Ambulance Need at Mass Gatherings

Elissa Meites, MD, MPH;[1] John F. Brown, MD, MPA[1,2]

1. University of California, San Francisco, San Francisco, California USA
2. San Francisco Department of Public Health, City and County of San Francisco, San Francisco, California USA

Correspondence:
Dr. John Brown
San Francisco EMS Agency
30 Van Ness Avenue
Suite 3300
San Francisco, California 94102 USA
E-mail: john.brown@sfgov.org

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Abbreviations:
CAD = computer-aided dispatch
EMS = emergency medical services

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Abstract

Introduction: Scant evidence exists to guide policy-making around public health needs during mass gatherings. In 2006, the City and County of San Francisco began requiring standby ambulances at all mass gatherings with attendance of >15,500 people. The objectives were to evaluate needs for ambulances at mass gatherings, and to make evidence-based recommendations for public health policy-makers. The hypothesis was that the needs for ambulances at mass gatherings can be estimated using community baseline data.

Methods: Emergency medical services plans were reviewed for all public events with an anticipated attendance of >1,000 people in San Francisco County during the 12-month period 01 August 2006 through 31 July 2007. Ambulance transport data were confirmed by event coordinators and ambulance company records, and the rate was calculated by dividing ambulance transports by event attendance. Baseline ambulance transport rate was calculated by dividing the annual ambulance transports in the county's computer-aided dispatch system by the census population estimate. The risk ratio was calculated using the risk of transport from a mass gathering compared with the baseline risk of ambulance transport for the local community. Significance testing and confidence intervals were calculated.

Results: Descriptive information was available for 100% of events and ambulance transport data available for 97% of events. The majority of the mass gatherings (47 unique events; 59 event days) were outdoor, weekend festivals, parades, or concerts, though a large proportion were athletic events. The ambulance transport rate from mass gatherings was 1 per 59,000 people every six hours. Baseline ambulance transport rate in San Francisco was 1 per 20,000 people every six hours. The transport rate from mass gatherings was significantly lower than the community baseline (risk ratio [RR] = 0.15, 95% CI = 0.10–0.22, p <0.001). At events reserving a standby ambulance, 46% of ambulances were unused.

Discussion: San Francisco mass gatherings appear to present a lower risk of ambulance transports compared to the community baseline, suggesting that the community baseline sets an appropriate standard for requiring standby ambulances at mass gatherings. The initial ambulance requirement policy in San Francisco may have been overly conservative.

Conclusions: Local baseline data is a recommended starting point when setting policy for public health needs at mass gatherings.

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Introduction

Public mass gatherings are common in community settings, but scant evidence exists to guide policy-makers planning for public health needs during mass gathering. Nationally, mass-gathering legislation is rare. As late as 1999, only six states had legislature regarding mass-gathering plans, and these requirements were highly variable.[1] In 2006, the San Francisco Department of Public Health (SFDPH) instituted a new policy requiring an emergency medical services (EMS) plan from all mass gathering coordinators during the process of applying for a city event permit. This study reviews all event plans during the first year of the mass-gathering EMS plan-

Event Type	Crowd Size (anticipated)	CPR & 9-1-1 Acccess	First Aid Station with EMT	First Aid Station with Nurse or Paramedic	First Aid Station with Physician	BLS or ALS Ambulance	Mobile Teams
Concert/ Music Festival	<2,500	X	X	*			
	2,500–15,500	X		X		BLS*	*
	15,500–50,000	X		X	*	ALS (X)#	X
	>50,000	X			X	ALS (X)#	X
Athletic/ Sporting Event*	<2,500	X	X	*			
	2,500–15,500	X		X	*	BLS (X)	X
	15,500–50,000	X			X	ALS (X)#	X
	>50,000	X			X	ALS (X)#	X
Parade*/ Block Party/Street Fair/Outside Venue	<2,500	X	*				*
	2,500–15,500	X	X	*		BLS*	X
	15,500–50,000	X		X	*	ALS (X)#	X
	>50,000	X			X	ALS (X)#	X
Conference or Convention	<2,500	X	*				
	2,500–15,500	X	X	*		BLS*	*
	15,500–50,000	X		X	*	ALS (X)#	X
	>50,000	X			X	ALS (X)#	X

Figure 1—Initial emergency medical services minimum standards guidelines for mass gatherings in San Francisco X = required; * = recommended; # = multiple units may be required depending on history and size of event. A reasonable planning guide is 1 unit per 10,000 participants or spectators (ALS = advanced life support; BLS = basic life support; CPR = cardiopulmonary resuscitation; EMT = emergency medical technician)

ning policy to evaluate whether these standards reflect appropriate requirements for mass gatherings in this community. The hypothesis is that a reasonable standard for mass gatherings is the baseline rate of medical events in the surrounding community. The objectives were to evaluate the need for ambulances at mass gatherings, and to make evidence-based recommendations for public health policy-makers.

