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AN INTEGRATED APPROACH TO EMERGENCY TRIAGE ASSESSMENT AND TREATMENT IN UGANDA
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AN INTEGRATED APPROACH TO EMERGENCY TRIAGE ASSESSMENT AND TREATMENT IN UGANDA

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ABSTRACT

Background: **Reducing mortality among patients who present to primary referral facilities in need of emergency care requires efficient triage and immediate correct management known more commonly as Emergency Triage, Assessment and Treatment (ETAT). Integrated Management of Infectious Disease (IMID) training and on-site support (OSS) have been the tools used to build capacity among mid-level practitioners who have been found to be lacking in ETAT skills in the region.**

Objective: **To investigate the use of Integrated Management of Infectious Disease (IMID) training and on-site support (OSS) tools to improve ETAT in health care facilities in rural Uganda.**

Design: **Randomized mixed methods evaluation.**
Setting: **Thirty-six facilities in Uganda were randomized 1:1 to arm A (IMID and OSS) and arm B (IMID alone).**
Subjects: **Two mid-level practitioners, (clinical officers or senior nurses), from each facility participated in offsite IMID training. Staff at 18 facilities in arm A participated in OSS (two days each month of outreach and quality improvement for nine months).**
Results: **Time series data on facility performance of three ETAT indicators were compared over 14 months and data on mortality among pediatric inpatients were compared across arms.**
Improvements differed across facilities and indicators, but steady improvement in triage occurred in arm A, with convergence across arms in the management of emergency patients. Analysis of baseline indicators and improvements demonstrated that facilities could improve their performance regardless of their starting point.
Conclusion: **IMID and OSS both improved the management of patients with an acute illness presenting to rural health facilities.**

INTRODUCTION

Deaths from acute illnesses is common worldwide but many can be prevented by skilled triage and correct immediate management. The World Health Organization (WHO)'s Integrated Management of Childhood Illness program sought to improve management of pediatric emergencies by: 1) training health care providers at primary care facilities to recognize danger signs and refer patients (1,2) and, 2) developing Emergency Triage, Assessment, and Treatment (ETAT) protocols (3,4,5). An ETAT protocol implemented at a pediatric hospital in Malawi decreased mortality (6). ETAT was extended to include neonatal care and management of serious pediatric illness, referred to as ETAT+ (7), was implemented in Kenya (8), and taught at a medical school in Rwanda (9). Experts recommend adapting and implementing ETAT protocols at district hospitals (10,11,12,13), and health centers (14).

Health centers serve as primary referral facilities. They differ from district hospitals in that they rarely have medical officers on site, they provide urgent episodic care for children and adults so that pediatric and adult ETAT is combined and they have fewer laboratory tests with limited expertise.

Clinical practice is nested within complex health systems. A health systems approach is required to improve clinical practice (15). We elaborate on three IDCAP results that support successful implementation and evaluation of ETAT at rural referral facilities:

1. Time series graphs of facility performance improvements following educational interventions
2. Dispersions graphs with the range of baseline values and performance improvements across facilities at specific points in the interventions.
3. Exploratory results using prospective data on pediatric inpatient mortality within 48 hours of admission.

METHODS AND MEASUREMENTS

Study design and setting: The Integrated Infectious Disease Capacity-Building Evaluation (IDCAP implemented ETAT approach for children and adults at 36 primary referral facilities in Uganda. Two

focused interventions were tested: the Management of Infectious Disease (IMID) training program at the Infectious Diseases Institute in Kampala and monthly on-site support (OSS) at 18 facilities. Two mid-level practitioners from each of the 36 facilities attended IMID. Eighteen facilities (arm A) were randomly assigned to receive OSS visits, whereas 18 facilities (arm B) did not have this experience until much later. Both interventions were to be integrated into their clinical workload included an ETAT approach, as well as case management for common infections.

IDCAP was a mixed design study with pre/post and cluster-randomized trial components. This manuscript focuses on the pre/post difference component, which measures the combined effect of IMID and OSS in arm A, and the effect of IMID alone in arm B. Methods for the trial component were previously reported including randomization, blinding, sample size, facility performance data collection and entry, CONSORT flow diagram, and recruitment.

The pre and post time periods were not exactly the same for both arms, because mid-level practitioners in arm A attended the first two sessions of IMID training (March 15-April 2, 2010 and April 12-30, 2010) and those in arm B attended the final two sessions (May 3-21, 2010 and June 7-25, 2010). Consequently, baseline (Time 0) was from November 2009 to March 2010 in arm A and from November 2009 to May 2010 in arm B. In arm A, the intervention (Time 1) began in April 2010 and extended for nine months until December 2010. In arm B, Time 1 began in June 2010 and extended for seven months until December 2010.

Selection of participants: The sites were 36 health center IV (HC IV) or comparable facilities drawn from all four regions of Uganda. An HCIV provides primary care and is the referral facility of the health sub-district in the public system. Four district hospitals that were functioning as HCIV's were also included but they did have increased workloads and staffing in their capacity as a referral center. Two mid-level practitioners, either clinical officers, registered nurses, or registered midwives, from each facility undertook IMID training. Inclusion criteria for health facilities and mid-level practitioners were previously described (16,17). All staff could participate in OSS activities.

