

**Patient presentations during the 2010 FIFA World Cup: Cape
Town, South Africa's public emergency centres**

by

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PART A: THE PROTOCOL

Title of study: Did the 2010 FIFA World Cup South Africa™ influence patient presentations at Cape Town, South Africa's public emergency centres?

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This study is in partial fulfillment of the Master of Medicine (Emergency Medicine)

1. Introduction

1.1. Literature review

“Some people believe football is a matter of life and death. I’m very disappointed with that attitude. I can assure you it is much, much more important than that.” (Bill Shankly, OBE, Liverpool Manager).¹

Association football, commonly known as football or soccer, not only has the highest global television audience in sport (FIFA, 2006), but at the turn of the 21st century, the game was played by over 250 million players in over 200 countries, making it the world's most popular sport.² Despite a significant economic downturn, total revenues of the 92 top professional clubs grew by 5% to almost £2.7 billion in 2009/10³ and the 2010 World Cup in South Africa generated £2.3 billion.⁴

Events of such magnitude result in a significant influx of people into the host country, potentially resulting in a temporarily increased local population. The requirements of such a population may be assumed to increase in proportion with its size and lead one to question whether emergency department load would be affected by such events, to any significant degree.

Mass gatherings have a higher patient presentation rate than is found within the general population⁵ which may well translate to a higher emergency department presentation rate to the closest referral facilities' emergency departments, depending on variables such as the nature of illness as well as the medical coverage and resources available at the event. In addition, an increase in the local population alone as a result of influx due to a major sporting event may be a factor contributing to an increase in emergency department presentations.

Smith et al⁶ have developed a mass-gathering medical resource matrix for a developing world scenario, to ensure that adequate medical resources are provided at such events as the 2010 FIFA World Cup South AfricaTM, albeit in a developing country where medical resources may not be as plentiful.

There is currently only limited, and contradictory, information in the literature on the effects of large sports events on the workload of accident and emergency departments.⁷

Cooke et al⁷ retrospectively assessed emergency department presentations after the European Football Championships (Euro96) and concluded that a positive variation of 9–10% should be included when calculating manpower needs within an emergency department. The conclusion, based on these results was that special measures for increased workload are not required by emergency departments for major sporting events such as Euro96 over and

above their capacity to increase throughput on other days, but that more research was required to confirm this initial finding.

An additional aspect of increased attendances to emergency centres during sporting events relates to the presentation of cardiovascular events. Wilbert-Lampen and Leistner⁸ prospectively assessed cardiovascular events during the 2006 FIFA World Cup GermanyTM. This study concluded that viewing a stressful soccer match more than doubles the risk of an acute cardiovascular event. In view of this excess risk, particularly in men with known coronary heart disease, it was recommended that preventive measures were urgently needed.

In further corroboration, Leeka et al⁹ concluded that sporting events are predictable triggers of cardiovascular events and are more likely to affect passionate fans and patients with known cardiac disease and supported the introduction of risk-mitigating measures in relation to sporting events. They also noted that no significant difference was observed in the incidence of hospital admissions for acute myocardial infarction in Sydney, Australia, in association with 2 dramatic local soccer matches or in the incidence of cerebrovascular events in a hospital in Germany during soccer games in the 2006 FIFA World Cup GermanyTM.

Carroll et al¹⁰ examined hospital admissions for a range of diagnoses on days surrounding England's 1998 FIFA World Cup FranceTM football matches and found that the risk of admission for acute myocardial infarction increased by 25% on 30 June 1998 (the day England lost to Argentina in a penalty shoot-out) and the following two days. Kirkup et al¹¹ found an association between the outcome of football matches and deaths from circulatory disease, for men but not women.

Despite the above evidence for the argument that major sporting events do result in an increase in emergency centre presentations within the host region or at least influence the case mix of presentation to an extent, there are just as many examples in the literature of absent, variable or inconsistent findings. For instance, Mattick¹² assessed the impact of the 1998 FIFA World Cup FranceTM and concluded that the workload of the emergency department was only substantially affected after one match, that of the opening game between Brazil and Scotland. In addition, Cooke et al⁷ noted that both the Superbowl and the America's Cup have been reported to be associated with a decrease in emergency attendances.

Even with regards to increased cardiovascular presentations during sporting events, there is a significant degree of controversy in terms of study findings. Barone-Adesi et al¹³ investigated this association in the entire Italian population and found no evidence of increased rates of hospital admissions for acute myocardial infarction associated with football matches played by the Italian national team in three international competitions held between 2002 and 2006 (the 2002 FIFA World Cup Korea/JapanTM, the European Championship 2004 and the 2006 FIFA World Cup GermanyTM). This study (Barone-Adesi et al,)¹³ also reviewed the 10 published studies on the association between football matches and the risk of cardiovascular

events. With the exception of the German study and two small Swiss studies, all relative risk (RR) estimates were spread around the null value, ranging between 0.7 and 1.3. The conclusion therefore, was that the cardiovascular effects of watching a football match are likely to be, if anything, very small.

1.2. Motivation for study

In light of the inconclusive findings highlighted within the literature currently, suggestions have been made that further studies are required in order to gain deeper insight into the dynamics and variables which may influence patient presentation to emergency centres during major sporting events, as well as their significance, if any.

1.3. Research question

Did the 2010 FIFA World Cup South Africa™ influence patient presentations to Cape Town, South Africa's public emergency centres?

1.4. Aim

The primary aim of the study is to determine what impact the 2010 FIFA World Cup South Africa™ had on emergency centre presentations.

1.5. Objectives

The objective of the study is to conduct a retrospective, observational, cross-sectional study utilizing previously collected audit data from emergency centre records during the period of a major sporting event, the 2010 FIFA World Cup South Africa™, ie. 11th June 2010 to 11th July 2010.

The data of the WC2010 audit will be analysed to assess the presence of any statistically significant differences between analyzed variables within the period in question as compared with the control period (11th June to 11th July 2009), in which there was an absence of such an event.

A comparison of the data described, to control periods with an absence of major sporting events may allow insight into whether such events require consideration of staffing requirements, capacity/throughput assessment and contingency planning, or not.

2. Methods

2.1. Study design

This study will build on a pilot project done in the form of an audit, utilizing data already collected for the WC2010 audit.

Patient presentation data has been collected retrospectively from the emergency centres of 8 key public centres of the Cape Metropole over the period 11th June – 11th July 2010 and compared with the same data within the control periods, 11th June – 11th July 2009. This study period was chosen as it coincided with a major sporting event, the 2010 FIFA World Cup South Africa™.

Study population

The population group included at least 10 000 patients which presented to one of 8 key emergency centres within the Cape Metropole over the period 11th June – 11th July 2009 as well as the same period in 2010. The control period was chosen as the prior year in order to minimise the impact of the annual increase in patient volume. An assessment of annual growth in patient volume will be done in order to identify any confounding variables.

