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# Scientific Oral Paper Presentations

## Track I

Great Hall Center

Friday, June 14, 1991

Moderator: Donald Yealy

1:00 PM

### Seroconversion of HBV-DNA Vaccinated EMS Personnel

*Koenigsberg MS, Ward S, Koslenko T, Herman L, McDonald C, Feigon KL, Feldman RM*  
 University of Illinois College of Medicine, Chicago, Illinois; Chicago North EMS System, Illinois Masonic Medical Center, Chicago, Illinois

**Objective:** To evaluate seroconversion rate of EMS personnel given the HBV recombinant DNA vaccine Series.

**Design:** Retrospective review of paramedics and fire fighters consecutively completing the HBV recombinant DNA vaccine program.

**Setting:** Urban, Non-profit, private, regional EMS resource hospital, the Chicago North EMS System is under contract with the Chicago Fire Department. This contract allows for the voluntary vaccination of EMS personnel with recombinant DNA-HBV vaccine and treatment and follow-up of paramedics and firemen possible exposed to HBV.

**Population:** Initial 50 EMS personnel completing HBV recombinant DNA vaccine program.

**Intervention:** The HBV recombinant DNA series was voluntarily administered per manufacturer's recommendations to Chicago North EMS System paramedics and firemen. After two weeks post-vaccination series completion, HBV antibody titres were drawn to determine reactivity and need for further immunization.

**Results:** Of the 50 vaccinated individuals, only two were found to have negative titre (4%). These two individuals were given a fourth dose of vaccine with successful seroconversion.

**Conclusions:** Prehospital care personnel are known, high-risk, health care workers for acquiring HBV and should be prophylactically vaccinated. there is a high seroconversion rate (96%) utilizing HBV recombinant DNA vaccine, however, post-vaccination antibody titres must be performed to identify those rare individuals that do not seroconvert.

## Track I

Great Hall Center

Friday, June 14, 1991

Moderator: Donald Yealy

1:15 PM

### The Use of Pulse Oximetry in the Prehospital Detection of Occult Disease

*Fugelso DK, Saunders CE, Knudson MM*  
 University of California, San Francisco, School of Medicine; San Francisco Department of Public Health, San Francisco, California

**Purpose:** This study investigated pulse oximetry in the prehospital setting to determine its value in detecting occult clinically important cardiac, pulmonary, or hypoxic conditions.

**Methods:** Oxygen saturation (SO<sub>2</sub>) in critically ill, prehospital patients was monitored prospectively by paramedics using pulse oximetry, both upon initial arrival and during treatment and transport. Subsequent in-hospital clinical and laboratory data were reviewed by a blinded physician reviewer, to determine the patient's ultimate diagnosis. The diagnosis was categorized as apparent or occult based on whether prehospital assessment alone would have identified the condition. Cutoff SO<sub>2</sub> values were then determined which would have detected clinically occult conditions with the greatest sensitivity (SENS), specificity (SPEC), positive (PPV), and negative (NPV) predictive value (test of proportions: chi-square analysis).

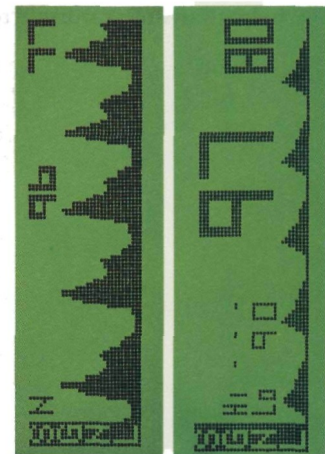
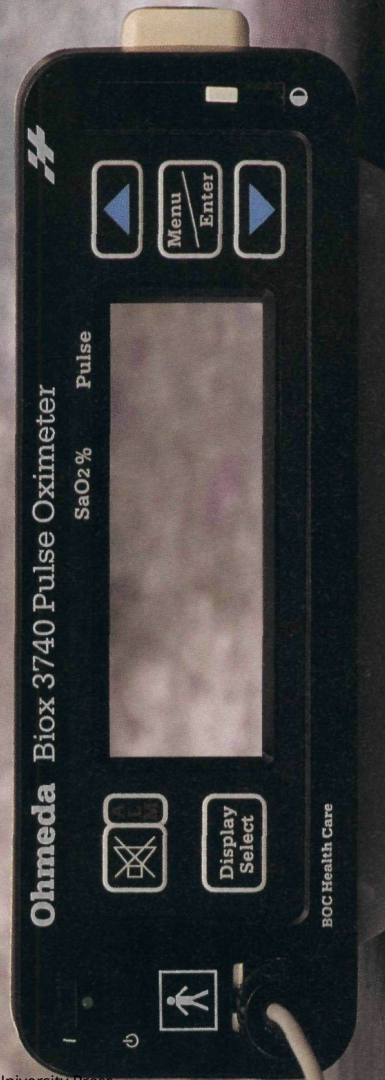
**Results:** A total of 201 patients were studied; 39 (19.4%) had clinically important conditions of which 32 (82.1%) were occult. On room air, 12 of 18 occult conditions would have been detected using SO<sub>2</sub> values less than 92% (p=.0001); SENS 66.7%, SPEC 91.3, PPV 57.1, NPV 94.0); in patients on supplemental oxygen, nine of 14 would have been detected using SO<sub>2</sub> values less than 98% (p-.01; SENS 64.3, SPEC 69.8, PPV 36.0, NPV 88.1).

