

# Abstracts of Papers to be Presented at the 6th Annual Conference of National Association of EMS Physicians

## Oral Presentations

Friday, June 15, 1990

10:30 a.m.: Galleria I, II

Track 1: EMS Systems Evaluations

Moderator: Marvin Birnbaum, MD, PhD

### 1) Age-related Utilization of Advanced Life Support

#### Services

Meador SA

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#### Purpose

To investigate the relationship between age and Advanced Life Support (ALS) utilization.

#### Population

All patients from January 1, 1987 to December 31, 1988 transported by Advanced Life Support personnel from within Lebanon County, a rural, urban county with a population of 112,000.

#### Methods

The data from run sheets were entered into a database. All runs resulting in patient transport by Advanced Life Support personnel were tallied at five-year age intervals and sub-grouped by trauma and non-trauma-related calls. Transport rates for each age group were obtained by dividing the calls by the population of each group. Correlation with age was tested by Spearman's rank correlation. To illustrate the effect of different age distributions, age rates were applied to state and national population distributions, both current and projected.

#### Results

There was a significant correlation with age for all transports ( $p < .01$ ,  $r = .93$ ) and non-trauma ( $p < .01$ ,  $r = .98$ ) but not for trauma ( $p > .10$ ,  $r = .20$ ). Non-traumatic case incidents varied by age groups, ranging from 1.1/1000 for ages 5-9 years to 89/1000 for ages 80-84 years. Older populations have a higher projected utilization of Advanced Life Support services.

#### Conclusion

Non-trauma Advanced Life Support utilization is highly dependent on the age of the patient. Due to projected aging of the population and increased utilization of Advanced Life Support by the elderly, projected utilization will increase at a faster rate than the population. Age rate data can be combined with population projections to help forecast future need.

### 2) Compliance with Closest Hospital Transportation

#### Protocol

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#### Hypothesis

Paramedics accurately estimate the closest trauma hospital for ground transport.

#### Population

Scene transports of injured patients in an urban trauma system with six participating trauma hospitals were studied. Transports involving multiple patients or pediatric patients were excluded.

#### Methods

A retrospective analysis was performed on consecutive patient transports taken to the closest trauma hospital. When several hospitals were available, if the paramedics selected the "closest" hospital, the availability of each hospital to receive trauma patients was monitored continuously by a central communications facility; paramedics were updated at the time of patient system entry. Subsequently, the vector distance from the trauma site to each of the available hospitals was measured using a grid map. This method was validated by odometer measurement ( $R^2 = 0.924$ ). Frequency of closest hospital bypass and 95% confidence intervals (CI) were determined for all patients and for patients with a trauma score (TS)  $\leq 12$ . Chi square analysis was used to analyze hospital bypasses to specific hospitals.

#### Results

Of the 1193 cases eligible, 160 (13%; 95% CI=11-15%) transports by-passed the closest available hospital for a receiving hospital  $\geq 1$  mile distance from the site. There were 11 (1%; 0-2%) patients transported to a hospital  $\geq 5$  miles distant. Of the 152 patients with a TS  $\leq 12$ , 15 (10%; 9-21%) were taken to a hospital  $\geq 1$  mile beyond the closest hospital while none (0%; 0-2%) were transported  $\geq 5$  miles past the closest hospital. Of the six hospitals, two were by-passed  $\geq 1$  mile twice as often as they received by-passed patients; one hospital received such patients four times more than it was by-passed ( $p < 0.0001$ ).

#### Conclusions

While paramedics generally can identify the closest hospital for trauma patient transport, some systematic hospital by-pass errors do occur. To ensure equitable patients for participating trauma hospitals and the most rapid delivery of injured patients, map vector distance determination to identify the closest available hospital should supplement paramedic dispatching.

### 3) Correlation between Motor Vehicle Mortality Rates and Density of Medical Resources

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An inverse correlation has been reported between motor vehicle crash mortality rates (MVCMR) and population density. The reasons for this are unknown, but variation in prehospital and hospital resources may be a possible explanation.

#### Hypothesis

To examine the relationship between medical resources and motor vehicle mortality rates we hypothesized that the densities of prehospital and hospital resources of a county would be correlated inversely with the motor vehicle crash mortality rate.

#### Methods

The following data were obtained from the State of Michigan, USA, Department of Public Health for each county in the state: population, area, number of motor vehicle deaths, number and types of ambulances, number and types of EMTs, total number of acute care hospital beds, total number of operating rooms, total number of physicians, total number of surgeons, and total number of emergency department physicians. Data were entered into a DBASE3<sup>R</sup> database and imported into SYSTAT<sup>R</sup> for analysis. Variables were transformed to create measures of resource per square mile for each county. Correlations between motor vehicle death rate per hundred thousand population and medical resources were performed. Scatter-plots were constructed, Pearson correlation coefficients were calculated, and p values were computed for each coefficient. A p value of 0.05 or less was considered statistically significant.

#### Results

Correlations Between MVCMR (per hundred thousand population) and Medical Resources in Michigan Counties:

Resource	Coefficient	P Value
<u>Prehospital</u>		
EMTs/sq. mi.	-0.224	0.043
Ambulances/sq. mi.	-0.196	0.078
<u>Hospital</u>		
Non-physician resources		
Beds/sq. mi.	-0.167	0.134
ORs/sq. mi.	-0.174	0.119
<u>Physician resources</u>		
Physicians/sq. mi.	-0.171	0.124
Surgeons/sq. mi.	-0.203	0.067
EM physicians/sq. mi.	-0.176	0.114

#### Conclusions

Small negative correlations exist in Michigan Counties between MVCMR and Medical resources. However, only the coefficient for EMTs/sq. mi. is statistically significant. We conclude that only a small proportion of the variation in MVCMR can be accounted for by the density of medical resources.

