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INFLUENCE OF HOSPITAL INFRASTRUCTURE ON QUALITY HEALTHCARE SERVICE PROVISION AT KENYATTA NATIONAL HOSPITAL

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ABSTRACT
Quality healthcare service provision is pivotal for achieving Sustainable Development Goals, particularly in national referral hospitals like Kenyatta National Hospital, Kenya. This study aimed to identify determinants influencing quality healthcare provision at KNH, focusing on human resources, infrastructure, system optimization, and health financing. This paper focuses on the influence of hospital infrastructure on quality healthcare service provision at Kenyatta National Hospital. A descriptive cross-sectional design was employed, targeting 5,779 healthcare workers with a stratified random sample of 374. Data were collected using pre-tested questionnaires, achieving an 88.2% response rate (n=330). Reliability was confirmed with Cronbach's a=0.811. Descriptive statistics revealed a high level of agreement regarding the influence of infrastructure, with mean scores exceeding 3.0. Inferential analysis showed a significant positive relationship between hospital infrastructure and quality care (r=0.445, p<0.01). Furthermore, logistic regression identified infrastructure as the strongest predictor of quality healthcare service provision (β=0.593), with the model explaining 66.8% of the variance (Cox & Snell R^2=0.668). The findings underscore the pivotal role of hospital infrastructure investment in enhancing service quality at KNH. The study recommends prioritizing infrastructure upgrades as a strategic pathway to improve patient care outcomes and operational efficiency.

KEY WORDS: *Hospital Infrastructure, Quality Healthcare Service, Healthcare Workers*

INTRODUCTION
Quality healthcare is a fundamental pillar of health systems and is essential to achieving Sustainable Development Goals (SDGs), especially in public hospitals such as Kenyatta National Hospital (KNH). According to the World Health Organization (2016), quality service delivery encompasses timely, effective, and patient-centered care supported by appropriate facilities and a skilled workforce. Hospital infrastructure—comprising buildings, medical equipment, layout, and sanitation—plays a pivotal role in facilitating or impeding this delivery. As observed by Moro Visconti and Martiniello (2019), the absence of reliable infrastructure affects not only clinical care delivery but also the morale and productivity of healthcare workers. Furthermore, Zodpey et al. (2018) emphasize that infrastructure is a critical enabler of Universal Health Coverage (UHC), underpinning the broader objective of accessible and equitable healthcare.

Studies have consistently highlighted the significant relationship between healthcare infrastructure and patient outcomes. Aiken et al. (2011) found that modern facilities equipped with up-to-date technology were associated with lower mortality rates, reinforcing the value of continuous infrastructure investment. Similarly, Banerjee et al. (2020) demonstrated that a clean, accessible, and comfortable hospital environment contributes to greater patient satisfaction and better clinical outcomes. The World Health Organization (2020) further asserts that the availability and maintenance of essential equipment and medicine are central to achieving high-quality care, particularly in resource-constrained settings. Infrastructure, therefore, not only enhances clinical efficiency but also directly impacts safety, accuracy of diagnosis, and treatment effectiveness.

Infrastructure maintenance and modernization are indispensable for sustaining quality service delivery. Adeoye et al. (2022) emphasized that poor sanitation, aging buildings, and malfunctioning equipment increase the risk of healthcare-associated infections and compromise patient safety. Moreover, Kampf et al. (2022) linked inadequate hygiene infrastructure to high infection rates, while Galea et al. (2021) pointed out that resilient infrastructure is crucial in managing emergencies and maintaining service continuity. Investments in design, accessibility, and maintenance not only foster a healing environment but also empower healthcare professionals to perform their duties efficiently (Ulrich et al., 2020; WHO, 2022). These studies collectively underscore that infrastructure must be both physically robust and functionally responsive to dynamic healthcare needs.
Technological integration within hospital infrastructure further elevates care quality by improving communication, diagnostics, and operational efficiency. Kwon et al. (2023) found that digital technologies such as electronic health records

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and automation significantly enhanced patient safety and clinical decision-making. Likewise, Bates et al. (2021) noted that electronic systems reduce medication errors and streamline processes. However, technology must be implemented alongside human-centered design principles to ensure usability and effectiveness (Char et al., 2023). In the context of KNH, the strategic adoption of such innovations within a well-maintained physical environment is crucial for meeting patient expectations and bridging the quality perception gap (Kenyatta National Hospital, 2023; Oketch, 2020). These insights affirm that hospital infrastructure, when well-resourced and integrated with smart technologies, is a foundational determinant of quality healthcare service provision.

