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Achievement of key performance indicators in initial assessment and care of injured patients in Ghanaian non-tertiary hospitals – an observational study

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Abstract

Introduction—We aimed to determine the level of achievement of key performance indicators (KPIs) during initial assessment and management of injured persons, as assessed by independent observers, at district and regional hospitals in Ghana.

Methods—Trained observers were stationed at emergency units of six district (first level) and two regional (referral) hospitals, from October 2020 to February 2021, to observe management of injured patients by health service providers. Achievement of KPIs was assessed for all injured patients and for seriously injured patients (admitted for ≥24 hours, referred, or died).

Results—Management of 1,006 injured patients was observed. Road traffic crash was the most common mechanism (63%). Completion of initial triage ranged from 65% for oxygen saturation to 92% for mobility assessment. For primary survey, airway was assessed in 77% of patients, chest examination performed in 66%, and internal abdominal bleeding assessed in 43%. Reassessment

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rates were low, ranging from 16% for respiratory rate to 23% for level of consciousness. Thirty-one percent of patients were seriously injured. Completion of KPIs was higher for these patients, but reassessment remained low, ranging from 25% for respiratory rate to 33% for level of consciousness.

Conclusion—KPIs were performed at a high level but several specific elements should be performed more frequently, such as oxygen saturation and assessment for internal abdominal bleeding. Reassessment needs to be performed more frequently, especially for seriously injured patients. Overall, care for the injured at non-tertiary hospitals in Ghana could be improved with a more systematic approach.

Keywords

Trauma care; district hospital; referral hospital; non-tertiary hospital; Ghana; LMIC

Introduction

Injury remains a leading cause of mortality and morbidity worldwide, with a disproportionate majority of the burden borne by low- and middle-income countries (LMIC) [1]. Together with improvements in the human and physical resources for trauma care, improving the processes of care has been identified as an important contributor to better injury outcomes [2, 3].

A systematic approach to the initial assessment and care of the injured can ensure early detection of life-threatening conditions in order to prompt timely interventions [4, 5]. Such a systematic approach is especially important as the initial period of trauma care can be chaotic with a high propensity for errors. Majority of the literature documenting process of trauma care comes from high-income countries [2, 6] [7–10]. Less is known about the status of process of care for the injured and the extent to which a systematic approach is employed in their initial assessment at LMIC hospitals. Given the shortcomings in documentation in medical records in many LMIC hospitals, obtaining accurate information on process of care would often depend on additional methods, such as direct observation [3].

Direct observations to document real-world process of care of injured patients has been used in several LMIC locations. The World Health Organization (WHO) pilot tested the Trauma Care Checklist (TCC) in 11 tertiary centers in 9 countries at all economic levels, using direct observation to document process of care at baseline and after implementation of the checklist [3]. Sawe et al. reported the capture of variables specified in the WHO dataset for injuries in six regional (referral) hospitals in Tanzania, using direct observations [11]. Many of the items assessed were process of care items. However, such reports are rare and, as yet, have not included smaller (e.g. first-level) hospitals. We sought to address this gap by assessing process of care measures by direct observation at non-tertiary hospitals in Ghana, including both district and regional hospitals. By so doing, we also sought to identify specific elements of care that needed to be strengthened.

Methods

Setting

Ghana is a lower-middle-income country with a population of over 30 million [12]. Ghana has 16 regions divided into 260 districts. The healthcare system has four levels: primary health centers (PHC); district (first-level), regional (referral) and tertiary hospitals. PHCs only provide basic public health and primary care services. District hospitals are staffed by nurses, medical officers, and sometimes fully-trained specialists, and offer at least some essential surgical services. Regional hospitals are typically staffed by specialist trauma care providers (e.g., general and orthopedic surgeons) while tertiary hospitals offer a broader range of trauma care [13]. Trauma care items, such as chest tubes, portable X-Rays and focused sonography for trauma, are lacking at district hospitals [14]. Availability of these items is only marginally improved at regional hospitals. Additionally, these hospitals rarely have quality improvement processes that monitor care for trauma patients.

Study design

We performed an observational study of the initial assessment and care provided for the injured by emergency unit health service providers (EHSPs, including doctors, physician assistants, and nurses) in six district and two regional hospitals across four regions in Ghana. These hospitals were purposively selected due to their adequate flow of injured patients (≥75 patients per month).

