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ORIGINAL RESEARCH ARTICLES

In-service training of physician assistants in acute care in Ghana: Challenges, successes, and lessons learned



*Formation interne des médecins assistants en soins intensifs au Ghana: défis, succès et leçons tirées*

Anjali Niyogi <sup>a,b,\*</sup>, Barbra Villona <sup>a,c</sup>, Beth L. Rubenstein <sup>a,d</sup>, Stephanie J. Hubbard <sup>a</sup>, Frank Baiden <sup>e</sup>, Rachel T. Moresky <sup>a,f</sup>

<sup>a</sup> Columbia University Mailman School of Public Health, Department of Population and Family Health, New York, NY 10032, USA

<sup>b</sup> Tulane University School of Medicine, Department of General Internal Medicine and Pediatrics, New Orleans, LA 70112, USA

<sup>c</sup> Department of Emergency Medicine, Anchorage, AK 99508, USA

<sup>d</sup> Columbia University Mailman School of Public Health, Department of Epidemiology, New York, NY 10032, USA

<sup>e</sup> Ghana Health Services, Research and Development Division, PO Box MB190 Ministries, Accra, Ghana

<sup>f</sup> Columbia University College of Physicians & Surgeons, Department of Medicine, New York, NY, USA

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**Introduction:** To meet the greater demand for skilled personnel in Emergency Medicine (EM) in Ghana, the authors developed an in-service course in basic acute care for Physician Assistants (PAs) working in district hospitals.

**Methods:** An initial training of trainers course was held for twenty-two PAs. From this initial group, ten were selected as Senior Trainers. Following a refresher course, Senior Trainers facilitated an in-service training and refresher course for other PAs from their regions. The course was organised into modules consisting of didactic lectures and interactive small group sessions. Assessment included testing, observation, case review, and simulations.

**Results:** All groups showed improvement in knowledge. The majority learned information sequentially, inconsistently used physical examinations for diagnosis, and rarely reassessed following interventions. Practical skills were more easily acquired than clinical decision-making skills. The case discussions and simulations were the most helpful learning tools. Symptom-based algorithms were useful for daily practice.

**Conclusion:** The greatest successes of this programme were providing the participants with greater confidence in basic life-saving skills and increasing their knowledge of and advocacy for EM. For continued success of this programme, a formal course with greater emphasis on filling Senior Trainer knowledge gaps, increased coordination with administrative authorities, and specific measurable clinical outcomes are needed.

**Introduction:** Pour répondre à la demande accrue de personnel qualifié en médecine d'urgence (MU) au Ghana, les auteurs ont élaboré une formation interne sur les soins intensifs de base destinée aux médecins assistants (MA) travaillant dans les hôpitaux de district.

**Méthodes:** Une formation initiale des formateurs a été dispensée à vingt-deux MA. Dans ce groupe initial, dix ont été choisis comme formateurs principaux. Après un cours de remise à niveau, les formateurs principaux ont animé une formation en interne et un cours de remise à niveau pour les autres MA de leurs régions. Le cours était organisé en modules comprenant des conférences didactiques et des sessions interactives en petits groupes. L'évaluation comprenait des examens, une observation, une étude de cas et des simulations.

**Résultats:** Tous les groupes ont démontré une amélioration des connaissances. La majorité a appris les informations de façon séquentielle, a utilisé de façon irrégulière les examens physiques pour les diagnostics, et a rarement réalisé une réévaluation des interventions subséquentes. Les compétences pratiques ont été acquises plus facilement que les compétences de prise de décisions cliniques. Les outils d'apprentissage les plus utiles étaient les discussions et simulations de cas. Les algorithmes basés sur les symptômes étaient utiles pour la pratique quotidienne.

**Conclusion:** Les plus grands succès de ce programme ont été de fournir aux participants une meilleure maîtrise des compétences de base vitales et de développer leurs connaissances et leur plaidoyer en faveur de la MU. Pour la poursuite du succès de ce programme, un cours formel avec un accent plus prononcé sur le traitement des lacunes en termes de connaissances des formateurs principaux, une coordination accrue avec les autorités administratives, et des résultats cliniques mesurables spécifiques sont nécessaires.

African relevance

- Trauma and non-communicable diseases are amongst the top ten causes of mortality and morbidity in low to middle income countries.
- Physician and healthcare shortages exist throughout the African continent, particularly amongst workers trained in acute care.

