

Analysis of Trauma Care Education in the South Sudan Community Health Worker Training Curriculum

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Abbreviations:

CHW: community health worker
CME: Continuing Medical Education
CO: clinical officer
ESS: Essential Surgical Skills course
HIC: high-income countries
IMC: International Medical Corps
LMIC: low- and middle-income countries
NTMC: National Trauma Management Course
PTC: Primary Trauma Care course
WHO: World Health Organization

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Abstract

Introduction: Trauma is a leading cause of morbidity and mortality worldwide, with the majority occurring in low- and middle-income countries (LMICs). Allied health workers are often on the front lines of caring for trauma patients; this is the case in South Sudan, where a system of community health workers (CHWs) and clinical officers (COs) form an essential part of the health care structure. However, curricula for these workers vary, and it is unclear how much these training programs include trauma education.

Hypothesis/Methods: The CHW training curriculum in South Sudan was reviewed to evaluate the degree to which it incorporates trauma education, according to established guidelines from the World Health Organization (WHO). To the authors' knowledge, this is the first formal comparison of a CHW curriculum with established WHO trauma guidelines.

Results: The curriculum incorporated a number of essential components of the WHO guidelines; however, the concepts taught were limited in scope. The curriculum only covered about 50% of the content required for basic providers, with major deficiencies being in the management of head and spinal injuries, safety protocols for health care personnel, and in the management of pediatric patients.

Discussion/Conclusion: The CHW training curriculum lacks the requisite content to provide adequately a basic level of trauma care and requires amending to ensure that all South Sudan citizens receive appropriate treatment. It is recommended that other LMICs review their existing training curricula in order to improve their ability to provide adequate trauma care and to ensure they meet the basic WHO guidelines.

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Introduction

After seceding from North Sudan in July of 2011 (following almost 60 years of civil war), South Sudan is the world's newest country. Due to years of unrest, much of the country's infrastructure is currently in the redevelopment stage, and a large proportion of the gross national product comes from foreign aid. The new nation is now one of the poorest in the world and has some of the worst health indicators. About 4.1 million people are food insecure (with 2.8 million targeted for food assistance),¹ and as of 2013, less than 20% of the population has access to health services.² As a result, South Sudan has some of the highest rates of malnutrition, maternal-child mortality, and communicable diseases, which are responsible for high levels of morbidity and mortality in the country.

Trauma is another significant health concern in South Sudan, with years of civil war and internal conflict resulting in a number of war victims and internally displaced people. Worldwide, trauma is one of the leading causes of morbidity and mortality, accounting for about 16% of the global disease burden.³ This is worse in low- and middle-income countries (LMICs), which see a disparate proportion of trauma and account for approximately 90% of the total global injury burden.³ A contributing factor to this disparity is the stark difference in trauma outcomes when comparing high-income countries (HICs) to LMICs. One study showed a mortality rate of approximately 36% in LMICs for patients with moderately severe injuries compared to six percent in HICs.⁴ Similarly, another study

comparing outcomes for severely injured adults in three cities at different economic levels showed mortality rates increased from 35% in the HIC to 55% in the middle-income country and 63% in the low-income environment.⁵

In part to address the growing and disparate burden of trauma in LMICs, the World Health Assembly (Geneva, Switzerland) passed Resolution 60.22 in 2007.⁶ This resolution highlights the importance of trauma care and the improvement of emergency health systems, even in LMICs. It also recognizes the significance of primary prevention as a vital way to reduce the global injury burden. It states that:

Additional efforts should be made globally to strengthen provision of trauma and emergency care so as to ensure timely and effective delivery to those who need it in the context of the overall health care system, and related health and health-promotion initiatives.⁶

One way to achieve this goal is to improve health worker education at the most basic level.^{6,7}

The World Health Organization (WHO; Geneva, Switzerland) *Guidelines for Essential Trauma Care*³ outlines goals for injured patients, specifically addressing the proper management of life- and limb-threats that require immediate intervention. Since the capacity to achieve these goals varies by the type of health facility in question, the guidelines identify services and resources deemed as “essential” at each different facility level. The WHO trauma guidelines classify these facilities as:

