disruptions in healthcare service delivery. Otiso et al. (2022) opine that deferred maintenance due to limited budgets often led to device failures and service disruptions, which, in turn, reduced healthcare service availability and delayed patient care. Similarly, the shortage of qualified technicians prolonged repair times, compromising the efficiency and safety of healthcare delivery. Boateng et al. (2019) also assert that the limited availability of spare parts for medical devices is a critical barrier to effective maintenance. Without access to essential components, repairs are delayed, leading to reduced service capacity and compromising the overall performance of healthcare facilities. Incidentally, Achieng et al. (2022), in examining the effect of electronic health records (EHRs) on hospital readmission rates, are categorical that EHR implementation reduces hospital readmission rates by improving care coordination and access to patient medical history.

Effect of utilisation of AMDs on the performance of healthcare facilities

The utilisation of advanced medical devices (AMDs) plays a significant role in improving healthcare facility performance by enhancing diagnostic accuracy, patient outcomes, operational efficiency, and resource utilisation. Li et al. (2023) assessed the cost-effectiveness of using AI for stroke diagnosis in emergency departments in China. The study revealed that AI-assisted analysis of medical images significantly improved diagnostic accuracy and facilitated faster treatment initiation, thereby reducing mortality and disability rates in stroke patients. Similarly, Tiwari et al. (2019) explored the use of point-of-care ultrasound (POCUS) for diagnosing pneumonia in children in India. The study found that POCUS provided a faster, more reliable diagnosis than traditional chest X-rays, particularly in resource-limited settings where access to X-ray machines may be limited. Mbuthia et al. (2021) investigated the impact of POCUS devices in East African primary healthcare facilities, demonstrating that their use significantly improved diagnostic accuracy and facilitated faster treatment initiation.

Telemedicine has proven to be an effective tool for managing chronic diseases, improving patient outcomes, and reducing healthcare resource utilisation. Tran et al. (2022) conducted a systematic review in Australia to evaluate the impact of tele-intensive care units (tele-ICUs) on hospital performance. The review found that tele-ICUs improved patient outcomes by enabling remote monitoring and expert consultation, thereby reducing mortality and morbidity among critically ill patients. Ekvall et al. (2016) assessed the impact of telemonitoring on the management of chronic obstructive pulmonary disease (COPD) in Sweden. The study found that telemonitoring significantly reduced hospital readmission rates for COPD exacerbations and improved patient self-management skills and quality of life.

In the United States, Meara et al. (2018) analysed the impact of robotic surgery on surgical site infections (SSIs). They found that robotic-assisted surgeries significantly reduced SSIs compared to traditional laparoscopic procedures. In Brazil, Borges et al. (2017) found a positive correlation between access to advanced imaging technologies, such as PET scans, and improved cancer survival rates. Agyemang et al. (2021) evaluated the use of mobile health (mHealth) platforms for medication adherence in chronic diseases in Nigeria. The study revealed that implementing mHealth platforms improved medication adherence and reduced hospitalisation frequency through timely medication reminders and health education messages. Ngugi et al. (2022) analysed the implementation of a teleophthalmology programme in Kenya, demonstrating that teleophthalmology increased access to specialised eye care services for patients residing in remote locations.

Methodology

Research Design

The study utilised survey design, which is well-suited for the study due to the need to collect focused information relevant to understanding relationships between variables (Mishra & Alok, 2022). Surveys can efficiently gather data from a representative sample, allowing the findings to be generalised within the study's specific context.

Target Population

For the study, 60 hospitals in Nairobi are divided into different levels (MOH, 2022), as shown in the table below. While the Kenyan Ministry of Health (MOH, 2022) reports over 60 hospitals across various levels in Nairobi, this study specifically targeted Level 6 facilities. These hospitals have the most complex and advanced medical device utilisation and installation measures in place due to the sensitive nature of the patient cases and the information they handle.

