Health System Factors Associated with Mortality in the Emergency Department at Selected Public Health Facilities in Kirinyaga County, Kenya

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ABSTRACT

Background: Emergency department (ED) mortality is a sensitive barometer of health-system performance, yet in low- and middle-income settings the structural and access-related determinants of ED death remain poorly characterized. In Kenya, ED mortality rates substantially exceed international benchmarks, and county-level evidence is scarce.

Methods: An analytical cross-sectional design integrating quantitative and qualitative approaches was used. Data were collected from 296 patient encounters and their caregivers using structured questionnaires, supplemented by key informant interviews (KIIs) with ED healthcare workers. Health system variables included regularity of care-seeking, chronic illness status, convenience of treatment schedules and facility opening hours, distance to facility, mode and cost of transport, travel time, cost-related postponement of care, and waiting time for treatment. The chi-square test of independence assessed associations between categorical health system variables and mortality, with statistical significance set at $p < 0.05$. Qualitative data were analyzed thematically.

Results: Overall, ED mortality was 19.3% (57 of 295 patients with a documented outcome). Eight health system factors were significantly associated with mortality. Delay-1 (care-seeking) factors: irregular care seeking (41.3% vs 9.3%; crude OR 6.85, 95% CI 3.65–12.85; $\chi^2 = 41.733$, df = 1, $p = 0.0001$), chronic illness (26.0% vs 14.2%; OR 2.12, 1.18–3.81; $\chi^2 = 6.475$, $p = 0.011$), inconvenient treatment schedule (37.3% vs 12.2%; OR 4.29, 2.34–7.85; $\chi^2 = 23.283$, $p = 0.0001$), and cost-related postponement of care (35.6% vs 10.4%; OR 4.75, 2.57–8.77; $\chi^2 = 27.465$, $p = 0.0001$). Delay-2 (reaching care): distance >15 km vs <5 km (34.1% vs 12.9%; OR 3.51, 1.37–8.95; $\chi^2 = 8.474$, $p = 0.037$) and travel time >1 hour vs <30 minutes (43.6% vs 11.5%; OR 5.97, 2.76–12.91; $\chi^2 = 26.604$, $p = 0.0001$). Delay-3 (receiving care): inconvenient opening hours (34.2% vs 14.3%; OR 3.11, 1.69–5.73; $\chi^2 = 14.003$, $p = 0.0001$) and waiting time >2 hours vs <30 minutes (42.3% vs 15.3%; OR 4.06, 1.56–10.52; $\chi^2 = 10.060$, $p = 0.018$). Transport mode ($\chi^2 = 5.988$, $p = 0.112$) and transport cost ($\chi^2 = 4.297$, $p = 0.231$) showed higher mortality in disadvantaged categories but were not statistically significant.

Conclusion: Mortality in Kirinyaga County EDs is strongly associated with access-related, financial and systemic barriers that map onto all three phases of delay. Because these crude associations are unadjusted, confounding by age, sex and disease severity cannot be excluded, and a multivariable logistic regression on individual-level data is the recommended next step. Interventions with LMIC evidence-formal triage systems, prehospital/emergency-medical-services development, extended-hours access and transport/treatment subsidies-should be prioritized.

Keywords: emergency department, mortality, health system factors, access to care

INTRODUCTION

The emergency department (ED) is the front door of the hospital and, for many acutely ill patients, the decisive point at which survival is won or lost. It provides round-the-clock access to resuscitation, stabilization, diagnosis and definitive referral for undifferentiated patients of all ages (Covino et al., 2023). Because the ED aggregates the sickest patients in the system, its mortality rate reflects not only disease severity but the cumulative performance of everything that happens before and around the clinical encounter: how quickly patients recognize danger and seek help, whether they can physically and financially reach a facility, and how efficiently the facility receives and treats them once they arrive (Guttmann et al., 2021).

