ORIGINAL RESEARCH

"EM Doc On Call:" A Pilot Study to Improve Interhospital Transfers in Rwanda

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Abstract

Introduction: Treatment of seriously ill patients is often complicated by prolonged or complex transfers between hospitals in sub-Saharan Africa. Difficulties or inefficiency in these transfers can lead to poor outcomes for patients. "On-call" triage systems have been utilized to facilitate communication between facilities and to avoid poor outcomes associated with patient transfer. This study attempts to examine the effects of a pilot study to implement such a system in Rwanda.

Methods: Data collection occurred prospectively in two stages, pre-intervention and intervention, in the emergency department (ED) at Kigali University Teaching Hospital (CHUK). All patients transferred during the pre-determined timeframe were enrolled. Data were collected by ED research staff via a standardized form. Statistical analysis was performed using STATA version 15.0. Differences in characteristics were assessed using χ^2 or Fisher's exact tests for categorical variables and independent sample t-tests for normally distributed continuous variables.

Results: During the "on call" physician intervention, the indication for transfer was significantly more likely to be for critical care (P <.001), transfer times were faster (P <.001), patients were more likely to be displaying emergency signs (P <.001), and vital signs were more likely to be collected prior to transport (P <.001) when compared to the pre-interventional phase.

Conclusion: The "[Emergency Medicine] EM Doc On Call" intervention was associated with improved timely interhospital transfer and clinical documentation in Rwanda. While these data are not definitive due to multiple limitations, it is extremely promising and worthy of further study.

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Abbreviations:
CHUK: Kigali University Teaching Hospital [Centre Hospitalier Universitaire de Kigali]
COVID-19: coronavirus disease 2019
ED: emergency department
EM: Emergency Medicine
GP: General Practitioner
PGY: post-graduate year
SAMU: Emergency Medical Services [Service d'Aide Médicale d'Urgence]
TEWS: Triage Early Warning System

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Introduction

In sub-Saharan Africa, one in six people live more than two hours away from a public hospital, and one-eighth of the population is farther than one hour away from any health facility.[1] For critically ill and medically complex patients who make it to an initial hospital for evaluation, the process is further compounded by the need for transfer to a higher level of care.[2,3] Previous studies suggest that transfer to a higher level of care is correlated with increased patient morbidity and mortality rates,[4,5] higher health care costs, longer durations of stay,[6] and that these transfers tend to relocate patients farther from their homes and support systems. Delayed or unnecessary transfers can further negatively impact patients. In developing countries, nine out of ten patients lack access to timely care.[7] For acutely ill and injured patients, timely transfer to definitive care can significantly predict patient outcomes. If there are complications, transfer delays can lead to increases in resource consumption and patient morbidity and mortality. The unnecessary transfer of stable patients places undue burdens on receiving tertiary hospitals, such as overcrowding and an increased frequency of immediate counter-referral.[8] When transfer systems are inappropriately utilized, it can lead to poor allocation of available resources[9,10] and overall poor health outcomes.

The coordination and efficiency of the transfer process relies heavily on communication. Communication between the specialized receiving physician and transferring physician determines which patients are appropriate for transfer, helps to stabilize critically ill patients, and ensures that a proper transfer mode is used.[11] This is a crucial component of the health care system,[12] and specifically, the Rwandan system. The Rwandan health care system maintains a pyramidal model, whereby each unit offers a specific package of services. There is a need for referral systems to ensure the proper application of services.[13] The current referral system demonstrates a multi-directional pattern with district hospitals referring to each other, as well as sending referrals to tertiary hospitals. Though feasible, transfers from a tertiary hospital to district hospital are uncommon.[13]

In Rwanda, the health structure is in pyramid starting from health centers staffed by nurses, district hospital staffed mostly by general practitioners (GPs), and followed by referrals hospitals with specialists. The process of interhospital transfer helps to escalate from lower to higher level of care using hospitals' ambulances, and this lacks standardization and is plagued by challenges in communication across facilities. Interhospital transfers have historically been associated with the problems in continuity of care due to communication errors and information gaps.[14] Since 1990, on-call medical care and triage systems have been in place in certain parts of the world. These systems facilitate conversations between transferring and receiving physicians,[15] thus strengthening health care accessibility in different countries, including the United Kingdom, the United States, Denmark, and Switzerland.[16] Developing a strategy to facilitate communication between district hospitals and the receiving transfer center can be an effective way to improve the outcomes for transfer patients. Therefore, transfer delays, unnecessary transfers, and negative patient outcomes might be reduced through the implementation of an on-call consultation service.

