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ORIGINAL ARTICLE

Systemic emergency department performance in a low resource tertiary health facility in central Kenya: Micro level emergency care system evaluation

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ABSTRACT

Emergency care system (ECS) performance is a proxy indicator of emergency care (EC) response and health systems resilience. The Emergency Care and System Assessment tool (ECSA) provides a structure for measuring emergency department (ED) systemic performance, using high quality ECS metrics. These metrics aligned with WHO targeted priority action areas facilitate synergies in supporting ECS evaluation at the micro level.

Retrospective file reviews and anecdotal evidence from a low resource tertiary health facility between 1st January 2020 – 31st May 2021 showed that: - the governance structure had administrative and financial autonomy from the public healthcare system, healthcare financing was mostly out of pocket (OPP) and the human resource ecosystem was structured in operations, enforcement and training to drive EC quality improvement. More than two thirds of the patients were high acuity but only 2% of the patients died. Most sentinel ED functions were available at the facility however the facility does not have a developed prehospital care, neurosurgical nor a burns unit.

Micro ECS framework derived from ECSA objectively interrogates performance of the healthcare system that supports EC in a tertiary facility.

African relevance

- Research conducted in central Kenya.
- Faith Based organizations in Africa complement the national emergency care system.
- Microlevel ECS appraisal complements macro level ECS development.

Introduction

The Emergency Care System (ECS) reflects on emergency response and health systems resilience [1]. Emergency Care (EC) in Kenya has evolved significantly over the past decade [2] however, emergency department (ED) performance lacks consensus on specific metrics [3]. We have validated tools that assess hospital-based ED capacity [4,5] however, few studies assess the ECS locally. European and American metrics are non-representative of our local priority areas [2,6]. Local assessment of EC capacity [7], analysis of clinical practice in Kenyan ED [8] and country specific ECS assessment in Africa[5] highlight some metrics but none qualifies ED performance in the context of the entire health care system, beyond the ED capacity.

EC systematic assessments can be facilitated using two World Health Organization (WHO) validated tools; the Emergency Care System Assessment Tool (ECSA) and the Hospital Emergency Unit Assessment Tool (HEAT) [9]. HEAT is a survey which evaluates the hospital's emergency unit capacity to deliver EC [9,10]. ECSA is a survey complemented by the WHO Emergency Care System Framework[9] in evaluating progressive stages of the ECS to generate priority national action plans. Kenya launched its first policy (2020 - 2030) aimed at establishing a working ECS nationally in 2020 [11]. The policy was based on the ECS framework and it will be operationalized through the Kenya Emergency Medical Strategy 2020 -2025 [12]. Both the policy and the strategic plan are nested within the public health system at the national and the county level. However, they are silent on micro level appraisal of the ECS at the facility.

A Consensus review of the African ECS in Uganda, Madagascar, Rwanda and Tanzania proposed five domains linked to ECSA tool in interrogating the quality of the ECS [5]. The review applied the five

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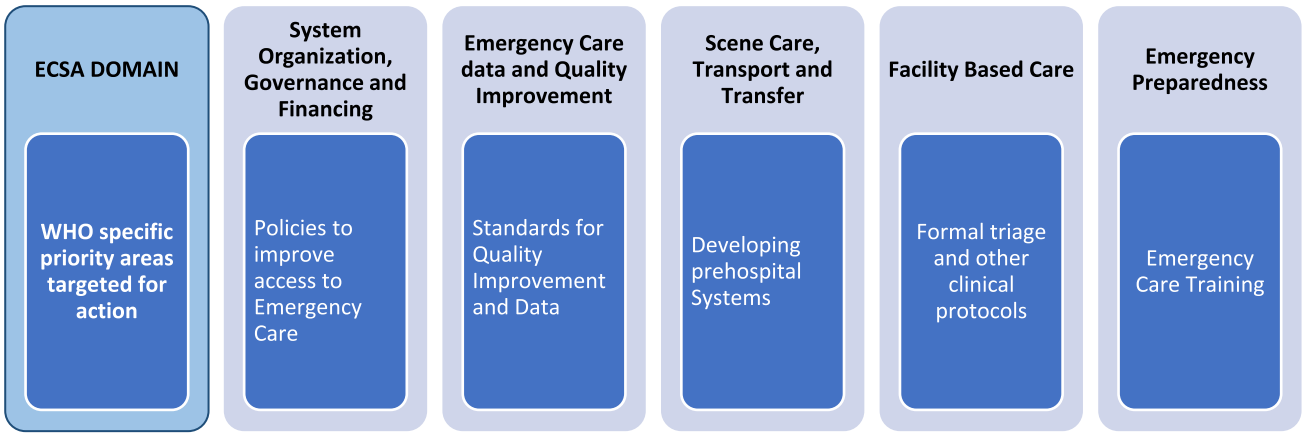

