

Impact of the San Diego County Firestorm on Emergency Medical Services

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Abbreviations:

ALS = advanced life support
DMAT = disaster medical assistance team
EMS = emergency medical services
EMT = emergency medical technician
EOC = emergency operations center
MICN = mobile intensive care nurse
QCS = County Quality Assurance Network

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Abstract

Background: In October 2003, San Diego County, California, USA, experienced the worst firestorm in recent history. During the firestorm, public health leaders implemented multiple initiatives to reduce its impact on community health using health updates and news briefings. This study assessed the impact of patients with fire-related complaints on the emergency medical services (EMS) system during and after the firestorm.

Methods: A retrospective review of a prehospital database was performed for all patients who were evaluated by advanced life support (ALS) ambulance personnel after calling the 9-1-1 emergency phone system for direct, fire-related complaints from 19 October 2003 through 30 November 2003 in San Diego County. The study location has an urban, suburban, rural, and remote resident population of approximately three million and covers 4,300 square miles (2,050 km²). The prehospital patient database was searched for all patients with a complaint that was related directly to the fires. Charts were abstracted for data, including demographics, medical issues, treatments, and disposition status.

Results: During the firestorm, fire consumed >380,000 acres (>938,980 hectares), including 2,454 residences and 785 outbuildings, and resulted in a total of 16 fatalities. Advanced life support providers evaluated 138 patients for fire-related complaints. The majority of calls were for acute respiratory complaints. Other complaints included burns, trauma associated with evacuation or firefighting, eye injuries, and dehydration. A total of 78% of the injuries were mild. Twenty percent of the victims were firefighters, most with respiratory complaints, eye injuries, or injuries related to trauma. A total of 76% of the patients were transported to the hospital, while 10% signed out against medical advice.

Conclusion: Although the firestorm had the potential to significantly impact EMS, pre-emptive actions resulted in minimal impact to emergency departments and the prehospital system. However, during the event, there were a number of lessons learned that can be used in future events.

Vilke GM, Smith AM, Stepanski BM, Ray LU, Murrin PA, Chan TC: Impact of the San Diego County firestorm on emergency medical services. *Prehosp Disast Med* 2006;21(5):353–358.

Introduction

Disasters affect communities at multiple levels at varying times during and after the precipitating event.^{1–5} In October 2003, San Diego County, California, USA, experienced the worst firestorm in recent history. These fires in the suburban community immediately affected the emergency medical services (EMS) and hospital systems. During the subsequent days and weeks, surveillance reflected trends that required public health, emergency hospitals, and EMS agencies to work together closely.

The fires and the associated poor air quality directly affected many citizens in the County. Once the fire emergency was declared, EMS worked with local media to inform the citizenry of the potential effects of poor air quality, especially on chronically ill populations. The media broadcasted preventive mea-

<i>Medical (event related)</i> —non-respiratory medical conditions aggravated during an event occurring geographically remote to the fire, but felt to be related to the event
<i>Smoke-induced medical</i> —non-respiratory medical conditions aggravated by smoke
<i>Smoke-induced respiratory distress</i> —respiratory medical conditions aggravated by smoke
<i>Smoke inhalation injury</i> —inhalational injury related to smoke in direct proximity to fire with documentation of soot in the nose and mouth
<i>Trauma</i> —injury related to evacuation or defense against fire
<i>Burn</i> —fire-related burn of any degree
<i>Burn with inhalation</i> —fire-related burn with inhalational injury related to smoke in direct proximity to fire with documentation of soot in nose and mouth
<i>Chest pain cardiac (evacuation-related)</i> —complaint of cardiac chest pain during evacuation and or defense against fire
<i>Chest pain cardiac (even-related)</i> —complaint of cardiac chest pain occurring geographically remote to the fire, but felt to be related to the event
<i>Dehydration</i> —heat related or inadequate oral intake due to fire
<i>Eye Injury</i> —ocular injury caused by an ember or ash
<i>Medical (evacuation related)</i> —non-respiratory medical conditions aggravated by evacuation or defense against fire

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Table 1—Clinical diagnostic category definitions

tures to avert related health issues, and advised chronically ill patients to contact their primary care physicians in order to keep emergency departments and prehospital services available. This study assesses the impact patients with fire-related complaints had on the EMS system and offers lessons learned.