**Conclusions:** Pulse oximetry is a useful, non-invasive technology in the prehospital setting which aids the early detection of clinically important occult injury or illness.



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**Track I**

Great Hall Center

**Friday, June 14, 1991**

Moderator: Donald Yealy

1:30 PM

**Results of Transcutaneous Cardiac Pacing in an Urban EMS System**

Cionni DJ, Spillane LL, Angelini KM, Cohen SB, Klein SW, Lindell DW, Davidson SJ  
The Medical College of Pennsylvania, Philadelphia, Pennsylvania

**Hypothesis:** Transcutaneous cardiac pacing (TCP) may improve perfusion in prehospital patients with symptomatic bradycardias and restore perfusion to those in bradycardic cardiac arrest.

**Methods:** Following the introduction of TCP to the field, all pre-hospital patient encounters (4/1/90–2/14/91) in which TCP was attempted were identified during 100% chart review of ALS. Available data were evaluated to obtain the response time, duration of pulselessness if known, initial rhythm, presence of pulses prior to TCP, rhythm prior to TCP, evidence of electrical capture, presence of pulses consistent with the TCP rate and administration of ACLS drugs.

**Results:** TCP was attempted in 78 patients. Four patients were excluded from analysis because of incomplete data. Electrical capture was noted in 64% (47/74) of patients. Ninety-four percent (44/47) of these patients had received atropine without improvement prior to pacing. Fifty-three percent (25/47) of these patients had no pulses prior to pacing and 56% (14/25) of these patients developed pulses at a rate consistent with the TCP rate. Forty-seven percent (22/47) of patients with electrical capture had pulses prior to TCP but had a symptomatic bradycardia. Ninety-five percent (21/22) of these patients developed pulses consistent with the TCP rate. Two of these 22 patients had been resuscitated from a pulseless rhythm to a symptomatic bradycardia. Thus, a total of 74% (35/47) of patients with electrical capture developed pulses consistent with the TCP rate.

**Conclusions:** TCP applied according to standing orders in an urban EMS system is capable of improving perfusion in patients with symptomatic bradycardias and restoring perfusion to those in bradycardic cardiac arrest.

**Track I**

Great Hall Center

**Friday, June 14, 1991**

Moderator: Donald Yealy

1:45 PM

**A Prospective Analysis of the Impact of Initial Glasgow Coma Scale on Prehospital Treatment and Transport of Seizure Patients**

Spaite DW, Valenzuela TD, Criss EA, Meislin HW, Ross J  
Arizona Emergency Medicine Research Center, University of Arizona College of Medicine; Medical Division, Tucson Fire Department, Tucson, Arizona

**Hypothesis:** The initial Glasgow Coma Scale (GCS) obtained by prehospital personnel on seizure victims is associated with the likelihood of treatment and transport.

**Methods:** Prehospital data were prospectively collected for all patients presenting with seizures to an urban EMS system during a five-month period. Statistical evaluation was chi-square analysis (Yates') with  $p < 0.05$  considered significant.

**Results:** A total of 419 cases occurred (62.8% male). Seizure frequency was highest in infants under age three and in adults in their late twenties. Transport to the hospital was arranged for 289 patients (69.0%). The GCS was recorded in 378 cases (90.2%). The GCS was  $>10$  in 304 patients (80.4%) and  $\leq 10$  in 74 (19.6%). Patients with  $GCS \leq 10$  were more likely to receive the following: oxygen (50.0% vs 20.1%,  $p < .001$ ); establishment of intravenous (IV) line (35.1% vs 8.9%,  $p < .001$ ); IV medications (16.2% vs 1.0%,  $p < .001$ ); transport (94.6% vs 63.8%,  $p < .01$ ).

**Conclusion:** Seizure patients with a GCS of  $\leq 10$  were more likely to receive a variety of prehospital treatments and to be transported than patients with  $GCS > 10$ . However, the clinical indicators that were used to make the decision that it was "safe" not to transport nearly one-third of the patients are unclear. Essentially, no data exist regarding the parameters impacting treatment and transport of seizure patients. Future investigations, with outcome data, are needed to determine whether low risk criteria can be developed to identify those patients (if any) that do not require treatment or transport. GCS may provide an objective, reproducible parameter upon which to begin formulating such criteria.

**Track I**

**Friday, June 14, 1991**

*Great Hall Center*

*Moderator: Donald Yealy*

**2:00 PM**

**Emergency Physician Interpretation of Prehospital, Paramedic-Approved Electrocardiograms**

*Schaffer JA, Valenzuela TD, Wright AL, Clark L, Brakema R, Goldman S, Spait DW*

*Arizona Emergency Medicine Research Center. Department of Mathematics, University of Arizona; Section of Cardiology, Department of Internal Medicine, Veterans Administration Medical Center, Tucson, Arizona*

**Hypothesis:** Emergency Physician interpretation of prehospital, paramedic-acquired electrocardiograms (ECGs) is accurate judged by comparison with that of a reference cardiologist.

**Methods:** Over a two-month period, 12 lead ECGs were obtained by paramedics in the field from 73 patients presenting with acute chest pain. The ECGs were transmitted by cellular telephone to a central location. Each ECG was assessed for the presence of acute myocardial infarction (AMI) by a third-year, emergency medical resident (EMP-R), a residency-trained, board-certified, emergency physician (EMP-RT), an emergency physician, board certified under practice option (EMP-PT), and a board-certified cardiologist. Agreement between each emergency physician and the cardiologist was determined by the kappa statistic. Hospital records were reviewed for final diagnosis of each patient.