Interventions: The IMID training program consisted of a three-week core course followed by two, one-week boost courses 12 and 24 weeks later, and weekly distance learning assignments. The curriculum built on several curricula including the Integrated Management of Childhood Illness, and Integrated Management of Adult Illness. The session on 'Emergency Care in Infectious Disease' was presented on the second day and reinforced with case studies throughout. Two Clinical Decision-Making Guides were developed as job aids to supplement the course: 1) initial triage and emergency management in all patients; and 2) continued urgent treatment. (See Supplementary File S1). They were accompanied by guidelines on appropriate drug doses.

OSS consisted of nine two-day visits each month by a mobile team. The four team members were: a medical officer with expertise in CQI, a clinical officer, a laboratory technologist, and a registered nurse. The first day focused on multidisciplinary team training, cadre-specific clinical break-out sessions, and one-on-one mentoring. The three cadre-specific sessions were for: 1) clinicians, 2) counselors, and 3) laboratory professionals. The second day focused on CQI

activities that were adapted for low and middle income countries from the Institute for Health Improvement's collaborative improvement model (18).

Each OSS visit was devoted to a specific topic, beginning with 'Emergency Care in Adults and Children.' At the first visit, mobile teams supported participants to select six of 13 CQI goals, one of which was linked to the ETAT indicator "proportion of outpatients triaged." Fifteen of 18 facilities in arm A chose this goal. Progress towards the goals was reviewed during subsequent visits.

Participants decided how to improve the processes of care to reach the goals. Four ETAT examples were: designating triage staff, analyzing and improving workflow for emergency cases, creating areas to retain emergency and priority patients, and procuring and stocking trays with emergency appliances, drugs and supplies. Improvements were implemented differently across facilities; at some a nurse was responsible for triage, while at others the person who registered patients was responsible.

Case definitions: Emergencies were defined as patients with one or more of the ABCDO signs: Airway; Breathing difficulty; Circulation / Coma / Convulsion / Confusion; Dehydration; and Other. Priorities were defined as patients with 3TPR-MOB priority signs: Tiny baby (sick child under two months of age); Temperature; Trauma or other urgent surgical condition; Pallor (severe); Poisoning; Pain (severe); Respiratory distress; Restless, lethargy or continuously irritable; Referral; Malnutrition (severe); Oedema of both feet; and Burns.

Facility performance indicators: The three ETAT indicators were the proportions of: 1) outpatients triaged; 2) emergency and priority patients admitted, detained, or referred; and 3) estimate of emergency patients that received at least one appropriate treatment. Data were collected on every outpatient using the Uganda Ministry of Health revised Medical Form 5. The form was initially modified by the Uganda Malaria Surveillance Project (19) and further revised by IDCAP to add a section on triage, additional drugs for emergency patients, and additional types of referrals, among other revisions (20).

The triage section was at the top of the form to report ABCDO emergency signs, and three triage categories: emergency, priority, and queue. A patient was considered triaged if either an emergency sign was circled or triage category ticked. The three referral categories were: admitted, detained in the clinic setting, or referred for other services. "Detained" referred to a 'space' for the patient to be treated until recovery or transfer to the district hospital.

The broad criteria for 'appropriate treatment' was that at least one emergency drug was prescribed and in stock. Fourteen drugs that could be used for emergency care and were listed on the form were: Artesunate, Aspirin, Benzyl penicillin (X-pen), Chloramphenicol, Cloxacillin, Diazepam, Gentamycin, intravenous fluids, Magnesium, Oxygen, oral rehydration solution, Phenytoin, Quinine, and Salbutamol. Eight "other" drugs that clinicians specified also met the criteria for appropriate treatment: Ampicillin, Benzathine penicillin, Ceftriaxone, Cefuroxime, Epinephrine, Paraldehyde, Penicillin, and Phenoxymethyl penicillin.

Pediatric inpatient mortality: Mortality among inpatients under five years of age was measured within 48 hours of admission. Initially, we relied on retrospective inpatient records, but a pilot study showed that the date and discharge status of up to 30% of inpatients were missing. Protocol

modifications for the inpatient data and approval were delayed until January 31, 2011, which was after Time 1. During the follow-up period from March to September 2011, data entry assistants stationed at each facility checked the status of all pediatric inpatients prospectively every 24 hours and updated the inpatient register accordingly.

Ethical Considerations: IDCAP was approved by the School of Medicine Research and Ethics Committee of Makerere University (#2009-175) and Uganda National Council on Science and Technology (#HS-722). Informed consent of participants was not required because the interventions were evaluated on facility rather than individual performance. Informed consent of patients was waived for the ETAT indictors. University of Washington Human Subjects Division determined that IDCAP did not meet the regulatory definition of research under 45 CFR 46.102(d).