\* Correspondence to Anjali Niyogi. [aninyogi@tulane.edu](mailto:aninyogi@tulane.edu)

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- Task-shifting can provide an interim solution to this human resource gap.

## Introduction

Non-communicable diseases are amongst the top ten causes of mortality in low- and middle-income countries (LMICs).<sup>1</sup> Many of these illnesses require rapid interventions to reduce morbidity and mortality.<sup>2,3</sup> Emergency Medicine (EM) could potentially play a critical role in improving the outcomes of acute presentations to health facilities.<sup>4,5</sup> However, in many LMICs, this potential is hindered by a shortage of physicians in general, and specialised acute care health workers specifically.

In the absence of such specialised staff, task-shifting can provide an interim solution to this human resource gap. Task-shifting has been applied in other sectors of health delivery systems in LMICs. Faced with the HIV epidemic, community health workers, clinical officers, and nursing assistants have taken on tasks previously considered beyond the scope of their responsibilities and training.<sup>6-9</sup> A trial in South Africa found that there was no difference in measured outcomes when anti-retroviral therapy was monitored by a nurse versus a doctor.<sup>10</sup> Non-physician clinicians perform minor surgical procedures in almost half of all Sub-Saharan African countries. In Mozambique, they perform 92% of emergency obstetric surgeries.<sup>11</sup> A study from Tanzania found no difference in maternal or perinatal mortality when care was provided by an assistant medical officer compared to a medical officer.<sup>12</sup> The application of task shifting in acute care in LMICs is relatively new, and to date there are few studies on this topic in EM.<sup>13</sup>

Due to epidemiologic transitions and gaps in human resources, Ghana is an ideal setting for work in this area. Like many other LMICs, Ghana is dealing with the double burden of chronic and infectious diseases due to rapid urbanisation and other societal changes.<sup>14</sup> Ghana is also facing particularly severe health worker shortages, with only 56% of its clinical workforce needs being met in 2010.<sup>15</sup> The existing healthcare workforce distribution is unbalanced, with two teaching hospitals employing more than 45% of the country's doctors while less than 15% are in district hospitals. Greater Accra has eight times more physicians per capita than the most rural region of the country.<sup>16</sup> The Ministry of Health (MoH) has tried different strategies to incentivise clinicians to work in underserved areas, including 20–30% salary top-ups and a staff vehicle purchase scheme, with only minimal success. Out of 43 doctors posted to the rural Upper East Region from 2001 to 2009, only four assumed their posts.<sup>17</sup>

Task shifting started in Ghana in 1969, with the creation of the Rural Health Service, staffed by Physician Assistants (PAs, then known as Medical Assistants). 98% of PAs are based in rural areas, and 93% of district and sub-district facilities employ PAs, making them a vital healthcare resource in these settings.<sup>15</sup> Given the need for acute care in Ghana, the paucity of doctors in rural areas, and the growing number of PAs, at the direction of the Ghana Health Service (GHS) we undertook a pilot project to provide in-service acute care training to PAs. The remainder of this paper describes the details of the training and discusses the successes, limitations, and lessons learned from the pilot.

## Methods

The primary course objective was to teach experienced PAs to identify and stabilise patients presenting with common acute conditions. The secondary course objective was to prepare a cadre of Senior Trainers to teach this information to their colleagues throughout Ghana.

The course was organised into modules consisting of PowerPoint lectures, problem-based learning case discussions, skill stations, and simulations. Objectives for each module were developed so as to establish, reinforce, and build upon the ABCs of EM. Quick-reference algorithms for evaluating and treating common acute presentations were created. The initial Senior Trainer programme spanned nine full days. Because the PAs cited difficulty being absent from their health posts for this duration, the course was shortened to five days for all subsequent trainings.

