SPECIAL REPORT

Measuring the Masses: A Proposed Template for Post-Event Medical Reporting (Paper 4)

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Keywords: case reporting; data modeling; mass gathering; mass-gathering health; mass-gathering medicine

Abstract

Background: Standardizing and systematizing the reporting of health outcomes from mass gatherings (MGs) will improve the quality of data being reported. Setting minimum standards for case reporting is an important strategy for improving data quality. This paper is one of a series of papers focused on understanding the current state, and shaping the future state, of post-event case reporting.

Methods: Multiple data sources were used in creating a lean, yet comprehensive list of essential reporting fields, including a: (1) literature synthesis drawn from analysis of 54 post-event case reports; (2) comparison of existing data models for MGs; (3) qualitative analysis of gaps in current case reports; and (4) set of data domains developed based on the preceding sources.

Findings: Existing literature fails to consistently report variables that may be essential for not only describing the health outcomes of a given event, but also for explaining those outcomes. In the context of current and future state reporting, 25 essential variables were identified. The essential variables were organized according to four domains, including: (i) Event Domain; (ii) Hazard and Risk Domain; (iii) Capacity Domain; and (iv) Clinical Domain.

Discussion: The authors propose a first-generation template for post-event medical reporting. This template standardizes the reporting of 25 essential variables. An accompanying data dictionary provides background and standardization for each of the essential variables. Of note, this template is lean and will develop over time, with input from the international MG community. In the future, additional groups of variables may be helpful as "overlays," depending on the event category and type.

Conclusions: This paper presents a template for post-event medical reporting. It is hoped that consistent reporting of essential variables will improve both data collection and the ability to make comparisons between events so that the science underpinning MG health can continue to advance.

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Introduction and Background

The Problem

All around the world, as mass gatherings (MGs) take place, health outcomes for many events have been reported and analyzed.[1-4] Currently, there is an imperfect understanding of which factors influence health outcomes at MGs, both at the individual and population levels, and how the level of the supporting health services affects these outcomes.[5] Because standardized data reporting does not currently exist, the ability to make meaningful comparisons between similar and dissimilar MGs demonstrating radically different health outcomes is challenging due to heterogeneity in the definitions and variables reported in the literature.

Abbreviation:
MG: mass gathering

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A Partial Solution

Improving the understanding of health outcomes requires the standardization of post-event medical reporting. Case reports, case series, and field reports all have a recognized role to play in advancing knowledge, and many health care specialties have recommended specific standards for reporting as an important strategy for improving data collection.[6-13] In the context of MGs, standardized reporting has been discussed for years, with several authors having argued that this strategy will improve the quality of case reports.[14-18] Setting minimum standards for case reporting is recognized as an important strategy for improving data quality.[3,6,7,9,13]

The goal of this project was to create and launch a lean, practical, efficient, and effective post-event medical reporting template.

Research Questions: What are Essential Variables for Post-Event Medical Reporting?

Also of interest to the research team, from a knowledge translation perspective, was understanding the role of professional journals in advancing the science underpinning MG medicine.

Methods

Literature Review

A decade (January 2009-December 2018) of MG case reports (n = 54) were analyzed.[19-71] In brief, the authors analyzed case reports published in two peer-reviewed journals: *Prehospital and Disaster Medicine* and *Current Sports Medicine Reports*, with the search strategy outlined in Turris, et al.[62] An additional literature search was undertaken looking for existing models describing data reporting methods for MG health outcomes. Existing models were identified, compared, and summarized.

Template

The template proposed in the present paper is based on data from an earlier study by Turris, et al detailing the *current state* of post-event medical reporting.[62] Both quantitative and qualitative methods were employed. Analysis of the data from that study led to a deeper understanding of what might constitute systematic, rigorous, lean data collection and analysis for a soon to be realized *future state*. Specifically, the authors identified the lack of well-developed conceptual models to underpin and inform data collection vis a vis clinical presentations, disposition, and health outcomes. Initial conceptual models supporting the proposed publication template are published elsewhere.

