

## Factors Affecting Medical Equipment Utilization in Health Service Delivery in Mandera County Referral Hospital

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### Abstract

Health service delivery in Kenya and Mandera County Referral Hospital (MCRH) in particular has been hampered by low utilization medical equipment. This study sought to investigate factors that influence the utilization of medical equipment in health service delivery in MCRH. This was a cross-sectional study design with a sample of 108 health workers from MCRh. The study adopted questionnaires for data collection and data was analysed using SPSS V.23. Descriptive analysis involved frequencies, percentages and cross tabulations. The inferential analysis was done using binary logistic regression. The findings revealed that human resource capacity development is a significant predictor of utilization of medical equipment ( $p = 0.001$ ,  $Ex (\beta) = 0.064$ ). The study also established that medical equipment management policy is a significant predictor of medical equipment utilization ( $p = 0.031$ ,  $Ex (\beta) = 8.891$ ). The causal effect relationship between medical equipment procurement policy and medical equipment utilization was also significant ( $p = 0.025$ ,  $Ex (\beta) = 1.221$ ). Finally, adherence to service charter was a significant predictor of utilization of medical equipment at Mandera county referral hospital ( $p = 0.001$ ,  $Ex (\beta) = 2.119$ ). The study concluded that the major determinants of medical equipment utilization at Mandera referral hospital included human resource capacity development, medical equipment management policy, medical equipment procurement policy and adherence to service charter. The study recommends that management of Mandera county referral hospital to improve the capacity of the staff through training, have in place detailed medical equipment policy and adhere to medical equipment procurement policy.

**Key Words:** Utilization of medical equipment, human resource capacity development, medical equipment management, medical equipment procurement, adherence to customer service charter, Mandera Kenya

Date of Submission: 26-07-2021

Date of acceptance: 11-08-2021

### I. Introduction

Globally, the issue of weaknesses in the health systems is a challenge to the delivery of health services and the achievement of the Sustainable Development Goals (SDGs) and other health targets at the global, regional, national and county levels. Health system challenges emanates from inadequate health policies, inadequate staff, backward health technology coupled with poor levels of health service delivery. The challenges need timely and urgent address to strengthen the health sector (Barr, 2007). Countries around the world particularly in Africa have had weak health systems that has roots in inadequate skilled health workers, poor state of health equipment, poor quality of care, inadequate drugs supply among other critical challenges and Mandera county is not exceptional in the above phenomenon (Mutia et al., 2012). Literature has established that in the United Kingdom (UK), about four hundred people lose their lives annually due to serious injuries in accidents involving medical equipment every year. The situation in Ireland is not any different thereby calling for the need to adopt strong governance procedures in the health systems to ensure that Medicare is in tandem with set regulations and best practices. The major setback in Kenya and more so in the devolved system of government is that the resources have been devolved but policies are not in place to guide the procurement and use of medical device and the aftermath of which is the haphazard procurement of important devices which are dumped in stores because of lack of prioritization and staff capacity development on the use of the device (Buse & Hawkes, 2015; WHO, 2008; WHO, 2011). The World Health Organization (WHO) has continuously identified and advised that policies regarding medical equipment be revised to enable the health systems globally to handle emerging needs for the equipment in managing health conditions. The Commission on Patient Safety and Quality Assurance has strictly stressed on the need to adopt standards and best practices in the utilization of medical equipment in enhancing Medicare management and governance (Douglas & Connor, 2003; WHO, 2011). Several factors have been identified that affects medical equipment utilization including human resource capacity development, medical equipment management policy, medical equipment procurement policy and adherence to customer service charter.

Success of medical equipment utilization has been curtailed by various human resource challenges including training and motivation of staff. The training should involve the operation of the medical equipment together with continuous skill update on improvement of the technology used in the medical equipment (Mutia et al., 2012; Fulmer & Ployhart, 2014). Umunna (2012) noted that utilization of medical equipment was influenced by experience and perception of medical facility users. Additionally, the study revealed that medical equipment utilization were influenced by staff level of training and adequacy of the staff.