Globally, ED mortality in high-income countries ranges from roughly 0.12% to 0.87%, but figures in low- and middle-income countries (LMICs) are considerably higher, frequently reflecting late presentation, weak pre-hospital systems and resource constraints (Buunaaim et al., 2022). In Kenya, the 2022 Emergency Care Situational Analysis reported that only a minority of public facilities operate functional emergency units, with mortality in these departments materially above international standards. These elevated rates signal systemic deficiencies in triage, early recognition of critical illness and timely intervention, but they also point upstream, to the health-system conditions that determine whether a patient arrives in time to be saved (Kaduka et al., 2019).

Health system factors, the organizational, financial and geographic features of the care environment, shape mortality through their effect on the timeliness of care. A patient who seeks care irregularly, lives far from a facility, cannot afford transport, or waits hours for treatment accumulates delay at every step, so that even an efficient ED receives a patient already in extremis. Understanding these determinants is therefore essential for designing interventions that prevent deaths before they reach the resuscitation bay (Ouma et al., 2022; Ravindran et al., 2020).

Kirinyaga County, a largely agricultural county in central Kenya served by a mix of public, faith-based, private and non-governmental facilities, has had no comprehensive documentation of ED mortality or its determinants. This study addresses that gap by quantifying the health system factors associated with ED mortality at selected public health facilities, using robust inferential analysis complemented by the perspectives of frontline healthcare workers. The specific objective reported here was to identify the health system factors associated with mortality in the emergency department at selected public health facilities in Kirinyaga County.

MATERIALS AND METHODS

Study design

The study used an analytical cross-sectional design integrating quantitative and qualitative (mixed methods) approaches. The cross-sectional component captured patient-level data at a single point in time, enabling estimation of mortality proportions and the testing of associations between health system exposures and the clinical outcome of death. The qualitative component, conducted through key informant interviews (KIIs) with experienced ED staff, provided explanatory depth on the mechanisms linking systemic barriers to patient outcomes.

Study area and population

The study was conducted in Kirinyaga County, central Kenya; the county hosts 299 health facilities across four sub-counties, of which the Ministry of Health operates a substantial share; selected public facilities with functional emergency units served as study sites. The study population comprised caregivers of patients receiving care in the EDs and the healthcare providers (nurses, clinical officers and medical officers) staffing those units. Approximately 956 patients annually require urgent care within these EDs.

Inclusion and exclusion criteria

Eligible participants were caregivers of ED patients aged 18 years and above, and healthcare workers who had worked in the county for more than one month and who consented voluntarily. Patients not accompanied by a

caregiver and healthcare workers on leave were excluded.

Data collection

Quantitative data were collected using structured questionnaires administered to caregivers and abstracted from clinical records, capturing demographic, clinical and health-system variables alongside the treatment outcome (alive, dead or referred). The health system module recorded regularity of medical attention, frequency of care-seeking, chronic illness status, convenience of the treatment schedule, distance to the facility, mode of transport, transport cost, travel time, convenience of facility opening hours, cost-related postponement of care, waiting time for treatment, and perceived healthcare-worker attitude. Ten KIIs were conducted with ED healthcare workers (clinical officers, nurses and medical officers) purposively selected for direct experience managing emergency cases. Interviews followed a semi-structured guide covering health-seeking behaviour, access and transport, service organization and perceived determinants of mortality, and continued until no substantively new themes emerged.

Data analysis

Data were entered, validated, cleaned and analyzed using SPSS version 29. Descriptive statistics summarized the distribution of each health system variable and the corresponding mortality proportions. The chi-square (χ^2) test of independence assessed the association between each categorical health system factor and mortality, reporting the test statistic, degrees of freedom (df) and p-value. To quantify the strength and direction of each association, crude (unadjusted) odds ratios with 95% confidence intervals were computed directly from the contingency-table cell counts, using the lowest-risk category as the reference. Statistical significance was set at $p < 0.05$.