Trained observers were stationed at emergency units (ER) of study hospitals, from October 2020 to February 2021, to observe EHSP practices regarding initial assessment and care of the injured. Due to limited number of observers, we could not include all injured patients presenting to the ER during the study period. Hence, to adequately capture EHSP practices across the entire work day, observers were stationed at each ER in rotating 8-hour shifts, so that each time of day and day of week were sufficiently represented.

An observation form was developed to record performance of key actions (e.g. vitals signs checked on arrival, examination of abdomen) and documentation of information such as demographics and mechanism of injury in the medical record. Key performance indicators (KPIs) for this study were derived from the WHO TCC [3] and from a set of audit filters (KPIs) considered context-appropriate for LMICs, which were developed through a Delphi process with global experts [15]. The KPIs observed by the research assistants are listed in Table 1.

The research assistants used this form to record the implementation (or lack thereof) of KPIs as they observed EHSPs assess and manage each injured patient arriving during the 8-hour shift. They filled the observation form without interaction with EHSP or the patient. The main parameter used for chest examination was auscultation while abdominal bleeding was assessed with abdominal examination, ultrasound, x-ray, computerized tomography. For multiple patients undergoing care concurrently, they observed EHSP actions on the first patient until completion of the physical examination, then moved to observe another patient at the beginning of assessment. For components of the assessment and management that they missed during observation, they obtained information from patient records to complete the

observation form. Research assistants had bachelors level education and were trained by the principal investigator in a two-day session.

Data analysis

Analyses were performed with STATA version 14 (College Station, TX). We created binary variables describing whether each of the KPIs were performed. A given KPI was considered as performed if the research assistant observed an EHSP perform it or if there was documentation of the KPI performed in the medical record or both. We also defined a variable describing whether important clinical data (all of the following eight variables: age, sex, mechanism of injury, intention of injury, injury type, heart rate, blood pressure, and consciousness level on arrival at ER) had been documented for each patient. We compared performance between hospital types with Chi-square test or Fisher's exact test. A subgroup analysis was performed for seriously injured patients defined as patients who stayed in hospital for ≥24 hours, were referred to higher levels of care, or died. Finally, we performed a sensitivity analysis with a redefinition of seriously injured patients using anatomic and physiologic criteria: patients with fractures, internal chest/abdominal injury, patients not fully alert on presentation, or patients presenting in shock appropriately characterized for age [16]. The anatomic criteria approximated to patients with maximum abbreviated injury scale scores of 2 or more.

Ethics

The study was approved by Kwame Nkrumah University of Science and Technology Committee for Human Research and Publication Ethics (CHRPE/AP/142/20). Written informed consent was obtained from EHSPs to be observed. This study includes data from the baseline phase of a randomized clinical trial (Improving Initial Management of the Injured at Ghanaian District and Regional Hospitals with a Trauma Intake Form) (NCT04547192).

Results

Patient characteristics

One thousand and six patients presented with injuries during the study period. Majority were male (733;73%) with a mean age of 28 (range: 0.25–105) years. Most (898;89%) injuries were unintentional. Road traffic crash was the most common mechanism (636;63%) followed by penetrating mechanisms (119;12%) and falls (85;9%). Among road traffic crash victims, 206 (32%) were passengers in the vehicle, 133 (21%) were pedestrians, and 200 (31%) were motorcycle riders (Table 1).

The majority of injuries were lacerations (535;53%), fractures (182;18%) and, superficial injuries (141; 14%). One hundred and one (10%) patients had multiple injuries. Most patients (802;80%) were alert at presentation to the ER while 30 (3%) were unresponsive. From the ER, 632 (63%) patients were discharged home while 285 (28%) and 79 (8%) were admitted and referred, respectively. A quarter (241;24%) of the patients spent ≤1 hour at the ER whereas 73 (7%) spent >12 hours (Table 2).

