Rwanda Medical Journal RMJ

ORIGINAL ARTICLE Open Access

Assessing the waiting time for emergency orthopedic surgery for open fractures – A 6-month review of records at one of the largest referral public hospitals in Rwanda

Authors: M. Nkeshimana[1,2,3,*]; R. Wong[3,4]; J. Bikoroti[2,6]; S. Jayaraman[5]; J. C. Byiringiro[2,6]; Z. El-Khatib[3,7,8]

Affiliations: *[1]Department of Accident & Emergency, Centre Hospitalier Universitaire de Kigali, Rwanda; [2]University of Rwanda, College of Medicine and Health Sciences, Kigali, Rwanda; [3]University of Global Health Equity, Kigali, Rwanda; [4]School of Public Health, Yale University, USA; [5]Virginia Commonwealth University, Department of Surgery; [6]Department of Surgery, Orthopedics Unit, Centre Hospitalier Universitaire de Kigali, Rwanda; [7]Department of Global Public Health, Karolinska Institutet, Stockholm, Sweden; [8]World Health Programme, Université du Québec en Abitibi-Témiscamingue (UQAT), Québec, Canada*

ABSTRACT

INTRODUCTION: The delay in surgical intervention for open fractures can have severe negative consequences. However, the delay for patients with open fractures presenting at Centre Hospitalier Universitaire de Kigali (CHUK), one of the largest public hospitals in Kigali, Rwanda, had not been studied. This study assessed the waiting time for surgery and compared it against the 6-hour (ideal time) and 24-hours (acceptable time) standards.

METHODS: A review of the postoperative register and patients' records was conducted. All medical charts of open fracture cases between April and September 2018 were audited. A surgical case was considered significantly delayed if the time interval from patient arrival at the emergency room to the operation theater was longer than 24 hours. The demographics, acuity level, insurance status and work shifts, were assessed using bi- and multivariate analysis.

RESULTS: A total of 115 open fracture case files were audited. From arrival at the emergency room to surgery, the median time was 41 hours (IQR 21, 93). Only 3 (2.6%) were operated within 6 hours and 38 (33%) within 6 to 24 hours. The main factor contributing to the delay was obtaining orthopedic consultation note and documenting the decision to operate (median 10 hours, IQR 4 to 17). Meanwhile, the designated emergency theater was not utilized for a total of 18 hours per day, especially during night shifts.

CONCLUSION: There was a significant delay in obtaining emergency orthopedic consultation and, thus, the timing of the surgical treatment. Examining the patient flow system in orthopedic surgical care delivery is needed in order to maximize theater utilization at this urban university hospital.

Keywords: Trauma, Emergency, Orthopedic Procedures, Operative Time, Global Health, Rwanda

***Corresponding author:** Menelas Nkeshimana, Department of Accident & Emergency, Centre Hospitalier Universitaire de Kigali, Rwanda, E-mail: mnls.nke@gmail.com;
Potential Conflicts of Interest (CoI): All authors: no potential conflicts of interest disclosed; **Funding:** All authors: All authors: no funding has been sought or gained for this project; **Academic Integrity.** All authors confirm that they have made substantial academic contributions to this manuscript as defined by the ICMJE; **Ethics of human subject participation:** The study was approved by the local Institutional Review Board. Informed consent was sought and gained where applicable; **Originality:** All authors: this manuscript is original has not been published elsewhere; **Review:** This manuscript was peer-reviewed by three reviewers in a double-blind review process; **Type-editor:** Tristan (USA).

Received: 29th November 2020; **Initial decision given:** 11th September 2021; **Revised manuscript received:** 29th November 2021; **Accepted:** 18th February 2022.