Purchasing, use and disposal of medical equipment have a significant bearing on the quality of health services offered to patients (Mutia et al., 2012). The medical equipment management policy should guide the management and health care managers during the life cycle of medical equipment including purchase, use, maintenance and sale of medical equipment, provision of manuals for operation, training of biomedical technicians, provision of needed spare parts (Douglas & Connor, 2003; Kirui et al., 2013). Ademe, Tebeje and Molla (2016) revealed that utilization of medical equipment was influenced by lack of maintenance, over use, purchasing not needed devices, inadequate training on the operation of the medical equipment. Bahreini, Doshmangir and Imani (2018) revealed medical equipment that were rarely maintained were prone to breakdown. Suji and Vaanmathi (2020) revealed that lack of strategic planning in management of medical equipment especially acquisition of equipment at the right time, right place and right maintenance agreement influenced utilization rate.

The public procurement reforms in Kenya led to the enactment of Public procurement and Disposal Act 2005 and the Public Procurement and Disposal Regulations 2006. The acts provides for a framework for regulation of procurement under the auspices of the Public Procurement Oversight Authority (PPOA), The PPOA functions at the macro level, However the entities in the medical sector should observe procurement policy to ensure compliance with provisions of the act as well as other international legal instruments that have been adopted into Kenyan law that are propagated by the WHO regarding the availability of Essential Medicines and Medical Supplies. A comprehensive medical equipment procurement policy must be based on needs, Stakeholder Participation and Quality Supplies. The medical hospitals have been facing the challenges purchasing and disposal of medical equipment not based on needs but rather. This system of procurement leads to problems such as obsolescence, overstocking, understocking and expiry of medical supplies (CSCMP 2010). Oloo, Atambo and Muturi (2017) showed that integrity of the procurement staff was very critical to performance of public hospitals in terms of medical equipment utilization.

Health service charter is a written document that contains the agreement obtained between the health service provider and patients with the organization stating expressly the promises on the quality standards that can be expected from it (Baccarani & Ugolini, 2000; Mwanja, 2015). Adherence to service charter is dependent on employee awareness including ensuring integrity and transparency, disseminating corporate culture and ethics, and enhancing the commitment to performance codes. Awareness further involves employees having practical knowledge and skills regarding processes, procedures and routines (Labani, 2019). The employees needs to be aware of the services they are supposed to offer and the quality standards to be offered as stated in the charter (Mwamunyange, 2019). The medical staff of the organization are the critical resources of health service provision of the organization. The employees need to be treated with care to ensure their loyalty and commitment to delivery of excellent services. The organization's image especially regarding the quality of health care services depends on the employees who are delivering health services (Raphael, 2019).

Health system challenges faced globally is also an issue of concern for Kenya and particularly for Mandera County. In Mandera County Referral Hospital (MCRH), poor utilization of important medical equipment remains to be a challenge. There is no known empirical study done to establish factors that influence the utilization of medical equipment Mandera county referral hospital.

The overall objective of this study was to establish factors influencing utilization of medical equipment in health service delivery in Mandera County Referral Hospital. The specific objective were to establish the influence of i) capacity development, ii) medical equipment management policy, iii) medical equipment procurement policy and iv) adherence to customer service charter on medical equipment utilization for service delivery in Mandera County Referral Hospital.

## **II. Methods**

This was a cross-sectional study design with quantitative data collection method. The target population was 147 health workers from MCRH. The study sample was determined using the (Yamane, 1967)  $nf$  formula.

$$n = \frac{N}{1+N(e)^2} \quad n = 147/1+147 (0.05)^2 \quad n=108$$

Primary data was collected using a structured questionnaires, which had binary scale responses in the form of 'yes' and 'no'. The questionnaires were self-administered by the randomly selected health workers who were present at the time of data collection and who gave informed consent to participate in the study. A pre-test was done among 11 respondents from Marsabit Sub-County Hospital. The pre-test reliability test for the

questionnaire revealed that all study variables had a Cronbach Alpha value of > 0.70 hence the instrument of data collection was deemed reliable. Quantitative data was analysed using SPSS version 23. Descriptive statistics used included frequency distribution, percentages, means and standard deviation. To test for relationship the study adopted binary logistic regression analysis. The level of significance was set at  $p < 0.05$ . The regression model used is presented in the equation below:

$$\text{logit}(p) = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + \dots + b_nX_n \dots \dots \dots [1]$$

