Minimum Data Set for Mass-Gathering Health Research and Evaluation: A Discussion Paper

Jamie Ranse, RN, FRCNA, BN, GCertClinEd, GCertClinEpi, MCritCarNurs;[1,2]
Alison Hutton, RN, Dip of Ap. Sci(Nsg), BN, MN, PhD, MRCNA[2]

1. Faculty of Health, University of Canberra, Canberra, Australian Capital Territory, Australia
2. School of Nursing and Midwifery, Flinders University, Adelaide, South Australia, Australia

Correspondence:
Jamie Ranse, RN, BN, MCritCarNurs
Faculty of Health
University of Canberra
Canberra, Australia, ACT, 2601
E-mail: jamie@jamieranse.com

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Abbreviations:
MUR: medical usage rate
PPR: patient presentation rate
TTHR: transportation to hospital rate

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Abstract

This paper discusses the need for consistency in mass-gathering data collection and biomedical reporting. Mass gatherings occur frequently throughout the world, and having an understanding of the complexities of mass gatherings is important to inform health services about the possible required health resources. Factors within the environmental, psychosocial and biomedical domains influence the usage of health services at mass gatherings. The biomedical domain includes the categorization of presenting injury or illness, and rates such as patient presentation rate, transferred to hospital rate and referred to hospital rate. These rates provide insight into the usage of onsite health services, prehospital ambulance services. and hospital emergency department services.

Within the literature, these rates are reported in a manner that is varied, haphazard and author dependent. This paper proposes moving away from an author-dependent practice of collection and reporting of data. An expert consensus approach is proposed as a means of further developing mass-gathering theory and moving beyond the current situation of reporting on individual case studies. To achieve this, a minimum data set with a data dictionary is proposed in an effort to generate conversation about a possible agreed minimum amount and type of information that should be collected consistently for research and evaluation at mass gatherings. Finally, this paper outlines future opportunities that will emerge from the consistent collection and reporting of mass-gathering data, including the possibility for meta-analysis, comparison of events across societies and modeling of various rates to inform health services.

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Introduction

Mass gatherings such as soccer games, pageants and concerts occur frequently throughout the world. Commonly, mass gatherings impact health services such as onsite health services, ambulance and prehospital emergency medical services, hospital emergency departments, and acute medical care services including operating theatres. Furthermore, mass gatherings are important sites to research health behaviors because they help researchers to understand how to manage large numbers of people in temporary environments.

Throughout the literature, the term "mass gathering" is defined in many ways. Commonly, the defining factor of a mass gathering is related to the number of attendees at an event, such as an event with >25,000 attendees. However, on closer examination, a mass gathering seems more complex than this. An alternative and perhaps more appropriate definition of a mass gathering is: "a situation (event) during which crowds gather and where there is the potential for a delayed response to emergencies because of limited access to patients or other features of the environment and location. This potential delay requires planning and preparation to limit (or mitigate) the hazards inherent in a mass gathering and ensure timely access to appropriate health care is available."[1] Throughout this discussion, the term attendee will be used to describe a spectator or participant of an event.

According to Arbon,[2] it has been suggested that there are three distinct domains which influence the health service presentation of patients at mass gatherings: environmental, psychosocial and biomedical. The environmental domain includes factors such as the nature of the event, availability of drugs or alcohol, venue characteristics and meteorological factors. The psychosocial domain includes the crowd mood and behavior, crowd culture, and reason for attendance. The biomedical domain includes factors such as demographics and health status of spectators and participants.

This paper aims to initiate international discussion of the need for consistency in the reporting of data from mass gatherings, while acknowledging that meaningful data collection and reporting across societies and mass gatherings needs to be flexible. The current situation of data collection and reporting is presented, along with a possible minimum data set, and future opportunities are outlined.

Current Situation

When examining the biomedical domain of the mass-gathering literature, the focus is on categorizing presenting injury or illness, reporting patient presentation rates (PPRs) or medical usage rates (MURs), and exploring other factors, such as transportation to hospital rates (TTHRs).

Injury/Illness Categorization

In the earlier mass-gathering literature, authors commonly listed a breakdown of specific types of injuries and illness of patients who presented to health services at mass gathering sites.[3,4] For example, Rose et al[5] reviewed data from six and a half years of patient presentations at college football games in the United States. However, the authors did not commonly make reference to the origin of these lists of types of injuries and illness; therefore, this patient presentation method is author dependent, and cannot be generalized to other mass-gathering events.

