

A Redundant Resource: A Pre-Planned Casualty Clearing Station for a FIFA 2010 Stadium in Durban

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Conflicts of interest: The authors have no disclosures or conflicts of interest to report.

Keywords: Federation Internationale de Football Association; FIFA; mass gathering medicine; patient presentation rate; triage; World Cup

Abbreviations:

ALS: Advanced Life Support
CBRNE: chemical biological radio-nuclear explosive
CCS: casualty clearing station
FIFA: Federation International de Football Association
NMR: National Mounted Rifles
PPR: patient presentation rate
PROVJOC: Provincial Joint Operations Centre
SAMHS: South African Military Health Services

Received: September 15, 2010

Accepted: September 13, 2011

Revised: February 10, 2011

Online publication: May 17, 2012

doi:10.1017/S1049023X12000453

Abstract

This report details the background, planning, and establishment of a mass-casualty management area for the Durban Moses Mabhida Stadium at the Natal Mounted Rifles base, by the Department of Health and the eThekweni Fire and Rescue Service, for the Fédération Internationale de Football Association (FIFA) 2010 Soccer World Cup. The report discusses the use of the site during the seven matches played at that stadium, and details the aspects of mass-gathering major incident site planning for football (soccer).

The area also was used as a treatment area for other single patient incidents outside of the stadium, but within the exclusion perimeter, and the 22 patients treated by the Casualty Clearing Station (CCS) team are described and briefly discussed. A site-specific patient presentation rate of 0.48 per 10,000 and transport-to-hospital rate (TTHR) of 0.09/10,000 are reported. Lessons learned and implications for future event planning are discussed in the light of the existing literature.

Hardcastle TC, Samlal S, Naidoo R, Hendrikse S, Gloster A, Ramlal M, Ngema S, Rowe M. A redundant resource: a pre-planned casualty clearing station for a FIFA 2010 stadium in Durban. *Prehosp Disaster Med.* 2012;27(5):409-415.

Introduction

Soccer is called the “beautiful game;” however, there have been more major incidents at soccer matches over the past few decades than at many other sports events. Fires (Bradford City)¹ and crowd surges with multiple crush injuries, have occurred in South Africa (Orkney 1991, Ellis Park 2001) and other parts of Africa (Ghana).^{2,3} With large international tournaments, there are other aspects to consider when planning for the medical response, such as the risk of contaminated food from vendors at matches causing mass food poisoning outbreaks. The latter, fortunately, did not occur at the events under discussion, but was one of the major concerns, with large numbers of people and a limited number of food vendors utilizing newly-employed, temporary staff.

Southern Africa previously has hosted numerous mass-gathering events, including the visit of the Pope to Lesotho in 1988,⁴ and major sports events such as the Rugby (1995) and Cricket (2003) World Cup tournaments. However, none of these were of the scale of the Fédération Internationale de Football Association (FIFA) Soccer World Cup 2010. The planning process for this event was initiated in 2007 at the request of the Health Department.⁵

The tournament involved 10 stadia with, on average, three matches per day during the group match phase, and a round of 16 quarter-finals, semi-finals, a play-off, and the final. Durban’s new Moses Mabhida Stadium hosted five games in the group phase, one round-of-16 matches, and one of the semi-final encounters (Table 1).

The Moses Mabhida Stadium is one of the completely new stadia built specifically for the Soccer World Cup, with a seating capacity of >63,000 people, excluding staff, and vendors. Its total capacity is nearer 70,000. Access and egress routes were planned to allow for a complete evacuation of the stadium within 12-15 minutes.

Integral to the planning for this stadium was medical and other emergency support services within the stadium complex. However, its capacity did not allow for the stockpiling of mass-casualty resources at the stadium. With this in mind, the decision was

Match No.	Time	Date	Team 1	Team 2
1	8:30 PM	June 13, 2010	Germany ^a	Australia
2	4 PM	June 16, 2010	Spain	Switzerland ^a
3	1:30 PM	June 19, 2010	Netherlands ^a	Japan
4	8:30 PM	June 22, 2010	Nigeria ^a	Korea Republic
5	4 PM	June 25, 2010	Portugal	Brazil
6 – Round of 16	4 PM	June 28, 2010	Netherlands ^a	Slovakia
7 – Semi Final	8:30 PM	July 7, 2010	Spain ^a	Germany

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Table 1. World Cup matches at Moses Mabhida Stadium^adenotes winning team (Portugal/Brazil draw).

made to provide a pre-sited, dedicated, mass-casualty area (Casualty Clearing Station, or CCS) at a suitable venue nearby, with rapid access from the stadium. The CCS is a specific requirement that forms an integral part of the plan for the stadium disaster management. The CCS is required to have the capacity to triage, treat, and transport at least two percent of the stadium capacity in case of a mass-casualty event. The CCS also must provide a practical patient flow from the stadium, which includes a triage and treatment area, ambulance loading area, and a temporary morgue. This resource also had to have the capacity to manage chemical, biological, radio-nuclear, or explosive (CBRNE) incidents.

