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ORIGINAL RESEARCH

Ambulance or taxi? High acuity prehospital transports in the Ashanti region of Ghana

Ambulance ou Taxi? Le transport préhospitalier des patients gravement malades dans la région d'Ashanti au Ghana

C. Nee-Kofi Mould-Millman [a], Sarah Rominski [b,*], Rockefeller Oteng [c]

[a] *Department of Emergency Medicine, Emory University, United States*
[b] *Global REACH, University of Michigan Medical School, United States*
[c] *Department of Emergency Medicine, University of Michigan, United States*

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Introduction: African emergency medical services (EMS) systems are inadequate, thereby necessitating its selective use. This study aims to investigate differences in mode of arrival to the Emergency Centre (EC) at Komfo Anokye Teaching Hospital in Kumasi, Ghana by acuity, injury and referral status.
Methods: A cross-sectional survey was conducted in the EC at the Komfo Anokye Teaching Hospital (KATH) in Kumasi, Ghana, in 2011. A survey was administered to all patients triaged to the EC. Patients were excluded if they were under 18 years of age, unable to communicate in English, Twi, or Fante, had altered mental status, or were deceased. Data were inputted into an excel spread sheet and uploaded to SPSS. Descriptive statistics were computed. Inferential statistics were performed testing for differences and associations between modes of arrival and acuity level, referral and injury status.
Results: Of the 1004 patients enrolled, 411 (41%) had an injury-related complaint, and 458 (45.6%) were inter-facility transfers ("referrals"). 148 (14.8%) arrived by ambulance, and 778 (77.6%) non-ambulance (38% private cars, 38% taxis). 67 (6.7%) were triaged as Red, 276 (27.5%) as Orange, and 637 (63.4%) as Yellow (highest to lowest acuity). Ambulance arrival was positively associated with a higher triage score (OR: 1.53). Patients referred from other facilities were almost twice as likely (OR 1.92) to arrive at the KATH EC via ambulance than those not referred. Patients with injuries and higher acuities patients were more likely to be transported to KATH by ambulance (OR 1.86 and 1.87 respectively). All results are highly statistically significant.
Conclusion: Although a minority of patients were transported by ambulance, they represented the most acute patients arriving at the KATH EC. Given the limited availability of EMS resources and ambulances in Ashanti, selective ambulance use appears warranted and should inform prehospital care planning.

Introduction: Les services d'aide médicale d'urgence (SAMU) en Afrique sont inadéquats, ce qui nécessite par conséquent de les utiliser de manière sélective. L'objectif de cette étude est de se pencher sur les différences dans le mode d'arrivée aux urgences de l'hôpital universitaire Komfo Anokye à Kumasi, au Ghana, en fonction de la gravité, du type de blessure et d'orientation.
Méthodes: Une étude transversale été réalisée au services des urgences de l'hôpital universitaire Komfo Anokye (KATH) à Kumasi, au Ghana, en 2011. Une enquête a été menée auprès des patients orientés vers le service des urgences. Les patients âgés de moins de 18 ans, qui ne pouvaient communiquer en anglais, en Twi ou en Fante, souffrant de troubles mentaux ou décédés ont été exclus de l'étude. Les données ont été saisies dans un tableur Excel et téléchargées dans SPSS. Des statistiques descriptives ont été calculées. Des statistiques inférentielles ont également été calculées afin de tester les différences et associations entre les moyens de transport pour se rendre aux urgences et le degré de gravité, le type d'orientation et de blessure.
Résultats: Sur les 1 004 patients inclus dans l'étude, 411 (41%) souffraient d'une blessure, et 458 (45,6%) correspondaient à des transferts hospitaliers (orientations). Cent quarante-huit (14,8%) étaient arrivés en ambulance, et 778 (77,6%) par un autre moyen de transport (38% en véhicule privé et 38% en taxi). Soixante-sept (6,7%) ont été classés en rouge, 276 (27,5%) en orange et 637 (63,4%) en jaune (de la gravité la plus forte à la moins forte). L'arrivée en ambulance était positivement associée à une note de classement plus élevé (RC: 1,53). Les patients orientés vers les urgences depuis d'autres structures de santé étaient presque deux fois plus susceptibles (RC: 1,92) d'arriver aux urgences du KATH en ambulance que ceux qui n'avaient pas été orientés. Les patients souffrant de blessures ou d'états physiques plus graves étaient davantage susceptibles d'être transportés au KATH en ambulance (RC 1,86 et 1,87 respectivement). Tous les résultats sont statistiquement très significatifs.
Conclusion: Bien qu'une minorité de patients était transportée par ambulance, ces derniers représentaient les patients arrivant aux urgences du KATH présentant l'état physique le plus grave. Étant donné la disponibilité limitée des ressources et ambulances du SAMU à Ashanti, l'utilisation sélective des ambulances s'avère nécessaire et devrait informer la planification des soins préhospitaliers.