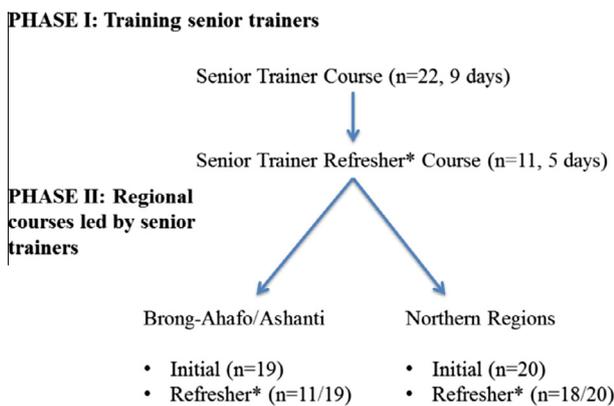
The in-service course content was developed by United States-trained physicians working with the Systems Improvement at District Hospitals and Regional Training of Emergency Care (sidHARTE) programme, based out of the Columbia University Mailman School of Public Health. Through partnerships with local institutions, sidHARTE's mission is to generate tools and implement best practices to improve care for critically ill patients in the rural hospital setting. GHS and sidHARTE have been partnering on acute care initiatives in Ghana since 2009. Three of the four course developers were trained in EM and one was trained in Internal Medicine and Paediatrics. Each had clinical and educational experience in LMICs, including Ghana.

The implementation of the in-service course began with Phase I, the Senior Trainers programme. The initial nine-day in-service Senior Trainer course was taught to 22 PAs from four different regions of Ghana, from October 31 to November 8, 2011. PAs were selected by GHS, though sidHARTE recommended PAs from district-level facilities and have either EM training or significant acute care experience as well as teaching or leadership ability.

Based on subjective and objective evaluations of their performances during the initial training of trainer course, 10 PAs were selected as Senior Trainers. This group attended a five-day refresher course six months later in order to reinforce their knowledge, and to prepare them to act as regional course facilitators.

Phase II of implementation of the in-service course was comprised of a Regional Training Program in the Brong-Ahafo/Ashanti and Northern Regions. Working in groups of two or three trainers, the Senior Trainers facilitated five-day in-service trainings and refresher courses for other PAs from their regions. All courses were supervised by at least two sidHARTE physicians. Although shorter, these courses followed the same ABC structure and mix of interactive small group case discussion, skill stations, and case simulations as the initial trainer course. Phase I and II are depicted in Fig. 1.

The ABCCC method from the Integrated Management of Adolescent and Adult Illnesses and the Integrated Management of Childhood Illnesses provided the framework for the in-service curriculum.<sup>18,19</sup> Drug dosages and terminology were modified to align with Ghana Standard Treatment Guidelines. Specific diseases were chosen for emphasis based on an informal needs assessment involving patient chart



\* All refresher courses held six months following initial course

**Figure 1** Schematic of Phase I and II of in-service course.

reviews, mortality and morbidity record review, and discussion with local clinicians. The preliminary educational package was presented to Ghanaian district hospital PAs, who provided feedback regarding appropriateness of the topics and level of complexity. The package then went to the Medical Superintendent for final review prior to implementation. The educational package was based on adult-learning models that include theoretical and practical knowledge acquisition, skill demonstration, and hands-on experience.

The titles of the Senior Trainer course modules were Introduction to Accident and Emergency, Triage, Airway and Breathing, Circulation, Consciousness, Pain, Trauma, Fracture and Wound Care, Poisonings, Medical Emergencies

