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Mass Gathering Events: a Retrospective Analysis of the Triage Categories, Type of Injury or Medical Complaint, and Medical Usage Rates.

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Abstract

Background

Adequate on-site first aid delivery at mass gatherings (MGs) is one of the cornerstones to ensure safe and healthy MGs. We investigated medical usage rates, frequency of triage categories and type of injury or medical complaint, among attendees at MGs in Belgium.

Methods

We analysed the MedTRIS database (Medical Triage and Registration Informatics System) which includes prospectively collected person-level data regarding individuals visiting on-site posts at MGs in Belgium. MGs attended by >10,000 people and organized ≥5 times between 2009-2018 were included. We determined the proportion of patients in each triage category ('first aid' versus 'medical condition' versus 'medical emergency' versus 'no treatment') and each type of injury or medical complaint, and we calculated Patient Presentation Rate (PPR) and Transfer To Hospital Rate (TTHR).

Results

Twenty-eight MGs, totalling 194 events, were included involving 148,265 patient visits. 'First aid' was the most common triage category (80%, n=118,514). The need for a nurse/physician ('medical condition'), and for the treatment of life-threatening conditions ('medical emergency') was rare (8.9%, n=13,052, and 0.6%, n=860, of all patient presentations, respectively), but remarkably higher during indoor electronic dance music (EDM) events (17.8% (n=26,391) and 4.0% (n=5,930), of all patient presentations, respectively). "Skin wounds" were the most common injury category (42.4%, n=62,275). "Respiratory problems", "neurological problems", "intoxication", "heart complaints", and "gastrointestinal complaints" were more frequent during indoor (electronic) dance, whereas "burns", "fracture/contusion", and "skin wounds" were higher during outdoor music, sports events, and city festivals, respectively. PPR (per 10,000 attendees) was highest for outdoor EDM and outdoor music (median 130[IQR 79] and 129[IQR 104], respectively). TTHR (per 10,000 attendees) was highest for indoor EDM (median 4.4 [IQR 8.5]).

Conclusion

Medical usage rates, proportion of patients in triage and injury or medical complaint categories varied across different MG categories, suggesting opportunities for planning medical coverage at these events.

What is already known on this subject

- Adequate on-site first aid delivery at mass gatherings is one of the cornerstones to ensure a safe and healthy mass gathering.
- Data on triage and type of injuries or medical complaints at mass gatherings are scarce and medical usage rates were mainly studied in North America and Australia.

What this study adds

- This retrospective study found that medical usage rates, proportion of patients in triage and injury or medical complaint categories varied across 194 episodes of 28 mass gatherings in Belgium, with highest patient presentation rates for outdoor (electronic) dance music events, and highest transfer to hospital rates for indoor electronic dance music events.
- While the majority of incidents require only first aid, there are rare medical emergencies that will require the presence of a nurse or (emergency) physician. Our data in particular suggests more advanced providers should be present at indoor music events, either dance or EDM and transport should be more readily available.

Background

A mass gathering (MG) is defined as an occasion, either organized or spontaneous where the number of attendees is sufficient to strain the planning and response resources of the event's organizer.[1]

Major events such as war, terrorism, a pandemic or MGs may strain local resources and might be associated with increased (public) health risks including transmission of infectious disease, occurrence of non-communicable diseases, and physical or mental trauma and injuries.[2]

Information about the number of patients attending the on-site care posts at MGs, the type of injuries encountered, the urgency of injuries or diseases, and the number of patients transported to the hospital is key to providing adequate medical staffing and equipment at the event, transport capability, and assurance of sufficient local capacity for patients transferred.

The present study aimed to investigate the frequency of medical usage, the levels of care needed, and type of injuries or medical complaints, in a patient population evaluated at on-site care posts across different MG categories in Belgium.

Methods

We used prospectively collected data on triage, and type of injuries or medical complaints seen in patients attending on-site care posts at MGs in Belgium.

A MG was defined as an annual event attended by >10,000 people (cumulative over all event days). To generate a homogeneous population, we included MGs held ≥5 times between 2009-2018. MGs were categorised as city festivals, indoor electronic dance music (EDM) events, indoor dance events, outdoor EDM events, outdoor music events, or sports events. (**Table 1**)

The Belgian Red Cross is the major provider of Emergency Medical Services (EMS) in Belgium and provides on-site care at MGs. Patients treated by EMS were registered using a web-based client server system, called MedTRIS (Medical Triage and Registration Informatics System).[3]

People who sought medical assistance at an on-site care post were included. Informed consent was obtained to use their personal data for scientific purposes.[4] Each on-site care post was routinely staffed by first aid responders trained in basic life support, nurses, (emergency) physicians, and/or emergency medical technicians. All EMS had appropriate basic first aid and advanced life support equipment.

