

Impact of the 2010 FIFA (Federation Internationale de Football Association) World Cup on Pediatric Injury and Mortality in Cape Town, South Africa

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Objective To examine how a mass-gathering event (the Federation Internationale de Football Association World Cup, 2010, South Africa) impacts trauma and mortality in the pediatric (≤ 18 years) population.

Study design We investigated pediatric emergency visits at Cape Town's 3 largest public trauma centers and 3 private hospital groups, as well as deaths investigated by the 3 city mortuaries. We compared the 31 days of World Cup with equivalent periods from 2007-2009, and with the 2 weeks before and after the event. We also looked at the World Cup period in isolation and compared days with and without games in Cape Town.

Results There was significantly decreased pediatric trauma volume during the World Cup, approximately 2/100 000 (37%) fewer injuries per day, compared with 2009 and to both pre- and post-World Cup control periods ($P < .001$). This decrease occurred within a majority of injury subtypes, but did not change mortality. There were temporal fluctuations in emergency visits corresponding with local match start time, with fewer all-cause emergency visits during the 5 hours surrounding this time (-16.4% , $P = .01$), followed by a subsequent spike ($+26.2\%$, $P = .02$). There was an increase in trauma 12 hours following matches ($+15.6\%$, $P = .06$).

Conclusions In Cape Town, during the 2010 Federation Internationale de Football Association World Cup, there were fewer emergency department visits for traumatic injury. Furthermore, there were fewer all-cause pediatric emergency department visits during hometown matches. These results will assist in planning for future mass-gathering events. (*J Pediatr* 2014;164:327-31).

The Federation Internationale de Football Association (FIFA) World Cup was held in South Africa from June 11-July 11, 2010. This was the first time the FIFA World Cup was hosted on the African Continent,¹ which provided the opportunity to investigate the relationship between pediatric trauma and a mass-gathering sporting event that catalyses rapid change throughout many aspects of society.

There is evidence that large-scale events such as the Olympics, World Cup of Football, and the Super Bowl have the potential to significantly impact healthcare requirements. These events have been shown to increase cardiovascular events,² hasten the spread of communicable diseases,³ increase the number of road traffic accidents,⁴ influence medical decision-making by delaying presentation to hospital,⁵ and more. Yet, there is a paucity of data describing the impact of such an event on children.

We hypothesized that in South Africa, where trauma accounts for a disproportionately high burden of disease and where the largest and most enthusiastic football fan base is also at the highest risk for traumatic injury,⁶⁻⁸ the incidence of pediatric injury during the 2010 World Cup would increase. We focused on Cape Town, South Africa's second largest city and a popular tourist destination. Cape Town hosted 8 FIFA World Cup matches, including 3 elimination round games. It is the site of sub-Saharan Africa's only dedicated children's hospital. We looked to answer 4 questions regarding pediatric injury during the FIFA World Cup: Is there a change in the volume of injury related hospital visits? Is there a change in the distribution of the types of injuries? Are there changes in the timing of emergency visits corresponding to the occurrence of a local match? Are there changes in mortality related to trauma?

Methods

This cross-sectional study was prospectively designed prior to the start of the World Cup. Independent ethics review board approval was attained from the University of Toronto, University of Cape Town, and Stellenbosch University. This covered academic affiliations with all participating sites and authors.

The study period included the 31 days of the FIFA tournament, from June 11-July 11, 2010. The 5 control periods included, June 11-July 11 of 2007,

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FIFA Federation Internationale de Football Association
ICD-10 International Classification of Diseases, 10th revision

2008, and 2009, as well as the 2 weeks before (Pre-World Cup) and after (Post-World Cup) the tournament: May 26-June 10 and July 12-July 26, 2010.

We collected relevant patient information from the Western Cape Department of Health patient registry regarding all patients 18 years-old or less seen in the emergency departments at Cape Town's 3 largest regional public hospitals: Red Cross War Memorial Children's, Tygerberg, and Groote Schuur. This governmental database is compiled electronically using information registered upon arrival in the hospital. Similarly, we collected relevant patient information from the health record departments at 3 major private hospital groups: Life Healthcare, Mediclinic, and NetCare. Collectively, these hospital groups provided data for 14 separate hospital sites.

