

2019

Game Day Alters Crime Pattern in the Vicinity of Sport Venues in Cleveland, OH

Brian E. Menaker

Texas A & M University - Kingsville, brian.menaker@tamuk.edu

Devan A. McGranahan

North Dakota State University, devan.mcgranahan@ndsu.edu

Richard D. Sheptak Jr.

Baldwin Wallace University, rsheptak@bw.edu

Follow this and additional works at: <https://aquila.usm.edu/jsss>

Part of the [Criminology and Criminal Justice Commons](#), [Leisure Studies Commons](#), [Sports Management Commons](#), [Sports Studies Commons](#), and the [Urban Studies and Planning Commons](#)

Recommended Citation

Menaker, Brian E.; McGranahan, Devan A.; and Sheptak, Richard D. Jr. (2019) "Game Day Alters Crime Pattern in the Vicinity of Sport Venues in Cleveland, OH," *Journal of Sport Safety and Security*: Vol. 4 : No. 1 , Article 1.
Available at: <https://aquila.usm.edu/jsss/vol4/iss1/1>

This Article is brought to you for free and open access by The Aquila Digital Community. It has been accepted for inclusion in Journal of Sport Safety and Security by an authorized editor of The Aquila Digital Community. For more information, please contact Joshua.Cromwell@usm.edu.

Game Day Alters Crime Pattern in the Vicinity of Sport Venues in Cleveland, OH

Cover Page Footnote

Special thank you to Caroline Schneider for assistance in proofreading this manuscript.

Game Day Alters Crime Pattern in the Vicinity of Sport Venues in Cleveland, OH

Abstract

Sports venues can increase opportunity for crime and public order disturbances when they are in use, but the impact of sport venues on their local communities have largely been overlooked by sport management research. Theories from criminology provide utility for local public safety officers to plan for event-specific patterns in local criminal activity, but most research of the impact of sport venues on crime has either been theoretical or applied broadly at societal or city levels. Here, we consider routine activity theory and crime pattern theory to better understand the increased frequency of crime events within the local neighborhoods of sports venues on days when these facilities are used. This study presents an inferential analysis of crime reported in the vicinity of two major sport venue districts in Cleveland, Ohio, United States to test theoretical predictions for the impact of sporting events on neighborhood crime patterns. Results confirmed sports events at each venue affected the frequency, type, and time of crime in the vicinity of both districts; crime frequency was greater on game days. Moreover, the greater effect of game days was substantially increased frequency of violent crimes, resisting arrest, and property-related crime reports.

Keywords: Sport venue law enforcement, violent crime, non-violent crime, urban law enforcement, spatial distribution of crime

Game Day Alters Crime Pattern in the Vicinity of Sport Venues

Introduction

Sporting events and the venues in which they are held can affect cities and communities differently from other events, but the impact of sporting events on their local neighborhoods has largely been overlooked by sport management research. Empirical research on the nature and pattern of crime in and around sporting venues indicate substantial increases in crime associated with events. However, the relation and significance of these findings to sport management has largely been overlooked. Sport management research has generally focused on the impact of property through risk management, negligence, and liability (Miller & Gillentine, 2006; Fried & Ammon, 2009) rather than the potential impact that sporting events have on the people living in the vicinity of the venue and on community crime and safety. The issue of policing large-scale public assemblies like sporting events remains a prevalent concern of law enforcement and policymakers in cities with major sports stadia and arenas. Large-scale arena and stadium events bring large numbers of visitors to a focal area, often summing to millions of additional visitors to a city per year (Downtown Sacramento Partnership, 2017). Sporting events in particular can be especially problematic, causing greater crime near venues and spilling over to neighborhoods throughout the city (Campaniello, 2011; Merlo, Hong, & Cottler, 2010; Rees & Schnepel, 2009). Sporting events can also lead to other non-criminal law enforcement interventions such as spectator ejections due to a culture of aggression and alcohol consumption before, during, and after the event (Menaker, Barry, & Howell, 2018).

Law enforcement is an integral component of crowd and security management in sporting event planning. Empirical evidence demonstrates that bringing thousands of sports fans to a venue increases crime and other civil unrest in cities that host sports teams (Rees & Schnepel, 2009). Two theories of environmental criminology might explain the increased crime: routine activity (Cohen & Felson, 1979), and crime pattern theory (Brantingham & Brantingham, 1995; Eck & Weisburd, 1995). Concordant with an emergent emphasis on place, or the geographical and environmental context of criminal activity—as opposed to a previous focus on why an offender commits crime or a victim becomes victimized (Weisburd, 2015)—empirical data confirm that the frequency and pattern of crime change as a result of sporting events in cities as predicted by theories of routine activity (Breetzke & Cohn, 2013; Decker et al., 2007) and crime pattern (Kirk, 2008; Kurland, Johnson, & Tilley, 2014). Crime pattern theory suggests that stadia are crime generators—places that create high flows of activity concentrated at activity points that provide the necessary density of people and other suitable targets conducive to criminal activity (Brantingham, Brantingham, & Andresen, 2017).

Also relevant to law enforcement planning is the temporal and spatial distribution of criminal activity in relation to sporting events. Aside from simple increases in crime on game days in cities (Rees & Schnepel, 2009), game day crime tends to be localized around the venues that host sporting events (Breetzke & Cohn, 2013; Kurland, Tilley, & Johnson, 2014; Kurland, Tilley, & Johnson, 2017; Ristea, Kurland, Resch, Leitner, & Langford, 2018). As such, arrests of delinquent spectators appears commonplace (Madensen & Eck, 2008). Because stadia and arenas generate crime in their neighborhoods, it is critical to compare game day patterns against non-game day patterns beyond simply describing the nature of crime on game days alone. Existing work on the impact of sporting events and stadia—based on routine activity theory and crime pattern theory—has focused on rugby and soccer in South Africa (Breetzke & Cohn, 2013), soccer venues in the U.K. (Kurland, Johnson, & Tilley, 2010; Kurland, Johnson, & Tilley, 2011; Kurland, Johnson, & Tilley, 2014), and professional ice hockey in the U.S. (Kurland & Piza, 2018).