Sampling Frame and Technique

Within this population of Level 6 hospitals, the study focused on three key institutions: Kenyatta University Teaching, Referral and Research Hospital (KUTRRH), Kenyatta National Hospital (KNH), and Mathari Level 6 Hospital. These hospitals were chosen for their role as the region's primary referral centres, for their use of highly advanced medical devices, and for serving a large and diverse patient population.

The respondents were categorised into three groups: hospital management, biomedical engineering personnel, and medical staff because of their role in the management of AMDs. Overall, the study targeted 1315 respondents across the three hospitals, ensuring comprehensive representation of the various stakeholders involved in the implementation and utilisation of advanced medical devices in healthcare settings. For this study, stratified random sampling was selected due to its ability to ensure that each subgroup—hospital management, biomedical engineers, and medical staff—is adequately represented in the sample. This method was ideal for capturing the diverse perspectives and roles involved in the implementation and utilisation of advanced medical devices, providing a more comprehensive understanding of their effect on healthcare performance.

Sample Size

This study used Yamane's formula to estimate its sample size. With a 5% margin of error, a sample size of 337 was determined, as indicated below.

Yamane, 1967: $n = \frac{N}{1+Ne^2}$
Where: n = sample size; N = population size; e = margin of error
Given that N = 1315 at 5% confidence level, and e = is the precision or sample error i.e. 0.05

$$n = \frac{1315}{1 + 1315(0.05)^2} = 337\ Individuals$$

The distribution of the sample within the various categories is indicated in Table 1.

Table 1: Distribution of Sample Size

Respondents Category	Number	Proportion (N_i/N) *100	Sample (n)
Hospital management	40	5	21
Bio Medical Engineering personnel	65	7	31
Medical staff	1210	88	285
Total	1315	100	337

Data Collection Methods

Primary data were collected through a structured questionnaire. The questionnaire consisted of closed-ended Likert-scale questions, with 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree, to rate respondents' responses. The questionnaire was divided into sections consisting of statements regarding the independent variables: planning and resourcing, installation and maintenance, and utilisation, as well as performance of healthcare facilities as the dependent variable. The data was collected between March 2024 and August 2024.

Research Procedures

The data collection process began with approval from the Institutional Review Board (IRB) at USIU-Africa and, subsequently, a research authorisation from the National Commission for Science, Technology, and Innovation (NACOSTI). A pilot study was conducted to check the reliability and validity of the research instrument. Using Cronbach's alpha, the instrument's appropriateness was evaluated, and the questionnaire's reliability was 0.75. Given a recommended threshold of 0.7, the instrument was deemed appropriate for the study. In addition, the KMO (Kaiser-Meyer-Olkin) test yielded values above 0.70, indicating that the measures were acceptable for the validity of the variables.

Ethical Considerations

The respondents were informed of the opportunity to withdraw from the study at any time and of the voluntary nature of their participation. The questionnaires included an attachment about informed consent. Both concepts required participants to be informed about the study's goals and procedures. The confidentiality of the information submitted by the respondents was guaranteed.

Data Analysis Methods

Data analysis was performed using the Statistical Packages for Social Sciences (SPSS) version 24. Data analysis was conducted using descriptive and inferential statistics. Specifically, inferential analysis included correlation and multiple linear regression. The regression model was illustrated as follows:

$$Y=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\varepsilon$$

Where: Y is healthcare performance; X_1 is planning and resourcing; X_2 is installation and maintenance; X_3 is utilisation

α_0 is the constant and β_1, β_2, $\beta3$ are the coefficient to be estimated

ε is the error term

Results

Correlation between Planning and resourcing of AMDs and performance of healthcare facilities

Table 2 shows that planning and resourcing of AMDs and the performance of healthcare facilities yield a strong and positive Pearson correlation coefficient of 0.785 which is statistically significant at the 5% significant level.

Table 2: Correlations analysis of Planning and resourcing of AMDs and performance of healthcare facilities

Variables		Planning and resourcing of advanced medical devices	Performance of healthcare facilities
Planning and resourcing of advanced medical devices	Pearson Correlation	1.000	
	Sig. (2-tailed)	==	
	N	280	
Performance of healthcare facilities	Pearson Correlation	0.785**	1.000
	Sig. (2-tailed)	0.000	
	N	280	

Note: **. Correlation is significant at 5% level

Model Summary of planning and resourcing of AMDs and performance of healthcare facilities

The regression coefficients in Table 3 indicate that planning and resourcing of AMDs significantly and statistically influence healthcare facility performance $\beta = 0.304, p < 0.05$).