 Publisher: Rwanda Biomedical Centre (RBC)/Rwanda Health Communication Center, P. O. Box 4586, Kigali. ISSN: 2079-097X (print); 2410-8626 (online)

Citation for this article: M. Nkeshimana; R. Wong; J. Bikoroti et al. Assessing the waiting time for emergency orthopedic surgery for open fractures – A 6-month review of records at one of the largest referral public hospitals in Rwanda. Rwanda Medical Journal, Vol. 79, no. 1, p. 26-35, 2022. https://dx.doi.org/10.4314/rmj.v79i1.4

INTRODUCTION

Access to surgical care is a challenge across the world, where an estimate of 5 billion people worldwide are still unable to access surgical care, especially in low- and middle-income countries (LMIC) [1-2]. In resource-limited settings, surgical care is often delayed due to distance to the clinic, cost of care, resources, roads, availability of healthcare providers, organizational problems and cultural specific attitudes such as fear to undergo surgery [3]. The access to care is often driven by the overall readiness for surgery, including the correct diagnosis, the consent process, the financial requirements and the availability of the needed materials. A systematic review of articles published from 2006 to 2014 across Sub-Saharan Africa (SSA) has identified that finance issues, the turnaround time for laboratory and imaging tests, delayed decision to operate could lead to long waiting time [4–7].

For critical conditions such as open fractures, surgery should be ideally performed within six hours in order to obtain the most optimal care outcomes (the "six-hour rule"), although realistically, within 24 hours is still a reasonable and acceptable time frame [8]. Surgeries that are performed over 24 hours exponentially increase the risk of bacterial infection and, in turn, compromise the overall surgical outcomes [9-10]. Delayed surgical care can also cause a delay in recovery, permanent disability and even death [11-12]. Despite using quality improvement measures to enhance patient flow to facilitate timely provision of emergency care, the timeline of open fractures cares at the Centre Hospitalier Universitaire de Kigali (CHUK) has not been formally evaluated [13-14]. At this hospital, anecdotal evidence from observations and informal documentation showed that the average time from admission to an emergency room to surgeries was much longer than the 6-hour target. Almost three-quarter of patients (70%) in need of surgical care, especially orthopedic cases, had a waiting time up to one week in the emergency room before being transferred to surgery (Sitrep data CHUK since January 2017, unpublished reports).

To evaluate this problem formally, this study aimed to assess the magnitude of the waiting time between emergency department arrival and operating room care for patients needing emergency orthopedic surgery at CHUK, assess the associated risk factors with extended waiting time, and identify bottlenecks that may need to be addressed.

METHODS

Study setting: The Centre Hospitalier Universitaire de Kigali (CHUK) is a public tertiary hospital and academic center located in the center of Kigali city. Among 565 beds in CHUK, 24 beds are allocated to the Department of Accident and Emergency (A&E). The hospital A&E room receives a high volume of patients suffering from injuries due to road traffic accidents up to 200 cases per month (2400 admissions per year), as per the monthly internal reports from the Statistics department. The A&E was staffed by 40 nurses, one matron, one manager of the unit, one internist (who is also the head of the department), two emergency medicine specialists, two general practitioners, 19 emergency medicine residents, 22 support staff and three security staff. From the group of five orthopedic surgeons who staff the unit of Orthopedics surgery, a staff surgeon is scheduled for 24 hours/7 days' week on-call coverage, assisted by two resident doctors rotating in the Orthopedics unit, to provide emergency orthopedic surgical services. A separate operating theater is specifically allocated for emergency orthopedic cases and is available 24 hours a day with full support from nursing and anesthesia services.

Study design: This was a cross-sectional study from April through September 2018. We reviewed medical charts for all patients who received emergency orthopedic surgery at the CHUK during this time to assess the waiting times, risk factors, outcomes and barriers to care. Patients' charts were screened in the postoperative recovery area to identify patients who had emergency orthopedic surgery. Inclusion criteria were: all patients presenting to the A&E who required to undergo emergency orthopedic surgery for open fractures.

Exclusion criteria were: acute respiratory failure requiring intubation and ventilator support, concurrent severe traumatic brain injury, altered mental status or documented mental illness who can't consent for themselves, all for which surgery delay might be justified.

A data collection tool was used to extract information from from the patients' files.