Problem Statement

The provision of quality healthcare services in public hospitals remains essential to Kenya's national health goals and population well-being (Muthui, 2019). Yet, infrastructure challenges such as aging facilities, limited integration of digital systems, poor layout, and inadequate sanitation persistently hinder service delivery, particularly in major referral hospitals (Musyoka, Ochieng, & Nzioki, 2021). These structural issues have been linked to inefficiencies like prolonged waiting times, increased risk of infection, and reduced patient satisfaction. At Kenyatta National Hospital (KNH), Kenya's largest referral hospital, such infrastructural gaps are notably significant. Despite its strategic role in delivering specialized healthcare and setting benchmarks for other facilities, KNH continues to grapple with substandard buildings, outdated equipment, and limited adoption of smart technologies, all of which adversely impact service quality and staff effectiveness. A 2021 internal survey by KNH's Healthcare Quality Division revealed a 9.7% gap between patients' quality-of-care expectations (93%) and their perceived experience (83.3%) (Kenyatta National Hospital, 2021). This disparity has been partly attributed to dissatisfaction with the hospital's physical environment and infrastructure. Furthermore, issues such as overcrowding, broken equipment, and unsanitary conditions have led to avoidable delays and prolonged hospital stays, undermining operational efficiency and escalating costs (Oketch, 2020; Musyoka et al., 2021). While studies like those by Musyoka et al. (2021) and Mbangua et al. (2021) offer valuable insights, their scope excludes the unique infrastructure demands of a national referral hospital. Accordingly, this study focuses on exploring the influence of hospital infrastructure on quality healthcare service provision at Kenyatta National Hospital, Kenya.

Objective of the Study

The main aim of the study was to determine the influence of hospital infrastructure on quality healthcare service provision at Kenyatta National Hospital.

Research Questions

How does hospital infrastructure influence quality healthcare service provision at Kenyatta National Hospital?

LITERATURE REVIEW

Quality of Healthcare in Public Hospitals

Quality healthcare service provision is a multifaceted endeavor influenced by a variety of factors, as demonstrated in recent studies. In the context of public healthcare facilities, such as Mwingi Sub-county Hospital in Kitui County, several crucial elements have been identified. Muthui (2018) emphasized the significance of employee capacity, leadership, and commitment, alongside the availability of resources, as pivotal factors shaping the quality of healthcare services in the public sector. These findings underscore the vital role played by skilled professionals, effective management, and sufficient resources in ensuring the delivery of high-quality healthcare services.

Patient-centered care, a holistic approach focusing on individual patient needs and preferences, has emerged as a key determinant of healthcare service quality. A systematic review conducted in 2022 illuminated the positive impact of patient-centered care on the overall quality of healthcare services. This approach emphasizes a tailored, empathetic approach to patient care, recognizing the unique requirements of each individual. The findings underscore the importance of personalized healthcare delivery in enhancing service quality and patient satisfaction (Systematic Review, 2022).

Mortality Rates

Mortality rates are a fundamental indicator of healthcare quality, reflecting the ultimate outcome of care. Krumholz et al., (2020) analysed the correlation between hospital care quality and mortality rates for certain conditions like heart failure and pneumonia. The study found that hospitals with higher adherence to evidence-based care processes had significantly lower 30-day mortality rates. Weiser et al., (2021) highlighted the impact of surgical safety checklists on postoperative mortality, revealing a substantial reduction in death rates when checklists were rigorously applied.

Mbaruku et al (2018) explored the impact of quality improvement interventions, including enhanced communication and teamwork, on maternal mortality. The study's findings indicated a significant reduction in mortality rates following the implementation of these interventions. The success of these strategies underscores the critical role of effective communication and collaboration among healthcare providers in improving maternal outcomes in low-resource settings. This study suggests that targeted interventions focusing on the healthcare team's dynamics can lead to substantial improvements in patient care and survival rates.

Ntshali, Mkandawire and Zijen, (2019) assessed the link between the volume of surgical procedures performed in hospitals and the associated mortality rates. The findings revealed that hospitals with higher volumes of specific surgical procedures tended to have lower mortality rates. This correlation suggests that concentrating resources and expertise in higher-volume centers can enhance surgical outcomes and reduce mortality. The study highlights the importance of strategic resource allocation and the potential benefits of centralizing complex surgical care in high-volume hospitals to leverage experience and specialized skills.

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Atuyambeet al. (2017) focused on neonatal mortality trends over more than a decade. The study pinpointed critical factors contributing to high mortality rates, such as limited access to skilled birth attendants and quality care facilities. Despite some improvements over time, the persistently high rates of neonatal mortality emphasize the need for continued efforts to enhance access to and the quality of maternal and neonatal healthcare services. This study illustrates the ongoing challenges faced by rural areas in providing adequate healthcare and the necessity of targeted interventions to address these gaps.

Readmission rates

Readmission rates serve as an indicator of the effectiveness and continuity of care. High readmission rates often point to gaps in care coordination or the adequacy of treatment and post-discharge support. Figueroa et al., (2021) explored the relationship between hospital readmission rates and quality of care, indicating that lower readmission rates were associated with better patient outcomes and higher overall care quality, especially for conditions like heart failure and COPD. Moreover, interventions focusing on enhanced care coordination and patient education have shown promising results in reducing readmissions, emphasizing the role of comprehensive discharge planning and follow-up care.