Methods for Estimating Size and Resources

Much has been written about the need to provide medical capacity at mass gatherings, and numerous formulae for the estimation of medical capacity are available.^{6–8} However, there was very limited guidance, either from FIFA or from the published literature regarding the staffing of surge-capacity or major incident management areas, for this specific type of event. The Emergency Medicine Society of South Africa provides guidelines⁹ based on a national standards document (SANS 10366); these guidelines were used to estimate the ideal staffing requirements and level of care provision for stadia involved in the World Cup event. This national standards document was issued by the National Department of Health, together with the FIFA Local Organizing Committee, through a Health Technical Task Team (HTTT), as the national standard for medical requirements for mass gatherings.

Based on these national documents, the minimum staffing requirements were determined as follows (Health Professions Council of South Africa Scope of Practice): two doctors, one ICU-Trauma Nurse, three Advanced Life Support (ALS) Paramedics, three Intermediate Life Support (ILS), and 24 Basic Life Support (BLS) Paramedics, plus a full crew for a minimum of three ambulances.

In consideration of the potential for a mass-casualty situation to require patient care for an average of two percent of stadium capacity¹⁰ (1400 for the Durban stadium), the plan was adjusted to include a fixed CCS capable of managing approximately 200 patients at any given time. The latter called for a staffing of five to seven doctors, five ALS paramedics, and approximately 70 other prehospital providers, including first-aid responders from the voluntary aid services, and crew for the designated ambulances. This CCS area was supplemental to the in-stadium emergency

medical services. The staff determination was an empiric estimation of the numbers and severity of expected casualties, roughly based on the extrapolation of patient load from previous major incidents at soccer stadiums and other mass-gathering events.

The Process

The Natal Mounted Rifles (NMR), an established reserve military unit, is based at the site chosen for the CCS, which was the original Durban Airport terminal used during the post-World War II era. This site was selected based on safety and security (protected military base), proximity (<500 meters from the stadium, with a large stadium access gate nearby), and size (large enough open areas to stage vehicles and resources).

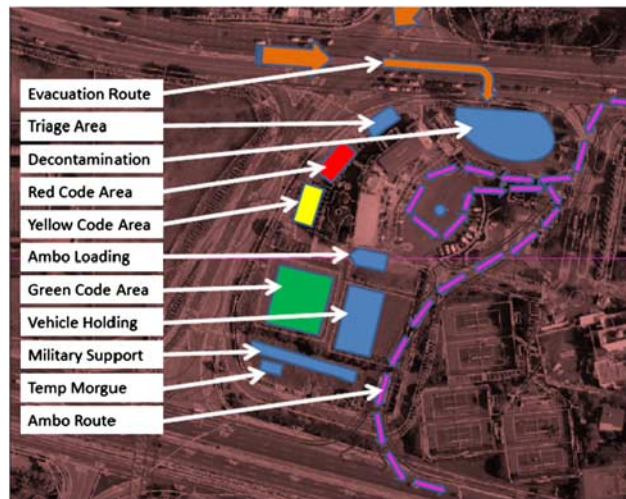
Meetings were convened over a period of approximately two years, during which stakeholders were engaged, and concerns allayed regarding the utilization of the site. The concerns arose mainly from the management of the site lessee and sub-lessee (Board of the NMR and the Durban Country Club) that the use of the site would be costly to the lessee, with no apparent gain. These fears were allayed by written guarantees that all ground-work, construction, or upgrades on the site would be performed at the cost of the eThekweni Municipality or the Defence Force/Government. The other concern regarding the payment for the additional use of water and sanitation during the period of the games was allayed by providing a separate additional water source and a serviced sewage point for the duration of the event, to avoid using the existing facilities on the base.

Plans were consolidated between the fire and ambulance/health services regarding equipment, power requirements, water sources, and site layout. This included installing a temporary electrical substation and back-up generator system.