This pilot study aimed to provide introductory data on the demographic characteristics and care of patients transferred from district hospital to tertiary hospital in Rwanda. Furthermore, the study aimed to examine the effects of an "[Emergency Medicine] EM Doc on Call" intervention on these variables.

Methods

Setting

This is a prospective, observational pilot study conducted in the emergency department (ED) at Kigali University Teaching Hospital (CHUK [Centre Hospitalier Universitaire de Kigali]), a tertiary hospital and the largest referral hospital in the city of Kigali with a 519-bed capacity. It receives referred trauma and medical patients from all over the country for diagnostic and management purposes exceeding 20,000 patient visits per year. The ED has a 24-bed capacity but is often overcrowded with 48 beds. The CHUK ED uses the Triage Early Warning Score (TEWS) to categorize patients based on the severity of illness. Patients are categorized as RED, ORANGE, YELLOW, or GREEN, with RED assigned to patients with the most severe illness.[17]

Study Design

This study featured a pre-intervention and intervention phase. In the pre-intervention phase, data were collected regarding patient transfers from ten randomly selected district hospitals in the CHUK catchment area (out of 19 possible hospitals) from November 19, 2019 through January 19, 2020.

The pilot intervention consisted of a senior EM Resident Physician (post-graduate [PGY]-3 or PGY-4) or EM Attending Physician, both known as the "EM Doc on Call" at CHUK, calling GPs at randomly selected district hospitals by mobile phone. The "EM Doc On Call" would respond or inquire about patients currently present at the district hospital and ask about any patients that might require transfer. This call would take place every day after morning rounds in the CHUK ED (approximately 10:00AM). The "EM Doc On Call" would remain available during daytime hours (7:00AM to 7:00PM) to receive calls and questions from the district hospitals. The number of calls and content of calls received by the "EM Doc On Call" was not recorded.

Due to staff and resource constraints at CHUK during the coronavirus disease 2019 (COVID-19) pandemic, the intervention was restricted to five of the ten district hospitals included in the pre-intervention phase (Figure 1). Specifically, staff from CHUK were relocated to other health facilities dedicated to providing care to patients with COVID-19. This significantly limited the abilities of the research team.

The five hospitals where the intervention was deployed were selected using a random number generator. Data on patient transfers were collected from these hospitals from March 19, 2020 through May 19, 2020. Pre-intervention and intervention data were then compared.

It should be noted that all COVID-19 patients in Rwanda were treated at specialized facilities erected during the pandemic. Few, if any, COVID-19 patients were treated at district or tertiary care facilities within the data collection period. As such, the data acquired during this study does not include patients with COVID-19.

Data Collection and Management

All patients who were transferred from selected hospitals during daytime hours (7:00AM to 7:00PM) were enrolled into the study. Following enrollment, prospective data were gathered by ED research staff on patient demographics, the reason for transfer, patient type, training of transferring doctor, vital sign documentation, injury severity, initial disposition, and final disposition. Information was collected on counter-referral, defined as the transfer of a patient back to the district hospital site of initial