### 4) Impact of the Speed Limit Increase to 65 mph on Crash Severity and EMS Agencies in Virginia

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The effect of the controversial federal legislation, which allowed states to raise rural interstate speed limits to 65 mph, on motor vehicle crash severity was assessed in a retrospective study. All rural interstate fatalities from July to December, 1988, the first six months of the 65 mph limit in Virginia, were compared to the same period in 1987 when the limit was 55 mph.

Compared to 1987, after the speed limit increase in 1988, rural interstate motor vehicle fatalities increased from 26 to 51 (+96.0%,  $p < .005$ ) and fatal crashes increased from 24 to 40 (+66.6%,  $p < .005$ ). Despite a statewide 2.2% reduction in the total number of crashes, multiple fatality crashes increased 533% from 3 in 1987 to 19 in 1988. Belted fatalities increased 63% from 1987 despite the 1988 mandatory usage law. A review of medical examiner reports on the interstate fatalities found significant increases in the numbers of victims with head trauma (69%) and blunt chest trauma (60%) as immediate causes of death. Only 2 of the initial 34 interstate fatalities survived for at least 24 hours after the limit was raised to 65 mph, compared to 9 of 32 fatal crash victims that survived an average of 5.5 days during 1987.

Our review of the Virginia EMS experiences indicated that daytime manpower shortages, increased extrication times, notification delays, and increased numbers of responses to fatal crashes had a negative impact on survival for rural interstate crashes. This finding confirms those of previous studies. These data suggest increases in fatality and crash severity rates are associated directly with the increase in speed limit and that rescinding the 65 mph speed limit should be considered.

**5) Accuracy of Paramedic Dispatchers at Prospectively Determining Call Priority and Level of Service (ALS vs BLS) in San Francisco.**

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The purpose of this study was to determine the accuracy of our 9-1-1 medical dispatch system, which uses paramedic dispatchers without rigid algorithms for the setting of call priority and level of services. We compared dispatcher (D) assignments of priority and service level (Advanced Life Support, ALS; or Basic Life Support, BLS) with those of a blinded panel of experts (P) who independently reviewed the dispatch tapes, and with a retrospective audit of the level of actual care rendered in the field (F) for 205 cases. Both the Expert Panel and the Dispatchers "over-triaged" calls as ALS that, according to field data, were actually BLS. The Expert Panel did so significantly more often than the dispatchers. Designations of calls as ALS and call priorities (1 = highest; 3 = lowest) selected by each group were:

	ALS	ALS	PRIORITY		
	<u>DESIGNATED</u>	<u>ACTUAL</u>	<u>1</u>	<u>2</u>	<u>3</u>
PANEL	129	54	131	72	2
DISPATCHERS	73	40	90	98	17
FIELD	55	55	NA	NA	NA

NA = not applicable

Differences were significant at  $p < .001$ . Agreement between groups was not high: Dispatchers showed greater agreement with the Field Audit than did the Expert Panel (phi coefficient: D vs F, 0.41; P vs F, 0.27; D vs P, 0.36). However, the Dispatcher sensitivity to true ALS cases, while the Expert Panel missed only one (sensitivity at detecting ALS cases: D, 0.73; P, 0.98). Specificity was low in both groups (D, 0.41; P, 0.31).

We conclude that call priority and service level determined by experienced paramedic medical dispatchers in a non-algorithm-based system has moderate agreement with independent measures, but that significant "under-triage" occurs. Currently, studies are under way to determine whether the use of detailed algorithms will improve dispatcher accuracy.

**6) Differences in Compensated and Non Compensated Off-Line Medical Control Participation in Texas**

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Off-line medical control (OLMC) is essential for Emergency Medical Services (EMS). There exist little data regarding comparisons of the performance of medical directors of OLMC over a wide range of EMS agencies. This research reports the results of a mail questionnaire to the administrators of the 259 Advanced Life Support (ALS) agencies in the state of Texas.

The administrators were surveyed regarding various demographic data, the compensation status of their medical directors, and the frequency of participation of their medical directors in four functions: 1) Protocol development; 2) Involvement in training; 3) Run reviews; and 4) System evaluation.

There was a 61% response rate. The average involvement of the medical directors state wide was in 2.5 of the described functions. Using a Tau-a technique, there was a statistically significant relationship ( $p < .05$ ) between medical director involvement in these functions and compensation. The average number of functions performed by compensated medical directors was 2.7 ( $SD \pm 1.12$ ), while the average number of functions by uncompensated medical directors was 2.3 ( $SD \pm 1.2$ ). Sixty-four percent of physicians performing functions were compensated, while 67% of those performing one function or less were not compensated. The degree of involvement of the medical directors did not correlate with any other demographic data, such as population size or particular function surveyed.

In Texas, there is a wide variation of involvement in OLMC in the EMS physician directors. The depth of this involvement appears to be related directly to the provision of compensation. The link between medical director performance, compensation, and quality assurance deserves further examination. Efforts to raise the level of physician involvement and OLMC may necessitate compensation for the medical directors and examination of the relationship between EMS medical directors and the agencies they serve.