The location of the research will be the emergency centres of 8 key hospitals within the Cape Metropole, namely Groote Schuur Hospital, Tygerberg Hospital, Somerset Hospital, GF Jooste Hospital, Victoria Hospital, Paarl Hospital, Red Cross War Memorial Children's Hospital and Hottentots Holland (Helderberg) Hospital.

2.2. Sampling

2.2.1. Inclusion criteria

Data previously collected for the purpose of an audit will be used. In that audit, any complete patient record from the included emergency centres during the study period was included within the data set (audit). Specifically, total patient presentations, age, gender, diagnosis on presentation and disposition were recorded.

2.2.2. Exclusion criteria

Any patient data that contained incomplete patient information in terms of the variables being analyzed within this study, were excluded from the data set. Any patient presentation to a centre not included within the 8 key centres in the Cape Metropole outlined within this study was also excluded.

2.4.2. Limitations

Data has previously been collected for the purpose of an audit and will be utilized for the purpose of this study. Any limitations within this pre-collected data set will be inherent within the subsequent analysis. There may be outlier risk contained within the data, as well as the exclusion of certain centres if all required variables are not included in the data-set.

2.3. Data collection and management

Patient data variables will be obtained from data previously collected for the purpose of an audit from the patient registries of the 8 emergency centres outlined above, ie number of presentations, age, gender, presenting complaint, triage code (where applicable) and disposal code. This data will be recorded onto the data collection form (Appendix A). Patients' names, hospital numbers or any other patient identifying information have been completely omitted from this process, thereby maintaining patient confidentiality. To further enforce security, the data will be accessible only to the conductor of the study and the 2 supervisors of the study. Data will be stored on a password protected laptop computer. The data from the data collection forms will then be compiled into an Excel spread sheet for data analysis.

2.4. Timeline

The proposal will be submitted to UCT's human research ethics committee. Should this be accepted, the study will be completed over the months of March, April and May 2012. Data analysis will be completed in May 2012. Thesis preparation and completion will be accomplished by June 2012 for submission. Preparation of manuscripts for submission for publication will be completed in July 2012.

3. Statistical analysis

Basic statistical tests will be applied to the data in order to create charts analyzing patient number, age and gender distributions. The 2010 data set will be analyzed using 2009 as the control data set in order to determine whether any impact is identifiable on the nature and frequency of visits to designated emergency centres. The null hypothesis asserts that the hosting of the 2010 FIFA World Cup South Africa™ had no significant impact on the presentations to selected emergency centres as compared with that of the equivalent periods in 2009.

Comparative charts with the control groups will be generated. A search for statistical trends related to variables such as match days will be conducted.

Basic statistical tests will be applied to the data set in order to search for other trends of statistical significance, related to age, gender, nationality and duration of stay. Variables such as match days will be used to detect any positive or negative associations.

Quantitative variables, eg. age or number of presentations will be treated as both continuous and discrete interval data for parametric and non-parametric analysis. Frequency distributions will be generated from this data and converted into histogram representations. The data will also be used to generate relative frequency distributions and converted into other graphic representations. Comparisons will be made between the study period in 2010 versus the same period in 2009.

Variables such as gender, diagnosis at presentation and disposition will also be treated as categorical data. Bar charts will be generated with comparisons between the study period in

2010 versus 2009. Bar charts of contingency tables may be used to compare selected nominal variables in categorical format.

Chi-square tests and t-tests will be applied to selected variables within the data set.

4. Ethical and legal considerations

The protocol will be submitted for approval by the Human Research Ethics Committee at the University of Cape Town. This is a low-risk study as data has previously been collected as an audit and consisted of register reviews. No patient care was affected due to this audit and no patient care will be affected by the subsequent analysis and write-up.

5. Limitations

The following biases may be pertinent limitations of the study:

1. Bias associated with a retrospective study.
2. A regional bias may apply as all data is generated within Cape Town, South Africa only.
3. A population bias exists in the fact that the data originates within the public healthcare sector only and therefore excludes patients treated within other centres over the period identified.

6. Resources

6.1. Available resource

The study will be self-funded.

6.2. Budget and budget motivation

The cost breakdown of the study is as follows :

Printing costs : R600

Stationery and other consumable items : R400

Data storage hard drive : R550

Fuel : R700

7. Reporting and implementation of results

The aim is to publish the results of this study in an accredited, peer-reviewed journal. Findings will also be presented either by poster or talk at a local or international conference as well as during one of the University of Cape Town's research days.

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PART B: Structured Literature review

1. Aim and objective of the literature review

The aim of the literature review is to retrieve available evidence-based information from publically available, accredited medical journals via database search engines. The search pertains to studies assessing the potential impact of major sporting events on emergency department presentations. A review of available information on mass gathering medical care is included and the relevance of this as a contributing variable to Emergency Department (ED) presentations has been considered. Other variables considered include the impact of local population swell on ED presentations, as well as catastrophic accidents and mass casualty events. Previous studies assessing the impact directly or indirectly from any of the variables mentioned will be included in the literature review.

The objective of the literature review is to identify any specific trends or consensus within the literature pertaining to aspects of the study, such as a statistically significant overall increase in ED presentations during a major sporting event or a statistically significant increase within a particular age group or gender of the population. Possible explanations for statistically significant data will be identified in the literature. The findings of prior studies of a similar nature will provide a benchmark against which to compare the findings of this study.

In addition to the identification of trends in the literature, an opposite and equal assessment of the gaps in the literature is important. This process may assist in identifying potential areas of future study, which may build on current literature contributing to a more comprehensive and deeper understanding.

2. Literature search strategy

2.1 Inclusion Criteria

Only studies relating to sporting events will be included and as far as possible FIFA World Cup™ events specifically. The reason for this is that variables such as the type of event and attendance expected are known to have an impact on patient presentation volume at the event and this may in turn impact local ED presentation volume. The inclusion of other mass gathering may result in an inaccurate perception of overall significant impact.

All published studies assessing the impact of a major sporting event, namely FIFA World Cup™ events on ED presentations will be included in the literature review, regardless of geographic location. It has been noted that an element of population/centre bias may be present here, but will be mitigated by the analysis of studies across a varied geographic spread.

Mass gathering literature will be reviewed only in terms of its relevance to ED presentation volume indirectly.

Any predictive statistical measurement tools described in the literature will be included in the literature review.

2.2 Exclusion Criteria

Any study pertaining to the impact of mass gathering events on ED presentations that are not major sporting events will be excluded from the literature review as variables such as event type is known to influence patient presentation volume at the event and therefore may indirectly impact ED patient presentation volume.

Any information pertaining to the impact of a major sporting event not published in a credible medical journal will be excluded from the review.

Any study design which contains significant bias (other than the geographic/centre bias described and mitigated above) or which is based on principles other than sound, accepted evidence-based methodology.

