

Research

Frequency and location of mass gathering events in relation to emergency departments: a descriptive study

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Abstract

Introduction

As the number of mass gathering events increases, so too does the reliance on tertiary emergency healthcare services. Approximately 1% of event attendees may present to a local emergency department for clinical assessment and/or management. Often, these attendees are transported by ambulance services. The purpose of this study is to determine the frequency and location of events held in New South Wales (NSW), Australia. This information may be used by event and health service personnel to further inform event planning such as staffing, equipment and economic considerations when large events in the community occur.

Methods

This descriptive study used data scraping of an established data warehouse to identify events held in the 2017 calendar year by name, type, location (within the state of NSW) and duration. Using Google Maps, the distance and travel time between these events and the nearest emergency department (ED) was determined. Data was analysed using simple descriptive statistics.

Results

Of the 722 events in NSW analysed, 395 were single-day events. The majority of these were concerts (n=284, 39%), followed by festivals (n=259, 36%) and sporting events (n=176, 24%). The average distance and time to arrive at an ED from an event was 15.0 (I35.8) kilometres and 15.4 (I27.2) minutes, respectively.

Conclusion

Existing literature has highlighted that event attendees are regularly transported to emergency departments from events. This research has demonstrated that events occur frequently with varying vicinity to nearest EDs, with the majority of events occurring near territory care centres. However, there is limited research on the impact on emergency healthcare services resulting from an event.

Keywords:

events; emergency departments; health care; planned events; in-event care

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Introduction

Thousands of mass gathering events are held in Australia each year. A mass gathering event is defined as an event (planned or spontaneous) that can potentially strain the resources of a community hosting the event (1,2). Mass gathering events are characterised by temporary structures, an influx of a large group of people with similar motivation and supported from a health perspective by in-event health services (2). Various terminologies can be used to describe large organised events; these include mass gathering events, major planned events, mass gatherings and special events (3). These types of events are held internationally and include sporting events, music festivals or celebrations, and/or cultural events. As mass gathering events evolve, so does in-event health services, with developing standards on skill mix, equipment, clinical governance and procedures (4). As a result, there are many models of care that exist within the in-event health space of an event (5). Despite evolving in-event healthcare services, some attendees of an event may require further clinical assessment and/or management by external health services, such as ambulance/paramedic and acute care services such as an emergency department (ED). However, the impact on these services is poorly understood in the literature (6). The purpose of this paper is to describe the frequency, nature and location of mass gathering events held in the state of New South Wales (NSW), Australia, in terms of distance and travel time to tertiary emergency healthcare facilities. Having an understanding of the frequency and location of events in relation to EDs, may provide insight into the possible impact of events on local emergency healthcare services such as ambulance and ED services as well as further inform event planning such as staffing, equipment and economic considerations.

Background

Planning for mass gatherings is driven by potential risks, immediate during and after the event, both large and small, foreseeable and not foreseeable. Mass gatherings encompass sporting, cultural religious and political events, planned and spontaneous (2). A mass gathering event that is attended by a large number of people is defined as a situation or event where there is a potential for a delayed response, due to limited access to patients, the location or other features of the environment (2,7). In Australia, the scale of mass gatherings is smaller than those held in the United States or Europe. Yet regardless of size, mass gathering events can impact on a range of health services such as acute medical services, hospital EDs, paramedical and ambulance services (5,6). From an ambulance service and paramedicine perspective, there is scant literature pertaining to ambulance use resulting from mass gathering events (4). When transport from mass gathering events is discussed in the literature, the transport to hospital rate (TTHR) is commonly presented, and this rate

varies between 0.0035 and 0.99 per 1000 event attendees often depending on the event (8). However, further information regarding patient presentations, clinical interventions and patient outcomes is often not presented. Meites examined the economic viability of having ambulances on stand-by at events (8). This study found that the general need of the community is greater than the population within the events (8), highlighting that further work in this space is required.