1. Basic facilities, which are primary health facilities staffed by village health posts, clinics staffed by nurses and medical assistants, and clinics with doctors (Table 1);
2. General practitioner hospitals, including those with basic surgical capabilities;
3. Specialty hospitals, which include hospitals with general surgeons, hospitals with general surgeons and orthopedic surgeons, and hospitals with general surgeons, orthopedic surgeons, and other specialties; and
4. Tertiary Hospitals, which include tertiary care facilities with both a limited and a full range of specialties.³

Due to a lack of trained physicians, and a geographic distribution placing 83% of people in rural areas, the South Sudan health system provides most of its trauma care at the basic facilities level, as defined by the WHO. The South Sudanese physician gap fits a pattern common to other LMICs; there are an estimated 50 surgeons for every 100,000 people in the US versus 0.5 for every 100,000 in Africa.⁸ Because of the lack of trained physicians, many LMICs, including South Sudan, have instituted a system of non-physician clinicians to bridge the provider gap; this includes community health workers (CHWs) and clinical officers (COs). A recent study showed that over half (25) of the 47 sub-Saharan African countries included in the study incorporated the use of non-physician clinicians, particularly in rural practice.⁹ The health system in South Sudan relies heavily on these allied health workers for health care provision, based on its Basic Package of Health Services (Table 2).

Most CHWs in South Sudan work through “basic facilities” and are on the front lines of caring for trauma patients. However, as observed in other LMICs, many of these allied health care workers have very limited training, particularly within the realm of trauma and emergency care. Studies in other LMICs have showed that the majority of the Emergency Medical Services personnel

providing out-of-hospital care had no formal training, with a resulting high variability in practice between providers.⁸

In 2012 through 2013, two authors (AO and MC) spent nine months educating health staff (CHWs, COs, and nurses) in rural South Sudan on the proper management of trauma victims and mass-casualty incidents through the nongovernmental organization, International Medical Corps (IMC; Los Angeles, California USA). The overall goal of the project was to reduce morbidity and mortality among the conflict-affected population in Akobo County. Jonglei state has a long history of inter-communal violence, particularly between the Luo Nuer and Murle ethnic groups who both have a record of cattle-raiding practices. Based on their pre-test scores, most course participants had minimal functional trauma knowledge. The authors, therefore, undertook this review of the overall South Sudan CHW training curriculum¹⁰ to evaluate the degree to which it incorporates trauma education according to established guidelines from the WHO.

Methods

This study was a descriptive comparison of the most recent trauma care curriculum in South Sudan with the standard curriculum content established by the WHO. A literature search was performed using the Google Scholar (Google Corporation; Mountain View, California USA) and PubMed (National Center for Biotechnology Information at the US National Library of Medicine; Bethesda, Maryland USA) search engines, using the following terms to generate a list of articles on CHWs in South Sudan and other countries: *village health workers training curriculum low income; community health workers training; community health workers training curriculum low income; community-based health care workers; village health workers training programs low income; and community health workers training curriculum third world*. Articles focused on trauma management were identified using the terms: *trauma; South Sudan; injury; developing; global; and low income*. A grey literature search was also performed, including contacts from IMC.

The WHO *Guidelines for Essential Trauma Care* were obtained from the WHO web site and identified services deemed as essential at basic facilities for each different medical goal (Table 1). Mr. J Geno, the Monitoring and Evaluation Officer from IMC-South Sudan, provided the South Sudan CHW training curriculum, which was the standard curriculum in use from 2005 until 2010. One author (AO) then reviewed the curriculum, examining all modules to identify content relevant for the management of trauma patients (specifically looking for those highlighted in the WHO guidelines). All modules were reviewed, including those not directly pertaining to trauma/first aid, as the curriculum covered some concepts in different parts of the training curriculum. For instance, the curriculum covered key concepts in airway management under the “Respiratory System” module, while it discussed elements important in the management of shock in the module on the “Circulatory System.” Any additional recommendations specific to the curriculum, but not included in the guidelines, were also noted.