Initial assessment and management of all injured patients

The percent completion for assessment of the different elements of initial triage ranged from 65% for oxygen saturation to 92% for mobility assessment (Table 3). However, among 929 patients who spent ≥30 minutes at the ER, re-triage was performed for only 16% (respiratory rate) to 23% (consciousness level). Conduct of the elements of the primary survey and initial management were completed at a moderate level. Airway was assessed in 772 (77%) patients and chest examination performed in 664 (66%) patients. However, internal abdominal bleeding was assessed in only 430 (43%) patients. Spine immobilization was performed for only 18% of 721 road traffic crash or fall patients. Splinting was done for 60% of 182 patients with fractures and total burn surface area was determined for 57% of 23 burn patients. Documentation in the medical record ranged from 68% for blood pressure to 99% for sex, mechanism, and intent of injury. Important clinical data (reflecting documentation of 8 important variables) were documented for 60% of patients.

Seriously injured patients (referred, died or stayed ≥24 hours in the hospital)

There were 308 (31%) seriously injured patients. In general, the KPIs tended to be higher than for the general patient population, but was suboptimal in several notable indicators (Table 3). Triaging information was generally high (75%–94%), however, assessment of respiratory rate (75%) and oxygen saturation (76%) were lower than ideal. Repeat measurements for the 285 patients who spent ≥30 minutes at the ER was less than 50% (25%–33%). Elements of the primary survey were performed for a generally high percentage of these patients. As example, airway was assessed in 264 (86%) patients. However, several components were on the lower side: chest examination (75%) and assessment of internal abdominal bleeding (59%). Spine immobilization was performed for only 58 (24%) of 242 patients involved in road traffic crash or falls. Documentation in the medical record ranged from 74% for blood pressure to 99% for sex, mechanism, and intent of injury. Important clinical data (8 important variables) were documented for 205 (67%) patients. Thirteen (4%) of the 308 were discharged home from the ER. Two hundred and six (66%) were admitted, out of whom 30 (15%) were later referred.

Sensitivity analysis for seriously injured patients (defined by anatomic and physiologic criteria)

With the new definition, 298 (30%) seriously injured patients were identified with similar percentage achievement of the KPIs as with the prior definition of seriously injured (Appendix). Although triaging information remained generally high (76%–92%) as before, respiratory rate (75%) and oxygen saturation (76%) assessments were still lower than ideal. Repeat measurements for 278 patients who spent ≥30 minutes at the ER remained low (25%–31%). While airway was assessed in 235 (79%) patients, other elements of the primary survey were on the lower side: chest examination (73%) and internal abdominal bleeding assessment (54%). Spine immobilization was similarly performed for only 63 of 259 patients involved in road traffic crash or falls.

Comparison of district and regional hospitals

Initial triage and most components of the primary survey and initial management were performed more frequently at regional hospitals compared to district hospitals ($p < 0.05$) (Table 4). Performance of re-triage was comparable at both hospital levels apart from mobility (33% vs 22%,p=0.04) and consciousness level (39% vs 26%,p=0.01), which were reassessed more frequently at district hospitals (Table 3). Important clinical data were documented more commonly at regional hospitals (93% vs 45%,$p < 0.001$).

Discussion

This study aimed to establish the achievement of KPIs during care of the injured at first- and second-level hospitals in Ghana. Percent completion of KPIs for initial triage varied widely, from 65% for oxygen saturation to 92% for mobility assessment. Repeat triage was performed for <25% of patients. Elements of primary survey were conducted at a moderate level. As would be expected, KPIs were achieved at a higher rate for seriously injured patients. However, the repeat triage measurements of 25%–35% were still low. Redefining seriously injured patients using anatomic and physiologic criteria did not meaningfully change the level of achievement of the KPIs. The study also evaluated documentation in the medical record. Demographic information and mechanism of injury were documented for almost all patients. However, a set of eight key variables was documented for only half of the injured patients.

Sawe et al. reported both the performance (assessed through direct observation) and the capture (in medical records) of variables specified in WHO's injury dataset in six regional hospitals in Tanzania [11]. They reported 91% for performance of blood pressure measurement, 64% for respiratory rate, and 23% for oxygen saturation [11]. In the current study, performance was lower for blood pressure (71%), similar for respiratory rate (68%), and higher for oxygen saturation (65%). Sawe et al. also evaluated the capture rate of data in the chart, for KPIs that had been observed to have been done. Capture rates were very low: 3.1% for consciousness assessment, 18% for respiratory rate, and 13% for oxygen saturation. Injury mechanism and intent, useful for informing injury prevention initiatives, were recorded for 45% and 6.8% of patients, respectively [11]. These variables were recorded to a much higher extent (>95%) in the current study.

