SYSTEMATIC REVIEW

Drug and Alcohol Related Patient Presentations to Emergency Departments during Sporting Mass-Gathering Events: An Integrative Review

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Abbreviations:
ED: emergency department
MeSH: Medical Subject Headings
MGE: mass-gathering event
PDM: *Prehospital and Disaster Medicine*
PPR: patent presentation rate
TTHR: transport to hospital rate
WHO: World Health Organization

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Abstract

Background: Drug and alcohol consumption at sporting mass-gathering events (MGEs) has become part of the spectator culture in some countries. The direct and indirect effects of drug and alcohol intoxication at such MGEs has proven problematic to in-event health services as well as local emergency departments (EDs). With EDs already under significant strain from increasing patient presentations, resulting in access block, it is important to understand the impact of sporting and other MGEs on local health services to better inform future planning and provision of health care delivery.

Aim: The aim of this review was to explore the impact of sporting MGEs on local health services with a particular focus on drug and alcohol related presentations.

Method: A well-established integrative literature review methodology was undertaken. Six electronic databases and the *Prehospital and Disaster Medicine* (PDM) journal were searched to identify primary articles related to the aim of the review. Articles were included if published in English, from January 2008 through July 2019, and focused on a sporting MGE, mass-gathering health, EDs, as well as drug and alcohol related presentations.

Results: Seven papers met the criteria for inclusion with eight individual sporting MGEs reported. The patient presentation rate (PPR) to in-event health services ranged from 0.18/1,000 at a rugby game to 41.9/1,000 at a recreational bicycle ride. The transport to hospital rate (TTHR) ranged from 0.02/1,000 to 19/1,000 at the same events. Drug and alcohol related presentations from sporting MGEs contributed up to 10% of ED presentations. Alcohol was a contributing factor in up to 25% of cases of ambulance transfers.

Conclusions: Drug and alcohol intoxication has varying levels of impact on PPR, TTHR, and ED presentation numbers depending on the type of sporting MGE. More research is needed to understand if drug and alcohol intoxication alone influences PPR, TTHR, and ED presentations or if it is multifactorial. Inconsistent data collection and reporting methods make it challenging to compare different sporting MGEs and propose generalizations. It is imperative that future studies adopt more consistent methods and report drug and alcohol data to better inform resource allocation and care provision.

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Introduction

Background

A mass-gathering event (MGE) has historically been defined as an event attracting more than 1,000 people at a particular location for a common purpose within a specific time period.[1,2] The World Health Organization (WHO; Geneva, Switzerland)[3] has built on this definition by recognizing the potential strain MGEs could have on planning and response resources of the local community. This WHO definition takes into consideration a community's ability to manage all facets of large crowds. Mass-gathering events can be planned or spontaneous social, cultural, sporting, political, or religious events.[3]

Other than crowd size, it has been recognized that variables such as weather, presence of drugs and alcohol, crowd demographics, and event type can impact upon health care access and delivery during MGEs.[4-6] These MGEs pose significant implications for public

Concept	MeSH Terms[a]	Keywords[b]
Mass Gathering	Mass Behavior, Sports, Crowding, Anniversaries and Special Events, Mass Gathering	sport mass gathering, sport event, event, major event, planned event, mass gathering health, festival
Hospital	Emergency Service, Hospital, Emergency Medical Services	emergency department, emergency room, emergency medicine, accident and emergency, hospitalization
Alcohol	Alcoholic Intoxication, Alcohol Drinking, Ethanol	alcohol, intoxication
Drugs	Street Drugs, Synthetic Drugs	drugs, illicit drugs, substances, recreational drugs, substance use, substance abuse, substance misuse

Table 1. Database Search Terms Using MeSH Terms and Keywords
Abbreviation: MeSH, Medical Subject Headings.
[a] MeSH terms used in PubMed, Medline, DARE, and CINAHL.
[b] Keywords used in PubMed, Medline, DARE, CINAHL, Embase, and Scopus.