The surgical note mentioned if the fracture is categorized as closed or open. And usually, open fractures are handled more urgently in order to minimize the risk of infection. If this information did not appear clearly, this was to be marked as "other". The disease condition was reproduced as written on the postoperative diagnosis, including the surgery specific categorization where appropriate. Emergency room triage coding: Reference made to the emergency room South African Triage Scale (SATS) triage tool, the colors of the code (per order of severity from severe to less severe) are red, orange, yellow and green, were extracted as part of pertinent data.

The commonly used insurance is Mutuelle de santé, Rwanda Social Security Board (RSSB), Military Medical Insurance (MMI), Societe Regionale d'Assurances (SORAS) and Compagnie Rwandaise d'Assurances et de Reassurances (CORAR). At this stage, we were not interested in the specific insurance but the presence or absence of any modality of co-pay. The emergency admission form always mentions the insurance status, either as present or not present. For road traffic accidents that might be covered by Fond de Guarantee (a public fund that "sometimes" might cover for medical bills for victims of road traffic accidents involving motorized vehicles at the condition that the victims were not the cause for the accident), we also marked as unknown. We marked it as unknown if the documentation was poor or the insurance status field was left blank.

Time from the arrival in the A&E to the time when the first orthopedic consult note is made and the decision to operate is made. The information on time of anesthesia induction and time of discharge from the hospital was also recorded.

The outcome measure, data management and analysis: In this study, delayed surgery is defined as the time from arrival to the emergency room to the time of anesthesia induction greater than 24 hours. Descriptive and comparative analysis using chi-square and Fisher's Exact test were conducted to assess the relationship between waiting time and factors including demographics, insurance status, working shifts, the most senior operating staff. All variables significant at p-value <0.20 in the bivariate were considered in the multivariate analysis. The exception was made for the emergency room triage category which was kept in the multivariate analysis because of its importance in the timeline of patient's disposition from the emergency room to theater. The multivariate analysis was conducted using multivariable logistic regression analysis. All analysis was conducted using Stata Version 14. The total number of hours the emergency theater remained unused per 24 hours shift block monthly was also counted. During the collection of data on the free time, one hour in between cases is subtracted from the counted time for which theater was not being utilized. The subtracted one hour accounts for the needed time to get the theater ready for the next patient's surgery.

Ethical permission to carry out this project was obtained from the University of Global Health Equity's Institutional Review Board (Protocol # 0069) and from the Ethical Committee of CHUK (EC/CHUK/749/2018).

RESULTS

A total of 280 emergency orthopedic operations were performed in the study period-- the majority (149 out of 280 surgeries, 53%) were for open fractures. Of those, 115 cases had complete data available for analysis (Figure 1).