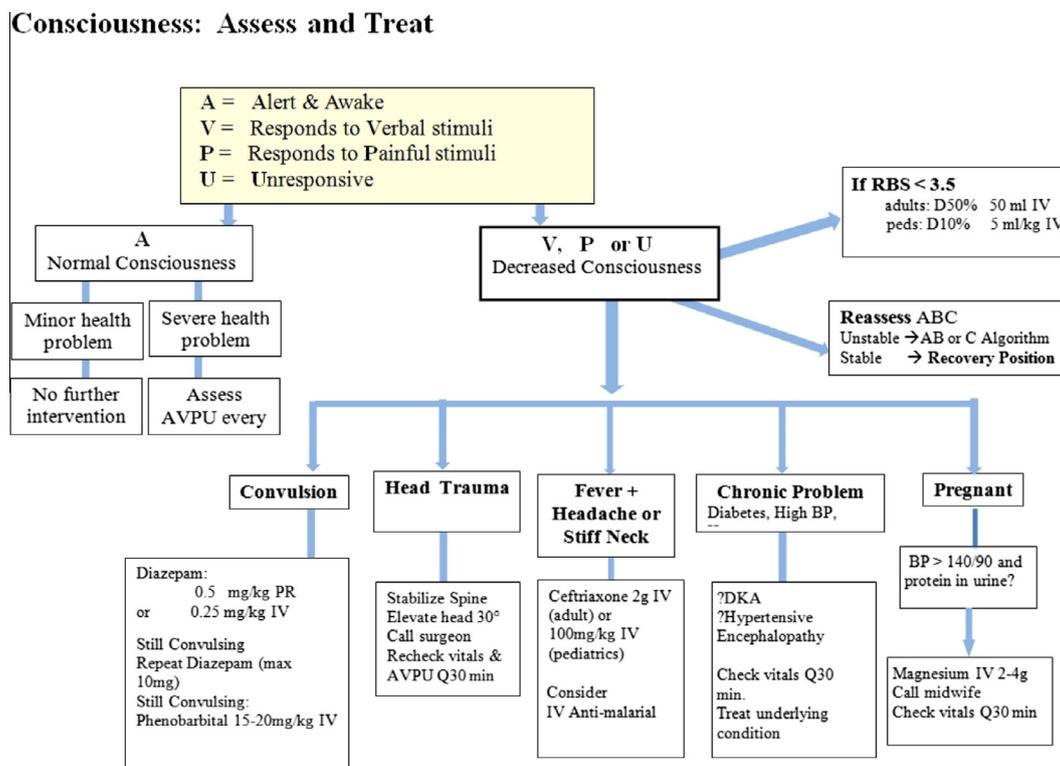
(DKA, hypertension, fluid overload states, anaemia, severe malaria), Ultrasound, Clinical Decision Making, and Teaching Methods.

Regional courses, restructured based on recommendations from the Senior Trainers, consisted of 17 lectures including Airway, Breathing, Clinical Decision Making, Circulation, Consciousness, Convulsions, Triage, Hypertensive Emergencies, Fractures, Wounds, Trauma Assessment, Burns, Trauma ABC Interventions, Trauma Mass Casualty Incident (MCI), Alcohol Withdrawal, Abdominal Pain, and DKA and Poisoning.

Facilitators, using written cases with prompts and specific questions, guided groups of five students in structured case discussions addressing the differential diagnosis, assessment, treatment, and disposition of standardised hypothetical patients.

Using adult volunteers and adult and infant mannequins, every student had the opportunity to practice basic airway management, suturing, extremity splinting, and c-collar and pelvic binder placement at skills stations. Additionally, a mass casualty incident table-top exercise was performed, with a mock emergency centre illustrated on a poster board. Facilitators presented twelve patients with varying levels of acuity, prompting students to triage and treat each patient with only two PAs and three nurses. A group discussion followed. Finally, working in teams, students evaluated and treated standardised simulated patient cases. Disposition and communication with an accepting physician were practiced in each case.

At the end of the training, participants received copies of each PowerPoint presentation, selected journal articles for more in-depth evidence-based learning, and laminated algorithms, exemplified by Fig. 2.



**Figure 2** Example of an algorithm used for the management of altered consciousness.

Participants were evaluated using pre- and post-tests, simulation checklists, checklists for problem-based learning cases, and informal end-of-session discussions. Pre- and post- tests were administered daily for the initial senior trainer course, and on days one and five in subsequent courses.

Students engaged in semi-structured discussions and formal evaluations using a 1-3 scale. Formal evaluation topics included: meeting stated objectives, clarity, relevancy, appropriateness, complexity, and potential for change in practice. These discussions and evaluations were used to provide feedback about the course and facilitators.

**Results**

Although the intended audience for Phase I of implementation was to be district hospital PAs, the majority of the actual participants chosen by GHS practiced at the sub-district or primary health centre (PHC) level. Additionally, teaching experience and leadership skills amongst selected participants varied greatly.

During the initial nine-day Senior Trainer Course, pre- and post-tests were administered daily and broken down by subject. The PAs scored the lowest on Poisonings and Medical Emergencies and highest on Trauma (see Table 1 for mean pre- and post-test scores for all modules). The overall combined average pre-test score was 70.1% (SD 6), and average post-test score was 90.7% (SD 5).

For the Senior Trainer Refresher Course and all subsequent five-day courses, pre- and post-tests were distributed only on Day 1 and Day 5. Average pre- and post-test scores for the Senior Trainer refresher course were 73% (SD 12.7) and 87% (SD 5.6), respectively.