Inclusion Criteria	Exclusion Criteria
• Real world sporting events.	• Not editorials, discussion papers, theoretical papers.
• Peer-reviewed.	• Not peer-reviewed.
• Published within 10 years (2008 – current).	• Published greater than 10 years (prior to 2008).
• Published in English.	• Not published in English.
• Description of alcohol and/or drug related presentations.	• Reports on multiple mass-gathering events, in which individual sporting event data were not reported.
• Description of local hospital impact.	

Table 2. Inclusion and Exclusion Criteria

health relating to both communicable and non-communicable conditions.[7] Non-communicable conditions such as cardiovascular disease, drug and alcohol intoxication, trauma, and temperature related illness are shown to be associated with greater levels of morbidity and mortality at MGEs, rather than communicable disease outbreaks.[6,8,9] To ensure timely health care for patrons at an MGE, in-event health services are commonly provided.[5,10] The presence of in-event health care professionals has been shown to significantly reduce the need for ambulance transfers and ultimately reduce the strain on local emergency departments (EDs).[11]

Sporting MGEs pose unique challenges for in-event and external health facilities. Although sporting MGEs bring people together and often encourage a sense of belonging, they can also encourage the over consumption of drugs and alcohol, consequently leading to cases of intoxication, assault, trauma, and exacerbation of underlying medical conditions.[9,12] The availability of alcohol at sporting MGEs has been repeatedly shown to impact upon patient presentation rates (PPRs) to in-event health services.[5,13,14] The extent sporting MGEs have on drug and alcohol related presentations to local EDs is not well-described in the literature. This knowledge is necessary to assist future health care provision and resource allocation in local EDs during sporting MGEs.[15]

Aim

The aim of this integrative review was to explore the impact of sporting MGEs on local health services with a particular focus on drug and alcohol related presentations. The research question for this integrative review was: what is the impact of sporting MGEs on drug and alcohol related presentations to local EDs?

Methods

Design

An integrative review design based on the Preferred Reporting Items of Systematic reviews and Meta-Analysis (PRISMA) Guidelines was used to answer the research question.[16] This integrative review used the methodology outlined by Whittemore and Knafl.[17] Integrative reviews take into consideration the findings from both experimental and theoretical papers. The inclusion of diverse methodologies allows for a better understanding of what is currently known and enables future translation of evidence-based knowledge into practice.[17]

Search Strategy and Data Collection

Papers were collected from various databases and search engines as artefacts of evidence. Databases and search engines included in this review were: Medline (Ovid; US National Library of Medicine, National Institutes of Health; Bethesda, Maryland USA); The Database of Abstracts of Reviews of Effects (DARE; Rutgers University Libraries; New Brunswick, New Jersey USA); Cumulative Index of Nursing and Allied Health Literature (CINAHL; EBSCO Information Services; Ipswich, Massachusetts USA); PubMed (National Center for Biotechnology Information; Bethesda, Maryland USA); Scopus (Elsevier; Amsterdam, Netherlands); and Embase (Elsevier; Amsterdam, Netherlands). The search strategy included different combinations of Medical Subject Headings (MeSH) terms and keywords that were relevant to MGEs, EDs, drugs, and alcohol. All proposed MeSH terms and keywords are outlined in Table 1. Terms and keywords in the columns were combined using the OR search strategy, while terms and keywords in the rows were combined using AND combinations.

In addition to the database search outlined, the journal *Prehospital and Disaster Medicine* (PDM) was specifically screened for papers that fit the inclusion criteria, as this journal is known to have numerous publications related to mass-gathering health.[18] The table of contents of each issue of PDM was screened within the inclusion period for papers relating to MGEs. To determine whether a manuscript was appropriate to answer the review question, specific inclusion and exclusion criteria were applied (Table 2).