3. Literature Review

“Some people believe football is a matter of life and death. I’m very disappointed with that attitude. I can assure you it is much, much more important than that.” (Bill Shankly, OBE, Liverpool Manager)¹

Association football, commonly known as football or soccer, not only has the highest global television audience in sport (FIFA, 2006), but at the turn of the 21st century, the game was played by over 250 million players in over 200 countries, making it the world's most popular sport.²

Despite a significant economic downturn, total revenues of the 92 top professional clubs grew by 5% to almost £2.7 billion in 2009/10³ and the 2010 World Cup in South Africa generated £2.3 billion.^{3,4}

Mass gatherings are characterized by large crowds of spectators and participants, and are an increasingly common feature of societies.⁵ Events of such magnitude result in a significant influx of people into the host country, resulting in a temporarily increased local population. The requirements of such a population may be assumed to increase in proportion with its size and lead one to question whether emergency department load would be affected by such events, to any significant degree.

These events are not well understood and, surprisingly, are more hazardous than would be expected: they generate a higher incidence of injury and illness than is apparent from general population statistics even though they are collections of “well persons”.⁵ Furthermore, in recent years, there is increasing concern that mass gatherings may be subject to a catastrophic accident or attack resulting in large numbers of injured or dead persons.⁵

Mass gatherings have a higher patient presentation rate than is found within the general population⁵ which may well translate to a higher emergency department presentation rate to the closest referral facilities' emergency departments, depending on variables such as the nature of illness as well as the medical coverage and resources available at the event. In addition, an increase in the local population size alone as a result of influx due to a major sporting event may be a factor contributing to an increase in emergency department presentations.

Not all mass-gatherings are equal.⁶ The American College of Emergency Physicians (ACEP) outlined several variables that should be considered by event planners including: alcohol and drug availability, 'type' of people participating, age distribution of the attendees, event duration and the time it occurs, mobile or stationary event, attendance expected, event type, presence of fireworks/torches/bonfires, physical plant and location characteristics, outdoor or indoor event, and weather.⁶ Levitan added access routes to and from the site and the number (and visibility) of first aid stations to this list.⁶

Smith et al⁷ have developed a mass-gathering medical resource matrix for a developing world scenario, to ensure that adequate medical resources are provided at such events as the 2010 FIFA World Cup South AfricaTM, albeit in a developing country where medical resources may not be as plentiful.

The transport-to-hospital rate (TTHR) and patient presentation rate (PPR) are examples of an emerging common language.⁵ The use of regression modeling to predict rates of patient presentation and of transportation-to-a-hospital for future mass gatherings has been described by Arbon et al.⁸ This may be relevant in its impact on ED presentation volume, but represents just one variable impacting total ED presentation volume.

It is important to note however, that patient presentations to local emergency departments from mass gathering sites accounts for a single variable, with an additional variable being the effect of local population swell on ED presentation volume. Furthermore, in recent years, there is increasing concern that mass gatherings may be subject to a catastrophic accident or attack resulting in large numbers of injured or dead persons.⁵

The effects of a mass-gathering on the local community are not entirely clear, although a British Emergency Department (ED) volume study failed to show an increase in activity level during an international sporting event, and the 1996 summer Olympics affected the local ED's 'minimally'.⁶

There is currently only limited, and contradictory, information in the literature on the effects of large sports events on the workload of accident and emergency departments.⁹

Cooke et al⁹ retrospectively assessed emergency department presentations after the European Football Championships (Euro96) and concluded that a positive variation of 9–10% should be included when calculating manpower needs within an emergency department. The conclusion, based on these results was that special measures for increased workload are not required by emergency departments for major sporting events such as Euro96 over and above their capacity to increase throughput on other days, but that more research was required to confirm this initial finding.

An additional aspect of increased attendances to emergency centres during sporting events relates to the presentation of cardiovascular events. Wilbert-Lampen and Leistner¹⁰ prospectively assessed cardiovascular events during the 2006 FIFA World Cup GermanyTM. This study concluded that viewing a stressful soccer match more than doubles the risk of an acute cardiovascular event. In view of this excess risk, particularly in men with known coronary heart disease, it was recommended that preventive measures were urgently needed.

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case mix of presentation to an extent, there are just as many examples in the literature of absent, variable or inconsistent findings. For instance, Mattick¹³ assessed the impact of the 1998 FIFA World Cup France TM and concluded that the workload of the emergency department was only substantially affected after one match, that of the opening game between Brazil and Scotland. In addition, Cooke et al⁹ noted that both the Superbowl and the America's Cup have been reported to be associated with a decrease in emergency attendances.

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4. Summary of the Literature Review

Multiple studies have been published which assess the impact of major sporting events on ED workload. A number of these have demonstrated no statistically significant increase in ED presentation volume as a result of these events. There have been a few contradictory studies which demonstrate a statistically significant increase within specific presentation groups, such as cardiovascular presentations, but this has not been borne out uniformly through studies. An extensive follow-up study with a significant population size found no statistically significant increase in cardiovascular presentations during major sporting events.

A review of mass gathering literature is relevant in terms of the translation of patient presentation rates to transport-to-hospital rates and the resultant impact of this variable on ED presentation volume. Regression analysis and measurement tools have been described in the literature in order to predict both patient presentation rates and transport-to-hospital rates, thereby aiding in staffing and logistical planning at venues. The relevance of this variable in terms of translated impact on ED presentation volume is undefined.

Despite there being a lack of statistically significant demonstrable impact of major sporting events on ED presentations in the literature, and therefore no direct implication of the need for special measures for increased staffing and capacity, there has been a suggestion of the usefulness of increased capacity 9-10% of certain days. Further research is required to clarify this requirement.

The requirement for a rapid increase in ED surge capacity becomes more prominent as the concern relating to mass catastrophes/attacks progressively increases globally.

Identification of gaps or needs for further research

The impact of major sporting events on the ED patient presentation volume in its entirety may be negligible, but it may be useful for ED management to have a good understanding of mechanisms that may assist in increasing surge capacity in times of increased need, as transient as they may be. These mechanisms may include increasing triage capacity through training, mobilization of additional space around the ED in order to increase throughput capacity and creating drill rosters for off-duty staff thereby increasing staff capacity in times of dire need. While these may not be required for the purpose of major sporting events themselves, they form a risk mitigation strategy for increasing concerns of mass casualty incidents.

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PART C: MANUSCRIPT

Patient presentations during the 2010 FIFA World Cup: Cape Town, South Africa's public emergency centres

M Galal, R Allgaier, W Smith

Abstract

Objective: The objective of the study was to assess the impact of an international sporting event (the 2010 FIFA World Cup™) on emergency centre presentations. Available evidence relating to this impact is unclear yet particularly relevant for developing countries where resources are limited.

Methods: Data was retrospectively collected from patient registries in seven emergency centres within the Cape Metropole for the period 11 June – 11 July 2010 and compared with these dates in 2009, as a control period. This study was granted approval by the Human Research Ethics Committee at the University of Cape Town.

Results: There was no statistically significant difference identified in the mean attendance ($p = 0.40$) to the seven centres included in the study period in 2010 as compared with the control period in 2009. There was no statistically significant difference between male, as compared with female gender presentations identified ($p = 0.78$) over the study period compared to the control period.