**Table 1** Average exam scores by the subject for initial senior trainer course (n = 22).

Course subject	Pre-test		Post-test	
	Mean (%)	SD	Mean (%)	SD
Airway and Breathing	70.9	17.2	81.8	16.2
Circulation	70.7	19.2	96.4	7.9
Consciousness	79.8	21.8	89.8	16.7
Pain	76	18.3	91.4	13.29
Trauma	80.8	10.9	88.9	11.4
Fractures	74.5	21.6	95.2	10.1
Wound Care	79.4	18.2	100	0
Poisonings	49.1	22.9	92.7	9.8
Medical	50.5	26.6	80	17.5
Combined	70.1	6	90.7	5

SD = standard deviation.

The average pre- and post-test scores for the initial Regional Courses were 52.3 (SD 12.6) and 82.5 (SD 9.3). The average pre- and post-test scores for the Regional Refresher Courses were 71.7(SD 11.4) and 83.4 (SD 7.0). See Tables 2 and 3 for further scores.

Direct observation during small group case reviews and simulations revealed consistent similarities amongst all participating groups. All groups quickly processed the ABCCC format, and heavily relied on this for each new case. Group participants also acquired practical skills, particularly splinting and suturing, more easily than clinical decision-making skills. Rarely were medical histories obtained or physical exams performed beyond asking about the ABCCCs.

Groups often had difficulty in translating knowledge to practice. When asked about the causes of abdominal pain, most participants could rapidly provide several answers, but in a simulated case of abdominal pain, they could not create the same differential diagnosis. Also, across groups, during simulations the patient was rarely readdressed following interventions (e.g., if intravenous fluids were requested for hypotension, the blood pressure was rarely re-checked following fluid administration).

During the formal course evaluations, participants reported the material was appropriately complex, relevant, well organised, and presented in an open and engaging environment. The majority found the case discussions and simulations to be especially useful. Feedback in refresher courses indicated that participants referenced the algorithms and printed lectures from the initial course regularly.

**Discussion**

Participants reported greater confidence in performing emergency interventions and a commitment to changing their practice patterns. Many used their new knowledge to introduce

**Table 3** Average exam scores for senior trainer course and combined regional courses.

Exam title	Senior trainers		Combined regional course	
	n	Mean % (SD)	n	Mean % (SD)
Initial pre-test	22	70.2 (6)	39	52.3 (12.6)
Initial post-test	22	90.7 (5)	39	82.5 (9.3)
Refresher pre-test	11	73 (11.7)	29	71.7 (11.4)
Refresher post-test	11	87.3 (5.6)	27	83.4 (7)

SD = standard deviation.

**Table 2** Average exam scores for regional courses.

Exam title	Brong-Ahafo/Ashanti		Northern region		Combined regions	
	n	Mean % (SD)	n	Mean % (SD)	n	Mean % (SD)
Initial pre-test	19	50.6(12.1)	20	54 (13.3)	39	52.3 (12.6)
Initial post-test	19	80.3 (9.7)	20	84.6 (8.6)	39	82.5 (9.3)
Refresher pre-test	11	71.2 (11.6)	18	72 (11.6)	29	71.7 (11.4)
Refresher post-test	11	82.2 (8.6)	16	85.1 (5.7)	27	83.4 (7)

SD = standard deviation.

triage or improve the supply of essential medications and equipment at their facilities. One PA reported the rapid stabilisation of a seizing patient and another had used a bag-valve-mask to resuscitate an apnoeic infant. Formal participant feedback indicated a desire to advocate for improved acute care and to promote the teaching of EM.

All groups showed significant improvement in basic knowledge, clinical reasoning, and procedural skills. Based on the comparison of post-test scores from the initial course and pre-test scores from the refresher course, retention of information for regional course participants was fair at six months.

PAs reported regularly using course materials while working at their district hospital, which they bound and placed on the desk alongside the Ghana Standard Treatment Guidelines. Half of the PAs displayed the algorithms in their office. A few used the algorithms to train clinical staff. One PA submitted a report to his district supervisor recommending that the in-service training be offered at all surrounding facilities.