Data analysis: Frequencies were calculated to describe outpatient samples across arms and time periods. Time series graphs were created with monthly results by arm for each indicator. Dispersion graphs were created by facility for each indicator. The horizontal axis reports the Time 0 value of the indicator, and the vertical axis reports the absolute change from Time 0 to Time 1. In these graphs a facility with zero percent of outpatients triaged in Time 0 could have a zero to 100% increase in Time 1, whereas a facility with 100% in Time 0 could only have zero or negative change in Time 1. Outpatient data were analyzed with Stata® version 11 (Statacorp, 2009 College Station, TX, USA). Inpatient mortality data were entered and analyzed in Microsoft Excel© (Microsoft Corporation, Redmond WA, USA).

Limitations: The pre/post component of the research design did not control for temporal effects, extraneous effects of the evaluation, or regression to the mean. Temporal changes at the district level however, would have affected only a few facilities because the 36 sites were located in 28 different districts. The definition of appropriate treatment was admittedly broad. Improvements in arm A are not evidence that all appropriate treatments were provided to each patient. It was not possible to link treatment to the patient's emergency signs (ABCDO), because patients had multiple signs and diagnoses. Appropriate treatment was based on drug name and availability, and did not reflect dosages, routes, and frequency of administration.

The triage status of the patients was not validated by the mobile team or by expert observation. A lower proportion of outpatients were categorized as emergencies in Time 1 than Time 0. If the interventions improved the capacity to classify patients by triage category, then the percentages in Time 1 may be more accurate than Time 0.

RESULTS

Characteristics of samples: The 36 facilities included 31 health center IV and five hospitals; six were private-not-for profit facilities. Among IMID participants, 46 were clinical officers (24 in arm A, 21 in arm B), 22 were registered nurses (12 in arm A, 11 in arm B), and four were registered midwives (all in arm B). From November 2009 to December 2010, data were collected on 777,667 outpatient visits. However patient age was not recorded for 24,593 (3·3%) visits. As shown in Table 1, data were analyzed on 330,596 outpatients in arm A and 422,478 in arm B, of which 26.4% and 28.4% were children under five, respectively. The higher volume of outpatients in arm B was due to the

random assignment of four out of the five hospitals to arm B.

Table 1

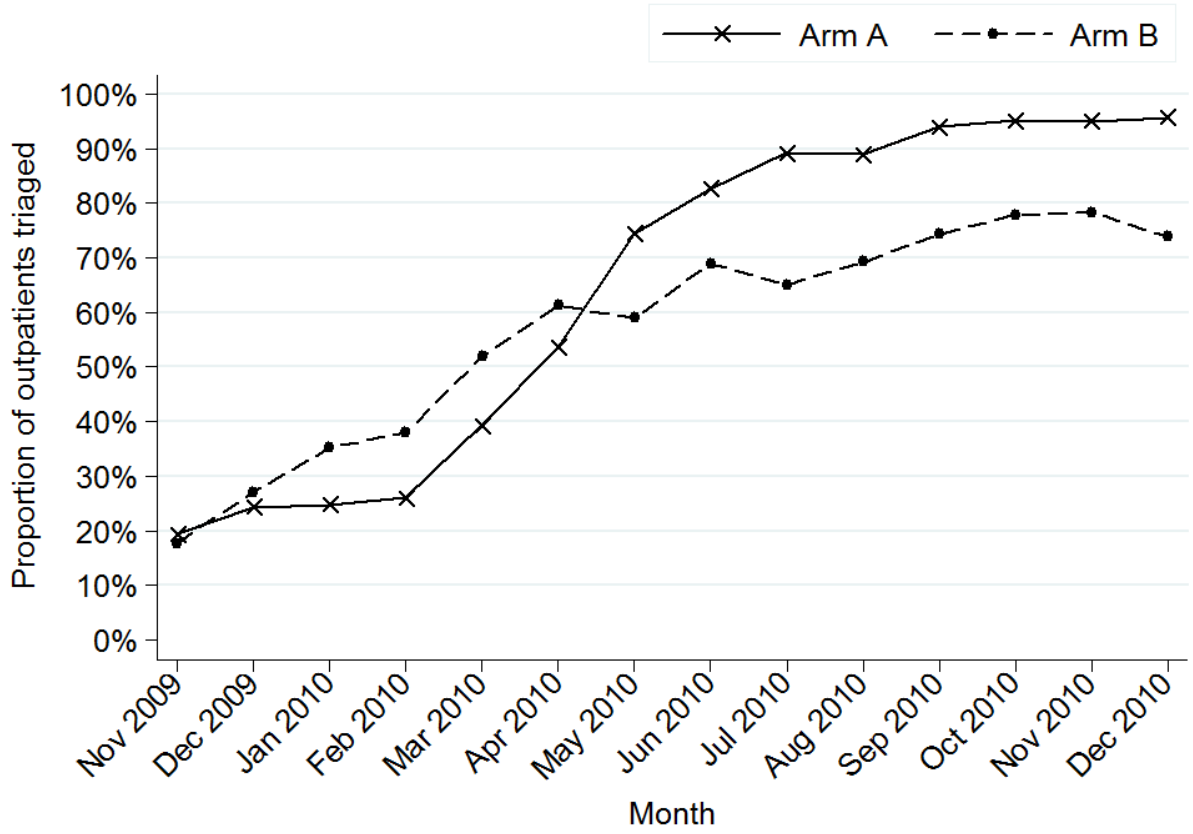
Patient population by age and triage status