Other reports from LMICs generally show a low achievement of KPIs for initial management of injured patients. Apart from assessment for disability, components of primary survey were assessed for 13%–59% of injured children in a Brazilian study [17]. Most injury assessment KPIs were achieved in <40% of patients in Iran, with improvements when checklists were used [18]. Similarly, time for trauma team assembly and time to computerized tomography were achieved in 50% and 56%, respectively, in a Fijian study [19]. Conversely, the Australia-India Trauma Systems Collaborative reported a rate of missingness of <20% for most KPIs [20].

Lashoher et al. piloted the WHO TCC for care of seriously injured patients at 11 hospitals [3]. Nine of these hospitals were in LMICs. Prior to checklist implementation, they reported a generally higher rate of KPIs than our findings. Chest examination was performed in 85%

of seriously injured patients (vs 75% in the current study), abdominal examination in 76% (vs 59%), and oxygen saturation in 95% (vs 76%). More of our patients had temperature recorded (90% vs 50%) and distal pulse examination was comparable (57% vs 54%) [3]. It should be noted that the WHO TCC was conducted at tertiary centers, in comparison to lower level facilities in the current study. Regardless of site, it would be ideal for all KPIs to be performed and recorded for all injured patients, and especially the seriously injured. Routine performance of these indicators has been shown to decrease errors and ensure early detection of life-threatening conditions, prompting timely performance of necessary interventions [7–10, 18, 21–23].

Important clinical data for injury are vital for documenting the burden of injury and also for quality improvement and system planning purposes to improve care. These were documented for 60% of our patients and only slightly higher for the seriously injured. Comparatively, just one-third of patients in Sawe et al's study had all the core variables within the WHO dataset for injuries recorded [11]. Our use of an observation form to record KPIs regardless of injury severity may have contributed to low recording rate for some variables that EHSPs might feel were irrelevant for minor injuries. However, we did not find a high recording rate even for seriously injured patients. Recording these KPIs for injuries of all severity is useful, if not necessary, to allow periodic assessment and improvement in the process of care for the injured.

Our study has some limitations that need to be addressed. First, our study hospitals were not randomly selected, which limits generalization of our findings to all first- and second-level hospitals in Ghana. However, they were purposively selected for the relatively high volumes of injured patients they receive and thus largely reflect the status of process of care for the injured at these hospital levels in Ghana. Second, we could not include all injured patients presenting to the ER during the study period due to limited number of independent observers. Our stationing of observers at the ER in 8-hour rotating shifts, ensured that each time of day and day of week were equally represented. Third, we may have missed performance of some KPIs that were performed primarily by observation by EHSP, such as assessing a patent airway through observing that a patient with a minor injury could easily speak. Fourth, EHSP may have improved their injury management practices due to knowledge of been observed. KPI achievement was, however, not consistently high over the observation period. Nonetheless, this study has the strengths of a large sample size and use of direct observations, which overcomes shortcomings of documentation in medical records.

Conclusion

Key performance indicators were performed at a high level for many elements of initial triage and primary survey. However, there were specific elements that should be performed more frequently, such as oxygen saturation measurement and assessment of internal abdominal bleeding. Reassessment of vital signs, especially for seriously injured patients, needs to be performed more frequently. Overall, care for the injured at non-tertiary hospitals in Ghana could be improved with a more systematic approach. This could be promoted by use of context-appropriate checklists such as the Trauma Intake Form, which is derived from

the WHO's Trauma Care Checklist and an international Delphi process on district hospital audit filters, and which is currently being field tested as the next stage of the current study.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Key performance indicators observed by the research assistants at the emergency unit

Background information
Date of patient arrival at ER recorded
Time of patient arrival at ER recorded
Date of injury recorded
Time of injury recorded
Initial clinical impression of injury recorded
Triage and monitoring
Mobility at ER arrival assessed
Respiratory rate at ER arrival assessed
Temperature at ER arrival assessed
Oxygen saturation level at ER assessed
Primary assessment and actions
Airway assessed
Chest examined
Intravenous line placed
External bleeding checked for and controlled
Internal abdominal bleeding ruled out
Pelvic fracture ruled out
All distal pulses checked
Fluid and/or blood requirement considered
Spine immobilized for RTI or fall victims
Splinting of fractures considered
Physical examination findings recorded
Alcohol on breath assessed
Total burn surface area recorded
Tetanus considered for bites, burns, lacerations, and abrasions
Antibiotic considered
Analgesics considered

ER – Emergency Unit

Table 2.