Another concern when presenting specific levels of data is that some categories may have larger counts than others. For example, in the comparison of injuries and illnesses from US football, baseball, and rock concerts, a large amount of presentations (69%) are termed as "medical related" with no further explanation.[3] By categorizing presentations as "medical related," the types of presentations are not well defined.

In addition, the 2002 FIFA World Cup data illustrated that "other" and "unrecorded" accounted for 24.9% and 21.7% of the total presentations respectively.[6] This unspecified data highlights how having large counts in categories such as "other" limits the insight gained at an event. While reporting at a specific category level, some reduce the number of counts in an "other" category to represent less than one percent.[4] This strategy is more useful to determine the true types of presentations.

To describe the severity of injury and illness, some authors report patient presentations in a broader, nonspecific manner. This may include categories such as minor, intermediate, and major.[7] Alternative categories have included "basic-level," "advanced-level," and "life-threatening level."[8] When these broad categories are used, the authors either provide descriptors,[7] or examples[8] of the types of injuries and illnesses included in each category. On occasion, it may be worthwhile to have a specific breakdown of injuries and illness which cannot be articulated from nonspecific levels of categorization. Broad illness and injury categories can be determined from reports of specific levels of categorization.

Patient Presentation Rates

Within the literature, terms such as "patient presentation rate" (PPR) and "medical usage rate" (MUR) are used interchangeably. These are crude rates[9] that refer to the number of attendees who present to onsite health services, in comparison to the overall number of attendees.

$$PPR = \frac{Attendees\ who\ present\ to\ the\ onsite\ health\ service}{Total\ number\ of\ attendees\ at\ the\ event}$$

The PPR provides insight into the onsite health service usage. However, PPR does not always reflect the acuity of individual patients, which may influence the onsite health service requirements. Additionally, event duration may be an important factor not explicitly considered in PPR, as PPR may vary over hours, days or weeks. In the literature, PPRs are presented as either raw numbers, or as presentations per 100, 1,000 or 10,000 attendees, with no consideration of the length of the event.

Raw numbers are used on occasion to highlight the number of patient presentations.[10,11] During the early development of mass-gathering research and evaluation, authors reported PPR per 100 attendees.[12] Following the 2002 FIFA World Cup, PPR was reported per 1,000 attendees.[6] This trend is similar to others who report per 1,000 attendees.[4] In contrast, some have reported PPR as presentation per 10,000 attendees. This paper encourages the standardizing of PPR as presentations to onsite health services per 1,000 attendees for generalizability across all events.

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

Other Rates

Transport to hospital rate (TTHR) provides insight into the prehospital ambulance or emergency medical service usage. In the literature, TTHR has been reported as a percentage,[13] as presentations per 1,000 attendees,[4] or as presentations per 10,000 attendees.[13] As variability exists in reporting TTHR, this paper encourages the standardized reporting of TTHR as presentations to onsite health services per 1,000 attendees.

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

A rate that has not been widely reported in the literature is the referral to hospital rate (RTHR). This rate includes patients who are transported to hospital (TTHR). Additionally, it includes patients who are referred to hospital and do not travel by ambulance. This rate gives some insight into the usage rate of hospital emergency departments in the vicinity of the mass gathering and the value of onsite care in regards to hospital avoidance.

$$RTHR = \frac{Attendees\ who\ are\ referred\ to\ hospital\ by\ all\ means}{Total\ number\ of\ attendees\ at\ the\ event} \times 1{,}000$$

Other Data Collection

In addition to categorizing injury and illness and highlighting various rates, some authors report on patient demographics.[3] This data provides additional insight into the "type" of patients at mass gatherings. Some authors report on the level of care, making comparisons of onsite health resources, such as number of medical officers, nurses, paramedics, volunteers, and ambulances compared to the number and type of patients treated.[14] Additionally, some authors include patient disposition, such as return to the event or transported to hospital.[3]

Minimum Data Set

In collecting biomedical data from mass gatherings, there may be an agreed-upon minimum data set.[15] A minimum data set is a

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tool that can be used to collect de-identified patient-level information for the purpose of making comparisons across societies and individual mass gatherings. Introduction of a minimum biomedical data set for mass-gathering evaluation and research is proposed. The proposed minimum data set (Table 1) was developed based on injury and illness categorizations of: (1) published authors in the mass-gathering literature; (2) the "injury surveillance national minimum data set" from the Australian Institute for Health and Welfare;[15] (3) the "event and emergency first aid minimum data set" from St John Ambulance Australia;[16] and (4) the authors' experience of undertaking research and evaluation and as practicing clinicians at mass gatherings.

