

Effect of enforcement of referral guidelines on patterns of orthopedic and trauma admissions to Kenyatta National Hospital, Kenya: quasi-experimental study design

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Abstract

Inappropriate utilization of higher-level health facilities and ineffective management of referral processes in resource-limited settings is increasingly becoming a concern in health care management in developing countries. This is characterized by self-referral and frequent bypassing of the nearest health facilities coupled with low formal referral mechanisms. This scenario lends itself to a situation where uncomplicated medical conditions are unnecessarily managed in a high-cost health facility. On July 1, 2021, Kenyatta National Hospital (KNH) did enforce the referral guidelines that required patients have a formal referral letter to KNH to reduce the number of walk-ins and allow KNH to function as a referral facility as envisioned by Kenya 2010 constitution and KNH legal statute of 1987.

Study Objective: To determine the effect of referral guidelines on patterns of orthopaedic and trauma admissions to KNH.

Methodology: This was a quasi – experimental design. Data abstraction was done for 459 and 446 before and after enforcement of referral guidelines.

Findings enforcement of the referral guidelines reduced the proportion of walk-in admissions from 54.9% to 45.1%, while facility referrals increased from 46.6% to 53.4%. The Non-trauma orthopaedic admissions doubled from 12.0% to 22.4% after enforcement of the referral guidelines ($p < 0.001$). The mean age was 33.8 years with mean age rising among females from 32.2 years to 38.0 years after the enforcement of the referral guidelines. There was a significant increase in the proportion of female admissions after the enforcement of the referral guidelines. The enforcement of the referral guidelines was associated with a statistically significant increase in the number of orthopaedic admissions with active insurance cover.

Conclusion: the enforcement of the referral guidelines reduced the proportion of walk-ins. The enforcement of the guidelines was also associated with orthopaedic and trauma admissions with more non-trauma cases, tertiary education level, and more active insurance cover.

Background

Approximately 90% of the estimated traumatic injuries occur in low and middle-income countries according to World Health Organization (1) and this represents an important global public health problem now and in the coming years (2, 3).

Tertiary hospitals in resource-limited countries treat referred patients but in most cases are the first level of care for the vast majority of patients (4). One of the challenges in health care delivery in resource-limited settings is the inappropriate utilization of tertiary health facilities that results in patients' congestion in referral hospitals with simple conditions that can be effectively managed at lower health facilities. The majority of these patients are self-referred, bypassing lower-level health facilities in the process (5–8).

This jeopardizes the appropriate delivery of primary, secondary, and tertiary health care. Tertiary health care is compromised by the large demand for primary health care and in the process cripples the primary health care system and this effectively ensures that primary health care facilities remain underused and inefficient (11).

Kenyatta National Hospital (KNH) was established as a National Referral and Teaching Hospital to provide training and medical research in Kenya. KNH was established in 1901 and became a State Corporation in 1987 and sits at the peak of the health referral system in Kenya (12). According to the KNH Board order of 1987 contained in the Legal Notice No. 109, the functions of KNH were spelled out as a) to receive patients on referral for specialized health care; b) to provide facilities for medical education for the University of Nairobi and other health allied courses; c) to contribute to national health planning (12). This understanding has been reinforced by the Kenya Health Sector Referral Implementation Guidelines, 2014, and the Constitution of Kenya 2010 which tasks KNH with the responsibility for health policy formulation (13, 14).

Orthopaedic wards in KNH have consistently recorded the highest bed occupancy percent for the last couple of years. In 2018, 2019, and 2020, it recorded bed occupancy percent of 142.2%, 138.2%, and 116.5%, respectively, with the overall KNH bed occupancy percent of 106.2%, 113.4 percent and 91.5% (15). The consequence of this is the low nurse-patient ratio of 1:10 that compromises not only the quality of nursing care given to patients but also compromises the ability of KNH to effectively perform its statutory obligations.

Consequently, on 1st July 2021, KNH management made a decision to reinforce the Kenya Health Sector Referral Guidelines 2014 that places KNH at the tip of the health sector referral system. This meant that patients will be seen based on referral letters from other health facilities to reduce the number of walk-in patients who would have otherwise been appropriately seen at the peripheral health facilities. This will contribute to the decongestion of KNH Orthopaedic and trauma admissions. The purpose of this study was to determine the impact of the enforcement of referral guidelines on the patterns of orthopaedic and trauma admissions to Kenyatta National Hospital.

Methods And Materials

Study design: This was a quasi – experimental study design. Enforcement of referral guidelines required that the referring health facility consults with KNH consultant on call to seek concurrence before that patients are referred. This is to ensure only a) patients who require advance medical and orthopaedic and trauma care or b) the referring health facility has no capacity to manage, get admitted to KNH.

Study area and study population: KNH is the largest referral hospital in East and central Africa. Kenyatta National Hospital (KNH) Orthopaedic Wards were the study area. KNH is the national teaching and referral hospital based in Upperhill, Nairobi, the capital city of Kenya. It is located along Hospital Road, about 5km from the city center. It has a bed capacity of approximately 2000 beds.

Study duration: The study duration was covered 5 months before and 5 months after enforcement of the referral guidelines, that is, from February 1, to June 30, 2021, before enforcement of the referral guidelines and from August 1, to December 31, 2021 after enforcement of the referral guidelines. The referral guidelines were enforced from July 1, 2021. Inclusion criteria was all orthopaedic and trauma admissions to KNH during the study period and patients and/or their guardians/next of kin that consented voluntarily to participate in the study.