Methods

This is a retrospective review of the San Diego County prehospital database collected from 19 October 2003 through 30 November 2003. This includes the pre-firestorm week (19–25 October 2003), the week of the firestorm (26 October–01 November 2003), and the post-firestorm period (02–30 November 2003). The data were collected and the surveillance performed utilizing the County Quality Assurance Network (QCS). The QCS is an online, real-time computer network that connects all receiving hospitals, base hospitals, trauma centers, and many ambulance stations. In San Diego County, prehospital providers and the mobile intensive care nurses (MICNs) enter data from calls run throughout the County into the QCS Electronic Prehospital Patient Record (ePPR). Aside from collecting prehospital patient data, the QCS also provides real-time updates on the resource status of all of the receiving hospitals and trauma centers.

The study was performed in a county with approximately three million people residing in urban, suburban, rural, and remote areas. Approximately 250,000 calls are received annually by the 9-1-1 emergency phone system dispatch agencies, resulting in 160,000 emergency patients. Eighteen advanced life support (ALS) ground transport agencies and a single aeromedical rotor-wing agency oper-

ate in the County, employing about 1,000 paramedics to provide emergency medical services to these areas. The location is served by 20 emergency departments (two of which are military) with two Level-1 trauma centers and four Level-2 trauma centers, one of which is the pediatric trauma center. Medical direction is provided by written protocols with available online medical direction via an MICN or base-hospital physician when necessary.

Data were collected prospectively during the course of the firestorm, tracking all EMS runs, individual emergency department run volumes, and ambulance diversion hours. The county has prehospital surveillance that is performed daily. It included the specific chief complaints from EMS runs. These data were monitored closely during and after the firestorm.

Additionally, a search of the QCS for all EMS runs related to the fire was performed. This was done through a keyword search of the prehospital database, for the records of all patients with the words “fire”, “smoke”, “inhalation”, “flame”, and “ash” included somewhere in the prehospital medical record. These EMS runs were hand-searched by two of the authors to assess whether the patients had complaints related directly to the firestorm and whether they were in communities directly affected by the firestorm. The included patient runs were abstracted for demographics, including age, gender, whether they were firefighters, acuity levels, chief complaints, and disposition. The clinical diagnostic category definitions are listed in Table 1.

This study was approved by the University of California–San Diego Human Research Protections Program.