There was a statistically significant decrease in the mean number of patient presentations to the emergency centre within the closest proximity to the match venue during the study period as compared with the control period ($p = 0.001$). The mean percentage of patient presentations to the medical specialty category as compared with other specialty categories showed a statistically significant increase ($p = 0.001$).

Conclusion: There was no statistically significant impact of the FIFA 2010 World Cup™ on the emergency centre presentations included in this study. This finding is consistent with studies conducted during the 1998 and 2002 FIFA World Cups™.

The total number of patient presentations to the emergency centre with the closest proximity to the match venue demonstrated a statistically significant decrease during the study period, contributed to by the active ambulance divert put into operation over the period of the international sporting event.

Introduction

“Some people believe football is a matter of life and death. I’m very disappointed with that attitude. I can assure you it is much, much more important than that.” [Bill Shankly, former Liverpool Manager (1913 – 1931)].¹

International sporting events result in a significant influx of people into the host country, resulting in a temporarily increased local population. The estimated final number of visiting 2010 World Cup tourists to the Western Cape was 108 384.² The requirements of such a population may be assumed to increase in proportion with its size and lead one to question whether emergency centre load would be affected by such events, to any significant degree.

Mass gatherings are not well understood and but recent literature has noted that they are more hazardous than would be expected: they generate a higher incidence of injury and illness than is apparent from general population statistics even though they are collections of “well persons”.³

Mass gatherings are characterized by crowds of spectators and participants, and are an increasingly common feature of societies.³ Not all mass-gatherings are equal.⁴ The American College of Emergency Physicians (ACEP) outlined several variables that should be considered by event planners including: alcohol and drug availability, ‘type’ of people participating, age distribution of the attendees, event duration and the time it occurs, mobile or stationary event, attendance expected, event type, presence of fireworks/torches/bonfires, physical plant and location characteristics, outdoor or indoor event, and weather.⁴ According to Milsten *et al*, Levitan added access routes to and from the site and the number (and visibility) of first aid stations to this list.⁴

Smith *et al.*, have developed a mass-gathering medical resource matrix for a developing world scenario, to ensure that adequate medical resources are provided at events like the 2010 FIFA World Cup South Africa™.⁵

The transport-to-hospital rate (TTHR) and patient presentation rate (PPR) are examples of an emerging common language.³ The use of regression modeling to predict rates of patient presentation and of transportation-to-a-hospital for future mass gatherings has been described by Arbon *et al.*⁶ This may be relevant in its impact on emergency centre presentation volume, but it is important to note however, that patient presentations to local emergency centres from mass gathering sites account for just a single variable, with an additional variable being the effect of local population swell on emergency centre presentation volume.

There is currently only limited and contradictory information in the literature on the effects of large sporting events on the workload of emergency centres.⁷

Mattick assessed the impact of the 1998 FIFA World Cup France™ and concluded that the workload of the emergency centre was only substantially affected after one match, that of the opening game between Brazil and Scotland.⁸ Mattick *et al.*, in 2003, further analyzed related attendances to an emergency centre during the televised coverage of the 2002 FIFA World Cup™ final match between Brazil and Germany.⁹ The overall impact on attendance was found to be limited.

Cooke *et al.* retrospectively assessed emergency centre presentations after the European Football Championships (Euro96) and concluded that a positive variation of 9–10% should be included when calculating manpower needs within an emergency centre.⁷ The recommendation was that special measures for increased workload are not required by emergency centres for international sporting events such as Euro96 over and above their capacity to increase throughput on other days, but that more research was required to confirm this initial finding.

While there is some evidence that sporting events do result in an increase in emergency centre presentations within the host region or at least influence the case mix of presentation

to an extent (e.g. by increasing the incidence of cardiovascular presentations^{10,11,12}), there are many examples in the literature of no significant increase in patient presentation.^{7,8,9,13}

Methods

Study design

This study utilized data previously collected for an audit. Patient presentation data from the emergency centres of seven public hospitals in the Cape Metropole was retrospectively collected and analyzed.

The study period of 11 June – 11 July 2010 was compared to the control period of 11 June – 11 July 2009. This study period was chosen as it coincided with an international sporting event, the 2010 FIFA World Cup South Africa™. The emergency centres included Groote Schuur Hospital, Tygerberg Hospital, New Somerset Hospital (NSH), GF Jooste Hospital, Victoria Hospital, Paarl Hospital and Hottentots Holland (Helderberg) Hospital. These 24-hour emergency centres were chosen due to their close proximity to 1) the stadium, 2) the official FIFA fanpark, and 3) the city centre presumed to host the most tourist spectators attending the games.

In addition, quantitative data variables such as age, gender, triage code and presenting complaint were included from the centre closest in proximity to the stadium, New Somerset Hospital (NSH), the designated hospital for the stadium for the duration of the study period. NSH was also the facility that received any emergency patients from the FIFA fanpark, fanwalk (designated walkway from the stadium to the city centre/fanpark), and city centre, due to its drainage area.

The triage codes were calculated on the South African Triage Scale (SATS). Patients are categorized into one of four acuity levels: red (emergency – should be seen immediately), orange (very urgent – should be seen in less than 10 minutes), yellow (urgent – should be seen in less than 60 minutes), green (routine – should be seen in less than 240 minutes/4 hours).¹⁴ A fifth category, unclassified, was created for data collected but not assigned to any of the four defined categories.

The presenting complaint was classified into a relevant specialist category, ie. internal medicine, general surgery, trauma, obstetrics/gynaecology, psychiatry or other. A seventh category, unclassified, consisted of data collected but not classified into one of the six specialist categories.

New Somerset Hospital (NSH)

New Somerset Hospital, the designated hospital in Cape Town for the 2010 FIFA™ World Cup, is located approximately 1km from Cape Town Stadium where all Cape Town matches were played during the event. NSH is a 260 bed, predominantly regional hospital, with a staffing profile consisting of 542 including doctors, nurses and administrative staff among others with supportive functions. Its specialties consist of Emergency Medicine, Internal Medicine, General Surgery, Orthopaedic Surgery, Anaesthetics, Obstetrics/Gynaecology, Paediatric Medicine and Radiology.

A large influx of people was expected in the immediate hospital drainage area during 2010 FIFA™ World Cup period because of not only the close proximity to the Cape Town stadium, but also the surrounding associated events as well as surrounding visitors' accommodation facilities. This was seen as a potential risk for an increase in emergency centre workload. An operational plan was therefore devised for this facility, specifically for the duration of 6 June 2010 through 11 July 2010 (the first match day was on 11 June).¹⁵

Specialist consultant cover was present on all match days and shift handover times were altered in order to accommodate match times for all categories of staff where applicable. In addition to increased staffing in all of the named specialties, the nursing staff as well as administrative staff complement was also increased on match days. Any other additional staff requirements were to be met as per an internal Major Incident Plan call-out list.

Supply chain management functions were implemented during non-match days, ie. re-stocking of equipment, consumables and oxygen. Increased stores of emergency blood were carried for the full period of time. Laboratory and forensic services functioned as normal.