Sample size calculation and sampling procedure: Using an adjusted formula for calculating sample sizes that compare two binomial distributions (19), a total of 459 files and 446 files were abstracted before and after the enforcement of the referral guidelines. Stratified sampling technique was used with orthopaedic and trauma admissions being stratified by month of admission and Population Proportionate to Size (PPS) was used to determine the sample size per strata. Systematic random sampling was then used to identify the sampled files using the KNH Health Records Register as the sampling frame from each of these three service entry points (Accident and Emergency, Orthopedic Clinic, and KNH Private Clinics/COC). This ensured the selected sample would be representative of the admissions by month from each of these three orthopedic and trauma admissions entry points. Informed consent, auditory, and visual confidentiality were provided.

Variables: variables abstracted for this study were a) Socio-demographic characteristics – age, sex, marital status, religion, education level b) Nature of admission; c) Occupation; d) Type of admission; e) Mode of payment;

Data collection procedures: Data collection was done through a data abstraction form.

Quality assurance & quality control procedures: Three Research assistants underwent two (2) day training on the study protocol. A pilot study was conducted during the design of the study protocol to test the data collection tools for relevance, appropriateness to answer the research questions, and adjustments of the data collection tools made as necessary. The PI conducted a daily review of all abstracted forms, verified for accuracy, completeness, and compliance with the research protocol.

Ethical considerations: The proposal was presented to the Department of Orthopaedics, UoN approved. UoN/KNH Ethics and Research Committee granted ethical approval (ERC No: P852/10/2021). Administrative approval was also sought from KNH Medical Research Department and KNH Orthopaedics Department. This study was carried out in accordance with UoN/KNH Ethics and Research Committee guidelines and regulations.

Informed consent were obtained from all subjects and/or their legal guardian(s). For patients who are under 18 years of age and for patients who were illiterate or with no formal education informed consent was obtained from their legal guardians / legally authorized representative.

Data management analysis plan: Data abstraction tool was used to collect quantitative. The data were entered into a password-protected Redcap database kept by the KNH Medical Research Department. Descriptive analysis was done using measures of central tendency (mean), measures of

dispersions such as range, standard deviation were used, frequency distribution were also used. Inferential analysis was done using Pearson's chi-square test, logistic regression, odds ratio to determine effect of the enforcement of the referral guidelines and also determine possible associations. SPSS version 21 was used.

Study limitations: a) Incomplete and missing records – this was addressed by increasing the sample size by 10%; c) Effect of COVID 19 pandemic on referrals of cases from peripheral health facilities and walk-in patients – this was addressed by ensuring the data collection period covered the covid period.

Results

Basic Profile of the sample population

Key socio-demographic characteristics of orthopaedic and trauma admissions at KNH before and after enforcement of the referral guidelines such as age, sex, education, occupation, and marital status were compared between the two groups. Education and sex were noted to be statistically significant between the two groups at $p = 0.001$ and $p = 0.005$, respectively, and 5% level of significance. However, age, religion, occupation, marital status, smoking, and alcohol intake habits were comparable amongst the two groups ($P > 0.05$) (Table 1). Orthopaedic admissions who were male before and after enforcement of referral regulations were 374(81.8%) and 329(74.1%), respectively. While females were 83 (18.2%) and 115 (25.9%) before and after enforcement of the referral guidelines. These differences were statistically significant ($p = 0.0005$). In addition, there was a statistically significant association with regard to education level before and after the enforcement of the referral guidelines ($p = 0.001$) (Table 1).

The mean age was 32.691 (SD 16.4122) and 34.978 (SD 16.6109) for orthopaedic and trauma admissions before and after enforcement of the referral guidelines, respectively. This was statistically significant ($p = 0.038$). The mean age was 33.8 years (SD 16.541) with mean age rising among females from 32.2 (SD 19.9) to 38.0 (SD 20.4) after the enforcement of the referral guidelines ($p = 0.046$). For males there was a slight increase in the mean age from 32.799 (SD 15.6) to 34.0 (SD 15.00) after the enforcement of the referral guidelines ($p = 0.311$). Based on age group, children represented 59 (12.9%) and 40 (9.0%) of the orthopaedic admissions before and after enforcement of the referral guidelines, respectively, while the majority of the admissions, 303 (66.0%) and 297 (66.6%) were observed among age group 25–64 years old before and after respectively. Orthopaedic admissions above 65 years of age represented 14 (3.1%) and 26 (5.8%) before and after enforcement of the referral guidelines, respectively (Table 1).

Table 1

Socio-demographic characteristics between orthopaedic and trauma admissions at KNH before and after enforcement of the referral guidelines, 2021

