

## CASE REPORT

## Major incident simulation in Rwanda: A report of two exercises

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## ABSTRACT

**Introduction:** Healthcare systems must be equipped to handle major incidents. Few have been described in the African setting, including in Rwanda. The purpose of this case report was to describe and discuss two major incident simulations in Rwanda with different challenges.

**Case report:** We report two recent major incident exercises conducted in Rwanda, in 2017. The exercises exemplify two different types of multiple casualty incidents requiring the deployment of extra-ordinary resources, one due to the location of the incident (off-shore), and the other due to the large volume of casualties. Both exercises required extensive multi-agency planning and training beforehand, as part of an increasing awareness of the need for preparedness for these types of incidents.

**Conclusion:** The exercises demonstrated the need for a standardised, physiological method of triage based on clinical needs; this is in order to maximise the number of lives saved. Triage training should be an integral part of further major incident exercises, which should be conducted regularly.

## African relevance

- These are the first published descriptions of major incident exercises in Rwanda.
- Successful management of major incidents is of growing importance in Africa.
- Major incident response needs to be appropriate to an African context.
- A description and discussion of our experience may encourage further local research into the local management of major incidents.

## Introduction

For healthcare responders, a “major incident” is any incident where the location, number, severity or type of casualties require extra-ordinary resources [1]. Examples include events sometimes that can also be described as disasters, mass casualty incidents, or multiple casualty incidents.

Several types of major incident have been reported in Rwanda, including fire, traffic accidents, lightning strikes, floods, earthquakes, and landslides [2]. Service d'Aide Medicale Urgente (SAMU), Rwanda's Emergency Medical Service (EMS), has been at the forefront of medical major incident management, often working in conjunction with military medical services and the Rwanda Red Cross (RRC) [3].

Healthcare systems need to be thoroughly prepared for all hazards in order to respond appropriately to a major incident; this response must be in collaboration with other emergency services [1,4]. Studies have shown that morbidity and mortality are reduced by appropriate training in hospital and prehospital management of major incidents [5]. Training and practice exercises are essential for equipping first responders to handle the challenges associated with major incidents [6].

One key aspect of successful management of a major incident is triage, the sorting of casualties according to priority for treatment and evacuation. Rwanda uses the standard colour-coded categories for triage: red (category one, for immediate treatment), yellow (category two, for urgent treatment) and green (category three, for delayed treatment) [1].

This paper describes two major incident exercises that took place in Rwanda in 2017. The incidents are summarised in Table 1, according to the METHANE mnemonic used in the Major Incident Medical Management and Support (MIMMS) course [1]. METHANE is a standardised method to assess and report major incidents: “Major incident”, “Exact location”, “Type of incident”, “Hazards”, “Access/egress”, “Number of casualties”, and “Emergency services” (Table 1). Both major incident exercises simulated multiple casualty incidents that required the mobilization of extra-ordinary resources: the Karongi exercise was located off-shore and the Kanobe exercise had a large volume of casualties.

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**Table 1**

The METHANE summary of major incident exercises.

Major incident	Karongi exercise	Kanombe exercise
Exact location	Lake Kivu, 1 km off-shore from Karongi (125 km from Kigali hospitals)	Kigali international Airport (less than 10 km from Kigali hospitals)
Type of incident	Boat capsized	Plane crash
Hazards	Water	Explosion, fire, debris
Access/egress	Boat from Red Cross base in Karongi (1 km), SAMU boat ambulance from military marine base (10 km); then land ambulance from those bases to hospitals	Airport road, helicopter
Number of casualties	12 (2 red, 4 yellow, 6 uninjured)	162 (10 red, 27 yellow, 67 green, 38 uninjured, 20 dead)
Emergency services	Military marine, Red Cross boat, SAMU boat ambulance, SAMU land ambulance	Fire, police, ambulance, military, hospital response teams

## Case report

The first major incident exercise, referred to as the Karongi Exercise, was conducted in the Karongi district in the Western Province of Rwanda. The aim of the exercise was to assess preparedness of pre-hospital services, Kibuye District Hospital (KDH), and Centre Hospitalier Universitaire de Kigali (CHUK), the major referral and teaching hospital in the country. The exercise was conducted as the culmination of a one week training for prehospital staff in the region. Hospital administrators, but not clinical staff, were given advance notice of the exercise.

The incident involved the simulated capsizing of a wooden transport boat, with twelve actors taking the role of casualties. The major incident was activated by calling the national emergency dispatch number. This mobilised SAMU, RRC and the military marine and put KDH and CHUK on standby. The RRC dinghy, based one kilometre away from the scene, was a small rescue boat that could accommodate three personnel members and three casualties. Triage started with RRC personnel observing casualties in the water. Able swimmers were considered green or uninjured casualties or category three. Those in the yellow classification, or category two, waited in the water until SAMU boat ambulances could arrive. Those classified as “red”, or category one, included one polytrauma and one peri-arrest; they were retrieved into the dinghy in addition to one yellow casualty who was unable to hold onto the side of the dinghy.