These odds ratios are crude and therefore unadjusted for potential confounders. A multivariable logistic regression adjusting for age, sex and disease severity (triage category) is the appropriate method to isolate the independent contribution of each health system factor; such a model requires the complete individual level dataset with all covariates recorded jointly for each patient. That line-level dataset was not available for the present analysis, so adjusted estimates are not reported here and residual confounding is addressed explicitly in the limitations. The crude estimates below should be interpreted as associations, not as independent or causal effects.

Qualitative data were analyzed thematically; audio-recorded interviews were transcribed verbatim and, where necessary, translated into English. Analysis followed Braun and Clarke's phases: familiarization through repeated reading; generation of initial codes using a combined inductive (data-driven) and deductive (three-delays) coding frame; collation of codes into candidate themes; review and refinement of themes against the coded extracts; and definition of final themes. Representative verbatim quotations were retained to illustrate each theme.

Ethical considerations

Participation was voluntary and based on informed consent. Confidentiality was protected by anonymizing questionnaires and omitting personal identifiers such as names, phone numbers and email addresses.

Results

Vital Signs

Table 4.4 shows that the slightly more than half of the patients, 152 (51.4%), presented with a fever, while 34 (11.5%) showed signs of hypothermia. Jaundice was observed in 36 (12.2%) of the patients, 77 (26.0%) were found to be hypoxemic, and 219 (74.0%) had normal oxygen saturation. The AVPU scale showed that 202 (68.2%) of patients were fully alert (A), 40 (13.5%) responded to verbal stimuli (V), and 17 (5.8%) were unresponsive (U). Additionally, 200 patients (67.6%) had a refill time of less than 2 seconds, indicating adequate perfusion. Delayed refill times of 2–3 seconds and more than 3 seconds were noted in 64 (21.6%) and 14 (4.7%) patients respectively. Pallor was observed in 78 patients (26.4%), while 218 (73.6%) showed no pallor. Further,

assessment of the airway status showed that the airways were clear in the majority of patients (233 or 75.3%). However, 42 patients (14.2%) presented with stridor, and 31 (10.5%) required active airway support.

Table 2. Vital Signs

Characteristics		Frequency	Percent
Temperature	Hypothermia	34	11.5%
	Normal	110	37.2%
	Fever	152	51.4%
Jaundice	Yes	36	12.2%
	No	260	87.8%
Oxygen saturation	Hypoxemia	77	26.0%
	Normal	219	74.0%
AVPU	A	202	68.2%
	V	40	13.5%
	P	37	12.5%
	U	17	5.8%
Cap fill	X	18	6.1%
	< 2	200	67.6%
	2-3	64	21.6%
	> 3	14	4.7%
Pallor	Yes	78	26.4%
	No	218	73.6%
Airways	Clear	233	75.3%
	Stridor	42	14.2%
	Need active support	31	10.5%

Overall mortality

Of the patients with a documented outcome, 75.7% (224) survived, 5.1% (15) were referred and 19.3% (57) died in the ED. This mortality rate is high relative to comparable settings and provides the outcome against which health system exposures were tested.

Distribution of health system exposures

Most patients (68.9%) reported regularly receiving medical attention, while 31.1% did not; 42.9% had a chronic condition such as hypertension or diabetes. Although 72.0% found their treatment schedule convenient, 28.0% did not. Geographic access was mixed: 23.6% lived within 5 km, 37.8% within 5–10 km, 23.6% within 11–15 km and 14.9% beyond 15 km. For transport, 35.8% used bodabodas, 31.1% public service vehicles (PSVs), 20.9% personal vehicles and 12.2% walked. Facility opening hours were deemed convenient by 75.3%, yet 35.1% had postponed care because of cost. Waiting times were under 30 minutes for 33.1% but exceeded two hours for 8.8%.