Variable	Category	Before (n = 459)	After (n = 446)	Chi-square,p-value
Age	0–14 years	59 (59.6%)	40 (40.4%)	7.121 (p = 0.068)
	15–24 years	83 (50.0%)	83 (50.0%)	
	25–64 years	303 (50.5%)	297 (49.5%)	
	Above 65 years	14 (35.0%)	26 (65.0%)	
Sex	Female	83 (41.9%)	115 (58.1%)	7.866 (p = 0.005)
	Male	374 (53.2%)	329 (46.8%)	
Marital status	Married	218 (48.9%)	228 (51.1%)	4.450 (p = 0.349)
	Minor	61 (55.5%)	49 (44.5%)	
	Separated & divorced	20 (40.8%)	29 (59.2%)	
	Single	147 (53.5%)	128 (46.5%)	
	Widow	13 (54.2%)	11 (45.8%)	
Religion	Atheist	2 (66.7%)	1 (33.3%)	2.113 (p = 0.609)
	Christian	433 (50.1%)	432 (49.9%)	
	Hindu	1 (33.3%)	2 (66.7%)	
	Muslim	15 (62.5%)	9 (37.5%)	
Occupation	Businessman/woman	60 (52.6%)	54 (47.4%)	1.416 (p = 0.841)
	Casual	204 (50.6%)	199 (49.4%)	
	Employed	64 (47.4%)	71 (52.6%)	
	Other	33 (55.9%)	26 (44.1%)	
	unemployed	92 (50.3%)	91 (49.7%)	
Education	None	33 (60.0%)	22 (40.0%)	0.001
	Pre-school	18 (81.8%)	4 (18.2%)	
	Primary	157 (51.0%)	151 (49.0%)	
	Secondary	166 (52.4%)	151 (47.6%)	
	Tertiary	74 (40.7%)	108 (59.3%)	
Smoking	No	348 (51.2%)	332 (48.8%)	0.078 (p = 0.780)

Variable	Category	Before (n = 459)	After (n = 446)	Chi-square,p-value
Alcohol	Yes	89 (50.0%)	89 (50.0%)	0.410 (p = 0.522)
	No	258 (50.1%)	257 (49.9%)	
	Yes	180 (52.3%)	164 (47.7%)	

Impact of the referral guidelines on orthopaedic and trauma admissions at KNH

The proportion of walk-ins declined from 248 (54.9%) to 204 (45.1%) before and after the enforcement of the referral guidelines, respectively, while facility referrals increased from 211 (46.6%) to 242 (53.4%) during the same period. This was statistically significant ($p = 0.013$) (Table 2) with an odds ratio of 1.653 (95% CI: 1.244–2.197) after controlling for possible confounders of sex and education. This means the enforcement of the referral guidelines had significantly reduced the walk-ins while increasing the numbers and proportion of referred cases during the study period.

Table 2
Walk-in and Facility Referrals before and after enforcement of referral guidelines, 2021

	Before (n = 459)	After (n = 446)	Chi-square; p-value	Logistic regression
Walk-ins	248 (54.9%)	204 (45.1%)	6.219; $p = 0.013$	1.653 (95% CI: 1.244–2.197) ($p = 0.001$)
Facility referrals	211 (46.6%)	242 (53.4%)		

Legend: Pearson chi-square test was used to test for statistical significance at 95% CI and Odds Ratio Estimate was used to test the strength of association.

Although the majority of orthopaedic and trauma admissions were admitted through Accident and Emergency department, there was a notable decline from 386 (84.1%) and 321 (72.0%) before and after enforcement of the referral guidelines respectively ($p = 0.0001$) with the least admissions through the Orthopaedic Clinics. There was also a notable increase in orthopaedic and trauma admissions through Corporate Outpatient Care (COC) after enforcement of the referral guidelines from 48 (10.5%) to 87 (19.5%) and this was statistically significant ($p = 0.011$) (Table 3). This means that there was a significant decline in admissions through A&E and an increase in admissions thorough the COC and Orthopaedic Clinics after the enforcement of the referral guidelines.

Table 3
Orthopaedic and trauma admissions to KNH stratified by point of admission, 2021.

	Before	After	Total	p-value
Accident & Emergency	386 (84.1%)	321 (72.0%)	707 (78.1%)	0.0001
COC	48 (10.5%)	87 (19.5%)	135 (14.9%)	0.011
Orthopaedic Clinics	25 (5.4%)	38 (8.5%)	63 (7.0%)	0.315
Total	459 (100.0%)	446 (100.0%)	905 (100.0%)	

The type of orthopaedic and trauma admissions was also reviewed before and after enforcement of referral guidelines. Emergency admissions declined from about 387 (84.7%) to 325 (73.4%), while elective cases increased from 70 (15.3%) to 118 (26.6%) of total orthopaedic and trauma admissions before and after enforcement of the referral guidelines, respectively (0.0001). Elective admissions were 50.2% less likely to occur before as opposed to after enforcement of referral guidelines and this was statistically significant (Table 4). This means that elective admissions increased while emergency admissions reduced after the enforcement of the referral guidelines.

Table 4
Type of orthopaedic and trauma admissions before and after enforcement of referral guidelines, 2021

Characteristics	Before	After	Chi-square test; p-value	OR Estimate (95% CI)
Type of admission	Elective	70 (15.3%)	17.441; p = 0.0001	0.498 (0.358–0.693)
	Emergency	387 (84.7%)		
	Total	457 (100.0%)	443 (100.0%)	

Facility referrals are expected to be accompanied by official written referral letters from the referring facilities to KNH. The study showed the proportion of orthopaedic and trauma referrals to official referral letters were comparable before and after enforcement of the referral guidelines (p = 0.821) (Table 5). This means that the enforcement of the referral guidelines had no statistically significant effect on the use of written referral letters by the referring health facilities.