When entering an on-site care post, one of our triage categories was assigned to patients[5]: “no further treatment”: no need for further treatment with non-prescription medication (e.g. paracetamol); “first aid”: injury or medical complaint treated by a first aid responder only; “medical condition”: patient should be seen by a nurse or physician; “medical emergency”: life-threatening medical condition.

Based on prior MedTRIS database analysis, the 32 most frequently encountered injuries or medical complaints were used.[3]

Data on triage, injury or medical complaints were collected systematically and individually, via a standardized Patient Encounter Form (PEF) and were subsequently entered into MedTRIS.[3]

Patient Presentation Rate (PPR) and Transfer To Hospital rate (TTHR) were compared among types of MGs, and were defined as the number of people presented at the EMS and transported to hospital by ambulance per 10,000 attendees, respectively.[6]

The total number of attendees was obtained by contacting the organizers of the MG and/or consulting news or MG company websites.

All statistical analyses were performed with statistical software package Rstudio: Integrated Development Environment for R (Rstudio, Inc., Boston, MA.). The level of significance was set at 0.05. Missing data for a certain variable were reported in the results and not used in the analysis of that variable.

No patient or public involvement was present.

Results

The study included 194 episodes of 28 MGs with a total of 24,820,234 attendees, of whom 148,265 were evaluated, and 3,083 (2.1%) required transport to hospital for further treatment. (**Table 1**)

"First aid" was the most common triage category (ranging from 66% during indoor EDM to 89% during sports events). **(Figure 1)** "Medical condition", or "medical emergency" was highest during indoor EDM events (17.8% and 4.0% of patient presentations ($p<0.00001$), respectively). Frequency of "no further treatment" ranged from 5% for city festivals to 13% for indoor/outdoor EDM/dance events.

Based on the 32 most frequently encountered injuries or medical complaints, we generated 9 injury categories. "Skin wounds" were the most common injury or medical complaint category, followed by "fracture/contusion", and "neurological problems". "Intoxication" was most common during indoor EDM events ($p<0.05$). **(Figure 2)** "Respiratory problems", "neurological problems", "heart complaints", and "gastrointestinal complaints" were more common during indoor EDM and/or indoor dance events ($p<0.05$), whereas "burns", "fracture/contusion", and "skin wounds" were more common during outdoor music events, sports events, and sport events/city festivals, respectively (all $p<0.05$).

Median PPR (range: 4-626) was highest for outdoor EDM and outdoor music events, with significantly lower rates for sports events, indoor dance events, and city festivals (all $p<0.05$). **(Figure 3A)**

Median TTHR (range: 0-16) was highest for indoor EDM events, followed by indoor dance events ($p>0.05$), outdoor EDM events ($p>0.05$), outdoor music events ($p<0.05$), sports events ($p<0.05$), and city festivals ($p<0.05$). **(Figure 3B)**

Table 1. Characteristics of the included mass gatherings.

Mass gathering category	Website*	Number of editions	Number of attendees	Number (%) of patients evaluated	Number (%) of patients transported to the hospital
City festivals (n=5): (music/carnival) festivals occurring in a city centre					
Carnaval Aalst	https://www.aalstcarnaval.be/	9	1,294,200	1,869 (0.14)	206 (0.01)
Gentse Feesten	https://gentsefeesten.stad.gent/en	9	11,710,000	10,516 (0.09)	790 (0.01)
Maanrock	https://www.maanrock.be/	8	902,500	793 (0.09)	20 (0.002)
Marktrock	https://nl.wikipedia.org/wiki/Marktrock_Leuven	6	545,500	497 (0.09)	18 (0.003)
Suikerrock	http://www.suikerrock.be/en	8	820,000	1,544 (0.18)	32 (0.003)
Indoor EDM (n=3): EDM encompasses styles from beatless ambient music to 200-beats-per-minute hardcore, with house music, techno, drum and bass, dubstep, and trance among the most-notable examples					
Bassleader	https://nl.wikipedia.org/wiki/Bassleader	5	80,000	822 (1.04)	32 (0.04)
I Love Techno	https://nl.wikipedia.org/wiki/I_Love_Techno	6	196,000	2,051(1.04)	226 (0.11)
Reverze	https://www.reverze.be/home	9	180,000	1,607 (0.89)	51 (0.02)
Indoor dance (n=2): indoor events with a non-EDM music style					
De Foute Party	https://qmusic.be/nieuws/kom-naar-de-foute-party-op-28-juni	6	105,200	447 (0.42)	27 (0.02)
I Love the 90s	https://www.ilovethe90s.be/	8	132,719	782 (0.59)	25 (0.02)
Outdoor EDM (n=3)					