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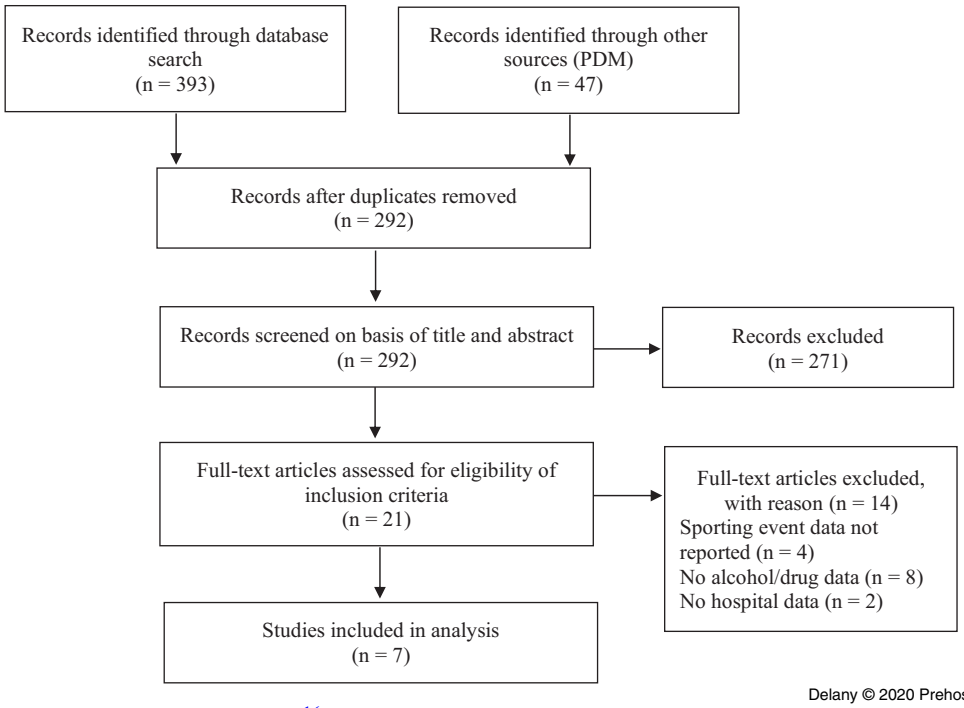

Figure 1. Modified PRISMA Flow Diagram.[16]
Abbreviations: PDM, Prehospital and Disaster Medicine; PRISMA, Preferred Reporting Items of Systematic reviews and Meta-Analysis.

Data Analysis

Information extracted from each paper was entered into a Microsoft Word 2018 table (Microsoft Corporation; Redmond, Washington USA). This information included: author(s), country where the MGE took place, the level of evidence in accordance with the National Health and Medical Research Council (NHMRC; Canberra, Australia),[19] MGE type, duration of MGE, whether alcohol was available, number of presentations to either in-event health services or to EDs, reported alcohol and/or drug related presentations, number of hospital transfers, external health services involved, and overall findings of the impact of drug and alcohol related presentations as reported by the authors.

For consistency, PPRs were calculated based on the raw data for number of presentations and total crowd numbers reported. Patient presentation rates can provide insight into the rates in which health service are required; however, it does not consider patient acuity. It has been suggested by Ranse and Hutton[20] that PPRs should be presented per 1,000 attendees, enabling ease of comparison across MGEs:

$$PPR = \frac{Attendees\ who\ present\ to\ the\ on-site\ health\ service}{Total\ number\ of\ attendees\ at\ the\ event} \times 1,000.$$

Transport to hospital rates (TTHRs) were also calculated based on the raw data presented for consistency and to enable comparisons. As with PPRs, Ranse and Hutton[20] suggest TTHRs should be based on per 1,000 attendees:

$$TTHR = \frac{Attendees\ who\ are\ transported\ to\ hospital\ by\ ambulance}{Total\ number\ of\ attendees\ at\ the\ event} \times 1,000.$$

Subsequent analysis was undertaken to determine the level of care and outcomes for patients presenting to in-event health services or EDs with drug and alcohol related presentations. These findings were also entered into a Microsoft Word 2018 table.