**Results:** Eight of 75 patients received a hospital diagnosis of AMI. See Table 1.

**Table 1—Results of Physician Interpretation of Paramedic-Acquired ECGs.**

	Total % Agreement	kappa	Sensitivity	Specificity
EMPR	97	.625	.125	.969
EMP-RT	99	.920	.250	.969
EMP-PT	97	.625	.125	.969
Cardiologist	NA	NA	.250	.985

The ECG of one patient with Prinzmetal's angina was interpreted as AMI by all three emergency physicians and the cardiologist.

**Conclusions:** Residency-trained or board-certified emergency physician interpretations of prehospital, paramedic-acquired, 12-lead ECGs who a high degree of agreement with reference cardiologist interpretation.

**Track I**

**Friday, June 14, 1991**

*Great Hall Center*

*Moderator: Donald Yealy*

**2:15 PM**

**Operational Safety on EMS Helicopters: A Longitudinal Study**

*Low RB, Carney M, Collins P, Defesne D, Hunt RC*  
*East Carolina University, Pitt County Memorial Hospital, Greenville, North Carolina; The University of Chicago Aeromedical Network, Chicago, Illinois*

**Hypothesis:** Emergency medical service (EMS) helicopter accidents are a concern of EMS personnel and the public. This research tests the hypotheses that: 1) helicopters permitted to fly into clouds under instrument flight rules (IFR) have a better operational safety record than helicopters limited to flight under visual flight rules; 2) programs are shifting to the use of helicopters certified for flight under IFR; and 3) busy programs have fewer accidents than programs that fly less frequently.

**Methods:** This is a longitudinal, epidemiologic study of all helicopter ambulance services in the United States and Canada. Four surveys cover the period between 1 January 1986-28 February 1991. Data were collected on the number of safely completed flights and the number of accidents. Statistical comparisons were done with chi-square and log likelihood ratio chi-square tests.

**Results:** Response rate for the first surveys was 98%; a similar response rate was expected from the last survey. Helicopter programs that can always fly under IFR had no accidents. Helicopter programs that are sometimes or always limited to visual flight had an accident rate of 58/million flights (p=.033). The percentage of patients flown on IFR certified helicopters has increased from 16% to 29% (p<.0005). Programs which fly frequently have a better safety record (24 accidents/million flights) than programs that fly infrequently (131 accidents/million flights, p<.001).

**Conclusions:** The ability to fly "on instruments" seems to improve the operational safety of civilian helicopter ambulances. Programs are shifting to the use of these more expensive aircraft. Busy flight programs have a significantly better safety record than programs that less frequently.



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PATENT PENDING

**Track I**

Great Hall Center

**Friday, June 14, 1991**

Moderator: Donald Yealy

**2:30 PM****United States Trauma Diversion****Policy and Triage Criteria Utilization**

Kolka J, Sloan E, Koenigsberg M, Nolin J, Fagan J,

Stein-Spencer L, Barrett J

Department of Emergency Medicine and Division of Trauma, Cook County Hospital; Department of Emergency Medicine, University of Illinois Hospital; Illinois Department of Health; Program in Emergency Medicine, University of Illinois College of Medicine, Chicago, Illinois

**Purpose:** Identification of criteria used by emergency medical service (EMS) systems in the United States to divert trauma patients to specialty care.

**Study Design:** This study conducted a cross-sectional mail and telephone follow-up survey of state and local EMS officials addressing trauma triage in the largest EMS system in each state.

**Results:** Surveys were returned from 40 states (80%). A formal state or local system which allowed diversion to trauma centers was present in 24 of 30 states (60%), of which 22 had written documents governing trauma diversion (92%). Eligibility for diversion was determined solely by paramedics in 14 systems (59%), medical control in five systems (21%), and jointly in five systems (20%). Seventeen of 24 (70%) included "relative or judgment criteria." Formal, published, decision schemes were incorporated into the 17 systems (70%). Eight systems (33%) used the American College of Surgeons decision scheme exclusively. The most commonly used physiologic criteria was low systolic blood pressure, which was used in 19 systems (79%), followed by respiratory abnormalities, used by 14 systems (58%). Traumatic arrest, alone, causes diversion in 12 systems (50%). Penetrating head trauma, alone, causes bypass in 16 systems (66%). Although the presence of flail chest prompted diversion in 15 systems (62.5%), other blunt injuries were absolute indications for diversion in only seven systems (29%).

**Conclusion:** A large number of states have no formal trauma network within EMS systems that allow for triage to trauma centers. In systems which allow for diversion, nearly all have policies which include specific criteria. The majority allow paramedic judgment to prompt diversion even when specific criteria are not met. The most frequently used criteria are anatomic (penetrating) injuries, followed by low systolic blood pressure. Formal (published) decision schemes were used to some extent in 17 systems (70%).