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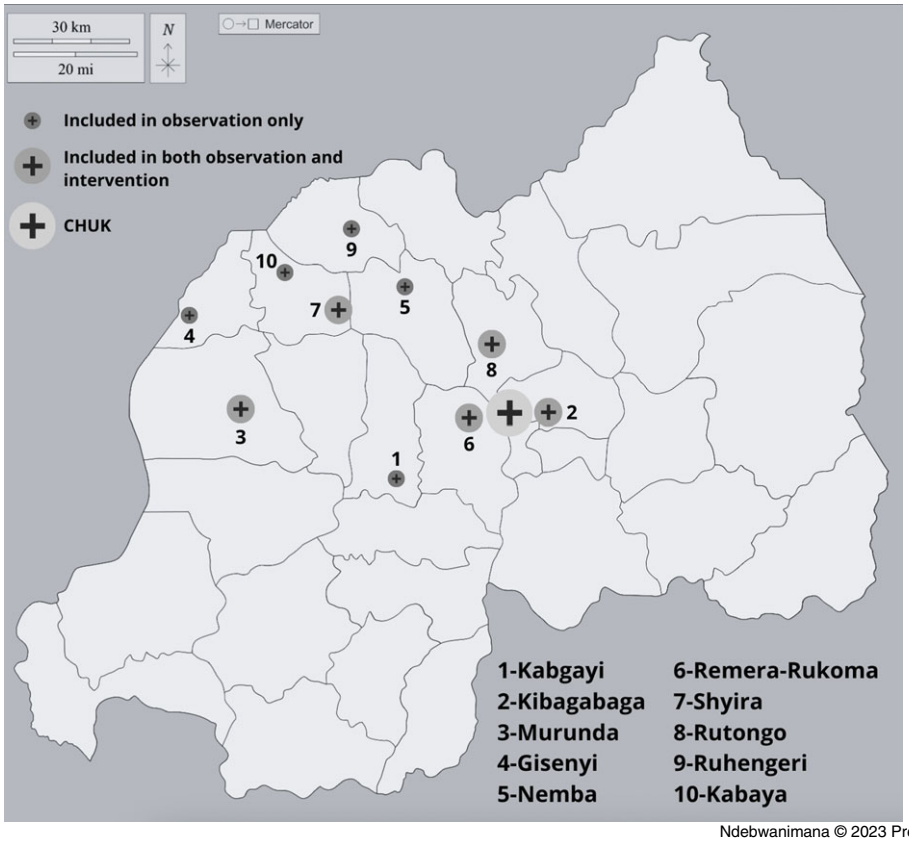

Figure 1. Map of Hospitals Included in the Study.
Abbreviation: CHUK, Kigali University Teaching Hospital.

transfer. Attention was given to immediate counter-referral upon presentation at the CHUK ED and counter-referral at final disposition. Counter-referral is determined by the ED receiving physician. Immediate counter-referral is used here as a proxy marker for inappropriate transfer, as the emergency physician is deciding on arrival that the patient does not meet criteria for treatment at the receiving facility. Data were collected using a pre-designed questionnaire (Appendix; available online only). Data collection began when a transferred patient arrived at the ED and continued until final disposition (ie, admission, discharge, death, or counter-referral).

Ethics

Research activities were reviewed and approved by the CHUK Institutional Review Board (reference: EC/CHUK/181/2019). The ethics committee determined that informed consent was not necessary for this study.

Statistical Analysis

Data analysis was performed using STATA version 15.0 (Stata Corp; College Station, Texas USA). Descriptive statistical analyses were completed for the overall cohort. Summary statistics were calculated using frequencies and percentages for all categorical variables, and continuous variables were summarized using median values and interquartile ranges. Cases were arrogated and stratified by the observational and intervention phase. Differences in characteristics were assessed using χ^2 or Fisher's exact tests for categorical variables and independent sample t-tests for normally distributed continuous variables. A significance level of $P < .05$ was utilized in the analyses.

Results

Pre-Intervention Phase

During the pre-intervention phase, 285 patients were transferred from district hospitals to CHUK (Table 1). Most patients presented with trauma (56.1%), with the most common indication for transfer being orthopedic evaluation (34.3%). Most common hospitals of origin were Kabgayi (21.0%), Ruhengeri (20.35%), and Kibagabaga (19.3%) Hospitals. The most common length of stay at CHUK was two to three days (26.8% of patients). A GP was the most likely medical provider specialty to initiate a transfer (90.0%). Vital signs were only recorded around one-half of the time (53.2%) before being transferred to CHUK.