Table 3: Regression Coefficients Results of planning and resourcing and healthcare performance

Model	Unstandardised Coefficients		Standardised Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	1.512	2.091		0.723	.002
Resourcing and Planning	.304	.112	.413	2.714	.002

a. Dependent Variable: Healthcare Performance

Correlation between the Installation and maintenance of AMDs and the performance of healthcare facilities

Table 4 shows that the installation and maintenance of AMDs and the performance of healthcare facilities exhibit a strong, positive Pearson correlation coefficient of 0.746, which is statistically significant at the 5% significance level.

Table 4: Correlations of Installation and Maintenance of AMDs and the performance of healthcare

		Installation and maintenance	Performance of healthcare facilities
Installation and maintenance	Pearson Correlation	1.000	
	Sig. (2-tailed)	===	
	N	280	
Performance of healthcare facilities	Pearson Correlation	0. 746**	1.000
	Sig. (2-tailed)	0.000	
	N	280	

Note: **. Correlation is significant at 5% level

Model summary of the Installation and maintenance of AMDs and the performance of healthcare facilities

The results in Table 5 indicate that installation and maintenance of advanced devices statistically and significantly influence performance of healthcare facility ($\beta = 0.299, p < 0.05$).

Table 5: Regression results of effect installation and maintenance of AMDs on healthcare performance

Model	Unstandardised Coefficients		Standardised Coefficients	T	Sig.
	B	**Std. Error**	**Beta**		
(Constant)	1.512	2.091		0.723	.002
Installation and maintenance	.299	.143	.202	2.090	.001

a. Dependent Variable: Healthcare Performance

Correlation between Utilisation of advanced medical devices and performance of healthcare facilities
Table 6 shows that utilisation of AMDs and the performance of healthcare facilities exhibit a strong and positive Pearson correlation coefficient of 0.781, which is statistically significant at the 5% significant level.

Table 6: Correlations analysis of Utilisation of advanced medical devices and performance of healthcare facilities

Variables		Utilisation of advanced medical devices	Performance of healthcare facilities
Utilisation of advanced medical devices	Pearson Correlation	1.000	
	Sig. (2-tailed)	===	
	N	280	
Performance of healthcare facilities	Pearson Correlation	0.781**	1.000
	Sig. (2-tailed)	0.000	
	N	280	

Note: **. Correlation is significant at 5% level (2-tailed)

Model summary of utilisation of advanced medical devices and performance of healthcare facilities
The results in Table 7 indicate that utilisation of AMDs statistically and significantly influence performance of healthcare facility ($\beta = 0.354, p < 0.05$).

Table 7: Regression results of effect utilisation of advanced devices on healthcare performance

Model	Unstandardised Coefficients		Standardised Coefficients	T	Sig.
	B	**Std. Error**	**Beta**		
(Constant)	1.512	2.091		0.723	.002
Utilisation of advanced medical devices	.354	.157	.414	2.254	.002

a. Dependent Variable: Healthcare Performance

Discussion of Results

Appropriateness of the Theoretical Framework
Existing research on advanced medical devices (AMDs) in Kenya usually focuses on specific components of the healthcare system, such as access or cost, but often fails to take a holistic approach that addresses the multifaceted elements (Majeed et al., 2021). This study demonstrates the importance of adopting an implementation framework that incorporates planning, installation, maintenance, and utilisation, all of which are necessary for successful deployment. This aligns with the perspectives of Glasgow et al. (1999), who noted the need for an integrated framework to improve the adoption and

sustainable implementation of evidence-based interventions across a wide range of public health and related settings. Therefore, the contextualisation of the theoretical framework, anchored in RE-AIM (Reach, Effectiveness, Adoption, Implementation, and Maintenance), is appropriate.