**Track II**

Great Hall Center

**Friday, June 14, 1991**

Moderator: Daniel Spaitte

**3:30 PM****Infant Ventilation and Oxygenation by Basic****Life Support Providers: Comparison of Methods**

Terndrup TE, Warner DA, Pierluisi GJ

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Little information is available on the performance of basic life support (BLS) providers in infant ventilation. The hypothesis of this study is that there are no significant differences between mouth-to-mouth (M-M), mouth-to-mask (M-Ma), and pediatric (PBM), or adult (ABM) bag-mask methods in the percentage of acceptable breaths when performed by BLS personnel. Fifty, certified, BLS providers performed five ventilation methods in random sequence for 60 seconds each on a 5 kg infant mannequin following standardized instructions. Supplemental oxygen, 10 L/min was supplied with one M-Ma trial and PBM methods. Airway patency, peak airway pressure (PAP), respiratory rate, tidal volume, and delivered oxygen concentration (FiO<sub>2</sub>) were recorded. The percentage of breaths with excessive PAP (i.e., 30 mmHg), percentage of acceptable breaths using loose (i.e., 25–125ml) and strict (i.e., 50–100ml) criteria, and FiO<sub>2</sub> at 15s, 30s, 45s, and 60s were compared among ventilation methods using ANOVA. For all subjects and those with a patent airway (n=36), there were no significant differences in the percentage of acceptable breaths among the ventilation methods using loose or strict criteria. The percentage excessive pressure breaths for PBM (56±6.0; mean±SEM; all subjects) and ABM (41±6.2) was significantly greater than M-Ma (18±4.8), with and without a patent airway. Although RR and percentage excessive pressure breaths were not significantly different, the percentage acceptable breaths and FiO<sub>2</sub> delivery with each ventilation method was significantly better in the patent airway group. In BLS providers, M-Ma ventilation with supplemental oxygen provided the best method of initial infant ventilation based upon the percent of acceptable breaths, oxygen delivery, and fewest excessive pressure breaths.



**Track II**

**Friday, June 14, 1991**

Great Hall Center

Moderator: Daniel Spaite

3:45 PM

**Demand Valve Ventilation in a Swine Pneumothorax Model**

Murray J, Menegazzi J, McCabe J, Seaberg D  
 University of Pittsburgh Affiliated Residency in Emergency Medicine,  
 Division of Emergency Medicine, University of Pittsburgh Center  
 for Emergency Medicine of Western Pennsylvania, Pittsburgh,  
 Pennsylvania

**Hypothesis:** Bag valve mask (BVM) and oxygen-powered demand valves (OPDV) are two available adjuncts for artificial ventilation. Use of OPDVs have been limited by concern for causing or worsening pneumothorax (PTX). The hypothesis of this investigation was that the OPDV and the BVM do not differ in their effects on PTX volume, and hemodynamic or ventilatory parameters.

**Methods:** In this randomized, cross-over design, five fasted female swine (16–23 kg, mean 20.5 kg) were sedated (ketamine/xylazine), anesthetized (alpha chloralose), intubated with a 5-0 cuffed endotracheal tube, ventilated with room air, paralyzed (vecuronium), and left femoral arterial lines placed. Right chest injury was induced using a 14-gauge (g) needle to produce disruption of underlying lung parenchyma. An 18g French Foley catheter was inserted and sealed in the right pleural space at the injury site. For each trial, a PTX was induced by instilling 300 cc of air. Each subject underwent 10-minute ventilation trials (to simulate prehospital transport times) with OPDV and with BVM by the same investigator, blinded to instrumentation. Measurements of post-trial PTX volume, heart rate (HR), blood pressure (BP), end-tidal CO<sub>2</sub> (ETCO<sub>2</sub>), and arterial blood gases (ABGs) were made. Data were compared using repeated measures ANOVA, Tukey's multiple comparisons, and Student's *t*-test with the alpha error rate set at 0.05.

**Results:** There was no significant difference in PTX volume after OPDV ventilation (310.8 cc) versus BVM ventilation (315.4cc) (*p*=.821). No significant differences in HR, BP, or ABGs were detected. The ETCO<sub>2</sub> showed significant decreases from baseline in both OPDV (33.0 to 28.6) and BVM (33.8 to 30.2) trials. However, multiple comparisons showed no significant differences between OPDV and BVM at any timepoints.

**Conclusion:** In this model, OPDV and BVM ventilation did not differ in their effects on PTX volume or hemodynamic variables. No animal showed signs of tension PTX. Hyperventilation occurred with both devices, but this may have been operator-dependent.

**Track II**

**Friday, June 14, 1991**

Great Hall Center

Moderator: Daniel Spaite

4:00PM

**Comparison of Delivered Volumes and Airway Pressures when Ventilating through an Endotracheal Tube with a Bag-Valve Demand Valve**

Mossesso V, Lukitsch K, Menegazzi J, Mossesso J  
 University of Pittsburgh Affiliated Residency in Emergency Medicine,  
 University of Pittsburgh Medical Center, Center for Emergency  
 Medicine of Western Pennsylvania, Pittsburgh, Pennsylvania

**Purpose:** Use of an oxygen-powered demand valve (DV) to ventilate through an endotracheal tube is generally considered inappropriate. This study hypothesized that ventilation with a bag-valve device (BV) and the recently re-designed DV would produce similar tidal volumes (TV), minute ventilation, and peak airway pressures (PAP).

**Methods:** This is a prospective, randomized, *in vitro*, experimental model. Subjects were blinded to volume and pressure gauges. Thirty-nine emergency medical technicians (EMTs) (mean age 27 years; mean experience 5 years) volunteered to ventilate a mechanical test lung through an endotracheal tube for ten minutes. Each subject was randomized to BV and to either normal (0.05 L/cm H<sub>2</sub>O) or poor (0.02 L/cm H<sub>2</sub>O) lung compliance. This DV delivers set flow of 40 L/min at a maximum 50±5 cm H<sub>2</sub>O. Subjects were instructed to use their "usual" technique for an average size adult in respiratory arrest with normal HR and BP. The TV and PAP were recorded for each breath; the MV and maximum PAP (PAP<sub>max</sub>) for each minute was noted. Data were analyzed using repeated measures, ANOVA, and Turkey multiple comparisons with alpha set at 0.05.