African relevance

- Emergency medical services (EMS) systems in Africa are currently inadequate to provide services to all citizens.
- Timely and effective prehospital transport is needed to improve patient outcomes.

* **Correspondence to Sarah Rominski**. sarahrom@umich.edu

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- The inadequacy of EMS systems in Africa has necessitated the ubiquitous use of commercial and private vehicles for emergency medical transportation.

Introduction

The care of the acutely ill or severely physically injured patient occurs on a continuum. To minimize morbidity and mortality, emergency care should begin at the scene of the incident and end in a definitive care facility. Prompt and effective prehospital transport represents a critical link in this sequence of care.

The African continent bears a disproportionately large burden of death and disability from emergency conditions such as traumatic injuries (secondary to road traffic collisions), obstetric complications including post-partum haemorrhage and arrested labour, sepsis, shock, and paediatric acute respiratory and diarrheal illnesses. The World Health Organization (WHO) reports that Africa has the highest mortality rate from road traffic crashes (32.2 per 100,000 population), nearly double of that in North America.[1]

Reasons for the disproportionately poorer outcomes of patients with emergency medical conditions in Africa are multifactorial. Timely and effective prehospital transport is needed to improve patient outcomes.[2–4] In Ghana, excess mortality of severely injured patients has been specifically attributable to the lack of formal prehospital emergency care systems.[5]

WHO supports the development of sustainable, locally-appropriate prehospital care systems to mitigate death and disability, in part through the implementation of emergency medical services (EMS) systems which can provide formal emergency medical transport with trained prehospital providers.[6] Unfortunately EMS remains a scarce healthcare resource in Africa. Where EMS systems exist, they are inadequately developed to meet the growing needs for emergency care.[7]

The inadequacy of EMS systems in Africa has necessitated the ubiquitous use of commercial and private vehicles for emergency medical transportation.[7] However, the safety profile and outcomes of patients transported urgently or emergently by such informal means have not been widely studied.

Ghana is a lower-middle income sub-Sahara African nation of 25 million people.[8,9] The Ashanti region, the most densely populated and centrally located geo-political region of Ghana, bears a large national burden of morbidity and mortality due to emergency medical conditions.[10,11] Kumasi, the largest city in the Ashanti region, is home to Komfo Anokye Teaching Hospital, the major referral centre in the region. In Ashanti, 2 parallel ambulance systems operate: the government owned and operated National Ambulance Service (NAS), and hospital-managed Facility-Based Ambulance System (FBAS).[12]

NAS is Ghana's only formal EMS agency. In 2011, 70 internally trained NAS emergency medical technicians (EMTs) delivered essential prehospital care in 5 well-equipped ambulances in the Ashanti region. Of the 2000 Ashanti region patient transports per year, over 60% were inter-facility transfers (IFTs), mostly for obstetric and traumatic emergencies [Personal Communication, Ahmed Zakariah]. The clinical outcomes of NAS-transported patients are unknown.

