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FOCUS ON EMS TRANSPORTS

ON-SITE PHYSICIANS REDUCE AMBULANCE TRANSPORTS AT MASS GATHERINGS

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ABSTRACT

Objectives. To prospectively determine if on-site physicians at a mass gathering reduced the number of ambulance transports to local medical facilities. The authors also wished to determine the level of care provider (emergency medical technician, EMT-P, registered nurse, or medical doctor) required to treat and disposition each patient. **Methods.** This study determined whether each patient presenting to on-site first aid stations at California Speedway during a large motorsports event would require ambulance transport to the hospital per the local emergency medical services (EMS) protocols. Whether the on-site physician prevented certain ambulance transports also was determined. Additionally, the minimum level of provider that could treat and disposition each patient was determined. **Results.** On-site physicians significantly reduced ($p < 0.001$) the number of ambulance transports at this mass gathering. Ambulance transports to local hospitals were reduced by 89% (from 116 to 13). Fifty-two percent of the patients were able to be treated and dispositioned (cardiac arrests, minor first aid, etc.) by a paramedic. Registered nurses were able to treat and disposition another 39% of the patients with pre-established protocols written by the track medical director. These patients had abrasions requiring tetanus shots, mild to moderate heat exhaustion that resolved with intravenous hydration, and other minor complaints. Finally, about 9% of the patients required physician-level care (suturing, prescriptions, etc.) to treat and disposition them. **Conclusion.** On-site physician-level medical care at large mass gatherings significantly reduces the number of patients requiring transport to hospitals, thus reducing the impact on the local EMS system and surrounding medical facilities. **Key words:** mass gatherings; emergency medical services; auto racing; motorsports.

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Emergency physicians increasingly are called on to organize medical support for mass gatherings such as professional and amateur sports venues, large commercial concerts, conventions, and motorsports events. Over the past 20 years numerous investigators have described various levels of physician staffing for such events.¹⁻¹² The role of physicians for routine on-site care at mass gatherings, however, continues to be controversial.

Several investigators have provided arguments supporting physician involvement in such settings. Boyle et al.² have noted that on-site physician participation is crucial in certain events such as air shows, boat races, and auto races where higher risk for major traumatic injuries exists. They also argue that on-site physicians enhanced overall care, reduced liability, and allowed safe disposition of certain patients back to the event without transport to a local medical facility. Chapman et al.³ reported a significant number of patients presenting during a concert required hospital treatment who might have benefited from the services of on-site physicians.

On the other hand, a retrospective study by McDonald et al.⁴ concluded that routine use of on-site physicians is not required if strong medical control is available and transport time is less than 30 minutes. This study's results, however, may have limited applicability by its small size and short duration. Additionally, the outcomes of 84% of the patients who refused care were not able to be determined. Similarly, Thompson et al.⁵ in their retrospective review of the Calgary Winter Olympic Games concluded that physician-based advanced life support (ALS) systems are not required for urban gatherings in communities with modern ALS ambulance service and short transport time.

To the best of the authors' knowledge, no study has analyzed prospectively the use of physicians at mass gatherings. This study prospectively focuses on the on-site patient care provided by medical personnel at a large mass gathering. Medical personnel ranged

from paramedics to nurses and physicians. Because a large influx of patients from a mass gathering potentially can overwhelm both an emergency medical services (EMS) system and the surrounding emergency department(s), we wished to determine whether on-site physicians reduced the numbers of patients transported to local hospitals.

The objective of our study was not only to determine if on-site physicians reduced ambulance transports, but also to determine the level of care provider [emergency medical technician (EMT), emergency medical technician-paramedic (EMT-P), registered nurse, or medical doctor] required to treat and disposition patients at a large mass gathering. The study also describes the spectrum of chief complaints of patients presenting to first-aid stations at one large mass gathering in southern California. The authors' null hypothesis was that on-site physicians would not decrease the number of ambulance transports to the hospital at a large mass gathering.

METHODS

Study Design

This was a prospective, observational study of all patient encounters during a large motorsports event at the California Speedway. The Loma Linda University Institutional Review Board reviewed the study protocol and determined the study was conducted in accord with appropriate ethical standards and qualified for exempt status (per 45CFR46.101[b][4]).