### 7) Failure of EMS Personnel to Measure Vital Signs: A Prospective In-Field Observation of Prehospital Patient Assessment

*Spaite DW, Criss EA, Valenzuela TD, Harvey W, Meislin HW, Hinsberg P*

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#### Purpose

To evaluate whether advanced life support (ALS) prehospital emergency medical services (EMS) personnel frequently fail to attempt to measure blood pressure (BP) and pulse (P) during patient assessment.

#### Methods

A single, in-field observer rode on ALS rescue-vehicles from 20 EMS agencies throughout the state of Arizona during a one-year study (January 1989 - December 1989). Data were collected from urban, suburban, and rural systems. The observer (no medical training) never performed or aided in patient care and never commented on the care provided. The data utilized for this analysis included sex and age of the providers, and whether or not a BP and/or P were measured during the patient encounter. Statistical evaluation was performed by Chi Square analysis with  $p < 0.05$  considered as significant.

#### Results

227 patient encounters were observed (51.1% male) with a mean patient age of 36. No BP was measured in 61 patients (26.9%) and no P in 71 (31.3%). The likelihood of failure to obtain vital signs was associated strongly with age of the provider. 35 (46.1%) patients, age  $< 18$  yr., did not have BP measured compared to 26 (17.2%) patients  $\geq 18$  yr.,  $P < 0.0001$ . Failure to measure P also occurred more frequently in patients  $< 18$  yr., (40, 52.6%) compared to those  $\geq 18$  yr., (31, 20.5%,  $p < 0.0001$ ). The likelihood of failure to obtain vital signs in medical cases as compared to trauma was not significantly different.

#### Conclusion

In a statewide evaluation of prehospital patient assessment, failure to measure a BP and P occurred frequently. Significant differences were not observed between trauma and medical patients. However, patients  $< 18$  yr. were much more likely to have vital signs omitted from their assessment than older patients. These findings indicate a lack of attention by these ALS providers to the most basic details of patient assessment. It is possible that failure to measure vital signs might happen even more frequently during routine patient encounters when an observer is not present. Medical control physicians must emphasize the paramount importance of careful patient assessment to ensure optimal prehospital patient care.

### 8) An Analysis of the Association between Prehospital Scene Time and Survival in Out-of-Hospital, Non-Traumatic Cardiac Arrest

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#### Purpose

To determine whether shorter prehospital scene time (ST) is associated with an increased survival rate in non-traumatic, out-of-hospital cardiac arrest in a medium-sized metropolitan EMS system.

#### Methods

Information was reviewed for all victims (age  $\geq 18$ ) of non-traumatic cardiac arrest treated and transported by a metropolitan fire department over a 16 month period (6/87-9/88). Data were retrieved from the fire department's EMS database, hospital records and death certificates. The data included were age, sex, ST, whether spontaneous circulation was restored in the field (successful prehospital resuscitation), and survival (discharged alive from the hospital). ST was defined as the total time elapsed from the unit reporting on-scene until the unit reported leaving the scene. ST was recorded by dispatchers and did not rely on times estimated by EMS personnel. Statistical analysis of continuous variables was performed using the two-tailed, Student's t-test and non-parametric evaluations were performed by Chi Square analysis with  $p < 0.05$  considered significant.

#### Results

298 patients met study criteria (63.1% male) with a mean age of 67 years. 293 patients (98.3%) had ST recorded. 79 patients (27.0%) had ST  $< 12$  min. while 214 (73.0%) had ST  $\geq 12$  min. Patients with ST  $< 12$  were more likely to have successful prehospital resuscitation (26.6% vs. 15.9%,  $p < 0.05$ ) and were more likely to survive (13.9% vs. 6.5%,  $p < 0.05$ ) than patients with ST  $\geq 12$  min. Mean ST for survivors was significantly less than for non-survivors (12.8 min. vs. 15.3 min.,  $p < 0.05$ ).

#### Conclusion

Adult victims of non-traumatic, out-of-hospital cardiac arrest with ST of  $< 12$  min. were more likely to survive than patients with longer ST in a metropolitan EMS system. In addition, the mean ST for survivors was shorter than for non-survivors. It remains unclear whether shorter ST actually has an impact on survival, or is merely a reflection of a subgroup with rapid resuscitation, and, consequently, a higher likelihood of survival. Future investigations are needed to determine whether shorter ST impacts the likelihood of survival from cardiac arrest.

**Friday, June 15, 1990**  
**3:30 p.m.: Galleria I,II**  
**Track 2: Therapeutics and Interventions**  
**Moderator: Nicholas Benson, MD**

**9) A Comparison of Field Techniques Used to Pressure-Infuse Intravenous Fluids**

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 Pennsylvania*

Paramedics use a number of methods to infuse intravenous (IV) fluids under pressure, none of which have been evaluated for efficacy. This study was designed to determine which field method of applying infusion pressure maximizes IV flow rate.

