Mass-Gathering Medical Care: Retrospective Analysis of Patient Presentations over Five Years at a Multi-Day Mass Gathering

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Abbreviations:
PPR = patient presentation rate
TTHR = transport to hospital rate

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Abstract

Introduction: There is a scarcity of analytical data regarding mass-gathering medical care. The purpose of this study was to identify and evaluate the range and nature of illness and injury for patrons of an annual, multi-day, mass gathering.

Methods: Encounter data from all patients seen by emergency physicians at the New York State Fair Infirmary during the past five years were analyzed. From these data, a category list was consolidated to 36 reasons for the visit based on chief complaint, nursing notes, and physician notes. The most common reasons for being seen by a physician were analyzed to determine age and gender discrepancies.

Results: The average number of attendees at the Fair per year from 2004–2008 was 950,973. Emergency physicians evaluated a total of 2,075 patients from 2004–2008. The average patient presentation rate over the past four years (2005–2008) was 4.8 ±1.1/10,000 patrons. The average transport to hospital rate over the past four years was 2.7 ±1.1/100,000 patrons. The average age of all patients seen was 34.4 ±21.6 years, and 58.1% of the patients were female. The most common reasons to seek medical attention included: dehydration/heat-related illness (11.4%); abrasion/laceration (10.6%); and fall-related injury (10.2%). Two groups, dehydration/heat-related illness 74% (t (4) = 2.90, p <0.05), and fall-related injury (68%; t (4) = 5.17, p <0.05) were disproportionately female. There also was a direct relationship between age and female gender within the fall-related injury category (χ^2 (1, n = 213) = 11.41, p <0.05).

Conclusions: Patron data from fairs and expositions is a valuable resource for studying mass-gathering medical care. A majority (58%) of patients seen at the infirmary were female. The most common reason for being seen was dehydration/heat-related illness, which heavily favored females, but favored no age groups. The abrasion/laceration category did not contribute to the gender discrepancy. Patients who fell tended to be females >40 years of age. Further analysis is required to determine the reason for the gender discrepancies. Planners of multi-day mass gatherings should develop public education programs and evaluate their impact on the at-risk populations identified by this analysis.

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Our Majesty is Welcome to a fair;
Such Place,
such Men,
such Language,
and such ware…
-"Bartholmew Fair" 1614 Ben Jonson

Introduction

The New York State Fair is a 12-day annual event held during the last week of August, and features agricultural and industrial attractions, displays, and

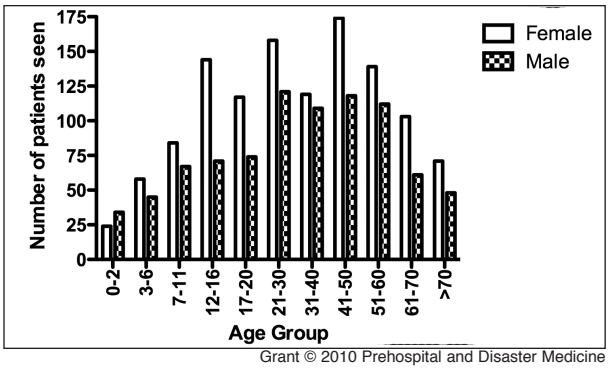

Figure 1—Age (years) and gender of all patients 2004–2008. Data are presented as totals.

Year	Patient Presentation Rate n/10,000	Transport to Hospital Rate n/10,000
2005	4.5	1.4
2006	3.8	2.7
2007	6.3	4.2
2008	4.6	2.6
Average 2005–2008	4.8 ±1.1	2.7 ±1.1

Table 1—Patient presentation rate and transport to hospital rate by year, and as an average with standard deviation. Data are the number of patients per patron of the New York State Fair.

large concert entertainment. Due to its assorted variety of attractions ranging from livestock competitions to big-name bands, the fair draws a diverse crowd. On any given day, the New York State Fair is one of the largest "cities" in the state, with a daily population near 100,000 people confined to an area of 490 square acres. Therefore, attendees and workers require all of the major services that are provided in a city, including health care.