Table 5
Facility referrals with referral letters before and after enforcement of referral guidelines, 2021

		Facility referrals		Chi-square; p-value
		Before	After	
Have referral letters	No	101 (48.1%)	118 (49.2%)	0.051; p = 0.821
	Yes	109 (51.9%)	122 (50.8%)	
Total		210 (100.0%)	240 (100.0%)	

Binary Logistic regression was used to estimate the probability of occurrence of key characteristics before and after the enforcement of the referral guidelines, namely, sex, education level, and mode of payment. The study revealed that the likelihood of being male was 1.575 (1.145–2.166) more compared to females before the enforcement of the referral guidelines compared to those after the enforcement of the referral guidelines (0.005) (Table 6). This means that there were fewer male admissions after enforcement of the referral guidelines.

With regard to education level, the study demonstrated that the likelihood of having a tertiary level of education was about 54.4% less before the enforcement of the referral guidelines as opposed to after the enforcement of the referral guidelines ($p = 0.001$) (Table 6). This means that more orthopedic and trauma admissions had a tertiary level of education after enforcement of the referral guidelines. However, there was no observable difference in the number and proportion of referrals based on levels of education namely pre-school, primary and secondary levels of education before and after enforcement of the referral guidelines (Table 6).

Regarding the mode of payment, the odds of being a cash payer were 1.846 (1.387–2.458) more before compared to after the enforcement of referral guidelines and this was statistically significant. This means that the enforcement of the referral guidelines was associated with a statistically significant increase in the number of orthopedic and trauma admissions with active insurance cover (Table 6).

The likelihood of orthopedic and trauma admissions having insurance cover was 46.2% less likely before enforcement of referral guidelines compared to after enforcement of referral guidelines and this was statistically significant (Table 6). This means that the likelihood of orthopedic admissions having insurance cover increased after enforcement of the referral guidelines.

Table 6

Multivariable analysis of socio-demographic characteristics of orthopaedic admissions to KNH before and after enforcement of referral guidelines, 2021

Characteristics		Before	After	Chi-square test; p-value	Logistic regression (95% CI)
Sex	Female	83 (18.2%)	115 (25.9%)	7.866; p = 0.005	1.0
	Male	374 (81.8%)	329 (74.1%)		1.575 (1.145–2.166)
	Total	457 (50.7%)	444 (49.3%)		
Education level	None	33 (7.4%)	22 (5.0%)	18.128; p = 0.001	1.0
	Pre-school	18 (4.0%)	4 (0.9%)		3.0 (0.894–10.063)
	Primary	157 (35.0%)	151(34.6%)		0.693 (0.387–1.243)
	Secondary	166 (37.1%)	151 (34.6%)		0.733 (0.409–1.313)
	Tertiary	74 (16.5%)	108 (24.8%)		0.457 (0.247–0.845)
	Total	448 (50.7%)	436 (49.3%)		
Mode of payment	Cash	344 (75.3%)	277 (62.2%)	17.837; p = 0.0001	1.0
	Insurance	113 (24.7%)	168 (37.8%)		0.538 (0.404–0.716)
	Total	457 (50.7%)	445 (49.3%)		

The mode of payment and its association with sex was reviewed and it showed no statistically significant association before the enforcement of the guidelines. However, males were 2.366 times more likely to be cash payers compared to females after enforcement of the referral guidelines (Table 7). This means more females admissions had insurance cover after enforcement of referral guidelines.

Table 7

Multivariable analysis of sex of orthopaedic admissions to KNH before and after enforcement of referral guidelines, 2021 disaggregated by mode of payment

	Sex	Cash	Insurance	Chi-square, p-value	OR (95% CI)
Before	Female	58 (17.0%)	25 (22.1%)	1.519; p = 0.218	1.0
	Male	284 (83.0%)	88 (77.9%)		1.391 (0.822–2.355)
After	Female	54 (19.6%)	61 (36.5%)	15.574; p = 0.0001	1.0
	Male	222 (80.4%)	106 (63.5%)		2.366 (1.534–3.649)

The study revealed that amongst walk-ins, orthopaedic, and trauma admissions, those aged 15–24 years are 4.30 times more likely to pay in cash before compared to after enforcement of the referral guidelines. Similarly, those aged between 25–64 years are 2.008 more times likely to pay in cash before compared to after enforcement of the referral guidelines. However, the enforcement of the referral guidelines had no statistically significant association between the mode of payment and age amongst facility referred orthopaedic and trauma admissions (Table 8). This means that enforcement of referral guidelines increased the proportion of orthopaedic and trauma admissions with active insurance cover for those aged between 15–64 years amongst walk-ins' admissions.

Table 8

Association between mode of payment and age before and after enforcement of referral guidelines stratified by Facility referral and Walk-ins, 2021

	Age category	Mode of payment	Before	After	Chi-square, p-value	MH OR
Walk-ins	0–14 years	Cash payment	15 (71.4%)	6 (28.6%)	1.380; p = 0.240	2.222 (0.580– 8.511)
		Insurance	9 (52.9%)	8 (47.1%)		
	15–24 years	Cash payment	43 (68.3%)	20 (31.7%)	8.737; p = 0.003	4.30 (1.581– 11.698)
		Insurance	8 (33.3%)	16 (66.7%)		
	25–64 years	Cash payment	124 (60.8%)	80 (39.2%)	8.096; p = 0.004	2.008 (1.238– 3.256)
		Insurance	44 (43.6%)	57 (56.4%)		
	Above 65 years	Cash payment	3 (30.0%)	7 (70.0%)	0.552; p = 0.457	2.143 (0.281– 16.369)
		Insurance	2 (216.7%)	10 (83.3%)		
Facility referral	0–14 years	Cash payment	23 (63.9%)	13 (36.1%)	1.523; p = 0.217	1.917 (0.679– 5.414)
		Insurance	12 (48.0%)	13 (52.0%)		
	15–24 years	Cash payment	23 (42.6%)	31 (57.4%)	0.409; p = 0.522	1.391 (0.505– 3.833)
		Insurance	8 (34.8%)	15 (65.2%)		
	25–64 years	Cash payment	106 (48.2%)	114 (51.8%)	2.389; p = 0.122	1.528 (0.891– 2.619)
		Insurance	28 (37.8%)	46 (62.2%)		
	Above 65 years	Cash payment	7 (53.8%)	6 (46.2%)	0.277; p = 0.599	1.75 (0.215– 14.224)
		Insurance	2 (40.0%)	3 (60.0%)		