**Results:**

Normal Compliance (0.05 L/cm H <sub>2</sub> O), Mean (SD)				Poor Compliance (0.02 L/cm H <sub>2</sub> O), Mean (SD)			
MINUTE	TV (ml)			MINUTE	TV (ml)		
	1	5	10		1	5	10
BV	1079(189)*	1089(134)*	1120(111)*	BV	1059(152)	1092(161)	1070(170)
DV	899(477)	902(582)	949(550)	DV	1083(391)	1102(412)	1104(323)
MINUTE	MV (L)			MINUTE	MV (L)		
	1	5	10		1	5	10
BV	18.4(6.0)	18.8(5.6)	18.2(6.0)	BV	14.8(3.7)	15.3(4.8)	16.0(4.8)
DV	14.0(6.7)	14.9(7.3)	15.7(7.6)	DV	15.6(6.4)	15.8(6.3)	15.9(5.6)
MINUTE	PAP (cm H <sub>2</sub> O)			MINUTE	PAP (cm H <sub>2</sub> O)		
	1	5	10		1	5	10
BV	23(6)*	27(5)*	27(6)*	BV	32(7)*	38(8)*	39(9)*
DV	10(4)	10(4)	11(5)	DV	22(7)	22(8)	23(6)
MINUTE	PAP <sub>max</sub> (cm H <sub>2</sub> O)			MINUTE	PAP <sub>max</sub> (cm H <sub>2</sub> O)		
	1	5	10		1	5	10
BV	26(7)*	29(6)*	31(8)*	BV	36(8)*	42(7)*	44(7)*
DV	12(4)	12(5)	13(6)	DV	25(8)	26(8)	25(7)

\**p*<.01, significantly higher than DV by ANOVA and Turkey multiple comparisons.

**Conclusions:** In this model, ventilation with BV and DV both provided more than adequate TV and MV; values were similar except for higher TV with BV at normal compliance. However, DV yielded significantly lower PAPs and PAP<sub>max</sub> than BV over each minute at both poor and normal compliance. These findings need corroboration in an *in vivo* model, but suggest that with proper training DV ventilation through an endotracheal tube may be advantageous.



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**Track II**

Great Hall Center

**Friday, June 14, 1991**

Moderator: Daniel Spaite

4:15 PM

**Confirmation of Prehospital Endotracheal Intubation Using an Infrared End-Tidal CO<sub>2</sub> Detector**

McCabe L, Heller MB, Doctor A

University of Pittsburgh Affiliated Residency Emergency Medicine, The University Pittsburgh School of Medicine, and the Center for Emergency Medicine of Western Pennsylvania, Pittsburgh, Pennsylvania

**Hypothesis:** A miniature, infrared, solid-state, end-tidal CO<sub>2</sub> detector (MSA Minicap III) can quickly and accurately confirm endotracheal tube placement in the prehospital setting, especially during cardiac arrest.

**Methods:** A total of 25 consecutive, adult patients requiring endotracheal intubation in the field were prospectively entered into the study. Intubation was performed by paramedics or emergency medicine physicians from the City of Pittsburgh. Difficulty of intubation as well as confirmation was recorded in a scale of zero to three, zero representing no difficulty and three representing most difficult. Intubation was confirmed by CXR or visualization. Time without a perfusing rhythm before intubation also was recorded. Twenty-five randomly selected historical controls were compared for age, indication for intubation, and mean duration of absent perfusion using Fisher's Exact Test.

**Results:** Tracheal intubation was achieved by the orotracheal route in 23 patients, nasotracheal in one and cricothyroidotomy in one. The mean difficulty of intubation was 1.04±2.3. The mean difficulty of auscultative confirmation was 0.92±1.4. Twelve of 25 patients had witnessed cardiac arrests with a mean duration without perfusion of 13 minutes, the longest known duration being 40 minutes. The CO<sub>2</sub> detector registered positive in all of these patients. In three of these patient, the detector initially registered negative then turned positive upon reintubation. Radiographic or visual documentation of incorrect placement was not obtained in these patients. Of the five unwitnessed cardiac arrests, CO<sub>2</sub> was detected in three and was not detected in two. The remaining eight patients had respiratory failure and sustained some degree of perfusion. All had CO<sub>2</sub> detected on the monitor. Comparison of 25 randomly selected controls revealed no statistically significant differences. One of these control patients had an esophageal intubation detected by visualization in the emergency department.

**Conclusion:** Based on preliminary data, the MSA Minicap II end-tidal, CO<sub>2</sub> detector appears to be a rapid and accurate method of confirming endotracheal tube placement in the pre-hospital patient.

**Track II**

Great Hall Center

**Friday, June 14, 1991**

Moderator: Daniel Spaite

4:30 PM

**Comparison of Albuterol Delivered by Nebulizer or Metered Dose Inhaler with Spacer for the Treatment of Acute Asthma**

Idris AH, McDermott MF, Morrabel A, Raucci J

Division of Emergency Medicine, University of Florida College of Medicine, Gainesville, Florida; Department of Emergency Medicine, Cook County Hospital, Chicago, Illinois; University of Illinois College of Medicine, Chicago, Illinois

**Hypothesis:** Patients treated for acute asthma respond equally well to nebulized albuterol or to albuterol dose inhaler with a spacer device (MDIS).