The goal of this project was to create a lean, practical, efficient, and effective post-event medical reporting template, containing only *essential* variables that might aid in rigorous comparison between events. Note that the astute reader will argue that the definition of "essential" could be argued a number of different ways, depending on capacity, event type, and many other factors. The authors acknowledge that the proposed template is version 1.0 and will evolve over time with discussion, debate, and collaboration amongst members of the international MG community. As well, authors would be at liberty to include additional detail as appropriate.

Based on the data domains, essential variables were selected for the template using the following criteria:

1. Reported in peer-reviewed MG literature;
2. Highly relevant to understanding the *basic context* of the event;
3. Highly relevant to understanding the *risk level* of the event;
4. Highly relevant to understanding the *capacity* of the event to manage patients on-site; and
5. Captured an important concept related to the *impact of events on local health services* infrastructure.

Two examples of how variables were screened for inclusion/exclusion were as follows. "Gender" is an oft-cited data point in the MG literature; however, based on a review of the 54 case reports, in none of those papers did gender offer any insights into health-related outcomes for events. Although gender is important in comparing populations of attendees or participants, it was judged not to be *essential* to understanding the health outcomes of a given event. In contrast, temperature was both oft-cited and essential to understanding health outcomes, and so temperature was included in the template.[20,27,70]

Data Dictionary

A data dictionary is a living document that provides a list of variables along with clear, standardized definitions, moving users away from inconsistent naming conventions and variations in data reporting. The primary purpose of a data dictionary is to provide a "controlled vocabulary" that reduces inaccuracies and the variability of the data.[72] Having a data dictionary imposes standards for reporting and can produce data that is comparable across multiple users.[73,74] The data dictionary was assembled by the research team with the aid of documents and resources from the following sources, and those sources are cited in the findings section of the manuscript:

- World Health Organization (WHO; Geneva, Switzerland);
- Government publications;
- Published peer-reviewed literature;
- Policy statements from professional organizations;
- Grey literature; and
- Expert opinion.

Results

Template

Based on the four data domains developed (ie, Event, Hazard and Risk, Capacity, and Clinical Domains) and the screening criteria described above, 25 essential variables were identified as most relevant for post-event case reporting (Table 1).

Data Dictionary

The following abbreviated data dictionary provides the background required for reporting on the 25 essential variables (Table 2[75], Table 3[49,53,65,76-91], Table 4[19,28,33,65,92-96], and Table 5[65,97,98]).

Discussion

Setting the Stage

The authors of the present paper have argued that a post-event medical reporting template should contain only essential variables. The alert reader may be wondering why the template proposed above is perhaps more comprehensive than the contents of many published case reports. For example, the current template contains multiple variables that address hazard and risk and focuses on variables that provide measures of capacity (for on-site and community medical services). This was a deliberate choice. As argued by Aitsi-Selmi, et al, influencing the health outcomes associated with MGs requires a comprehensive approach, looking at upstream factors that contribute to outcomes, rather than focusing *solely* on the outcomes.[1] Turris, et al took a similar position arguing that a broad understanding