The authors determined the degree to which the South Sudan curriculum followed WHO guidelines using a point system: one point was assigned where all essential topics were covered, and partial credit was awarded (0.5 points) for concepts covered in limited detail. No credit was given to content covered in the curriculum but not deemed essential by guidelines. This point system was then used to determine the percentage of trauma content

Essential Service	Knowledge/Training Required	Equipment and Supplies
Airway Management	Ability to diagnose and open an obstructed airway (ability to recognize signs of obstruction, how to clear it and keep the airway patent, maintain oxygenation and ventilation; ie, assessment of airway compromise) Manual maneuvers (chin-lift, jaw-thrust, recovery position, etc)	None essential
Breathing	Assessment of respiratory distress and adequacy of ventilation Three-way dressing application	Stethoscope Dressing materials
Circulation	Assessment of shock Compression for control of external bleeding Arterial tourniquet for extreme situations Splinting of fractures for hemorrhage control Recognition of hypothermia in shock External rewarming in hypothermia Training required: Checking a pulse, skin temperature, capillary refill, pressure dressing application and tourniquet application	Stethoscope Blood pressure cuff Dressing materials (gauze/ bandages, preferably sterile) Tourniquet Thermometer Watch or clock with a second hand
Management of Head Injuries	Assessment of neurologic status using the Glasgow Coma Scale Recognition of altered level of consciousness: lateralizing signs, pupillary reflexes/size Preventing hypoxia, hypotension/hypovolemia	Light source
Management of Penetrating Neck Injuries	External pressure for bleeding neck wounds	None essential
Management of Chest Injuries	See Breathing	None
Management of Abdominal Injuries	Clinical assessment of intra-abdominal injury Identification of shock Training required: Physical examination skills	Same as those for Shock
Management of Extremity Injuries	Recognition of major limb injuries and neurovascular compromise, including disability-prone injuries) Basic immobilization skills (with splints/slings) Wrapping of pelvic fractures for hemorrhage control	Splints/slings (including hands) Dressing materials Supplies for pain relief Materials for patient transport Materials for pelvic stabilization and immobilization of femur fractures
Management of Spinal Injuries	Recognition of the presence/risk of spinal injury Monitoring of neurologic function	None
Management of Burns/Wounds	Assessment of the 'ABCs' (airway, breathing, and circulation) Assessment of depth and extent of a burn Assessment of wounds for the potential for disability and mortality (ie, damage to underlying nerves, vessels, and components of the locomotive system: muscles/bones/tendons and soft tissue defects) Wound cleaning/dressing (for uncomplicated wounds)	Dressing materials (clean)
Rehabilitation	Not essential for basic facilities	N/A
Pain Control/ Medications	Recognition of need for these medications	Acetylsalicylic acid, acetaminophen Antiseptics (povidone, chlorohexidine, ethanol)
Diagnosis and Monitoring	Measurement of vital signs	Blood pressure cuff Stethoscope Thermometer Torch/flashlight
Safety for Health Care Personnel	Training in universal precautions	Gloves Goggles Sharps disposal Biological waste disposal

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Table 1. Essential Services for Basic Health Care Facilities (*continued*)

Essential Service	Knowledge/Training Required	Equipment and Supplies
Special Considerations for Children	As above for all categories with special knowledge of pediatric nuances such as: Recognition of the differences in airway anatomy in children Knowledge of different baseline vital signs by age Knowledge of varying physiological responses to blood loss and varying manifestations of shock in children of different ages Knowledge of pediatric doses for fluids, both for baseline requirements and treatment of shock Ability to calculate modified Glasgow coma scale for young children Understanding of specific pediatric orthopedic injuries which are highly prone to disability Knowledge of the varying anatomy of the childhood spine Assessment of percentage body surface area of burn wounds in young children Monitoring of growth and development to assure that the normal milestones are met as closely as possible, despite the injury and any related physical impairment Knowledge of pediatric doses/appropriate references/charts to calculate pediatric doses	Pediatric blood pressure cuff Weighing scale

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Table 1 (continued). Essential Services for Basic Health Care Facilities