Clearly, venue and security managers must be able to prepare for the disruption and crime that accompanies sporting events, as well as manage the activity and security of large sport venues on non-game days. The present study aims to test the utility of routine activity and crime pattern theories to explain the count and distribution of crime events, as well as the status of sport venues as crime generators in a novel American setting different from the focus of previous studies—specifically, Cleveland, Ohio, a U.S. city with two independent sport venue districts 1.8 km apart. Combined, these venues host American football, baseball, basketball, ice hockey, and arena football.

Interest in the impact of crime rates associated with sport venues and their status as crime generators in their local neighborhoods drives the following research questions:

Research Question 1: Is there a relationship between crime and game days versus non-game days?

Research Question 2: Are game day crimes characterized by a different proportion of incident types than non-game day crime?

Research Question 3: Do game day crimes occur at different times of the day than non-game day crimes?

Research Question 4: Do the frequency or type of crime vary with event type?

Research Question 5: Are stadia crime generators, in Cleveland, Ohio?

Literature Review

Risk Management of Crime in Stadia

Sport management studies related to crime and game day issues have primarily focused on analyses of risk management policies and stakeholder perspectives of organizing committees (Loepkey & Parent, 2009) or venue managers (Menaker, Chaney, & Sheptak, 2016). The risk management approach looks at the impact of risks on the event, venue, and sport-specific contexts. This includes perceptions of risk management procedures and risk management practices to prevent terrorism in NCAA football venues (Baker, Connaughton, Zhang, & Spengler, 2007). The security and risk mitigation measures engaged by the English Football League focus on stadium design and risk management among other factors (Hall, 2010). Stadium alcohol management has also been an important topic in sport management research (Filce, Hall, & Phillips, 2016). Prior scholarship has also focused on the efficacy of alcohol management in and around sport venues (Fried & Ammon, 2009) along with institutional liability and alcohol policy related to sport tailgating (Miller & Gillentine, 2006).

Much of the literature in sport management has focused on how different types of risk impact venue safety or expose a venue to liability. While keeping spectators within a venue safe and limiting financial and organizational liability are important considerations for venue operators, the impact of the events and the venue itself on the local community has been overlooked in sport management literature. Theories of environmental criminology provide another direction for stadium and sport managers to consider the impact of their events on not only venue patrons but on non-event-attending community members who are potentially affected by the unintended crime attracted and generated by these events and venues.

Sporting Events Impact on Crime

While the literature on the impact of sport venues on crime is somewhat limited, the studies that have been conducted show a relationship between sporting events and substantially-greater crime, as well as altered overall distribution of crime. Some literature has shown a decrease in crime after prohibitions of alcohol and increased oversight and restrictions on alcohol

consumption have been implemented in college football stadia (Bormann & Stone, 2001; Johannessen et al., 2001). Boyes and Faith (1993) suggested that outright bans of alcohol consumption during football games forced a shift in intoxication to unregulated periods through the intertemporal substitution of alcohol consumption (Merlo et al., 2010; Rees & Schnepel, 2009). Based on arrest and ejection reports at seven college football stadia, Menaker and Chaney (2014) attributed increased crime to higher attendance, warmer temperatures, on-site alcohol sales, and later game start times.

The outcome of sporting events also appears associated with crime levels. Campaniello (2011) found an increase in Italian province-level crime following the 1990 FIFA World Cup held in Italy. Likewise, violent crime against women increased as a result of local (American) football team victories in Los Angeles (White et al., 1992), and losses due to home team upsets contributed to an increase in police reports of domestic violence of males on female partners in six U.S. states (Card and Dahl, 2009). Conversely, Fernquist (2000) reported a lower homicide rates in cities in the year after local teams won a championship. .

The impact of hosting sporting events on city-wide and neighborhood-specific crime has been widely considered. Baumann, Ciavarra, Englehardt, and Matheson (2012) found little evidence that spectator sporting events correlate with citywide criminal behavior showing that the presence of a major professional sports franchise or hosting FIFA World Cup or Olympics games had no influence on an increase or decrease in citywide crime. Marie (2016) found that police displacement during home soccer matches for London teams yielded an increase in property crime by 7 percent in areas that were underprotected by law enforcement. Using Marie's (2016) framework, Yu, McKinney, Caudill and Mixon (2016) found that hourly crime rates, specifically robbery, increased during home games around a basketball area in Memphis, TN. Munyo and Rossi (2013) concluded a causal link between sport results and violent property crime, observing greater violent property crime when an unexpected soccer result was linked to frustration, while less violent crime followed results related to euphoria; however, they found no association with non-violent property crime. Billings and Depken (2012) observed an increase in crime on event days within 1.6 km of a football stadium in Charlotte, NC, with most of the crime increasing within in an 800-m radius of the stadium. Interestingly, citywide crime was not shown to increase in association with sporting events, which suggests that crime in the vicinity of sporting venues occurs as localized phenomena independent of broad, city-level patterns. While previous studies show a relationship between sport venues and crime, the theoretical underpinning of crime opportunity theories such as routine activity theory and crime pattern theory can provide evidence for the importance of theory-driven crime management at stadia.

Routine Activity Theory

Routine activity theory posits that the occurrence of a crime requires the spatio-temporal convergence of (1) a motivated offender, (2) a suitable target, and (3) the absence of a capable guardian (Cohen and Felson, 1979). Accordingly, the way people move about in their daily lives influences the likelihood of crime, and a single missing element of the three will reduce that likelihood. A few studies have applied routine activities theory to crime related to sports venues and events. Decker, Varano and Greene (2007) assert that there has been little consideration of "'normal' or 'routine' social interactions" in the study of planned and unplanned events and crime. In their examination of the relationship between crime during the 2002 Salt Lake City Olympics and routine activity theory, Decker, et al. (2007) found that citizen complaints regarding crime spiked during the Olympics despite increased presence of police in the "Olympic envelope." It was found, however, that police resources had been diverted to the area around the Olympics and away from other parts of the city. This perhaps indicates that citizens outside the area surrounding the Olympic venue felt an absence of

capable guardians. Interestingly, “incidents and arrests” decreased during the 2002 Olympics, but returned to “normal” once the games were over (Decker et al., 2007, p. 99).