In 2011, Ashanti's FBAS included 13 ambulances each stationed at and operated by a government District Hospital. These hospitals semi-autonomously managed and operated the ambulances to meet individual facility transfer needs. General nurses, rather than specifically trained prehospital providers, occasionally accompanied transported patients. FBAS ambulances contained little to no WHO-recommended prehospital equipment or medications. The case types, volume and outcomes of patients transported via FBAS remain unstudied.

Despite existing EMS resources, Ghanaian studies indicate that the majority of acute patient transports are executed with non-ambulance means. One study in the Greater Accra Region found that 59.3% of referred obstetric patients self-transported by taxi.[13] The acuity level, safety and outcomes of these informal transports conducted in Ghana also remain unknown. In this study, we aim to characterize and compare ambulance to non-ambulance transported patients who arrived in the emergency department of a tertiary care hospital in Ghana.

In line with previous Ghanaian and African studies citing predominantly informal means of emergency transport, we hypothesize that a minority of all patients will arrive at the Komfo Anokye Teaching Hospital (KATH) Emergency Centre (EC) via ambulance, with the majority utilizing non-ambulance means of transport. Secondly, due to the limited number of ambulances in the Ashanti region and a high volume of physician-initiated ambulance transports, we also postulate that severely injured and ill patients will be more likely to be ambulance-transported than lower acuity patients.

Methods

This cross-sectional study was conducted in the EC at KATH in Kumasi, Ghana. This tertiary care facility provides injury and emergency care to the residents of Kumasi (population 1.4 million) and the surrounding Ashanti region (population 4.4 million). This academic emergency department's patient volume is 27,000 visits per year and functions as the referral centre for the northern two-thirds of the country.

Potential participants included all patients seeking care in the EC at KATH who were able to give informed consent or have family give informed consent if under 18 years of age. Inclusion criteria were any patient presenting to KATH EC between July 13, 2011 and August 12, 2011. The study was conducted in 8-h shifts from 8:00 a.m. to 4:00 p.m., 12:00 p.m. to 8:00 p.m. and 4:00 p.m. to 12:00 a.m.

At the beginning of the 8:00 a.m. shift, research assistants (RAs) consulted the log book in the triage area to ascertain how many patients sought care between midnight and 8:00 a.m. These patients were located within the EC and surveyed. Questionnaires were administered in all zones of the EC. Patients were excluded if they were under 18 years of age without a parent or guardian available to consent, were unable to understand English, Twi, or Fante, or if translation services for Twi or Fante were unavailable, had altered mental status, were in need of immediate resuscitative care, were sedated, or were admitted or deceased before the survey was completed.

Study procedures were approved and conducted in compliance with the Committee on Human Research Publication and Ethics, School of Medical Sciences, Kwame Nkrumah University of Science and Technology and the University of Michigan Institutional Review Board for Human Subjects guidelines.

This study represents a secondary analysis of data collected as per the methods detailed above. Data were inputted into an excel spread sheet and then uploaded to SPSS V. 20. Descriptive statistics were computed for basic demographic information (age, sex, acuity level as determined by South African Triage Score, SATS,[14] referral status, and mode of arrival to the EC). The most acutely injured and ill patients are triaged to Red, the sub-acute patients to Orange, and the least acute were triaged to Yellow. Patients triaged to Green (lowest acuity) were sent to the outpatient clinic after EC triage, and hence were excluded from the study.

Mode of arrival (originally collected as ambulance, private car, taxi, public transport, walking, other) was dichotomized into ambulance versus non-ambulance. To explore relationships between mode of arrival and other variables, descriptive cross tabs with Chi Square analysis were performed. Associations found to be significantly associated in these bivariate analyses were entered into multivariable regressions.