**Methods:** Thirty patients with acute asthma were investigated in a prospective, randomized, double-blinded, multi-center study. Data were analyzed with two sample *t*-test, significance of *p*<.05. Patients were treated every 30 minutes with four puffs of placebo MDIS followed by nebulized albuterol 2.5 mg in 2 ml of normal saline or with MDIS albuterol four puffs followed by placebo nebulizer (2.5 ml normal saline). Spirometry followed each treatment.

**Results:** Patients had moderate to severe asthma. Before treatment for the nebulizer and MDIS groups, respectively, the mean (±SD) percentage forced expiratory volume in 1 second (%PFEV<sub>1</sub>) was 37.2±19.1 and 37.6±16.2 (NS, *p*=.72). After the first treatment, the mean %PFEV<sub>1</sub> increased by 16.7±11.1 and 12.8±5.5 (NS, *p*=.21; power=.91, 10% difference of means), the mean maximum increase in %PFEV<sub>1</sub> was 25.8±11.7 and 24.0±9.7 (NS, *p*=.66; power=.96, 15% difference of means), and the mean duration of treatment was 125.0±82.0 min and 116.7±73.0 min (NS, *p*=.78). Twenty-eight (93%) patients were treated successfully within the study and discharged home.

**Conclusion:** Albuterol delivered by metered dose inhaler with a spacer device is an effective alternative for treating patients with moderate to severe asthma and may be useful for the pre-hospital treatment of asthma.

**Track II***Great Hall Center***Friday, June 14, 1991***Moderator: Daniel Spaite***4:45 PM****High Flow Sheath for Fluid Resuscitation:  
A Comparison of Flow Rates with Standard Catheters***Idris AH, Melker RJ**Division of Emergency Medicine, University of Florida College of Medicine, Gainesville, Florida; Department of Emergency Medicine, Cook County Hospital, Chicago, Illinois; University of Illinois College of Medicine, Chicago, Illinois***Study objective:** To study the flow rates of vascular infusion devices used in fluid resuscitation.**Methods:** The fluid flow rates of 22, 20, 18, 16, and 14-g catheters, 4.0, 5.0, 6.0, and 8.5 French sheaths were measured. A 1-liter plastic bag of Ringer's lactate was connected to a high-flow trauma fluid administration set which in turn was connected to one of the devices. The bottom of the bag was suspended one meter above the distal end of each device and the fluid was allowed to flow by gravity. Three units of each device were tested and the elapsed times of the three trials were averaged. The arithmetic means and standard deviation (SD) were then compared for the different devices. Significance testing was done using one-way analysis of variance and Duncan's multiple range test.**Results:** The mean times ( $\pm$ SD) necessary to drain 1 liter of fluid ranged from  $96\pm 0.72$  seconds for the 8.5 French sheath to  $1628\pm 29.22$  seconds for the 22 gauge catheter. When compared to a 14-g catheter, the 8.5 French sheath flow rate was significantly faster ( $p < .0001$ ).**Conclusion:** The 8.5 and 6.0 French sheaths provided flow rates sufficient to treat severe volume depletion or blood loss in adults. The 14 and 16 gauge catheters and the 4.0 and 5.0 French sheaths had flow rates capable of treating severe pediatric hypovolemia.**Track III***Great Hall East/West***Friday, June 14, 1991***Moderator: Eric Davis***10:00 AM****To Report or Not to Report: Emergency  
Services Response to Elder Abuse***Walker G, Jones JS, Krohmer J**Emergency Medicine Residency Program, Butterworth Hospital, Michigan State University College of Human Medicine, Grand Rapids, Michigan***Purpose:** Prehospital EMS personnel, as initial responders to calls for assistance, are in an ideal position to identify abused or neglected elderly. A survey was conducted of prehospital personnel in Michigan to determine the scope of this problem, levels of awareness, and willingness to report cases of elder abuse.**Methods:** The study population was a random sample of 500 prehospital personnel throughout one state. A blinded, self-administered survey was completed by EMTs and paramedics outlining their training, demographic characteristics, and attitudes. Attitudes concerning the understanding and reporting of geriatric abuse were measured using a Likert scale.**Results:** A total of 126 surveys (25%) were completed; 70% of the respondents were paramedics. Respondents had an average of 7.7 years of prehospital emergency-care experience and evaluated 11 patients >65 years old each week. Seventy-six percent had seen a suspected case of elder abuse or neglect during their career; 68% had seen a case during the past 12 months (mean 2.98 cases/yr). Despite these numbers, surveyed personnel reported only 25% of suspected cases to authorities last year (mean 0.74 cases/yr). Reasons given for not reporting included: lack of standardized abuse protocols, unaware of mandatory reporting laws, limited knowledge of available services, and unclear definitions of abuse/neglect. Eighty-four percent of respondents stated that training related to elder abuse was not available through their EMS agency.**Conclusion:** Paramedics and EMTs lack a complete understanding of their role in the identification and reporting of elder abuse. This information should be emphasized during EMS training and reinforced through continuing education.

**Track III***Great Hall East/West***Friday, June 14, 1991***Moderator: Eric Davis***10:15 AM****Analysis of Non-Productive Use of 911 Emergency Ambulance Resources: Implication for Policy and Research***Taliaferro E, Saunders CE  
University of California, San Francisco, School of Medicine;  
Department of Public Health, City and County of San Francisco,  
California*

**Purpose:** To analyze the non-productive use of 911 emergency ambulance resources to determine what policy changes were suggested that would conserve EMS resources.