The optimal configuration of EMS resources at mass gatherings has not been identified. Furthermore, many people who initially are transported by ambulance from mass gatherings are not admitted to the hospital.[2] Studies on optimal staffing for an on-site medical facility have demonstrated that multiple models may be beneficial.[3,4] Predictive modeling may be beneficial to determining optimal preparation, but retrospective review of similar events is useful as well.[5]

Given this lack of consensus in the literature, the San Francisco minimum standards requirements initially were based on anticipated crowd size and event type, following a model from San Diego county.[6] All events with attendance >1,000 people were required to have a plan for CPR and wireless communication including 9-1-1 access. Larger events were required to provide on-site medical services such as a first-aid station or medical staff. All mass gatherings planning for an attendance of >15,500 people were required to reserve a standby ambulance, defined as an ambulance stationed at the event and dedicated to EMS calls from the event's geographic area. Costs for meeting these requirements were borne by the event coordinators. Details of the minimum standards are presented in Figure 1.

Methods

The study population included all public events with an anticipated attendance of >1,000 people in the City and County of San Francisco for which an EMS plan was submitted during the 12-month period of 01 August 2006 through 31 July 2007. Three events that submitted EMS plans for events with attendance of <1,000 people were excluded from this analysis. Events occurring in parks or in private venues, such as theaters or stadiums, were not included as they were not required to submit EMS plans in 2006.

All submitted EMS plans were reviewed for descriptive information about mass gatherings estimated by the event coordinators. Event characteristics included environment, day of the week, length, and attendance. Events occurring on Friday night, Saturday, or Sunday were considered weekend events. Attendants were classified as observers (at street fairs, parades, or outdoor concerts) or participants (at athletic events).

Ambulance transport data were obtained retrospectively from event coordinators, and confirmed by standby ambulance company records. The mass gathering ambulance transport rate was calculated by dividing the number ambulance transports by event attendance. The baseline ambulance transport rate for the county was calculated over the same 12-month time period from the total number of ambulance transports in the county's computer-aided dispatch (CAD) system and the 2006 census population estimate for San Francisco. The risk ratio was calculated by comparing the risk of transport from a mass gathering event compared with the community baseline

Event Characteristic	n (%)
Outdoors	56 (98)
Weekend (Friday night through Saturday)	53 (93)
Single-Day	35 (61)
Events by type of attendants	
Observer events (street fairs, parades, outdoor concerts)	43 (75)
Participant events (athletic events)	14 (25)
Length of event (hours)	
Range	2–10
Median	7.0
Mean	6.9
Attendance	
Range	1,000–500,000
Median	40,000
Mean	59,000

Table 1—Characteristics of mass gatherings—San Francisco, California, 2006–2007

for ambulance transports. Significance testing and confidence intervals were calculated using EpiInfo version 3.3 (2004, Centers for Disease Control and Prevention, Atlanta, GA).

This analysis was Institutional Review Board (IRB)-exempt as information was obtained for public health evaluation rather than research purposes, and no protected health information on individual human subjects was collected or stored. A self-certification of Waiver of Review of the project by the IRB of the University of California at San Francisco was obtained.

Results

During the 12-month study period, EMS plans were submitted for 47 mass gatherings. All 47 EMS plans (100%) were reviewed for descriptive information. Ambulance transport data were abstracted and confirmed for 57 event days (97%). The 47 unique events occurred over a total of 59 event days.

Most San Francisco mass gatherings were single-day events held outdoors on a weekend, with an attendance of several thousand people. Events lasted up to 10 hours per day, not including the setup and dismantling time closed to public participation. Attendants at most events were observers rather than participants. Mass gathering characteristics are listed in Table 1. Events offered emergency medical services in accordance with the new mass-gathering planning policy. Wireless communications and a first-aid station were planned for most events, and some also planned to have at least one automated external defibrillator (AED) on-site. Event coordinators also planned for mobile medical response teams and standby ambulances at larger events.

The EMS plan characteristics are listed in Table 2. A total of 35% (20/57 event days) of mass gatherings had at least one patient transported to the hospital by ambulance. Of the 20 events in which transports occurred, 75% (15/20 event days) had reserved a standby ambulance, and 60% (12/20 event days) transported only one patient to the hospital. Of the 28 events that paid to reserve a standby ambulance, 54% transported a patient (15/28 events) and 46% did not transport any patients (13/28 events).

From mass gatherings in this study, there were a total of 64 transports during the study period. The average number of attendants at these events was 59,000 people. There were 383 hours of mass gatherings during the twelve-month period. Thus, over the one-year period, the mass-gathering ambulance transport rate was 2.8 transports per million person-hours, or, equivalently, one ambulance transport per 59,000 people every six hours.