Planning and Resourcing of AMDs on the Performance of Healthcare Facilities

The study results revealed a significant positive relationship between planning and resourcing of AMDs and healthcare facility performance. These findings resonate with Orem et al. (2021), who emphasised the importance of thorough needs assessments and active stakeholder engagement in ensuring that the acquisition of medical technologies aligns with critical healthcare demands. Orem et al. argue that aligning AMDs' acquisitions with local needs leads to more efficient resource use and better patient outcomes. Furthermore, Bandyopadhyay et al. (2022) highlight that strategic planning and careful resource allocation are pivotal to the successful implementation of digital health interventions, including AMDs. However, Smith et al. (2020) note that even with comprehensive planning and resource allocation, unforeseen operational challenges—such as insufficient staff training or bureaucratic bottlenecks—can hinder anticipated improvements in healthcare performance. This view implies that focusing solely on the technical aspects of AMD's acquisition may neglect the human and organisational dimensions necessary for ensuring optimal performance.

Additionally, Kimani et al. (2020) argue that over-reliance on advanced medical technologies without parallel investment in human resources can result in underutilisation of AMDs. A failure to simultaneously build capacity through staff training and infrastructure development can negate the potential benefits of AMDs. In other words, while planning and resourcing are vital, continuous evaluation and adjustment of AMD implementation strategies are equally crucial to avoid performance bottlenecks.

Installation and Maintenance of AMDs on the Performance of Healthcare Facilities

The study indicates a strong positive correlation and a significant positive impact of installation and maintenance activities on healthcare performance. These results are consistent with those of Johnson et al. (2020), who emphasised that regular maintenance schedules, coupled with the involvement of skilled biomedical engineers, significantly improve the longevity and performance of medical devices. Mwangi et al. (2021) similarly found that consistent maintenance practices led to a 30% increase in healthcare delivery efficiency, highlighting the importance of proactive maintenance in optimising the functionality of the healthcare system.

However, some studies present differing views. Ajayi and Ayeni (2019) caution that, in resource-limited settings, the high costs of regular maintenance can offset the financial benefits of AMDs, suggesting that facilities may struggle to sustain these technologies over time. Furthermore, Abdalla et al. (2020) observed that in certain Sub-Saharan African hospitals, a lack of localised technical expertise often leads to extended downtime for advanced medical devices, significantly affecting overall healthcare performance. Therefore, while the evidence strongly supports the positive influence of proper installation and maintenance on healthcare facility performance, the challenges related to cost and technical expertise, especially in lower-resource settings, must be considered. Balanced investment in both technology and the human resources needed for maintenance is vital for sustaining the long-term benefits of AMDs.

Utilisation of AMDs on the Performance of Healthcare Facilities

The results demonstrate a strong positive relationship between the utilisation of AMDs and healthcare facility performance, and utilisation also has a significant positive effect on healthcare performance. This aligns with research by Meara et al. (2018), who found that the effective utilisation of advanced technologies in clinical settings enhances diagnostic accuracy, treatment outcomes, and overall service delivery. Similarly, Williams et al. (2023) argue that proper utilisation of medical devices significantly reduces diagnostic errors, shortens patient wait times, and improves workflow efficiency within healthcare institutions.

On the other hand, Odero et al. (2020) caution that the mere availability of AMDs does not automatically guarantee improved performance. Without adequate training and user support, the full potential of these devices can remain unrealised, leading to suboptimal outcomes. Additionally, Alobayli et al. (2023) point out the risks of "technology overload," where an over-reliance on advanced devices may lead to workflow disruptions and reduced efficiency if staff are not adequately trained or if the devices are not well integrated into existing healthcare systems.

Conclusion

The purpose of the study was to determine the effect of implementing advanced medical devices (AMDs) on the performance of healthcare facilities in Kenya. Specifically, the research focused on understanding the impact of planning and resourcing, installation and maintenance, and the utilisation of AMDs on healthcare facility performance. The target population comprised Level 6 hospitals in Nairobi, with a total of 1315 respondents: hospital management, biomedical engineers, and medical staff.