The New York State Fair is not unique in its service needs. There are other agricultural/entertainment fairs and expositions at both the state and county levels with large numbers of attendees. Every year, the largest of these gatherings range from nearly one million, (Erie County, New York for 12 days) to more than three million patrons (State Fair of Texas for 24 days, averaging 250,000 patrons per day). There are many similarities between fairs, but the provision of medical care offered on-site is not one of them. The New York State Fair and the Eastern States Exposition offer physician- and nurse-staffed infirmaries, whereas the Ohio State Fair offers a nurse-staffed first aid center. The Texas State Fair, Arizona State Fair, Western Washington State Fair, and Erie County Fair offer paramedic- and emergency medical technician-staffed first aid stations. The commonalities in the provision of medical care at mass gatherings may be drawn from sources such as state public health laws, guidelines, and position papers published by organizations such as the American College of Emergency Physicians and the National Association of Emergency Medical Services Physicians.[1,2] For example, New York State Public Health Law mandates that public functions with attendance >50,000 people have at least two on-site emergency medical facilities. Two emergency medical technicians and one physician must staff these facilities, and three ambulances must be present on-site. With approval from the permit-issuing official, the physician may be substituted with a paramedic.[3]

There is a general lack of analytical literature regarding mass gathering medicine.[4] Milsten *et al* characterized numerous factors that influenced the patient presentation rate at mass gatherings.[5] In 2001, Arbon *et al* created regression models to predict the patient presentation rate (PPR) and transport to hospital rate (TTHR) based on weather, number of patrons, alcohol availability, and mobility and mood of the crowd.[6] There are several attempts to describe the types of patients that present at mass gatherings, but these studies are limited to single-day events.[7,8] The purpose of this study was to identify and evaluate the range and nature of illness and injury for patrons of an annual, multi-day, mass gathering.

Methods

This study was a retrospective analysis of medical encounter data for individuals presenting to or transported for medical care at the New York State Fair Infirmary collected between 2004 and 2008.[9] As this study consisted of analysis of a non-hospital, pre-existing data set, the Institutional Review Board deemed it exempt from review. The total number of attendees for each year is posted on the New York State Fair Website and is reported as persons entering the turnstile at the Fair's entrance. There are three ambulances staged on the fairgrounds, two paramedics on bicycles, and one Gator staffed by a paramedic and an emergency medical technician. The infirmary provides two levels of service. A paramedic stationed at the reception area in the front of the building screens patrons to determine those who needs to be seen by a physician. Patrons seeking bandages, sunscreen, over-the-counter analgesics such as acetaminophen or aspirin, and other non-urgent medical attention that were triaged by paramedics and not seen by physicians, were not included in the study. A Board-Certified Emergency Medicine Physician sees all other patients. All services are at no cost to patients. Some are treated and released, while others are transported to one of the five local emergency departments. If a paramedic in the field deemed that a patient required hospital services, that patient was transported directly to the hospital without being treated at the infirmary.

There is no extensive documentation of patient care visits, rather information collected from the medical encounter forms includes time in/out, name, address, date-of-birth, vital signs, past medical history, allergies, medication list, nursing notes, physician notes, and disposition. Data were de-identified and entered into a Microsoft

	# of patients (%)	Average Age ±Standard Deviation (years)	Gender (% female)	Relationship between age and gender	# Requiring transport to hospital
Dehydration-Related Illness	238 (11.4)	37 ±22.7	74	No	5
Abrasion/Laceration	217 (10.6)	31.3 ±22.0	44	No	6
Fall-Related Injury	213 (10.2)	40 ±24.9	68	Yes χ^2 (1, n = 213) = 11.41, p <0.05)	15

Table 2—Characterization of the patients that constitute the most common reason for being seen at the New York State Fair Infirmary from 2004 to 2008.