Health Care Facility	Catchment Population	Staff	Services Provided
PHCU (Primary Health Care Unit)	15,000	Community Health Workers (CHWs) Maternal-Child Health Workers (MCHWs)	Basic and Preventative Care
PHCC (Primary Health Care Center)	50,000	Clinical Officers (COs) Nurse-Midwives Vaccinators (EPI) Pharmacy technicians Laboratory Technicians Community Nurses Nutritionists	-Limited inpatient capabilities -Selected laboratory services -Basic Emergency Obstetric Care (BEmOC) -Can provide <ul style="list-style-type: none"> ■ Minor surgical procedures ■ Parenteral treatment
County Hospital	300,000	Physicians Community Health Workers (CHWs) Clinical Officers (COs) Nurse-Midwives Vaccinators (EPI) Pharmacy technicians Laboratory Technicians Community Nurses Nutritionists Other allied Health Staff	-Outpatient and inpatient care for complicated medical cases and severe acute malnutrition -Surgical care -Laboratory services -Comprehensive Emergency Obstetric Care (CEmOC) -Extremely complicated cases may be referred to the State or National Hospital level

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Table 2. Health System Structure in South Sudan¹⁹

covered by category and as a whole. Any disagreements regarding this point system were resolved through discussions between two researchers (AO and MC). If they were unable to achieve a consensus, the third author (RD) served as the tiebreaker.

Results

Table 3 provides the comparison between the WHO guidelines and the topics covered in the South Sudan training curriculum. The South Sudan curriculum included 53% of the material deemed essential by WHO trauma guidelines. The major deficiencies were in the management of head and spinal injuries, safety protocols for health care personnel, and in the management of pediatric patients.

The curriculum did cover all the key concepts requisite for the treatment of penetrating neck injuries, chest injuries, proper patient monitoring, and the provision of adequate pain control. About half of the essential content required for the management of

trauma airways, abdominal trauma, and extremity trauma was covered. Table 4 provides a breakdown of the amount of content covered by category.

Additionally, the CHW curriculum advocated for certain interventions that were of unknown standard-of-care based on internationally recognized protocols. Specifically, the use of oral hydration in burn patients, and for those in shock, had limited supporting research and may be controversial in practice.

Discussion

Despite trauma being a significant cause of morbidity and mortality, trauma education for CHWs in the South Sudan training curriculum appears to be inadequate. The curriculum incorporates only about 50% of content deemed essential for basic providers, which indicates that CHWs in the country are likely ill prepared to manage trauma patients appropriately. The curriculum does cover a number of basic concepts, including splinting, hemorrhage

Essential Service	WHO Guidelines	South Sudan Curriculum	Comments
Airway Management			
Ability to diagnose and open an obstructed airway (ability to recognize signs of obstruction, how to clear it and keep the airway patent, maintain oxygenation and ventilation i.e. assessment of airway compromise)	X	X	Identification and management of choking victims covered, including the use of the Heimlich maneuver; mouth-to-mouth resuscitation reserved for advanced learners
Manual maneuvers (chin-lift, jaw-thrust, recovery position, etc)	X	-	
Breathing			
Assessment of respiratory distress and adequacy of ventilation	X	1/2	Recognition of respiratory distress (dyspnea, cyanosis, stridor, apnea) covered Assessment of the adequacy of ventilation not covered
Three-way dressing application	X	X	
Circulation			
Assessment of shock	X	X	Signs and symptoms of shock covered, as well as assessment of vital signs Treatment of shock using the shock position and oral fluid hydration taught
Compression for control of external bleeding	X	X	
Arterial tourniquet for extreme situations	X	X	
Splinting of fractures for hemorrhage control	X	X	
Recognition of hypothermia in shock	X	-	Not explicitly covered, although trainees were expected to know how to take vital signs
External re-warming in hypothermia	X	-	
Management of Head Injuries			
Assessment of neurologic status using Glasgow Coma Scale	X	-	
Recognition of altered level of consciousness: lateralizing signs, pupillary reflexes/size	X	-	Only covered seizures as a sign of head injury
Preventing hypoxia, hypotension/hypovolemia	X	-	Not covered as a means to manage head injured patients
Management of Penetrating Neck Injuries			
External pressure for bleeding neck wounds	X	X	Covered under Management of Burns/Wounds
Management of Chest Injuries			
Three way dressings for sucking chest wounds	X	X	Other topics covered under Breathing
Management of Abdominal Injuries			
Clinical assessment of intra-abdominal injury	X	-	
Identification of shock	X	X	Physical examination skills also included
Management of Extremity Injuries			
Recognition of major limb injuries and neurovascular compromise, including disability-prone injuries	X	-	Recognition of other possible complications of fractures (including shock, pain) covered

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Table 3. Comparison of the Topics Covered Between the WHO Guidelines and the South Sudan CHW Training Curriculum (continued)