Seven experienced paramedics were asked to pressure infuse 1-liter IV bags of normal saline in two trials for each of the following methods: 1) disposable commercial pressure infuser (Infusable; Biomedical Dynamics) pressurized to 300mmHg; 2) The infusor to maximum pressure; 3) An adult blood pressure cuff wrapped around the bag and pressurized to 300mmHg (BPCUFF); 4) manually squeeze the bag with two hands (SQUEEZE); or 5) push/squeeze with two hands (PUSH); and 6) kneeling around the bag and pressurized on bag (KNEEL). Five trials of gravity flow at height of 80cm comprised the control group. 6mg IV bags/maxidrip infusion sets (178cm) were connected to 14 Gauge 5.7cm catheters (Quik-Cath; Travenol) and the infused volume was measured at 0.5 minute intervals until 1 liter was infused. Trials were randomized and investigators were blinded to method used by means of an interposed screen.

IV Flow Rate for 1 Liter of Fluid (ml/min)  
 (% of Control)

C	1	2	3	4	5	6
Gravity	Infusor 300mmHg	Infusor max mmHg	BPCuff	Squeeze	Push	Kneel
123±2 (100%)	257±54 <sup>1</sup> (209%)	296±53 <sup>1</sup> (241%)	135±28 (110%)	184±46 <sup>2</sup> (150%)	173±40 <sup>2</sup> (141%)	125±36 (101%)

<sup>1,2</sup>  $p < .001$  (ANOVA) compared to all other groups except between groups with the same superscript.

The pressure infuser produced flow rates 2-2.5 times that by gravity alone and significantly better than by any other method. Both manual methods generated enough pressure to significantly improve flow over gravity alone. Kneeling and blood pressure cuff application were ineffective methods.

We conclude that 1) a pressure infuser unequivocally is the best method of supplying infusion pressure; 2) it should be mandatory equipment on Advanced Life Support ambulances; and its use should be included in prehospital shock protocols. In the absence of such infusors, the only alternative is to squeeze the IV bag manually.

**10) Effect of 50% Nitrous Oxide Inhalation on Pneumothorax in Swine**

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 Pittsburgh, Pennsylvania*

Spontaneous inhalation of 50% nitrous oxide (N<sub>2</sub>O:O<sub>2</sub>) used widely in oxygen is for analgesia in the prehospital and emergency department settings. Pneumothorax (PNTX) is considered to be one of the contraindications to its use. Previous studies, using positive pressure ventilation with high concentrations of N<sub>2</sub>O, have shown up to a 50% increase in PNTX size within 5 minutes. This study was designed to investigate if spontaneous inhalation of 50% N<sub>2</sub>O for up to 30 minutes has any adverse clinical or hemodynamic effects in swine with PNTX.

Six fasted, female swine (13-17 kg) were sedated with intravenous ketamine, intubated, and then spontaneously inhaled either 50% N<sub>2</sub>O or room air (RA) using a sequential cross-over design in which each animal served as its own RA control. Small (Group 1, 150 cc), medium (Group 2, 300 cc), and large (Group 3, 500 cc) PNTX were created by instilling air into the left pleural space via an 18 Fr, 3-Way, Foley catheter. Changes in heart rate (HR), central venous pressure (CVP), systemic blood pressure (BP), electrocardiogram (ECG), arterial blood gases (ABG), and PNTX volume were recorded during separate 10 and 30 minute trials. A total of 60 trials was performed. A 15 minute washout period was inserted between each trial. Data were analyzed using repeated measures ANOVA and paired two-tailed t-tests.

In the 30 minute trials, a statistically significant increase in absolute PNTX size occurred with N<sub>2</sub>O breathing compared to RA for Group 1 (44±17 vs. 16±5 cc,  $p=0.02$ ), Group 2 (61±21 vs. 26±4 cc,  $p=0.01$ ), and Group 3 (62±32 vs. 40±5 cc,  $p=0.05$ ). No significant increase in PNTX size occurred during the 10 minute trials. No statistically significant differences in HR, CVP, systolic and diastolic BP, ABG's, or ECG were observed between the N<sub>2</sub>O and RA trials for any size PNTX. None of the animals developed signs of tension pneumothorax.

In conclusion, in this model, spontaneous inhalation of 50% N<sub>2</sub>O for up to 30 minutes is associated with little risk of hemodynamic or respiratory compromise. Although PNTX size increases with 50% N<sub>2</sub>O use, the magnitude observed is less than previously reported.

## 11) The Prehospital Use of Albuterol Inhalation Treatments

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 Department of Medicine, University School of Medicine,  
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### Purpose

Nebulized beta-agonists recently have been added to the prehospital treatment of asthma. To our knowledge, however, the effectiveness and efficacy of prehospital administration of nebulized albuterol, a bronchodilator commonly used in emergency departments, has not been reported.

### Methods

We prospectively studied the effects of the administration of albuterol via a small volume nebulizer to adult patients with asthma or chronic obstructive pulmonary disease (COPD) in the prehospital setting. Paramedics recorded vital signs, peak expiratory flow rates (PEFR), cardiac rhythm, and breath sounds before and after treatment. Mean changes were computed and compared using a paired t-test. In addition, the patient's assessment of the severity of dyspnea before and after treatment and adverse reactions were noted.

### Results

Eighty-four data forms were returned of which 29 were incomplete and excluded from analysis. (An audit showed the patients were non-consecutive.) In the remaining 55 patients, PEFR increased by a mean of 27 liters/minute ( $p < .0001$ ), mean systolic blood pressure decreased by 10 mmHg ( $p < .0005$ ), mean heart rate decreased by 7 beats per minute ( $p < .0001$ ), and mean respiratory rate decreased by 4 breaths per minute ( $p < .0001$ ). Breath sounds improved in 61% and 93% of the patients reported subjective improvement. No significant adverse reactions were noted.