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	Domain	Checklist Item	Abbrev
	Event Domain		
1	Event Demographics	Identify a category/type for the event: sport, music, political, religious, other (specify); marathon, triathlon.	
2		Number of attendees and/or participants. Include source of this number (eg, media, ticket sales).	
3	Event Geography	Provide details about geography (eg, length of course; wilderness versus urban; indoors versus outdoors versus mixed; bounded versus unbounded).	
4	Event Climate/Weather Conditions	Report the minimum/maximum temperatures and min/max humidity for the event (Celsius).	CEL
5	Event Population	Primary (estimated) age group (eg, children, youth/young adults, adults, seniors).	
	Hazard & Risk Domain		
6	Risk per Event	Brief narrative on event culture.	
7		Brief narrative on event history.	
8		High-risk activities embedded in the event.	
9	Risk per Crowd Dynamics	Brief narrative on anticipated risk behaviors.	
10	Risk per Built Environment	Physical/ergonomic hazards; Psychological hazards; Biological hazards; Mechanical hazards.	
11	Event Timing	Describe the duration of the event (eg, number of hours, time of day, number of days, potential for surge).	
	Capacity Domain		
12	Event Medical Team Capacity	Highest scope of practice for on-site medical team.	ACP, EMR, FR, LPN, MD, NP, PA, PCP, RN, RPN, SFA
13		Composition of on-site medical team.	ACP, EMR, FR, LPN, MD, NP, PA, PCP, RN, SFA
14		Clinical protocols in place during the event (Y/N).	
15	Event Medical Capacity – Equipment & Supplies	Emergency interventions available on-site.	
16	Host Community Resources	Distance from event to nearest hospital/ estimated travel time in minutes.	
17	Post-Event Capacity Analysis	Assessment of the degree of alignment between planned response and actual response.	
	Clinical Domain		
18	Patient Demographics	Total number of patient encounters.	TP
19		Average age of patients.	
20	Clinical Demographics	Patient Presentation Rate.	PPR
21		Types of patient presentations according to chief complaint.	
23		Percentage of patients seen by on-site medical and referred to hospital.	PPST
24		Number of patients transferred to hospital.	TTHR
25		Ambulance transfer rate.	ATR

Table 1. Essential Variables for Post-Event Medical Reporting
Abbreviations: ACP, advanced care paramedic; ATR, ambulance transfer rate; CEL, Celsius; EMR, emergency medical responder; FA, first aid; FR, first responder; HLC, higher level of care; LPN, licensed practical nurse; MD, medical doctor; NP, nurse practitioner; PCP, primary care paramedic; PPR, patient presentation rate; PPST, percentage of patients seen and transferred to hospital; RN, registered nurse; RPN, registered psychiatric nurse; PA, physician assistant; SFA, standard first aid; TP, total patients; TTHR, transfer-to-hospital rate.

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Data Dictionary	Definition/Example
Category of Event	The category of an event at a macro level; the classification of event, including each of the following broad categories: sport, music, political, religious, and other.[75] *Example:* *This mass gathering was classified as a sporting event.*
Type of Event	A sub-section of the category of an event, the event type identifies the specific kind of event. *Example:* *This event, in the sport category, was a triathlon.* *This event, in the political category, was a state funeral.*
Number of Attendees/Participants	The number of attendees/participants at a given event. This is almost always an estimate and may be drawn from the following sources: ticket sales, gate counts, media reports, capacity of venue seats, and other miscellaneous sources. The number of attendees/participants ideally includes the athletes/participants, spectators, vendors, volunteers, and event staff (eg, police, security, medical). Identify the source of the estimated attendance for your event. Report attendance/participation on a daily basis (per 24-hour period from 0600 each event day). *Example:* *According to ticket sales, the estimated attendance for this one-day music festival was 31,541 people. The number of event staff on-site was estimated to be approximately 2,000 as reported by the event producer.*
Event Geography	Brief details about the geography of the event. Provide data about the physical and geographical aspects of the event such as indoor/outdoor, wilderness versus urban, and bounded versus unbounded.
Event Climate/Weather Conditions - Maximum Humidity	The maximum relative humidity is reported as a percentage (%). Retrieve data about the local relative humidity from a reliable weather source such as a national weather service. *Example:* *The maximum relative humidity during the event was 93%.*
Event Climate/Weather Conditions - Minimum & Maximum Temperatures	Minimum and maximum local temperatures are reported in degrees Celsius per a reliable weather source such as a national weather service. *Example:* *The minimum temperature was 18°Celsius and the maximum temperature was 31°Celsius over the course of the event.*
Event Population	Provide descriptors about the actual event attendees/participants such as age group (ie, children, youth/young adults, adults, seniors) and social unit (eg, couples, families, friend groups). *Example:* *Attendees for this event were all ages and organized in family groupings.*