As part of their examination of crime patterns during rugby union and soccer games, Breetzke and Cohn (2013) used a geographic information system to test for game day effects on crime. They found a “localized effect” for crime in and around Loftus Versfeld stadium in Tshwane (Pretoria), South Africa, which did not extend city-wide. As such, crime around the stadium increased on game days, corroborating results cited above (e.g, Yu, McKinney, Caudill and Mixon (2016) and Billings and Depken (2012)). Breetzke and Cohn’s work supports routine activities theory in that it predicts such a localized effect of sporting events on crime.

Crime Pattern Theory

While routine activity theory may be a useful explanation for sport venue crime, crime pattern theory may provide additional explanation. Crime pattern theory uses the three conditions of crime from routine activity theory. Crime is not random and not part of daily activity, but rather it is committed with prior planning or due to opportunity (Brantingham & Brantingham, 1995). Crime pattern theory helps us understand why offenses are committed through individual’s activity and awareness spaces that are generated by the highly patterned movements of people across space and at particular times. Thus, offenders take advantage of opportunities that are furnished within this awareness space. Attendees of sporting events who are less familiar with an area may intersect with a motivated offender and it is these opportunities that give rise to the crime patterns that are generated in the context of a game day.

An example of a venue as a crime generator is as follows: the attractive target is one that has something of value that the motivated offender desires, which in the context of sporting events might take several forms. For example, within the spectator community, a fan or storefront supporting an opposing team might present an opportunity for an individual to focus anger, while within the context of the event within the neighborhood; a concentration of distracted tourists might present attractive targets for theft and assault (Kurland, 2014).

Previous studies support the theory that events at venues generate crime. Kurland, Johnson, and Tilley (2014) found that crime increased in the vicinity of Wembley Stadium in London during events relative to when it was not in use. Through a natural experiment they concluded that Wembley Stadium was indeed a crime generator. Crime patterns due to sporting events, specifically, have been considered as well; in Canada, Kirk (2008) reported an increase in vehicular theft in residential neighborhoods near arenas immediately after hockey games, while downtown patterns of crime were unaltered.

Contribution

The consensus that emerges from the above literature is that sporting events increase the incidence of crime. The significance of this study lies in its consideration of the impact of sporting events on the nature and timing of criminal activity within the vicinity of major sports venues in a major city, in addition to simple measurements of crime frequency. These findings are relevant to the relationship between sporting events and crime. Prior work clearly indicates that the presence of venues has an impact on crime, but most research has focused on broad, city-wide patterns. Work focused on crime within the vicinity of venues has largely occurred outside of the U.S. (e.g., Breetzke & Cohn 2013, Kurland et al., 2014). This study considers crime patterns in the vicinity of sports venues in a major U.S. urban center and focuses specifically on the impact of sport venues on the frequency, nature, and timing of crime on game days versus non-game days. Furthermore, this study builds on Kurland and Piza’s (2018) research with an analysis of other U.S.-based sports venues.

Methods

Data and Descriptive Analysis

This study analyzes the reported crime in the immediate vicinity (800 m radius) of two sport stadium districts in Cleveland, OH: First Energy Stadium, which hosts professional American football (seating capacity of 73,200) and 10 games per year, and The Gateway District, which includes Progressive Field (seating capacity of 35,225) for baseball which hosts 81 games per year and Quicken Loans Arena (seating capacity of 20,562) for basketball, hockey, and arena football which hosts approximately 100 games per year. The relatively short radius was chosen to isolate the effects that each venue has on crime in close proximity to the two stadium districts. The need for a buffer between the two venue districts was identified to maintain them as discrete observations. This approach is justified since spatially-explicit analysis of game day crime in prior research indicates increased criminal activity is concentrated within the vicinity of venues as they are hotspots of crime (Kurland, Tilley, Johnson, 2014; Kurland, Johnson, Tilley, 2014) and does not extend city-wide (Breetzke & Cohn 2013). The two districts are 1.8 km apart in downtown Cleveland. All reported crime within the area of those venues was compiled from Cleveland Police Department crime records between January 2009 and February 2014. Frequencies of the number of crimes reported between 2009 and February 2014 revealed the following: of the 241 reported crimes at both stadium districts, 61.4% of crime adjacent to the sports venues occurred on game day. There were 113 crimes reported at First Energy Stadium during the time period of interest and 60.1% (68) occurred on a football game day. Of the 128 crimes reported in the Gateway District 43.8% (56) occurred on a baseball game day, 27.3% (35) occurred on an arena sports event game day. These reports include charges for assault, trespassing, intimidation, sexual imposition, robbery, rape, murder, alcohol consumption by a minor, and resisting arrest, among others. Case numbers, date, day of the week, time of infraction, address, and precinct were all available in the crime report summaries. The dates of games were collected via the websites of the teams who play their games in the three venues. Dates on which crime did not occur are not considered in this analysis.

Data analysis

General statistical framework.

This study employed a general regression approach. All statistical analyses consisted of Generalized Linear Mixed-effect Models (GLMMs) fit with either Poisson or Gamma distributions (table 1). Observational units, or dependent variable, consist of individual incidents reported and responded to by the Cleveland police department. All models included venue as a random effect. Models were fit with the glmer function in the lme4 package for the R statistical environment (Bates, Mächler, Bolker, & Walker, 2015; R Core Team, 2017 Table 1 details response, fixed-effect, and random-effect variables for each GLMM by research question.

	Response	Fixed effect(s)	Random effect	Distribution
1. Are there more charges on game days?				
	Number of charges	Game day (Y/N)	Venue	Poisson
2. Which types of charges vary with game day?				