Ozaydin, Caliskan and Unal (2021) found that 30-day readmissions after heart failure hospitalizations were closely associated with increased mortality. This association underscores the necessity of considering readmission rates as a vital quality indicator for heart failure care. The study's findings suggest an urgent need for strategies that not only improve the initial hospital care but also ensure effective post-discharge support and management.

Similarly, a systematic review and meta-analysis conducted by Peverill, Robinson, and Desai (2016) examined hospital readmissions for COPD, revealing that readmission rates were high and correlated with worse patient outcomes. The study identified factors such as inadequate discharge planning and lack of social support as significant contributors to high readmission rates. These findings highlight the complexities of managing COPD post-discharge and the importance of comprehensive care strategies.

An extensive review by Linden, Rosenthal and Ware (2014)on the "Impact of unplanned readmissions on healthcare costs and outcomes" across various conditions confirmed that readmissions significantly burden healthcare costs and are linked with poorer patient outcomes. This study emphasizes the broader implications of readmissions beyond individual conditions, suggesting systemic issues within healthcare transitions and discharge processes.

Timeliness of care

Timeliness of care is critical in preventing complications and worsening of health conditions. Delays in care can significantly impact outcomes, especially in acute conditions requiring immediate attention. Pines et al., (2022) examined the effects of emergency department wait times on patient outcomes. It found that longer wait times were associated with increased in-hospital mortality, longer hospital stays, and higher costs. On the other hand, initiatives to improve access to primary care and streamline emergency department processes have been effective in reducing wait times and improving patient satisfaction and outcomes.

Zhang et al., (2020) conducted a retrospective cohort study to investigate the association between emergency department (ED) length of stay (LOS) and 30-day mortality in critically ill patients. The study, published in BMC Emergency Medicine, aimed to provide insights into the impact of ED wait times on patient outcomes. The study population consisted of critically ill patients admitted to the ED. The researchers analyzed data on LOS in the ED and subsequent 30-day mortality rates. Their findings revealed a significant association between prolonged ED LOS and increased 30-day mortality rates among critically ill patients. Specifically, patients with longer ED stays were more likely to experience adverse outcomes within 30 days of admission.

Shanafelt, Edelson and McGuire (2013) investigated the effect of ED wait times on hospital readmissions and mortality. Published in JAMA Internal Medicine, this study aimed to explore the impact of prolonged ED wait times on patient outcomes beyond the initial ED visit.The researchers analyzed data on ED wait times, hospital readmissions, and mortality rates among a large cohort of patients. Their findings revealed a significant association between extended ED wait times and higher rates of hospital readmissions and mortality. Patients who experienced longer wait times in the ED were more likely to be readmitted to the hospital within 30 days and had increased mortality rates compared to those with shorter wait times.This study highlights the potential consequences of delays in accessing emergency care on subsequent healthcare utilization and patient outcomes. It emphasizes the importance of improving ED efficiency and reducing wait times to enhance patient care quality and reduce the burden on healthcare systems.

Sauerland, Liu and Zare(2016) conducted a systematic review to evaluate the impact of reducing ED wait times on patient satisfaction and clinical outcomes. Published in the Annals of Emergency Medicine, this review aimed to assess the effectiveness of interventions aimed at improving ED efficiency.The researchers synthesized evidence from multiple studies investigating interventions to reduce ED wait times, such as process improvements, staffing changes, and technological innovations. Their review found that interventions aimed at reducing ED wait times were associated with improvements in patient satisfaction and clinical outcomes. Specifically, shorter wait times were correlated with higher patient satisfaction scores and better clinical outcomes, including reduced mortality rates and hospital admissions.

Hospital Infrastructure and provision of quality Healthcare Service

The physical environment of a hospital, encompassing its infrastructure and facilities, plays a crucial role in the quality of healthcare services provided. This review explores the relationship between hospital infrastructure and the delivery of quality care, examining relevant research and its implications.

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Studies have demonstrated that improved infrastructure and patient outcomes has a positive correlation between well-maintained and modern hospital infrastructure and improved patient outcomes. For instance, research by Aiken et al. (2011) highlights how modern facilities with appropriate technology are associated with lower mortality rates. The physical environment can significantly impact patient experience. Studies like that of Banerjee et al. (2020) find that factors like cleanliness, comfort, and accessibility within the hospital contribute to patient satisfaction and overall well-being.A well-designed and well-maintained hospital infrastructure can contribute to improved staff efficiency and workflow. Studies by the American Hospital Association (AHA) (2023) highlight how modern facilities with proper layout and equipment can optimize staff workflows, leading to better time management and patient care.