Ambulatory status (initially collected as walking, walking with help, or immobile) was dichotomized to ambulatory or non-ambulatory. Patients who reported being either ambulatory or ambulatory with assistance were classified as ambulatory, while immobile patients were deemed non-ambulatory. Using a high acuity dummy variable (defined as patients triaged to Red and Orange) as the dependent variable, a logistic regression with the dichotomized ambulance variable as well as dichotomized ambulatory status variable was conducted.

Using the dichotomized mode of transport (ambulance versus non-ambulance) as the dependent variable, a logistic regression was performed. The independent variables included being referred to KATH from another facility, being a high acuity patient, presenting for care of an injury, age and sex. Statistical significance was set at p-value less than 0.05.

Table 1 Frequency table of study population characteristics.

		Frequency	Percent
Sex	Male	617	61.5
	Female	381	37.9
	Missing	6	.6
	Total	1,004	100
Mode of transport	Bicycle	1	.1
	Motorcycle	1	.1
	Walked	8	.8
	Ambulance	148	14.8
	Public Transport	383	38.2
	Car	385	38.4
	Missing	78	7.6
	Total	1,004	100
Final triage category	Green	3	.1
	Yellow	637	63.4
	Orange	276	27.5
	Red	67	6.7
	Missing	7	5.9
	Total	1,004	99.9
Ambulance arrival by final triage category	Green	0	0
	Yellow	81	8.07
	Orange	49	4.89
	Red	16	1.60%
	Non-ambulance arrival	856	85.3%
	Total	1004	100
Injury-related complaint	Yes	411	41.0
	No	559	55.6
	Missing	34	3.4
	Total	1,004	100
Referred patient	Yes	458	45.6
	No	374	37.3
	Missing	172	17.1
	Total	1004	100

Results

The total number of patients enrolled was 1004, of which the majority (n = 617, 61.5%) were male. The mean age was 39.86 (S.D. 21.95). 148 (14.8%) arrived to EC by ambulance. Of the 778 (77.5%) non-ambulance arrivals, an approximately equal number arrived either by private car (n = 385, 38.4%) or by public transportation (n = 383, 38.2%). Public transportation included taxis and small public buses (“tro-tros”). Mode of arrival data were missing for 76 (7.6%) of the sample. 411 (41%) patients presented to KATH with an injury complaint (see Table 1, online data supplement), but only 378 had corresponding mode of arrival data. Of the 144 ambulance-transported injury patient, 80 (56%) were injured while 64 (44%) were not injured (Fig. 1). Similarly, of the 458 (45.6%) referred patients to KATH, 426 had associated transportation data. Of those, 98 (70%) were referred patients who arrived by ambulance, and 42 (30%) were non-ambulance transported to KATH (Fig. 2). In our study population, the majority (n = 637, 63.4%) of patients were triaged to Yellow, 276 (27.5%) were triaged to Orange and 67 (6.7%) were triaged to Red (see Fig. 3). Triage score was missing for 6 (5.9%) of the participants.

Results of Chi-Square analysis of the mode of arrival against final triage category suggest that ambulance arrival and triage category are highly related ($p < 0.001$; not shown).

Results of the logistic regression (Table 2) demonstrate that higher acuity patients are positively associated with ambulance arrival (odds ratio (OR) = 1.53). This positive association remained unchanged even when ambulatory status is controlled for. This again suggests that more severely injured and ill patients are being transported by ambulance to KATH regardless of patients’ ability to walk.

Results of the logistic regression (Table 3) suggest that patients referred to KATH EC by providers from other facilities (OR 1.922), patients of higher acuity (OR 1.874), measured by being triaged to either Red or Orange, and injured patients (OR 1.863) are more likely to be transported to KATH by ambulance. All of these results are highly statistically significant.