	Number of charges	Game day (Y/N), Game day (Y/N) x charge type	Venue	Poisson
3. How do charges vary with time of day?				
<u>Model</u>				
<u>1</u>	Number of charges	Charge type x Time of day	Venue	Gamma
<u>2</u>	Number of charges	Charge type x Game day (Y/N) x Time of day	Venue	Gamma
<u>3</u>	Number of charges	Charge type	Venue	Gamma
<u>4</u>	Number of charges	Game day (Y/N) x Time of day	Venue	Gamma
<u>5</u>	Number of charges	Time of day	Venue	Gamma
<u>6</u>	Number of charges	Intercept-only	Venue	Gamma

Table 1. Model terms used in all Generalized Linear Mixed-effect Models (GLMM), organized by research question, and the distribution used for each model. Interaction terms in fixed effects denoted with "x". Models for research question 3 compared with AIC_c-based model selection.

The statistical significance of fixed effects was determined by comparing GLMMs against null, intercept-only models via analysis of deviance; models were considered significantly different when $P < 0.05$. In this framework, a significant difference between models indicates that the fixed-effect term meaningfully explains variation in the data tested. As a measure of effect size, we calculated confidence intervals from regression parameters (estimated β coefficients) at $\alpha = 0.95$. Parameter estimates and confidence intervals combine a quantitative measure of effect size—the sign and magnitude of the estimate—with a qualitative indication of statistical significance—parameters are considered significant when their 95% confidence intervals do not overlap zero.

Specific statistical models.

To test the research question of whether more incidents occurred on game days than non-game days, we fit our response variable, frequency of incidents, against our predictor variable, game day as a binary factor (Yes/No), in a GLMM and tested it against a null, intercept-only GLMM, each with venue as a random effect. Models were compared via analysis of deviance and 95% confidence intervals for the game day term calculated with R function `confint`.

To test whether game day incidents were characterized by a different proportion of incident types than non-game day incidents, we first grouped incidents into broad categories using the specific charge types provided by the police department: domestic violence, endangering children, harassment, menacing, minor alcohol, other, property, resisting arrest, robbery, and violent crimes including murder, rape, and assault. Then, with number of incidents as the response variable, we tested for a significant interaction between game day and incidence type in a GLMM. When the GLMM including the interaction term as a fixed effect was significantly different from the null, intercept-only model, we estimated β coefficients and 95% confidence intervals for each incident type based on 1000 simulations of the GLMM following script modified from Nakagawa and Cuthill (2007).

To test whether game day incidents occur at different times of the day than non-game day incidents, we tested the number of reported charges against the time (hour of day) given by the Cleveland Police Department for each charge in a GLMM with a Gamma distribution (table 1). To ensure that the effects of game day, hour of day, and charge type were compared equitably, we used an information-theoretic approach (Burnham and Anderson, 2002) to compare several GLMM models with different fixed-effect variables based on AICc information criteria using the AICcmodavg package in *R* (Mazerolle, 2019). In AICc model selection, plausible GLMM regression models are ranked by AICc value and evaluated by log-likelihood, with lower AICc values indicating models that better represent information contained in the data. AICc model selection focused on three charge types: Violent crimes, property-related charges, and resisting arrest.

To test whether the frequency or type of incidents vary with event type, we employed an exploratory analysis to visualize any discrepancy in the frequency of reported crime (by time of crime reported) on game day and non-game day for both venues and frequency of crimes on different sporting event days at the Gateway District.

Results

Incidents of crime increase on game days

There is moderate statistical support for the claim that there are more charges on game days ($\chi^2=20.03$, $P < 0.001$). The regression parameter is positive and non-zero ($b = 0.59$; 95% CI: 0.33 – 0.86), but less than 1, suggesting a moderate effect on overall crime incidence. A contingency table of total reported crimes on game days and non-game days is presented in table 2. The results for this regression model are presented in table 3.

Venue	Game day?	Total charges
First Energy Stadium	No	43
	Yes	70
Gateway District	No	43
	Yes	85

Table 2. Total number of charges reported for two professional sports venues in Cleveland, Ohio during the study period January 2009 – February 2014. The Gateway District refers to both Progressive Field and Quicken Loans Arena.

Model	df	AIC	BIC	Loglikelihood	deviance
<i>Null.t</i>	2	49.065	47.838	-22.533	45.065
<i>Game day</i>	3	31.031	29.190	-12.515	25.031

Note. $n = 241$; $\chi^2 = 20.034$; $df=1$, $p < 0.0001$.

Table 3. Model specifications and ANOVA result

Type and time of day of crime change on game days

The “Violent” category includes all assaults, attempted murder, and rape, and was the most frequently-reported category of reported crime (see Figure 1). A significant interaction between game day and charge type ($\chi^2=183.0, P<0.001$) confirms that the nature of incidents varies with whether or not it is a game day. Simulated 95% confidence intervals around parameter estimates for the interaction between game day and charge type indicate three reported charges are more likely to occur during game days. Violent crimes (primarily assault charges), resisting arrest, and property violations (primarily trespassing). Minor in possession of alcohol, robbery, child endangerment, and other crimes showed a trend towards higher incidence on game days, but their 95% confidence intervals overlapped zero possibly due to low sample size (see table 4).