Several key infrastructure components significantly impact the provision of quality healthcare services. Functional layouts that optimize patient flow, minimize travel distances, and ensure efficient use of space are essential The Joint Commission, (2023).Access to cutting-edge medical equipment, efficient information systems, and well-maintained facilities are crucial for accurate diagnoses, effective treatment, and improved patient outcomes Aiken et al. (2011).Regular maintenance of buildings, equipment, and proper sanitation practices are essential to ensure a clean, safe, and hygienic environment for both patients and staff World Health Organization, (2017).Ensuring the entire facility is accessible to individuals with disabilities and adhering to safety regulations are paramount American with Disabilities Act, (1990).

Hospitals are increasingly focusing on sustainable design and construction practices that minimize environmental impact and promote energy efficiency AHA, (2023).The integration of smart technologies like building automation systems, tele-health, and data analytics is transforming hospital operations and improving efficiency in areas like resource management and patient care delivery Zhang et al. (2020).The design of hospitals is evolving to prioritize patient-centered care, with a focus on creating comfortable, healing spaces that support patient autonomy and well-being (The Center for Health Design, 2023).

Essential Equipment and Medication

Aiken et al. (2022) conducted a comprehensive cross-sectional study across multiple hospitals in sub-Saharan Africa to assess the relationship between the availability of essential intensive care unit (ICU) equipment and medications and hospital mortality rates. Utilizing a detailed survey that quantified the availability of critical ICU resources, the study applied statistical analyses to correlate these availability metrics with patient mortality data extracted from hospital records. The significant association found between limited ICU resource availability and higher mortality rates underscores the necessity of bolstering ICU resources to improve patient outcomes in the region.

Meara et al. (2020) employed a mixed-methods approach to explore the impact of limited access to essential surgical equipment on outcomes in LMICs. The study combined quantitative data analysis of surgical success rates from hospital records with qualitative interviews from surgical staff across various countries. This methodology highlighted the direct link between resource scarcity and compromised surgical care quality, advocating for targeted interventions to enhance the availability of surgical equipment.

The World Health Organization (2020) undertook a systematic review to scrutinize the impact of essential medicine availability and affordability on healthcare quality in LMICs. This review meticulously analyzed data from numerous studies, employing a rigorous inclusion criterion that ensured the synthesis of high-quality evidence. The findings pointed to the stark impact of medicine scarcity on healthcare quality, emphasizing the need for comprehensive policy reforms.

Saksena et al. (2021) conducted an observational study to investigate how healthcare infrastructure and resources affect the utilization of essential medicines. By collecting data on infrastructure quality, medicine supply chains, and healthcare accessibility across several LMICs, and analyzing these against medicine utilization rates, the study provided empirical evidence on the necessity of infrastructure improvements for enhancing medicine accessibility.

Frenk et al. (2021) utilized a case study approach to examine the relationship between a skilled healthcare workforce, the availability of essential medicines, and the quality of care. Through in-depth analyses of several healthcare settings with varying levels of resource availability, the study illuminated how the expertise of the healthcare workforce plays a critical role in the effective use of essential medicines, directly impacting care quality. This approach underscored the multifaceted nature of healthcare quality improvement, which requires simultaneous investment in both human and material resources.

Infrastructure Maintenance

Adeoye et al. (2022) conducted a systematic review to synthesize evidence on the impact of health facility infrastructure on quality of care. The methodology involved a comprehensive search of databases for studies that assessed infrastructure's influence on various qualities of care aspects, including patient safety, infection control, and efficiency. By aggregating data from numerous studies, the review highlights the substantial effect of infrastructure on care quality, emphasizing the need for improved facility design and maintenance.

Kampf et al. (2022) explored the association between hospital hygiene, sanitation infrastructure, and the incidence of healthcare-associated infections. The study employed a cross-sectional design, gathering data from various hospitals to evaluate their sanitation practices and infrastructure. Statistical analysis revealed a strong link between inadequate sanitation infrastructure and increased rates of healthcare-associated infections, highlighting the critical role of proper sanitation in ensuring patient safety.

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Clasen et al. (2021) investigated the impact of water and sanitation infrastructure on maternal health outcomes in rural communities. The study's methodology involved a longitudinal analysis of maternal health records from several rural communities, comparing outcomes in areas with varying levels of water and sanitation infrastructure. The results demonstrated that poor infrastructure significantly contributes to adverse maternal health outcomes, emphasizing the need for improved water and sanitation facilities in these areas.

Galea et al. (2021) conducted a study to explore the importance of resilient infrastructure in maintaining healthcare quality during emergency situations. Utilizing a case study approach, the research examined health facilities' responses to public health emergencies, focusing on infrastructure's role in these responses. The findings suggest that resilient infrastructure is crucial for sustaining care quality during crises, providing valuable insights into emergency preparedness.

Ulrich et al. (2020) examined how healthcare facility design and maintenance affect patient experience and staff well-being. Through a mixed-methods approach that combined surveys, interviews, and facility audits, the study assessed perceptions of design and maintenance among patients and staff. The results indicate a significant connection between facility design, maintenance, and both patient and staff satisfaction, underlining the broader implications of infrastructure on healthcare quality.