Where:  $p$  = probability of presence of the characteristic of interest,  $b_0$  = representation of the reference group.  $b_1$  = the regression coefficients associated with the reference group.  $X_1$  = Human Resources capacity development.  $X_2$  = Medical equipment management policy.  $X_3$  = Medical equipment procurement policy, and  $X_4$  = adherence to service delivery charter. The researcher obtained ethical approval from Scientific and Ethical Review Committee of Kenya Methodist University. Research permits were obtained from the National Council of Science and Technology, Mandera County Research Committee and the management of MCRH. The researcher had informed consent from all participating study respondents for consent to participate in the study and assurance of ethical considerations.

### III. Results

The researcher delivered 108 questionnaires to the respondents of which 82(75.9%) were adequately filled for analysis. The research sought to establish the demographics of the respondents with the major demographic variables including age, education and marital status. Majority of the respondents 70 (85.4%) were aged 20-39 years, majority 61(74.4%) had tertiary level of education, and over half 55(67.1%) were married. The results are shown in **Table 1**.

**Table 1: Demographic Characteristics**

Variable	Category	Frequency	Percent
Age	20-29 years	40	48.8
	30-39 years	30	36.6
	40-49 years	9	11.0
	50 years and above	3	3.7
	<b>Total</b>		<b>82</b>
Education level	Secondary	2	2.4
	Diploma/Certificate	61	74.4
	Bachelors	17	20.7
	Post graduate	2	2.4
	<b>Total</b>		<b>82</b>
Marital status	Single	21	25.6
	Married	55	67.1
	Divorced	5	6.1
	Widow	1	1.2
	<b>Total</b>		<b>82</b>

#### Status of utilization of medical equipment at Mandera county Referral Hospital

The research adopted descriptive statistics to examine the study variables. The ‘Yes’ responses were coded (1) and the ‘No’ responses were coded as (0). The research sought to establish the nature and level of utilization of medical equipment at Mandera county referral hospital. The findings are presented in **Table 2**. Over half of the respondents 52(63.4%) indicated that “the services offered using the medical equipment are at the expected level”, however, they disagreed that “the quality of health services provided by availing equipment are much higher” 45(65.9%).

**Table 2: Utilization of Medical Equipment at Mandera county Referral Hospital**

Statements		Frequency	Percent
The medical equipment rarely breaks down at the facility	No	40	48.8
	Yes	42	51.2
The services offered by the medical equipment are at the expected level	No	30	36.6
	Yes	52	63.4
When medical equipment break down, they are repaired immediately	No	36	43.9
	Yes	46	56.1
The medical equipment are performing according to design capacity	No	28	34.1

	Yes	54	65.9
Patients don't wait for long for their turn to use medical equipment	No	31	37.8
	Yes	51	62.1
The quality of health services provided by availing equipment are much higher	No	45	54.9
	Yes	37	45.1
Medical equipment rarely lies idle at the health facility for no reason	No	55	67.1
	Yes	26	31.7

### Human Resource Capacity Development and Utilization of Medical Equipment

Among the statements describing human resource capacity development, the least supported statement was that staffs are adequately compensated to motivate them to do their best at work attracted 63(76.8%). The findings are presented in **Table 3**.