**Table 2**

The Karongi exercise timeline.

Time	Event
1100	Boat capsized with 12 people overboard
1101	Emergency services notified
1104	SAMU boat ambulance and RRC dinghy mobilised, Karongi District Hospital (KDH) and Centre Hospitalier Universitaire de Kigali (CHUK) put on standby
1110	RRC dinghy on scene
1119	SAMU boat Ambulance on scene
1127	SAMU boat ambulance departs scene with 2 red casualties RRC dinghy remains with 4 yellow casualties
1142	SAMU boat ambulance arrives base, transfers casualties to 2 SAMU land ambulances
1145	SAMU boat ambulance leaves base to return to scene
1150	SAMU land ambulances depart for Karongi District Hospital (KDH)
1155	SAMU land ambulances arrive KDH
1200	SAMU boat ambulance on scene
1205	SAMU boat ambulance departs scene with 4 yellow casualties RRC retrieves remaining 6 uninjured survivors, departs scene for RRC base
1220	SAMU boat ambulance arrives base, transfers casualties to military minibus
1222	RRC dinghy arrives base, unloads survivors
1230	Minibus leaves marine base
1235	Uninjured survivors assessed and discharged
1240	Minibus arrives KDH
1300	Stand down

The SAMU boat ambulances arrived from ten kilometres from the site of the accident. The SAMU boat crew comprised of four military marine and four SAMU personnel, and could carry three stretchers or four seated patients. Cardiac arrest was simulated for one red patient in the boat, and cardio-pulmonary resuscitation was performed en route, using a resuscitation mannequin.

Although SAMU had notified the hospitals of a major incident prior to arrival of casualties, there was variation among the hospitals in disseminating this information to relevant staff members. At CHUK, WhatsApp™ was used to inform the emergency centre group; this included lead nurses and all emergency medicine residents and faculty. At KDH, there was no similar system, leading to significant delays in notifying staff. In fact, at KDH, porters were the first to recognise incoming casualties and had to seek medical staff for assistance. The exercise lasted from 1100 to 1300 (Table 2).

The second major incident exercise, referred to as the Kanombe Exercise, was conducted at Kigali International Airport, following two months of preparation and training. The aims were to raise awareness, develop training and prepare for an all-service response to a mass casualty incident at the airport, and to assess the preparedness of the local hospital response. The exercise involved airport fire-fighters, police and military staff, five SAMU and five RRC ambulances staffed with 30 members, and four medical teams from Kigali hospitals with five doctors and twelve nurses. All responders were at the airport when the exercise began. The three referral hospitals in Kigali, CHUK, Rwanda Military Hospital (RMH), and King Faisal Hospital (KFH), were on standby to receive large numbers of casualties. These facilities were not notified it was an exercise.

The exercise simulated an aeroplane crash, with 162 actors playing the roles of passengers and crew. Police established inner and outer cordons to demarcate ‘bronze’ and ‘silver’ areas of control. Patients were triaged by the medical teams using standard colour-coded categories and labels. Casualty-actors were briefed on their injuries and

**Table 3**

The Kanombe exercise timeline.

Time	Event
0840	Aeroplane crash on runway & control tower declares major incident
0843	Fire service on scene
0845	Police and pre-hospital teams on scene
0850	Triaging of casualties
0900	Helicopter makes first trip to King Faisal Hospital (KFH)
0903	SAMU ambulances depart for Centre Hospitalier Universitaire de Kigali (CHUK)
0905	SAMU ambulances depart for Rwanda Military Hospital (RMH)
0910	RRC ambulances depart for other hospitals, 10 further ambulances deployed by RRC and SAMU
1030	Last casualties arrive at hospital
1045	Stand down

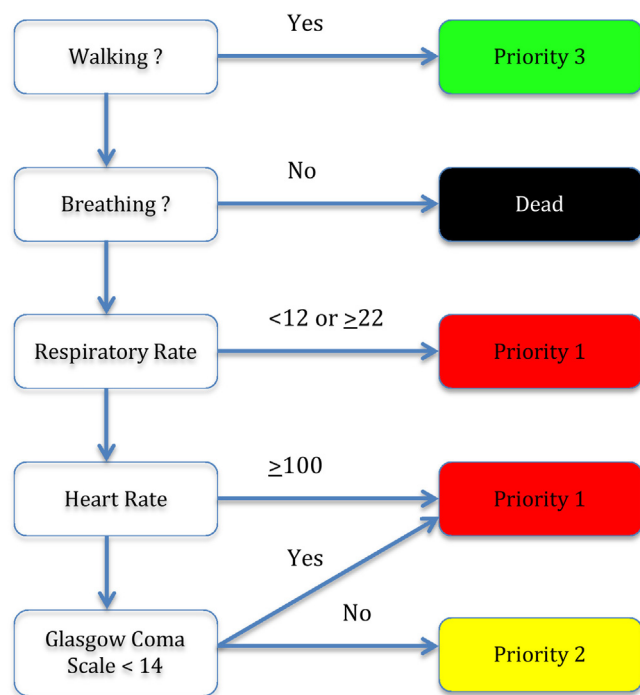


Fig. 1. Modified Physiological Triage Tool.