**Methods:** A retrospective analysis was performed on all non-productive 911 ambulance runs in San Francisco over a one-month period. Non-productive runs are defined as those not resulting in patient treatment or transport). The appropriateness of non-transport was determined by a physician audit of those cases in which a transport decision was possible. The cost of the diversion of system resources was calculated using financial data, and the impact on the system response times was determined using a computer simulation model of the EMS system.

**Results:** of 5,632 runs dispatched, 2,202 (39%) were non-productive. Patient contact was made in 1,040 (47%) cases. of 702 cases in which a transport decision was made, 605 (86%) were deemed appropriate, 84 (14%) lacked adequate documentation to establish appropriateness, and 13 (2%) were deemed inappropriate and should have been transported. The total annual cost to the city of San Francisco of non-productive runs was \$3,550,099, or \$148 per run. When non-productive runs were excluded from the EMS system by computer simulation, ambulance utilization fell 15.6% and response times for high-priority calls (45% of all calls) fell by 1.13 minutes.

**Conclusion:** Non-productive ambulance runs consume large amounts of EMS resources and lengthen response times for those truly in need. When patient contact is made, only rarely is the non-transport decision in error. Future research is needed to prospectively identify calls at dispatch which could safely utilize alternative resources or assistance.

**Track III***Great Hall East/West***Friday, June 14, 1991***Moderator: Eric Davis***10:30 AM****Outcome of Patients Not Transported by Ambulance***Bryan ED, Zachariah BS, Griffin MP  
University of Texas Medical School at Houston; Department of  
Surgery, Division of Emergency Medicine; Harris County Emergency  
Corps, Houston, Texas*

**Purpose:** Few authors have addressed the medical and legal risk of ambulance patients (PTs) refusing or being refused transport, but no data exist on PT outcomes. A study was undertaken to determine why PTs were not transported and their subsequent outcomes.

**Setting:** A busy, urban, volunteer EMS system with indirect medical control.

**Methods:** This study involved the review of 158 consecutive charts where an ambulance was called but the PT was not transported (no-loads). The PT was contacted by telephone by the investigators. Telephone follow-up was available for 93 PTs (59%). This follow-up was used to determine the PTs' outcome. The PTs also were asked why they were not transported.

**Results:** of the 93 Pts, 60 went to a physician by another method. Of these 60, 15 (25%) were admitted, mean stay duration 6.6 days, median 3.0 days, range 1-30 days. There were two ICU admissions and two deaths. Of the 93 respondents, 43 (46%) were true PT refusals. Paramedics suggested no transport or agreed to no transport in 50 cases (54%). These accounted for 11 of 15 hospitalizations ((73%). While not statistically significant, the trend was toward the paramedic-selected, no-loads to be more often admitted (22% vs 9%,  $p=.156$  Fisher's exact test).

**Conclusions:** A significant percentage of no-loads have serious, even fatal illnesses or injuries. When the decision not to load is made or supported by the paramedic, the PT is twice as likely to require hospitalization, The data suggest that paramedics should always encourage patients to be transported, but further prospective study is needed.

**Track III***Great Hall East/West***Friday, June 14, 1991***Moderator: Eric Davis***10:45 AM****Unexpected ALS Procedures on Non-Emergency Ambulance Calls: The Value of a Single-Tier System***Wilson BD, Gratton MC, Overton J, Watson W  
Department of Emergency Medicine, University of Missouri,  
Truman Medical Center West, Kansas City, Missouri*

**Objectives:** For many years, debate has existed as to the best EMS system—single-tier or 2-tier providers. In a 2-tier system, a BLS unit provides triage when it responds to non-emergency (Code 3) calls. If on arrival an emergency is found, an ALS unit is called in. If unexpected ALS care was needed for calls dispatched as “non-emergency,” this would be a weakness of 2-tier systems. The purpose of this study was to determine the frequency rate of ALS care in patients that underwent triage who were not predicted as Code 3 in a single-tier system, to estimate the problems with a 2-tier system.

**Design:** A single-tier, all ALS provider EMS system, serving an urban population of 450,000 with an annual response volume of 45,000 calls.

**Participants:** All Code 3 calls over a 12-month period were evaluated to determine the prevalence of unpredicted ALS care, defined as EKG monitoring, initiating or attempting IV access, administration of medications, or endotracheal intubation.

**Results:** A total of 6,362 Code 3 calls were identified; 309 were upgraded to emergency en route based on additional information obtained by dispatchers. Of 6,053 Code 3 calls, 710 (11.7%) involved the provision of one or more ALS procedures, with 296 (4.9%) receiving an IV, and three requiring endotracheal intubation. The documentation rate of procedures on run tickets reviewed was 98%, compared to computerized data. Calls upgraded by dispatchers required one or more procedure in 144/309 calls (46.6%) more frequently than Code 3 calls ( $p < 0.005$ ).

**Conclusion:** Procedure rates for upgraded calls document that dispatchers properly establish call priority. Despite strict dispatching protocols, 11.7% of Code 3 calls required ALS procedures. If these results are similar in 2-tier systems, this supports the need for all ALS, single-tier systems.