Results

Seven papers met the criteria for inclusion (Figure 1) with eight individual sporting MGEs reported. All included papers had an evidence level of IV.[19] Information extracted to inform this integrative review is displayed in Table 3, Table 4, and Table 5.

A Prehospital Perspective

Five of the seven included papers described the impact of six sporting MGEs from the prehospital or in-event perspective (Table 3[15,21-24]). The calculated PPR for these six sporting MGEs ranged from 0.186/1,000 spectators at a rugby game[15] to 41.9/1,000 at a recreational bike riding event[21] where most patients were participants rather than spectators. Drug and alcohol related presentations were shown to contribute to approximately one percent to ten percent of presentations to in-event health services in the same studies. The calculated TTHR similarly showed a wide variance as the PPR with the rugby game[15] having the lowest TTHR of 0.02/1,000 and the recreational bike riding event[21] having the highest rate of 19/1,000. Only two studies reported on whether drugs and alcohol were precipitating factors in ambulance transfers.[15,22] From the alpine games, drug and alcohol intoxication contributed to over three percent of all ambulance transfers to hospital.[22] Intoxication was not a cause for ambulance transfers from a horse racing event, however, it did contribute to 25% of transfers from a rugby game.[15]

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Author (year) Nation Level of Evidence (LOE)	Event Type	Duration	Alcohol Available	Drug and Alcohol Related ED Presentations	EDs Involved in Health Service Provision	Statistically Significant Impact of MGE on Drug/Alcohol Presentations
Miller, et al (2012)[25] Australia LOE: IV	AFL	5-years (Jul 2005- Feb 2010) = 36 home games	Yes	9494	1 Regional ED	No
Todkill, et al (2016)[26] UK LOE: IV	OG	44 days (2012) (Including pre- & post-Olympic period)	Yes	-[a] Observed increase in ED presentations around Opening Ceremony	23 EDs	Yes

Table 4. Summary of articles included: ED perspective
Abbreviations: AFL, Australian Football League; ED, emergency department; LOE, level of evidence; MGE, mass-gathering event; OG, Olympic Games.
[a] Data only presented graphically in paper.

Author (year)	Event Type	Level of Care Reported	Patient Outcomes Reported
Boeke, et al (2010)[21]	Recreational bicycle ride	No	No
Burton, et al (2012)[15]	Rugby	2 presentations for falls between both events, 1 required suturing	1 presentation for alcohol related seizure required hospital transfer
	Horse racing		-[a]
Ho, et al (2014)[24]	Formula One car racing	No	No
Hostettler-Blunier, et al (2017)[22]	Wrestling and alpine games	Drug/alcohol use was the third most common cause for patients' NACA score > 1 (specific treatment not reported)	Drug/alcohol use was the eighth most common cause for hospital transfer
Lyons, et al (2011)[23]	Cricket	-[a]	-[a]
Miller, et al (2012)[25]	AFL	No	No
Todkill, et al (2016)[26]	Olympic Games	No	No

Table 5. Level of Care Provided and Patient Outcomes Related to Drug and Alcohol Use
Abbreviations: AFL, Australian Football League; NACA, National Advisory Committee for Aeronautics.
[a] Variable was reported for all presentation types, not specifically for drug and alcohol related presentations.