Limitations of the study include a non-consecutive study group, incomplete data forms, and previously reported problems with the accuracy of peak flow measurements when performed by paramedics.

### Conclusions

Nebulized albuterol can be administered safely in the prehospital setting to patients with asthma or COPD and results in improvement of PEFR and dyspnea.

## 12) In-Field Comparison Between Fully and Semi-Automatic Defibrillators

Bocka JJ  
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A comparison between two similar suburban fire departments, one using fully automatic, and the other using semi-automatic defibrillators, is presented.

In 1989, Royal Oak Fire Department EMTs used the Heart Start 2000 semi-automatic defibrillator on 21 patients in cardiac arrest. Seven (33%) presented in ventricular fibrillation (VF). Ferndale Fire Department EMTs used the HeartAid 1000 fully-automatic defibrillator on 29 patients in 1989. Fifteen (52%) presented in VF. Both fire departments had an average response time of 3.7 minutes. The time from proper electrode placement to shock was significantly greater for semi-automatic defibrillation compared to fully automatic ( $40.5 \pm 7.6$  seconds versus  $16.9 \pm 2.9$  seconds;  $p < 0.05$ ). Resuscitation (33% vs. 29%), admission (33% vs. 14%) and discharge (27% vs. 0%) rates were greater for the patients in whom fully-automatic defibrillation were used.

Two patients in VF (one fine and one coarse) were not shocked by the fully-automatic defibrillator. Our protocol was modified to include frequent reassessments. One patient in fine VF that would have been missed earlier was shocked on reassessment and no further patients in VF were missed. EMTs using semi-automatic defibrillators properly assessed all patients in VF.

Our data show a greater survival rate (and faster time to shock) for fully-automatic defibrillation when compared with semi-automatic defibrillation (which had greater VF sensitivity). The safety of fully automatic defibrillators and their role in EMS (as they are less expensive, require less highly-training, and may be used with less trained personnel) needs to be studied further. Directors of semi-automatic defibrillator programs should monitor the time to shock while those responsible for fully-automatic defibrillator programs should have frequent reassessment within their protocols.

**13) Comparison of Prehospital Cervical Immobilization Devices**

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No study has compared cervical immobilization devices (CIDs) designed for use with the long spine board. We hypothesized that six of the commonly utilized CIDs are equally effective in limiting flexion/extension, rotation, and lateral movement.

**Methods**

Twenty-six emergency medical technicians (EMTs) engaged in paramedic training applied the devices to each other. None had a pre-existing or current cervical injury. Six devices were compared: Bashaw CID™, Ferno-Washington CID™, Head Brace™, HeadBed™, blanket rolls, and sandbags. After a review of didactic material on immobilization, subjects were immobilized on a long spine board with torso straps and a rigid cervical collar. Then, each EMT applied each of the 6 devices to a single subject under supervision of an investigator. Angular degrees of rotation, lateral bending, and flexion/extension were measured geometrically using a rigid, orofacial template while subjects exerted maximal force in each direction. Data were analyzed by two-way ANOVA and Tukey's test. The alpha error was set at  $p < 0.05$ , and the study was designed with a power of 0.90 to detect a difference  $> 33\%$ .

**Results**

Results are in the table. A significant difference between devices was found only in rotation. The Bashaw™ allowed significantly more movement than each of the other devices. However, variability between appliers was highly significant ( $p > 0.001$ ) 3 directions for each of the three tested.

Table: Mean degrees of movement  $\pm$ S.D. allowed by CIDs in 26 EMTs.

	<u>Bashaw</u>	<u>Ferno</u>	<u>HeadBrace</u>	<u>HeadBed</u>
Lat	11.6 $\pm$ 7.9	8.0 $\pm$ 6.1	10.2 $\pm$ 7.5	9.9 $\pm$ 6.2
Rot	14.3 $\pm$ 9.1*	11.5 $\pm$ 6.6	9.5 $\pm$ 6.1	10.5 $\pm$ 7.9
F/E	13.3 $\pm$ 7.4	13.4 $\pm$ 7.3	15.0 $\pm$ 8.3	14.8 $\pm$ 9.2
	<u>Blanket</u>	<u>Sandbags</u>	<u>P</u>	
Lat	8.2 $\pm$ 6.9	10.1 $\pm$ 10.8	0.10	
Rot	10.2 $\pm$ 7.9	11.0 $\pm$ 10.0	0.02	
F/E	12.4 $\pm$ 8.5	12.8 $\pm$ 7.9	0.40	

\*  $p < 0.05$  compared to every other device

**Conclusion**

The 6 CIDs were similar in their ability to immobilize the cervical spine. One device was significantly less effective in limiting rotational movement. The rather large inter-subject variation demonstrates the importance of proper techniques.

**14) Out-of-Hospital Deliveries, a Five-Year Experience**

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**Purpose**

We sought to determine the frequency and outcome of pre-hospital deliveries in an urban ALS, EMS system (60,000 calls/year).

**Methods**

We performed a retrospective review of all prehospital records that involved the care of women delivering babies out-of-hospital for the years 1984 through 1988.