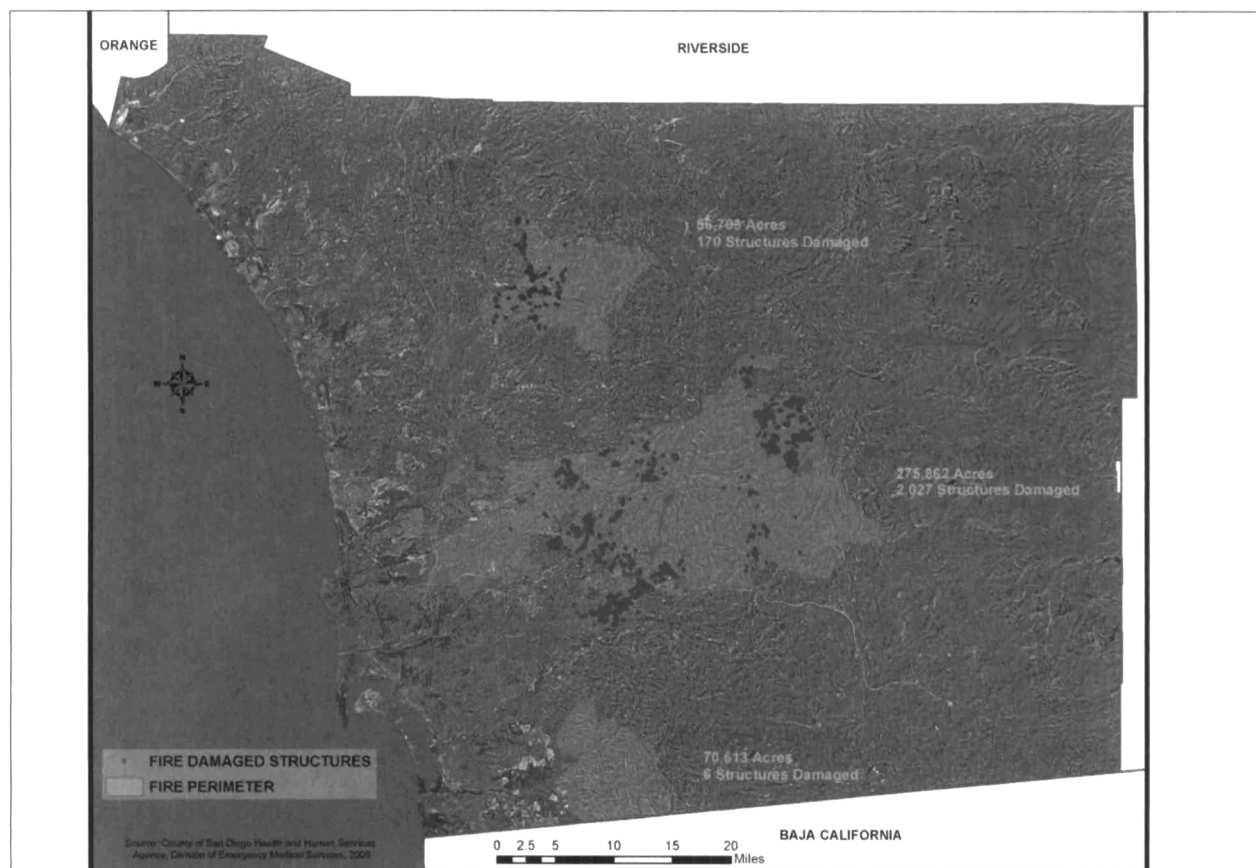


Figure 1—Map of the area affected by the 2003 San Diego Firestorm

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Fire	Acres	Residences Burned	Outbuilding/businesses burned	Fatalities
Cedar	280,278	2,232	588	14
Paradise	56,700	221	192	2
Otay	46,291	1	5	0

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Table 2—Statistics from the three fires during the firestorm