Discussion

Mock et al.,[5] in a comparative study of low-, middle- and high-income settings, reported that the high morbidity and mortality in Ghana (specifically from traumatic conditions in the Ashanti Region) is largely attributable to a lack of formal pre-hospital care. To help address this need, the Government of Ghana invested in a nationalized EMS system (NAS) and a hospital-based ambulance system (FBAS) in Ashanti. These

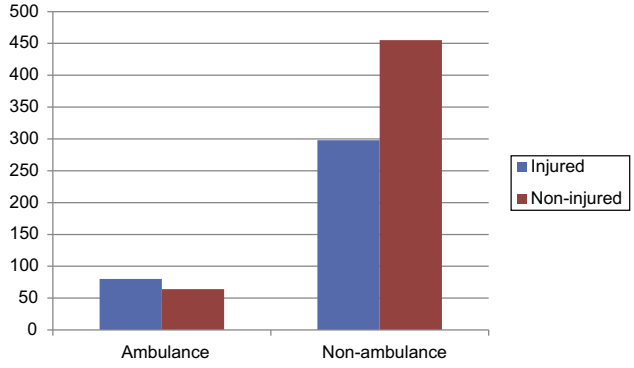

Figure 1 Ambulance arrival versus injured status.

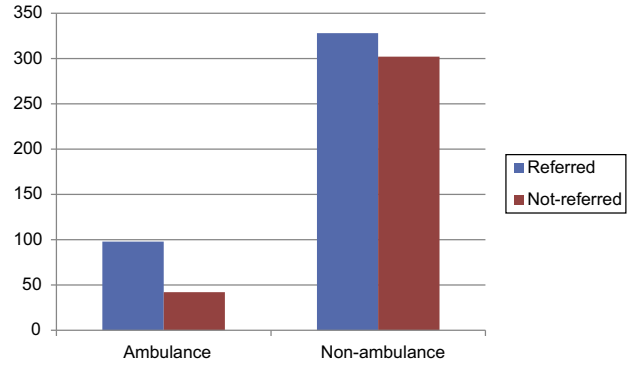

Figure 2 Ambulance arrivals versus referral status.

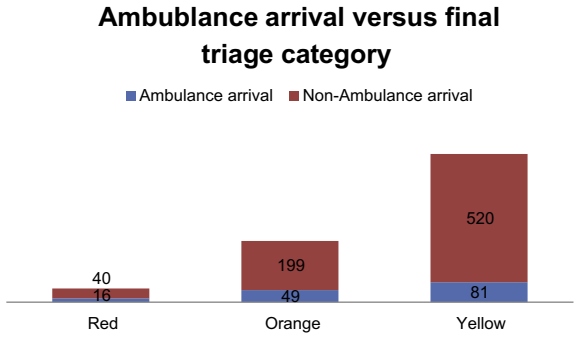

Figure 3 Distribution of SATS triage category by ambulance arrival.

ambulances and prehospital providers represent a relatively scarce healthcare resource in the Ashanti Region and in Ghana. Until now, no report has linked ambulance utilization to acuity level.

To the knowledge of the authors, this study represents the first attempt to characterize factors associated with mode of transport in a population of patients with undifferentiated emergency complaints presenting to an accident and emergency centre in Ghana. Our cross-sectional study of 1004 KATH EC patients yielded several interesting findings, both about the characteristics of this population, and also about the associations of mode of transport with acuity level, injury-related complaints, and referral status.

First, as hypothesized, we discovered that a minority (14.8%) of patients arrived at the KATH EC via ambulance. The majority of patients who presented to KATH EC arrived via non-ambulance means, mostly private car (38.4%) and commercial transport (38.2%). This high rate of non-ambulance utilization for emergency transportation is congruent with a study in Ghana amongst obstetric patients referred to a major teaching hospital in the capital city, Accra, where the majority (72.7%) of labouring women were transported via taxi and private vehicles.[13] Other Ghanaian, Nigerian and Kenyan prehospital studies have similarly reported that an overwhelming majority of trauma victims were transported to the hospital via non-ambulance means.[15–17]