**Track III***Great Hall East/West***Friday, June 14, 1991***Moderator: Eric Davis***11:00 AM****Analysis of Ambulance “Response Time” and Component Intervals: Suggestions for Standard Definitions***Saunders CE, Amick P, Applegarth J  
University of California, San Francisco; Department of Health,  
City and County of San Francisco, California*

**Purpose:** “Response Time” is a key variable in evaluating cardiac arrest survival and for inter-system comparisons, yet definitions vary widely. This study sought to identify and define common functional components and devise a standard definition.

**Methods:** This study surveyed medium-sized cities in the United States to identify and define common functional components and devise a standard definition. A retrospective study of ambulance response time intervals also was conducted for all critical calls during a one-month period in San Francisco based on dispatch data.

**Results:** Of 30 cities surveyed, 24 (80%) responded, and common functional component time intervals were identified. Using these definitions, mean intervals for San Francisco were calculated ( $n=1,519$ ): initial receipt at 911 answering point (PSAP) to transfer to medical dispatcher (PASP-I, 0.52 min), arrival at medical communications center to dispatch queue (MEDCOM-I, 0.65 min), dispatch queue to ambulance assignment (QUEUE-I, 2.08 min), ambulance assignment to arrival at scene (OUTBOUND-I, 5.28 min), arrival at scene to departure from scene (SCENE-I, 17.61 min), departure from scene to arrival at the destination (TRANSPORT-I, 12.94 min), arrival at destination to back in service (RECOVERY-I, 25.41 min), initial receipt at PASP to arrival at scene (TOTRESP-I, 8.53 min), arrival at medical communications center to arrival at scene (MEDRESP-I, 8.01 min).

**Conclusions:** The time intervals identified represent different functional components of an EMS system and have defined end points. This study recommends that TOTRESP-I be used in cardiac arrest studies and for inter-system comparisons. Intervals should be separately determined for first responder versus advanced life support (ALS) ambulance arrival.

**Track III**

**Friday, June 14, 1991**

*Great Hall East/West*

*Moderator: Eric Davis*

**11:30 AM**

**EMS Quality Management: Implementing an Operationally Integrated Quality Control Program**

*Saunders CE*

*University of California, San Francisco School of Medicine, and Department of Public Health, City and County of San Francisco*

**Purpose:** Industrial Concepts of Quality Control (QC) differ from traditional medical Quality Assurance (QU) by their focus on managing quality through operationally integrated, closed-loop, control systems, and real-time control processes. The QA programs in emergency medical services (EMS) usually lack this degree of direct operational integration, and control processes often have a long lag time and exert controls only weakly or indirectly. This study reports the feasibility and results of a broad-based QC system implementation in San Francisco.

**Methods:** A QC system was implemented which had the following components: defined clinical and operational performance variables and set standards; computer-based performance monitoring; and multiple, closed-loop, real-time, operationally integrated, control pathways (feedback, feed-forward, and steering). Specially trained, paramedic quality control officers and full-time physician medical direction was integrated into the operating system. Performance data and quality control management activity data were collected prospectively (105 variables).

**Results:** In the first 12 months, over 200,000 data elements have been collected and analyzed, 52 separate reports are regularly prepared and utilized operationally, and 7,000 hours of in-service instruction have been provided to paramedics, including 32 new protocols. In-field quality control personnel have responded to and corrected 96 clinical complaints or unusual occurrences and made 1,812 real-time, field contacts or process adjustments.

**Conclusions:** The QC programs are feasible in the EMS industry. Studies are underway to determine this program's effectiveness using outcome measures.

**Track III**

**Friday, June 14, 1991**

*Great Hall East/West*

*Moderator: Eric Davis*

**11:45**

**The Prospective Analysis of the Impact of the Number of Helicopters on Emergency Air Medical Transport in a Regional EMS System**

*Brophy T, Spaite DW, Valenzuela TD, Meislin HW, Criss EA, Hinsberg P*

*Arizona Emergency Medicine Research Center, University of Arizona, College of Medicine, Tucson, Arizona*

**Introduction:** Changing the number of helicopters available to an EMS system alters the use patterns of air medical transport.

**Methods:** Prospective evaluation of helicopter dispatch data from a centralized EMS dispatch agency in a regional EMS system. During the study period, four alterations in the total number of helicopters available to the system occurred (1,2,3,2,3). Statistical analysis consisted of Chi Square with Yates' correction and comparison of sample proportions with  $p < .05$  considered significant.

**Results:** A total of 667 helicopter dispatches occurred during the 20-month study (4/89-11/90).

**Helicopter Dispatches Days of Patients Cancellation**

	<u>Available Per Day</u>	
1	113/170=0.66	67/170=39%
2	165/171=0.96	85/171=50%
3	389/259=1.50	193/259=74%
Total	667/600=1.11	345/600=58%
p-value	<.01	<.01

	<u>Utilization Per Day Rate</u>	
1	51/170=0.30	62/113=55%
2	73/171=0.43	92/165=56%
3	192/259=0.74	197/389=51%
Total	316/600=0.53	351/667=53%
p-value	<.01	.474

**Conclusions:** Changes in dispatch patterns could result either from increased availability or alterations in the dispatchers' "threshold" for use based upon a perceived lessening of the need to save a "scarce" resource. Had the second possibility played a significant role, the rate of cancellation by ground personnel after arrival at the scene would be expected to have increased. Since this did not occur, it is likely that the increased use was actually a result of increased availability. In systems that dispatch helicopters prior to ground personnel arrival, evaluation of cancellation rates may provide useful information for analyzing the impact of system alterations.