Table 2. Data Dictionary for Event Domain

of the context of an event category, event type, and the characteristics of a specific event are necessary to interpret and understand health outcomes.[62]

A reporting template, incorporating carefully selected variables, can be both lean *and* comprehensive. Of note, the authors are proposing a standardized set of 25 variables be collected for every event, *at a minimum*. If additional variables are provided, that decision should rest with the authors of a given event report. For example, any unique occurrences such as a stage collapse, fire, or the total number of fatalities (if applicable) would also be important to report at the discretion of the research team.

Planning for Data Collection

Each of the 25 essential variables listed in the template are relatively easy to report if some planning with regard to data management is incorporated in the pre-event planning phase. Creating a plan for collecting each of the 25 variables will improve the chances that each data point will be addressed after the event is completed. For example, consider documentation of patient encounters. If there is no space on the form to enter the patient's age or arrival/discharge times, clinicians and researchers will be unable to report on those specific variables. Alignment between the collection of encounter data and reporting data is therefore key.

The current proposed template for post-event medical reporting supports written, peer-reviewed case reports. However, in the near future, the authors hope to develop an international, online Registry for MGs. This will reduce one barrier to an exchange of knowledge that is created by the length of time it takes to move a project from conception, to analysis, to writing, and then to peer review and publication. This process can result in a delay of one or more years. It is hoped that the creation of a Registry, based on earlier work that confirmed proof of concept, will eliminate that delay.[99]

Retrievability of Reports

Once pre-event planning has occurred, the event has taken place, and the data have been analyzed, publication is the final step. The authors propose that all clinicians and researchers consider carefully when choosing a title for submitted manuscripts, to improve retrievability. The words "case report" and the type of event should

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Data Dictionary	Definition/Example
Event Culture	As defined by the World Health Organization, culture includes a consideration of such things as customs, values, beliefs, behaviors, and practices. The culture of an event speaks to tone, mood, energy level, motivation of attendees, and a variety of other factors.[76-79] *Example:* *Consider the difference in event culture between a FIFA event (rivals), a five kilometer walk to end breast cancer, and a political protest.*
Event History	Event history is what happened at a given event in previous iterations, both per event category and for the specific event (eg, what happens at marathons in general; what happens at *this* marathon in particular).[80-82] *Example:* *Looking back over five years, this event has consistently had issues with extreme weather, which resulted in dozens of cases of hyperthermia.*
Hazard/High-Risk Activity Embedded in the Event	A hazard is a circumstance, agent, or action with the potential to cause harm. A hazard in the present context is any event-related hazard embedded in the normal operation of a mass gathering that presents an increased level of risk for attendees/participants, including (but not limited to) the following examples: the use of pyrotechnics or fire, high-density crowd conditions. *Example:* *The use of fireworks presents a hazard in the context of drought conditions.*
Risk Behaviors per Crowd	Any activity that might be anticipated to be undertaken by event attendees/participants, which might confer an increased risk of illness, injury, or other negative health outcomes.[49,53,86] *Example:* *There was an expectation that attendees would use recreational drugs while on festival grounds.*
Risk per Built Environment	Risks inherent in the physical environment of a given mass gathering, whether attributable to physical/ergonomic hazards such as obstacles embedded in an obstacle adventure course, psychological hazards such as crowd dynamics, biological hazards such as high particle counts (smog) or elevated pollen counts, and/or mechanical hazards such as the presence of motorized vehicles (eg, airplanes), mixing pedestrians and motorized vehicles, or the presence of large animals.[65,87-91] *Example:* *Felling a tree and then riding the log down the side of a mountain creates some inherent risk for event participants and spectators related to the physical environment.*
Event Timing	Provide data on the duration of the event as appropriate (eg, number of hours for an afternoon event, number of days for an event of several days duration, number of hours per day). *Examples:* *The event gates opened at 0900 and closed at midnight for each of the 14 days (15 hours each day; 210 hours in total).*

Table 3. Data Dictionary for Hazard and Risk Domain

appear in the title (eg, "Case Report on an Obstacle Adventure Course in a Hot Climate"). Similarly, in order to improve retrieval, the authors propose two to five keywords/phrases that identify areas covered in the case report; "mass-gathering medicine" and "mass-gathering health" should be included as keywords, as well as the event type (eg, "obstacle adventure course," "triathlon").