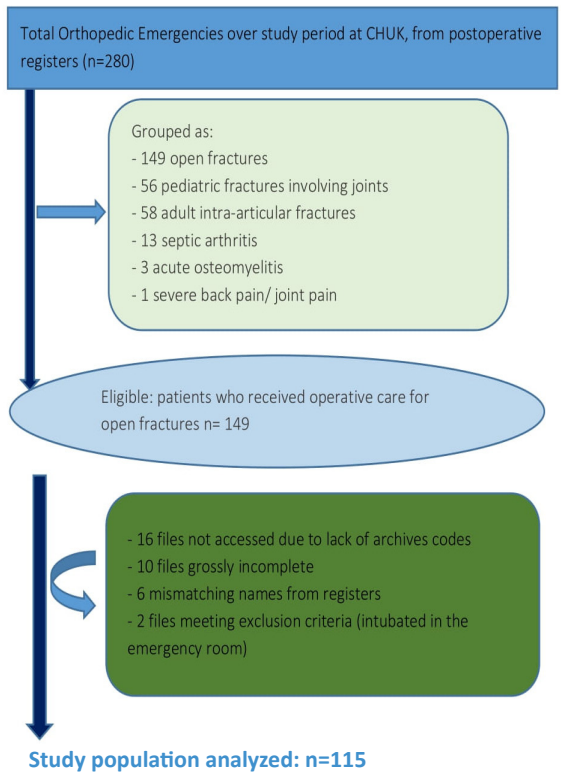

Figure 1: Study Flow chart

Table 1: Description of the variables using numbers and percentages

Variable	N=115	%
Age (years)		
< 30 years	37	32.2
30- 40 years	47	40.9
> 40 years	31	27.0
Gender		
Male	92	80.0
Female	23	20.0
Province		
Kigali	55	47.8
Eastern	2	1.7
Western	18	15.6
Northern	22	19.1
Southern	17	14.8
Out of Rwanda	1	0.9
Type of Insurance		
Mutuelle de santé	77	67.0
Other types	19	16.5
Uninsured	19	16.5
Triage (Acuity)		
Green	2	1.7
Orange	97	84.3
Red	5	4.3
Yellow	10	8.7
Unknown	1	0.9
Length of stay		
<=5 days	41	35.6
6 to 10 days	28	24.3
>10 days	46	40.0
Wound infection documented		
Yes	17	14.9
No	98	85.2
Time of Day (admission)		
Day shift	60	52.2
Night shift	55	47.8
The most senior operating person		
Consultant	45	39.1
Resident	70	60.9

As shown in table 1, the majority of patients enrolled in this study were in the age group from 30 to 40 years (40.9%) and were predominantly of male gender (80%). Only 19/115 (16.5%) participants were not insured. In 17 out of the 115 participants (14.7%), wound infections were

Table 2: Timelines of access to surgery

Variable	Unit measure	Value measured
Time from the patient's arrival in the emergency room to ortho consult (in hours)	Median	10
	IQR Range	4 – 17
Time from ortho consult to anesthesia induction (in hours)	Median	23
	IQR Range	12- 72
Overall timelines from arrival to surgery	Median, hours	41
	IQR Range, hours	21- 93
	<6 hours, n (%)	3 (2.6%)
	6 – 24 hours, n (%)	38 (33%)
	>24 hours, n (%)	74 (64.4%)

documented during hospitalization. The volume was equally distributed between day and night shift (52% versus 47.8%) and most of the surgeries were performed by the resident on-call (60.8%). The median time to receive a review by the orthopedic surgery team is 10 hours after arrival in the A&E (IQR 4, 17) (Table 2) and the emergency surgery took place 41 hours (IQR 21, 93) after arrival. Only 3 patients (2.6%) were operated on within 6 hours, 38 (33%) were operated on between 6 and 24 hours and 74 (64.4%) were delayed beyond 24 hours.

No covariates, including age, gender, province, insurance status, level of acuity, work shift and operating surgeon, were found statistically associated with long waiting time for emergency orthopedic surgery (p>0.05) (Table 3).

Table 4 shows that patients who came from the Northern province were less likely to wait long for surgery compared to the patients who came from Kigali (OR 0.59, CI 1.23 – 19.02).

From Table 5, it was notable that the emergency theater was not in use on average 6.5 hours during the day shift and on average 11.5 hours during the night shift.

DISCUSSION

This study was done at one of Rwanda's largest referral medical university hospitals and found an alarmingly long wait time for orthopedic surgery, with only three patients (2.6%) meeting the ideal time to surgery within six hours. This is comparable to the findings from Nigerian studies [5-6,15]. Of all the basic demographics and potential associations studied in this project, none of them was a factor of risk for surgical delay. On special emphasis, in our setting, the insurance status was not associated with the observed delay as it had been the case in Nigeria [5].

Although there are many milestones achieved in the process of improving access to care in Rwanda, the current metrics are evidence for residual serious system issues that would need timely identification and resolution. The time to obtain the orthopedic consult and decision to operate was found to be long (median 10 hours). This finding serves as an opportunity for a series of intervention points, including studying the timelines of calling the orthopedic surgery team to avail this specialized review as early as possible and ownership of the patient's care. The same would be to ensure that the orthopedic team leader leaves a clear note on the tentative schedule of the emergency surgery in the patient's chart with this communication being transmitted directly to all the operative theater teams that are concerned (i.e. nursing team, anesthesia team etc.). This would lead to the overall reduction in the waiting time for surgery (median 41 hours).

None of the covariates used in this project (which were also mentioned in the literature as potential root causes) has shown a significant association.