abilities. There were 38 uninjured casualties and a total of 67 walking injured casualties triaged as green or category three. Ten non-walkers with obvious serious injuries or who didn't respond to voice, were triaged as red or category one, 20 were declared dead, and the other 27 triaged as yellow. The casualty clearing station (CCS) was made of separate red, yellow and green areas. There was also a temporary mortuary set up in the airport.

Evacuation of casualties were either by military helicopter to KFH or by one of ten ambulances to CHUK and RMH. The helicopter took a total of eight red and yellow, and 12 green casualties. CHUK received 15 red and yellow patients, and RMH received 14. RRC evacuated the remaining green casualties and transported them among the three hospitals. Each ambulance could accommodate one stretcher and one seated patient. SAMU and RRC mobilised ten additional ambulances during the response. On arrival at local hospitals, receiving staff were initially unaware that the situation was an exercise. Providers at receiving facilities became aware when previously unstable casualties from the field had improved vital signs and when casualties arrived with simulated wounds. The exercise concluded after the last casualties arrived at hospital. This exercise lasted from 0840 to 1045 (Table 3).

## Discussion

The introduction of emergency medicine in African countries has led to improved morbidity and mortality outcomes, though most African countries continue to lag behind their Western counterparts [8]. One aspect of providing optimal emergency care requires readiness for major medical incidents; this can be achieved by holding exercises [6,7]. In Rwanda specifically, the introduction of emergency medicine in facilitated more opportunities for better training in systems-wide approach to emergencies and major incidents [9].

This report describes two mass casualty exercises that were conducted with a focus on training and on evaluating emergency centres, prehospital staff, and other emergency services. The two exercises were very different types of exercises, demonstrating different challenges

faced in multiple-casualty incidents, including a difficult location and a large volume of casualties. Both demonstrated effective responses to these logistical challenges.

The exercises were carefully planned and involved training of key staff beforehand. This is essential to the success of multi-agency exercises. Crucial "management" priorities, such as command and control, safety, communications and assessment, are often challenging without prior training. These management priorities are also necessary for the "medical" priorities of casualties, such as triage, treatment and transport. These priorities together, management and medical, form the 'CSCATTT' mnemonic, a key concept from the MIMMS course [1].

Furthermore, it is important for different agencies to practice communication and coordination in a controlled and simulated environment before facing a real-life situation. Both exercises demonstrated good team work between pre-hospital and hospital staff, healthcare providers and police, and civilian and military personnel. Fortunately, these exercises showed good working relationships among these groups, which is not true for all contexts. It also demonstrated the need for better systems of communication and triage, for example, at KDH, which has since been addressed.

Perhaps the most important lesson learned regards triage. Although triage was part of the pre-training package in both exercises, the process of triage during the exercises was based on the quick visual assessment of the person, rather than a structured physiological tool such as triage sieve or Simple Triage and Rapid Treatment (START) [1,10]. Moreover, since casualties were artificially given pre-designated triage categories according to their simulated injuries, triage by visual assessment was not ideal for the actual process of triage. Initial triage at the scene needs to be simple, quick, reproducible and reliable; it needs to identify which casualties need life-saving interventions. Different tools have been used in different countries, but recent evidence suggests that the Modified Physiological Triage Tool (MPTT) (Fig. 1) performs best in both military and civilian settings [11,12].

Mass casualty events can overwhelm healthcare systems. We have described two major incident simulation exercises conducted in Rwanda. To our knowledge, there has been no published description of such exercises in Rwanda before. Simulations and exercises are a major part in training and evaluation of staff and systems both in the pre-hospital and hospital settings. Although such exercises are expensive to conduct, they should be run regularly to be better prepared. We strongly recommend the adoption of evidence-based, physiological methods of triage based on clinical need, with the goal of saving the most lives.

## Conflicts of interest

The authors declare no conflicts of interest.

## Dissemination of results

These exercises have been reported locally in EM training conferences, and in EMS/military debriefing sessions.

## Authors' contributions

GM and EN conceived the original idea, and were instrumental in the planning and execution of the exercises described, wrote reflective notes of those exercises. NP-R supervised GM and EN, and contributed to the editing of the manuscript. GC wrote the manuscript. All authors were involved in revisions of the manuscript, and approved the final version.

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