Fig. 1. Five ECSA tool domains aligned to the five WHO specific priority areas targeted for action [5,13].

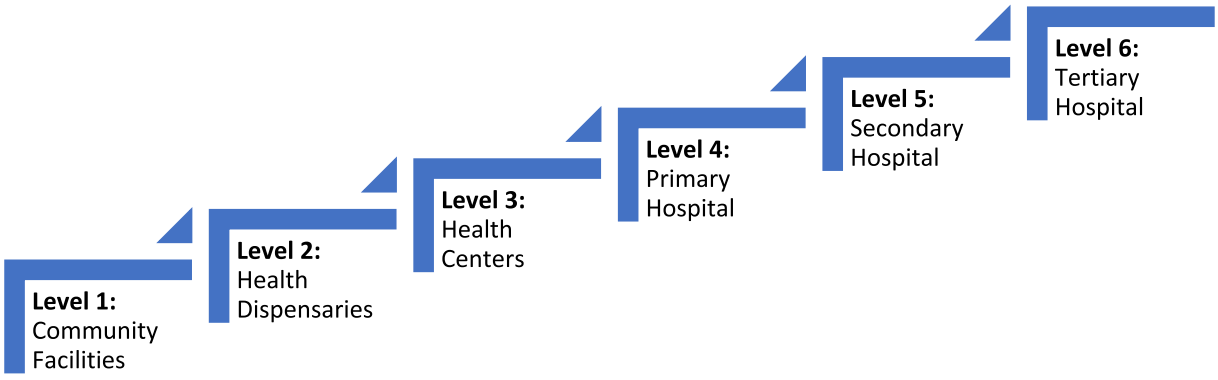

Fig 2. Classification of levels of health care delivery[14].

domains in illustrating how experts gauged performance of their ECS at the national and at the health facility level. The performance indices were however not standardized. A preliminary report from 30 countries defined areas of priority action derived from ECSA framework and assessment tool [13]. These are standardized performance indices on what needs to be assessed.

The main endpoint of the study is to demonstrate how WHO priority action areas linked to the five main domains from the ECSA framework (macro level ECS) can be applied in developing a microlevel ECS framework, and using the framework in objective systemic ED performance appraisal of a tertiary health facility. Fig. 1 shows the correlates of the five domains to the priority action areas.

Emergency care in Kenya

Emergency care system

The Health Act of 2017 defines *a medical emergency as one that poses an "immediate risk to life or health of a person or has potential for deterioration", and emergency treatment is that which is "necessary immediate health care that must be administered to prevent death or worsening of a medical situation"*[*14*] This forms the constitutional foundation within which EC operates. The ECS in Kenya is offered through stratified health facilities depending on the complexity of care required. This hierarchical system is applied across all public, private and faith-based health care facilities as shown in Fig. 2.

The existing ECS in Kenya is guided by an implementation strategy and a policy that are anchored to the public health system [11,12]. The private healthcare system in Kenya accounts for about 53% of the 14,154 health facilities spread across the country [15]. To harness on synergy in developing a shared ECS, perhaps a facility driven appraisal may complement national and county efforts.