Table 3: Bivariate analysis using numbers, percentages and p-values to assess associations between long waiting time and other variables. n=113

Variable	Long waiting n (%)		p-value
	Yes	No	
Age			
Below 30 years	27(37.5)	10(24.4)	0.31
30 to 40 years	29(40.3)	18(43.9)	
Above 40 years	16(22.2)	13(31.7)	
Gender			
Male	15(20.8)	7(17.1)	0.63
Female	57(79.2)	34(82.9)	
Province			
Kigali	32(44.4)	22(53.7)	0.09
Eastern	1(1.4)	1(2.4)	
Western	9(12.5)	9(21.9)	
Northern	19(26.4)	3(7.3)	
Southern	11(15.3)	6(14.6)	
Insurance			
Mutuelle de santé	51(70.8)	25(61.0)	0.56
Other types	10(13.9)	8(19.5)	
Uninsured	11(15.3)	8(19.5)	
Triage			
Red or Orange	39(95.1)	63(86.3)	0.21
Green or Yellow	2(4.9)	10(13.7)	
Length of stay			
≤5 days	24(33.3)	16(39.0)	0.16
6 to 10 days	22(30.6)	6(14.6)	
>10 days	26(36.1)	19(46.3)	
Wound infected			
No	60(83.3)	36(87.8)	0.52
Yes	12(16.7)	5(12.2)	
Work shift			
Day shift	37(51.4)	21(51.2)	0.99
Night shift	35(48.6)	20(48.8)	
The most senior operating person			
Consultant	28(38.9)	16(39.0)	0.99
Resident	44(61.1)	25(61.0)	

Variables are included in log regression analysis if p<0.2

By referencing to other studies in similar settings, there is a need to interrogate in-depth other issues that could potentially lead to this undesired reality of long waiting time for emergency surgery, such as those related to the maximization of theater utilization and efficient staffing. A review of internally reported CHUK statistics reveals that the bed occupation rate on the orthopedic ward has

Table 4: Multivariable logistic regression using odds ratios and p-values to assess associations between long waiting time and predictors. N=113

	Full model*			Reduced model		
Variable	**OR**	**p-value**	**95%CI**	**OR**	**p-value**	**95%CI**
Length of stay						
<=5 days	1					
6 to 10 days	2.83	0.08	0.83- 9.01			
>10 days	0.82	0.67	0.32- 2.08			
Triage						
Red or Orange	1					
Green or Yellow	2.55	0.27	0.48- 13.49			
Province						
Kigali	1					
Eastern	2.55	0.90	0.05-14.87	0.69	0.79	0.41- 11.60
Western	0.84	0.36	0.19- 1.83	0.69	0.49	0.24- 2.01
Northern	0.59	0.02	1.23- 19.02	4.35	0.03	1.15- 16.52
Southern	1.08	0.90	0.33- 3.54	1.26	0.69	0.41- 3.91

Variables are significant if p<0.05; OR is an odds ratio

decreased from 79% (July 2018) to 75% (March 2019), and this provided more room to maximize the current emergency theater utilization rate by availing the other needed logistics that are not space-related. This project has documented an average of 18 hours per day during which the emergency theater was not in use 6.5 hours during the day shift and 11.5 hours during the night shift. This project also gives room to openness to learn from other successful systems where the 4S, i.e. stuff, staff, space and systems, might be running smoothly. There is a need for continued work on this problem to identify proper interventions to be tested and evaluated to inform our current policy on possible root causes beyond those that were thought of during the conception of this project. Using the current theater utilization data and lack of evidence incriminating the common associations for the surgical delay, we should consider hiring "surgical nocturnists" (surgeons dedicated to operating during night shifts) as seen in other countries are currently facing the same

Table 5: Hours the emergency theater is not in use per shift (weekdays and weekends)

Month/year	Day shift (not in use, hours)	Night shift (not in use, hours)	TOTAL (not in use, hours)
April 2018	6.4	11.3	17.7
May 2018	6.7	11.7	18.8
June 2018	8.2	11.4	19.6
July 2018	7.4	11.6	19
August 2018	5.5	11.1	16.6
September 2018	4.6	11.7	16.3
AVERAGE	6.5	11.5	18

problem. Of course, that might mean maximizing efficiency and or increasing the current surgical staffing size, and reliably engaging with other disciplines involved in surgical care delivery at CHUK. Contrasting this project's findings to the similar project that involved patients in need of emergency general surgery at the same center whereby up to 91% of cases, the general surgeon was immediately available [16], we might argue that the observed delay to obtain orthopedic consult was an internal issue to be interrogated within the Orthopedics unit.