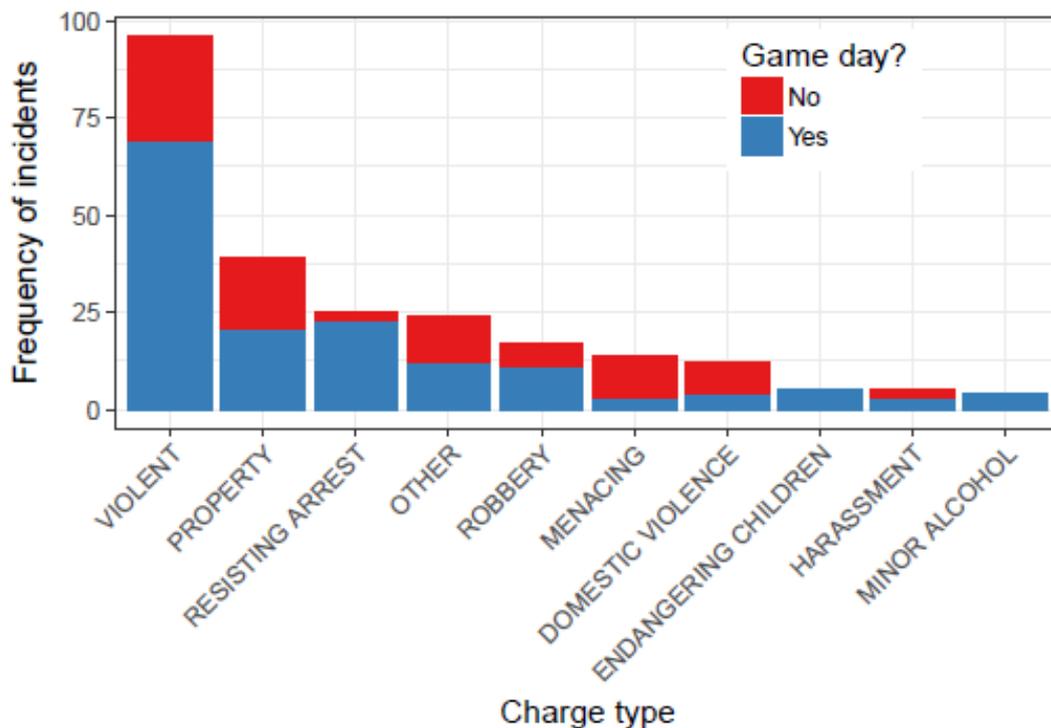


Figure 1. Frequency of 11 types of charges reported within 800 m of two professional sports venues in Cleveland, OH, January 2009 – February 2014. Charge frequency generally increased on game days (table 1) although the effect was limited to specific charges (figure 2).

Variable	Lower	upper	mean
<i>Endangering children</i>	-1.386	1.769	0.154
<i>Harassment</i>	-1.792	1.099	-0.351
<i>Menacing</i>	-1.792	1.099	-0.348
<i>Minor alcohol</i>	-1.609	1.609	-0.060
<i>Other</i>	0.000	2.565	1.114
<i>Property</i>	0.754	3.091	1.678
<i>Resisting arrest</i>	0.827	3.219	1.784
<i>Robbery</i>	0.000	2.485	1.023

Violent 2.067 4.263 2.897

Note.: n = 241; game day mean = 0.59; 95% CI=0.33 - 0.86)

Table 4. Model specification to estimate 95% confidence intervals for each regression parameter to determine which charges vary with game day.

Model selection returned two competitive models that included charge type, hour of the day, and whether it was a game day or not (Table 5). The high rank of the three-term model with charge type, hour of day, and whether or not the crime was reported on a game day confirms that the three charge types of interest not only occur more frequently on game days but also occur earlier in the day (Figure 2). Violent crime was the most likely crime to be committed on game day.

Model	k	AICc	ΔAICc	AICc _w	Cum. Wt	Loglikelihood
type.x.time	13	312.90	0.00	0.67	0.67	-142.19
type.game_day.time	21	314.39	1.49	0.32	0.99	-132.80
type.only	12	320.92	8.02	0.01	1.00	-147.38
game_day.x.time	5	349.75	36.85	0.00	1.00	-169.68
time.only	4	354.51	41.61	0.00	1.00	-173.13
null	3	365.25	52.35	0.00	1.00	-179.55

Table 5. Model selection based on AICc to assess charges over the course of game day.

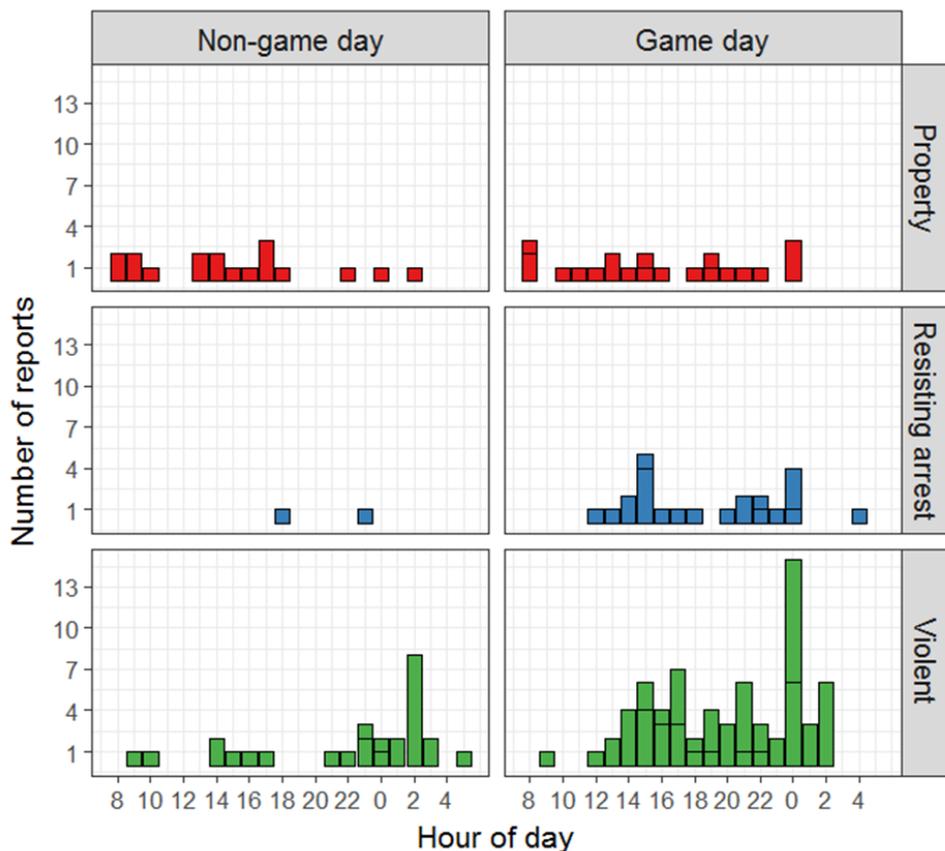


Figure 2. Within-day distribution of three types of charges—violent crimes, resisting arrest, and property-related charges—reported on game days and non-game days within 800 m of two professional sports venues in Cleveland, OH, January 2009 – February 2014. In addition to occurring more frequently on game days (figure 2), these charge types also tended to occur earlier in the afternoon and earlier in the evening on game days than on non-game days.