**Results**

A total of 81 out-of-hospital deliveries (1.4/month) occurred during the study years. The average age of the mothers was 24 years, and the average gestational period was 30 weeks. The women had an average of three previous pregnancies and two previous deliveries. Ten were primigravida. Seventy-two (89%) of the deliveries occurred in the home. There was one set of twins. The following complications were noted by the paramedics at the time of delivery: five neonates initially were apneic and pulseless (four of which were less than 20 weeks gestation and were not resuscitated); the umbilical cord was wrapped around the fetus' neck in ten deliveries (all were removed successfully); one fetus required assisted ventilations for resuscitation; seven neonates initially were cyanotic at the time of delivery and required suctioning and assisted ventilation; three neonates were apneic and required assisted ventilation; two deliveries were breach; two neonates were retrieved from a toilet bowl, and in one delivery, the amniotic sac had not ruptured. The placenta was not delivered in 27 of the cases. Nine neonates were delivered prior to the arrival of the paramedic team. Twenty-four neonates had Apgar scores calculated and the one and five minute Apgars averaged eight and nine, respectively. Five of the mothers had no prenatal care.

**Conclusions**

In our EMS system, out-of-hospital deliveries especially pre-term, are a common event, and there appears to be a significant number of neonatal complications which face prehospital providers. Our paramedics were deficient in their documentation of the neonatal assessment. Continuing education programs for paramedics should include reviewing normal and complicated vaginal deliveries as well as advanced life support measures for neonates. Detailed protocols for obstetrical emergencies need to be developed.

### 15) A Method to Reduce Rural EMS Response Times

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Prolonged EMS response times are a significant problem in rural areas. To minimize delay in a small volunteer rescue service in Central New Mexico, we placed two-way VHF radios and medical kits in the privately owned vehicles of EMTs. As calls were received in the dispatch center, EMTs were paged over a one-way, VHF paging system. The response was then coordinated using the two-way radios located in each EMT's private vehicle. EMTs of the highest training level who were closest to the scene were sent directly to the scene. Those closest to the unmanned station were sent to pick up the rescue truck.

All calls over a 13-month period were evaluated. Of the 45 rescue calls, 10 were excluded from analysis because of incomplete data or study protocol violations. This left 35 calls for analysis.

EMTs in private vehicles arrived prior to the rescue vehicle on 30 of 35 (85.7%) calls. In 25 of 35 calls, the first person on the scene was above the EMT-Basic level even though the majority of responses (56%) were made by Basic EMTs ( $p < 0.001$ ). The mean response time of the EMTs in private vehicles was  $9 \pm 4$  minutes compared with  $16 \pm 9$  minutes for the rescue truck ( $p < 0.01$ ).

In all cases, when EMTs arrived at the scene prior to the rescue truck, a brief patient assessment with vital signs was performed. In some cases, a number of other procedures including CPR, oxygen administration, endotracheal intubation, and IV catheter insertion were performed prior to rescue truck arrival.

An effective EMS response can be made in rural areas by sending EMTs directly to a scene in private vehicles. VHF radios placed in these vehicles are useful in coordinating these responses.

**Saturday, June 16, 1990**

**11:00 a.m.: Plaza I,II**

**Track 3: EMS Systems Evaluations II**

**Moderator: Paul M. Paris, MD**

### 16) Reporting of Child Abuse by Prehospital Personnel

King BR, Baker MD, Ludwig S  
 University of Pennsylvania School of Medicine, Children's  
 Hospital, Philadelphia, Pennsylvania

#### Introduction

Prehospital EMS personnel routinely enter patient's homes and often are the *first trained persons* to evaluate an ill or injured child. Therefore, it is vital for these individuals to recognize child abuse (CA) and to understand the proper procedures for reporting *suspected* cases.

#### Methods

In order to test paramedics' and EMTs' understanding of CA, we administered a questionnaire to prehospital care-givers participating in a seminar on pediatric emergencies. Questions were designed to test factual knowledge of CA and the correct reporting procedures, as well as to evaluate the participant's attitudes toward CA.

#### Results

There were 48 subjects; 34 (71%) were paramedics, the remainder were EMTs and RNs. Thirty-three (69%) practiced either in a rural or suburban setting. Subjects had an average of 10.8 years of prehospital emergency-care experience. Twenty-eight (58%) reported no previous training in CA. All participants understood the nature of CA, were able to identify the various forms of CA, and believed CA to be a significant problem. However, 33 (69%) did not understand *mandated reporter status*, and while 27 (56%) claimed to have reported CA, only 16 (33%) had made a report to either police or to children's services workers. Of the 21 who had not reported a case of CA, 14 (67%) believed that they had never encountered an abused child. The remainder were not certain, and therefore, did not report or thought that the hospital staff would report.

#### Conclusion

In the case, we conclude that while this subject deserves further study, it seems that many EMTs and paramedics lack a complete understanding of their role in the identification and reporting of CA. This information should be emphasized further in paramedic education and should be reinforced through continuing education.



**17) Hazardous Materials Incidents: A One Year**

**Retrospective Review**

Walter FG, Dedolph R, Kallsen GW, Knopp RK  
 Valley Medical Center, Fresno, California, University of  
 California, School of Medicine, San Francisco, California

This study analyzed hazardous materials (hazmat) incidents to provide a basis for improving Emergency Medical Services (EMS) at these events. We retrospectively reviewed all Hazmat Response Team reports for our county of 635,000 people, as well as all related prehospital, emergency department, and inpatient records for the period of July 1, 1988 to July 1, 1989. There were 103 hazmat incidents reported. They involved oil products (20%), acids (11%), unidentified chemicals (11%), pesticides (10%), gases (8%), and miscellaneous chemicals (40%). Nine of 103 incidents required on-scene evaluation of 67 patients and transport of 30 of these patients to emergency departments. Three patients required admission. No deaths occurred. Five incidents produced multiple victims from gaseous exposures, accounting for 62 of 67 (92.5%) patients. In 4 incidents, 5 patients were exposed to solid or liquid pesticides. Ambulance personnel became contaminated in 2 of these 4 incidents.