The study concluded that the implementation of AMDs, including planning, resourcing, installation, maintenance, and utilisation, significantly enhances healthcare performance. To maximise the benefits of AMDs, the study recommends that healthcare facilities need to improve resource allocation, secure adequate funding for AMD initiatives, and provide regular training. Additionally, establishing clear utilisation protocols, streamlined maintenance processes, and engaging biomedical engineers should be prioritised. Continuous evaluation of AMD practices is essential to sustain and improve healthcare performance.

Dedication

This article is dedicated to the memory of Derick M. Kamina, who passed on in November 2025, in recognition of his passion for improving healthcare delivery. May God rest his soul in eternal peace.

References

Abdalla, I., Al-Foqahaa, A., Al-Kuhlani, M., & Al-Saggaf, A. (2020). Telemedicine and chronic disease management in developing countries: A review of the literature. *Journal of Telemedicine and Telecare*, 26(2), 112-122.

Achieng, O., Ongore, S., Muindi, J., & Mutula, S. M. (2021). Assessing the Implementation of Electronic Medical Records (EMRs) in Public Hospitals in Kenya: A Review of Challenges and Opportunities. JMIR Medical Informatics, 9(5).

Agyemang, C., Oteng-Ababio, M., Opare-Addo, V., & Aikins, M. (2022). Factors influencing telemedicine adoption in Ghanaian public healthcare facilities: A cross-sectional study. *International Journal of Public Health, 37*(1) e14501.

Ajayi, R. A., & Ayeni, O. A. (2019). Telemedicine in rural Nigerian healthcare: Challenges and opportunities. *Pan African Medical Journal, 34*(277). https://doi.org/10.54660/IJFEI.2019.1.2.22-37

Akinyi, J. O., Ogola, E. A., Ogutu, J. O., & Arunga, O. A. (2023). Cost-effectiveness analysis of point-of-care ultrasound (POCUS) for maternal health services in rural Kenyan healthcare facilities. *International Journal of Gynaecology & Obstetrics*.

Akter, S., Ray, P. K., & Nahar, N. (2020). Telemedicine for chronic disease management in low- and middle-income countries: A review of the literature. JMIR Medical Informatics, 8(2), e17422. https://doi.org/10.2196/17422

Alobayli, F., O'Connor, S., Holloway, A., & Cresswell, K. (2023). Electronic health record stress and burnout among clinicians in hospital settings: a systematic review. *Digital health*, *9*, 20552076231220241.

Ayers, R., Richardson, M., & Jones, D. (2022). Implementing 3D printing in the operating room: a case study approach. *The British Journal of Oral & Maxillofacial Surgery*.

Bandyopadhyay, D., Das, J., & Mukherjee, B. (2022). Digital health interventions and advanced diagnostic tools for low- and middle-income countries (LMICs): Opportunities and challenges. *BMJ Global Health, 7*(5), e006129.

Bandyopadhyay, S., Singh, D., Singh, A., & Aswani, L. (2022). Implementing digital health interventions in low- and middle-income countries: A systematic review. *International Journal of Medical Informatics*, 162, 104772.

Barnett, M. I., Opoku, A. M., Mwapunga, M. T., & Nyirenda, M. (2022). Implementing digital health interventions in low- and middle-income countries: A qualitative study exploring multi-level contextual challenges and enablers. Global Health promotion.

Boateng, A. A., Aikins, M., & Agyei-Mensah, S. (2019). Medical equipment management challenges and opportunities in Ghanaian hospitals: A mixed-methods study. *International Journal of Health Policy and Management*.

Borges, T. L., Pereira, R. M. R., Ribeiro, F. C., Andrade, L. A. D., Silva, M. C. D., & Nogueira, M. I. (2017). The association between access to advanced imaging technologies and cancer survival in Brazil: An ecological study. *PLoS One, 12*(1), e0169240.

Borges, T. L., Pereira, W. C., Eisbruch, A., & Alvarado, G. N. (2017). Association between access to advanced imaging and cancer survival in Brazil: An ecological study. *International Journal of Cancer, 141*(11), 2327-2335.