Challenges

Although the ultimate desired result is an internationally standardized case reporting template for post-event medical case reports, standing in the way of achieving this result lie a myriad of challenges. At the macro level, launching a standardized reporting template depends on the willingness of researchers and clinicians, as well as journal editors, to support and operationalize standardized reporting. This challenge has been met in other contexts within health sciences.[6-9,100]

In terms of public policy, standardized reporting would benefit local governments and decision-making authorities because the quality of the data would improve. However, at this time, local governments are seeking to understand how to support community events while preserving local services for the host community. Attention is not currently being directed toward standardized reporting of outcomes. Advocacy at the level of local, state, and federal governments might advance the adoption of standardized reporting.

As discussed above, the time it takes to move a study from the conceptual stage to publication is considerable.[101] The time it will take to grow, evolve, and improve a post-event reporting template, based on feedback from the international community, will require additional time and resources. And, it may not be possible to engage a fully representative sample of the MG community.

At the meso level, challenges related to data collection and analysis, in the absence of a partnership with a research team, may be solvable if the reporting template is stream-lined and straightforward. And at the micro level, as discussed above, medical directors will need to consider and embed the collection and management of data within event medical plans

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Data Dictionary	Definition/Example
Highest Scope of Practice for On-Site Medical Team	On-site medical team is defined as the team deployed specifically for a given event. Scope of practice in this context can be described vis a vis the scope of practice of the most qualified member of the team.[33,92] *Example:* *The provider with the most comprehensive scope of practice was an emergency physician.*
Composition of On-Site Medical Team	The number of medical team members, reported according to professional designation.[19,33] *Example:* *The event medical team was composed of five first aid attendants, three paramedics, two registered nurses, and an emergency physician.* Note: For larger teams, reporting in a table may be a simpler format.
Clinical Protocols	Clinical protocols in the context of mass gatherings identify procedures to follow in the case of certain clinical presentations. Protocols may be synonymous with clinical guidelines and codes of practice.[93-95] *Example: "Clinical guidelines for cardiac arrest, eye injuries, flash burns, abdominal pain, . . . poisoning, seizures, and sexual assault were developed and provided to on-site medical unit team members prior to the start of the event."*[66p.597]
Emergency Interventions Available On-Site	A list of procedures or groups of procedures able to be carried out by the on-site medical team to treat life threatening conditions.[28] *Example: The medical team was capable and equipped to provide intravenous fluids and endotracheal intubation.* Note: A table format is useful to display a list of interventions.
Distance and Time from Event to Nearest Hospital	The distance between the event and the nearest hospital, measured in kilometers, including an estimate of the amount of travel time in minutes. Google Maps is available internationally and could be a source for this data point.[96] *Example: The event was held 18 kilometers away from the nearest hospital, with an average travel time of 19 minutes by private vehicle.*[65]
Post-Event Capacity Analysis	Taking a retrospective view, capture the degree to which the planned response was appropriate (or not). *Examples:* *We were not prepared for the surge in patient presentations that occurred five hours into the event. Our staff worked 12-hour shifts and we had no people assigned to cover surge conditions.* *OR* *We did not anticipate the dry conditions that created a surge in asthma presentations and so we had not stocked enough bronchodilator medication.*

Table 4. Data Dictionary for Capacity Domain

because a lack available rigorous data (eg, attendance numbers for a given event) is a barrier to advancing the science underpinning MG health.