	Arm A (n=18)		**Arm B (n=18)**	
	Time 0	**Time 1**	**Time 0**	**Time 1**
	N (%)	**N (%)**	**N (%)**	**N (%)**
Total Patient Population	94,812	235,784	195,371	227,107
Age				
Under 5 years	26,264 (27·7%)	60,988 (25·9%)	59,921 (30·7%)	60,211 (26·5%)
5 years and over	68,548 (72·3%)	174,796 (74·1%)	135,450 (69·3%)	166,896 (73·5%)
Any Triage Status	25,494 (26·9%)	201,877 (85·6%)	85,043 (43·5%)	164,980 (72·6%)
Emergency	2,677 (2·8%)	4,382 (1·9%)	9,960 (5·1%)	6,733 (3·0%)
Priority	3,660 (3·9%)	13,112 (5·6%)	13,703 (7·0%)	12,944 (5·7%)
Queue	19,157 (20·2%)	184,393 (78·2%)	61,380 (31·4%)	145,303 (64·0%)

An overview of results for 23 IDCAP facility performance indicators reported that the interventions were associated with statistically significant pre/post improvements in two of three ETAT indicators (21). The proportion of outpatients triaged increased by 103% (adjusted relative risk (aRR) = 2.03; 99% CI: 1·13, 3·64) in arm A, which was attributed to IMID and OSS, and by 29% (aRR = 1.29; 99% CI: 1·01, 1·64) in arm B, which was attributed to training limited to IMID training. The proportion of emergency and priority patients who were admitted, detained, or referred increased by 203% in arm A (aRR = 3.03; 99% CI: 1·40, 6·56) and 59% (aRR = 1.59; 99% CI: 1·04, 2·44) in arm B. The estimated proportion of emergency patients that received at least one appropriate treatment increased by 75% in arm A (aRR = 1.75; 99% CI: 0.99, 3·06), but by only 4% in arm B (aRR = 1.04; 99% CI: 0.80, 1·35). The cluster randomized trial results of the comparison across arms did not show statistically significant incremental effects.

Monthly results for each indicator by arm are presented in Figures 1 to 3. Figure 1 shows the proportion of outpatients triaged, which was higher in arm B than arm A during Time 0. The proportions increased in both arms at a faster rate in March 2010 when data entry assistants were stationed at the 36 facilities. The proportion in arm A increased above arm B in May 2010 after the OSS session on ETAT, and reached 94% by September 2010.