Study Setting and Population

California Speedway is a state-of-the-art, 2-mile, D-shaped super speedway built in 1996-1997 by Penske Motorsports, Inc., and is the largest sports venue in California. California Speedway has hosted numerous racing events, including the National Association of Stock Car Auto Racing (NASCAR) Winston Cup race, the Indy Racing League race, the American Motorcyclist Association Superbike race, the CART FedEx series, International Race of Champions, NASCAR Busch Grand National series, NASCAR Trucks, NASCAR Winston West series, and Indy Lights series. California Speedway is also the fastest speedway in the world with a closed course qualifying speed of over 241 mph.

Typical race weekends start on Thursday with race car testing and continue with qualifying on Friday, a support race on Saturday, and the main race on Sunday. The speedway can host up to 125,000 spectators on a Sunday with up to 250,000 people over an entire race weekend. Additionally, approximately 20,000 people camp overnight on the speedway property in recreational vehicles.

Paramedics, nurses, and physicians provide medical support for all race car drivers, spectators, and

others on speedway property 24 hours per day at no cost throughout race weekends. During the daytime, up to nine first-aid stations are staffed with nurses and paramedics. In addition, two of the stations are staffed with emergency physicians and provided with equipment to provide more advanced medical support such as suturing, splinting, defibrillation/cardioversion, medications, surgical airways, rapid-sequence intubation, central line insertion, and other advanced medical interventions. At night, the Infield Care Center is staffed with an emergency physician, nurse, and paramedics. X-ray and laboratory facilities were not available on-site at the time of this study. All 9-1-1 medical calls are forwarded by the local public safety answering point to the California Speedway communications center, which dispatches appropriate on-site resources. Additional medical resources include four roving ALS mini-ambulances, nine roving golf cart teams, and a dedicated, medically configured helicopter with a paramedic/nurse/pilot flight crew. Overall, approximately 100 (paramedics, nurses, physicians, dispatchers) medical team personnel provide care to patients during a large race weekend.

Paramedics at the track operate essentially under local EMS system protocols, which predate this study. Paramedics in this system have standing orders to intubate, defibrillate, start intravenous lines, provide advanced cardiac life support medications, provide nebulized breathing treatments, give anticonvulsants, provide oxygen, and package and transport patients to hospitals or on-site facilities staffed with nurses or physicians. Paramedics also always have online medical direction available from on-site physicians. Nurses have protocols that allow them to do everything that a paramedic does plus treat other common complaints that have specific protocols. For instance, nurses can treat heat-related illness with fluids and cooling measures. If the patient's symptoms completely resolve, the nurse is able to discharge the patient. Nurses also have protocols for wound care that allow them to assess a wound, give tetanus shots, and discharge patients who do not require further interventions such as wound repair. Nurses also have protocols that allow them to render basic first aid and hand out acetaminophen or ibuprofen. Patients with complaints that are not covered by these protocols generally are seen by the on-site physicians. Typical complaints that require physicians include abdominal pain, lacerations, motor vehicle crashes, syncope, chest pain, eye complaints, and complaints requiring prescriptions.

Although most patients present to first-aid stations requesting assistance, many patients also are seen by mobile medical response units. Additionally, track policy dictates that all drivers that make contact with anything (the wall or other cars) and are unable to drive their car away from the incident must be seen and examined by the track physician. We collected

TABLE 1. Patient Transports with and without On-site Physicians

Day	Attendance	Total Patients	Ambulance Transports without On-site Physicians	Ambulance Transports with On-site Physicians
Thursday	Closed to public	18	2	0
Friday	10,000	43	12	3
Saturday	55,000	223	53	5
Sunday	82,000	201	49	5
Total	147,000	485	116	13

descriptive data on each of the earlier-described patient encounters during the four-day event.

Study Protocol

All patient encounters were recorded during a four-day race weekend from October 28 to 31, 1999. The following information was collected on each patient encounter: chief complaint, time, date, age, status (i.e., spectator, employee, driver, crew), diagnosis, and treatment provided. Final diagnosis for this study was determined by the highest medical authority (paramedic, nurse, or physician) who provided care for the patient. All medical personnel involved in direct patient care, the data entry individual (DEI), the paramedic reviewer, and the physician reviewer were blinded to the study hypotheses. These data were recorded on one of two standard medical records and entered into a computer database (Microsoft Excel, Microsoft Corp., Redmond, WA) by a single DEI. The DEI was an experienced emergency medicine registered nurse with a strong background in the area of EMS and intimate knowledge of local rules and regulations governing local EMS providers. The DEI collected and entered the data on a continuous basis throughout each day so that she could interview each care provider regarding patient contact details to prospectively and accurately answer the study questions. All data elements were required in order to be entered into the study database. The DEI was asked to answer the following two questions for each encounter at the time of entry of patient encounters: 1) If physician services were not available at the speedway, indicate for each patient whether or not transportation to a local hospital would be required under the local EMS guidelines given the presenting complaint; 2) for each patient encounter, please indicate the lowest provider level necessary to definitively treat and disposition the patient (EMT, paramedic, nurse, or physician). No physician input for these responses was allowed. A paramedic and physician familiar with local EMS protocols and blinded to the others' answers also reviewed the data and answered the same two questions. Patient refusals of care were handled according to local protocol, which allows any competent adult to refuse care and requests that he or she sign a "Release of Liability" form. Refusals of care by minors also were handled by local protocol, which allows parents to