Characteristics of injured patients presenting to emergency units (ER) of select Ghanaian district and regional hospitals (N = 1006)

	N	(%)
Sex		
Male	733	(73)
Female	265	(26)
Missing	8	(1)
Age, Mean (Range), Years	28	(0.25 – 105)
Mechanism of injury		
Road Traffic Injury	636	(63)
Penetrating	119	(12)
Penetrating – unintentional	78	(8)
Penetrating – intentional / stab	40	(4)
Penetrating – missing	1	(0.1)
Falls	85	(9)
Other blunt	52	(5)
Bites	51	(5)
Gunshot[a]	12	(1)
Fire/Heat	20	(2)
Hanging/Choking	5	(0.5)
Other penetrating	4	(0.4)
Unknown/Missing	8	(0.8)
Other	18	(2)
Intent		
Unintentional	898	(89)
Assault	87	(9)
Self-harm	12	(1)
Unknown/Missing	9	(0.9)
Role in RTI (n=636)		
Driver of vehicle	55	(9)
Passenger in vehicle	206	(32)
Pedestrian	133	(21)
Motorcycle rider	200	(31)
Bicycle rider	8	(1)
Motorking tricycle[b]	15	(2)
Pragya tricycle[c]	18	(3)
Unknown	1	(0.2)
Injury type [d]		
Laceration	535	(53)
Fracture	182	(18)

	N	(%)
Bruise/Superficial injury	141	(14)
Bites	46	(5)
Sprain/Dislocation	37	(4)
Burns	23	(2)
Pneumothorax/Hemothorax	3	(0.3)
Hemoperitoneum	4	(0.4)
Other	109	(11)
Missing	36	(4)
Consciousness level at ER arrival		
Alert	802	(80)
Responds to verbal stimuli	5	(0.5)
Responds to pain stimuli	95	(9)
Unresponsive	30	(3)
Missing	74	(7)
ER outcome		
Discharged home	632	(63)
Referred	79	(8)
Died	10	(0.9)
Admitted	285	(28)
Discharged home	241	(85)
Referred	30	(11)
Died	14	(5)
Length of ER stay, hours		
≤1	241	(24)
1–4	535	(53)
4–12	157	(16)
>12	73	(7)
Length of overall hospital stay, hours		
<24	798	(79)
≥24	208	(21)
Seriously injured (Referred, died, or length of overall hospital stay ≥24 hr)	308	(31)

[a] Only one gunshot injury was intentional

[b] Motorized tricycle with a bucket for transporting goods and supplies

[c] India-made tricycle for passenger transport

[d] Multiple injuries possible for a given patient, so total is greater than 1,006. Percentages based on denominator of 1,006.

Table 3.

Assessment and management of injured patients presenting to emergency unit (ER) of select Ghanaian district and regional hospitals