Mortality data were collected from Cape Town's two mortuaries: Tygerberg and Salt River. These mortuaries work in collaboration with Stellenbosch University, University of Cape Town, and local law enforcement agencies to investigate and record details regarding all suspicious or unnatural deaths.

Statistical Analyses

Data from the Western Cape Department of Health and Life Healthcare, Mediclinic, and NetCare Hospital groups were pooled for analysis. Primary coding from the *International Classification of Diseases, 10th revision* (ICD-10) was used to classify admission type. We defined ICD-10 blocks S, T, V, W, X, and Y as injury. We tested for variations when games were played inside or outside of Cape Town and/or if they were landmark games with emotional significance. We analyzed 5 landmark games which included the 3 matches featuring South Africa's national team (Bafana Bafana), the last match to feature an African nation (Ghana's dramatic shootout loss), and the World Cup Final. Factors associated with daily admission rates were sought in a linear regression model with a priori selection of time period, sex, age category, day of the week, Cape Town games, and Landmark Games as potential independent predictor variables.

ICD-10 diagnoses were collapsed into major categories to create subgroups of sufficient size for statistical analysis. These new categories were based on a modified version of the ICD-10 Injury Mortality Diagnosis matrix,⁹ a framework designed to organize injury diagnosis data into meaningful groupings by nature of injury.

To examine the influence of a local game on the timing of emergency department visits, we looked at the World Cup period in isolation and compared the 8 days with games played in Cape Town to the 23 days without. Days in which no games occurred in Cape Town were used to create an expected hourly admission rate. This expected admission rate was used to determine the relative hourly increase or decrease in admission rates associated with World Cup games using game start time as time zero. Binomial tests were used to calculate *P* values.

Mortuary data were pooled for analysis. Factors associated with mortality rates were sought in linear regression models with a priori selection of potential predictor variables.

Hospital admission rates and mortality rates are expressed as events per 100 000 population per day (stratified by age group/sex). Population estimates were obtained from the City of Cape Town.¹⁰ All statistical analyses were performed using SAS v. 9.3 (SAS Institute Inc, Cary, North Carolina).¹¹

Results

There were a total of 51 294 emergency department visits. Of these, 32 991 (64.3%) were excluded because they were not trauma-related, and 9031 (17.6%) were excluded because they were missing diagnostic data. The remaining 9272 (18.1%) were analyzed.

The period of the World Cup was associated with a significant decrease in admission compared with the 2009 control period and to both pre- and post-World Cup control periods with approximately 2 fewer trauma-related emergency department visits/100 000 population/d (37%, *P* < .001) (Table I). During the World Cup, there was no change in

Table I. Factors associated with injury-related paediatrics emergency department visits in multivariable linear regression models (further adjusted for population and day of the week, data not shown)

Associated factors	Ratio of admission rate with 95% CI	Change in admission rate (per 100 000 children) with 95% CI	<i>P</i> value
Age category			
0-4 years old	1.587 (1.227; 1.948)	+4.027 (+1.554; +6.500)	.001
5-9 years old	0.919 (0.689; 1.148)	-0.558 (-2.130; +1.014)	.49
10-14 years old	0.834 (0.750; 0.924)	-1.137 (-1.722; -0.552)	<.01
15-18 years old	reference category	reference category	
Sex (male)	1.722 (1.639; 1.806)	+3.954 (+3.498; +4.410)	<.001
Period			
Control 2007	1.001 (0.886; 1.115)	+0.005 (-0.746; +0.755)	.99
Control 2008	1.001 (0.891; 1.111)	+0.006 (-0.713; +0.725)	.99
Control 2009	1.344 (1.237; 1.451)	+2.256 (+1.554; +2.958)	<.001
Control 2010 pre-World Cup	1.315 (1.190; 1.439)	+2.063 (+1.245; +2.881)	<.001
Control 2010 post-World Cup	1.376 (1.249; 1.504)	+2.469 (+1.634; +3.304)	<.001
2010 World Cup	reference category	reference category	
Landmark games	1.026 (0.836; 1.217)	+0.170 (-1.062; +1.402)	.79
Cape Town games	0.905 (0.754; 1.056)	-0.645 (-1.672; +0.381)	.22

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