Despite these successes, Senior Trainer knowledge gaps continue to exist and their retention at six months was poor. The average pre-test score during the initial course was 70% and although the post-test average rose to 90.7%, the average pre-test score during the refresher course dropped again to 73%. Some of this change could be attributed to the different format of testing during the refresher course. During the initial course, the tests were administered daily with a large number of questions dedicated to individual topics, while the pre-test for the Senior Trainer refresher course (and all subsequent regional courses) was a compilation of topics with a smaller number of questions for each topic. Lack of post-course and inter-session review material to refresh and reinforce modular objectives likely also contributed to poor retention.

The average post-test score for the Senior Trainer Refresher Course (87%) was not much higher than the average post-test scores for the regional courses (83.4%), suggesting that Senior Trainers knew the information only slightly better than first-time participants. This was apparent when Senior Trainers would struggle to answer questions that went beyond material written on the slide.

Other challenges came in the form of infrastructural scarcities. Since many of the participants came from the sub-district or even health centre level, many of the first-line medications taught in the courses were unavailable to the PAs. This was true even for some of the district hospital PAs, the intended audience of the course.

An additional unexpected challenge came from legal and policy limitations placed on PAs. While PAs are the only clinicians attending to the majority of cases at most health facilities, according to rules established by GHS, PAs are not allowed to administer certain first-line medications, as this responsibility is reserved for physicians.

There was a great variability in skill amongst the Senior Trainers. Only a minority reviewed the material prior to presenting their assigned topics. Though all participants felt the small group cases and simulations offered the greatest learning opportunity, very few Senior Trainers could sufficiently guide students through the cases.

The use of small group sessions, particularly the case studies, provided the greatest yield and should be optimised as integral components of future curricula. However, case-based learning is new in many regions of the world, and training in case-based methodologies for Senior Trainers will be needed

if the in-service course is to be taught independently. Performance on the simulation exercises varied significantly. This may be due to confusion regarding the format and function of these exercises, or may truly reflect patterns of practice (i.e., lack of clinical follow-up post-intervention). The use of video training may help tease out some of these nuances. Video demonstrations could be used both to clarify the point of the activity by demonstrating a well-executed simulation, and to highlight areas of improvement.

At the end of each simulation, one participant from the group had to discuss the patient with an accepting physician. This proved to be a useful exercise, as it required participants to summarise key information, review interventions performed, and discuss outcomes. This exercise should be routinely incorporated at the conclusion of each simulation.

Refresher courses are essential for retention. A six-month gap between the initial and refresher course may be too long, particularly without a specific post-course review material embedded into the structure of the programme. This post-course material could build upon individual module objectives. Monthly on-line questions could serve as refreshers for knowledge, case studies and discussions from individual practices could reify attitudes towards acute care and stabilisation, and site visits, depending on available resources, could monitor practical skills.

To assess the value of the programme, measurable outcomes should be determined prior to course development. These could be impact outcomes (e.g., morbidity, mortality, readmission rates), process outcomes (e.g., vital sign documentation, door-to-treatment times, emergency centre equipment lists), or training outcomes (e.g., knowledge testing, skill testing).

There were several limitations. The course was geared towards PAs practicing at the district hospital level. However, many of the PAs worked at the sub-district or community level and did not have access to oxygen and certain intravenous medications that the course prescribed. In the future, it may be prudent to select only PAs working in facilities with access to essential resources, or to subdivide the course with emphasis on referring from lower levels.

A five-day course is not an enough time to cover even the most basic first-line emergency interventions. Unfortunately, it was difficult to obtain permission for PAs to step away from their posts for any longer duration of time.

The sidHARTE physicians' experiences in Ghana were in only two regions of the country and the course design may not be appropriate for other regions. A PA educational needs assessment was not conducted. Additionally, measurable outcomes were not established prior to implementation of the course, making it difficult to provide any analysis of benefit.

## Conclusion

The course was well received. All PAs reported greater comfort in handling emergency cases and strongly recommended distribution of the course. Post-test scores reflected improved knowledge, and testimonials indicated the utilisation of course information in practice settings. A more formal course with an educational needs assessment, coordination with administrative authorities regarding policy changes, and measureable outcomes could improve emergency care in Ghana.

**Conflict of interest**

The authors declare no conflict of interest.

**Author contribution**

AN, BV, BLR, SJH, FB and RTM have directly participated in the planning, execution, or analysis of this study, have directly participated in drafting the article or revising it critically for important intellectual content, and have given final approval of the version to be submitted.

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