Figure 1
Proportion of outpatients triaged by month and arm

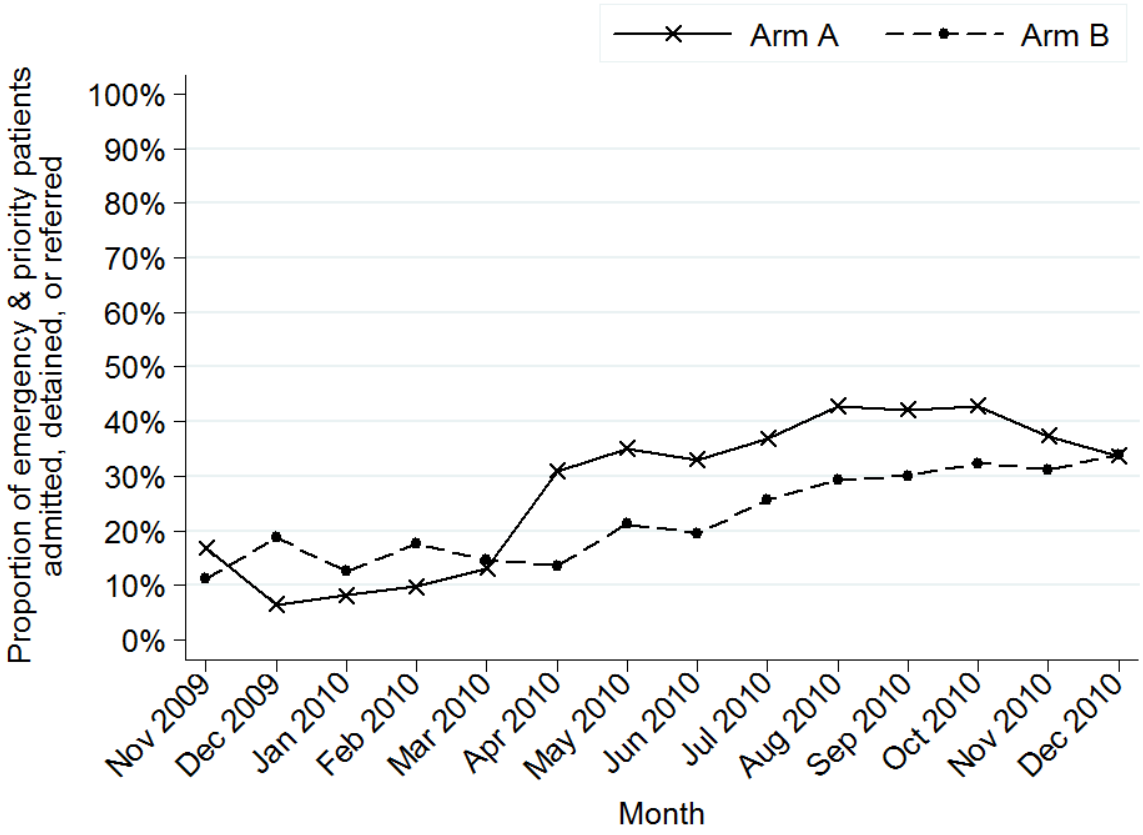


The figure shows the proportion of outpatients triaged each month by arm. For arm A, baseline (Time 0) was from November 2009 to March 2010 and Time 1 was from April to December 2010. For arm B, Time 0 was from November to May 2010 and Time 1 was from June to December 2010. The data entry assistants began work to support data collection at the facilities in March 2010 in both arms.

As the proportion of patients triaged increased, so did the percentage in the queue category, as shown in Table 1. Similarly, the proportion of outpatients who were admitted, detained or referred was higher in arm B than arm A initially, with arm A overtaking arm B in April 2010, as shown in Figure 2. The proportion in arm B increased at a slow and steady rate however, and matched arm A in December 2010.

Figure 2

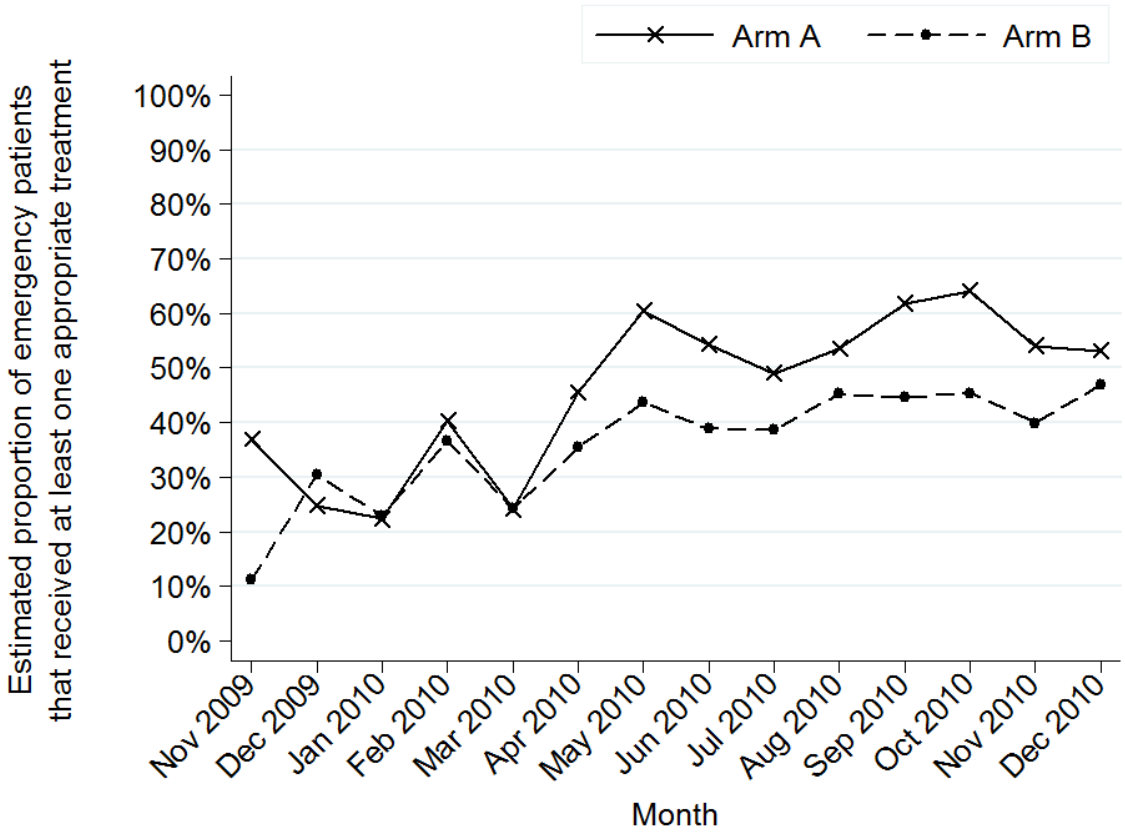
Proportion of emergency and priority patients admitted, detained, or referred by month and arm



The figure shows the proportion of outpatients who were classified as an emergency and priority who were admitted or detained at the facility or referred each month by arm. For arm A, Time 0 was from November 2009 to March 2010 and Time 1 was from April to December 2010. For arm B, Time 0 was from November to May 2010 and Time 1 was from June to December 2010. The data entry assistants began work to support data collection at the facilities in March 2010 in both arms.The estimated proportion of emergency patients receiving treatment according to ETAT standards fluctuated over Time 1 as shown in Figure 3, but remained higher in arm A than B.