The World Health Organization (2022) emphasized the importance of investing in infrastructure maintenance as a strategy for sustainable healthcare quality improvement. This report adopted a policy analysis approach, reviewing existing data on maintenance practices and their outcomes in healthcare settings. It advocates for increased investment in maintenance, highlighting its potential to significantly enhance care quality across various dimensions.

Technology Adoption

Kwon et al. (2023) conducted a systematic review analyzing numerous studies to understand the impact of digital technologies on healthcare quality. The methodology involved a comprehensive search of databases for studies that reported on digital technology interventions in healthcare settings. The review specifically looked at patient safety, efficiency, and clinical decision-making. The findings revealed a consistently positive impact of digital technologies across these areas, highlighting the potential of technology to enhance various aspects of healthcare quality.

Topol and Rajalingham (2022) review current applications of artificial intelligence (AI) in healthcare and its future directions. The review method involved analyzing studies and reports on AI applications in clinical settings, including diagnosis, treatment planning, and patient monitoring. The findings suggest that AI has the potential to revolutionize healthcare by improving accuracy in diagnosis and personalizing treatment plans, thereby enhancing overall care quality.

Bates et al. (2021) systematically reviewed the impact of electronic health records (EHRs) on patient safety. The review methodology included searching for studies that assess EHR implementations' effects on safety outcomes. The findings indicated that while EHRs have the potential to improve patient safety by reducing medication errors and improving clinical decision-making, they also present challenges such as user interface issues and information overload.

Char et al. (2023) emphasize the role of human-centered design in developing healthcare technologies. The article methodologically reviews principles of human-centered design and their application in technology development processes. It argues that focusing on the users' needs and experiences can ensure that healthcare technologies are both ethical and effective in improving quality of care. Understanding the needs, experiences, and limitations of patients, clinicians, and other stakeholders is crucial. This goes beyond demographics to consider emotional, cultural, and accessibility factors.

RESEARCH METHODOLOGY

Research Design and Target Population

The study employed a descriptive cross-sectional survey design, as advocated by Kothari and Garg (2014), to capture the current status of healthcare workers without manipulating any variables. This design, supported by Cooper and Schindler (2007), is well-suited for analyzing and understanding prevailing conditions. Its structured approach also facilitates focused data collection aligned with the study's objectives, enhancing the research's overall validity.

The target population consisted of 5,779 healthcare workers at Kenyatta National Hospital (KNH), including nurses, clinical officers, medical officers, and support staff. Drawing from definitions by Cooper and Schindler (2003) and Mugenda and Mugenda (2003), the population encompassed all individuals with relevant, observable characteristics necessary for the study. This diverse and inclusive population enabled a comprehensive assessment of healthcare professionals across different roles.

Sampling

To determine the sample size, Yamane's 1967 formula was used with a 5% margin of error, yielding a sample size of 374 respondents, equivalent to 6.5% of the total population. Stratified random sampling was applied to ensure proportional representation across different departments. This technique divides a heterogeneous population into homogenous subgroups, from which random samples are then drawn. This method minimizes sampling error and ensures that all groups within KNH were adequately represented.

Data Collection

Data were collected using structured, self-administered questionnaires distributed to Kenyatta National Hospital staff via a drop-and-pick method, allowing flexible completion. A pilot test with 30 Mbagathi Hospital staff ensured clarity, flow, and reliability, with Cronbach's alpha ≥ 0.7 confirming internal consistency. Validity was ensured through supervisor-reviewed content and face validity, enhancing the tool's accuracy and standardization.

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Data analysis

Data analysis included editing the questionnaires for completeness and consistency. The study gathered both qualitative and quantitative data, with the latter entered into SPSS Version 26 for analysis. Descriptive statistics, such as frequencies, means, and standard deviations, were used alongside inferential statistics, specifically logistic regression, to examine relationships between independent and dependent variables. Results were presented through tables and graphs, with interpretations provided in narrative form.

Ethical Considerations in Research

Ethical approvals were sought from KEMU and NACOSTI before commencement of study. Additionally, written consent was sought from all respondents before commencement of data collection. The confidentiality and privacy of the respondents were assured. The researcher made sure the respondents understand that the data collected will be treated with utmost respect with a sole purpose of fulfilling an academic study requirement.

RESULTS AND DISCUSSIONS

Response Rate and Instrument Reliability and Validity

Out of the 374 targeted respondents, the study achieved a high response rate of 88.2% with 330 completed questionnaires. Reliability of the instrument was confirmed with a Cronbach's Alpha of 0.811, exceeding the acceptable threshold of 0.7, indicating consistent responses. Validity was ensured through expert input from the research supervisor, who reviewed and approved the refined tool.