Emergency care purchase

EC in Kenya can be purchased through public or private insurances, government/donor funds and out of pocket expenditure [16]. The public health care system largely purchases EC through the National Hospital Insurance Fund (NHIF), government allocations and donor funds disbursed through the national and county governments. The private and the faith-based healthcare systems largely purchase EC through private health insurers, private donors and out of pocket funds from households. The Kenyan constitution mandates that all Kenyan citizens "*shall not be denied emergency medical treatment* [17]." The constitution aligns with the Sustainable Developmental Goals (SDG) advocating for Universal Health Care (UHC) [1]. However, inequity in health financing translates to inequity in EC purchasing power.

Emergency care physician training

Institutions of higher learning in Kenya offer EC training through masters of Medicine in Emergency Medicine (EM) [18], higher diploma in EM and fellowships in EM. Certified EC short course trainings are available through independent training institutions/ hospitals [19]. The short courses include: - Advanced Care Life Support (ACLS), Advance Trauma Life Support (ATLS), Advanced airway interventions, Point of Care Ultrasound (POCUS) use etc. None the less, most EDs in Kenya lack specialist coverage which limits competence in the triage and stabilization of acute, critical and trauma conditions [14,15].

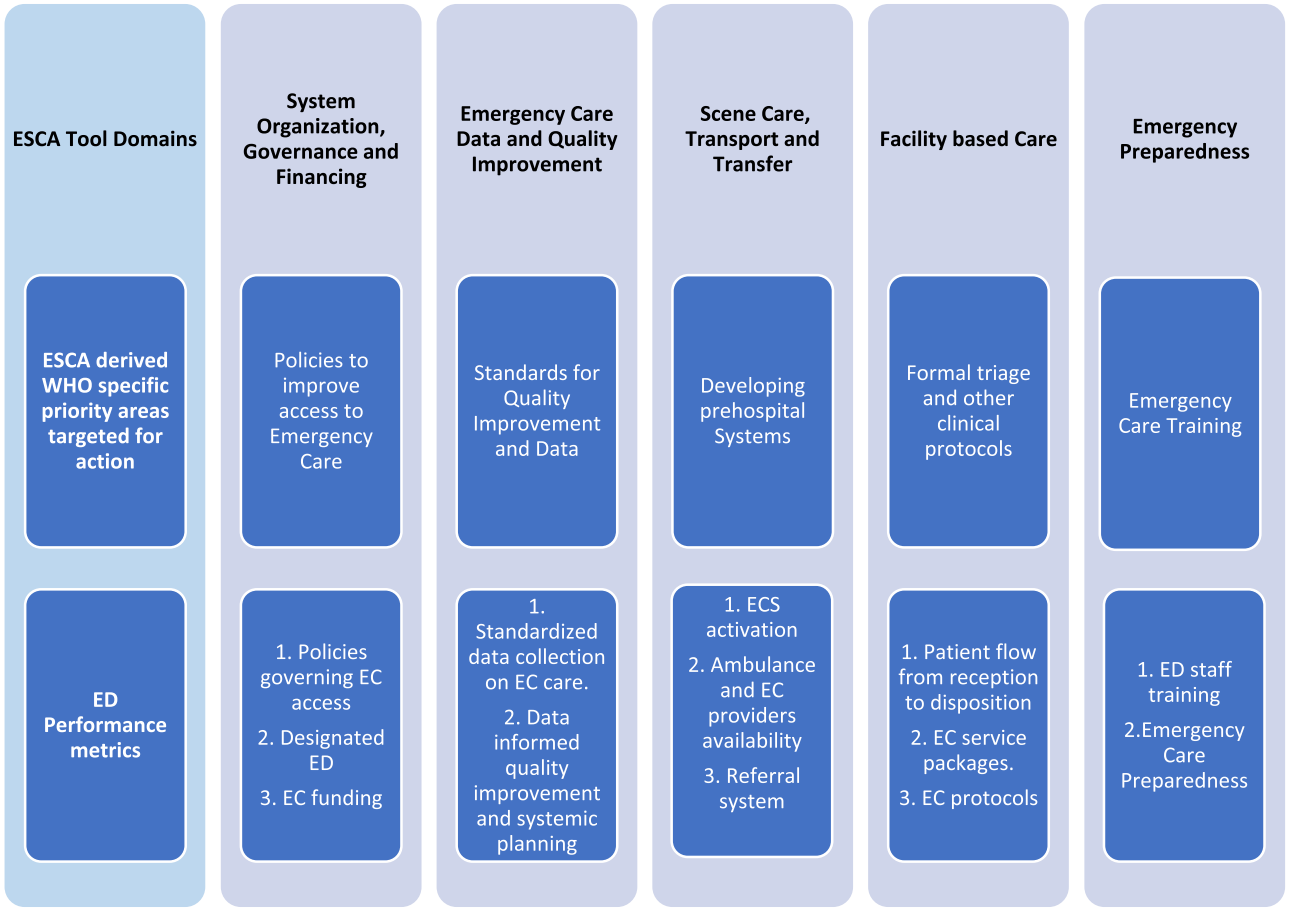

Fig. 3. Micro level ECS framework.

Methods

Study design

This was a retrospective file review of the system organization, governance, financing, emergency care data and quality improvement, scene care, transport and transfer, Facility care and Emergency Preparedness. Secondary data was supplemental by anecdotal evidence from ED users/ stakeholders during the study period. The study period was between 1st January 2020 – 31st May 2021.

Ethical consideration

Ethical waiver was granted by the institutional ethical & research committee (KH-IERC/02718/0094/2020) and data handling was confidential in compliance with the hospital's data handling policy.

Results

Each ECSA domain has a WHO guided thematic priority area targeted for action. ED performance metrics were deduced from the 2 stems. Translation of the domains in demonstrating ED performance metrics was structured as shown in the micro level ECS framework in Fig. 3. This iteration facilitated a roadmap for deducing priority action points for this health facility.

System organization, governance and financing

EC Organization: The study was carried out in a 363-bed faith-based referral hospital located in central Kenya with a rural urban catchment. The hospital is a level 5 health care facility with an emergency medicine higher diploma training program which offers short courses training in EC. It had a dedicated ED with 14 beds and a daily outpatient turnover of 500 patients. The ED was fully functional 24 hours a day, 7 days a week supported by theater, critical care, outpatient and in-patient services. The ED managed about 150 patients per month.