	All patients (N=1,006)		Seriously injured patients (N=308)	
	N	**(%)**	**N**	**(%)**
Background information				
Date of patient arrival at ER recorded	984	(98)	303	(98)
Time of patient arrival at ER recorded	983	(98)	302	(98)
Date of injury recorded	954	(95)	296	(96)
Time of injury recorded	945	(94)	291	(94)
Initial clinical impression of injury recorded	987	(98)	301	(98)
Triage and monitoring				
Mobility at ER arrival assessed	924	(92)	288	(94)
Respiratory rate at ER arrival assessed	683	(68)	232	(75)
Temperature at ER arrival assessed	851	(85)	276	(90)
Oxygen saturation level at ER assessed	653	(65)	235	(76)
Time of any repeat triage assessment recorded for patients who stayed ≥0.5 hr at the ER (n=929)[a]	211	(23)	97	(34)
Mobility re-assessed for patients who stayed ≥0.5 hr at the ER (n=929)[a]	202	(22)	79	(28)
Respiratory rate re-assessed for patients who stayed ≥0.5 hr at the ER (n=929)[a]	152	(16)	70	(25)
Heart rate re-assessed for patients who stayed ≥0.5 hr at the ER (n=929)[a]	164	(18)	81	(28)
Blood pressure re-assessed for patients who stayed ≥0.5 hr at the ER (n=929)[a]	176	(19)	86	(30)
Consciousness level re-assessed for patients who stayed ≥0.5 hr at the ER (n=929)[a]	216	(23)	94	(33)
Temperature re-assessed for patients who stayed ≥0.5 hr at the ER (n=929)[a]	175	(19)	88	(31)
Oxygen saturation level re-assessed for patients who stayed ≥0.5 hr at the ER (n=929)[a]	147	(16)	77	(27)
Primary assessment and actions				
Airway assessed	772	(77)	264	(86)
Chest examined	664	(66)	232	(75)
Intravenous line placed	604	(60)	271	(88)
External bleeding checked for and controlled	629	(63)	227	(74)
Internal abdominal bleeding ruled out[b]	430	(43)	182	(59)
Pelvic fracture ruled out	338	(34)	152	(49)
All distal pulses checked	438	(44)	175	(57)
Fluid and/or blood requirement considered	517	(51)	247	(80)
Spine immobilized for RTI or fall victims (n=721)[c]	130	(18)	58	(24)
Splinting of fractures considered (n=182)[d]	109	(60)	80	(63)
Physical examination findings recorded	964	(96)	301	(98)

	All patients (N=1,006)		Seriously injured patients (N=308)	
	N	(%)	N	(%)
Alcohol on breath assessed	314	(31)	99	(32)
Total burn surface area recorded (n=23)[e]	13	(57)	10	(83)
Tetanus considered for bites, burns, lacerations, and abrasions (n=721)[f]	551	(76)	142	(76)
Antibiotic considered	811	(81)	259	(84)
Analgesics considered	921	(92)	280	(91)
Documentation				
Patient sex	998	(99)	306	(99)
Patient age	960	(95)	293	(95)
Mechanism of injury	999	(99)	306	(99)
Intent of injury	998	(99)	305	(99)
Heart rate at ER arrival	750	(75)	256	(83)
Blood pressure at ER arrival	684	(68)	228	(74)
Consciousness level at ER arrival	932	(93)	297	(96)
Injury type	970	(96)	300	(97)
Patient encounter signed by EHSP	734	(73)	238	(77)
Date of ER disposition recorded	810	(81)	263	(85)
Time of ER disposition recorded	760	(76)	256	(83)
Important clinical data documented [g]	602	(60)	205	(67)

Seriously injured – Referred, died, or length of overall hospital stay ≥24 hours; ER – Emergency Unit; RTI – Road Traffic Injury; EHSP – Emergency Unit Health Service Provider

[a]For seriously injured patients, n=285;

[b]Internal abdominal bleeding ruled out by any one of: abdominal exam, ultrasound, x-ray, computerized tomography;

[c]For seriously injured patients, n=242; spine immobilization implies use of either cervical collar or backboard;

[d]For seriously injured patients, n=126;

[e]For seriously injured patients, n=12;

[f]For seriously injured patients, n=186;

[g]Important clinical data documented - all of the following: patient sex, patient age, mechanism of injury, intent of injury, heart rate at ER arrival, Systolic blood pressure at ER arrival, Diastolic blood pressure at ER arrival, Consciousness level at ER arrival, and Injury type.

Table 4.

Assessment and management of seriously injured patients presenting to emergency units (ER) of select Ghanaian district and regional hospitals