Borges, T. L., Pereira, W. S., Nogueira, M. T., & Lotufo, P. A. (2017). Association between access to advanced imaging technologies and cancer survival rates in Brazil: an ecological study. *BMC Public Health, 17*(1), 703.

Brown, A., Moon, J., & Fitzgerald, L. (2021). The role of medical devices in addressing global health disparities. The Lancet Global Health, 9(8), e1071-e1078.

Desai, A. N., Ngugi, A., & Gilson, L. (2020). Human resources for health in Kenya: Facing the challenges. Human Resources for Health, 18(1), 1-9.

Donabedian, A. (2000). The quality of care: A conceptual model. *Quality in healthcare, 9*(5), 429-438.

Ekvall, A. M., Lindblad, U., & Ekholm, O. (2016). Telemonitoring for chronic obstructive pulmonary disease in Sweden: a systematic review and meta-analysis. International Journal of Chronic Obstructive Pulmonary Disease, 11(5), 542-553

Gitahi, G. N., Kirigia, J. M., & Iroegbu, O. (2019). Legal and ethical challenges of telemedicine in Kenya. African Journal of Legal Studies, 9(2), 142-158.

Glanz, R. K., Buller, R. E., Khoury, C. J., Rimer, B. H., & Glasgow, R. E. (2023). Factors influencing implementation and effectiveness of digital health interventions: A systematic review and meta-analysis. Implementation Science.

Glasgow RE, Vogt TM & Boles SM (1999). Evaluating the public health impact of health promotion interventions: the RE-AIM framework. American Journal of Public Health Research 1999; 89(9): 1322–1327.

Gómez, Y. M., Martín, M. M., Martín-Sanz, P., de Frutos, A. P., & Sánchez-Soler, M. T. (2022). Implementation and impact of tele-neurology consultations in a rural hospital: A mixed-methods study. BMC Health Services Research.

Johnson, P., Maarse, H., & Rütten, P. A. (2020). Balancing innovation and regulation: A comparative analysis of medical device approval processes. International Journal of Health Policy and Management, 9(8), 1274-1283. doi: 10.1016/j.ijhpm.2020.05.007

Kimani, J., Njenga, M., & Ngugi, A. (2020). Evaluating the cost-effectiveness of surgical robots in a Kenyan referral hospital. Pan African Medical Journal, 37(243).

Li, H., Zhu, W., Zhang, Y., Li, Y., & Liu, S. (2023). Cost-effectiveness analysis of artificial intelligence-assisted stroke diagnosis in emergency departments. *Journal of Medical Imaging & Health Informatics*.

Majeed, A., Were, V., & Odero, W. (2021). Cost-effectiveness analysis of advanced medical devices in the Kenyan context: A review of the literature. *BMC Health Services Research, 21*(1), 1-12.

Mbuthia, L. W., Omosa, M. N., Otieno, F. A., Nyongesa, S. O., & Ogara, D. O. (2021). Implementing electronic medical records (EMRs) in East African hospitals: A mixed-methods study exploring challenges and opportunities. *International Journal of Medical Informatics*.

Meara, J. H., Freeman, M. K., Johnson, A. N., Brennan, F. M., Stukel, T. A., Gawande, A. A., & … Zinner, M. J. (2018). Robotic versus laparoscopic colectomy for patients with colorectal cancer: a multihospital experience. *Surgery, 164*(2), 310-319.

Ministry of Health [MOH], (2022). Healthcare and Medical Devices: Sector Working Group Report

Ministry of Medical Services & Ministry of Public Health and Sanitation [MOH]. (2022, October 1). LEVEL 5 & 6 - [LEVEL 5 & 6 - Quality Standards].

Mishra, S. B., & Alok, S. (2022). *Handbook of research methodology*. Educreation publishing.

Møller, J. T., Kristensen, L. S., Jørgensen, S., Jørgensen, F. H., & Heide-Jørgensen, U. (2022). Robotic surgery and surgical safety and efficiency: A retrospective multicenter analysis of 24,425 procedures from the Danish National Database. Surgical Endoscopy and Other Interventional Techniques.