Elective theatre lists and specialist outpatient clinics were deferred for the period in question, with the exception of ante-natal clinic and orthopaedic fracture clinic.

NSH was put onto proactive ambulance divert on the match days which meant that none of the usual ambulance workload was taken to NSH on those days.

Data collection

Patient data from the patient registries of the seven emergency centres had been entered into patient collection data sheets for the purposes of the World Cup (WC) 2010 audit. This data was captured onto Excel (Microsoft Corporation, Redmond, WA) spreadsheets.

The data variables, presenting complaint and triage code were collected from the centre with the closest proximity to the stadium, which was also the designated hospital for the World Cup according to the World Cup 2010 Health Plan.¹⁴

Patients' names, hospital numbers or any other patient identifying information was completely omitted from this process therefore patient confidentiality was maintained.

Data analysis

The original data from the seven centres included in the study was re-worked to number of patients per group per year per hospital. Differences between years and groups were tested using a 2-way ANOVA with year and group as the two factors, and the hospitals as replicates.

Significance testing and descriptive statistical methods were also applied to the patient variables from the centre closest to the stadium (NSH), to identify significant trends between the period containing an international sporting event as compared with the control period.

Results

A total of 7 266 (56%) males and 5 733 (44%) females presented to the emergency centres included in the control period (11 June – 11 July) in 2009. A total of 6 218 (56%) males and 4 799 (44%) females presented in the study period, 11 June – 11 July 2010. This represents a total patient presentation of 12 999 in June 2009 and 11 017 in June 2010. The mean patient presentation rate per centre for the control period in question was 1 927 in 2009 and 1 658 in the study period in 2010. There was no statistically significant difference identified in total attendance ($p = 0.40$) to the seven emergency centres included in the study between the control period and the study period. The mean number of male presentations per centre for the control period was 1 038 in 2009 and 888 in the period studied in 2010. The mean number of female presentations per centre for the same period was 819 in 2009 and 686 in 2010. There was no statistically significant difference between male gender presentations as compared with female gender presentations identified ($p = 0.78$) between the control period and the study period.

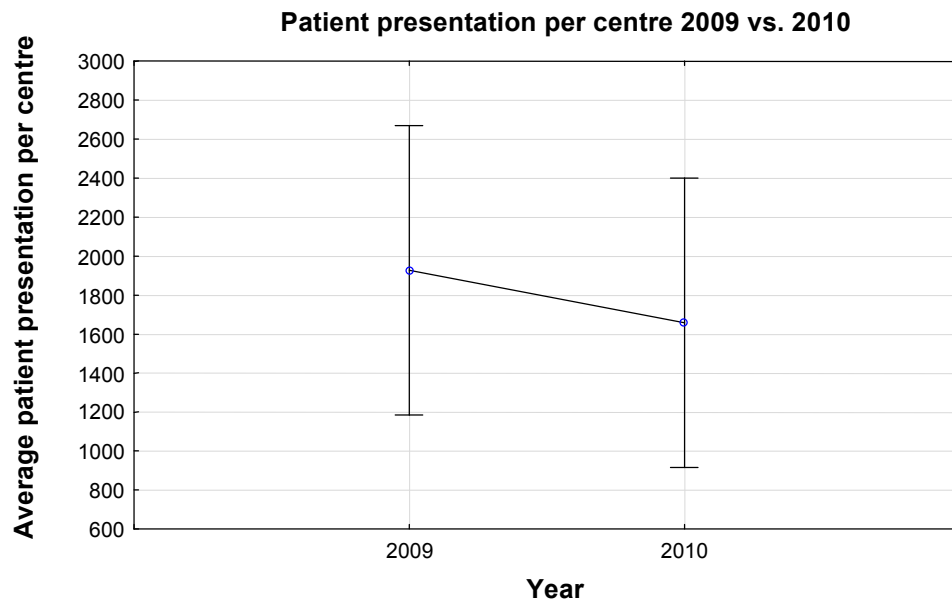


Figure 1. Adult presentations to seven emergency centres over the study period in 2009 as compared with the control period in 2010.

Further analysis was carried out within New Somerset Hospital (NSH), the centre with the closest proximity to the stadium, which was also the designated hospital for the World Cup according to the World Cup 2010 Health Plan¹⁵, in order to identify any significant trends. The analyses focused on two variables, the presenting complaint (by specialist category) and the presenting triage code.

The total number of patient presentations decreased during the study as compared with the control period analyzed. The mean number of patient presentations per day within this centre was 89.2 within the control period and 51.6 within the study period. This decline in patient presentation was statistically significant ($t = 9.9$; $p = 0.001$).

The presenting complaint data was assessed for normality using a Kolmogorov-Smirnov test and found to have a normal distribution ($p > 0.05$) for all events. The number of patient presentations within each category was compared through an analysis of variance between the study and control periods with the following result: medical ($F = 39.56$; $p = 0.001$); surgical ($F = 0.66$; $p = 0.42$); trauma ($F = 3.25$; $p = 0.76$); ob/gyn ($F = 0.71$; $p = 0.40$); psychiatry ($F = 1.61$; 0.21); other ($F = 3.60$; $p = 0.06$); unknown ($F = 72.6$; $P = 0.001$). The independent means test showed a statistically significant increase in the mean number of patient presentations to the medical specialty category, as well as a statistically significant decrease in the quantity of unknown data, confirming the results outlined.

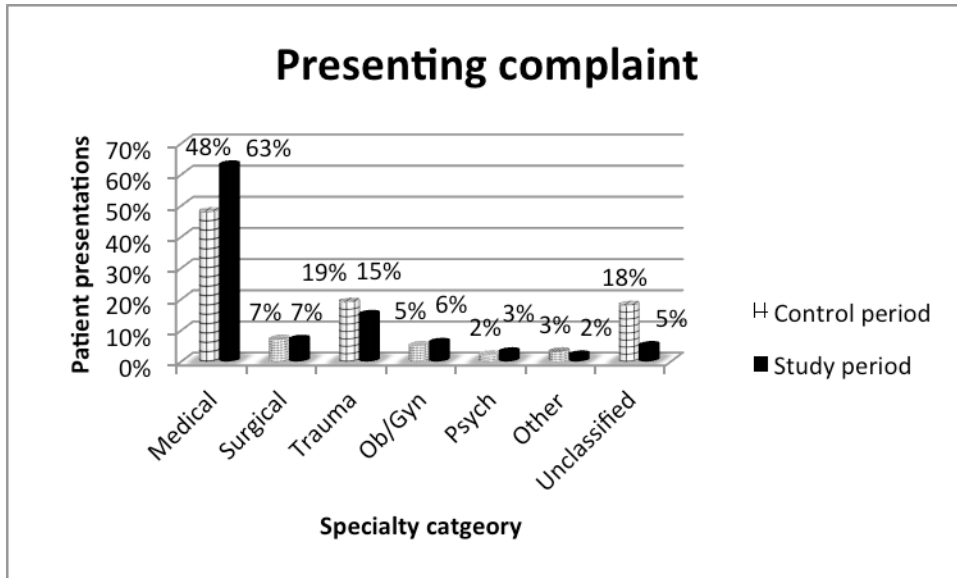


Figure 2. Initial patient presenting complaint per specialty as a percentage of the total number of patient presentations to New Somerset Hospital between the control period and the study period.