The plans were submitted to National Health and Police Service officials for approval. The South African Military Health Service (SAMHS) was engaged, and tasked with providing personnel and equipment support to the CCS team. Each service also would provide communications and technical support personnel, as required, for their operations.

Components and Facilities

The general layout of the CCS is shown in Figure 1 (color figure with explanatory overlay online). With the ever-present threat of terrorist activity, the eThekweni Fire and Rescue service provided a tented decontamination area for the wash down of any contaminated casualty in the event of CBRNE activation



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Figure 1. (Color online) Site plan of the Casualty Clearing Station (Moses Mabhida Stadium at top left)



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Figure 2. Fire Service CBRNE decontamination tent

(Figure 2). This constituted one chemical unit trailer appliance and one fire tender. In the event of non-CBRNE activation, the fire service personnel would assist the ambulance and health service staff, all of whom were trained at least to the level of Basic Ambulance Attendant. Additionally, the City Health Department provided a mobile weather station and air monitoring unit to assist in case of a toxic cloud event (Figure 3).

The medical component consisted of an area of tents, with approximately 15 meters between tents: one tent for triage (Sieve method^{11,12}), and a larger inflatable tented area (double tent) for Priority One cases (Red Codes), equipped for airway management, ventilation, resuscitation, cardiac monitoring, and surgical intervention (Figure 4).

Next to this was an inflatable tented area (triple tent) for Priority Two stretcher cases (Yellow Codes), equipped for fracture and wound care, and a large military tent with seats for Priority Three walking wounded, equipped for basic wound care (Green Codes). Finally, a similar large military tent for use as a temporary body-holding area was placed out of public view, at the rear of the



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Figure 3. Air safety monitoring unit



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Figure 4. The inflatable treatment tent (Red Zone)

site. Equipment and drugs included those required for the care of traumatic and medical ailments, and certain minor complaints.

The Military provided additional resources through two arms. The NMR regiment provided site security and logistical support, while the SAMHS provided additional paramedical and medical staff. The NMR provided a room within its headquarters for use as the CCS-Forward Command Post.

Roles and Responsibilities

Command and Control

The CCS site was considered to be a Stadium Resource and, as such, reported to the stadium Venue Operations Centre (VOC),

and henceforth, to the Provincial Joint Operations Centre (ProvJOC).

The overall command of the site was delegated to the Health Service with shared control of the site with Fire Service and Military. The Forward Command Post was staffed with a Communications Officer from each service, with the service commanders in attendance.

On each match day, the services were on-site four hours prior to the featured match time, and remained on-site until two hours post-match. As part of the ongoing service to spectators, four of the ambulances were positioned around the outer perimeter of the stadium (outside the stadium entrances, but within the no-drive exclusion zone), and the two rapid response units (staffed with a doctor and an ALS paramedic) roved the perimeter, to provide rapid access to emergency care if required. Two "foot-patrols" comprised of four Basic Ambulance Attendants each, equipped with a basic medical kit, portable oxygen, and a stair chair stretcher, roved the walkways around the perimeter.

Safety

Site security was provided by the NMR platoon; the Fire and Rescue Service Officer served as the Site Safety Officer in discussion with the Site Commander.

Communications

Each service provided a base-station radio for its staff to communicate with the VOC and with the vehicles and staff positioned around the site. The METHANE system^{11,12} of message distribution was to be used in case of major incident activation. The name, nationality, and severity of pathology for each patient treated were recorded in an Occurrence Book by the Communications Officer.

Triage and Treatment

South Africa has adopted and modified the Major Incident Medical Management and Support system (MIMMS)¹¹ developed by the British for the North Atlantic Treaty Organization forces, which uses the "Sieve and Sort" triage system.^{11,12} This system allows for rapid, repeatable triage with treatment limited to that necessary to allow safe transfer to definitive care facilities. All site staff had been trained in an abbreviated version of the course to facilitate smooth patient flow.

Transport Planning

At the vehicle staging area, 10 ambulances, a mass-casualty eight-stretcher "disaster bus," a 45-seater "green-code" bus, and two rapid response vehicles (equipped to ALS status) were held in reserve for any mass-casualty activation. The ambulances and response vehicles (ALS and doctor teams) were deployed within the perimeter before and after matches as early access opportunities for single patient incidents outside the stadium.