Demographic Analysis

The study had a nearly equal gender representation, with 51.8% female and 48.2% male respondents, indicating no gender bias. In terms of age, the majority of participants (43.6%) were between 30 and 45 years, followed by 40% who were above 45 years, and 16.4% under 30. Educationally, 42.1% held diploma qualifications, 24.5% had degrees, 22.4% held postgraduate qualifications, and 10.9% had certificates, reflecting a fairly educated workforce.

Regarding work experience, most respondents (36.7%) had over 15 years of service, while others had worked 11–15 years (21.8%), under 5 years (23%), or 6–10 years (18.5%). Professionally, nurses made up the largest group (47.6%), followed by administrative staff (20.3%), doctors (12.4%), paramedics (12.1%), and clinical officers (7.6%). This diversity ensured a comprehensive range of perspectives across different roles and experience levels.

Analysis of Hospital infrastructure

The analysis of hospital infrastructure at Kenyatta National Hospital (KNH) reveals a moderate level of agreement among staff, with an overall mean score of 3.44 (SD = 1.14), indicating that while the system is broadly functional, perceptions of full adequacy remain limited. Specific statements such as “The essential equipment I need to perform my duties is readily available” (mean = 3.47) and “If a piece of equipment malfunctions, it is promptly repaired or replaced” (mean = 3.52) suggest a reasonably satisfactory experience with both equipment availability and maintenance responsiveness. These findings reflect that infrastructure at KNH, though operational, has not fully met the expectations of staff in terms of reliability, accessibility, and technological support.

Disaggregated data highlights areas of strength in maintenance responsiveness and safety—for instance, safe elevator use scored relatively high (mean = 3.59). However, notable weaknesses were evident in the sufficiency of medicine stock and adequacy of technology training, both with mean scores of 3.34. These patterns are consistent with the conclusions drawn by Adeoye et al. (2022), whose systematic review underscored that infrastructure directly influences quality of care by impacting operational efficiency and staff workflows. Similarly, Kampf et al. (2022) established that hospital sanitation and infrastructure maintenance correlate strongly with staff morale and patient safety, reinforcing the need for robust facility upkeep.

Further, the finding that some staff perceive technology as slowing down workflow (mean = 3.47) echoes the work of Ulrich et al. (2020), who demonstrated that poorly integrated or inadequately supported health technology can create inefficiencies despite being structurally advanced. This concern is further supported by the World Health Organization (2022), which emphasized that investments in infrastructure must be matched by training and system optimization to yield tangible improvements. Clasen et al. (2021) also highlighted that insufficient infrastructure—particularly in water, sanitation, and essential services—has a measurable negative impact on healthcare outcomes, particularly in high-pressure environments like KNH.

In summary, the analysis suggests that KNH has established a functional infrastructural foundation, particularly in equipment maintenance and basic utilities. However, to transform moderate satisfaction into high confidence, targeted interventions are needed to enhance technological integration, streamline training programs, and ensure a consistent supply of essential medical resources. These enhancements are vital for maximizing the infrastructure’s impact on staff performance and, ultimately, on patient care outcomes.

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Table 1: Hospital Infrastructure

Statement	SD	D	MA	A	SA	Mean	SD
The essential equipment I need to perform my duties is readily available in my department.	6.7%	17.0%	15.8%	43.6%	17.0%	3.47	1.154
There are sufficient quantities of essential medicines stocked in the hospital pharmacy.	4.8%	23.0%	22.1%	33.3%	16.7%	3.34	1.146
I am aware of the protocols for requesting new or replacement equipment.	7.6%	16.7%	15.5%	45.2%	15.2%	3.44	1.158
If a piece of equipment malfunctions, it is promptly repaired or replaced.	3.3%	17.0%	20.0%	43.9%	15.8%	3.52	1.052
Expired medicines are promptly removed from circulation.	0.0%	24.8%	15.2%	38.5%	21.5%	3.57	1.085
I feel safe using the elevators at KNH.	0.0%	20.6%	20.9%	37.6%	20.9%	3.59	1.037
When I report a maintenance issue at KNH, staffs are responsive and take action to address it.	5.2%	20.0%	21.8%	34.8%	18.2%	3.41	1.148
KNH communicates planned maintenance activities clearly and provides updates on their progress.	5.2%	20.3%	19.4%	40.0%	15.2%	3.4	1.123
Infrastructure issues at KNH rarely disrupt my ability to perform my duties effectively.	5.5%	19.1%	23.0%	36.7%	15.8%	3.38	1.124
The overall condition of the infrastructure at KNH promotes a positive work environment.	5.5%	20.3%	21.5%	33.6%	19.1%	3.41	1.166
I am comfortable using technology in my daily work at KNH.	5.5%	21.5%	17.3%	38.8%	17.0%	3.4	1.158
KNH provides adequate training for staff on new technologies.	9.7%	17.0%	17.3%	42.1%	13.9%	3.34	1.195
The technology currently used at KNH improves my ability to perform my job duties.	9.7%	19.1%	13.0%	43.9%	14.2%	3.34	1.215
The different technologies used at KNH integrate well with each other.	5.8%	19.4%	19.4%	40.9%	14.5%	3.4	1.137
The technology slows me down then hinders my workflow more than it helps.	4.2%	18.8%	14.8%	38.5%	23.6%	3.47	1.119
Aggregate mean						**3.43**	**1.13**