Health system factors associated with mortality

Eight of the ten health system factors examined were significantly associated with ED mortality on chi-square testing, with crude odds ratios reinforcing both the magnitude and direction of each association (Table 2). The results are presented below according to the three delays framework.

Phase 1 — Delay in deciding to seek care. Irregular care-seeking showed the strongest association in the study: patients who did not regularly receive medical attention had a mortality rate of 41.3% (38/92) versus 9.3% (19/204) among those who sought care regularly (crude OR 6.85, 95% CI 3.65–12.85; $\chi^2 = 41.733$, df = 1, p = 0.0001). Chronic illness was associated with higher mortality (26.0%, 33/127, vs 14.2%, 24/169; OR 2.12, 1.18–3.81; $\chi^2 = 6.475$, df = 1, p = 0.011). Patients who found their treatment schedule inconvenient had a mortality rate of 37.3% (31/83) versus 12.2% (26/213) (OR 4.29, 2.34–7.85; $\chi^2 = 23.283$, df = 1, p = 0.0001). Cost-related postponement of care was associated with a mortality rate of 35.6% (37/104) versus 10.4% (20/192) (OR 4.75, 2.57–8.77; $\chi^2 = 27.465$, df = 1, p = 0.0001).

Phase 2 — Delay in reaching care. Mortality rose monotonically with distance, from 12.9% (<5 km, reference) to 17.0% (5–10 km; OR 1.38, 0.59–3.26), 20.0% (11–15 km; OR 1.69, 0.68–4.22) and 34.1% (>15 km; OR 3.51, 1.37–8.95), a significant distance-decay gradient ($\chi^2 = 8.474$, df = 3, p = 0.037). Travel time showed one of the steepest gradients: 11.5% (<30 minutes, reference), 16.0% (30–60 minutes; OR 1.47, 0.70–3.08) and 43.6% (>1 hour; OR 5.97, 2.76–12.91) ($\chi^2 = 26.604$, df = 2, p = 0.0001). Two phase-2 factors were not statistically significant although mortality was higher in the more disadvantaged categories: mode of transport (PSV users 27.2%, OR 2.99, 0.96–9.30, vs walking; $\chi^2 = 5.988$, df = 3, p = 0.112) and transport cost (≥Ksh 150, 30.6%, OR 2.93, 0.96–8.93, vs <Ksh 50; $\chi^2 = 4.297$, df = 3, p = 0.231). In both, the confidence intervals crossed 1, indicating the sample was underpowered to confirm these specific affordability effects.

Phase 3 — Delay in receiving adequate care. Patients reporting inconvenient facility opening hours had more than double the mortality of those who found hours convenient (34.2%, 25/73, vs 14.3%, 32/223; OR 3.11, 1.69–5.73; $\chi^2 = 14.003$, df = 1, p = 0.0001). In-facility waiting time was associated with mortality, rising from 15.3% (<30 minutes, reference) and 17.6% (30–60 minutes; OR 1.19, 0.56–2.51) to 18.6% (1–2 hours; OR 1.26, 0.56–2.85) and 42.3% (>2 hours; OR 4.06, 1.56–10.52) ($\chi^2 = 10.060$, df = 3, p = 0.018).

Table 2. Health system factors associated with mortality in the emergency department