	District hospital (N=168)		Regional hospital (N=140)		
	N	(%)	N	(%)	p-value[h]
Background information					
Date of patient arrival at ER recorded	163	(97)	140	(100)	0.04
Time of patient arrival at ER recorded	163	(97)	139	(99)	0.15
Date of injury recorded	161	(96)	135	(96)	0.79
Time of injury recorded	162	(96)	129	(92)	0.10
Initial clinical impression of injury recorded	163	(97)	138	(99)	0.36
Triage and monitoring					
Mobility at ER arrival assessed	148	(88)	140	(100)	<0.001
Respiratory rate at ER arrival assessed	95	(57)	137	(98)	<0.001
Temperature at ER arrival assessed	136	(81)	140	(100)	<0.001
Oxygen saturation level at ER assessed	112	(67)	123	(88)	<0.001
Time of any repeat triage assessment recorded for patients who stayed ≥0.5 hr at the ER (n=152)[a]	51	(34)	46	(35)	0.85
Mobility re-assessed for patients who stayed ≥0.5 hr at the ER (n=152)[a]	50	(33)	29	(22)	0.04
Respiratory rate re-assessed for patients who stayed ≥0.5 hr at the ER (n=152)[a]	38	(25)	32	(24)	0.85
Heart rate re-assessed for patients who stayed ≥0.5 hr at the ER (n=152)[a]	47	(31)	34	(26)	0.32
Blood pressure re-assessed for patients who stayed ≥0.5 hr at the ER (n=152)[a]	39	(26)	47	(35)	0.08
Consciousness level re-assessed for patients who stayed ≥0.5 hr at the ER (n=152)[a]	60	(39)	34	(26)	0.01
Temperature re-assessed for patients who stayed ≥0.5 hr at the ER (n=152)[a]	40	(26)	48	(36)	0.08
Oxygen saturation level re-assessed for patients who stayed ≥0.5 hr at the ER (n=152)[a]	35	(23)	42	(32)	0.11
Primary assessment and actions					
Airway assessed	154	(92)	110	(79)	0.001
Chest examined	122	(73)	110	(79)	0.23
intravenous line placed	136	(81)	135	(96)	<0.001
External bleeding checked for and controlled	108	(64)	119	(85)	<0.001
Internal abdominal bleeding ruled out[b]	65	(39)	117	(84)	<0.001
Pelvic fracture ruled out	51	(30)	101	(72)	<0.001
All distal pulses checked	75	(45)	100	(71)	<0.001
Fluid and/or blood requirement considered	124	(74)	123	(88)	0.002
Spine immobilized for RTI or fall victims (n=128)[c]	16	(13)	42	(37)	<0.001

	District hospital (N=168)		Regional hospital (N=140)		
	N	(%)	N	(%)	p-value[h]
Splinting of fractures considered (n=76)[d]	52	(68)	29	(50)	0.03
Physical examination findings recorded	161	(96)	140	(100)	<0.001
Alcohol on breath assessed	59	(35)	40	(29)	0.22
Total burn surface area recorded (n=8)[e]	7	(88)	3	(75)	1.00
Tetanus considered for bites, burns, lacerations, and abrasions (n=96)[f]	66	(69)	76	(84)	0.01
Antibiotic considered	127	(76)	132	(94)	<0.001
Analgesics considered	149	(89)	131	(94)	0.138
Documented information and actions					
Patient sex	166	(99)	140	(100)	0.20
Patient age	157	(93)	136	(97)	0.13
Mechanism of injury	166	(99)	140	(100)	0.20
Intent of injury	166	(99)	139	(99)	0.67
Heart rate at ER arrival	118	(70)	138	(99)	<0.001
Blood pressure at ER arrival	93	(55)	135	(96)	<0.001
Consciousness level at ER arrival	157	(93)	140	(100)	0.002
Injury type	160	(95)	140	(100)	0.009
Patient encounter signed by EHSP	102	(61)	136	(97)	<0.001
Date of ER disposition recorded	127	(76)	136	(97)	<0.001
Time of ER disposition recorded	125	(74)	131	(94)	<0.001
Important clinical data documented[g]	75	(45)	130	(93)	<0.001

Seriously injured – Referred, died, or length of overall hospital stay ≥24 hours; ER – Emergency Unit; RTI – Road Traffic Injury; EHSP – Emergency Unit Health Service Provider

[a]For seriously injured patients, n=133;

[b]Internal abdominal bleeding ruled out by any one of: abdominal exam, ultrasound, x-ray, computerized tomography;

[c]For seriously injured patients, n=114; spine immobilization implies use of either cervical collar or backboard;

[d]For seriously injured patients, n=58;

[e]For seriously injured patients, n=4;

[f]For seriously injured patients, n=90;

[g]Important clinical data documented - all of the following: patient sex, patient age, mechanism of injury, intent of injury, heart rate at ER arrival, Systolic blood pressure at ER arrival, Diastolic blood pressure at ER arrival, Consciousness level at ER arrival, and Injury type.

[h]Comparison by chi-square test and Fisher's exact test where appropriate