We conclude: 1) Routine ambulance dispatch to all hazmat incidents was unnecessary because only 9% involved patients; 2) EMS training should emphasize personal protection and proper patient decontamination to help prevent the contamination of EMS personnel that occurred in half the exposures to solid or liquid pesticides; and 3) EMS preparation also should emphasize gaseous exposures because these produced the majority of patients.

**18) Prospective Evaluation of In-the-Field Medical**

**Command with Emergency Response Duties as Part of an Emergency Medicine Residency Curriculum**

Hutton KC, LaCovey MA  
 University of Pittsburgh, Residency in Emergency Medicine, Center for  
 Emergency Medicine of Western Pennsylvania, Pittsburgh,  
 Pennsylvania

Formal training in Emergency Medical Services (EMS) is a requirement of the Residency Review Committee (RRC) which is designed to allow emergency medicine (EM) residents to assume leadership roles in EMS. The educational value of primary medical command with emergency field response duties to an EM resident in training is presumed to be high. However, prospective evaluation of this type of prehospital care training is lacking. Our hypothesis is that these duties have high educational value to EM residents in training, and that the educational value varies with response type and with response severity.

A total of 710 field responses by 16 EM residents (PGY-2 & 3) who shared faculty, supervised primary EMS physician duties for an urban EMS system (approximately 16,000 ALS runs/year) were evaluated over 9 months (July 1, 1989 to March 25, 1990). Prospective data collected included numbers of interventions (INT), response type, number of non-protocol decisions (DEC), and whether any of the other ongoing research projects were performed or supervised. The perceived severity (SEV) and educational value (EV) of each response were assigned numeric values from 0 (minor/non valuable) to 4 (high severity/highly valuable) immediately after each response by the EMS physician. Spearman's correlation coefficient (rho) was used for statistical analysis (alpha error rate of 0.05).

Each physician responded to an average of 44 patient emergencies (range 7-92). Data are summarized in Tables 1 & 2. All rho values showed significant correlations (p<0.01; except where indicated). (Overall, rho = 0.45; p<0.01). Of the total 710 patients, 205 (28.9%) patients were enrolled in ongoing research projects.

Table 1 (\*Denotes mean values)

Response Type	No. (%)	SEV*	EV*	DEC	INT	rho
Cardiac Arrest	229 (32)	3.4	2.6	56	249	0.40
Resp. Arrest	62 (9)	3.4	2.8	35	63	0.48
Entrap/Trauma	133 (19)	2.4	2.0	9	15	0.29
Shock	22 (3)	3.2	2.7	11	27	0.54
3 Alarm Fires	20 (3)	1.0	0.8	0	0	0.44+
Psych/Suicide	16 (2)	1.4	1.3	0	0	-0.18+
Peds (<18 yrs)	156 (22)	2.0	1.7	25	51	0.40
Med/Surg/OB	157 (22)	2.2	2.0	38	75	0.69

(+p<.05; \*p=NS)

Table 2

Data Examined	Avg/MD
Interventions	26.8
Medical Decisions	9.3
Central Lines	6.4
Field Intubations	7.4
Nasal tracheal Intub.	4.5
External Pacemaker	3.8
Pulse Oximeter	8.6
Pronounced at Scene	2.5
Psych Commitment	<1.0

**Conclusions**

Duties as an EMS physician are perceived to be educationally valuable by emergency medicine residents in training; educational value increases with response severity. Cardiac arrests, respiratory arrests, shock patients, and acute medical surgical patients were judged as most valuable and required significantly more interventions and non-protocol designs. This type of experience benefits the system through on-line continuing education, field medical control, and through the research and development of new prehospital techniques. These duties provided a physician-controlled forum for prehospital research as well as a triaged prehospital ALS experience.

**19) CHORAL (Computerized Hospital On-Line Resources Allocation Link): A Mechanism to Monitor and Establish Policy for Diversions of Hospital Ambulance**

*Neely K, Bennison A, Acker J, Long D, Norton R, Schriver J  
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Hospitals, Emanuel Hospital and Health Center, Portland,  
Oregon*

Hospital closure and diversion of ambulances are becoming an increasing problem for the emergency medical services system (EMSS). In our densely populated urban county, ambulances have been diverted by radio from several hospitals before finally finding one willing to accept a patient, communications to dispatch centers by the hospitals relative to their divert status were inadequate and, we lacked data necessary to establish policy.

In response, this community developed an on-line, computerized system, known as CHORAL, that visually displays to the 911 dispatch center, base station and hospitals, the minute-to-minute divert status of each of the hospitals. All but one of the hospitals in this county participates. Two hospitals in adjacent counties also participate. Using personal computers, each hospital is able to control its own status and can change their divert status from green (accepts all advanced life support [ALS] patients), to red (accepts no ALS patient), or yellow (divert selective patient groups). Each status change requires simple keystrokes on the computer key pad. These data are then transmitted to all other CHORAL computers.