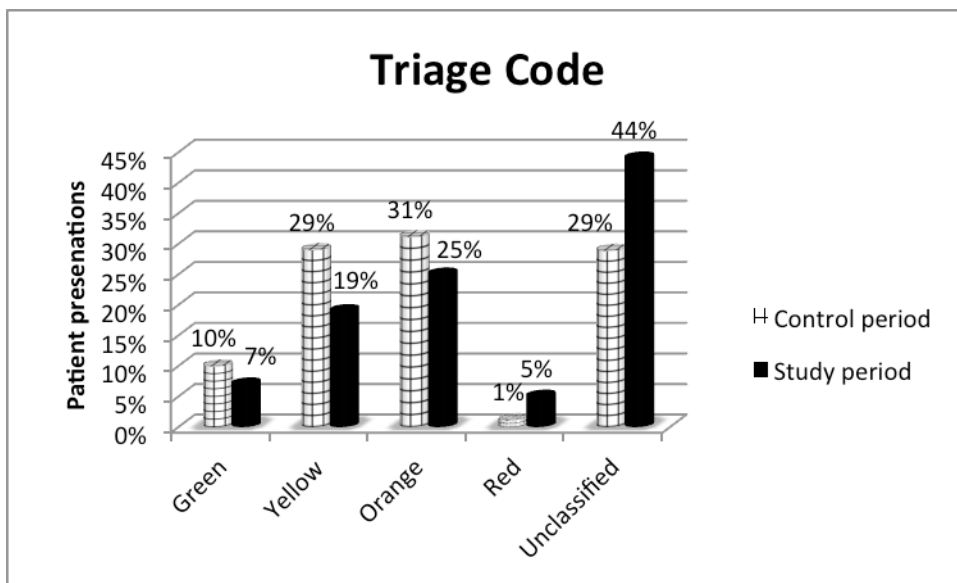


Figure 3. Triage codes of patient presentations as a percentage of the total number of patient presentations to New Somerset Hospital between the control period and the study period.

The triage data was tested for normality utilizing the k-test and found to have a normal distribution ($p > 0.05$). The analysis of variance between the control and study periods generated the following results: green ($F = 4.60$; $p = 0.04$); yellow ($F = 12.96$; $p = 0.001$); orange ($F = 5.09$; $P = 0.03$); red ($F = 10.62$; $p = 0.002$); unclassified ($F = 9.32$; $p = 0.003$). The independent means test confirmed the findings outlined with a statistically significant increase in red-coded patients and unclassified data, as well as a statistically significant decrease in green, yellow and orange-coded patients.

Discussion

Total patient presentations to seven centres combined

The total mean patient presentations to all seven emergency centres included in this study did not demonstrate a statistically significant difference between the control period in 2009 as compared with the study period in 2010. This finding is consistent with studies conducted during the 1998 and 2002 FIFA World Cups^{TM 7,8,9}.

Total patient presentations to NSH

The total mean patient presentations within NSH decreased significantly during the study as compared with the control period analysed.

This decline in patient presentation is in part explained by the intentional diversion of ambulances during match days, which meant that none of the usual ambulance workload was taken to NSH on those days, but directed to other facilities. In addition, limited elective services for the duration of the international sporting event were offered at this centre. Further research would be required in order to establish the degree to which the above factors account for the decline in patient presentation demonstrated, as well as identifying further contributory factors.

Presenting complaints (NSH)

A comparative analysis of the mean presenting complaints between the study period as compared with the control period showed that only the mean percentage of patient presentations to the medical specialty increased over the duration of the international sporting event. This finding is congruent with literature that has identified a trend toward increased medical presentations as opposed to trauma presentations during international sporting events.¹⁶

However, even though the mean percentage of patient presentations to the medical specialty category showed a statistically significant increase, total numbers of patient presentations to the medical specialty category decreased over the period of the international sporting event. This is most likely due to the ambulance diversion effect of the operational plan highlighted.

The statistically significant decrease noted in the unclassified category of data is a result of improved data logging during the study period as compared with the control period. This may be due to increased staffing and heightened awareness of the importance of patient data recording during the 2010 FIFA World CupTM. However, this improved data-recording trend was not consistent across all data variables.

Overall, medical and trauma presentations made up the vast majority of the presenting complaints to this facility. This trend was maintained between the control and study periods.

Triage Codes (NSH)

The percentage of unclassified data (ie. data which was collected, but not assigned to a specific triage category) within this portion of the analysis was high and proved to be a limiting factor. The results of the analysis of triage codes showed a statistically significant difference in every category. However, the amount of unclassified data was also statistically significantly higher within the year of the international sporting event as compared with the control period. If one assumes that the unclassified data has a normal distribution pattern, as did the classified data, then the statistically significant increase in red-coded patients may in fact be under-reported. Conversely, if the same assumption is held, then the green-, yellow- and orange-coded patient presentation percentage decrease may not be significant.

However, it is important to highlight that while the percentages of the individual code categories may have increased or decreased between the control and study period, that total numbers of patient presentations within each of these categories decreased during the period of the international sporting event.

Limitations

Since the study was retrospective, data had been collected for the WC2010 audit and analyzed thus holding inherent limitations. The percentage of unclassified data within the 'presenting complaint' and 'triage' variables was found to be statistically significant and proved to be limiting in the interpretation of that portion of the analysis. In addition, any potential missing/unrecorded data would result in an inaccuracy of the data analysed, particularly if the omissions involved were greater in any particular category/ies.

The use of a historical control contains the inherent risk of the effect of confounding variables on the results produced.

The data was collected within the public sector hospitals only and excluded private healthcare facilities, which serve a far smaller percentage of the population but the majority of healthcare insured patients, which tourists tend to be. A degree of population bias is expected as a result.

Conclusions

Based on the results of this study, the total patient presentation volume did not show a statistically significant difference within the seven emergency centres analysed during the period of an international sporting event, the 2010 FIFA World Cup™. This finding is consistent with the results of studies conducted during the 1998 and 2002 FIFA World Cups™^{7,8,9}.

Further research is required to determine whether throughput capacity during certain portions of the day may lead to an increase in patients as a result of, for instance, delayed patient presentations due to a match day.

Upon further analysis conducted on the available data from the centre with the closest proximity to the stadium, the designated hospital for the match venue, mean patient presentation numbers decreased over the study period as compared with the control period, as a result of a proactive ambulance divert on match days. Mean patient presentation percentage to the medical specialty increased significantly over the study period, as compared with mean presentation percentage to other specialty categories.

Triage data from the same centre showed statistically significant changes through all categories. However, the percentage of unclassified data present served as a limiting factor to the interpretation of this outcome. A trend toward an increased percentage of red-coded patients was noted, even though total numbers of these presentations had decreased over the study period.