Figure 3

Estimated proportion of emergency patients that received at least one appropriate treatment by month and arm

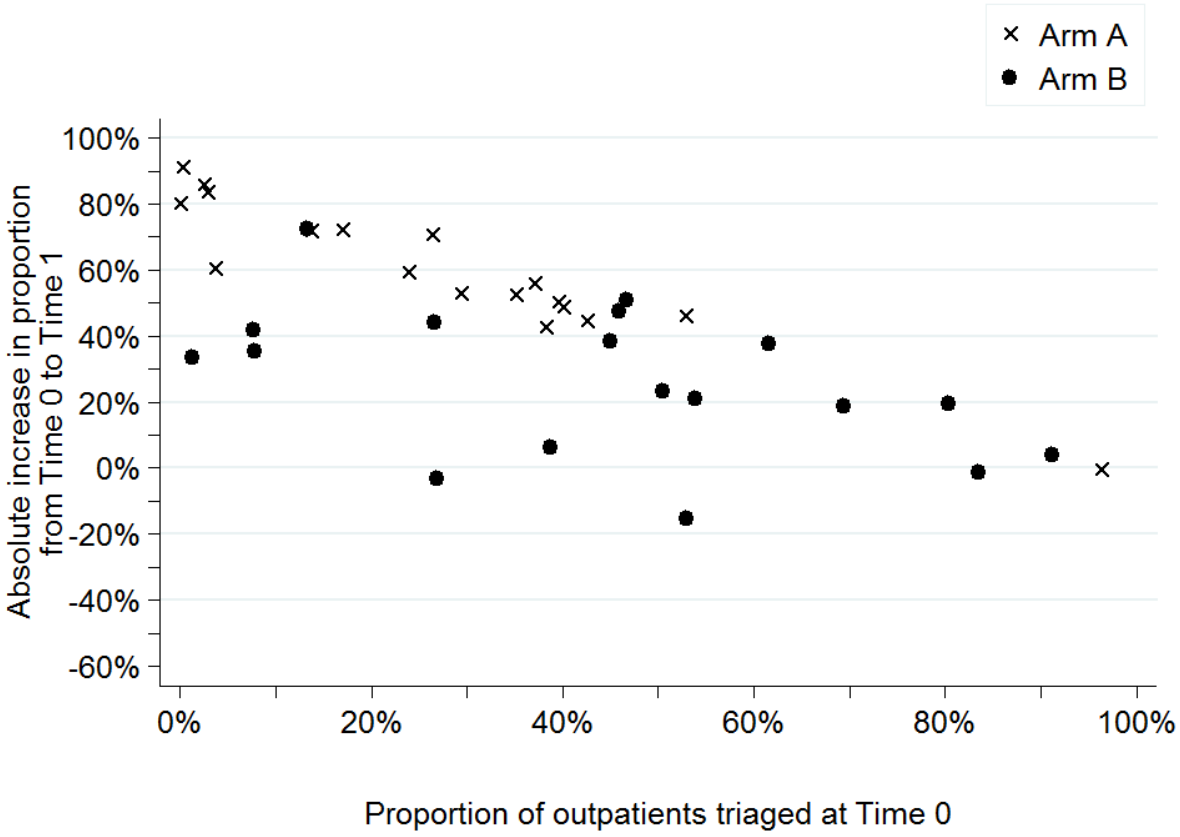


The figure shows the estimated proportion of outpatients classified as emergencies that received at least one appropriate treatment each month by arm. For arm A, Time 0 was from November 2009 to March 2010 and Time 1 was from April to December 2010. For arm B, Time 0 was from November to May 2010 and Time 1 was from June to December 2010. The data entry assistants began work to support data collection at the facilities in March 2010 in both arms.

The range of values of the indicators across facilities was large in Time 0, as were their improvements in Time 1. As shown in Figure 4, Time 0 values ranged from zero to more than 90% of patients triaged. Arm B facilities generally started with higher proportions; eight facilities in arm B were triaging 50% or more of outpatients in Time 0 compared to two in arm A. Facilities in arm A showed a greater improvement than arm B.