The study revealed a marginal statistically significant increase in the proportion of female orthopedic and trauma admissions after enforcement of the referral guidelines amongst both walk-ins and facility

referrals (Table 9). This means that the enforcement of referral guidelines was associated with increase in female orthopedic admissions to KNH amongst both walk-ins and health facility referrals.

Table 9
Association between sex and enforcement of referral guidelines amongst walk-ins and facility referrals, 2021.

	Sex	Before	After	Chi-square, p-value	MH OR
Walk-ins	Female	51 (45.9%)	60 (54.1%)	4.729; p = 0.030	0.621 (95% CI: 0.404–0.956)
	Male	197 (57.8%)	144 (42.2%)		
Facility referral	Female	32 (37.2%)	54 (62.8%)	3.906; p = 0.048	0.616 (95% CI: 0.380–0.999)
	Male	178 (49.0%)	185 (51.0%)		

The study revealed that amongst walk-ins, orthopaedic and trauma admissions, those aged 15–24 years are 91.2% less likely to be elective admissions before enforcement of the referral guidelines compared to after the enforcement of the referral guidelines. Similarly, those aged between 25–64 years are 57.9% less likely to have elective admission before enforcement of the referral guidelines compared to after enforcement of the guidelines (Table 10). This means the enforcement of the referral guidelines were associated with more elective orthopaedic and trauma admissions and fewer emergency orthopaedic and trauma admissions, especially amongst walk-ins aged 15–64 years.

Table 10

Association between mode of payment and age before and after enforcement of referral guidelines stratified by Facility referral and Walk-ins, 2021

	Age category	Type of admission	Before	After	Chi-square, p-value	OR
Walk-ins	0–14 years	Elective	10 (58.8%)	7 (41.2%)	0.248; p = 0.618	0.714 (0.190– 2.688)
		Emergency	14 (66.7%)	7 (33.3%)		
	15–24 years	Elective	3 (17.6%)	14 (82.4%)	14.623; p = 0.0001	0.098 (0.026– 0.377)
		Emergency	48 (68.6%)	22 (31.4%)		
	25–64 years	Elective	38 (40.4%)	56 (59.6%)	11.888; p = 0.001	0.421 (0.256– 0.692)
		Emergency	129 (61.7%)	80 (38.3%)		
	Above 65 years	Elective	2 (18.2%)	9 (81.8%)	0.259; p = 0.611	0.593 (0.078– 4.498)
		Emergency	3 (27.3%)	8 (72.7%)		
Facility referral	0–14 years	Elective	6 (66.7%)	3 (33.3%)	0.431; p = 0.511	1.643 (0.370– 7.301)
		Emergency	28 (54.9%)	23 (45.1%)		
	15–24 years	Elective	0 (0.0%)	2 (100.0%)	1.384; p = 0.239	-
		Emergency	31 (41.3%)	44 (58.7%)		
	25–64 years	Elective	10 (27.0%)	27 (73.0%)	5.971; p = 0.015	0.394 (0.183– 0.848)
		Emergency	124 (48.4%)	132 (51.6%)		
	Above 65 years	Elective	1 (100.0%)	0 (0.0%)	0.944; p = 0.331	-
		Emergency	8 (50.0%)	8 (50.0%)		

The study revealed that amongst walk-ins, orthopaedic and trauma admissions, those aged 15–24 years and 25–64 years had statistically significant decline in orthopaedic and trauma admissions through the

A&E and increase in admissions through the Orthopaedic clinic and COC enforcement of the guidelines. However, amongst the referral admissions, no statistically significant difference was noted in the orthopaedic and trauma admissions (Table 11). This means the enforcement of the referral guidelines were associated with more orthopaedic and trauma admissions in the orthopaedic clinic and COC and less admissions through the A&E amongst the walk-in admissions.

Table 11

Association between mode of payment and age before and after enforcement of referral guidelines stratified by Facility referral and Walk-ins, 2021