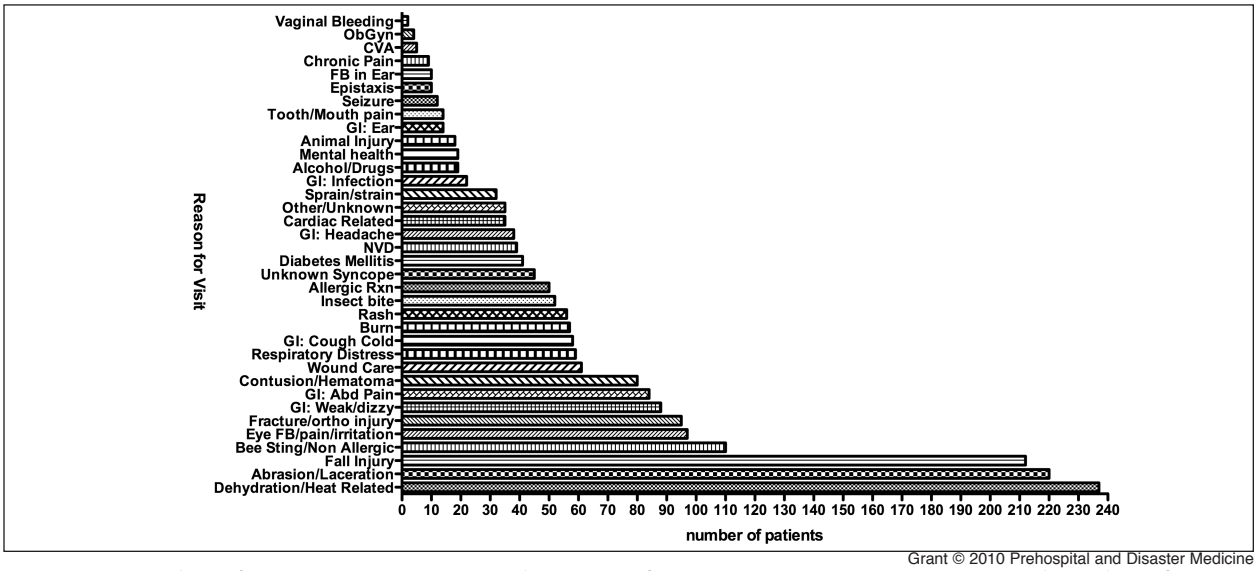

Figure 2—Number of patients presenting in each category from 2004–2008. Data represent total number of patients (GI = general illness)

Excel™ 2003 (Microsoft, Inc., Redmond, WA) database and analyzed using GraphPad Prism Software version 4.0 (Graphpad Software Inc., La Jolla, CA). A 10% random sample was checked for accuracy by double entry of the data. A minimum of 99% agreement was required to certify the database. There were no disagreements observed in the samples checked, therefore, the data extracted are complete. From these data, a category list was reduced to 36 reasons for the visit based on chief complaint, nursing notes, and physician notes. A *t*-test was conducted on all patients divided into groups based on gender. The PPR was calculated based on the number of patients presenting divided by the number of attendees per year. The transport to hospital rate was calculated by dividing the number of patients transported from the infirmary to a nearby hospital divided by number of attendees per year. A *t*-test and a χ^2 analysis was then run on each of the top three reasons for being seen to determine contribution to gender discrepancy, and relationship between age and gender.

Results

Over the five-year period (2004–2008), the average number of attendees per year was 950,973, and physician report data was available for 2,075 patients. The data from 2004 were limited to weekend only, and did not include calculation of the PPR or TTHR. The average age for all patients cared for in the infirmary was 34.4 ±21.6 years, and 58.1% were female (Figure 1). The PPR and TTHR are presented in Table 1. The most common reasons for fairgoers to seek medical attention over the five-year period included: dehydration/heat-related illness (11.4%); abrasion/laceration (10.6%); and fall-related injury (10.2%; Table 2, Figure 2). The raw data of the number, age, and gender of the patients comprising the three most common reasons for being seen at the infirmary are presented in Table 2. The number and gender of patients within age groups for dehytration-related illness, abrasion/laceration injuries, and fall-related injuries are found in Figures 4, 5, and 6, respectively.

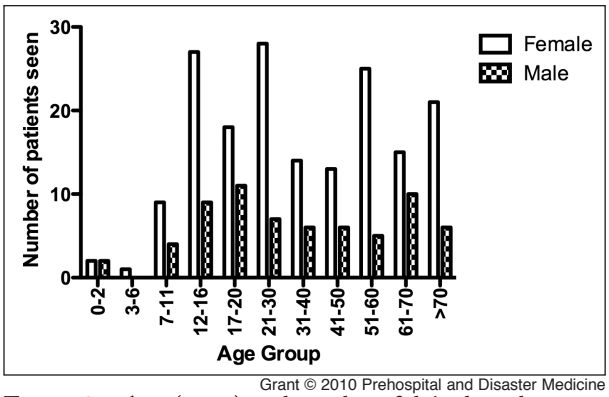

Figure 3—Age (years) and gender of dehydrated patients 2004–2008. Data presented are totals. [χ^2 (1, n = 238) = 0.22, p >0.05]

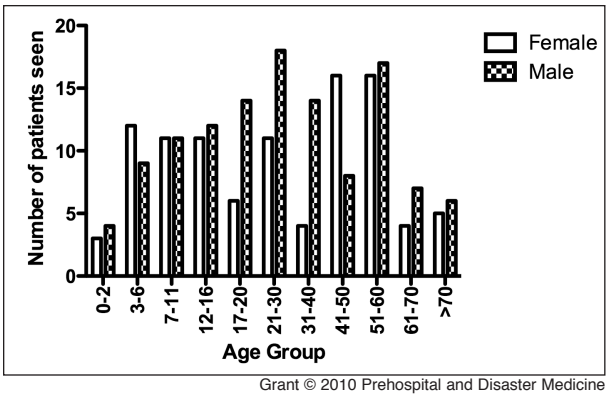

Figure 4—Age (years) and gender of abrasion/laceration 2004–2008. Data presented are totals. [χ^2 (1, n = 217) = 0.06, p >0.05]