DayDream	https://daydreamfestival.nl/	6	148,000	2,097 (1.41)	42 (0.03)
Laundry Day	https://nl.wikipedia.org/wiki/Laundry_Day	9	449,000	5,196 (1.16)	63 (0.01)
Summerfestival	https://nl.wikipedia.org/wiki/Summerfestival	7	358,000	5,786 (1.62)	89 (0.02)
Outdoor music (n=12)					
Afro-Latino	https://afro-latino.be/en/	6	122,000	1,230 (1.00)	25 (0.02)
Antilliaanse Feesten	https://antilliaansefeesten.be/?locale=en	9	336,000	2,746 (0.82)	50 (0.01)
Blues Peer	https://bluesfestival.be/en/	6	130,000	704 (0.54)	5 (0.003)
Dranouter	https://www.festivaldranouter.be/	9	286,000	8,808 (3.08)	82 (0.03)
Graspop	https://www.graspop.be/en	9	1,322,000	24,534 (1.85)	361 (0.03)
Ieperfest	http://www.ieperfest.com/	6	58,500	1,729 (2.95)	43 (0.07)
Mano Mundo	https://nl.wikipedia.org/wiki/Mano_Mundo	5	355,000	1,036 (0.29)	26 (0.007)
Pennenzakkenrock	https://www.pennenzakkenrock.be/	9	185,200	3,031 (1.64)	9 (0.005)
Reggae Geel	https://www.reggaegeel.com/nl	9	449,000	5,758 (1.28)	113 (0.02)
Rock Werchter	https://www.rockwerchter.be/en/	9	3,029,000	53,764 (1.77)	561 (0.02)
Sfinks	https://www.sfinks.be/?lang=en	9	568,000	4,417 (0.78)	39 (0.007)
TW Classic	https://www.twclassic.be/en/	8	374,000	3,062 (0.82)	41 (0.01)
Sports events (n=3): recreational/competitive sports events with medical care delivery to both participants and spectators					
Antwerp Marathon & 10 miles	https://www.sport.be/antwerp10miles/en/	7	249,865	1,388 (0.55)	37 (0.01)
Gordel	https://www.gordelfestival.be/	9	301,050	962 (0.32)	30 (0.009)
Ronde van Vlaanderen cyclo	https://www.werideflanders.com/en/	8	133,500	1,089 (0.82)	40 (0.03)

*Accessed 3 January 2022; EDM: Electronic Dance Music; The research sample included 194 editions of 28 MGs: 5 city festivals, 3 indoor EDM events, 2 indoor dance events, 3 outdoor EDM events, 12 outdoor music events, and 3 sports events. PEF data related to the triage category or injury category were missing in 1% and 14%, respectively.

Discussion

This study found that medical usage rates, proportion of patients in triage and injury or medical complaint categories varied across 194 episodes of 28 mass gatherings in Belgium, with highest PPR for outdoor (electronic) dance music events, and highest TTHR for indoor EDM events.

While the majority of incidents require only first aid, there are rare medical emergencies that will require the presence of a nurse or (emergency) physician. Our data suggests more advanced providers should be present at indoor music events, either dance or EDM and transport should be more readily available. Subsequently, future research should be focused on the proper development and validation of a multivariate model (including different biomedical and environmental factors) is needed to estimate the absolute number of patients presented in EMS and number of hospital transportations, and to estimate the specific deployment of medical personnel and first aid material, correspondingly.[7] Information about the study limitations can be found in the supplementary material.

Conclusion

Medical usage rates, proportion of patients in triage and injury or medical complaint categories varied across MGs. While the majority of incidents require only first aid, more advanced providers should be present at indoor dance events, and hospital transport should be readily available.

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Declaration of interests. The Belgian Red Cross is responsible for the provision of preventive EMS at mass gatherings in Belgium.

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Figure captions

Figure 1. Triage categories in EMS across different MG categories. Triage categories were expressed as a %, i.e. proportion of patients in a specific triage category divided by the total amount of patients presented in the EMS. Comparison of triage categories among types of MGs was done by chi-square test, with Bonferroni correction.

Figure 2. Injury and medical complaint categories in EMS across different MG categories. Injury and medical complaint categories were expressed as a %, i.e. proportion of patients in a specific injury and medical complaint category divided by the total amount of patients presented in the EMS. Comparison of injury and medical complaint categories among types of MGs was done by chi-square test, with Bonferroni correction.

Figure 3. Box and whisker plot showing the patient presentation rate (PPR) (**Panel A**) and the transfer to hospital rate (TTHR) (**Panel B**) across the different MG categories. The black centre line denotes the median value, while the black box represents the 25^{th} to 75^{th} percentiles. The black whiskers mark the minimum and maximum. The Shapiro-Wilk test was used to test the continuous variables for normality. Due to the skewed distribution, PPR/TTHR were expressed as median with interquartile range (IQR) and testing of PPR/TTHR among the MG event categories was done by a non-parametric test (i.e. Kruskal-Wallis test including Dunn's multiple comparison test).

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