n = 330

Provision of Quality Healthcare Service

The analysis of responses concerning the provision of quality healthcare services at Kenyatta National Hospital (KNH) reveals a moderate level of agreement among staff, with an overall mean of 3.47 (SD = 1.16). This indicates a general sense of neutrality, suggesting that while there are ongoing efforts to improve service quality, further enhancements are necessary to translate moderate perceptions into strong approval. Notably, higher ratings were observed in areas such as reduced mortality and complication rates (mean = 3.57) and the improved cost-effectiveness of interventions (mean = 3.50), indicating a perceived advancement in tangible clinical outcomes. However, slightly lower scores for adherence to clinical protocols (mean = 3.41) and optimized resource utilization (mean = 3.43) point to persistent challenges in procedural consistency and operational efficiency.

These findings align with those of Aiken et al. (2022), who demonstrated that limited availability of ICU equipment and essential medicines significantly compromised clinical outcomes, such as increased mortality, across hospitals in sub-Saharan Africa. Similarly, Meara et al. (2020) emphasized that the lack of critical surgical resources in LMICs led to decreased surgical success rates, reinforcing the notion that inefficiencies in resource utilization impede the delivery of high-quality, patient-centered care. Moreover, Saksena et al. (2021) showed that poor infrastructure and weak supply chains directly affect the accessibility and effective use of essential medicines, further echoing staff concerns at KNH.

In summary, the KNH findings reflect a broader pattern observed in the literature: while structural and clinical improvements are underway, achieving consistent and high-quality healthcare delivery in public hospitals requires strategic investments in infrastructure, supply systems, and workforce development. The results advocate for a systemic and sustained approach to reform that strengthens both the hardware (infrastructure and equipment) and software (protocols, training, and coordination) of healthcare delivery.

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Table 2: Provision of Quality Healthcare (n = 330)

Statement	SD	D	MA	A	SA	Mean	SD
Patients are treated with courtesy and respect	6.1%	16.7%	20.9%	38.8%	17.6%	3.45	1.14
Timeliness of Care is boosted	5.8%	16.7%	21.5%	39.7%	16.4%	3.44	1.121
Patient safety and infection control is enhanced	5.8%	20.9%	16.4%	36.7%	20.3%	3.45	1.192
Patient satisfaction is enhanced e.g. reduced patient complaints	6.1%	17.9%	19.7%	37.0%	19.4%	3.46	1.167
Mortality Rates, Morbidity Rates and Complication Rates have decreased	6.1%	15.2%	15.5%	42.1%	21.2%	3.57	1.157
Adherence to clinical protocols is enhanced	6.1%	19.4%	19.4%	37.6%	17.6%	3.41	1.162
Access to healthcare is boosted	5.8%	19.4%	14.5%	40.6%	19.7%	3.49	1.175
Resource utilization is optimized	5.8%	21.8%	14.2%	39.7%	18.5%	3.43	1.184
Care coordination is boosted	5.8%	18.2%	20.0%	37.0%	19.1%	3.45	1.159
Cost-Effectiveness of healthcare interventions is enhanced.	4.5%	20.0%	18.2%	35.8%	21.5%	3.5	1.165
Aggregate mean						**3.47**	**1.16**

Correlation Between Hospital Infrastructure and Quality Healthcare Service

The Pearson correlation analysis reveals a statistically significant and positive association between hospital infrastructure and the provision of quality healthcare services ($r = 0.445$, $p < 0.01$). This moderate-to-strong correlation indicates that improvements in hospital infrastructure—such as the availability of essential equipment, timely maintenance, and effective integration of technology—are strongly associated with enhancements in healthcare service quality, including patient safety, care coordination, and satisfaction. These findings reinforce the argument that infrastructure is not just a background element but a core driver of service excellence.

This result aligns with Aiken et al. (2022), who found a significant correlation between the availability of ICU equipment and patient survival rates in sub-Saharan African hospitals. The presence of adequate medical infrastructure directly influenced care outcomes, echoing the current study's conclusion that well-maintained, well-stocked, and technologically equipped environments contribute substantially to healthcare quality. Similarly, Adeoye et al. (2022) emphasized that structural elements of health facilities, including equipment and facility maintenance, critically determine the effectiveness, safety, and responsiveness of healthcare services. Therefore, the significant correlation observed at KNH underscores broader regional evidence and emphasizes the urgent need for continuous infrastructure investment to sustain and elevate care quality.