A total of 216 transferred patients (76.3%) were admitted to CHUK while 67 patients (23.7%) were immediately counter-referred. Of the admitted patients, 166 patients (58.6%) were discharged home, 79 (27.9%) were referred back to their original institution, five (1.77%) were transferred to another hospital, and 33 (11.7%) died (Table 1).

Intervention Phase

A total of 93 patients were transferred from district hospital to CHUK during the intervention phase (Table 2). Similar to what was seen in the pre-intervention phase, patients were most commonly categorized as trauma (53.7%). However, 28% of indications were critical care, as compared to 10.2% in the pre-intervention phase, making critical care the most common

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Characteristics	n (%)/ median (IQR)
Total Transfers	285
Transfer Hospital	
Kabgayi-1	61 (21.0%)
Kibagabaga-2	55 (19.3%)
Murunda-3	13 (4.6%)
Gisenyi-4	25 (7.4%)
Nemba-5	11 (3.9%)
Remera-Rukoma-6	24 (8.4%)
Shyira-7	7 (2.5%)
Rutongo-8	14 (4.9%)
Ruhengeri-9	58 (20.4%)
Kabaya-10	17 (5.9%)
Gender	
Male	177 (62.1%)
Female	108 (37.9%)
Age (years)	38 (23, 58)
Patient Type	
Trauma	160 (56.1%)
Medical	88 (30.9%)
Surgical Non-Trauma	37 (13.0%)
Reason for Transfer	
Neurosurgery	68 (23.9%)
Orthopedic	98 (34.3%)
Critical Care	34 (11.9%)
CT-Scan Only	44 (15.4%)
Internal Medicine	36 (12.6%)
Other	5 (1.75%)
TEWS Color	
Red	50 (17.6%)
Orange	128 (45.1%)
Yellow	101 (35.6%)
Green	5 (1.8%)
Training Level of Transferring Doctor	
General Practitioner (GP)	253 (90.0%)
Specialist	28 (9.9%)
Patient Length of Stay at Original Hospital Before Transfer	
Less Than One Day	37 (13.1%)
One-Two Days	123 (43.1%)
Two-Three Days	75 (26.8%)
More Than Three Days	48 (17.0%)
Vital Signs Documented Before Transfer	
No	133 (46.8%)
Yes	151 (53.2%)
Emergency Signs Shown	
No	96 (32.7%)
Yes	189 (66.3%)
Initial Disposition	
Admitted to CHUK	216 (76.3%)
Sent Back to District Hospital	67 (23.7%)
Final Disposition	
Discharge Home	166 (58.7%)
Counter-Referral	79 (27.9%)
Transferred	5 (1.8%)
Died	33 (11.7%)

Table 1. Characteristics of Transfers During Observational Phase (*continued*)

Abbreviations: TEWS, Triage Early Warning System; CHUK, Kigali University Teaching Hospital.

indication for transfer (Table 1). This difference in critical care indications was statistically significant (P <.001). Transfer times to CHUK during the intervention phase were quicker (P <.001), with 95.7% of patients being transferred within one day compared to only 34% during the pre-intervention phase. Patients were more likely to be showing emergency signs (55.9%) compared to 31.6% in the pre-intervention phase (P <.001). Vital signs were more likely to be documented before transfer (89.2%) compared to 50.9% during the observational phase (P <.001). During the intervention phase, patients were less likely to be counter-referred and mortality decreased from 11.7% to 9.7%. However, these changes were not statistically significant, likely because the study was not adequately powered for these variables.

Discussion

This study provides introductory data on the transfer of patients from district hospitals to a tertiary hospital in Rwanda. The majority of patient transfers involved traumatic injury with many patients requiring transfer for orthopedic or neurosurgical evaluation.