Problems

As with all first-time events, there were a number of minor problems on the first evening. The lighting was found to be inadequate, and certain items of new equipment were found to be incompatible with existing devices. These problems were remedied by the second match, and the system ran smoothly for the other matches.

Some additional medications for certain minor ailments also were required during the first two matches; these were acquired

via the SAMHS pharmacy, thus ensuring an ability to assess, treat, and discharge patients with minor ailments. These included anti-emetic tablets, anti-diarrhea medication, and non-steroidal oral or suppository medications, which are not usually within the prehospital scope of practice, and therefore not carried by ambulance crews. The initial planning from the ambulance services dictated that medications were to be those of the prehospital scope of practice only, as the CCS site originally was intended to serve only as a major incident treatment and holding area. The function was adjusted to include out-of-stadium single patients as a late additional service when the size of the no-drive perimeter was determined.

Staff Deployment

On average, the actual staff deployment per match, excluding command and technical staff, was: six doctors (range 4-8); five ALS paramedics (range 4-6); 22 ILS paramedics (range 16-25), and 52 BLS paramedics (range 52-54) to staff the vehicles and the treatment areas. This exceeds the mass-gathering norms for South Africa,⁹ but was based on the expected need in the case of a major incident, rather than primarily on the mass-gathering aspect of the medical preparation. It is emphasized that these were *additional* staff, over and above the predetermined mass-gathering medical staff for the stadium itself.

Patient Care

The CCS area was utilized on an ongoing basis for the treatment of "single incident" patients within the no-drive exclusion zone around the stadium perimeter. The spectrum of pathology and management of these non-mass-casualty cases are detailed in Table 2. In total, 22 patients were treated by the CCS team, either at the CCS or at the points of CCS ambulance deployment. There were 14 male patients (63%), and the average age of the patients treated was 29.4 years (range 6-77 years). Additionally, there were three calls that were attended in which services were refused, or no patient was found. Four of the patients (18%) were foreign visitors to South Africa.

In keeping with literature reports, the majority of incidents involved injuries of minor or moderate severity, and patients could be treated and released without the need for transport to hospital.¹³ Most of the minor incidents related to musculoskeletal and inflammatory problems, and were spread across the age spectrum. None of the three cases of suspected food poisoning were related to each other, nor were they related to food or beverages consumed at the event, which is important in light of the fear of mass food poisoning.

The three injuries were from a motor vehicle collision that occurred outside the stadium perimeter. These patients were transported because the CCS ambulance was the closest vehicle to that incident, and the victims were in need of hospital assessment. The patients were neither spectators, nor stadium workers.

It is interesting to note the episodes of angina in the older members of the spectator population, and the three asthma attacks, as the distances to the stadium from parking points and bus-drop zones were considerably further than is the norm with local sports events. This may have led people who were at risk to attempt more than they could manage in terms of exercise, and may have contributed to episodes of angina and asthma attacks. This may have been compounded by the nocturnal air temperature, as most of the Durban matches occurred in late

Number (years of age)	Complaint	Severity	Management
2 Adults (65/74)	Acute angina, without hemodynamic instability	Moderate	Glycerol trinitrate spray
			ECG
			Vital signs assessed
			Discharged
3 Adults (24-77)	Asthmatic attack	Moderate	Nebulized beta stimulants—all recovered and refused transport
1 Adult (38)	Allergic Reaction	Minor	Antihistamine and steroid administration and release
1 Child (14)	Acute food poisoning	Moderate	IV ^a rehydration and metoclopramide administration
2 Adults (35/40)	Gastro-enteritis/food poisoning	Minor	Symptomatic treatment, prescription given on discharge
1 Adult (37)	Acute alcohol intoxication	Moderate	IV rehydration and release
2 Adults (35/49)	Acute gout	Minor	Anti-inflammatory medication administration
2 Adults (15/40)	Ankle sprain	Minor	Analgesia and strapping of ankle
1 Adult (29)	Pain due to bilateral inflammatory breast engorgement	Minor	Analgesic (non-steroidal) provided and advised on further management at home
3 Adults (26-42)	Minor motor vehicle collision	Minor	Transported to hospital—incident outside exclusion zone
1 Adult (67)	Fall—ground level	Minor	Cleaned and dressed wounds
1 Child (6)	Laceration on foot	Minor	Applied dressing—refused transport
1 Adult (31)	Advanced pregnancy—tired from extended walking	Minor	Assisted transport to vehicle
1 Adult (25)	Invalid (post-op knee ligaments)—shuttle bus did not arrive	Minor	Transportation home provided

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Table 2. Patient care summary^aintravenous

afternoon or evening with sunset around 5:45 PM. Fortunately, all of these patients recovered well with rapid intervention, and could proceed to the event or their place of residence, depending on the time of the incident.