refuse care or transport in coordination with the on-site physician. All patients who required transport off-site had daily telephone follow-up until time of discharge from the hospital.

Data Analysis

Data analysis was conducted using Systat 8.0 statistical software (Systat Inc., Evanston, IL). P-values < 0.05 were considered statistically significant. Total patient transports assuming no on-site physicians was compared with total patient transports with on-site physicians using chi-square analysis of the DEI data. A kappa value also was calculated to compare the results between the nurse, paramedic, and EMS physician. Additional descriptive statistics are reported to describe the spectrum of medical complaints seen.

RESULTS

Total spectator attendance was about 147,000. This did not include the employees, drivers, crewmembers, media, and so forth, which is estimated to be another 5,000 people per day.

A total of 485 patients were seen over the four-day race weekend by California Speedway medical staff (Table 1). Spectators comprised 68% (331 of 485) of the patients seen. Track staff, vendors and race officials comprised 25% (121 of 485) of patients seen, whereas crewmembers, drivers, and owners comprised another 5% (25 of 485) of those seen. Eight patients were categorized as "other."

The most common chief complaint was soft-tissue injury, followed by headache (Table 2). The patients treated per 10,000 (PPTT) spectators varied from 40.5 PPTT on Saturday to 24.3 PPTT on Sunday.

Chi-square analysis revealed physicians significantly reduced ($p < 0.001$) the number of transports that would have been required had no physicians been present (Table 3). Ambulance transports to local hospitals were reduced by 89% (from 116 to 13).

There was relatively good agreement among the nurse, physician, and paramedic regarding the overall number of patients who would have required transport if there had not been an on-site physician (nurse—115, physician—93, paramedic—94). However, there was poor agreement between the nurse and

TABLE 2. Medical Problems Encountered

Medical Problem/Injury	Total	Percent
Allergic reaction	2	0
Burns	10	2
Cardiac	4	1
Head injury	0	0
Eye problem	26	5
Gastrointestinal	19	4
Heat-related illness	13	3
Intoxication	2	0
Miscellaneous	93	19
Orthopedic	36	7
Headache	130	27
Respiratory	9	2
Soft-tissue injury	140	29
Major trauma	1	0
Total	485	100

TABLE 3. Chi-square Analysis

On-site Physician	Ambulance Transport Required	
	Yes	No
Yes	13	470
No	116	367

Chi-square value (χ^2): 93.

physician ($\kappa = 0.04$) and nurse and paramedic ($\kappa = -0.03$) regarding which specific patients would have required ambulance transport without on-site physicians.

About half (52%) of the patients seen could be treated and dispositioned (Fig. 1) by a paramedic (252 of 485). These patients included minor first-aid patients, cardiac arrests, altered patients requiring transport, and so forth. Registered nurses were able to treat and disposition another 39% (189 of 485) of the patients with pre-established protocols written by the track medical director. These patients included abrasions requiring tetanus shots, mild to moderate heat exhaustion that resolved with intravenous hydration, and other minor medical problems. Finally, about 9% (44 of 486) of the patients seen required a physician to treat and disposition the patient. The majority of these patients either required wound repairs (11 of 44), driver evaluations after high-speed on-track accidents (7 of 44), prescriptions for infections (5 of 44), or evaluation and/or prescriptions for orthopedic injuries (9 of 44). Other patients requiring physician-level evaluation or intervention had eye foreign bodies, dyspnea, nose bleeds, seizures, dehydration and headaches. The majority of drivers involved in high-speed incidents generally are uninjured and released after on-site evaluation by physicians.