In a literature review of 24 varying types of mass gathering events, only seven studies included raw numbers of patients referred to EDs and only one study included a referral to hospital rate (RTHR) (6). Since this literature review, two case studies pertaining to the impact of mass gathering events on EDs in the US have been published; again raw numbers rather than a rate were presented (9,10). Furthermore, one Australian study has demonstrated that at a music festival event with 20,000 attendees, 1.2/1000 attendees were reviewed by in-event volunteer doctors, nurses and paramedics (4). Seven of these, or 0.35/1000, were referred to ambulance paramedic care and transported to the local ED. These patients had a median ED length of stay of 7 hours, with one patient requiring an operation and another required intensive care unit admission (4). What this study shows is that a small but critically unwell percentage of people who receive onsite care are transferred to EDs, and this has wider ramifications for the hospital setting and its services. The aim of this study was to describe the frequency, nature and location of mass gathering events in regards to closest emergency healthcare services during events.

Methods

Study design

A descriptive design was used for this study as there was no hypothesis to be tested nor causal inferences to be made from this research (11).

Setting

This research was set in the state of New South Wales, Australia. NSW covers an area of 800,642 square kilometres and has the largest population of any Australian state or territory with 7.95 million people (as at 2016) (12).

Population

This research included events held in 2017 listed on the NSW Destinations website (<http://visitsw.com>), a government website listing tourism, destinations and event information. Events listed are divided into nine categories: business, classes and workshops, community, exhibitions and shows, food and wine, markets, performances, and sporting. For the purpose of this work the authors focus on the three categories of concert or performance, festival or celebration, and sporting events.

Procedures

The inclusion criteria for the data scraping, included the month of the event (time of year), the location, the type of event and distance to ED as this information was readily available. Exclusion criteria included audience profile, onsite accommodation, presence of alcohol and other drugs, as this information was inconsistently available on the site. Data scraping took place in November 2017, with all events documented on this website included. Although data scraping took place in November, events to be held in December that were included on the website were included as part of the data scraping process. Data was collected and organised using four steps. First, event data was obtained from the NSW Destinations website using a web scraping technique. This technique is used to extract large amounts of data from websites and display this data in a spreadsheet format (13). Second, data was organised to include event name, event category (e.g. festival), date of event, and location of event. Third, the closest ED was determined from the NSW Health Emergency waiting times website (www.emergencywait.health.nsw.gov.au/). Fourth, Google Maps was used to determine the distance (in kilometres) and travel time (in minutes) for a car travelling from the event to the nearest ED. The shortest kilometre route provided by Google Maps was used and the travel time was conducted using standard travel times. 'Real time' traffic updates were not used in Google Maps to allow for a consistent approach to data collection.

Data analysis

Data analysis included descriptive statistics, such as frequencies and means of central tendency. The number of events per month were not normally distributed across the year, as such non-parametric measures of median and interquartile ranges were used to present this data. The distance and time was normally distributed across the 719 events. Parametric measures of a two-sided t-test was used to compare the mean

distance and mean time from the event to the closest ED against single and multi-day events; and against rural/remote and metropolitan EDs. The statistical significance was set at $p < 0.05$.

Ethics

Human Research Ethics approval was not sought for this study as the data being used was publicly available information of events, rather than human participants. Furthermore, the event-level data that was used in this research was de-identified following analysis. As such, individual events are not represented in this paper.

Results

All events

As a result of the data scraping, 722 events were identified. Three events were excluded from the study as they took place on islands off the mainland coast of NSW, and as such differed from the other events in terms of geographical location and location to an ED; 719 events were included in this analysis. A median of 34 (IQR 15-60) events per month were held during the study period. However, the majority of events ($n=397$, 55.2%) were held during November and December. Figure 1 displays the frequency of events per month.