The reason for this common practice of non-ambulance use in emergency transport in Ghana is multifactorial. Although beyond the scope of this analysis, we offer two possible explanations. First, we suggest that some combination of the five barriers to access (specifically, the lack of availability, poor accessibility, non-affordability, inadequacy, and poor acceptance of ambulances[18]) may contribute to this practice. The lack of published data necessitates further scientific investigation to elucidate which barriers to access contribute to poor EMS utilization in Ashanti, Ghana and Africa. Second, we noted that the majority of patients in our study were triaged as low to moderate acuity, i.e. Yellow (63%). Therefore, the high volume of non-ambulance transports to KATH EC may be justified due to the obvious absence of a life- or a limb-threatening emergency condition in our study population. Given the limited availability of ambulances in 2011 in the Ashanti region (i.e. 18 ambulances for 4 million people), utilization of private and commercial vehicles for transporting low acuity patients may not only be necessary but inadvertently appropriate.

To more accurately delineate the relationship between acuity level and mode of transport, our analysis confirmed our second hypothesis by revealing that the odds of patients arriving at KATH EC by ambulance are 1.9 times higher than non-ambulance arrivals to be triaged to Red and Orange (i.e. the highest acuity area of the EC). This demonstrates that severely injured and ill patients are more likely to be ambulance-transported as opposed to lower acuity patients. However, it could be argued that in our study, higher acuity patients were more likely to be ambulance-transported not just because of the severity of their illness, but because they were unable to walk (due to debility from grave illness or injury), or because they were transferred from a hospital (where staff may have access to an on-site ambulance). However, when we controlled for ambulatory status, the positive relationship between high acuity and ambulance arrival remained. Further, being of high acuity, referral status and injury were also found to be positively associated with ambulance-transport. This last finding is reassuring as it suggests that ambulances arriving at KATH are being utilized to transport higher acuity patients, regardless of injury status or whether they were referred from another healthcare facility.

Prior to this study, it was unknown what percentage of referred patients in the Ashanti Region was transported by ambulance versus non-ambulance means. This study is the first to report that about 15% of patients seeking treatment at the KATH EC in the Region were transported by ambulance. However, despite being in the minority, patients referred to KATH from other healthcare facilities are 1.92 times more

Table 2 Logistic regression of high acuity versus arrival by ambulance and ambulatory status.

Variable	*B*	Standard error	Odds ratio	95% CI
Ambulance arrival	0.43**	0.20	1.53	1.03–2.28
Ambulatory status	1.68***	0.17	5.34	3.84–7.41
Constant	0.27***	0.14	0.24	
Adjusted R^2	0.17			

CI, confidence interval.
** Significant at the $p < 0.05$ level.
*** Significant at the $p < 0.001$ level.

Table 3 Logistic regression of mode of arrival versus referral status, triage score, and injury.

Variable	*B*	Standard error	Odds ratio	95% CI
High acuity	0.63***	0.20	1.87	1.26–2.79
Referred	0.65***	0.21	1.92	1.28–2.86
Injury	0.62***	0.20	1.86	1.27–2.73
Constant	−2.38***	0.21	0.09	
Adjusted R^2	0.07			

CI, confidence interval.
*** $p < .001$.

likely to be transported by ambulance than those patients who self-selected KATH as their destination. Although this study was not designed to explain why referred patients in Ashanti were more likely to arrive at the KATH EC by ambulance, the Ministry of Health's Referral Policy and Guidelines[11,19] emphasize provider-initiated timely and rapid transport, preferably via ambulance, for patients who may be critically ill, severely injured, or those in need of additional healthcare resources (available at KATH). To help ameliorate the morbidity and mortality associated with delayed referrals, the National Ambulance Service widely disseminated its contact information (including handheld radio devices) to many healthcare facilities nationwide and prioritizes these calls. Hence, although more research is necessary to fully assess this finding, discovering that referred patients are more likely to be transported to KATH EC by ambulance may be a testament to these collaborative efforts between the MOH, NAS, healthcare facilities and medical providers in the Ashanti region.