ED governance: The hospital had both financial and administrative autonomy from the public healthcare system. The hospital had its own Standard Operating Procedures Manual (SOPM) developed by the ED manager with input from ED users. The hospital complies with all the standard statutory and reporting prerequisites as defined by the national and regional regulatory units. These pre requisite are embedded in the national constitution however, the Kenyan policy and the framework are yet to develop a clear roadmap for the health facilities in the implementation of the policy.

EC funding: 1963 (99%) patients attended to during this period incurred out of pocket expenditure (OPP) while only 1% had their cost incurred by other private insurers. The National Health Insurance Fund (NHIF) opted by the facility does not cater for the cost of healthcare in the ED and other outpatient clinics however inpatient and theater services are covered by NHIF. During high acuity emergencies, patient clinical stabilization took precedence over financial and operation compliance. The process of overriding the operational and financial process was also stipulated in the SOPM to ringfence standardization and integrity in the delivery of care. This transferred the cost of EC to the facility and the patients directly.

Emergency care data and quality improvement

Emergency Care Data: The ED sustainably collects data through a hospital wide integrated Electronic Medical Records System. 2229 patient files were extracted however only 1983(89%) had complete data, in-

complete medical records were excluded from the study. The EMR has standard patient file templates with some clinical tools. The EMR was not integrated to the National nor county health information system.

Manual trauma templates were used during mass accidents to mitigate automation lag whenever apt clinical response was needed. Secondary data such as death register were captured in designated registers which were under the custody of the manager in charge of the ED. Some of these reports were templates provided by the national /county government and remitted back once filled e.g., the death register.

Quality Improvement: All emergency care data could be extracted from the EMR or secondary data reports. Data was reviewed in clinical audits which were convened: -Within 24 hours of unsuccessful resuscitation in unexpected deaths, monthly during departmental meetings and hospital wide clinical audits conducted every 3- 6months. The output of the audit included a report on workload, quality improvement projects, mortality, near miss cases and resolved gaps in patient care.