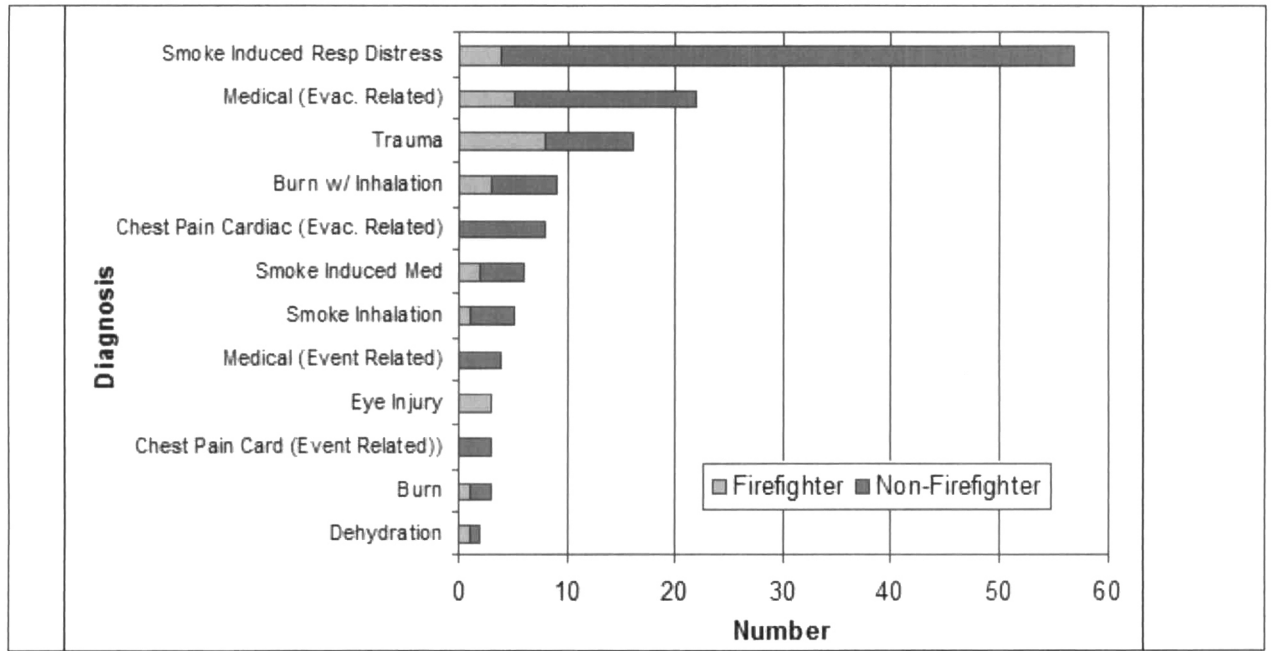
Results

The firestorm in San Diego County actually was three separate fires burning simultaneously (Figure 1). All of the fires started on 26 October 2003. During the firestorm, the fires consumed >380,000 acres (15% of the county land mass), destroyed 2,454 residences and 785 outbuildings, and caused 16 fatalities. The breakdown for the three different fires is included in Table 2.

Advanced life support providers evaluated 138 patients for fire-related complaints during the week of the fire. The majority of calls were for non-chronic respiratory complaints. Other complaints included burns, trauma-related injuries associated with evacuation or firefighting, eye injuries, and dehydration. The breakdown of the chief complaints is represented in Figure 2. The acuity status of patients as defined by paramedics is represented graphically in Figure 3, with the majority of patients presenting with mild injuries. The age breakdowns are graphed in Figure 4. A total of 76%

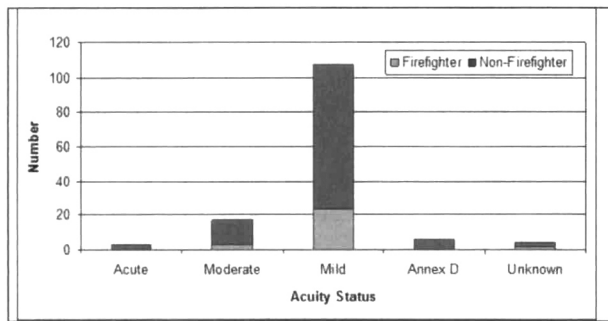
of the patients being transported to the hospital while 10% signed out against medical advice (Figure 5). Another 4% of patients were transferred by alternative transport units, and 1% was released at a scene without the need for transport. An additional 9% had unknown run outcomes. Overall, 20% of the patients were firefighters, most with respiratory complaints during the firestorm was noted using the County’s surveillance system (Figure 6).

The County Emergency Operation Center (EOC) was opened at 05:30 hours (h) on Sunday, 26 October, and it was determined that it would not be contained easily. A local “state of emergency” was proclaimed at 07:50 h with the Governor proclaiming a “state of emergency” later that day. The next day, the President of the United States proclaimed San Diego County a “state of emergency.” The EOC remained open until Saturday, 01 November 2003 when it was closed officially at 16:00 h.



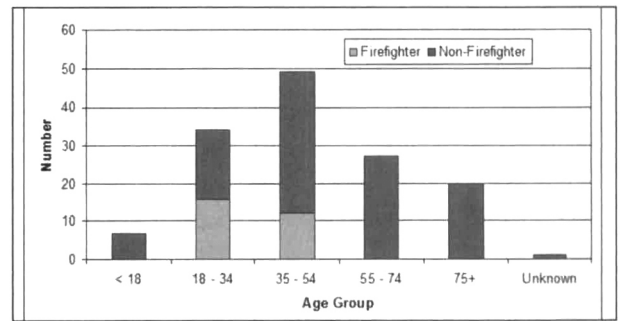
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Figure 2—Numbers of patients in each of the diagnostic categories (Card = cardiac; Evac = evacuation; Med = medical; Resp = respiratory; w/ = with)