DISCUSSION

Physicians were required for nearly half (48%) of the patient care provided at our venue. Although direct

physician care was required for only 9% ($n = 44$) of all patients seen, another 39% of the patients required a nursing level of care that required a physician to provide medical oversight. This medical oversight could be in the form of either on-site supervision or prewritten protocols. Protocols allow prehospital and nursing personnel to treat and release certain patients who clearly meet predetermined criteria for a specific condition without the need for evaluation by the on-site physician. For example, extremes of temperature could lead to many young, otherwise healthy patients with heat exhaustion and dehydration. Protocols could allow experienced nurses to hydrate patients both orally and intravenously for suspected heat exhaustion with discharge for patients who have their symptoms completely resolve. Any patients who do not get better would then have to be seen and evaluated by an on-site physician or transported to a hospital. The safety and effectiveness of protocols in reducing unnecessary transports depend heavily on the immediate availability of on-site physicians for consultation when necessary.

Because mass gatherings are simply subsets of the general population, it is understandable why several studies have shown the diversity of medical problems that may be encountered at such large events. Some investigators have questioned the necessity of having on-site physicians at large mass gatherings and whether they significantly contribute to the quality of care provided. This argument generally is based on the notion that the majority of problems encountered are minor and can be managed by prehospital personnel. This study shows, however, that in large mass gatherings a significant number of patients present with problems that may require care that is outside the scope of practice of prehospital personnel (i.e., suturing, kidney stones, medication refills, pharyngitis). Additionally, prehospital personnel cannot typically treat and release patients without transporting them to a medical facility for further evaluation regardless of how minor the presenting problem may be. Without on-site physicians,

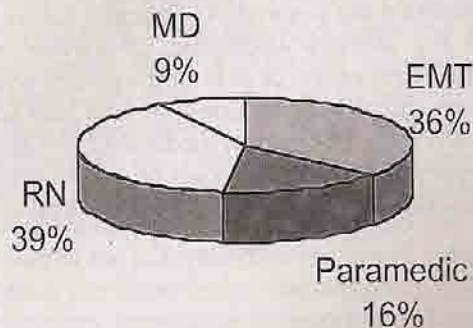


FIGURE 1. California Speedway 1999 CART Season Finale minimum level of provider required to treat and disposition 485 patients. MD = physician; EMT = emergency medical technician; RN = registered nurse.

many of these patients could require transport via EMS to a local medical facility for proper treatment and disposition. This could have a significant impact on the local EMS system and emergency departments whose availability may become crucial in the event of a multiple casualty incident or disaster.

Patients at our venue historically have presented with a multitude of complaints ranging from chest pain, active labor, pediatric fevers, cough, altered mental status, difficult airways, to major trauma after hitting the wall at 240 mph. Thus, physicians working at such a venue must be qualified and experienced in assessing and managing such a diverse group of chief complaints. Physicians working at a large mass gathering must be able to work well with prehospital personnel such as EMTs, paramedics, and nurses, and understand their scope of practice and capabilities. They must have an intimate knowledge of the local EMS system and the rules and regulations governing it. In general, emergency physicians with experience in EMS who are capable of working in the out-of-hospital environment are the most suited to plan and deliver medical care at such events.

Organizers of large mass gatherings may benefit from a higher level of medical care owing to increased customer satisfaction and liability reduction. If a higher level of medical care is unavailable at the venue, many patients may not obtain necessary care. In the authors' experience when on-site physician care is available, the spectators not only obtain necessary medical care, but also tend to be more satisfied with their experience at the venue, tend to want to return to the venue in the future and may even be less litigious.

LIMITATIONS AND FUTURE STUDIES

There are several important limitations to this study. The data were collected during a single race weekend and may not be representative of medical care at other large racing events or other large mass gatherings. Whenever expert opinion such as that of the DEI is used to answer a question, there is always the possibility that bias can be introduced. Poor interrater reliability confirms the somewhat subjective nature of the question the authors attempted to answer in this study. This comparison of patient transports with and without on-site physicians does not take into account patients who sign out against medical advice and thus may overestimate the true impact of on-site physician care. This comparison also does not take into account

alternative modes of transportation such as a wheelchair van, private transportation, or other public transportation that could be used in lieu of an ambulance. The data were collected in southern California and it is uncertain how climatic differences in other regions might produce variations in overall patient load and spectrum of medical illness.

Future studies should assess the ratios of EMTs, paramedics, nurses, and physicians that are most efficient for support of large mass gatherings.

CONCLUSIONS

On-site physicians at large mass gatherings significantly reduce the number of patients requiring transport to hospitals, thus reducing the impact on the local EMS system and surrounding medical facilities.

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