In addition to presenting a minimum data set, a data dictionary with associated descriptors relating to data entry codes (Table 2) is provided to assist in differentiating among the various categories and to assist in providing consistency in reporting.

An example of a data collection tool and data entry using Microsoft Excel 2010 (Microsoft Corp., Redmond, Washington USA) is shown in Figure 1. This data includes the minimum data set in Table 1 and categories from the data dictionary in Table 2.

Future Opportunities

Currently, mass-gathering data is collected and held by individual persons or organizations undertaking research and evaluation. To enhance understanding of the complexities of mass gatherings, there is a need for consistent collection of data by individuals and organizations. Having consistent data will provide the possibility for meta-analysis of events, and comparison of similar events within different societies or the comparison of a single event over time. In addition a consistent data set would better inform health services about their possible involvement and requirements at mass gatherings and inform event managers about health risks and implications of their event.

Retrospective review of mass gathering data has been proposed as an accurate predictor of PPR and TTHR.[11,17] However, as retrospective information about a future mass gathering is not available, being able to compare similar mass gatherings in different societies, or different mass gatherings, may be sufficient to gain some insight into the likely PPR, TTHR and RTHR. Statistical analysis using odds ratios or chi-square[9] may be a first step in gaining a better understanding of some of the variances among societies and mass gatherings.

Modeling to predict health service requirements at Australian mass gatherings has been published.[18] However, these models are limited, as they were generated from Australian populations with >25,000 attendees per mass gathering, and were developed more than a decade ago. Predicting and modeling health service resources is important for health workforce strategies at mass gatherings. In predicting health resources at a mass gathering, the PPR, TTHR, and RTHR would be considered the outcome (dependent) variables. Explanatory (independent) variables from the biomedical, psychosocial and environmental domains should be included in any modeling. With a consistent data set, it can be argued that predictive modeling would more closely forecast the realities of a mass gathering.[9]

A minimum biomedical data set and agreed method of reporting rates and outcomes associated with mass gatherings will allow for the retrospective comparison of events and prospective predictive modeling of events. The information derived from retrospective comparison and predictive modeling can aid in

DEMOGRAPHICS			
Individual	Age		Years
	Gender	1	Male
		2	Female
	Reason at Event	1	Participant
		2	Spectator
		3	Official
		4	Other
Presentation	Date		dd/mm/yy
	Time		24 hour clock
	Duration of Treatment		In minutes
PRESENTATION TYPE			
		1	Injury
		2	Illness
		3	Environmental
		4	Mental health
INJURY			
Major injury		1	Fracture
		2	Dislocation
		3	Crushing injury
		4	Traumatic amputation
		5	Intracranial injury (incl. concussion)
		6	Injury to internal organ
		7	Drowning, immersion
		8	Asphyxia or other threat to breathing
		9	Burn or corrosion
		10	Electrical injury
Soft tissue		11	Sprain or strain
Wound		12	Blister
		13	Abrasion
		14	Superficial laceration
		15	Open wound
		16	Other minor wound
Face specific		17	Eye injury
		18	Dental injury
Foreign body		19	Foreign body in external eye
		20	Foreign body in ear canal