An ED Perspective

Two of the included papers described the impact of sporting MGEs from an ED perspective (Table 4[25,26]). One reported 9,494 alcohol related ED presentations over a five-year period but found that there was no statistically significant difference between Australian Football League (AFL; Victoria, Australia) game days and non-game days on drug and alcohol related presentations.[25] The other paper described the impact of the 2012 London Olympics on local health services, reporting a statistically significant increase of drug and alcohol related presentations to London EDs directly after the Opening Ceremony, equating to double the numbers seen during the same time period in the preceding and following weekends.[26]

Level of Care and Patient Outcomes

Three of the seven papers reported on the level of care provided and the outcomes for the entire patient population (Table 5[15,21-26]). Only one paper, however, reported on the level of care and outcomes specifically for drug and alcohol related presentations to in-event health services.[15] Burton, Corry, Lewis, and Priestman[15] reported that there were two presentations for falls to in-event health services at the rugby and horse racing events directly caused by alcohol, in which one person required suturing and one person presented with an alcohol related seizure who required ambulance transfer to the ED. Neither of the papers reporting from an ED perspective discussed level of care or patient outcomes.

Discussion

The majority of literature on sporting MGEs consist of either retrospective descriptive or prospective observational studies. These study designs provide low-quality of evidence (all were level IV evidence) and can make it challenging to generalize and apply findings to future sporting MGEs.[27] Some studies have indicated that using historical data to inform resource allocation at MGEs is a more accurate method compared to predictive models.[28,29] However, it is argued that predictive models would be more accurate if data collection and reporting methods were consistent throughout the literature.[20]

The culture of alcohol consumption at spectator sports and other MGEs is well-recognized.[30,31] The availability of alcohol at sporting MGEs has been repeatedly shown to predispose participants to inadvertent injury and harm resulting in increased PPRs to in-event health services.[9,13,32-34] This review, however, has demonstrated that despite alcohol being available at sporting MGEs, less than ten percent of presentations to in-event health

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services are as a result of alcohol or drug intoxication. Arbon, Bridgewater, and Smith[34] found that one percent of patient presentations to 201 various Australian MGEs were drug and alcohol related, with just under 12% of those people requiring transport to hospital, yet 99% of drug and alcohol related presentations were at MGEs where alcohol was available. There have been multiple studies reporting similar findings which, despite alcohol being available at sporting MGEs, only a small percentage of patient presentations to in-event services were due to intoxication.[15,23,35]

The impact of sporting MGEs on ED presentations is still not well-understood, with some studies reporting an increase in workload,[36,37] some showing a decrease,[38,39] and others showing no effect at all.[40] Multiple studies have suggested, however, that the presence of highly skilled health professionals at in-event health services reduces the demand on ambulance services and EDs.[33] Peaks in ED presentations related to drugs and alcohol have been identified in the literature to occur more commonly before and after the sporting MGE.[39,41] Similar to the findings reported by Todkill, et al,[26] a peak in presentations due to illicit drug use was observed immediately after the Sydney 2000 closing ceremony; the majority of whom were transported to hospital by ambulance.[41] This review highlights the need for further research at other sporting MGEs in determining whether they impact upon ED presentations.

The overall impact on EDs from drug and alcohol related presentations from sporting MGEs has not been thoroughly explored in the literature. The limited reporting of patient-level data such as the level of care provided and their outcomes, evident from this review, does not adequately inform future in-event and external health services on resource allocation for patients presenting with drug and alcohol related presentations.[27] The wider literature suggests that patients who are intoxicated often present in clusters, have a longer length of stay, and require sedative medication administration as well as costly diagnostic tests.[40,42] One study reported that ED patients with uncomplicated acute alcohol intoxication had an ED length of stay of around 4.5 to five hours, regardless of whether the patient received intravenous fluids.[43] The Institute of Alcohol Studies (London, United Kingdom)[44] demonstrated that patients who are intoxicated not only place unnecessary strain on health services, they can also pose a significant threat to the health and safety of staff. Consistent reporting methods are needed at both in-event health services and EDs to gain a better understanding of the impact drug and alcohol presentations are having on overall health care provision.