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Figure 3—Acuity status of the patients evaluated for fire-related issues as defined by paramedics (Annex D = San Diego County’s multiple victim disaster plan to bring more resources to a scene)



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Figure 4—Age groups of the patients evaluated by paramedics for fire-related issues

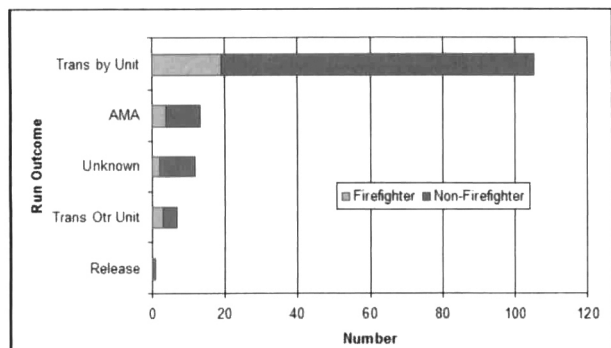
Providing public updates was challenging, as the fire was moving at speeds up to 60 miles per hour with >140,000 acres burned in the first day. Given the speed of the spread, maps of the fire locations were essentially outdated by the time they were ready for distribution.

As many of the county’s 1,000 paramedics are firefighters, and many of the firefighters coming into San Diego County to assist in fire fighting were emergency medical technicians (EMTs). Three emergency concessions were made by the County EMS Medical Director to optimize utilization of personnel resources. These included: (1) utilizing one paramedic and one EMT (instead of staffing two paramedics in an ambulance for primary response); (2) granting blanketing reciprocity to out-of-county or out-of-state EMTs to allow them to practice as EMTs in San Diego County; and (3) granting blanket permission to prehospital EMS agencies to transport injured firefighters to the disaster medical assistance team (DMAT) treatment facilities instead of emergency departments.

Public service announcements were made to warn county residents of the poor air quality and to remain indoors as much as possible. People with respiratory illnesses were targeted in particular with warnings about the possible health effects of the poor air quality. The significant amount of smoke and ash that was carried across the County during the fires is illustrated in Figure 7.

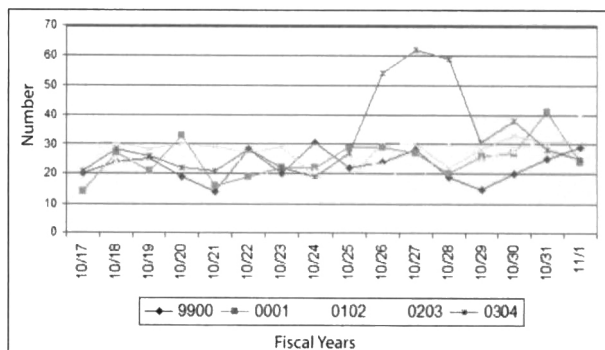
During the fires, several political leaders requested that only essential employees go to work, and all others were asked to remain at home. This caused some confusion as many people, such as nurses and other hospital employees who did not consider themselves essential, and did not report to work.

Requests were made to avoid inappropriate use of the 9-1-1 emergency telephone system or emergency departments. The Public Health Officer addressed preventive measures and advised chronically ill patients to contact their primary care physicians first, in order to keep emergency departments and prehospital services available. During the fires, the emergency department census at local hospitals was reported as lower than usual, whether this was a result of the requests or that people were staying home to follow the news coverage