Table 1. Patient Data Set and Entry Codes *(continued)*

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		21	Foreign body in nose
		22	Foreign body in respiratory tract
		23	Foreign body in alimentary tract
		24	Foreign body in genitourinary tract
		25	Foreign body in soft tissue
		26	Foreign body, other/ unspecified
Review		27	Review of injury
Multiple injuries		28	Injuries of more than one 'nature'
INJURY LOCATION			
Location		1	Head
		2	Face
		3	Neck
		4	Spine
		5	Back
		6	Thorax
		7	Abdomen
		8	Pelvis
	Limb	9	Shoulder
		10	Upper arm
		11	Elbow
		12	Forearm
		13	Wrist
		14	Hand
		15	Thigh
		16	Knee
		17	Lower leg
		18	Ankle
		19	Foot
		20	Multiple locations
ILLNESS			
Major	Cardiac	1	Cardiac arrest
		2	Chest pain
		3	Other
	Respiratory	4	Respiratory arrest
		5	Asthma
		6	Other
	Neurological	7	Seizure
		8	Collapse, unspecified
	Gastrointestinal	9	Nausea/vomiting
		10	Diarrhea
		11	Diabetes related
Minor		12	Headache
		13	Skin/rash
		14	Fever
		15	Pain
		16	Eye
		17	Ear
		18	Faint
		19	Other
ENVIRONMENTAL			
Heat related		1	Sunburn
		2	Exhaustion
		3	Stroke
Cold related		4	Hypothermia
		5	Frostbite
Bites and stings		6	Bite or Sting
		7	Envenomation
Drug related		8	Alcohol related
		9	Substance related
		10	Both substance and alcohol related
MENTAL HEALTH			
		1	Anxiety
		2	Psychiatric disorder
OUTCOME			
Referred to further health treatment		1	Hospital by ambulance
		2	Hospital by own arrangements
		3	Referred to doctor
Not referred		4	Nil
		5	Refused treatment

Table 1. Patient Data Set and Entry Codes *(continued)*

Table 1 *(continued)*. Patient Data Set and Entry Codes

mass-gathering medical services planning. Highlighted above are some possible approaches to data analysis. The specific details of a possible data analysis plan and possible data analyses are not the focus of this paper; however, they should be taken into consideration in any overarching conversation about consistency in a minimum data set.

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DEMOGRAPHICS	
Age	Age in years at time of treatment
Gender	Male or Female
Date	The date of presentation
Presentation time	The time of presentation (using the 24 hour clock)
Duration of treatment	In minutes (time in versus time out)
Participant	Someone who is participating in the race when the injury/illness occurred
Spectator	Someone who is watching the event when the injury/illness occurred
Official	An official of the event
Other	Anyone else not included in the above
PRESENTATION TYPE	
Injury	As defined below
Illness	As defined below
Environmental	As defined below
Mental Health	As defined below
INJURY	
Select the item which best characterizes the nature of the injury chiefly responsible for the presentation, on the information available at the time it is recorded.	
Fracture	Excludes tooth
Dislocation	Includes ruptured disc, cartilage, ligament
Crushing injury	
Traumatic amputation	Includes partial amputation
Intracranial injury	Includes concussion
Injury to internal organ	
Drowning, immersion	
Asphyxia or other threat to breathing	Excludes drowning
Burn or corrosion	Excludes eyes
Electrical injury	
Sprain or strain	
Blister	Simple friction wound
Abrasion	
Superficial laceration	
Open wound	Not superficial
Other minor wound	
Eye injury	Excludes foreign body in external eye, includes burns
Dental injury	Includes fractured tooth
Foreign body in external eye	

Table 2. Data Dictionary to Supplement Minimum Data Set and Entry Codes *(continued)*

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Foreign body in ear canal	
Foreign body in nose	
Foreign body in respiratory tract	Excludes foreign body in nose
Foreign body in alimentary tract	
Foreign body in genitourinary tract	
Foreign body in soft tissue	
Foreign body, other/unspecified	
Review of injury	A representation for the review of an injury or wound
Multiple Injuries of more than one 'nature'	Indicate 'multiple injuries' as the primary presentation, and include the specific injuries as secondary, tertiary and so on.
INJURY LOCATION	
Head	Excludes face
Face	Excludes eyes
Neck	
Spine	
Back	
Thorax	
Abdomen	
Pelvis	Includes perineum, genital area and buttocks
Shoulder	
Upper arm	
Elbow	
Forearm	
Wrist	
Hand	Includes fingers
Thigh	
Knee	
Lower leg	
Ankle	
Foot	Includes toes
Multiple locations	Involving more than one bodily location
ILLNESS	
Cardiac arrest	No pulse present at some time related to presentation
Chest pain	Chest pain likely to be cardiac in origin
Cardiac other	Any other cardiovascular presentation
Respiratory arrest	
Asthma	Shortness of breath with history of asthma

Table 2. Data Dictionary to Supplement Minimum Data Set and Entry Codes *(continued)*