Acknowledgements

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PART D: APPENDICES

Appendix A: Data Collection Sheet Template

**WC2010 HOSPITAL IMPACT
DATA COLLECTION SHEET**

FACILITY : _____

DATE : _____

Age				
1.	Child ≤ 12	Adult	Unknown	TOTAL
Sex				
2.	Male	Female	Unknown	TOTAL
Triage Colour				
3.	Green	Yellow	Unclassified	TOTAL
	Orange	Red		
Presenting Complaint				
4.	Medical	Surgical	Unknown	TOTAL
	Trauma	Ob/Gyn		
	Psych	Other		
Disposition				
5.	Discharged	Admitted	Died	TOTAL
	Left before being seen	Transferred to another facility	Unknown	
Time				
6.	00h01-04h00	04h01-08h00	08h01-12h00	TOTAL
	12h01-16h00	16h01-20h00	20h01-24h00	

**WC2010 HOSPITAL IMPACT
DATA COLLECTION TICK SHEET**

Green														
Orange														
Yellow														
Red														
?unk														
Med														
Surg														
Trauma														
Ob&G														
Paed														
Other														
?unk														
DC														
Left														
Admit														
Transfer														
Died														
?														

Appendix B: Data Spread Sheet Template

Date		11-Jun-09	12-Jun-09	13-Jun-09
# Patients seen				
Age	Child			
	Adult			
	Unknown	0	0	0
Sex	Male			
	Female			
	Unknown	0	0	0
Triage Colour	Green			
	Yellow			
	Orange			
	Red			
	Unclassified	0	0	0
Presenting Complaint	Medical			
	Surgical			
	Trauma			
	Ob/Gyn			
	Psych			
	Other			
	Unknown	0	0	0
Disposition	Discharged			
	Left			
	Admitted			
	Transferred			
	Died			
	Unknown	0	0	0

Prehospital and Disaster Medicine

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Manuscripts in one of five different categories can be submitted for review and publication in *Prehospital and Disaster Medicine* (PDM): (1) Original Research; (2) Brief Report; (3) Special Report; (4) Case Report; or (5) Comprehensive Review. Other types of manuscripts must have the approval of the Editor before being submitted. The characteristics specific to each of these categories are described below:

1. Original Research—structured research that uses quantitative and/or qualitative data collection methods and analyses to establish a hypothesis or prove a cause and effect relationship is included in this category. The manuscript must be structured as follows:

Abstract—concise summary (not to exceed 375 words) in the following format:

Introduction: Describes the need for the study

Hypothesis/Problem: What was tested (experimental studies only) If qualitative, statement of problem addressed.

Methods: Summary of methods used with subsections as appropriate (type of subjects, number of subjects, study design, statistical tests). If the work is qualitative, the types of instruments used and the scope and type of work must be described.

Results: Summary of principal findings.

Conclusion: Implications of findings.

Introduction—provide justification for the effort with appropriate references annotated. If quantitative, the concluding sentence should define the hypothesis. If qualitative, the problem being addressed should be stated clearly.

Methods—detailed description of methods used, including type and number of subjects, study design, statistical tests, software and equipment. This section should be sufficiently detailed that other investigators would be able to reproduce the study. Statistical methods used must be annotated. Approval by an Institutional Review Committee must be included when appropriate.

Results—results must be presented in text using both numbers and percentages where applicable, and may be accompanied by tables and figures (tables and figures must be referred to in text). The text must explain all data included in tables and figures, but should not be unnecessarily redundant. All direct results from the study must appear in this section. **No discussion of the results may be included.**

Discussion—the discussion should provide an interpretation of the results in terms of meaning and application. **Results should not be repeated.** Computations or extrapolations that may help explain the results may be provided. Limitations of the study should be defined and suggestions for future research should be included. Also include references that support or negate explanations provided.

Conclusion—the findings in terms of implications for the practice of prehospital, emergency, and/or disaster (humanitarian) medicine should be summarized in a few sentences.

References—a numbered list of references in the order in which they appear in the text. References should not be formatted as footnotes.

2. Brief Report—a short report on work that does not meet all of the criteria required for original research. Preliminary reports also are included in this category. The format used should be identical to that used for Original Research.

3. Special Report—describes activities or aspects of our science that provide information necessary for the progression of the science. The manuscript should be structured as follows:

Abstract—concise summary (not to exceed 375 words)

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Report—describes an aspect of science or information. Any subsections should be subtitled. Include citations for sources of the material.

Discussion—describes the significance of the report in terms of the science. Includes a comprehensive review of the pertinent literature.

Conclusion—the findings in terms of implications for the practice of prehospital, emergency, and/or disaster (humanitarian) medicine should be summarized in a few sentences.

References—a numbered list of references in the order in which they appear in the text. References should not be formatted as footnotes.

4. Case Report—uses one or more cases of specific patients or events/responses to highlight a current aspect of medical care or a phenomenon. Case reports also may have value in the development of definitive research projects by the same or other investigators. The format for a Case Report is the same as that for Special Report described above.

5. Comprehensive Review—a review of the literature to be used to clarify areas in which there seems to be disagreement. Comprehensive reviews seek to establish the evidence base for the area being addressed. The format used should be identical to that described for Special Reports.

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Cover Letter—each manuscript should be accompanied by a cover letter addressing the following:

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- The institution(s) in which the work was performed, the sponsoring institution(s), and the respective departments are annotated
- The name of the author to whom any correspondence should be directed, along with correspondence street address and email address
- Three to five keywords or phrases in alphabetical order separated by semicolons to facilitate indexing or electronic searches. Use the US National Library of Medicine Medical Subject Headings database (<http://www.ncbi.nlm.nih.gov/mesh>) to develop these keywords or phrases.

Cover Page—includes the title of the paper, first names, middle initials, last names, and highest academic degrees of all authors (abbreviated as MD, MPH, etc.), along with institutions each author is affiliated with. Reiterate from the cover letter the name of the author to whom any correspondence should be directed, and the street address and email address. **Do not indicate author names or institutions anywhere in the manuscript other than on the cover page.**

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Language—all manuscripts must be submitted in American English. Do not use *I*, *We*, or *Our* when describing the researchers. The fact that the research was conducted by the authors is implicit.

Type Style—use Times New Roman 12 point font. Double space all text, including references. Left-justify the text; leave right margins unjustified.

Abbreviations—provide a list of abbreviations used more than once and what they stand for at the beginning of the manuscript (example: WHO: World Health Organization). Whenever such abbreviations are used, they also must be annotated with the initial mention of words within the manuscript followed by the abbreviation in parentheses.

Generic Names—whenever possible, use generic names. Brand names may be indicated parenthetically and the name and location of the manufacturer must be provided in parentheses followed by a generic description of the medication, drug, product, or equipment.

Software and Equipment Descriptions—specify version number, name, manufacturer or developer of all software and equipment used. Include the city, state or province and country in which the manufacturer or developer is headquartered. Example: the data were entered into a Microsoft Excel spreadsheet Version 7.0.25 (Microsoft Corporation, Redmond, Washington, USA).