Figure 4

Proportion of outpatients triaged, displayed by facility and by arm

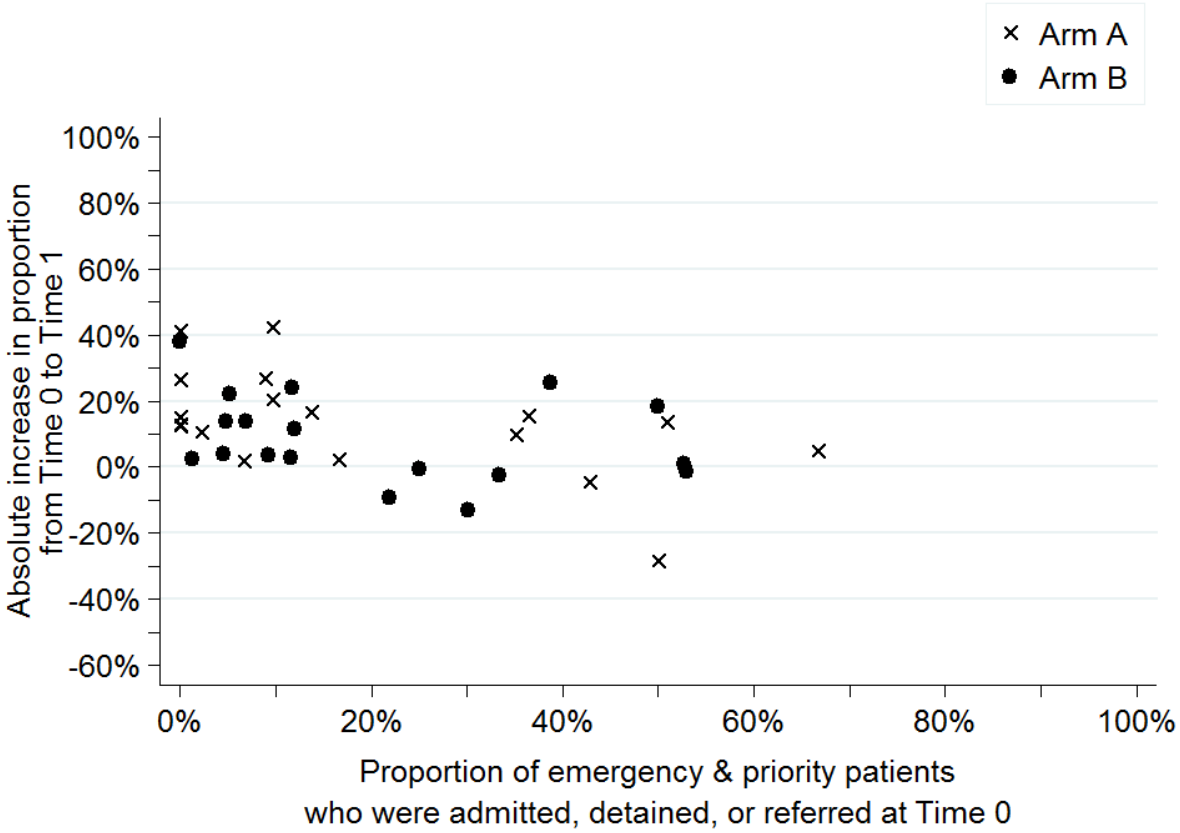


This figure shows the proportion of outpatients triaged for each facility at Time 0 on the horizontal axis. The absolute change in the proportion from Time 0 to Time 1 is measured on the vertical axis. An "X" represents an arm A facility and a dot represents an arm B facility. For any given value on the horizontal axis, a higher value on the vertical axis represents a larger improvement.

Figure 5 shows that the range of values for the proportion of emergency and priority patients admitted, detained, or referred at Time 0 was narrower; the highest value was 67% for an arm A facility. The range of improvements was also narrower, with the largest improvement just above 40% for an arm A facility.

Figure 5

Proportion of emergency and priority patients admitted, detained, or referred, displayed by facility and by arm