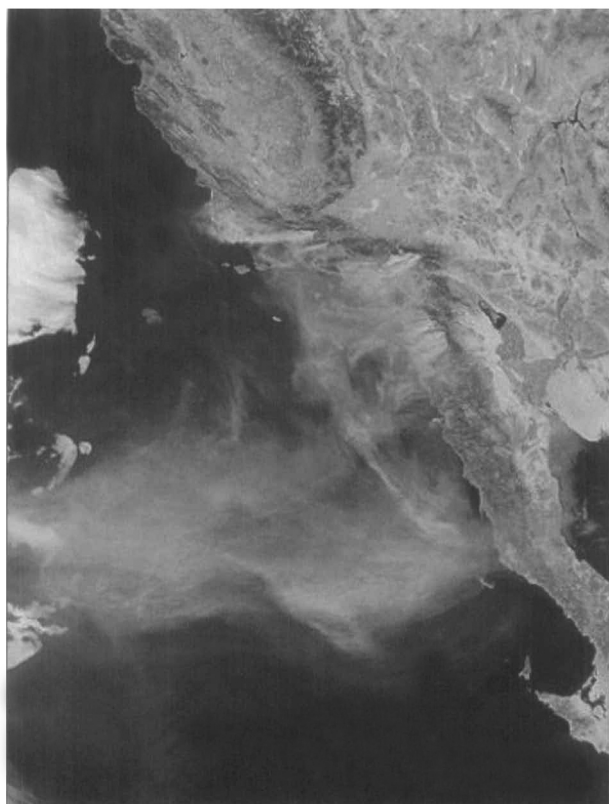
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Figure 5—Run outcomes of the patients evaluated by paramedics for fire-related issues



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Figure 6—The number of patients with respiratory-related chief complaints (including respiratory distress, asthma, COPD (chronic obstructive pulmonary disease), and CHF (congestive heart failure)) reported to MICNs by Paramedics from 17 October 2003–01 November 2003



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Figure 7—Satellite view of the smoke from the firestorms over southern California

of the fires is unclear. Emergency paramedic transports for patients during this event were relatively low; however, this study did not measure treatments of firefighters at the DMAT treatment facility or of patients who came to emergency departments by private vehicle or mass transit.

Discussion

The firestorm was unlike any previous local emergency in recent history in both the magnitude and the number of people affected. This study focused on the effects that the firestorm had on the affected population, which, in turn, imparts upon EMS operations. The speed of the spread of the fire affected many aspects of EMS-related operations, including: (1) evaluation; (2) creation of shelters; (3) distribution of resources; and (4) public information.

The State of California often contracts for DMAT teams to stage a Medical Aid Station staffed with physicians and nurses near large fire lines to offer treatment for the minor medical issues of firefighters, like dehydration or ash in the eyes, without the need to be transported to emergency departments. This has multiple positive impacts, including: (1) facilitating the return of firefighters to the lines; (2) avoiding long transports that occupy other individuals and units; and (3) avoiding additional strain on already busy emergency departments. However, county protocols dictate that patients evaluated by paramedics be transported to emergency departments with provisions for alternative destinations upon the approval of the paramedic base hospital. By offering the DMAT treatment facility as an acceptable alternative destination for firefighters, the base hospitals were not inundated with calls.

Little has been published on firestorms and their effects on the local EMS response or patient demographics in general, let alone in a suburban region of a major city. A number of papers have been published about the Oakland/Berkeley firestorm in 1991 and its effects on the population in the form of psychosocial stressors and other post-traumatic responses.⁶⁻⁸ The pulmonary effects of wildfires on firefighters in general, but these were not localized to specific fire events have been reviewed.⁹⁻¹⁰ Some clinical demographics were offered on 233 patients from the Volendam Café fire.¹¹⁻¹² Inhalation injuries and burns were the most common chief complaints, as would be expected, since this was a closed-space fire event in a building, which contrasts the complaints observed during the firestorm.

During future disasters, press announcements should be clear and specific with collaboration among public figures to avoid confusion.

Limitations to reporting in this study result from the use of an existing database to search for patients. Medical care records that did not reflect any of the keywords that were searched were overlooked. Another limitation is that it is not possible to determine that the public health initiatives had any direct impact on reducing or limiting EMS use during the firestorm.

Conclusions

While the firestorm had the potential to have a significant impact on EMS, it only had a minimal impact to the pre-hospital system.

Acknowledgements

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