An average of three patients were treated per match with, on average, 60,000 plus persons in attendance and approximately 5000 staff working around the stadium. This equates to a patient presentation rate (PPR) of 0.48/10,000 over the total of the seven games in Durban, where a total of over 455,000 people passed through the stadium. This does not include those patients treated inside the stadium itself.

An interesting observation was the low rate of ambulance transfers to hospital. This likely was related to the presence of the medical doctors on the team who had the capacity to treat and discharge patients if they were deemed adequately recovered and stable for discharge. This is noteworthy, as the South African EMS protocols currently do not allow paramedics to undertake such discharge decisions; this would have led to a much higher transport rate if the doctors were not on-site. The transport-to-hospital rate (TTHR) was only 0.09/10,000, or 13.6% of all the patients treated at the CCS site.

Discussion

The role of the Department of Health in the provision of services was guided by the government's guarantees to FIFA. The Minister of Health committed to FIFA that the infrastructure of the South African National Health System, specifically, a comprehensive medical service (including 24-hour emergency medical treatment) and disaster management would be put at the disposal of the 2010 FIFA World Cup in the cities where the games would be played.

However, it must be stated that, in as much as FIFA had specific requirements of what medical services were required and where, there were no FIFA-specific guidelines and standards to determine an acceptable level of preparedness, or to justify the resource allocation for rendering the medical services at the CCS. The absence of FIFA guidelines can result in discrepancies and inconsistencies in how services are rendered at these events. In particular, the mass-casualty areas, or CCSs, were redundant, despite being absolutely essential, due to the absence of any major incidents, medical or traumatic, during the FIFA events. This most likely was due to the heightened security service presence during the event. Other redundant medical staffs were the on-field doctors, who were superseded at all times by the Team Doctors, and thus were not utilized.

Much has been written regarding mass-gathering medicine, and there are a number of methods to determine staffing and equipment norms for such events,⁶⁻⁹ including an extensive literature review,⁶ and a call for more scientific approaches to the reporting of such events.⁷

However, there is a limited English literature base related to major soccer events, specifically from the perspective of the spectator and mass-casualty planning aspect. Most of the literature in this regard relates to specific stadium incidents^{1-3,14} and single center use reviews,¹⁵⁻¹⁷ with a focus on personnel deployment,^{18,19} or descriptions of a host city plan, without patient care details.¹⁴ In preparation for the current events under review, a collaborative literature overview also was undertaken,¹⁰ with most of the aspects highlighted in that review implemented in the planning for this CCS site, including the environmental health and safety involvement with air monitoring. Additional aspects, which were highlighted in a recent review,²⁰ including the newer concepts of surge capacity, were incorporated into the site plan along with a unified command structure. The command structure was unique, as it combined "city," provincial, and national services under one Commander.

Many of the more comprehensive reports in the peer-reviewed literature relate to other sporting codes or the various Summer or Winter Olympic Games, where the climate, atmosphere, and spectator profile are very different from the FIFA Soccer World Cup.²¹⁻²⁵ Additionally, none of the papers identified addressed the specific issue of major incident preparedness as the main focus. This makes comparison to existing publications difficult, particularly as there are no comprehensive equipment and staffing standards for planned mass-casualty deployment for sports events. Existing standards are for the routine provision of event medical care.

While it is difficult to compare the current experience of this CCS site, in isolation, to the existing literature, some comparisons can be drawn. The PPR of 0.48/10,000 is in keeping with the existing literature, in which rates between 0.42 and 30/10,000 are recorded.^{15-17,21-25} However, when the English soccer literature is reviewed in isolation, rates average 0.42-3.1/10,000, which is even closer to the rates seen at the local CCS site.¹⁵⁻¹⁷ To place this in context, it is important to remember that this CCS site was not designed primarily for single patients, as there were other medical services in the stadium restricted area. However, it does emphasize the need for effective planning for out-of-stadium medical incidents when there is a long distance from public access points to the stadium. This may be relevant in planning for surge capacity for other events, such as Olympic games, where similar security cordons may be activated subsequent to the September 11, 2001 attacks in the United States.