Frequency and incidence of charges by sport

While First Energy Stadium mainly hosts American football and a few concerts (the latter not considered here), the Quicken Loans Arena and Progressive Field complex together host four sports: baseball, basketball, hockey, and arena football. Baseball clearly contributes the most to reported crime, with nearly three times as many total charges as basketball, and over three times when the same proportion is applied to days on which baseball and hockey occurred on the same day (Figure 3).

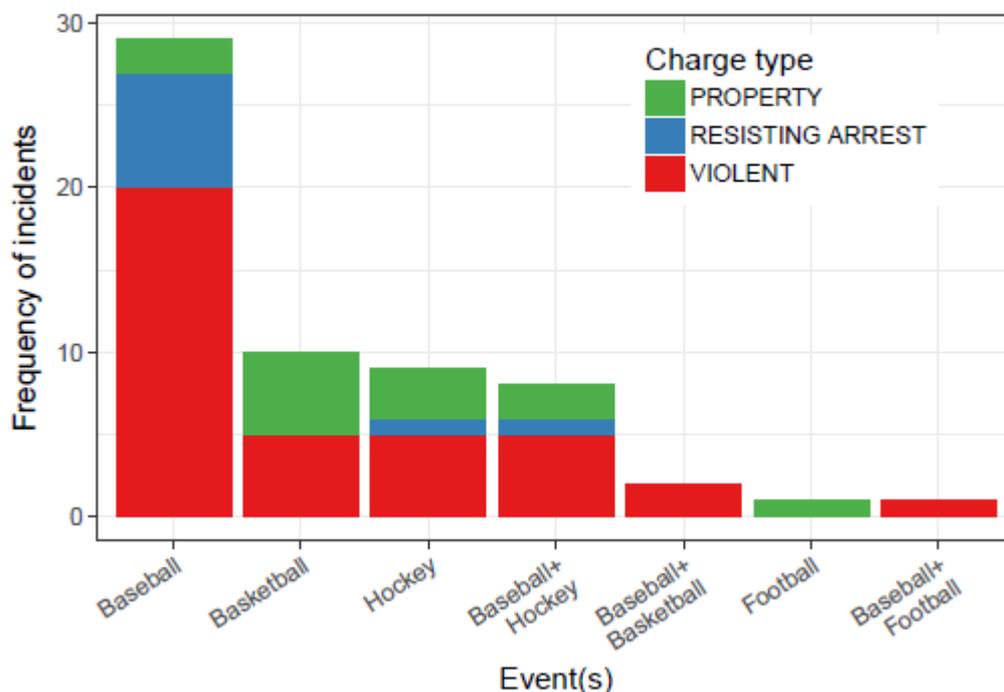


Figure 3. The frequency of charges reported on game days within 800m of the Quicken Loans Arena, January 2009 – February 2014, varied with event type.

Discussion

The study suggests a relationship between crime and game days versus non-game days; there is a significant relationship between crime and game days in the stadium districts. More crime occurs on game day than non-game day. Game day crimes are characterized by a different proportion of incident types than non-game day crime, particularly a higher proportion of violent crimes (primarily assault charges), resisting arrest, and property violations (primarily trespassing). Crime occurred earlier in the day and clustered more around the afternoon, showing that sporting events in the stadia impact the time when crime is committed. The higher proportion of crime on baseball game day suggests that frequency or type of crime varies with event type. Furthermore, more crime occurs on game days and earlier in the day (closer to when sporting events begin) in comparison to non-game days, suggesting that stadia in Cleveland, Ohio are indeed crime generators.

This study provides strong evidence that the events that occur in sporting venues have an impact on the types of crimes reported in their vicinities. Our finding that overall crime incidence increases on game days is consistent with Kurland, Tilley, and Johnson (2014). As such, these venues in Cleveland can be categorized as crime generators since crime in their vicinities increases on game day. Also in accordance with Kurland, Tilley, and Johnson (2014), incidents on game days in Cleveland tended to occur earlier in the day, starting in the early afternoon and continuing until midnight. Our analyses also provide novel insight into patterns of sporting events and crime in that we observed altered nature in the types of crimes reported.

Game days increased the frequency and shifted the timing of crimes in three major categories: Violent crimes, resisting arrest, and property-related charges. These results suggest that crimes of opportunity by fans are associated with sporting events in Cleveland, and the greater frequency of game day crimes are more likely to be perpetrated by attendees of events, either spectators themselves or other fans drawn to the vicinity of venues during events.

Around the Gateway (stadium/arena) complex at which multiple sporting events are held, approximately three times as many incidents are reported on baseball game days than other sports (Figure 4); however, these data are only presented graphically, not statistically tested, for lack of replication across venues. Baseball stands out as the driver of crime rates near this complex. One of the primary explanations behind the large number of incidents on days with baseball games relates to disproportionate representation in the dataset: firstly, there are more baseball games during their season versus other sports, and secondly, the baseball stadium has a larger capacity and thus seats more potential offenders. These results suggest public safety managers can anticipate specific patterns in the type, frequency, and time of certain criminal activity near sports venues from the athletic schedules at these facilities and incorporate anticipated patterns into city-level resource planning.