Considering the current average of emergency room overstay at CHUK, which is estimated at around three days (all patients counted together regardless of admitting disciplines), the orthopedic ward patients' length of stay in the hospital ranging between 8 – 10 days (CHUK Statistics, Unpublished), the emergency theater under-utilization, and an orthopedic caseload of 149 open fracture cases over six months for a group of five orthopedic surgeons, we can hypothesize to clear staff and space as major reasons for the observed surgical delay. That said, the proposed interventions from this project would be geared towards tackling issues related to stuff such as sterile drapes and other theater consumables, and those addressing systems issue as it had been speculated before in a similar project that was aimed to interrogate the access to emergency general surgery [17].

This project studied the care pathway for relatively young patients (majority aged below 40 years old) with open fractures but omitted to collect data on concurrent comorbidities, and it is hard to assume that the delay was not medically justified and protective against adverse surgical outcomes as it was recently reported in a Colombian study [18]. On the other hand, the lack of association between surgical delay and the patients' insurance status is reassuring and reflective of an "equity agenda" that is being commonly held among healthcare providers in Sub-Saharan Africa (SAA); meaning that all patients should be able to access the needed healthcare regardless of their social rankings and the ability to pay out of their pockets.

There were 34 (23%) missing files and it is not clear how the missing information would have altered the results.

This study could only provide a general overview on the magnitude of the problem, as only limited number of factors that influence the limeliness of sugery were collected.

The pre-hospital data has not been captured, although it would be added to the already prolonged time to surgery and augment further the magnitude of this problem.

The retrospective design with patients' charts review is also known to provide a limited pool of data to allow in-depth analysis of details pertaining to the healthcare process.

This project was only carried out at one of the three tertiary public hospitals in Rwanda, however, he findings could be extrapolated to the other two Rwandan tertiary care centers (including one located in the Southern Province of Rwanda), and also to similar hospitals that operate at the same level in the same settings of the public domain in SAA.

CONCLUSION

There is an alarmingly long waiting time for patients with open fractures presenting at CHUK needing emergency orthopedic surgery.

The commonly thought to be predictors of long wait time (age, level of acuity, insurance status, shift and the rank of the provider on-call) are not found to be associated with this challenging problem evaluated in this study. The reason behind this surgical delay remains unknown to date.

The emergency theater is not fully utilized and vacates about 18 hours per day, especially during night shifts.

There is a need for future studies to evaluate the feasibility of availing quality surgery in the seemingly under-utilized emergency theater slots, especially during night shifts, even if it required hiring additional staff dedicated to working efficiently during those vacant theater slots at night.

The findings from this project were presented at the annual meeting of the Rwanda Surgical Society, and this study has enhanced our collaborative efforts to improve the care delivery for time-critical conditions such as limb-saving surgery.

We also recommend for future studies go deep into the interrogation of systems and staff issues as potential main drivers of surgical delay in Rwandan tertiary hospitals.