Table 1. Number of events and distance from EDs

Distance to ED	No. of events
0 km to 10 km	554
11 km to 20 km	55
21 km to 30 km	28
31 km to 60 km	37
61 km to 90 km	7
90+ km	38

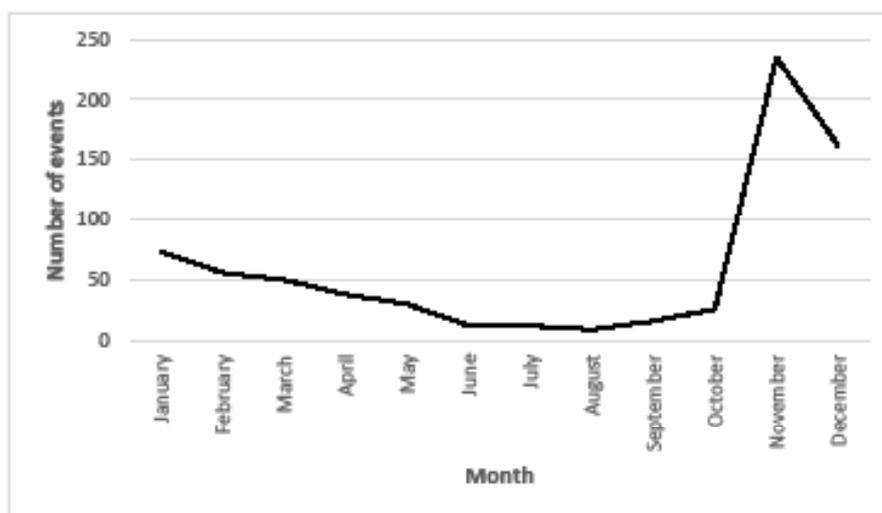


Figure 1. Number of events held per month

The mean (SD) distance in kilometres from an event to an ED was 15.0 (135.8). The majority (n=554, 76.7%) of events were held within 10 kilometres of an ED (Table 1).

The mean (SD) travel time from an event to an ED was 15.43 minutes (127.27). The majority (n=459, 63.84%) of events were held within 10 minutes of an ED (Table 2).

Table 2. Number of events that fell within certain timeframes from nearest ED

Time to ED	No. of events
0 min to 10 min	459
11 min to 20 min	145
21 min to 30 min	39
31 min to 60 min	31
61 min to 90 min	33
90+ min	12

Distance and time to ED based on types of event

The most common event type was concert or performance followed by festival and celebration and then sporting event. Table 3 presents the distance and time to ED based on event type.

Table 3. Number of events, distance and time to ED by event category

	Concert or performance	Festival and/or celebration	Sporting event
Number of events (f, %)	284 (39.5)	259 (36.0)	176 (24.5)
Distance to nearest ED, km (mean, SD)	15.16 (36.04)	15.10 (36.00)	14.98 (35.82)
Time to nearest ED, min (mean, SD)	15.57 (27.46)	15.53 (27.43)	15.44 (27.28)

Single versus multi-day events

Differences between single and multi-day events were considered in terms of distance and time to ED. Compared to multi-day events, single day events were held further from an ED (p=0.040), however, time from an event to an ED did not differ (p=0.075) (Table 4).

Metropolitan versus rural/regional events

Differences between metropolitan and rural/regional events were considered in terms of distance and time to ED. Metropolitan was considered to be Sydney, Newcastle and Wollongong. Regional and rural was considered all other locations. Compared to events held in metropolitan areas, those held in rural/regional areas were held further from an ED (p<0.001) and also had a longer travel time to an ED (p<0.001) (Table 5).