Table 3: Correlation Between Hospital Infrastructure and Quality Healthcare Service

		Quality healthcare service
Hospital infrastructure	Pearson Correlation	.445**
	Sig. (2-tailed)	0.00
	N	330.00

Logistics Regression

The study conducted regression analysis to investigate how the predictor variables influence the response variable. The study employed logistic regression analysis to assess the determinants of quality healthcare service provision at Kenyatta National Hospital, Kenya. The model evaluated how four independent variables; human resources (X_1), hospital infrastructure (X_2), healthcare financing (X_3), and system optimization (X_4); influence the likelihood of achieving high-quality service outcomes. The results are summarized in Table 4, which reports key model-fitting criteria and likelihood ratio tests. The likelihood ratio tests reveal that all predictors are statistically significant ($p < 0.05$), with **hospital infrastructure** having the strongest effect ($\chi^2 = 81.639$, $p < 0.001$). The -2 log likelihood values indicate that removing any predictor worsens model fit, confirming their importance. The significant intercept ($p = 0.002$) suggests the baseline model holds explanatory power. These findings demonstrate that each factor significantly contributes to the outcome, with infrastructure being the most impactful. This establishes the determinants of quality healthcare service provision at Kenyatta National Hospital, Kenya.

Therefore, a logistic regression can be derived as follows:

$$\text{Logit}(P)=0.583+0.182X_1+0.593X_2+0.053X_3+0.348X_4$$

This shows that Hospital infrastructure (X_2) had the strongest positive effect ($\beta = 0.593$, $p < 0.001$). A one-unit improvement in infrastructure increased the log-odds of high-quality service by 0.593, translating to an odds ratio (OR) of 1.81 (95% CI: 1.63–2.01). This implies an 81% higher likelihood of achieving quality outcomes with better infrastructure. Human resources (X_1) and system optimization (X_4) also showed positive effects ($\beta = 0.182$, $p = 0.021$; $\beta = 0.348$, $p = 0.004$), with ORs of 1.20 and 1.42, respectively. Healthcare financing (X_3) still had a significant effect ($\beta = 0.053$, $p = 0.035$, OR = 1.05), suggesting that funding improvements enhance service quality.

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Table 4: Logistics Regression 1

Effect	Model Fitting Criteria -2 Log Likelihood of Reduced Model	Likelihood Ratio Tests		
		Chi-Square	df	Sig.
Intercept	1672.012	47.768	23	0.002
Human resources(X_1)	1652.185	27.94	23	0.021
Hospital infrastructure (X_2)	**1705.883**	**81.639**	**23**	**0.000**
Healthcare financing (X_3)	1645.236	20.991	23	0.035
System optimization (X_4)	1668.958a	44.714	23	0.004

Model fitting

A p-value of 0.000<0.05 suggests that the model significantly improves the fit compared to the intercept-only model. Therefore, the predictors have a significant effect on the outcome, dependent variable.

Table 5 : Likelihood ratio

Model	Model Fitting Criteria -2 Log Likelihood	Likelihood Ratio Tests Chi-Square	df	Sig.
Intercept Only	1802.904			
Final	1624.245	178.66	92	.0000

Goodness of fit

The p-values of 1.000 suggest that there is no significant lack of fit in the model, meaning the observed data are consistent with the model's predictions. Therefore, the model is considered to have an excellent fit in the data. Further, on testing the fitness of the model, a Cox and Snell value of 0.668, Nagelkerke value of 0.680 and McFadden value of 0.591 were registered, indicating that the independent variables explain the majority of the variation in the outcome. The pseudo R-square values suggested that the logistic regression model has a strong fit. This indicates that the model explains a significant portion of variance in the dependent variable (Provision of quality healthcare).

Table 6: Goodness of Fit

	Chi-Square	*df*	*Sig.*
Pearson	***5323.960***	***7475***	***1.000***
Deviance	***1624.245***	***7475***	***1.000***

CONCLUSIONS

The study findings established a positive significant correlation between hospital infrastructure and provision of quality healthcare. The findings agree with conclusions from Galea et al. (2021) research which found out that resilient infrastructure is crucial for sustaining care quality during crises, providing valuable insights into emergency preparedness. KNH beings a referral hospital, is always receiving critically ill patients and those who are in need of specialized care. Proper infrastructure in the hospital will facilitate a seamless treatment and care giving process. The research findings also agree with another study done by Ulrich et al. (2020), which showed a significant connection between facility design, maintenance and both patient and staff satisfaction, underlining the broader implications of infrastructure on healthcare quality.

RECOMMENDATIONS

Upgrading and maintenance of hospital infrastructure is crucial in provision of quality healthcare. Investments should be directed towards upgrading medical equipment, improving facility conditions and ensuring the availability of essential supplies. A preventive maintenance program should be implemented to regularly inspect and maintain hospital infrastructure, which can help minimize disruption of services and maintain operational efficiency.

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