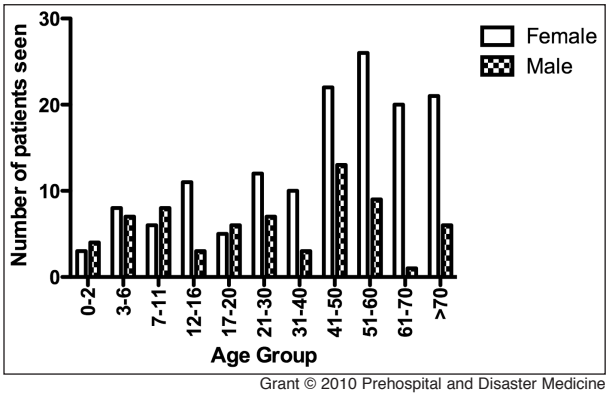

Figure 5—Age (years) and gender of fall-related patients 2004–2008. Data presented are totals. [χ^2 (1, n = 213) = 11.41, p >0.0208]

The three most common reasons to seek medical attention accounted for >30% of patients seen at the New York State Fair Infirmary between 2004 and 2008. Other common reasons for being seen included bee stings, eye problems, and orthopedic injuries (Figure 2). Relatively infrequent, but noteworthy problems included allergic reactions, alcohol/drug intoxication, and seizures. Within the dehydration- and fall-related injury categories, there were marked age and gender discrepancies.

Discussion

There were more female patients in the dehydration/heat-related illness and fall-related injury categories, as well as in the entire patient population. Studies of single-day mass gatherings with a similar PPR also have shown a gender discrepancy in dehydration/heat-related illness patients and in the entire patient population.[7,10] Age was not a contributing factor in the dehydration/heat-related illness or the abrasion/laceration categories, however in the fall-related injury category, there was a higher number of females >40 years of age. The correlation between age and fall-related injury comes as no surprise, however the fact that more adult females then males experienced falls is puzzling.

The reason for the increased number of female patients in the dehydration/heat-related illness and fall-related injury categories is unknown. There could be a relationship between dehydration/heat-related illness and fall-related injury, where some of the fall-related injury patients may have had an element of dehydration/heat-related illness that was not reported in the patient encounter data sheet. There are many factors that would place male and female fairgoers at equal risk for dehydration/heat related illness including, but not limited to: lack of fluid intake, hot weather, physical exercise and exhaustion, crowd density, and co-morbid illness.

There were several categories that were not in the top three reasons for seeing a physician, but should not be overlooked because of their potential severity. Bee stings were the fourth most common reason for seeing a physician at the fair, and have the potential for anaphylaxis (Figure 2). While allergic reactions were relatively low on the list, they deserve special attention at a mass gathering that offers agricultural entertainment. An interesting population made up the category of "other". The State Fair Infirmary was not geared to treat many of these patients, which included those asking for medication refills, those who forgot their medications, and those with complaints of chronic illnesses. Drug use and alcohol intoxication ranked relatively low on the list of complaints. It should be noted that patients were placed in this category were seen primarily for drug use or alcohol intoxication. Not all patients were asked if they had consumed alcohol or used drugs, and therefore, it was impossible to determine which patients in dehydration/heat-related illness, fall-related injury, and other categories had used drugs or alcohol. Moderate alcohol use could have contributed to the dehydration/heat-related illness population.

Limitations to the study also included a lack of uniformity of note-taking by paramedics, nurses, and physicians on the medical encounter forms. The PPR and TTHR in this study did not include patients that required immediate transport to the emergency department. It also should be noted that the infirmary at the New York State Fair is its own building with many resources not available at all mass gatherings; therefore the TTHR may have been influenced. The results also are limited by the inability to determine the male to female ratio of the population of fairgoers as a whole.

Future research should be targeted at determining the cause of the gender discrepancy in the patient population. Simultaneous collection and analysis of data from other fairs and expositions would be required to determine if these data are generalizable.

Conclusions

The most common reason for being seen by a physician in the New York State Fair Infirmary over the past five years was dehydration/heat-related illness, followed by abrasion/laceration and fall-related injury. The data showed marked differences between female and male PPR. Analysis of this data set may be useful in planning mass gathering medical care. Special consideration should be paid to the distinct gender bias of dehydration/heat-related illness, and fall-related injury. Dehydration/heat-related illness is of interest given the fact that it is the most amenable to prevention. Planners of multi-day mass gatherings should develop and implement public education programs and evaluate their impact on the at-risk populations identified by this analysis. Furthermore, the many summer fairs and expositions at the state and county level share similar crowd sizes, season, and attraction types. Given these commonalities, they might prove to be an excellent medium for the study of multi-day, mass-gathering medical care.

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