Pre-intervention data demonstrated several problems with the interhospital transfer process. These data showed significant delays in transfer (43.8% occurring after two days), inconsistent documentation of pre-transfer vitals (46.8% missing vitals), and a high degree of inappropriate transfers as evidenced by immediate counter-transfer (23.7%).

The "EM Doc On Call" intervention indicated improvements in district hospital to tertiary hospital transfers. As a pilot study, it hoped to identify promising improvements of patient care and determine the feasibility of the future implementation of a similar system geared towards improving interhospital transfer in Rwanda. This pilot generated many intriguing data that point towards improvements in this process. Specifically, the pilot intervention led to more timely patient transfers, with 100% of patients transferred within two days in the intervention phase when compared to 66.2% in the observation phase. This may indicate that communication between facilities resulted in a more streamlined transfer process, as patients inevitably transferred are not admitted to the hospital in the Rwandan system but instead stay in the ED until transfer. The "EM Doc On Call" pilot intervention also led to more effective communication between health care

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	Observation Phase	Intervention Phase	
Characteristics	**n (%)/median (IQR)**	**n (%)/median (IQR)**	**P Value**
Total Transfers	110	93	
Transfer Hospital			
Kibagabaga-2	55 (50.0%)	42 (45.2%)	
Murunda-3	13 (11.8 %)	9 (9.7%)	
Nemba-5	11 (10.0%)	20 (21.5%)	
Remera-Rukoma-6	24 (21.8.%)	6 (6.6%)	
Shyira-7	7 (6.4%)	16 (17.2%)	
Gender			
Male (ref)	72 (65.5%)	60 (64.5%)	.889
Female	38 (34.6%)	33 (35.5%)	
Age (years)	37 (23, 58)	38 (27, 57)	.7886
Patient Type			
Trauma (ref)	74 (67.3%)	50 (53.7%)	.144
Medical	22 (20.0%)	26 (28.0%)	
Surgical Non-Trauma	14 (12.7%)	17 (18.3%)	
Reason for Transfer			
Neurology	34 (30.9%)	15 (16.1%)	
Orthopedic	42 (38.2%)	18 (19.4%)	
Critical Care	12 (10.9%)	26 (28.0%)	<**.001***
CT-Scan	13 (11.8%)	17 (18.3%)	
Internal Medicine	9 (8.18%)	16 (17.2%)	
TEWS Color			
Red	18 (16.4%)	13 (14.0%)	
Orange	50 (45.5%)	52 (55.9%)	.509
Yellow	41 (37.3%)	27 (29.0%)	
Green	1 (0.9%)	1 (1.1%)	
Training Level of Transferring Doctor			.706
General Practitioner (GP)	105 (97.2%)	89 (95.7%)	
Specialist	3 (2.8%)	4 (4.3%)	
Patient Length of Stay at Original Hospital Before Transfer			
Less than 24 Hours	13 (12.8%)	34 (36.6%)	
One Day	21 (19.1%)	55 (59.1%)	<**.001***
One to Two Days	28 (25.5%)	4 (4.3%)	
Two to Three Days	31 (29.1%)	0 (0.0%)	
More Than Three Days	16 (14.5%)	0 (0.0%)	
Vital Signs Documented Before Transfer			<**.001***
No	58 (52.7%)	10 (10.8%)	
Yes	52 (47.3%)	83 (89.2%)	
Emergency Signs Present			
No (ref)	34 (30.9%)	52 (55.9%)	<**.001***
Yes	76 (69.1%)	41 (44.1%)	
Initial Disposition			
Admitted to CHUK	90 (82.6%)	74 (79.6%)	.587
Sent Back to District Hospital	19 (17.4%)	19 (20.4%)	
Final Disposition			
Discharge Home	67 (61.5%)	66 (66.7%)	
Counter-Referral	26 (23.6%)	22 (23.7%)	.501
Transferred	2 (1.8%)	0 (0.0%)	
Died	14 (12.8%)	9 (9.7%)	

Table 2. Comparison of Transfer Characteristics During the Observation and Intervention Phases
Abbreviations: TEWS, Triage Early Warning System; CHUK, Kigali University Teaching Hospital.