The number of patients transported to hospital (13.6% of those treated at the CCS) was low, largely due to the presence of doctors on-site, who were able to treat and discharge patients who became stable after intervention.^{13,18,19} This compares favorably with the overall published patient transportation rates of 4%-20%, with rates of 9%-20% for the English Football League literature.¹⁵⁻¹⁷

The average age of the patients treated by the CCS (29 vs. 34 years) and the gender mix (63% male compared to 54-75%) are in keeping with the published literature. The majority of patients had injuries or illnesses of minor or moderate severity, in keeping with the published rates of 88%-99%.^{15-17,21-25} Interestingly, rates of heat- or cold-related illness presentations were low, compared to some previous reports, where rates of 10%-12% were reported.^{24,25} However, the few cases of either asthma or angina

pectoris may have been related to the cool climate, combined with the need for a long walk of approximately 3 km from the parking and bus stop areas to the stadium.

The need for a surge capacity site was essential in light of the risk of unexpected major incidents at the FIFA event; this site was planned for such an event. Other published series have highlighted the need for such planning since the September 11, 2001 attacks. The requirement for training of stadium medical staff in MIMMS¹¹ or similar major incident courses is noted in one Olympic-related and two soccer-related publications.^{16-17,22}

The experience of planning for and providing this Casualty Clearing Station resulted in several "lessons learned" that may be useful in planning efforts for future mass-gathering events. The first lesson learned was the need to have more types of medications on-site for minor ailments to avoid having to dispense discharge prescriptions. In future planning, event managers should take notice of the personnel skills mix required to enable efficient "treat and release" of minor casualties, thereby providing medications that are used by those with additional skills in their scope of practice. Second, managers should have new equipment, which may be purchased specifically for a major event, delivered sufficiently early to ensure compatibility of connections and electrical fittings. Third, managers must ensure there is a maintenance system for on-site servicing of items that may have problems or incompatibilities.

A fourth lesson was the need for the staff to be on-site early to allow for adequate coverage, remaining on-site until the stadium and the no-drive precinct was clear. Spectators began arriving more than four hours prior to the matches and, often, they stayed in the precinct until well past the two-hour egress period, due to the celebratory nature of the events. This necessitated staff working longer than normal shifts. Future planning efforts may need to consider a system of divided shifts to provide medical coverage. Staff rehabilitation is essential, through provision of meals and refreshments.

The greatest challenge identified was the fact that, with no actual major incidents, the system never was tested, making it impossible to discuss whether the plans would have worked in an actual major incident. This has been mentioned in recent publications from the English premier league experience, which have as their focus the treatment of single patient spectator episodes.^{16,17} Therefore, it was not possible to establish whether the staffing and equipment norms, as determined, are valid.

It should be noted, however, that mass-casualty incidents (such as train, bus, and mini-bus accidents) occur regularly in South Africa, and that these have been efficiently managed with the use of the MIMMS¹¹ or similar systems.²⁶⁻²⁸ The important difference with this site was that the set-up was predetermined, with the intention to undertake early management of any eventuality that may have occurred.

Unlike the situation that occurred at the World Cup in Germany,¹⁴ the system used in South Africa relied on prehospital staging prior to graduated transfer to the receiving hospitals, while the focus in Germany was on equipping each hospital with additional surge capacity facilities to cope with rapid admission of non-triaged patients. The difference in approach was based on distance to the receiving hospitals, and the different numbers of available ambulances at the venues, which were seemingly higher in the German model.

The chief benefit of this exercise was the opportunity for various unrelated services to work closely together, to align their chains of command, and communication language to a common,

functional system. This will pay dividends in the future for other such events, and during smaller mass-casualty incidents. This is an important aspect event planners in other countries should take into account.

Conclusions

The process of planning and preparing a continuously staffed site for potential mass-casualty management during a mass-gathering event is detailed in this study. In the process of planning and implementing this CCS site, lessons were learned that will facilitate the provision of such services in the future, especially from the perspective of catering to “single patient incidents.”

In modern practice, risk aversion and all-hazards planning is an essential component of hosting a major international sporting event. Hopefully, documentation of the planning and experiences of this CCS will facilitate planning for stadium major incidents for other cities hosting the FIFA World Cup games in the context of the lack of any published guidance to date.

Acknowledgments

The authors thank the staff from all the emergency, medical and military services, who worked each match-day at the site, especially those who worked as volunteers.

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