Table 4. Distance and time between single and multi-day events

	Single day	Multi-day	Statistic
Events	397	322	
Distance, km (mean, SD)	17.41 (43.87)	11.89 (21.69)	t=2.0615 p=0.040
Time, min (mean, SD)	13.41 (17.31)	17.05 (33.14)	t=1.7822 p=0.075

Table 5. Distance and time between metropolitan and rural/regional events

	Metropolitan	Rural/regional	Statistic
Events	395	324	
Distance, km (mean, SD)	8.73 (32.22)	20.05 (37.70)	t=4.2703 p<0.001
Time, min (mean, SD)	10.95 (24.95)	19.08 (28.52)	t=4.0206 p<0.001

Discussion

This work is (as far as the authors are aware) the first of its kind to describe distance and time from an event to the closest ED. Our key finding is that hundreds of events are held across NSW on an annual basis, with the majority (n=554, 76.7%) within 10 kilometres and 10 minutes from the nearest ED. Nicholl et al (14) identified that the increased journey distance in an ambulance was associated with increased risk of mortality for people with potentially life threatening conditions (excluding cardiac arrest). For example, a 10 kilometre increase in straight line distance was associated with a 1% absolute increase in mortality for the general population (14). Of the events identified, single day events were further in distance from an ED when compared to multi-day events, however travel time was not statistically significant. Further exploration of this is required to understand what the implication on EDs from mass gathering events might be.

Location of events is an important consideration for a country such as Australia where there is large geographical diversity and terrain within and between states and territories. The analysis of rural/regional versus metropolitan events reflect this, revealing distance and time to ED to be further and longer for rural/regional events. This finding is expected as within the metropolitan environment there may be more EDs than in the rural/regional environment. From this finding three core issues are highlighted. First, in-event health services (especially for rural/regional events) may need to be more reliant on in-event health care. Second, the further distance and travel time to and from events could mean that ambulance resources are utilised for a longer period of time, which may impact not only financially to the ambulance service, but on service provision to the existing local community. Third, in the rural environment the closest hospital ED is likely to receive all patients from the one

event, whereas in metropolitan areas, patients can be dispersed among a number of EDs. Further research is required that adjusts for aspects such as age, gender, illness severity and event type, to identify if outcomes are worse for people attending events in rural/regional locations who require transfer to an ED.

Given that the authors were not able to obtain the number of participants attending the events included, it is difficult to further determine the impact on emergency healthcare services. In a systematic review performed by Ranse et al (6) investigating the health service impact from events, all studies reported that at least one patient was transferred to hospital from each event. The transfer to hospital rate varied between 0.0035/1000 and 0.99/1000 (3). Ranse et al (4) using a single case study from an outdoor music festival held in Canberra, Australia, found that 28% of those who required in-event care from healthcare professionals were transferred to hospital with two of these people requiring admission; one to the intensive care unit. Hutton et al (15) examined 26 outdoor music festivals in Australia, finding a large percentage (n=571, 9.1%) of persons seeking in-event care were referred to hospital, yet there is no further information on the impact these transfers had on local EDs.

This study demonstrates that there is an expectation that once in-event care is extended beyond its capabilities, existing ambulance services are used to transport patients from an event to the ED. What remains unknown is how this use of ambulance services and EDs impacts on the existing local community and the broader hospital in terms of admission rates and other hospital services.

Study limitations

Using the NSW Destination website meant that only events available on that site, in that state of Australia, during the 2017 calendar year were included in this study. A peak in events was noted in November and December, this was likely related to the timing of data collection and the availability of listings on the website. Events in other months or years may have different frequencies and locations. Additionally, while data scraping was a useful way of finding the frequencies, type and locations of events, the number of people attending each event was indeterminable, limiting inferences regarding the possible impact on emergency health services and ability to determine the type of event (as mass gathering or otherwise).

Conclusion

Existing literature indicates that for most events, some people will require transport to a hospital ED. This research has identified that the majority of events held in NSW are within a relatively short distance and time of tertiary care.

Further research is required to articulate the financial and workload implications for health services that accounts for this information. More importantly there is a need to link patient data collected at events to admissions in EDs to develop an understanding of how EDs and health services are impacted by these events.

Conflict of interest

The authors report no conflicts of interest. Each author of this paper has completed the ICMJE conflict of interest statement.

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