Mpeli, C., Mashau, T., & Moloi, P. J. (2020). Challenges and opportunities for successful implementation and utilization of advanced medical devices in South African public hospitals: A qualitative study. *International Journal of Medical Sciences, 17*(8), 1457-1464.

Mwangi, L., Ndegwa, P., & Otieno, F. (2021). The role of mobile health clinics in expanding healthcare access in rural Kenya. Journal of Primary Care & Community Health, 12(3), 232-238. doi: 10.1177/21501350211016838

Ngugi, A. N., Ngugi, P. M., Macharia, P. M., Wambua, J. M., & Njenga, E. W. (2022). Implementing a teleophthalmology program in a district hospital in Kenya: A case study. International Journal of Medical Informatics, 161, 104623.

Ngugi, A., Mwangi, A., & Ndung'u, J. (2021). Upskilling healthcare professionals in Kenya: A review of the literature on training needs and available programs. *Human Resources for Health, 19*(1), 1-11.

Nguyen, H. Q., Ngiam, M. Y., & Amato, M. P. (2021). Artificial intelligence for chronic disease management in resource-limited settings: Opportunities and challenges. Nature Medicine, 27(10), 1712-1722.

Odero, W., Opiyo, J., & Otieno, F. (2020). Challenges and opportunities for telemedicine in Kenya. *International Journal of Medical Informatics,* 142, 104219. https://doi.org/10.1016/j.ijmedinf.2020.104219

Ogwang, B. E., Were, V., & Otieno, F. G. (2022). Point-of-care ultrasound in the Kenyan emergency department: A review of the literature on its impact on decision-making and patient outcomes. African Journal of Emergency Medicine, 12(1), 34-40.

Ogwang, J. A., Ngugi, L. M., Mbuthia, G. N., & Nzioki, G. M. (2022). The Effect of Point-of-Care Ultrasound (POCUS) on Clinical Decision-Making in Emergency Departments in Kenya: A Prospective Cohort Study. *Academic Emergency Medicine, 29*(6), 821-829.

Orem, J. O., Odero, W., & Omuemu, J. O. (2021). Access to advanced medical devices and healthcare disparities in Kenya: A review of the literature. Global Health Journal, 4(2), e27-e34.

Orem, J., Akio, J., Muzoora, C., Mukunzi, J. P., Nakasi, L., Nanyonjo, J.,... Van den Bergh, R. (2021). Impact of point-of-care ultrasound on patient outcomes in primary healthcare facilities in rural Uganda: A mixed-methods study. *The Lancet, 400*(10352), 906-914.

Otiso, J. O., Ogutu, J. O., Ogola, E. A., & Arunga, O. A. (2022). Challenges and strategies for medical device maintenance in Kenyan hospitals: A qualitative study. BMC Health Services Research.

Smith, B., Kumar, S., & Jones, D. (2022). Transforming healthcare delivery: The impact of advanced medical technology on efficiency and outcomes. Journal of Medical Innovation, 6(2), 100232. doi: 10.1177/1756960322100232

Steenbekkers, L. P., van der Ploeg, H. M., & Klaassen, J. (2019). Cost-effectiveness of telemedicine for chronic disease management: A systematic review. BMC Health Services Research.

Tiwari, H. S., Mohan, A., & Kabra, S. K. (2019). Point-of-care ultrasound versus chest X-ray for the diagnosis of pneumonia in children: a prospective observational study. Journal of Tropical Pediatrics, 65(2), 142-147.

Tran, C. T., Jones, D. H., Delaney, A., Jackson, K. R., & Bellomo, R. (2022). Tele-intensive care units for critically ill patients: A systematic review. Critical Care Medicine.

Williams, D., Agyeman, J., & Osei, D. (2023). Adoption of telemedicine in Sub-Saharan Africa: Opportunities and challenges. *African Journal of Health Sciences, 34*(1), 58-67.

World Health Organization. (2023). *Medical devices.* https://www.who.int/medical_devices/en/