	Age category	Point of admission	Before	After	Chi-square, p-value
Walk-ins	0–14 years	A&E	13 (72.2%)	5 (27.8%)	1.210; p = 0.546
		Clinic	6 (54.5%)	5 (45.5%)	
		COC	5 (55.6%)	4 (44.4%)	
	15–24 years	A&E	49 (69.0%)	22 (31.0%)	17.811; p = 0.0001
		Clinic	0 (0.0%)	6 (100.0%)	
		COC	2 (20.0%)	8 (80.0%)	
	25–64 years	A&E	129 (62.3%)	78 (37.7%)	13.641; p = 0.001
		Clinic	11 (39.3%)	17 (60.7%)	
		COC	28 (40.0%)	42 (60.0%)	
	Above 65 years	A&E	3 (30.0%)	7 (70.0%)	0.932; p = 0.628
		Clinic	0 (0.0%)	2 (100.0%)	
		COC	2 (20.0%)	8 (80.0%)	
Facility referral	0–14 years	A&E	30 (55.6%)	24 (44.4%)	0.687; p = 0.709
		Clinic	3 (75.0%)	1 (25.0%)	
		COC	2 (66.7%)	1 (33.3%)	
	15–24 years	A&E	31 (40.8%)	45 (59.2%)	2.833; p = 0.243
		Clinic	1 (100.0%)	0 (0.0%)	
		COC	0 (0.0%)	2 (100.0%)	
	25–64 years	A&E	123 (48.2%)	132 (51.8%)	5.169; p = 0.075
		Clinic	4 (40.0%)	6 (60.0%)	
		COC	8 (26.7%)	22 (73.3%)	
	Above 65 years	A&E	8 (50.0%)	8 (50.0%)	2.00; p = 0.368
		Clinic	0 (0.0%)	1 (100.0%)	
		COC	1 (100.0%)	0 (0.0%)	

The study revealed a statistically significant increase in the proportion of non-trauma-related orthopaedic admissions after enforcement of the referral guidelines amongst walk-in admissions ($p < 0.001$). The odds of trauma-related admissions were 2.829 times higher before enforcement of referral guidelines compared to after enforcement of referral guidelines amongst walk-ins' admissions (Table 12). This means that there was a statistically significant increase in non-trauma-related admissions after enforcement of the referral guidelines amongst walk-ins.

Table 12
Association between the nature of injury before and after enforcement of referral guidelines, 2021.

Nature of Injury		Before	After	Chi-square, p-value	OR
Walk-in	Trauma related	204 (62.0%)	125 (38.0%)	23.384; $p < 0.001$	2.829 (1.842–4.345)
	Non – Trauma related	45 (36.6%)	78 (63.4%)		
Facility Referral	Trauma related	200 (47.6%)	220 (52.4%)	2.095; $p = 0.148$	1.736 (0.816–3.690)
	Non – Trauma related	11 (34.4%)	21 (65.6%)		

Discussions

Basic Profile of the sample population

The study demonstrated orthopaedic admissions were male before (81.8%) and after (74.1%) enforcement of referral regulations during the study period. This compares favourably with studies done in Addis Ababa, India, Nepal, Middle East, and Botswana showed male predominates orthopaedic admissions (20–27). In addition, male orthopaedic admissions predominated and peaked at 25–64 years, and these admissions declined steadily to 65 years of age and orthopaedic admissions were comparable across sex for those above 65 years of age. This compares with a retrospective study done in a tertiary hospital in Nepal that showed similar admission rates from 60 years of age (22). However, the study revealed an overall increase in female orthopaedic admissions compared to males after the enforcement of referral guidelines. This can be attributed to reduction in the number of emergency admissions through Accident and Emergency department and the reduced number of admissions resulting from the road traffic accident due to the enforcement of the referral guidelines since the majority of these emergency admissions are male.

The mean age of orthopaedic admission was 33.82 years in this study. This compares with studies done in tertiary hospitals in Nepal, Middle East, Botswana that showed young adults as the common age group

for orthopaedic admissions (22–24, 26). However, while the mean age remained relatively the same for men before and after enforcement of the referral guidelines, for females the mean age increased significantly from 32.16 years to 38.00 years after enforcement of the referral guidelines. This compares favourably with studies done in Moshi, Northern Tanzania, that showed that males (37.8years) tended to be younger than females (43.9years) (25, 28). This is because the enforcement of the referral guidelines was accompanied by a corresponding increase in female elective admissions during the study period and these were largely non-trauma admissions that came with degenerative musculoskeletal disorders.

Based on age groups, children and those above 65 years represented the least orthopaedic admissions during the study period before and after enforcement of the referral guidelines, while the majority of admissions were observed among the age group 25–64 years. This compares with a retrospective study on orthopaedic admissions done in Warangal, India, that showed the average age was 41.14 years. There was a bimodal distribution with high rates of admission for young adults up to the age of 35 years old as well as for those above 45 years old (21). Similar studies also depicted low paediatric orthopaedic admissions (29). However, this contrasts with a study done in PCEA Kikuyu Mission Hospital, Kenya, that showed 18.84% orthopaedic admissions were of paediatric age group (27). This could be due to the fact that PCEA Kikuyu Mission Hospital is a private mission hospital and is an established and highly regarded orthopaedic centre in the country.

The enforcement of the referral guidelines was associated with more orthopedic and trauma admissions having a tertiary level of education and this could be explained by the proportion of admissions with insurance cover increased and this could be reflecting better education levels following the enforcement of the referral guidelines.

Impact of the referral guidelines on orthopaedic and trauma admissions at KNH

On 1st July 2021, KNH enforced referral guidelines that were meant to streamline the referral process from peripheral health facilities and allow KNH to manage complex orthopaedic and trauma cases that cannot be handled at lower-level health facilities. This resulted in a statistically significant reduction of the proportion of walk-ins and an increase in referral cases. Patients were encouraged to seek services from lower-level health facilities and that they should come to a referral letter from a lower-level health facility to KNH. However, there was no significant difference when it came to facility referrals being accompanied by official written referral letters from the referring facilities to KNH. This is because most of the referrals were verbal over the telephone and once a verbal consensus has been reached, the referring health facilities did not see the need of writing an official referral letter.