Numbers and Percentages—both numbers and percentages should be presented in the text, in the n (%) format.

Mean and Standard Deviation—when presenting means and standard deviations in the text, the mean (SD) format should be used, rather than the \pm format.

References—references **must** be cited in the References section at the end of the manuscript in the order in which they appear in the text. **Do not use automatic numbering, and remove any formatting (such as that from EndNote) linking the reference to citations in the text.** References should not be formatted as footnotes. All references must be cited by superscript Arabic numbers in the text, tables, and legends for illustrations. Citations in the text should be placed after punctuation such as periods or commas. Titles of journals referenced must be annotated using US National Library of Medicine abbreviations (<http://www.ncbi.nlm.nih.gov/nlmcatalog>) and must be italicized. If there is no US National Library of Medicine abbreviation, please do not abbreviate the journal title. Include volume and issue numbers when possible, and do not omit digits from inclusive page numbers. The following format for references **must** be used:

Journals—White SJ, Hamilton WA, Veronesi JF. Comparison of field techniques used to pressure infuse intravenous fluids. *Prehosp Disaster Med.* 1991;6(4):429-434.

Books—Schwartz GR, Safar P, Stone JH, et al, eds. *Principles and Practice of Emergency Medicine.* 2nd ed. Philadelphia, PA, USA: WB Saunders Co.; 1985:1198-1202.

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<http://www.cancer.org/Research/ResearchProgramsFunding/BehavioralResearchCenter/TheImportanceofBehaviorinCancerPreventionandEarlyDetection/the-importance-of-behavior-in-cancer-prevention-and-early-detection>. Accessed January 1, 2012.

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http://www.who.int/gho/publications/world_health_statistics/EN_WHS2011_Full.pdf. Published 2011. Accessed February 6, 2012.

Tables and Figures

Only essential figures and tables should be included. Further tables, figures, photographs and appendices may be published as supplementary material with the online version on the journal. All tables and figures must be referred to in text.

Tables—submit tables either at the end of the manuscript or as separate Word or rtf files. Tables should be numbered in the order in which they appear in the text, using Arabic numerals. Include table title above each table. Tables should be black and white, with text in Times New Roman 12 point font. Do not use shading, and do not include spaces, tabs, or hard returns. Table footnotes should be indicated with superscript lowercase letters in alphabetical order. Tables should be no more than nine columns wide, and should fit on one printed page (portrait orientation). Tables longer or wider than a page should be split into two or more tables.

Data presented as numbers and/or percentages must add up to totals; any discrepancies must be explained in table footnotes. Numbers and corresponding percentages should be presented in the same cell, using the n (%) format. Mean and standard deviation should also be presented in the same cell, using the mean (SD) format rather than the \pm format.

Figures—number all figures in the order they will appear in the text using Arabic numerals. Do not include place markers for figures in the text. Titles and legends for figures should be included as text at the end of the manuscript, and should not be included in the figure. Graphs, line art, diagrams, charts, and other figures should be submitted as black and white high resolution (300 dpi/120 pix per cm or higher) tiff files. Color photographs and graphs may be submitted as supplemental material for online publication.

Converting images to high resolution tiff files generally requires graphics software such as PhotoShop, InDesign, or Adobe Illustrator. In some cases, it is possible to convert Word or Excel files to pdf files, then pdf files to tiff files. To convert PowerPoint files to high resolution files, see instructions at <http://support.microsoft.com/default.aspx?scid=kb;en-us;827745>. Do not submit figures as Word, PowerPoint, Excel, jpeg, or similar files. Photographs should be black and white tiff files with at least 600 dpi resolution. Please ensure that your figures are saved at final publication size (see the latest issue of the journal for column widths).

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30 March 2012

HREC REF: 129/2012

Dr M Galal,
Emergency Medicine
Department of Surgery
J-Floor
OMB

Dear Dr Galal,

PROJECT TITLE: DID THE 2010 FIFA WORLD CUP SOUTH AFRICA™ INFLUENCE PATIENT PRESENTATIONS TO CAPE TOWN, SOUTH AFRICA'S PUBLIC EMERGENCY CENTRES?

Thank you for submitting your new study to the Faculty of Health Sciences Human Research Ethics Committee

It is a pleasure to inform you that the Ethics Committee has formally approved the above-mentioned study.

Approval is granted until 28 March 2013

Please submit an annual progress report (FHS016) if the research continues beyond the expiry date. Please submit a brief summary of findings if you complete the study within the approval period so that we can close our file (FHS010).

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please quote the HREC. REF in all your correspondence.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Marc Blockman'.

PROFESSOR MARC BLOCKMAN

CHAIRPERSON, FHS HUMAN RESEARCH ETHICS

Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938

This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Convention on Harmonisation Good Clinical Practice (ICH GCP) and Declaration of Helsinki guidelines.

The Human Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.

COVER SHEET FOR A PROTOCOL

CANDIDATE'S SURNAME: Galal

CANDIDATE'S FIRST NAMES: Meenal

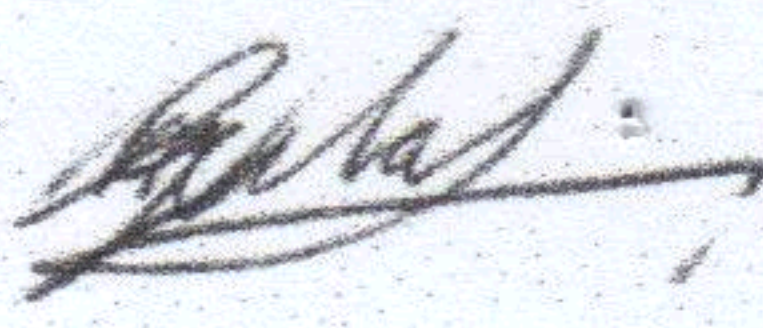
CURRENT QUALIFICATIONS: MBBCh/MBA

STUDENT NUMBER: 9400224M

DEGREE FOR WHICH PROTOCOL IS BEING SUBMITTED: MMed Emergency Medicine

YEAR & TERM FIRST REGISTERED FOR THIS DEGREE: 2009, July

TITLE OF PROPOSED RESEARCH: To describe the impact of a major sporting event (the FIFA World Cup 2010) on emergency department presentations in South Africa.

CANDIDATE'S SIGNATURE: 

DATE: 30/09/2011

SUPERVISOR'S NAME: Dr Mike Wells

SUPERVISOR'S QUALIFICATIONS: MBBCh/MSc/FCEM (SA)

SUPERVISOR'S DEPARTMENT: Division of Emergency Medicine, University of the Witwatersrand

SYNOPSIS OF RESEARCH: The aim of my study is to describe emergency department presentations to the Netcare Group over June 1st – July 15th 2010 and compare this with control periods in 2008, 2009 and 2011.

ETHICS CLEARANCE NUMBER: To Follow

SIGNATURE OF SUPERVISOR:

