ORIGINAL RESEARCH

Assessing the Psychosocial Elements of Crowds at Mass Gatherings

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Abbreviations:
BDO = Big Day Out
EMA = Emergency Management Australia
MUR = medical usage rate
PPR = patient presentation rate

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Abstract

Introduction: The environmental aspects of mass gatherings that can affect the health and safety of the crowd have been well described. Although it has been recognized that the nature of the crowd will directly impact the health and safety of the crowd, the majority of research focuses on crowd behavior in a negative context such as violence or conflict. Within the mass gathering literature, there is no agreement on what crowd behavior, crowd mood and crowd type actually mean. At the same time, these elements have a number of applications, including event management and mass gathering medicine. These questions are worthy of exploration.

Methods: This paper will report on a pilot project undertaken to evaluate how effective current crowd assessment tools are in understanding the psychosocial domain of a mass gathering event.

Results: The pilot project highlighted the need for a more consistent descriptive data set that focuses on crowd behavior.

Conclusions: The descriptive data collected in this study provide a beginning insight into the science of understanding crowds at a mass gathering event. This pilot has commenced a process of quantifying the psychosocial nature of an event. To maximize the value of this work, future research is required to understand the interplay among the three domains of mass gatherings (physical, environmental and psychological), along with the effects of each element within the domains on safety and health outcomes for participants at mass gatherings.

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Introduction

The environmental aspects of mass gatherings that can affect the health and safety of the crowd have been well described. These aspects include the type and duration of the event, the type and age of the crowd, and the availability of drugs and alcohol.[1,2] In 2004, Arbon proposed a conceptual model based on the idea that mass gathering health can be understood as an inter-relationship among three domains: (1) biomedical; (2) environmental; and (3) psychosocial.[3] To date, the science of mass gatherings has focused on the environmental and biomedical domains of mass gatherings. There is limited knowledge to support our understanding of the psychosocial domain, including identifiable key features and how these elements interact with one another.

Although it has been recognized that the nature of the crowd will directly impact the health and safety of the crowd,[4] the majority of research focuses on crowd behavior in a negative context such as violence or conflict.[5,6] Within the mass gathering literature, there is no agreement on what crowd behavior, crowd mood and crowd type actually mean. At the same time these elements have a number of applications, including event management and mass gathering medicine.[7] Even though crowd type, mood and behavior are only part of the psychosocial domain, these questions are worthy of exploration. This paper will report on a pilot project undertaken to evaluate how effective two crowd assessment tools are in gaining an understanding of the psychosocial domain of a mass gathering event.

Psychosocial Domain

The mass gathering conceptual model proposed by Arbon describes the relationship between the environmental, psychosocial and biomedical domains of mass gatherings.[3]

The relationship between the environmental and the biomedical domains has been well described in regard to the effect of features such as weather, boundedness, and mobility of the crowd.[1,3,8] The key features of each domain, it is argued, combine to produce an effect on the health and safety of the participants. Often this is measured as the patient presentation rate (PPR) or medical usage rate (MUR).

An important element in the Arbon model is the potential impact of the psychosocial domain on injury and illness rates due to elements traditionally described as crowd mood and type. This potential arises from the interaction of key features of the event, and these may be amenable to interventions that reduce risk and enhance safety. There is a dearth of literature describing the psychosocial domain and how participants' behavior, mood, and motivation impact their health and safety at mass gatherings. In addition, there is limited evidence of practical tools for monitoring and measuring crowd characteristics at mass gatherings.[8]

Crowd behavior is the most visible feature of the psychosocial domain of mass gatherings. Crowd behavior has been described by Zeitz *et al* as an important factor that requires assessment and monitoring to underpin management actions.[8] They argue that the term "crowd" refers to the gathering of a large number of people, and is not dependent on the reason for the gathering. Crowd type is defined as a descriptor of the societal subculture of a crowd; crowd mood is a descriptor of crowd emotion (psychology). Both crowd type and crowd mood can determine crowd behavior. Other factors identified as key influences on crowd behavior include the nature of the activity, the motivation of the crowd, the presence and nature of security interventions, weather conditions and the density of the crowd.[1,2]

Zeitz *et al* proposed three strategies to assist in the management of crowds: (1) on-going assessment and monitoring in the pre-event and event phases; (2) identification and management of "seed" behavior; and (3) "containment" of the crowd.[7] The "practical strategies to monitor and measure crowd type and mood have received limited attention" (p. 14) in the past.[9] Two models were developed by Berlonghi (USA)[4] and Pines and Maslach (UK)[9] in the mid-1990s to assess crowd mood and crowd type.[8] Berlonghi's classification of crowd types is now promoted by Emergency Management Australia (EMA),[10] and the work of Pines and Maslach was adapted by Zeitz *et al* to analyse the effect crowd mood may have on emergency services workload at mass gatherings.[8]

Crowd Type

Crowd types have been described by event managers and researchers within the context of crowd control and behavior management. Berlonghi argues that it is important to understand crowds to ensure "competent and effective action" when managing them (p. 239).[4] He argues that without understanding the nuances of the crowd's behavior, disastrous mistakes can happen in planning and in crowd control. Berlonghi's crowd typology as recommended by Emergency Management Australia to assess crowd behavior is presented in Table 1.

Crowd Mood

Pines and Maslach developed a matrix to calculate the resources required to support a public event and use the audience profile for assessment of crowd mood.[9] Their model is two-fold. First, they use descriptors to clearly identify separate groups (for example, families, young adults, children, elderly, and rival factions). Second, they attach a rating scale (1–5) to these groups. This rating scale is used to grade the amount of verbal noise, physical movement and overall audience participation. Attached to this numerical grading is a descriptor (see Table 2).

CROWD TYPE	COMMENT
AMBULATORY	Walking, usually calm.
DISABILITY/LIMITED MOVEMENT	Crowd has limited or restricted movement. Requires additional planning.
COHESIVE/SPECTATOR	Watching specific activity.
EXPRESSIVE/REVELOUS	Emotional release, for example, community fun runs.
PARTICIPATORY	Involved in actual event, for example, pickets, marches.
AGGRESSIVE/HOSTILE	Initially verbal, open to lawlessness.
DEMONSTRATOR	Organised to some degree, for example, pickets, marches.
ESCAPE/TRAMPLING	Danger may be real or imaginary.
DENSE/SUFFOCATING	Reduction of individual physical movement.
RUSHING/LOOTING	Attempt to acquire/obtain/steal something, for example, tickets.
VIOLENT	Attacking/terrorising.

Table 1—Crowd types (Berlonghi 1995/EMA 1999)

Using this model to assess 35 events, Zeitz *et al* found that crowd mood was an important factor in predicting medical workload at a mass gathering event, although it did not significantly affect the work of other emergency services, such as police or fire and rescue.[7] The mood of the crowd has been described as an important element in determining crowd behavior.[1]

Practical strategies to monitor and measure crowd mood and type, along with the resultant behavior of a crowd, have received limited attention.[7] This study was designed to pilot a process to measure and monitor crowd behavior to assist in the assessment of the psychosocial elements of a mass gathering.

Methods

The research piloted two currently available tools, Pines and Maslach[9] and Berlonghi,[4] to assess crowd behavior at a mass gathering event in Adelaide, South Australia. Human research ethics approval was sought and received from the Flinders University Social and Behavioral Research Ethics Committee.

Setting

The setting for this pilot was the Adelaide Big Day Out (BDO) alternative music festival held during the summer of 2010. The size of the crowd attending this single- day event was approximately 35,000. The event was targeted at a younger audience (16–35 years of age) and conducted in a bounded (enclosed by a security fence), ticketed space. The environment is a mixture of indoor, outdoor, seated and standing, and

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Mood Descriptor	Score
Passive	1. Little or no talking
	2. Little or no physical movements
	3. Little or no physical contact
	4. Little or no audience participation
	5. Cooperative
Active	1. Moderate degree of talking
	2. Moderate degree of physical movements
	3. Moderate degree of physical contact
	4. Moderate degree of audience participation
	5. Cooperative
Energetic	1. Considerable degree of talking
	2. Considerable degree of physical movements
	3. Considerable degree of physical contact
	4. Considerable degree of audience participation
	5. May be episodes of violence

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Table 2—Crowd mood classification (Pines and Maslach 1993; Zeitz *et al* 2009)

Psychological domain	
Behaviour	Dancing, Singing, Sitting, Resting, Walking, Talking, Chatting, Talking on a mobile, Sending SMS, Fighting, Wrestling, videotaping, Taking pictures, Cerebrating, Socialising,
Mood	Passive Active Energetic 1. (little/moderate/considerable) talking 2. (little/moderate/considerable) physical movements 3. (little/moderate/considerable) physical contact 4. (little/moderate/considerable) audience participation 5. (little/moderate/considerable) Cooperative
Type	1. Ambulatory (walking, usually calm) 2. Disability/ Limited movement (crowd was limited or restricted movement, requires additional planning) 3. Cohesive/Spectator (Watching specific activity) 4. Expressive/Revelous (Emotional release, i.e. community fun runs) 5. Participatory (involved in actual event, i.e. pickets marches) 6. Aggressive/ Hostile (initially verbal, open to lawlessness) 7. Demonstrator (organised to some degree, i.e. pickets marches) 8. Escape/ Trampling (Danger maybe real or imaginary) 9. Dense/ Suffocating (Reduction of individual physical movement) 10. Rushing/ Looting (Attempt to acquire/ obtain/steal something, i.e. tickets) 11. Violent (attacking/ terrorizing)

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Table 3—Data collection sheet

has a variety of ground surfaces including concrete and grass. There is a mixture of shaded and enclosed areas resulting in six separate stage areas. Patrons, once they had accessed the event site, were able to move freely through the various performance venues. There were six different entertainment zones within the BDO, and data were collected from all six venues. For the purpose of this pilot, data is taken from one zone only, as this was the largest and most heavily populated stage area of the event. This area was an outdoor venue, on grass with no shade. The grassed area was partially surrounded by covered stadium-style seating.

Collection of Data

The study was interpretive, used participant observation, and was supported by a data template to collect qualitative data. Inter-rater reliability was strengthened by the use of three trained data collectors. Pre-event training included orientation to the data collection tools and peer review of trial crowd assessments. A data collection information sheet providing the descriptors in each model was used by all data collectors to ensure comprehensive and uniform data collection (Table 3).

In addition to the two tools used, the research team decided to include brief descriptions of their observations during the day. These assisted the team in interpreting the data set. Predetermined vantage points were chosen to allow for consistent observation throughout the day. Data were collected at hourly intervals, and described using the two data collection tools and additional brief descriptions.

In analyzing the data, researchers applied a simple scoring schema to each tool, attributing numerical values to each element to quantify the findings and identify any trends. For the crowd mood descriptors of Pines and Maslach, a score was applied to each element from 1–15. For example, passive (little or no talking) was assigned a score of 1, passive (little or no physical movements) a score of 2 etc., through to energetic (maybe episodes of violence) being assigned a score of 15. Berlonghi's crowd types were also assigned scores, with Ambulatory = 1, Disability Limited Movement = 2, Cohesive = 3, Expressive = 4, and so on. Finally, for the descriptive notes, a score was attributed to the behaviors observed using the classifications (active, passive, energetic) provided by Pines and Maslach. Each behavior was placed into a category; then assigned a score (Passive = 1, Active = 2, Energetic = 3).

Results

Crowd Type

The crowd type, based on the categories of Berlonghi, was predominantly ambulatory and cohesive, moving on to a more expressive and participatory crowd category as the day progressed. The scores assigned for Berlonghi's categories of crowd type are described in Table 4.

The main crowd types observed throughout the day were participatory, ambulatory, cohesive and expressive. The numerical value for these measurements shows an emerging pattern of more expressive activity (Figure 1).

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Time	Crowd Type	Brief Descriptor	Score Assigned
10 – 11	Ambulatory	Walking around venues	1
11 – 12	Ambulatory	Walking around venues	1
12 – 13	Cohesive	Watching band	3
	Ambulatory	Walking around venues	1
	Cohesive	Watching band	3
13 – 14	Expressive	Dancing	4
	Ambulatory	Walking around venues	1
	Cohesive	Watching band	3
	Expressive	Dancing	4
14 – 15	Participatory	Hands in the air	5
	Ambulatory	Walking around periphery of stage areas	1
	Cohesive	Watching band	3
	Expressive	Dancing	4
15 – 16	Participatory	Hands in the air	5
	Ambulatory	Walking around periphery of stage areas	1
	Cohesive	Watching band	3
	Expressive	Dancing	4
16 – 17	Participatory	Hands in the air	5
	Ambulatory	Walking around periphery of stage areas	1
	Cohesive	Watching band	3
	Expressive	Dancing	4

Table 4—Data collected (crowd type)

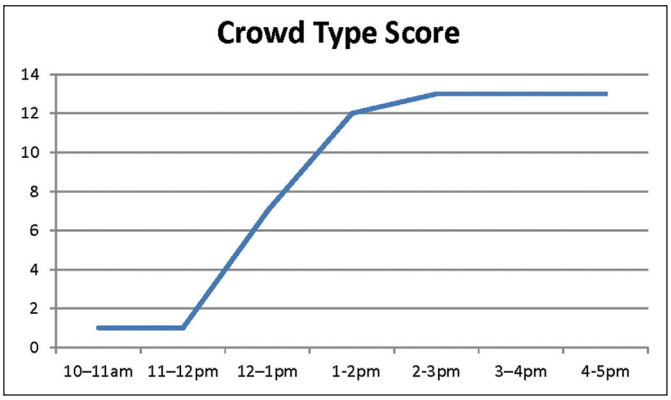

Figure 1—(Color online) Scoring of crowd type

Crowd Mood

The crowd mood descriptors of passive, active and energetic (based on Pines and Maslach) were assigned to the crowd throughout the data collection period. These findings are summarised in Table 5.

The total score for each hour indicates an increase in the incidence of energetic activity. The table shows that after midday, the crowd was primarily observed to be active and energetic. Figure 2 is a pictorial representation of increased activity that captures crowd mood.

Crowd Descriptors

The analysis of the descriptive notes showed there were recurring crowd descriptors captured that helped describe crowd patterns. These indicated, in more detail, the specific activities of patrons. Documented descriptors included time on their feet, walking around or dancing, and watching entertainment. The descriptors of behavior were used to help the researchers understand in more detail the activities occurring within the crowd (Table 6).

Using these descriptors, a score was then assigned to each behavior, using the framework provided by Pines and Maslach. Each descriptor was mapped under these headings. Each category was attributed a score as described above to give the behavior a ranking (Table 7).

As with crowd mood and type, behavioral scores were then plotted on a graph to show the changing pattern in behavior throughout the data collection period (Figure 3). Again, an increase in activity such as dancing, moshing, and the audience waving hands in the air and cohesively responding to the music is noted throughout the seven hour data collection period.

Finally, scores for all three models were plotted to identify similarities and variations (Figure 4).

Discussion

This pilot was designed to evaluate the effectiveness of current tools for measuring and monitoring crowd behavior, in an attempt to increase the understanding of the psychosocial domain of a mass gathering event.

This pilot highlighted that crowd descriptive tools such as those promoted by Pines and Maslach and Berlonghi are limited. In these tools, the language used to describe aspects of the crowd is poorly defined. For example, Pines and Maslach describe crowd mood, but in fact, physical descriptors of crowd activity such as talking or participation are used. Berlonghi's descriptors of crowd type focus on the actions of the crowd, and are not a descriptor of the type of the crowd. The collection of brief qualitative descriptors in this pilot allowed a more dynamic picture of crowd behavior to emerge, and has highlighted the influence that drug and alcohol use can have on crowd behavior. This is absent from the existing models. Finally this pilot has shown that, along with the crowd observation process, the addition of a scoring matrix to any model allows a more practical surveillance method to emerge.

Further consideration is required as to whether this data set actually captures crowd mood as distinct and different from other descriptors of the crowd's behavior. The results of this pilot support the notion that crowd "mood" and "type" are outward displays of the interplay among mood, motivation, and type. Therefore, the data collected for the psychological domain should primarily focus on crowd "behavior" as the observable and measurable element. Within the paradigm of crowd behavior, crowd mood, type and descriptors can be assessed, and then used to describe or even predict behavior.

The addition of other measurements such as the basic descriptors of crowd activities, presence of alcohol and drugs, measures of crowd density and the scoring of behaviors, may improve the data set to better illuminate the psychological domain. Data collected in this study show that crowd descriptors are useful data to collect, in addition to the crowd mood and crowd type data.

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Time	Classification	Crowd Descriptor	Score assigned
10 – 11	Passive	Little or no audience participation	4
	Active	Moderate degree of talking	6 (10)
11 – 12	Passive	Little of no audience participation	4
	Active	Moderate degree of talking Moderate degree of physical movements	6 7 (17)
12 – 1	Passive	Little of no audience participation Little or no talking Little or no physical movements	4 1 3
	Active	Moderate degree of talking Moderate degree of physical movements	6 7
	Energetic	Considerable degree of audience participation Considerable degree of physical movements	14 12 (46)
1 – 2	Passive	Little of no audience participation Little or no talking Little or no physical movements	4 1 2
	Active	Moderate degree of talking Moderate degree of physical movements Moderate degree of physical contact Moderate degree of audience participation Cooperative	6 7 9 8 9 10 (40)
2 – 3	Passive	Little or no physical movements	2
	Active	Moderate degree of talking Moderate degree of physical movements Moderate degree of physical contact Moderate degree of audience participation Cooperative	6 7 8 9 10
	Energetic	Considerable degree of audience participation Considerable degree of physical movements	14 12 (70)
3- 4	Passive	Little or no physical movements	1
	Active	Moderate degree of talking Moderate degree of physical movements Moderate degree of physical contact Moderate degree of audience participation Cooperative	6 7 8 9 10
	Energetic	Considerable degree of audience participation Considerable degree of physical movements Considerable degree of audience contact Considerable degree of talking	14 13 11 13 (92)
4 – 5	Passive	Little or no physical movements	1
	Active	Moderate degree of talking Moderate degree of physical movements Moderate degree of physical contact Moderate degree of audience participation Cooperative	6 7 8 9 10
	Energetic	Considerable degree of talking Considerable degree of physical movements Considerable degree of audience participation Considerable degree of audience contact	11 12 13 14(91)

Table 5—Data collected (crowd mood)

Observing and collecting data on crowd behaviors is useful in the comparison of crowd "mood" with crowd "type." For example, at one data collection point the crowd was observed and described as "jumping up and down" as one to the music. This mood can be described as "energetic." When this finding is cross-matched with crowd type, the crowd is more fully described as "energetic, participatory and cohesive." When the additional descriptors are added, noting the "crowd jumping up and down in unison," the data set collected becomes richer. The act of jumping up and down for an extended period of time may predict a potential for

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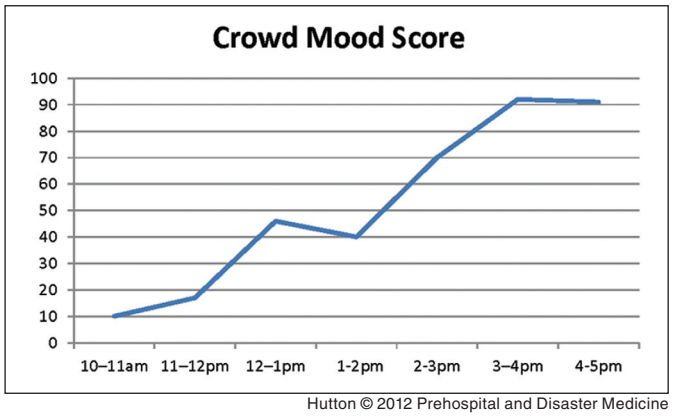

Figure 2—(Color online) Scoring of crowd mood descriptors

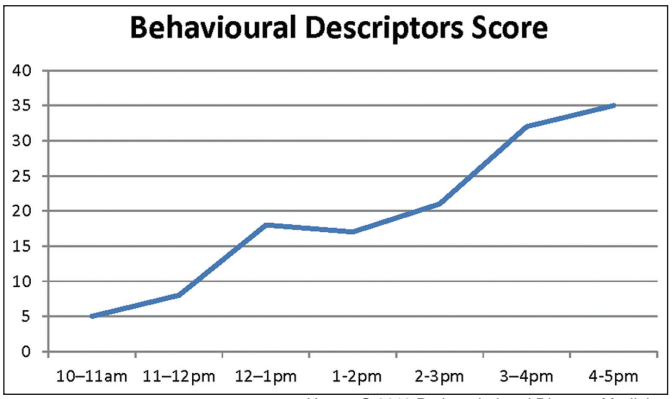

Figure 3—(Color online) Scoring of behavioral descriptors

Time	Crowd descriptors
10 – 11	• subdued, walking around • greeting each other and drinking
11 – 12	• subdued, walking around • greeting each other and drinking, talking on mobile phones and singing along to band
12 – 1	• subdued, walking around, watching band, sitting relaxing in shade • greeting each other, drinking, talking on mobile phones and singing along to band, moving to band • dancing hands in the air
1 – 2	• subdued, walking around, watching band, sitting relaxing in shade • greeting each other, drinking beer, talking on mobile phones and singing along to band, moving/dancing to band • dancing hands in the air
2 – 3	• subdued, walking around, watching band • greeting each other, drinking beer, talking on mobile phones and singing along to band, moving to band, head nodding • dancing hands in the air, crowd moving cohesively jumping up and down, singing along to music
3 – 4	• behavior subdued in patches, walking around, watching band, sitting relaxing in shade • greeting each other, drinking beer, talking on mobile phones and singing along to band, moving to band • dancing hands in the air, near stage singing dancing along throwing cans at each other, people bumping into each other, people appearing intoxicated, people on shoulders. All crowd jumping up and down to the music
4 – 5	• behavior subdued in patches, walking around, watching band, sitting relaxing in shade • greeting each other, drinking beer, talking on mobile phones and singing along to band, moving to band • dancing hands in the air, near stage singing dancing along throwing cans at each other, people bumping into each other, people appearing intoxicated, people on shoulders.

Table 6—Brief descriptors of behavior collected throughout the day

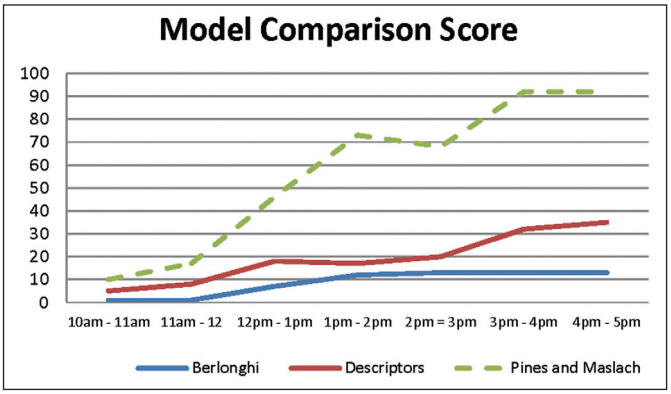

Figure 4—(Color online) Comparison of the scores

unexpected outcomes such as foot injuries, physical exhaustion or crush injuries.[5]

It is well reported that the availability of alcohol increases patient presentation rates at mass gatherings.[1,2] The crowd descriptors highlighted that the presence of drugs and alcohol is not captured by the traditional models. Incorporating the presence of drugs and alcohol into the data set, along with the subsequent impact on crowd behavior, is worthy of further exploration. In addition, other data elements (e.g., temperature and humidity) will improve the meaning and usefulness of the psychosocial domain in the assessment of crowds, their likely behaviors and, consequently, potential patient presentations.

The results of this pilot show that it is possible to monitor elements of the psychosocial nature of crowds at mass gathering events. The data collected showed a change in crowd behavior from the commencement of this event until data collection ceased at 5 pm. This finding begins to verify what event organizers may already know: crowd behavior changes through the duration of a festival or event. Getz states that as people interact with the setting, human behavior will change.[11] This study demonstrated that these changes can be identified in a practical way as an event progresses in time and in its programmed performance elements.

Having a measurement scale that enables real-time identification of changes in crowd behaviors allows an event designer or event manager to modify the existing setting or program to influence change in audience behaviors to assist with the crowd control and risk management

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	Passive	R (1)	Active	R (2)	Energetic	R (3)	Total Score
10 – 11am	Subdued	1	Walking around Greeting each other	2 2			5
11 – 12pm	Subdued 1	1	Walking around Talking on mobile phones Greeting each other Singing along to band	2 2 2 2			8
12 – 1pm	Subdued Sitting relaxing in shade	1 1	Walking around Watching band Talking on mobile phones Singing to band	2 2 2 2	Greeting each other. Dancing to band Dancing hands in the air	3 3 3	18
1 – 2pm	Subdued Sitting relaxing in shade	1 1	Walking around Watching band Greeting each other Talking on mobile phones	2 2 2 2	Singing along to band Moving/dancing to band Dancing hands in the air	3 3 3	17
2 – 3pm	Subdued	1	Walking around Watching band Greeting each other Talking on mobile phones Singing along to band	2 2 2 2 2	Moving/ dancing to band head nodding Dancing hands in the air Crowd moving cohesively jumping up and down singing along to music	3 3 3	21
3 – 4pm	Subdued in patches Sitting relaxing in shade	1 1	Walking around, watching band Greeting each other Talking on mobile phones	2 2 2	Dancing and singing along to band, moving to band Dancing hands in the air Singing dancing along Throwing cans at each other People bumping into each other (moshing) People on shoulders Crowd jumping up and down to the music	3 3 3 3 3 3 3	32
4 – 5pm	Behaviour subdued in patches Sitting relaxing in shade	1 1	Walking around Watching band Greeting each other Talking on mobile phones	2 2 2 2	Singing along to band Dancing/ moving to band Dancing hands in the air Singing dancing along Throwing cans at each other People bumping into each other (moshing) People on shoulders.	3 3 3 3 3 3 3	35

Table 7—Scoring of descriptors of behaviour using Pines and Maslach

Limitations

In piloting the tools and process to assess the psychological domain of a mass gathering, it is recognized that the data collection occurred at only one venue within a larger event. In the current Australian mass gathering climate, it is not always clear where the patient injury or illness arose within an event. A more definitive breakdown in crowd behavior across an event may not useful from a presentation point of view. The data was only collected until 5 pm, well before the official close of the event and before many of the event's headline music performances were scheduled, so this snapshot of the psychosocial nature of the event was limited.

From an event safety perspective, the mapping of psychosocial data against the physical and environmental domains is required to more fully describe the interplay of domains. This understanding would illuminate the connections among the various factors on outcomes such as patient presentation volume and type.

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Conclusions

The data collection process using existing psychosocial data collection tools at a mass gathering enabled the development of a data set to support a description of the psychosocial domain of the event. In addition, it highlighted that traditional models of "crowd" typology are enhanced with a scoring system, and that this scoring system can identify trends of behavior throughout events.

The pilot also highlighted a need for a more consistent descriptive data set that focuses on crowd behavior. The descriptive data collected in this study provides a beginning insight into the science of understanding crowds at a mass gathering event. This pilot has commenced a process of quantifying the psychosocial nature of an event. To maximize the value of this work, future research is required to understand the interplay among the three domains of mass gatherings (physical, environmental and psychological), along with the effects of each element within the domains on safety and health outcomes for participants at mass gatherings.

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