The study revealed that most of the orthopaedic and trauma admissions were emergency admissions, although there was a statistically significant decline in the proportion of emergency admissions from 84.7–73.4% after enforcement of the referral guidelines. The enforcement of the referral guidelines was associated with more elective orthopaedic and trauma admissions and less emergency orthopaedic and

trauma admissions, especially amongst walk-ins aged 15–64 years. Consequently, there was an increase in the proportion of elective orthopaedic admissions during the study period.

In addition, there was a statistically significant increase in non-trauma orthopaedic admissions doubling from 12.0–22.4% after enforcement of the referral guidelines, and this was a reinforcing the fact that elective orthopaedic admissions increased while emergency orthopaedic admissions reduced after the enforcement of the referral guidelines.

There was a significant decline in admissions through A&E and an increase in admissions through the COC and Orthopaedic Clinics after the enforcement of the referral guidelines. This means the enforcement of the referral guidelines were associated with more orthopaedic and trauma admissions in the orthopaedic clinic and COC and less admissions through the A&E due to reduction in proportion of patients admitted as walk-ins.

The enforcement of referral guidelines was associated with a statistically significant increase in the proportion of orthopaedic and trauma admissions with active insurance cover for those aged between 15–64 years amongst walk-ins' admissions. The increase in the proportion with insurance cover after the enforcement of the referral guidelines could be due to an increase in the number and proportion of female orthopedic admissions through the orthopedic clinics and COC. More females' admissions had insurance cover after enforcement of referral guidelines and this could be due to the fact that there were more elective admissions after enforcement of the referral guidelines and these were mostly women with non-trauma orthopedic conditions that were age-related. That also supports the initial finding that the mean age of women increased after enforcement of the referral guidelines. This contrasts with a multicenter observation study done on the distribution of orthopedic fractures in low and middle-income countries revealed about 18% of orthopedic admissions in Africa had health insurance cover (30). It also contrasts with a retrospective study done in PCEA Kikuyu Mission Hospital in Kenya showed about 60.82% of orthopedic patients have insurance cover (27). This could be explained by the fact that PCEA Kikuyu Mission Hospital is a private health facility that admits patients with higher socio-economic status compared to KNH which is a public health facility.

Conclusions

In conclusion, the enforcement of the referral guidelines reduced the proportion of walk-in patients from 54.9–45.1%, while facility referrals increased from 46.6–53.4%. There was also a notable increase in orthopaedic and trauma admissions through the orthopaedic clinics and COC after enforcement of the referral guidelines. The proportion of emergency admissions declined while that of elective admissions increased during the study period. The increase in elective cases were mainly due to the increase in female admissions.

The enforcement of the guidelines also was associated with increase in the proportion of admissions with active insurance cover and these were mostly non-trauma elective admissions. This is in tandem

with an increase in mean age of admission mostly among females as well as increase in the proportion of admissions with tertiary level of education after enforcement of the referral guidelines.

The enforcement of the referral guidelines did have an impact on the patterns of orthopaedic and trauma admissions to KNH and was associated with a decline in the proportion of walk-ins.

Declarations

Ethical considerations: The proposal was presented to the Department of Orthopaedics, UoN approved. UoN/KNH Ethics and Research Committee granted ethical approval (ERC No: P852/10/2021). Administrative approval was also sought from KNH Medical Research Department and KNH Orthopaedics Department. This study was carried out in accordance with UoN/KNH Ethics and Research Committee guidelines and regulations.

Informed consent were obtained from all subjects and/or their legal guardian(s). For patients who are under 18 years of age and for patients who were illiterate or with no formal education informed consent was obtained from their legal guardians / legally authorized representative.

Consent for publication

Not applicable

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Competing interest

The authors declare that they have no competing interests.

Availability of Data and Materials

We confirm that the raw data for this study is available in both excel spreadsheet and SPSS dataset format and can be shared to the journal on request. The corresponding author, Maxwell Philip Omondi (maxwellomondi@gmail.com) will be responsible for sharing the raw data. This will be done within 24hours once requested.

Authors contributions

Maxwell Philip Omondi, Joseph Chege Mwangi, Fred Chuma Sitati and Herbert Ong'ango' wrote the main manuscript text. Maxwell Philip Omondi prepared the tables and references section. All authors reviewed the final manuscript.