Essential Service	WHO Guidelines	South Sudan Curriculum	Comments
Basic immobilization skills (with splints/slings)	X	X	
Wrapping of pelvic fractures for hemorrhage control	X	-	
Fluid administration	-	X	The use of oral fluids covered as treatment for hypovolemia
Pain control	X	X	
Management of Spinal Injuries			
Recognition of the presence/risk of spinal injury	X	-	
Monitoring of neurologic function	X	-	
Management of Burns/Wounds			
ABCs (airway, breathing, and circulation)	X	1/2	
Assessment of depth and extent of a burn	X	-	
Assessment of wounds for the potential for disability and mortality (ie, damage to underlying nerves, vessels, and components of the locomotive system – muscles/bones/tendons and soft tissue defects)	X	-	Symptoms of wound infections covered
Wound cleaning and dressing (for uncomplicated wounds)	X	X	Appropriate dressing application for large burns, treatment of clean and contaminated wounds, wound care and dressing/bandaging covered
Pain control	X	X	
Maintenance of adequate hydration	-	X	Using oral fluids
Rehabilitation – Not Essential for Basic Facilities			
Pain Control/Medications			
Recognition of the indications for certain medications	X	X	Antibiotics for infected wounds, tetanus prophylaxis for contaminated wounds covered
Diagnosis and Monitoring			
Measurement of vital signs	X	X	
Safety for Health Care Personnel			
Training in universal precautions	X	-	
Special Considerations for Children			
See Table 2 for the list of topics pertaining to pediatric trauma care	X	-	Not covered

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Table 3 (continued). Comparison of the Topics Covered Between the WHO Guidelines and the South Sudan CHW Training Curriculum

Abbreviations: CHW, community health worker; WHO, World Health Organization.

control, identification of shock, and wound/burn care. However, it outlines these topics in limited detail. For instance, CHWs learn that seizures are indicative of neurologic injury, but do not learn other critical aspects of head injury management, particularly the use of specific protocols and methods to determine the level of alertness and the severity of injury.

When looking at actual practice, a recent study in Juba, South Sudan showed that the majority of traumatic injuries occurred because of road traffic collisions, with most of the victims

sustaining short or long bone fractures (72%).¹¹ The remaining patients sustained head injuries (12%), pelvic fractures (8%), multiple rib fractures (6%), and spinal fractures (2%).¹¹ Based on this review of their training curriculum, South Sudanese CHWs would be able to adequately manage only those with isolated extremity injuries (72%), but would likely be ill equipped to manage the remaining 28% of patients with other injury patterns. The curriculum clearly lacks training on the management of head trauma (12%), pelvic fractures (8%), and spinal trauma (2%).

Essential Service	Percentage Covered
Airway Management	50%
Breathing	75%
Circulation	67%
Management of Head Injuries	0%
Management of Penetrating Neck Injuries	100%
Management of Chest Injuries	100%
Management of Abdominal Injuries	50%
Management of Extremity Injuries	50%
Management of Spinal Injuries	0%
Management of Burns/Wounds	50%
Rehabilitation	N/A
Pain Control/Medications	100%
Diagnosis and Monitoring	100%
Safety of Health Care Personnel	0%
Special Considerations for Children	0%
Average	53%

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Table 4. Trauma Content Covered by Category

The curriculum coverage of thoracic trauma with multiple rib fractures (6%) is less clear, since these patients can have varied presentations, but appears overlooked, especially for higher acuity presentations.

The curriculum also advocates for the use of oral hydration in burn patients, and for those in shock, which is contraindicated under internationally recognized protocols (eg, Advanced Trauma Life Support) that typically recommend keeping these patients *nil per oris* in case they need operative intervention. Unfortunately, the placement of intravenous lines, which is typical in international and advanced practice, is beyond the CHW scope of practice, and access to timely surgical support is also frequently uncertain. Under such restricted conditions, the authors unfortunately know of no evidence- or consensus-based guidelines to establish best-practice care. Although well-defined guidelines exist for HICs, this and other similar questions have no established answers in low resource settings. Expert consensus guidelines and research on trauma, specifically in LMICs, with an eye toward possible task shifting, would be very helpful to determine the most appropriate methods to manage these patients.