The inconsistent reporting of variables such as PPR and TTHR also make comparison between MGEs challenging. Similarly, the identification of individual patient types, such as participant, spectator, or staff, could assist in predicting specific patient presentations and needs. This review highlights that not distinguishing sporting MGE participants from spectators can skew results and reduce comparability, evident by the significant increase in PPR and TTHR reported by Boeke, et al.[21] A minimum data set has been proposed by Ranse and Hutton[20] to aid retrospective comparison and predictive modelling. It is also suggested that concurrent and follow-up surveillance of EDs surrounding MGEs should be incorporated into future research, as this enables a more thorough evaluation of medical care demand and the overall impact of MGEs on local EDs.[27] Consistent data collection and reporting is essential for the development of future MGE health service research and theory.

Limitations

The keywords and MeSH terms used for this review may not have captured all relevant articles as some studies may have used specific sports terms such as "football" or "athletics" rather than the broader term of "sports." The ability to generalize results across all sporting MGEs is limited due to the heterogeneity of the included papers and inconsistent reporting methods. Despite these limitations, the small number of studies included in this review highlight the current gap in the literature.

Conclusion

This review is part of a larger research agenda to develop a clearer understanding of the impacts sporting MGEs have on drug and alcohol related presentations to local EDs. This integrative review has demonstrated that although alcohol is readily available at many sporting MGEs, it has varying results on PPR and TTHR. While it remains unclear to what extent sporting MGEs have on drug and alcohol related presentations to EDs, peaks in presentations may coincide with MGE related ceremonies usually preceding or proceeding the event. With the culture of alcohol consumption at spectator sporting MGEs, ED crowding, and safety implications surrounding MGEs, it is necessary for future research to elucidate the impacts of drug and alcohol intoxication at in-event and hospital levels. It is suggested that minimum data sets for MGEs should include information on whether the patient is affected by alcohol and or drugs, the level of care provided, and patient outcomes. This review demonstrates that most studies do not specifically focus on drug and alcohol related presentations to in-event and external health services as a result of sporting MGEs, and future research should investigate this relationship further.

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Author (year) Nation Level of Evidence (LOE)	Event Type	Duration	Alcohol Available	Number of In-Event Presentations (calculated PPR/1,000)	Drug/Alcohol Related Presentations to In-Event Health Services (% of total presentations)	Hospital Transfers (calculated TTHR/1,000)	Statistically Significant Impact of MGE on Drug/Alcohol Presentations (observed)
Boeke, et al (2010)[21] USA LOE: IV	Recreational bicycle ride	7-day event 2004-2008	Yes	419 (41.9)	9.9% of minor injury presentations	190 (19)	No
Burton, et al (2012)[15] UK LOE: IV	Rugby	12 months (Sep 2008-Aug 2009) =15 game days	Yes	47 (0.186)	2 (4%)	4 (0.02) 1 (25%) alcohol related	No
	Horse racing	12 months (Sep 2008-Aug 2009) = 27 racing fixtures	Yes	16 (0.471)	1 (6%)	1 (0.03) 0 alcohol related	
Ho, et al (2014)[24] Singapore LOE: IV	Formula One car racing	3-day event 2009-2012	Yes	2.11[a]	-[b] Observed total <10	0.034[a]	-[c] (No)
Hostettler-Blunier, et al (2017)[22] Switzerland LOE: IV	Wrestling and alpine games	3-day event 2013	-[c]	1533 (5.11)	44 (4.1%) medical emergencies	58 (0.19) 2 (3.4%) alcohol related	-[c] (No)
Lyons, et al (2011)[23] UK LOE: IV	Cricket	2009 season = 29 matches	-[c]	444 (2.42)	2 (+5 requesting cures for hangovers) (1.58%)	7 (0.04)	-[c] (No)

Table 3. Summary of Articles Included: Prehospital Perspective

Abbreviations: ED, emergency department; LOE, level of evidence; MGE, mass-gathering event; PPR, patient presentation rate; TTHR, transport to hospital rate.

[a] Only average PPR/TTHR reported.

[b] Data only presented graphically in paper.

[c] Variable not reported by authors.