Factor	Category	Died, n (%)	Survived, n (%)	Crude OR (95% CI)	χ^2 (df)	p-value
Phase 1 — Delay in deciding to seek care						
Regularly receives medical attention	Yes (ref)	19 (9.3)	185 (90.7)	1.00	41.733 (1)	0.0001*
	No	38 (41.3)	54 (58.7)	6.85 (3.65–12.85)		
Chronic condition	No (ref)	24 (14.2)	145 (85.8)	1.00	6.475 (1)	0.011*
	Yes	33 (26.0)	94 (74.0)	2.12 (1.18–3.81)		
Treatment schedule convenient	Yes (ref)	26 (12.2)	187 (87.8)	1.00	23.283 (1)	0.0001*
	No	31 (37.3)	52 (62.7)	4.29 (2.34–7.85)		
Postponed care due to cost	No (ref)	20 (10.4)	172 (89.6)	1.00	27.465 (1)	0.0001*
	Yes	37 (35.6)	67 (64.4)	4.75 (2.57–8.77)		
Phase 2 — Delay in reaching care						
Distance to facility	<5 km (ref)	9 (12.9)	61 (87.1)	1.00	8.474 (3)	0.037*
	5–10 km	19 (17.0)	93 (83.0)	1.38 (0.59–3.26)		
	11–15 km	14 (20.0)	56 (80.0)	1.69 (0.68–4.22)		
	>15 km	15 (34.1)	29 (65.9)	3.51 (1.37–8.95)		
Travel time to facility	<30 min (ref)	14 (11.5)	108 (88.5)	1.00	26.604 (2)	0.0001*
	30–60 min	19 (16.0)	100 (84.0)	1.47 (0.70–3.08)		
	>1 hour	24 (43.6)	31 (56.4)	5.97 (2.76–12.91)		
Mode of transport	Walking (ref)	4 (11.1)	32 (88.9)	1.00	5.988 (3)	0.112
	Personal vehicle	10 (16.1)	52 (83.9)	1.54 (0.45– 5.32)		
	Bodaboda	18 (17.0)	88 (83.0)	1.64 (0.51–5.20)		
	PSV	25 (27.2)	67 (72.8)	2.99 (0.96–9.30)		
Transport cost	<Ksh 50 (ref)	6 (13.0)	40 (87.0)	1.00	4.297 (3)	0.231
	Ksh 50–99	17 (17.5)	80 (82.5)	1.42 (0.52–3.87)		
	Ksh 100– 149	23 (19.7)	94 (80.3)	1.63 (0.62–4.31)		
	≥Ksh 150	11 (30.6)	25 (69.4)	2.93 (0.96–8.93)		
Phase 3 — Delay in receiving adequate care						

Convenient opening hours	Yes (ref)	32 (14.3)	191 (85.7)	1.00	14.003 (1)	0.0001*
	No	25 (34.2)	48 (65.8)	3.11 (1.69–5.73)		
Waiting time for treatment	<30 min (ref)	15 (15.3)	83 (84.7)	1.00	10.060 (3)	0.018*
	30–60 min	18 (17.6)	84 (82.4)	1.19 (0.56–2.51)		
	1–2 hours	13 (18.6)	57 (81.4)	1.26 (0.56–2.85)		
	>2 hours	11 (42.3)	15 (57.7)	4.06 (1.56–10.52)		

*Statistically significant at $p < 0.05$. Odds ratios are crude (unadjusted); the reference category is the lowest-risk group. CI = confidence interval; df = degrees of freedom; PSV = public service vehicle

Qualitative findings

Thematic analysis of the ten KIIs produced three themes that corresponded closely to the three delays.

Theme 1 — Reactive care-seeking and fragile chronic-disease continuity (phase 1). Informants described care-seeking as reactive rather than preventive, compounded by interrupted chronic-disease management.

> *"Chronic conditions like hypertension and diabetes are common, but poorly managed. Health seeking behavior is reactive, not preventive. Patients wait too long to seek help because they think they'll improve or because they don't understand the risks of delay." (KII 2)*
>
> *"Most of the emergency cases from chronic diseases are preventable. If they followed their treatment schedule strictly, they wouldn't end up in the ED. But there are also systemic issues — sometimes drugs are unavailable, or clinics are understaffed." (KII 3)*
>
> *"Supportive care works best when it's started early. By the time some patients arrive, they're severely dehydrated, malnourished, or in multi-organ failure ... We need to focus on education and referral linkages at the community level." (KII 4)*

Theme 2 — Transport and cost barriers to reaching care (phase 2). Informants repeatedly linked transport unreliability and cost to late arrival.