Building for the Future

The post-event medical reporting template will continue to evolve. The next phase of this project will involve seeking input from the international MG community, after clinicians and researchers have had a chance to apply the template. With regard to the data dictionary, there should be a plan for constant evolution and updating.[72]

Limitations

The template presented in this paper has not yet been vetted by the international MG medicine community. It is the hope of the authors that the template will be in constant evolution in the next decade, becoming more usable and being refined as the understanding of events, and the health outcomes of events, becomes more sophisticated.

The authors look forward to collaborating with colleagues with the goal of improving the current version (1.0).

Conclusions

The goal of this project was to create a lean, practical, efficient, and effective post-event medical reporting template. The authors of this paper propose moving toward a future state for post-event medical case reporting. That future state will, at a minimum, involve standardization of data collection and analysis. The development of such a reporting template is consistent with the goal of improving data quality and allowing comparison between and among events.

The proposed template will standardize the reporting of 25 essential variables. An accompanying data dictionary provides background for each of the essential variables. Of note, this template will develop over time, with input from the international MG community. In the future, additional groups of variables may be helpful as "overlays," depending on the event category and type, and could be developed in the future.

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Data Dictionary	Definition/Example
Total Number of Patient Encounters (TP)	The sum of patient encounters, in any capacity or duration of time, assessed and treated by the on-site medical team, without regard for individuals who may have presented for care on more than a single occasion. *Example:* *The total number of patient encounters for the present marathon was 1,320.*
Average Age of Patient Seen	The mathematical mean age of the patient population presenting to the medical team. Calculated taking the sum of all the patient ages and dividing by the corresponding number patients seen. *Example:* *The average age of the patients seen at this event was 26 years old (n = 4).*
Patient Presentation Rate (PPR)	The number of patients seen by the on-site medical team, per 1,000 participants/attendees. Calculated by taking the total number of patient encounters and dividing them by the most reliable total attendance/participation number, multiplied by 1,000 and then written numerically.[65] *Example:* *The PPR for this event was 18/1,000.*
Analysis of Illness and Injury Profile by Presenting Complaint	The categorization of presenting conditions to the on-site medical team by using body systems (eg, cardiac, neurologic, dermatologic) and then specifying by presenting diagnosis (eg, myocardial infarction, seizure, dermatitis) or presenting complaint if diagnosis is unknown/unattainable. *Example:* *The most common presentations at the electronic dance music concert were cardiac (n = 10; 20%), neurological (n = 8; 16%), and respiratory (n = 6; 12%) with the most common presenting diagnosis of atrial fibrillation (n = 6; 12%), serotonin syndrome (n = 4; 8%), and asthma (n = 4; 8%).*
Percentage of Patients Seen and Transported (PPST)	The proportion of patients who were transferred to hospital, per 100 patients seen by medical services. Calculated by taking the total number of patients transferred to the hospital by ambulance and non-ambulance measures and divided by the total number of patient encounters for the event, then multiplied by 100 and presented as a percentage.[65] *Example:* *The PPST for the event was 2.12%.*
Transferred to Hospital Rate (TTHR)	The proportion of patients who were transferred to hospital, per 1,000 patients seen by medical services. Calculated by taking the total number of patients transferred to the hospital by ambulance and non-ambulance measures and dividing them by the most reliable total attendance/participation number, then multiplied by 1,000.[65] *Example:* *The TTHR for the event was 0.25/1,000.*
Ambulance Transfer Rate (ATR)	The proportion of attendees requiring transfer-to-hospital by ambulance specifically, per 1,000 attendees. Calculated by taking the number of patients transferred to the hospital by ambulance dividing them by the most reliable total attendance/participation number, multiplied by 1,000.[65]An ambulance is defined as a vehicle legally permitted to transport a patient from the site of illness/injury to a hospital.[97,98] *Example:* *The ATR of the festival was 0.12/1,000.*

Table 5. Data Dictionary for Clinical Narrative

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