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Other	Other respiratory problems, such as hyperventilation
Seizure	
Collapse	Patient presenting having collapsed with sustained alterations to vital signs
Nausea/vomiting	Patient presenting vomiting, having vomited or feeling like vomiting
Diarrhea	Suspected gastrointestinal cause
Diabetes related	Presentation relating to diabetic management
Headache	Simple headache with no neurological changes
Skin/rash	Any skin reaction
Fever	Any presentation for management of a fever
Pain	Presentations for management of pain that is not resultant from a recent injury
Eye	Presentation for eye irritations, foreign bodies in eye, and sore eyes
Ear	Presentations for foreign bodies in ear and ear ache
Faint	A patient having collapsed who fully recovers to normal
Other	Any other presentation for a significant medical reason, for example anaphylaxis
ENVIRONMENTAL	
Sunburn	Redness and tenderness of skin resulting from sun exposure
Exhaustion	Heat injury due to extreme heat and excessive sweating
Stroke	Exposure to intense heat, associated with high fever and collapse
Hypothermia	Extreme exposure to the cold
Frostbite	Frostbite related to extreme exposure to the cold
Bite or sting	Insect bites or stings. Animal bites, such as dog bite, are considered wounds
Envenomation	Snake, spider or sea creature envenomation
Alcohol related	Presentations that primarily related to the consumption of alcohol
Substance related	Presentations that primarily related to the consumption of prescription or non prescription substances e.g. overdose
Both substance and alcohol related	Presentations that primarily related to the consumption of a combination of alcohol and prescription or non prescription substances
MENTAL HEALTH	
Anxiety	Presentation related to anxiety or panic attack, not necessarily psychiatric in nature or substance related
Psychiatric disorder	Psychiatric or mental health related presentations
OUTCOME	
Hospital by ambulance	Immediate ongoing medical assistance required - ambulance transport to hospital
Hospital by own arrangements	Medical assistance or intervention at a hospital required – ambulance transport not required
Referred to doctor	Referred to own general practitioner for non-urgent follow-up
Nil	Person discharged, not required to seek medical assistance
Refused treatment	Patient does not want treatment

Table 2 *(continued)*. Data Dictionary to Supplement Minimum Data Set and Entry Codes

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No	Age	Gender	Date	Time	Rx Dur	Type	Injury	Inj Loc	Injury	Inj Loc	Injury	Inj Loc	Illness	Enviro	MH	Out
1	41	1	20/10/2004	1010	8	1	11	19								0
2	32	1	20/10/2004	1055	10	1	25	14								0
3	25	1	20/10/2004	1040	5	1	14	14								0
4	36	1	20/10/2004	1210	14	1	25	17								1
5	46	1	20/10/2004	1210	5	1	25	12								0
6	39	1	20/10/2004	1215	5	1	25	14								0
7	36	1	20/10/2004	1318	40	1	11	13								0
8	32	1	20/10/2004	1345	11	1	16	16								0
9	30	1	20/10/2004	1410	15	1	13	20								0
10	28	1	20/10/2004	1432	11	1	28	20	13	11	13	17				0
11	31	0	20/10/2004	1435	52	1	13	16								1
12	34	1	20/10/2004	1435	15	1	13	20								0
13	23	0	20/10/2004	1455	75	1	28	20	14	14	19	2				1
14	32	1	20/10/2004	1505	6	1	11	13								0
15	33	1	20/10/2004	1530	10	1	12	19								0
16	30	1	20/10/2004	1545	18	0							5			0
17	44	1	20/10/2004	1620	5	1	13	17								0
18	23	1	20/10/2004	1625	15	1	28	20	13	10	13	15				0
19	24	0	20/10/2004	1630	20	1	28	20	13	15	15	12				0
20	42	1	20/10/2004	1634	6	0							12			0
21	28	0	20/10/2004	1654	11	1	28	20	13	12	14	17				1

Figure 1. Example of Data Collection Tool
Abbreviations: Enviro, environmental; Inj Loc, injury location; MH, mental health; Out, outcome/disposition; Rx Dur, duration of treatment

Conclusion

This paper has highlighted the research and evaluation of the biomedical domain of mass gatherings as being varied, haphazard and author dependent, particularly in terms of data collection and reporting. This is illustrated in terms of the various data collection and reporting of patient categories, rates and other biomedical-related information. It is proposed that a minimum data set and data dictionary be developed to begin discussion of the need for consistency in collecting and reporting data. Moving to a more expert consensus approach, and beyond a haphazard, author-dependent approach, will allow development of mass-gathering health service research and theory.

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