While 41% of the entire study population presented to KATH due to an injury related complaint, in the ambulance-transported population we found that injury was present for 56% of these patients. Having an injury increases the odds of being transported by ambulance by 1.7 as compared to non-injured patients. The Ministry of Health, Ghana Health Service and Ghana Road and Traffic Commission report that the Ashanti region shares a disproportionally large burden of death and disability from trauma.[11] These agencies attribute this to a high frequency of severe road traffic collisions (RTCs), explained by Ashanti's heavily trafficked motorways traversing densely populated areas. Furthermore, a Ministry of Health National Accident and Emergency Services Assessment revealed that most district and sub-district government healthcare facilities are inadequately equipped to manage most moderate to severe injuries as they lack orthopaedists, trauma surgeons, radiographic services and blood banks.[12] Guidelines from the national Referral Policy stipulate that such injured patients require transport to higher levels of care. We suspect the combination of these factors (i.e. high incidence of severe RTCs and the regional referral practices) may contribute to the strong association between injury, referral and ambulance-transport. Again, we recommend further scientific investigation be dedicated to understanding the aetiology of our finding.

This study does not make any conclusions about the causal relationship between higher acuity and ambulance arrival. We have simply discovered a positive association between ambulance arrival and higher acuity level. We are unable to say whether patients were sicker hence an ambulance was called, or whether patients deteriorate in ambulances, hence arrived at KATH in more critical conditions.

The authors recognize several limitations of this study. First, these data were analysed as a secondary analysis of an existing dataset, originally designed to characterize patients presenting to the KATH EC. The subjects enrolled in the study represent a convenience sample of all KATH EC patients. The exact denominator (i.e. total KATH EC patient volume) for the study period is unknown, but historical trends suggest that the volume was between 2000 and 2300 patients. Hence, our sample size was approximately one-half. Ambulance mode of arrival and other survey data were collected from patients or family members and subject to recall bias. Unfortunately, we were unable to tease apart NAS versus FBAS ambulance transports. Since NAS is the only formal EMS system in Ghana, we are unable to conclude whether it is NAS or the FBAS conducting the majority of these high-acuity transports, especially referrals.

Our study, due to its retrospective nature, was limited in design and we were unable to link mode of arrival to patient outcomes, hence we are also unable to state whether ambulance-transported patients had a higher morbidity or mortality than non-ambulance-transported patients. However, data from the KATH EC during our study period showed the mortality in the red and orange zones were 37% and 13% respectively, compared to 2.2% in the yellow zone.

The EMS system in the Ashanti Region represents a valuable yet limited healthcare resource. This scarce EMS resource should ideally be reserved to transport the medically neediest patients i.e. those of highest acuity. As hypothesized, based on other Ghanaian and African EMS studies, we found that a minority (14.8%) of all patients arrived at the KATH EC by ambulance. Further, our study demonstrated that the ambulance-transported patients were of higher acuity than non-ambulance transported patients, and that injured patients and those referred to KATH EC from other healthcare facilities were almost twice as likely to arrive by ambulance.

Although a majority of all patients were transported by non-ambulance means, a higher proportion of lower acuity patients received prehospital transport by commercial and private vehicles. While this study was not designed to investigate causal relationships, these findings possibly signal an appropriate use of ambulances, advertently or inadvertently, to mediate potentially risky and medically complicated inter-facility high-acuity transfers. The results from this preliminary study are encouraging as we have demonstrated an appropriate use of valuable ambulances resources for high acuity transport in the Ashanti Region of Ghana. We hope the findings of this study will spur more focused prehospital studies, including outcomes-based research and additional work on the causal pathways that result in appropriate ambulance utilization, in the Region and the country.

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