While a simple conclusion to this study's findings is that a game being played means there is more crime, a critical finding is the ability to parse the type and timing of crime to compare the impact of different types of sports. Since this study confirms sport stadia's status of crime generators, it highlights the importance of a theory-driven approach to security and crime management at stadia. The application of environmental criminological theories is useful to sport managers as it helps provide a framework for the planning of and preparation for large sports events. The types of data presented in this study are helpful to public safety managers to help them plan more efficiently for game day security and law enforcement deployment. If stadium personnel understanding starts and ends with the presence of a game means more crime, they risk deploying resources for the maximum when they might not need to. Thus, focusing on Cleveland was prudent since it hosts multiple sports year-round and sets up a good comparison. Additionally, pursuing similar studies in other cities with multiple venues and sports can help aide venue managers in their public safety deployment.

Limitations

Due to the nature of analysis and data used, there are some limitations in this study. The city of interest implemented a new reporting system in 2009, so the earliest data available was from that time period. We limited our focus on crime within an 800 m radius of the venues because (1) The downtown area is compact and the distance from the venues to the edge of the downtown area is approximately 800 m, and (2) police department recommendation of "immediate area of impact". While it is possible that the events might affect crime outside of that delimited area, our scale of focus is supported by observations of crime around Loftus Versfeld stadium in South Africa (Breetzke & Cohn, 2013). Sports venues' security units are also likely to use proactive policing during games which means law enforcement is less likely to cite people for minor offenses (Kurland et al., 2011). A conspicuous presence of law

enforcement personnel along with usage of closed-circuit television a proactive approach encourages a community, in a sporting event context the spectators, to look after their own interest and inform police of any wrongdoing that may occur (Warren and Hay, 2009). Venue operators and police at college football games in the United States also favor proactive law enforcement. Having a large presence of law enforcement officers, many of whom serve in an informational, educational, and pre-emptive role to diffuse potentially dangerous and violent situations as opposed to serving in a reactive role of arresting fans for minor alcohol-related or public order offenses (Menaker et al., 2016).

Future Study

Future study could help to alleviate some of these limitations. Expressing crime as a proportion of attendance might characterize the criminal activity of the average fan of a given sport in the city, but the raw numbers better represent the impact of each sport on local law enforcement and citizens. A primary reason to express crime as a proportion would be part of a cost/benefit argument of cost to cities vs. financial gain to businesses; in the instance of Cleveland, does baseball bring sufficiently greater business to offset its three-fold increase in crime? This could prove to be an important contribution to city planners in any city currently managing or considering stadium development and franchise expansion. Opponents of a new arena or stadium project might use the first of these findings—that the volume of crime on game days—to argue against the project, but deeper in the data it is clear that not all stadia are equal based on the nature or size of the events they hold and the fans they attract. Another prudent direction would be an analysis of all downtown crime over a defined time period and how sporting events affect crime counts. Those findings could potentially serve as an exploration into crime pattern theory in this context. All city crime could be analyzed as well, leading to spatial analyses of cities in general that host sporting events. Overall, a larger empirical base for future study is necessary in order to be more confident about the ubiquity of this problem at stadia and arenas around the world. Equally important, is that with a growing evidence base better safety and security management practices can be implemented to reduce the negative externalities that no one who is involved, be it players, coaches, venue managers, or spectators wants as part of their game day experience.

References

- Baker III, T. A., Connaughton, D., Zhang, J. J., & Spengler, J. O. (2007). Perceived risk of terrorism and related risk management practices of NCAA Division 1A football stadium managers. *Journal of Legal Aspects of Sport*, 17(1), 27-51.
- Bates, Douglas, Martin Mächler, Ben Bolker, and Steve Walker. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software* 67(1), 1-48.
- Baumann, R., Ciavarra, T., Englehardt, B., and Matheson, V. A. (2012). Sports franchises, events, and city livability: an examination of spectator sports and crime rates. *Economic and Labour Relations Review*, 23(2), 83-97.
- Bormann, C. A. & Stone M. H. (2001). The effects of eliminating alcohol in a college stadium: The Folsom Field beer ban. *Journal of American College Health*, 50, 81-87.
- Boyes, W. J. & Faith, R. L. (1993). Temporal regulation and intertemporal substitution: The effect of banning alcohol at college football games. *Public Choice*, 77(3), 595-609.
- Brantingham, P. L. & Brantingham, P. J. (1995). Criminality of place. *European Journal on Criminal Policy and Research*, 3(3), 5-26.