**Table 3: Human Resource Capacity Development and Utilization of Medical Equipment**

Statements	Disagreed N(%)	Agreed N(%)	Chi square	p-value
Management involves employees when medical equipment are to be purchased	50(61)	32(39)	3.408	0.078
Staff who works with equipment are usually trained well in advance	40(48.8)	42(51.2)	2.077	0.165
The hospital has enough qualified staff that are highly trained on use of different equipment	61(74.4)	21(25.6)	1.833	0.218
The staffs are adequately compensated to motivate them to do their best at work	63(76.8)	19(23.2)	1.606	0.258
The hospital has specialist medical engineer who oversee repairs and maintenance	41(50)	41(50)	5.325	0.027
The staffs are required to put on protective clothing when dealing with equipment's at the hospital	23(28.1)	59(71.9)	0.423	0.809
The hospital has a good program for staff retention at the facility	48(58.5)	34(41.5)	3.772	0.063
The hospital recognizes the hard work of employees by compensating good performance	49(59.8)	33(40.2)	3.586	0.166

The relationship between employee compensation and utilization of medical equipment was positive but not statistically significant ( $\chi^2 = 1.606, p = 0.258$ ). The most supported statement was that staffs are required to put on protective clothing when dealing with equipment's at the hospital received 59 (71.9%) 'Yes' responses and 23(28%) 'No' responses implying that the staff always put on protective clothing while operating medical equipment's at the hospital. The relationship between statement that staff are required to put on protective clothing when dealing with equipment's at the hospital and utilization of medical equipment were positively correlated but not scientifically significant ( $\chi^2 = 0.423, p = 0.809$ ).

### Medical Equipment Management Policy and Utilization of Medical Equipment

The study sought to establish the existence and use of medical equipment management policy as presented in **Table 4**. Most of the respondents 55(67.1%) disagreed that stakeholders are rarely involved when the hospital makes purchasing decisions over medical equipment ( $\chi^2 = 14.908, p = 0.001$ ). The respondents 56(68.3%) disagreed that the health facility keeps equipment use logs for all equipment ( $\chi^2 = 4.684, p = 0.025$ ). Majority of the respondents 67(81.7%) agreed that preventive maintenance ensures that the equipment is safe for the patients and staff ( $\chi^2 = 15.920, p = 0.042$ ).

**Table 4: Medical Equipment Management Policy and Utilization of Medical Equipment**

Statement	Disagreed N(%)	Agreed N(%)	Chi-square	P-Value
All stakeholders are usually involved before an equipment is purchased	55(67.1)	27(32.9)	14.908	0.001
The health facility has a detailed medical equipment policy for use	45(54.9)	37(45.1)	1.850	0.397
Medical equipment policy has been effectively and adequately established	54(65.9)	28(34.1)	1.128	0.208
The hospital continuously monitors and evaluates the use of the medical equipment	49(59.8)	33(40.2)	5.553	0.032
The staffs are well informed of the medical equipment policy at the hospital	47(57.3)	35(42.7)	15.213	0.034
The health facility keeps equipment use logs for all equipment at the health facility	26(31.7)	56(68.3)	4.684	0.025
The hospital performs scheduled time intervals to minimize equipment degradation	34(41.5)	48(58.5)	10.088	0.044

The health facility has a detailed plan on the preventive maintenance practices activities	45(54.9)	37(45.1)	13.241	0.021
Preventive maintenance ensures equipment is performing at a reliable level	42(51.2)	40(48.8)	3.960	0.555
Preventive maintenance ensures that the equipment is safe for the patients and staff	15(18.3)	67(81.7)	15.920	0.042
Preventive maintenance ensures that the medical equipment is available when needed	30(36.6)	52(63.4)	16.261	0.031

**Adherence to Medical Equipment Procurement Policy and Utilization of Medical Equipment**

The study sought to establish the existence and adherence to procurement policy when purchasing or disposing off medical equipment at MCRH. The findings are presented in **Table 5**. Most of the respondents 58(70.7%) that medical equipment not meeting set quality standards are returned back to the suppliers at their cost ( $\chi^2 = 2.203, p= 0.168$ ). However, half 43(52.4%) agreed that that procurement of all medical equipment is done based on needs assessment ( $\chi^2 = 5.871, p= 0.050$ ). The findings implies that the hospital does not always follow the procurement policy as required by law.