> *"Many patients live close to the hospital, but they rely heavily on bodabodas or public transport, which can be unreliable or expensive. Sometimes patients delay coming because they can't afford transport, especially at night or during emergencies." (KII 5)*
>
> *"The cost of transport is a real issue. Even if the facility is nearby, paying more than 100 shillings for a ride is too much for some patients, so they come late after their condition worsens." (KII 7*

Theme 3 — Service organization and waiting at the facility (phase 3). Informants connected long queues, stock-outs and limited staffing to discouragement and late escalation.

> *"Patients appreciate the facility's opening hours but often complain about waiting times. Some wait for more than an hour, which discourages them from seeking early care, leading to more advanced illnesses by the time they present." (KII 9)*
>
> *"We see a lot of patients who postponed care because of transport costs or long waiting times. Even though the clinic hours am from seeking early care, leading to more advanced illnesses by the time they present." (KII 9)*

DISCUSSION

This study found that mortality in Kirinyaga County emergency departments is strongly associated with health system factors operating along the pathway from illness onset to definitive treatment. Of ten factors examined, eight were significantly associated with death, and the pattern is internally coherent within the three delays

framework: factors that lengthen each phase of delay were associated with higher mortality. The overall mortality of 19.3% provides the backdrop against which these gradients become clinically meaningful. Throughout, these crude associations should be read as associations rather than independent effects, because they are unadjusted for age, sex and disease severity.

Phase 1 (deciding to seek care). The strongest association was with regularity of care-seeking (41.3% vs 9.3%; crude OR 6.85). Patients disconnected from routine care tend to present later and with more advanced pathology, a pattern consistent with evidence that weak health-seeking behaviour produces delayed diagnoses and worse outcomes (Covino et al., 2023; Hunchak et al., 2020). The association with chronic illness (26.0% vs 14.2%; OR 2.12) is consistent with reports that comorbidities compound risk where continuity of care is interrupted by medication stock-outs and inconsistent follow-up, as the key informants described. Both findings implicate the primary-care and chronic-disease management interface as an upstream correlate of ED death.

Phase 2 (reaching care). The distance-decay gradient (12.9% at <5 km to 34.1% at >15 km; OR 3.51) and the steeper travel-time gradient (11.5% at <30 minutes to 43.6% at >1 hour; OR 5.97) indicate that physical reach to care is closely associated with survival. That travel time was more strongly associated with mortality than raw distance suggests road quality, transport reliability and time-of-day effects are associated with outcomes as much as kilometres — plausible given the county's reliance on bodabodas and PSVs. These findings align with Kenyan and wider LMIC evidence that geographic access is associated with emergency outcomes (Ouma et al., 2022). The non-significant but directionally consistent associations for transport mode (PSV 27.2%) and cost (≥Ksh 150, 30.6%) are compatible with an affordability pattern that the sample was underpowered to confirm, as reflected in confidence intervals that crossed 1.

Phase 3 (receiving adequate care). Inconvenient opening hours (34.2% vs 14.3%; OR 3.11) and prolonged waiting time (42.3% at >2 hours vs 15.3% at <30 minutes; OR 4.06) show that in-facility organisation is associated with mortality even after patients overcome access and cost barriers. Prolonged ED waiting has been associated with higher short-term mortality elsewhere (Guttmann et al., 2021), and the informants' accounts of queues, stock-outs and limited staffing offer a plausible local mechanism.

Taken together, these findings are consistent with a view of ED mortality in this setting as closely tied to timeliness and access rather than to patient demographics alone, echoing evidence that social and health system determinants are associated with early mortality at least as strongly as age or sex (Guttmann et al., 2021; Workina et al., 2023). The convergence of quantitative gradients and qualitative testimony strengthens confidence that the observed associations reflect real pathways operating through delay, while stopping short of causal claims.