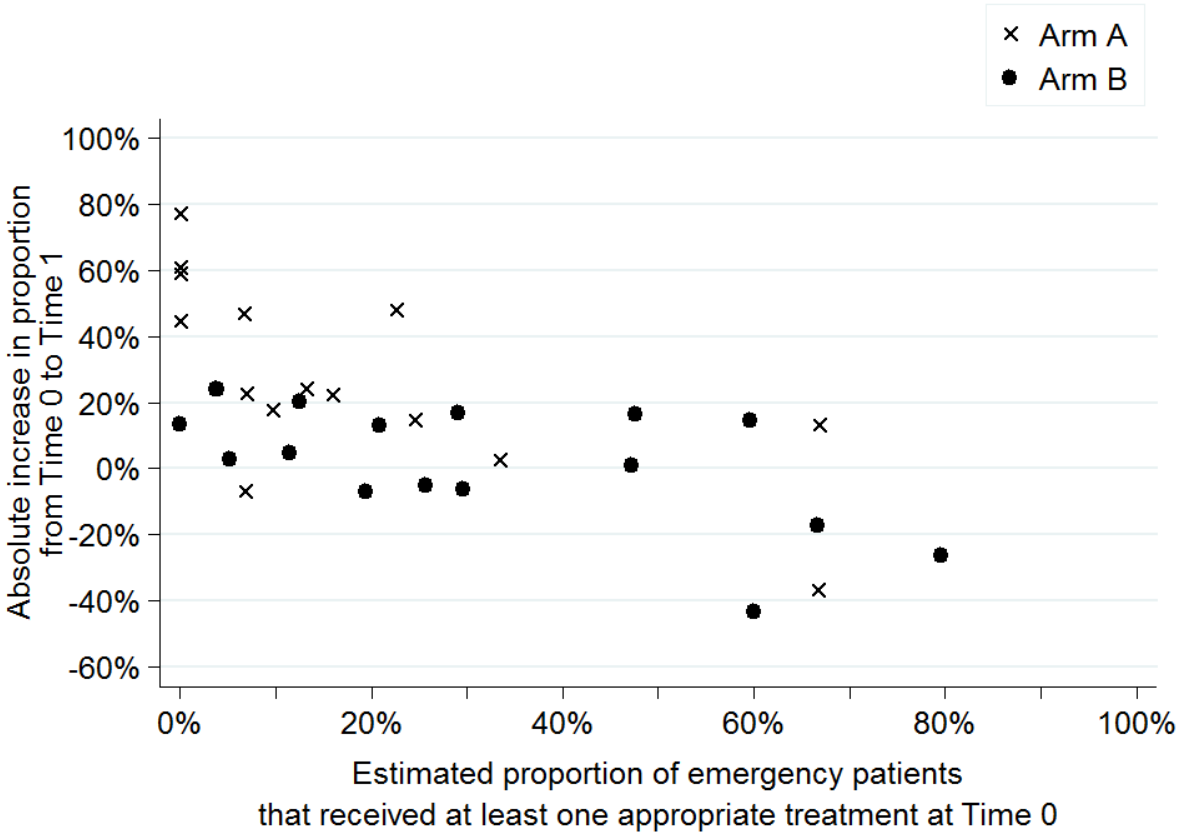


This figure shows the proportion of outpatients who were classified as an emergency or priority who were subsequently admitted or detained at the health facility or referred at Time 0 on the horizontal axis. The absolute change in the proportion is measured on the vertical axis. An "X" represents an arm A facility and a dot represents an arm B facility. For any given value on the horizontal axis, a higher value on the vertical axis represents a larger improvement.

Figure 6 shows that the estimated proportion of emergency patients that received at least one appropriate treatment was generally higher in arm B than arm A in Time 0 presumably due to the increased weighting of the district hospitals. In Time 1 however, six arm A facilities improved by 40% or more, and three arm B facilities declined by more than 15%.

Figure 6

Estimated proportion of emergency patients that received at least one appropriate treatment, displayed by facility and by arm



This figure shows the estimated proportion of outpatients who were classified as an emergency and received at least one appropriate treatment at Time 0 on the horizontal axis. The absolute change in the proportion is measured on the vertical axis. An "X" represents an arm A facility and a dot represents an arm B facility. For any given value on the horizontal axis, a higher value on the vertical axis represents a larger improvement.

From March through September 2011, 12,787 children under five were admitted as inpatients to the 36 facilities. Twenty-four of 4,460 inpatients (0.54%) died in arm A compared to 95 of 8,327 (1.14%) in arm B ($p<0.001$). When the five district hospitals were excluded from the comparison, 19 of 4,300 inpatients (0.44%) died in arm A compared to 46 of 4,143 (1.11%) in arm B ($p<0.001$).

DISCUSSION

ETAT is one of the major responsibilities of health care providers working within emergency care facilities. Patients arrive with only their personal assessment of symptoms. A proportion of the millions presenting for care each day globally, have an illness or an outcome following trauma that will be fatal if not adequately treated in a timely manner.

WHO has emphasized both the knowledge and skill set required to provide consistent, competent, directed care for these individuals. The educational strategies to prepare individuals for this difficult role however are uncertain. The present study was designed to evaluate and compare the effectiveness of small offsite group classroom training alone to two selected individuals from each facility with the classroom training plus 'onsite support' delivered monthly for nine months to most of the facility care personnel. It was anticipated that the classroom offsite training would diffuse through the facility and change practice.

The monthly time series graphs showed the course of improvements in three ETAT facility performance indicators in relation to IMID training and OSS visits in arm A, as well as the arrival of the data entry assistants in March 2010. The dispersion graphs demonstrated that facilities were able to improve performance regardless of baseline values for the indicators. A trial for a vertical program that focused on a single indicator might select facilities on the basis of either poor or good performance. In contrast, for our interventions, facility performance was not an inclusion criterion, and the dispersion graphs showed a broad range of values of the performance indicators in Time 0. Health system investigations should consider dispersion, and balance restrictive inclusion criteria against potentially greater dispersion and larger sample sizes.

We checked inpatient registers daily to collect prospective data on inpatient mortality. The mortality rate within 48 hours of admission was significantly lower in arm A than arm B among pediatric inpatient with or without inclusion of the five district hospitals. This is evidence that OSS was associated with decreased mortality. Similar findings were demonstrated by Molyneux et al in hospitals in Malawi (6). The timing of data collection however, was problematic. We could not control for differences that may have existed across arms at baseline. The IDCAP protocol and CONSORT checklist are available as Protocol S1 and Checklist S1 of Weaver and colleagues (21). Anonymous, facility performance data are available on the Global Health Data Exchange website at http://ghdx.healthdata.org/.

IDCAP also contributed integrated Clinical Decision-Making Guides in emergency care. Mid-level practitioners at health centers however, may not have expertise in both children and adults. We demonstrated that it was possible and practical to create integrated guidelines for both. The Clinical Decision-Making Guides noted different specific guidance for children and during pregnancy when relevant.

CONCLUSION

Further improvements in ETAT processes of care are required. During the interventions in arm A, only 37% of emergency and priority patients were admitted, detained, or referred, and only 55% of emergency patients received at least one appropriate treatment.

RECOMMENDATION

Improving ETAT in the management of patients with life threatening illness remains an unfinished task.

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