The audience included clinical, allied health staff and trainees. Due to COVID restrictions, the meeting platform was a hybrid of in person meetings and an on-line interactive platform. These audits earned participants Continuous Profession Development (CPD) points to incentivize attendance. Clear prehospital care data was not traceable.

Scene care transport and transfer

The hospital is about 9km away from the main highway hence a majority of the pre hospital ED clientele constitute road traffic accident victims. The hospital does not have structured pre hospital care structures nor an activation system. The ED team and the hospital's ambulance was frequently deployed to facilitate scene care and transfers along the highway.

Facility based care

Patient flow: All ambulatory patients were managed in the outpatient unit with relevant escalation to the ED. Patients who presented to the ED were triaged within 10minutes and designated to the relevant area of care depending on acuity as defined by the clinician or nurse in the ED. Resource capacity was modified to accommodate more patients during mass incidents through an escalation protocol where ED patients were prioritized until they were stabilized. Once stabilized patients were sent to theater or inpatients unit or they would be discharged home . Patients who arrived dead were not recorded as hospitals deaths however the relevant civil processes ensued.

EC protocols: Operational guidelines were stipulated in the SOPM while clinical guidelines were referenced from the Emergency Medicine Kenya Foundation clinical guidelines and algorithms which are free and available online. The ED always has specialist coverage on site with a masters or a higher diploma qualification however inter-departmental consults for high acuity patients were available through phone calls and on site within 10minutes.

Table 1
Patient characteristics.

Characteristics	Proportion	Percentage
Age		
0 – 18 years	372	19
19 - 45 years	774	39
46 – 85 years	677	34
Above 85 years	160	8
Gender		
Male	1158	58
Female	825	42

EC service packages

The hospital has both pediatric and adult emergency specialists. Most patients seen were between 19 – 45 years predominantly male in gender as shown in table 1.

Most patients were emergencies from triage (61%) with high acuity clinical status (67%). High acuity patients were operationally defined as patients with life threatening diagnosis as defined by the lead specialist, or they were admitted to the critical care units, theater, required services beyond routine investigations. Obstetric emergencies were transferred to the obstetric unit directly where comprehensive emergency obstetric services and definitive care was offered. A specific COVID 19 unit was set up in March, 2020 with an outpatient unit, an ED, Routine and Critical care wards. The EMR had an innate software flaw in assigning length of stay in casualty during the study period however most clients stayed between 24 – 48hours. ED service packages are shown in Table 2.

Table 2
ED service packages.

ED flow	ED services	Proportion (%)
Triage	Emergency (*Theater/ Critical Care Units*)	1219 (61)
	Urgent (*Wards/Home discharge*)	351(18)
	Referred out	414(21)
Primary Care Team	Internal Medicine	719(36)
	Surgical	610 (31)
	Multi-disciplinary Team	367(19)
	Pediatrics/ Pediatrics Surgery	247(12)
	Palliative	10 (1)
	Undesignated	30 (1)
Resources	Routine labs (CBC, Creatinine and Electrolytes, Urinalysis, HIV and RBS)	Done 1186 (60)
		Not Done 797 (40)
	Other labs: Blood grouping and cross match, thyroid function tests, Spinal fluid analysis etc.	Done 654 (33)
		Not Done 1329 (67)
	Routine Imaging (X rays and Ultrasound)	Done 1267 (67)
		Not done 716 (36)
	CT SCAN	Done 504 (25)
		Not done 1479(75)
Disposition	Discharged home	945 (48)
	Admitted to the wards	725 (37)
	Referred out	203 (10)
	Undetermined (absconded)	69 (3)
	Death	37(2)
Acuity	High	1333(67)
	Low	650 (33)

Table 3
Systemic emergency preparedness.