Of greater concern is the apparent disconnect between the classroom and the reality in the clinical setting. Although the CHWs were motivated and hardworking, the authors noted that most of the CHWs they interacted with were unable to transfer the principles outlined in their CHW curriculum to the management of actual patients. One potential reason could be that many South Sudanese CHWs have a lower level of education at baseline than CHWs in other countries. Their limited primary

school education may limit the amount of advanced material they can study and retain. They may also have received poor initial training, which would have laid a poor foundation. Furthermore, evidence has shown that problems in understanding training manuals often lead to difficulties in following protocols; one suggestion is that on-the-job training might help overcome this problem.⁹

One potential way to improve retention and to ensure that trauma education is up-to-date is to require attendance at recertification courses on a set basis, similar to Continuing Medical Education (CME) courses in HICs. Although the authors were unable to find any official policy from South Sudan, various LMICs have implemented CME requirements for CHWs with some success. Examples include the Better and Systematic Team Training program used in Botswana,¹² a trauma continuing education program established in Ghana,¹³ and the Trauma Team Training course used in Uganda.³ Other trauma CME courses are The National Trauma Management Course (NTMC) in India, the Primary Trauma Care (PTC) course used worldwide, and the Essential Surgical Skills (ESS) course in East Africa. Both the NTMC and the PTC course are 2-day courses focusing on initial trauma management, while the ESS course is a week-long course that covers a number of surgical problems, including trauma.¹² The caveat is that many of these courses are geared towards advanced health practitioners (doctors and nurses) with a baseline level of trauma knowledge, and might not be as applicable to those with minimal training.¹⁴⁻¹⁶ They would require significant modification in order to adapt them to this target audience.

Another major obstacle is the cost, which is often significant and possibly prohibitive in a setting such as South Sudan. As such, in places where CHWs provide the bulk of direct patient care, it might be more beneficial and cost-effective to incorporate the essential topics into initial CHW training programs, so they receive exposure to the key material from the onset. One successful training program specifically geared towards village health workers was implemented in Cambodia/Northern Iraq.¹⁷ Participants were trained in first-responder care over a 3-year period, with the core group of 44 trainees going on to educate 2,800 layman village health responders. A total of 813 patients were managed through this system over the course of three years, with the mortality rate for trauma victims decreasing from 22.6% to 13.7%.¹⁷

The availability of necessary resources on a routine basis is as important as comprehensive trauma education. This is often lacking in South Sudan, as well as in many similar LMICs. Not only do the resources need to be available, but they should also be accessible in a timely manner. Studies performed in similar LMICs reinforce the importance of physical infrastructure. One frequent finding is that although some clinics have adequate resources, they are frequently unavailable when necessary.¹⁸ In addition to resource allocation, proper administration, monitoring, and evaluation are other key facets of a robust trauma and emergency care system.

These findings have important policy implications for the government of South Sudan and those of other LMICs with similar CHW training programs. National governments have a critical role to play in the implementation of training programs and the development of health policies that recognize the importance of trauma care. The World Health Assembly Resolution 60.22 highlights the need "to ensure that appropriate core competencies are part of relevant health curricula and to promote continuing education for providers of trauma and emergency care."⁶ Only through such efforts

can society “ensure that a core set of trauma and emergency care services are accessible to all people who need them.”⁶

Limitations

The South Sudan CHW curriculum reviewed was in use from 2005 until 2010 (with a few trainees completing the course in early 2011, as they were enrolled before the release of the circular ending the program). Since then, there has been no uniform training curriculum in use. While many recent graduates from CHW programs have continued to use this curriculum, others may have received other training. This could explain some of the differences in practice patterns noted in the field.

In addition, South Sudan is a new country and its training programs may lag behind those in countries like India, Bangladesh,

and Nepal, where CHW training programs have been in existence for years. Therefore, the findings here are not necessarily generalizable to other contexts.

Conclusion

The authors found that the most recent national South Sudan CHW training curriculum lacked the requisite content to provide adequately a basic level of trauma care. As such, it requires review and improvement before reinstatement in order to ensure that all of South Sudan’s citizens receive proper trauma and emergency care. Other LMICs may also wish to review their trauma training curricula to ensure they are meeting WHO guidelines and providing optimal care to their populace.

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