Interventions with evidence in LMIC emergency care

Several interventions have an evidence base for reducing emergency mortality in LMICs and map onto the delays identified here. For phase 3, implementing structured triage-the WHO/ICRC Interagency Integrated Triage Tool, the South African Triage Scale, and paediatric Emergency Triage Assessment and Treatment (ETAT) — has been associated with reduced mortality and shorter time-to-treatment in African EDs (Kilaru et al., 2017; Reaven et al., 2022; Teklu et al., 2021). Establishing dedicated emergency units and strengthening WHO Emergency Care System building blocks (triage, basic resuscitation, data systems) has been linked to improved outcomes (Ahmed et al., 2022). For phases 1 and 2, developing prehospital and emergency medical services, including lay-first-responder and community-transport schemes, has improved outcomes in several LMIC settings (Wangara et al., 2020), and task-shifting with short structured training (e.g. emergency-care courses for non-specialists) has strengthened frontline capacity. For phase 1, community health-worker engagement and chronic disease continuity programs support earlier, preventive care-seeking. Transport and user-fee subsidies address the affordability barriers signaled by the cost-postponement and distance findings. These options give county decision-makers an evidence-informed menu rather than generic exhortation.

Generalizability

The findings generalize most directly to users of public EDs in Kirinyaga County. However, the structural barriers identified, limited chronic-disease continuity, distance and transport constraints, cost-related

postponement, and in-facility delay, are widely documented across rural and peri-urban Kenyan counties and comparable LMIC settings (Hunchak et al., 2020; Kaduka et al., 2019; Ouma et al., 2022). It is therefore plausible that similar associations operate in counties with comparable health-system configurations and socioeconomic profiles, though the magnitude of each association would be expected to vary with local infrastructure, EMS availability and facility density. The results are less likely to apply directly to well-resourced urban referral settings with mature prehospital systems. County-specific confirmation, ideally with adjusted analyses, is warranted before extrapolating quantitative estimates elsewhere.

Limitations

The analytical cross-sectional design captured patient information at a single point, limiting the ability to establish temporal relationships or causal effects between health system factors and emergency department mortality. Second, the study was conducted in selected public health facilities in Kirinyaga County, which may limit the generalizability of the findings to private facilities and other counties in Kenya. Third, some information, including care-seeking behaviour, transport costs, and delays in accessing treatment, was obtained from caregivers and may have been affected by recall bias or subjective perceptions. Fourth, the analysis relied on crude odds ratios and chi-square tests without multivariable adjustment because the complete individual-level dataset containing relevant covariates was unavailable, consequently, potential confounding by age and sex were excluded. Finally, the exclusion of patients without caregivers may have introduced selection bias, potentially limiting the representativeness of the study population.

CONCLUSION AND RECOMMENDATIONS

Mortality in Kirinyaga County emergency departments is significantly influenced by access-related, financial and systemic health factors. Irregular care-seeking, chronic illness, inconvenient treatment schedules and opening hours, long distance and travel time to facilities, cost-related postponement of care, and prolonged waiting times were all significantly associated with death. These determinants act largely by increasing delay, so that patients arrive late and critically ill.

To address preventable ED mortality, the Ministry of Health, county government and facility administrators should prioritize evidence-based interventions matched to each delay: strengthening chronic-disease continuity of care and community health education to support earlier care-seeking (phase 1); decentralizing emergency services, extending operating hours, and subsidizing transport and treatment to reduce travel time and cost barriers (phases 1–2); and implementing structured triage, improving staffing and streamlining in-facility flow to compress waiting times (phase 3). Developing prehospital and emergency medical services, and embedding the WHO Emergency Care System building blocks, would reinforce these measures.

Future research should employ multivariable and longitudinal designs that adjust for disease severity and socioeconomic status, and should quantify the impact of staffing adequacy and clinician competencies on survival, so that scarce resources can be directed to the interventions that most reduce mortality in resource-constrained emergency care.

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Declarations

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