- Brantingham, P. J., Brantingham, P. L., & Andresen, M. A. (2017). The geometry of crime and pattern theory. In R. Wortley & M. Townsley (Eds.) *Environmental criminology and crime analysis* (pp. 98-116). New York: Routledge.
- Breetzke, G. and Cohn, E.G. (2013). Sporting Events and the Spatial Patterning of Crime in South Africa: Local Interpretations and International Implications. *Canadian Journal of Criminology and Criminal Justice*, 55(3), 387-420.
- Burnham, K. P., & Anderson, D. R. (2003). *Model selection and multimodel inference: a practical information-theoretic approach*. Springer Science & Business Media.
- Campaniello, N. (2013). Mega events in sports and crime: Evidence from the 1990 Football World Cup. *Journal of sports economics*, 14(2), 148-170.
- Card, D. and Dahl, G. B. (2011). Family violence and football: The effect of unexpected emotional cues on violent behavior. *The Quarterly Journal of Economics*, 126(1), 103-143.
- Cohen, L.E. and Felson, M. (1979). Social change and crime rate trends: A routine activity approach. *American Sociological Review*. 44, 588-608.
- Decker, S.H., Varano, S.P. and Greene, J.R. (2007). Routine crime in exceptional times: The impact of the 2002 Winter Olympics on citizen demand for police services. *Journal of Criminal Justice*, 35(1), 89-101.
- Downtown Sacramento Partnership (2017). Golden 1 Center profoundly impacting downtown business and region. Retrieved from <http://www.downtownsac.org/wp-content/uploads/2017/10/Golden-1-Center-Fact-Sheet-.pdf>
- Eck, J. E., Clarke, R. V. and Guerette, R. T. (2007). Risky facilities: Crime concentration in homogeneous sets of establishments and facilities. *Crime Prevention Studies*, 21, 225-264.
- Eck, J.E. and Weisburd, D. (1995). Crime places in crime theory. *Crime and Place, Crime Prevention Studies*, 4(1), 1-33.
- Fernquist, R.M. (2000). An aggregate analysis of professional sports, suicide, and homicide rates: 30 US metropolitan areas, 1971–1990. *Aggression and Violent Behavior*, 5(4), 329-341.
- Filce, R., Hall, S. A., & Phillips, D. (2016). Stadium Alcohol Management: A Best Practices Approach. *International Journal of Sport Management, Recreation and Tourism*, 21, 48-65.
- Fried, G., & Ammon, R. (2009). Alcohol management: Boon or boondoggle. *Journal of Crowd Safety and Security Management*, 1(2), 62-80
- Johannessen, K., Glider, P., Collins, C., Hueston, H. and DeJong, W. (2001). Preventing alcohol-related problems at the University of Arizona's homecoming: an environmental management case study. *The American Journal of Drug and Alcohol Abuse*, 27(3), 587-597.
- Kalist, D. E., & Lee, D. Y. (2016). The National Football League: Does crime increase on game day?. *Journal of Sports Economics*, 17(8), 863-882.
- Kirk, M. G. (2008). *The spatio-temporal effects of spectator events on crime* (Doctoral dissertation, School of Criminology-Simon Fraser University).
- Kurland, J. (2014). *The ecology of football-related crime and disorder* (Doctoral dissertation, UCL (University College London)).
- Kurland, J., Johnson, S. D., & Tilley, N. (2011). An Analysis of the Spatio-Temporal 'Footprint' of Crime in and around Aston Villa FC (Villa Park). London: Association of Chief Police Officers.
- Kurland, J., Johnson, S. D., & Tilley, N. (2010). Late weekend kick-offs at premier football matches and their possible link to increased levels of alcohol-related ASB and disorder. *Science. London: Government Office for London*.

- Kurland, J., & Piza, E. (2018). The devil you don't know: A spatial analysis of crime at Newark's Prudential Center on hockey game days. *Journal of Sport Safety and Security*, 3(1), Article 1.
- Kurland, J., Tilley, N., & Johnson, S. D. (2017). Football pollution: an investigation of spatial and temporal patterns of crime in and around stadia in England. *Security Journal*, 1-20.
- Kurland, J., Johnson, S.D. and Tilley, N. (2014). Offenses around stadia: A natural experiment on crime attraction and generation. *Journal of Research in Crime and Delinquency*, 51(1), 5-28.
- Kurland, J., Tilley, N., & Johnson, S. D. (2014). The football 'hotspot' matrix. In *Football hooliganism, fan behaviour and crime* (pp. 21-48). Palgrave Macmillan, London.
- Leopkey, B., & Parent, M. M. (2009). Risk management strategies by stakeholders in Canadian major sporting events. *Event Management*, 13(3), 153-170.
- Marie, O. (2016). Police and thieves in the stadium: measuring the (multiple) effects of football matches on crime. *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, 179(1), 273-292.
- Madensen, T., & Eck, J. E. (2008). Spectator violence in stadia. US Department of Justice.
- Menaker, B. E., Barry, A. E., & Howell, S. M. (2018). Identifying the influence of opponent ranking and game characteristics on alcohol-related stadium ejections. *The journal of primary prevention*, 39(2), 117-128.
- Menaker, B. E., & Chaney, B. H. (2014). College football game day stadium incidents: policy and environmental effects on alcohol-related ejections and crime. *Journal of Policy Research in Tourism, Leisure and Events*, 6(2), 119-134.
- Menaker, B. E., Chaney, B. H., & Sheptak Jr, R. D. (2016). Administrative Perspectives of Stadium Alcohol Policy: Alcohol-related Public Safety Measures in College Football Stadia. *Journal of Sport Safety and Security*, 1(1), Article 1.
- Merlo, L.J., Hong, J., & Cottler, L.B. (2010). The association between alcohol-related arrests and college football game days. *Drug and Alcohol Dependence*, 106(1), 69-71.
- Miller, J., & Gillentine, A. (2006). An analysis of risk management policies for tailgating activities at selected NCAA Division I football games. *Journal of Legal Aspects of Sports*, 16(2), 197-215.
- Mazerolle, M. J. (2019). *AICcmodavg: Model Selection and Multimodel Inference Based on (Q)AIC(c)*. {R package version 2.2-1. Available online: <https://cran.r-project.org/package=AICcmodavg>.
- Munyo, I., & Rossi, M. A. (2013). Frustration, euphoria, and violent crime. *Journal of Economic Behavior & Organization*, 89, 136-142.
- Nakagawa, S. and Cuthill, I. C. (2007). Effect size, confidence interval and statistical significance: a practical guide for biologists. *Biological Reviews*, 82(4), 591-605.
- R Core Team. 2017. *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing.
- Rees, D.I. and Schnepel, K.T. (2009) College football games and crime. *Journal of Sports Economics*, 10(1), 68-87.

- Ristea, A., Kurland, J., Resch, B., Leitner, M., & Langford, C. (2018). Estimating the spatial distribution of crime events around a football stadium from georeferenced tweets. *ISPRS International Journal of Geo-Information*, 7(2), 43
- Warren, I. and Hay, R. (2009). 'Fencing them in': the A-League, policing and the dilemma of public order. *Soccer and Society*, 10(1), 124-141.
- Weisburd, D. (2015). The law of crime concentration and the criminology of place. *Criminology*, 53(2), 133-157.
- White, G.F., Katz, J. and Scarborough, K.E. (1992). The impact of professional football games upon violent assaults on women. *Violence and Victims*, 7(2), 157-171.
- Yu, Y., McKinney, C. N., Caudill, S. B., & Mixon Jr, F. G. (2016). Athletic contests and individual robberies: an analysis based on hourly crime data. *Applied Economics*, 48(8), 723-730.