SENTINAL CONDITIONS	SIGNAL FUNCTION THEMES	Proportion of compliance to specific signal functions at least 90% of the time (%)
Respiratory failure - *inability of the respiratory system to support effective and continuous gas exchange.*	Obstructed airway	3/3 (100)
	Respiratory distress	10/10 (100)
Shock - *critical tissue hypoperfusion*	Hemorrhagic shock	9/9 (100)
	Other shock	6/6(100)
	Severe sepsis/septic shock	3/3(100)
Altered mental status – *changes in alertness, attention, memory, and/or awareness from the usual baseline status.*	Unconscious patient	5/5(100)
	Seizure	3/3(100)
	Others	1 / 2* (50)
Severe pain - *pain that interferes with some or all of the activities of daily living.*	General severe pain	1/1(100)
	Abdominal pain	6/6 (100)
	Chest pain	2/2 (100)
Trauma – *physical injury*	General trauma	13/15(87)
	Burns	1/2(50)
Emergency Obstetrics- *life threatening peri- partum health related events affecting pregnant women.*	Obstructed labor	4/4(100)
TOTAL		67/71 (94)

Emergency preparedness

Human resource ecosystem: ED had non rotational staff who also work in the critical care areas. Specialist coverage was always assumed by a specialist physician or a clinician with a higher diploma in emergency care training. Human resource capacity was guided by the SOPM including availability of allied health and support staff.

Emergency Care Preparedness: Emergency Care Assessment Tool (ECAT) for advanced health facilities was used in evaluating systemic emergency care preparedness [4]. ECAT was developed by the African Federation for Emergency Medicine to measure ED systemic capacity. ECAT assesses the provision of key medical interventions (signal functions) against common and life-threatening conditions (sentinel conditions). The proportion of ED compliance to specific signal functions was 94% against a minimum acceptable score of 90% as shown on Table 3. Inconsistent availability of a neurosurgeon, limitations in management of extremes in temperature, underdeveloped burns unit and lack of chest tube auto transfusion account for the deficit in score.

Discussion

The national ECS is nested within the public health care system based on the ECSA tool and framework [11,12]. This provides a macro ECS evaluation which is silent on micro ECS evaluation, especially in the private and faith-based organizations. This study applies a micro level ECS framework through performance metrics of a level 5 health care facility. This framework prompts a solution in bridging fragmentation in ECS as highlighted in the Kenyan EC policy [11].

The governance and finance structure sustains a human resource ecosystem that has a sound emergency preparedness system despite limitations in management of burns and comprehensive neurosurgical services. Resilience of this ECS remains a challenge when 99% of EC is directly funded by patients out of pocket .5 The emergency medical treatment support initiative advocated for in the national policy, needs to be extended beyond the public health care system, so as to avert in equity in healthcare financing [11].

The designated ED is technologically supported by computers, EMR, clinical tools, mobile phone calls to trigger medical consults and online clinical guidelines. Manual files still play a key role in supporting data extraction. Lack of standardization in data handling presents an opportunity for interagency automation of EC.

Despite challenges in the EC data, the available system facilitated audits. ED mortality was at 2% despite a high acuity clientele supported by ED coverage by trained staff who facilitated transfer of patients to designated care units as early as possible during the triage process.

Favorable emergency preparedness is expected in a private training institution triangulated by healthcare demands being met beyond routine care, availability of specialized services, low ED mortality and an ECAT score of 94% against a normal of 90%.

Conclusion

WHO priority action areas linked to the five main domains from the ECSA framework, (macro level ECS) can be applied in developing a microlevel ECS evaluation framework. The micro ECS framework can objectively interrogate performance of the healthcare system that supports EC in a tertiary health facility.

Micro ECS and macro ECS advocate for EC health financing and policy enforcement beyond the public health care system in Kenya.

Dissemination of results

The hospital already received the results of this study and interventions are ongoing including acquiring an electrophysiological (ECG) machine in the ED, onboarding a neuro surgeon with a clear referral pathway for neurosurgical services in the facility, inception a burns unit. A wider audience is targeted for these results once published.

Authors Contribution

Authors contributed as follows to the conception, research, drafting and revising the work critically for important intellectual content: MM contributed 80%, and EM contributed to 20%. All authors approved the version to be published and agreed to be accountable for all aspects of the work.

Declaration of Competing Interest

The authors declare no conflicts of interest.

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