**Table 5: Adherence to Medical Equipment Procurement Policy**

Statement	Disagreed N(%)	Agreed N(%)	Chi-square	P-Value
The procurement of all medical equipment is done based on need assessment	39(47.6)	43(52.4)	5.871	0.050
The hospital does not purchase any medical equipment it does not need	41(50)	41(50)	5.325	0.027
Medical equipment is usually disposed of following the laid down procurement policies	40(48.8)	42(51.2)	5.591	0.024
Stakeholders are involved in all decision regarding the purchase of medical equipment	50(61)	32(39)	3.408	0.041
The equipment purchased meet the quality standards set in advance	43(52.4)	39(47.6)	4.829	0.035
Equipment not meeting set quality standards are returned back to the suppliers at their cost	58(70.7)	24(29.3)	2.203	0.168

**Adherence to Customer Service Charter and Utilization of Medical Equipment**

The study assessed the influence of adherence to service charter on utilization of medical equipment at MCRH. Findings are shown in **Table 6**. Majority of the respondents agreed with the statements that MCRH treats all its customers with courtesy and respect 74(90.2%), ( $\chi^2 = 0.635, p= 0.410$ ), that MCRH treats, upholds professionalism in serving its customers 71(86.6%), ( $\chi^2 = 0.199, p= 0.523$ ), and that MCRH treats patients according to laid down clinical procedures 76(92.7%) ( $\chi^2 = 1.263, p= 0.323$ ).

**Table 6: Adherence to Customer Service Charter**

Statement	Disagreed N(%)	Agreed N(%)	Chi-square	P-Value
Mandera county referral hospital treats all its customers with courtesy and respect.	8(9.8)	74(90.2)	0.635	0.410
Mandera county referral hospital treats, upholds professionalism in serving its customers.	11(13.4)	71(86.6)	0.199	0.523
Mandera county referral hospital ensures equity in its allocation of medical equipment to patients care	21(25.6)	61(74.4)	8.268	0.014
Mandera county referral hospital treats patients according to laid down clinical procedures.	6(7.3)	76(92.7)	1.263	0.323
Mandera county referral hospital treats upholds good working ethics in a corruption free environment.	35(42.7)	47(57.3)	7.150	0.012

**3.5 Regression Analysis**

The research sought to establish the determinants of medical equipment utilization in Mandera county referral hospital. The study adopted binary logistic regression analysis to establish the causal effect relationship between determinants of medical equipment utilization and Utilization of medical equipment in Mandera county Referral hospital. The results of the analysis are as presented in **Table 7**.

**Table 7: Multivariate Regression Analysis results**

Variables	B	S.E.	P- value	Odds Ratio
<b>Human Resources Capacity Development:</b>				
There are staff training opportunities(ref)	-	-	-	1.000
No staff training opportunities	-2.742	0.756	0.000	0.064
<b>Medical Equipment Management Policy:</b>				
No detailed medical equipment policy (ref)	-	-	-	1.000
There is detailed medical equipment policy	2.185	1.012	0.031	8.891
<b>Medical Equipment Procurement Policy:</b>				
No procurement policy (ref)	-	-	-	1.000
There is a procurement policy	0.200	0.102	0.025	1.221
<b>Adherence to Service Charter:</b>				
Service charter is not adhered to (reference)	-	-	-	1.000
Service charter is adhered to	1.054	0.476	0.000	2.119

A binary logistic regression analysis was conducted to predict utilization of medical equipment at MCRH using human resource capacity development as a predictor of utilization of medical equipment. The results of the analysis indicated that there is a significant relationship between human resource capacity development initiatives and the utilisation of medical equipment in MCRH. Employees who are not subjected to continuous training are 0.064 times less likely to be effective in medical equipment utilization as compared to those who are trained.

The second study objective was determine the influence of medical equipment management policy on utilization of medical equipment utilization in health service delivery at MCRH. The results indicated that there is positive and scientifically significant relationship between medical equipment management policy and effective utilization of medical equipment. This means that health facilities that adhere to medical equipment policy, employees are 8.891 times more likely to effectively utilise medical equipment as compared to situations where medical equipment policy does not exist and is not adhered to.

The third objective was to assess the influence of medical equipment procurement policy on utilization of equipment in health service delivery at MCRH. The results of the analysis indicated that there is a significant relationship between adherence to the medical equipment procurement policy and utilisation of medical equipment. For instance, employees who are aware of medical equipment procurement policy are 1.221 times more likely to utilize medical equipment compared to those who are not aware of the medical equipment procurement policy.