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References

1. Hanche-Olsen TP, Alemu L, Viste A, Wisborg T, Hansen KS. Trauma care in Africa: a status report from Botswana, guided by the World Health Organization's "Guidelines for Essential Trauma Care". *World J Surg.* 2012 Oct;36(10):2371-83.
2. Murray CJL, AD L. The Global Burden of Disease: A Comprehensive Assessment of Mortality and Disability From Diseases Injuries, and Risk Factors in 1990 and Projected to 2020. *Journal [serial on the Internet].* 1996.
3. Murray CJL, AD L. Global Health Statistics: A Compendium of Incidence Prevalence and Mortality Estimates for Over 200 Conditions. *Journal [serial on the Internet].* 1996 Date.
4. Hensher M, Price M, Adomakoh S. *Referral Hospitals.* 2006.
5. Holdsworth G, Garner PA, Harphan T. Crowded outpatient departments in city hospitals of developing countries: a case study from Lesotho. *Int J Health Plann Manage.* 1993 Oct-Dec;8(4):315-24.
6. London L, Bachmann OM. Paediatric utilisation of a teaching hospital and a community health centre. Predictors of level of care used by children from Khayelitsha, Cape Town. *S Afr Med J.* 1997 Jan;87(1):31-6.
7. Ohara K, Melendez V, Uehara N, Ohi G. Study of a patient referral system in the Republic of Honduras. *Health Policy Plan.* 1998 Dec;13(4):433-45.
8. Sanders D, Kravitz J, Lewin S, McKee M. Zimbabwe's hospital referral system: does it work? *Health Policy Plan.* 1998 Dec;13(4):359-70.
9. Nordberg E, Holmberg S, Kiugu S. Exploring the interface between first and second level of care: referrals in rural Africa. *Trop Med Int Health.* 1996 Feb;1(1):107-11.
10. Akande T. Referral system in Nigeria: Study of a tertiary health facility. *Annals of African Medicine.* 2004;3(3):130 - 3.
11. Stefanini A. District hospitals and strengthening referral systems in developing countries. *World Hosp Health Serv.* 1994;30(2):14-9.
12. MoH. <https://knh.or.ke/index.php/history/> Nairobi, Kenya; 2021 [updated 2021; cited 2021 10th May]; Available from.
13. GoK. Article 6 of the Constitution of Kenya 2010. Nairobi, Kenya; 2010.
14. MoH. Kenya Health Policy 2014 – 2030. Nairobi, Kenya; 2014.
15. KNH IN-PATIENT STATISTICS REPORT 2018, 2019 & 2020 [database on the Internet]. 2020 [cited June 2020].
16. Duffield C, Diers D, O'Brien-Pallas L, Aisbett C, Roche M, King M, et al. Nursing staffing, nursing workload, the work environment and patient outcomes. *Appl Nurs Res.* 2010 Nov;24(4):244-55.

17. P. Buerhaus JN. Policy Implications of Research on Nurse Staffing and Quality of Patient Care Policy, Politics, & Nursing Practice. 2000.
18. Sharma SK, Rani R. Nurse-to-patient ratio and nurse staffing norms for hospitals in India: A critical analysis of national benchmarks. *J Family Med Prim Care*. 2020 Jun 2020;9(6):2631-7.
19. Casagrande PaS. *Biometrics* 1978;34:483-6
20. Ahmed E, Chaka T. The pattern of orthopedic admissions in Tikur Anbessa University Hospital, Addis Ababa. *Ethiop Med J*. 2005 Apr;43(2):85-91.
21. Saikiran Velpula, Laxmi Prasanna Gummadi, Nagaraju Vallepu, Bharath Kumar Dasari, Anchuri. SS. Epidemiology of orthopedic trauma admissions in a multispecialty hospital in Warangal-A retrospective study. *Clinical Practice*. 2019;16(6).
22. Mishra BN, Jha A, Gupta. Epidemiology of Orthopaedic Admissions at A Teaching Hospital of Eastern Nepal. . *Journal of Nobel Medical College*. 2017;6(1):56–62.
23. Suraj Bidary, Suresh Pandey, Hemant Kumar Gupta, Roshani Aryal, Bhattarai K. Pattern of Injury among Orthopaedic Inpatients in Teaching Hospital in Nepal. *Journal of College of Medical Sciences-Nepal*. Oct-Dec 2020;16(4).
24. Chandrashekara CM, George MA, Al-Marboi BSK. Demography of orthopaedic admissions in a secondary care hospital in oman. *Brunei International Medical Journal* 2013;9(4):236-42.
25. Premkumar A, Massawe HH, Mshabaha DJ, R.Foran J, XiaohanYing, Sheth NP. The burden of orthopaedic disease presenting to a referral hospital in northern Tanzania. *Global Surgery*. 2015;2(1):70-5.
26. Manwana ME, Mokone GG, Kebaetse M, T Y. Epidemiology of traumatic orthopaedic injuries at Princess Marina Hospital, Botswana. *South African Orthopaedic Journal*. 2018 March 2018;17(1):41-6.
27. Kihuba E. Epidemiology and medical costs of orthopedic conditions in a tertiary hospital in Kenya; A five-year analysis of admission data. *BMJ Yale*. 2022.
28. William Mack Hardaker, Mubashir Jusabani, Honest Massawe, Anthony Pallangyo, Rogers Temu, Gileard Masenga, et al. The burden of orthopaedic disease presenting to a tertiary referral center in Moshi, Tanzania: a cross-sectional study. *Pan African Medical Journal* 2022;42:96. 2022;42(96).
29. Pan RH, Chang NT, Chu D, Hsu KF, Hsu YN, Hsu JC, et al. Epidemiology of orthopedic fractures and other injuries among inpatients admitted due to traffic accidents: a 10-year nationwide survey in Taiwan. *ScientificWorldJournal*. 2014;2014:637872.
30. Pouramin P, Li CS, Sprague S, Busse JW, Bhandari M. A multicenter observational study on the distribution of orthopaedic fracture types across 17 low- and middle-income countries. *OTA Int*. 2019 Sep;2(3):e026.
31. Simba DO, Mbembati NAA, Museru LML, E.K. L. Referral Pattern of Patients Received at the National Referral Hospital: Challenges in Low Income Countries. *East African Journal of Public Health*. 2008;5(1):6-9.

32. Pittalis C, Brugha R, Bijlmakers L, Mwapasa G, Borgstein E, Gajewski J. Patterns, quality and appropriateness of surgical referrals in Malawi. *Trop Med Int Health*. 2020 Jul;25(7):824-33.