The total number of ambulance transports to hospital in the CAD system during the study period was 55,097 transports. The 2006 census population estimate for San Francisco was 744,041 people, and there are 8,760 hours in the year. Thus, over the one-year period, the community baseline ambulance transport rate in San Francisco was 8.4 transports per million person-hours, or, equivalently, one ambulance transport per 20,000 people every six hours.

The risk of ambulance transport per person-hour from mass gatherings was significantly lower than was that from the overall baseline for the community (RR = 0.15, 95% CI = 0.10–0.22, p <0.001). The difference in ambulance transport rates is diagrammed in Figure 2.

Discussion

Public mass gatherings present challenges to planning officials in anticipating short-term public health needs for large influxes of people. During the first year of the mass-gathering medical policy, San Francisco initially required a standby ambulance at events of any length attended by more than 15,500 people. However, this requirement may have been overly conservative. Of the standby ambulances reserved for mass gatherings, nearly half were not used to transport any patients. At the rate predicted by the local community baseline, the crowd size required to produce a single ambulance transport during a six-hour event would be 20,000 people.

Internationally, there has been a wide range of patient presentation rates reported at mass gatherings, from as few as 0.1–1.9 physician encounters per 1,000 observers at a stadium,[7] convention,[8] and outdoor festival,[9] respectively,

EMS Plan Characteristic	n (%)
Wireless communication	56 (98)
First-aid station(s)	54 (95)
AED(s)	37 (65)
Mobile medical response team(s)	29 (51)
Standby ambulance(s)	28 (49)

Table 2—EMS plan characteristics at San Francisco mass gathering events. (AED = automated external defibrillator, EMS = emergency medical services)

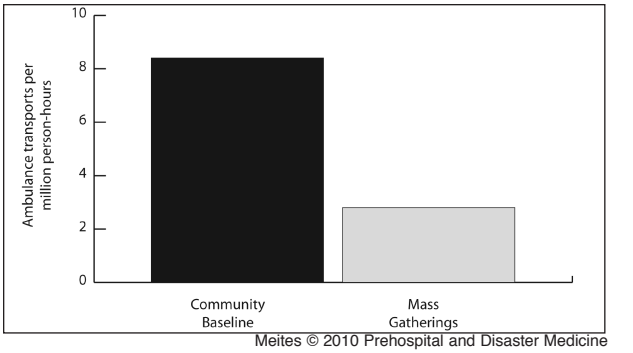

Figure 2—Ambulance transport rates in San Francisco

to as many as 192 physician encounters per 1,000 participants in an endurance sports event.[10] There is also a wide range of ambulance transport rates reported from mass gatherings, from as few as 0.002–0.09 transports per 1,000 observers at festivals and large public events,[9,11,12] to as many as 20.[7] transports per 1,000 participants at an endurance sports event.[10] The observed ambulance transport rate from San Francisco mass gatherings compares favorably to rates seen in previously published reports, suggesting the possibility of other protective effects.

Several additional modifying factors may complicate planning for resource allocation at mass gatherings. This study was not powered to allow risk stratification of mass gatherings by type, and could not distinguish the potentially greater health risks to attendants who were participants rather than observers at mass gatherings. Ambulance response time, rather than the number of standby ambulances used, may be a more sophisticated measure of whether medical needs at mass gatherings have been addressed appropriately. Also, the proportion of event attendants from outside of the county could not be measured, so the effect of their attendance was not assessed, even though many San Francisco events do regularly attract national and international interest.

Findings in this report are subject to at least three additional limitations. First, local data may not be generalizable, as not all mass gatherings submitted EMS plans. Second, methods for counting attendance at mass gatherings were not standardized and could have been inaccurate. Finally, transports occurring when the ambulance was called to an event by a participant (rather than event staff) may be under-represented in this analysis.

These conclusions led to revision of the initial San Francisco mass-gathering policy, and this experience may suggest guidelines for other communities in setting policy. Further studies in this area should attempt to evaluate the impact of first-aid stations and mobile medical teams on the use of ambulance resources, as well as the effects of mass gatherings on nearby locations where 9-1-1 ambulances may be summoned to assist participants who have exited the event venue.

Conclusions

In this study of San Francisco mass gatherings, the measured rate of ambulance transports from mass gatherings was compared to the overall community baseline. The conclusion was that the risk for an ambulance transport from mass gatherings was significantly lower than the baseline for the community. Though the utility of historical data for predicting medical needs at unique events should not be overlooked, the data presented here suggest that community baseline sets an appropriate standard for requiring standby ambulances at mass gatherings. Local baseline data are a recommended starting point when setting policy for public health needs at mass gatherings.

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