The fourth objective was to assess the adherence to customer service charter and utilization of medical equipment in health service delivery in MCRH. The results of the analysis indicated that there indeed exist a significant relationship between adherence to service charter and effective utilisation of medical equipment. Employees who adhered to service charter were 2.119 times more likely to utilisation medical equipment in MCRH compared to those who did not adhered to the service charter.

#### IV. Discussion

Findings on human resource capacity development and utilization of medical equipment showed that most respondents agreed that the medical equipment are performing according to design capacity, which concurs with Camino and Gatos (2015) findings who revealed that lack of enough qualified personnel is a major bottleneck in the current county health department.

The findings on existence and use of medical equipment management policy are in congruence with CSCMP (2016) which showed that the medical care establishment needs to carry out planned maintenance processes and activities on the existing stock of medical equipment Kirui et al., (2013). On the other hand, it showed that medical equipment management policy should be guided by cost effectiveness during the life cycle of the medical equipment from purchase, use, maintenance and disposal.

On human resource development, results showed that employees who are not subjected to continuous training are 0.064 times less likely to be effective in medical equipment utilization as compared to those who are trained. The findings are in agreement with Kirui, Luciani, Ochieng and Kamau (2013) who established that lack of staff involvement especially from the maintenance department in planning during purchase of equipment leading to idle equipment whose spare parts are not easily found in case of breakdown.

On the influence of medical equipment management policy on utilization of medical equipment utilization in health service delivery at MCRH. The results revealed that where there exist an elaborate medical equipment policy, employees are 8.891 times more likely to effectively utilise medical equipment as compared to situations where elaborate medical equipment policy does not exist. The findings are in agreement with Kirui et al., (2013) that established that health service cost is a function of medical equipment maintenance.

Binary logistic regression results on of adherence to medical equipment procurement policy and utilization of equipment in health service delivery at MCRH, the findings are in agreement with Diaconu (2017)

who established that the utilization of medical equipment is influenced by procurement policy, qualification of staff and management of medical equipment. Further, Oloo, Atambo and Muturi (2017) revealed that tendering, supplier selection and ethical practices influences performance of public hospitals in terms of service provision via medical equipment utilization.

Employees who adhered to service charter were 2.119 times more likely to utilisation medical equipment in MCRH compared to those who did not adhered to the service charter. The findings are in agreement with Labani (2019) who revealed that, medical equipment utilization was dependent upon the adherence to service charter. The employee's need to be aware of the services they are supposed to offer and the quality standards to be offered as stated in the charter (Mwamunyangye, 2019).

## V. Conclusion

The study concludes that human resource capacity development is a significant predictor of medical equipment utilization. The positive effect of human resource capacity development on medical equipment utilization implies that improving the human resources in terms of training, involvement in decision making, motivation and remuneration leads to enhanced utilization of medical equipment. The study also concludes that the existence and use of medical equipment management policy is associated with improved utilization of medical equipment at Mandera referral hospital. Firms having detailed medical equipment management policy may enjoy high utilization rate of the medical equipment given that there are proper plan on their use, maintenance and repair. The research concluded that medical equipment procurement policy was a significant predictor of medical equipment utilization. Finally, study also concludes that adherence to service charter has a significant effect on medical equipment utilization. The direct causal effect relationship between adherence to service charter and utilization of medical equipment implies that whenever the hospital is working in accordance with their customer service charter, the hospital experiences high utilization rate in medical equipment.

## Recommendations

- i. The management of Mandera County Referral Hospital should strengthen human resources capacity development programs in order to improve utilization of medical equipment among all staff.
- ii. The management of Mandera County Referral Hospital should develop detailed medical equipment management policy that covers all medical equipment.
- iii. The management of Mandera County Referral Hospital should enforce the strict adherence to medical equipment procurement policy in purchasing and/or disposal decisions.

## Acknowledgement

I wish to recognise Michael Ochieng Obuya for the assistance offered in data entry and document editing.

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