REFERENCES

[1] B. C. Alkire et al., "Global access to surgical care: A modelling study," Lancet Glob. Heal., 2015, doi: 10.1016/S2214-109X(15)70115-4.
[2] M. Punchak et al., "Neurosurgical Care: Availability and Access in Low-Income and Middle-Income Countries," World Neurosurg., 2018, doi: 10.1016/j.wneu.2018.01.029.
[3] C. E. Grimes, K. G. Bowman, C. M. Dodgion, and C. B. D. Lavy, "Systematic review of barriers to surgical care in low-income and middle-income countries," World J. Surg., 2011, doi: 10.1007/s00268-011-1010-1.
[4] E. O. Orji, E. O. Ojofeitimi, A. O. Esimai, E. Adejuyigbe, A. B. Adeyemi, and O. O. Owolabi, "Assessment of delays in receiving delivery care at a tertiary healthcare delivery centre in Nigeria," Journal of Obstetrics and Gynaecology. 2006, doi: 10.1080/01443610600903628.
[5] N. Mbah, W. Opara, and N. Agwu, "Waiting time among acute abdominal emergencies in a Nigerian teaching hospital: causes of delay and consequences," Niger. J. Surg. Res., 2010, doi: 10.4314/njsr.v8i1.54835.
[6] A. Adamu, M. Maigatari, K. Lawal, and M. Iliyasu, "Waiting time for emergency abdominal surgery in Zaria, Nigeria.," Afr. Health Sci., 2010.
[7] I. Abdulkareem, "The surgical waiting time initiative: A review of the Nigerian situation," Niger. Med. J., 2014, doi: 10.4103/0300-1652.144692.
[8] O. C L, M. M, and J. N, "Controversies in the management of open fractures.," Open Orthop. J., 2014, doi: 10.2174/1874325001408010178.
[9] G. Kumar and B. Narayan, "Prevention of infection in the treatment of one thousand and twenty-five open fractures of long bones. retrospective and prospective analyses," in Classic Papers in Orthopaedics, 2014.
[10] M. Swiontkowski and W. Cross III, "Treatment principles in the management of open fractures," Indian J. Orthop., 2008, doi: 10.4103/0019-5413.43373.
[11] J. C. Byiringiro, J. Gashegu, M. Nyundo, and D. S. Mugenzi, "Short term functional recovery in patients with delayed surgery for hip fractures," ISB 2011 Brussels, 2011, [Online]. Available: http://homepages.ulb.ac.be/~labo/ISB2011/ISB2011_ScientificProgram_files/1421.pdf.
[12] C. et al Mpirimbanyi, C., Rickard, J., Furaha, "Necrotizing Soft Tissue Infections at a Tertiary Referral Hospital in Rwanda: Epidemiology and Risk Factors for Mortality," World J Surg, vol. 42, no. 8, p. pp 2314–2320, 2018, doi: 10.1007/s00268-018-4515-z.
[13] J. Claude Byiringiro et al., "Applying quality improvement principles to improve accident and emergency department overcrowding and flow in Rwanda: a case study," J. Hosp. Adm., 2015, doi: 10.5430/jha.v4n5p47.
[14] C. Hategeka, L. Mwai, and L. Tuyisenge, "Implementing the Emergency Triage, Assessment and Treatment plus admission care (ETAT+) clinical practice guidelines to improve quality of hospital care in Rwandan district hospitals: healthcare workers' perspectives on relevance and challenges," BMC Heal. Serv Res, vol. 17, 2017, doi: 10.1186/s12913-017-2193-4.
[15] B. O. Mofikoya, G. O. Enweluzo, K. H. Tijani, E. O. Ogunleye, and O. O. Kanu, "Emergency Surgical Services in a Sub Saharan African Country: Can we meet the Needs?," Eur. J. Sci. Res., vol. 43, no. 2, p. pp.265-271, 2010, [Online]. Available: https://www.researchgate.net/publication/216439310_44.
[16] C. Mpirimbanyi et al., "Defining the Three Delays in Referral of Surgical Emergencies from District Hospitals to University Teaching Hospital of Kigali, Rwanda," World J. Surg., 2019, doi: 10.1007/s00268-019-04991-3.
[17] E. Tuyishime, R. P. Banguti, J. P. Mvukiyehe, F. Ntirenganya, and G. Cattermole, "Timing of emergency general surgery in a major referral hospital in Rwanda: A retrospective study," 4th African Conf. Emerg. Med. Kigali, Rwanda, 2018.
[18] F. R. Montes et al., "Association between emergency department length of stay and adverse perioperative outcomes in emergency

surgery: a cohort study in two Colombian University hospitals," BMC Emerg. Med., vol. 19, no. 1, p. 27, 2019, doi: 10.1186/s12873-019-0241-6.