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facilities, with appropriate pre-transfer vital sign documentation increasing to 89.2% from 53.2%. Such process improvements are likely to lead to better patient outcomes. Prior studies have demonstrated a positive association between clinical outcomes and faster transfer times,[18] as well as with the complete and timely delivery of transfer documentation.[19]

The intervention was also associated with notable changes in the types of patient transfers. The proportion of patients transferred for a critical care indication greatly increased from 11.9% to 28.0%. There was also a significant decrease in the proportion of patients transferred with the presence of emergency signs, from 66.3% in the observation phase to 44.1% in the intervention phase. This may indicate that patients were more adequately stabilized prior to transfer secondary to discussion with the "EM Doc on Call," especially when contextualized by the higher proportion of patients considered "critical" by the referring physician during the intervention phase.

While not statistically significant, there was a decrease in patient mortality and counter-transfers following implementation of the "EM Doc On Call" intervention. The study set out to test a system that could improve the interfacility transfers, and the data appear to indicate that this method is extremely promising.

Limitations

Of the several limitations that should be considered within the context of this study, perhaps the most apparent is that the intervention was employed during the COVID-19 pandemic. This certainly affected the capabilities for data collection and resulted in a smaller sample size than initially intended, secondary to resource reallocation at CHUK. Any pandemic-related disruptions to Rwanda's medical landscape at the time of this study could have also altered the results to a degree that might not fully represent what would have been observed prior to 2020.

Other important limitations of this study relate to the collection of the data. First, information was not collected on how patients were transported to their original district hospital. Previous research in other sub-Saharan countries has established that a dysfunctional ambulatory network contributes to delays in interhospital referrals.[20] Determining whether patients were transported by the Emergency Medical Service (SAMU [Service d'Aide Médicale d'Urgence]) or by private vehicle could provide a more complete picture of the many factors impacting patient referrals and outcomes in Rwanda. This information could also help determine if future training for SAMU could direct more emergent patients to CHUK faster.

Secondly, patient outcome data were not obtained for those recommended to stay at district hospitals as part of the referral system. To more accurately assess outcomes of the intervention, further research should thoroughly track outcomes for patients who remain at district hospitals in addition to those transferred to a tertiary hospital. Doing so will better control for the effects of changes in the types of patients transferred as a result of the "EM Doc On Call" pilot intervention, such as differences in illness severity.

Lastly, this intervention was only applied during daytime hours. While it is more difficult to staff referral phone calls overnight, the design of a 24-hour research model which includes nighttime workers will ensure that overnight referrals and transfers are not missed. Doing so will increase the scope of the study's impact and provide a more complete dataset.

Conclusion

The "EM Doc On Call" intervention set out to begin to classify transfers in Rwanda so that data could be collected on the pilot intervention aimed at improving the timeliness and documentation associated with interhospital transfers. While there are valid limitations in the study, the data collected are extremely promising and warrant further study in the future. Future studies can further explore the effects of this intervention on patient-oriented outcomes while controlling better for confounders, such as lack of nighttime data collection or reduction of study size secondary to unforeseen resource reductions. The epidemiological data from this study, while perhaps not complete or representative of all Rwandan interfacility transfers, are the first attempt at documentation of this critical aspect of medical care and can help to inform further research and interventions regarding interhospital transfer.

Author Contributions

Authors contributed as follows to the conception or design of the work; the acquisition, analysis, or interpretation of data for the work; and drafting the work or revising it critically for important intellectual content: VN, AB, AG, and KDM contributed 20.5%; CU, DU, CR, SL, SDN, NJP, GGD, ED, and MVA contributed 2.0%. All authors approved the version to be published and agreed to be accountable for all aspects of the work.

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Supplementary Materials

To view supplementary material for this article, please visit https://doi.org/10.1017/S1049023X23005927

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