There are six selective categories: Adult Ward (AW), CT Scan (CT), Critical Care (CC), Labor and Delivery (LD), Pediatrics (PEDS), and Psychiatric Secure Beds (PSB). Paramedics determine if their patient fits a particular divert category based on existing definitions. Hospital data are relayed to paramedics by the 911 dispatch center or the base station: both monitor the system when an ambulance is en route to a hospital.

During a recent two week period, there were 33 diversions: 1 for AW, 7 for CC, 1 for CT, 2 for LD, 0 for PEDS and 12 for PSB, and 10 total diversions (red status). Total divert time was 559.6 hours. PSB accounted for 374 of the hours (66.8%). Apart from PEDS, which was not diverted during the two weeks, AW accounted for the fewest hours (11.8 or 2.1%).

In this system, paramedics know the status of each destination hospital immediately. Communications between the dispatch center base station and the hospitals are accurate, and data are available readily. We believe this model can help other systems monitor and establish policy to rectify the problems associated with diversion of ambulances from hospitals.

**20) The Current Practice of Prehospital Involuntary Commitment**

*Adams J, Gerard J, Verdile VP, Paris PM  
Affiliated Residency in Emergency Medicine, Division of  
Emergency Medicine, University of Pittsburgh School of  
Medicine, Pittsburgh, Pennsylvania*

**Purpose**

Suicidal patients who refuse prehospital treatment and transport remain a difficult problem for EMS systems. We conducted a survey in an attempt to define the scope of this problem and the current management strategy.

**Methods**

One hundred and thirty-five of the largest EMS systems nationwide were mailed a questionnaire to determine their operating procedures for dealing with suicidal patients.

**Results**

Fifty-nine out of 130 questionnaires (45%) were returned. Seventeen EMS systems (29%) served populations of less than 250,000 while 41 (69%) served populations greater than 250,000. Cumulatively, respondents represented in excess of 2.1 million EMS responses per year, of which 0.5% - 10% involved behavioral emergencies. Twenty-five EMS systems (42%) perform prehospital involuntary commitment. Of these 25, the initiation of commitment proceedings is performed by the following (more than one may apply to a given system): 11 (44%) by base-station physicians, 6 (24%) by the EMT, 23 (92%) by the police officer, and 5 (20%) by family or friends. Ten of the 59 systems (17%) require a mental health delegate to authorize commitment. Involuntary commitment by two-physician directive is performed in only one of the responding systems. Eleven of the 59 responding EMS systems (19%) had explicit policies guiding prehospital involuntary commitment. Seven of the 25 systems (28%) which actually perform involuntary prehospital commitment and only four of the 34 systems (12%) which do not perform involuntary prehospital commitment had established policies.

**Conclusion**

The suicidal patient refusing prehospital treatment and transport represents a potential problem for EMS systems nationwide. These patients commonly are seen in all EMS systems. Many EMS systems lack explicit policies for managing such patients. The current practice of involuntary prehospital commitment is not uniform or widespread and the medicolegal ramifications have not been tested. Prospective studies should be undertaken to define further the extent of the problem and protocols should be developed to ensure consistent management of such patients.

### 21) A Meta-Analysis of Hepatitis B Serologic Marker Prevalence in EMS Personnel

Menegazzi JJ

Center for Emergency Medicine of Western Pennsylvania,  
Pittsburgh, Pennsylvania

The risk of exposure to the hepatitis B virus (HBV) is a known occupational health risk in medical personnel. The specific risk in emergency medical services (EMS) personnel in the United States is not known. Estimates have ranged from 0.6% to 30%. The purpose of this investigation was to provide an estimate of the prevalence of this exposure, to determine if this risk is homogeneous throughout the U.S., and to provide an estimate of relative risk. The study hypothesis was that the risk of exposure to HBV is not homogeneous throughout the U.S.

#### Methods

All articles containing HBV studies of non-immunized EMS personnel (physicians, nurses, and EMTs), were considered, provided they reported at least two of the following seromarkers; HB surface antigen, HB surface antibody, HB core antibody. An exhaustive computerized literature search of the MEDLARS Database from 1980-1989 was performed. Reference sections of relevant articles and texts also were searched. The chi-square test of homogeneity of proportion was used, assuming the binomial distribution. The alpha error rate was set at 0.05.

#### Results

Seven articles from 1982 to 1989 qualified for review. The average rate of prevalence for all studies was 14.0% (160/1,140), with a 95% confidence interval of 11.4% to 16.7%. The chi-square test was statistically significant ( $X^2 = 12.59$ , 6 df,  $p < .01$ ), indicating that the risk of exposure is not homogeneous throughout the U.S., and may not be homogeneous within a city, or between prehospital and hospital personnel. This analysis indicates that the risk of HBV exposure of EMS personnel is three (2.8) times that estimated by CDC for the general population.

#### Conclusion

EMS personnel run a great risk of exposure to HBV with a nationwide prevalence of 14.0%, but this risk is not homogeneous throughout the country.

## Poster Presentations: Q&A Session

Saturday, June 16, 1990

12:30 p.m.: Exhibit Hall

### 22) A Radiographic Comparison of Prehospital Long Backboard Immobilization Methods

McDonald P, Krohmer J, Scheidel E, Jones J

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State University College for Human Medicine, Davenport  
College Center for the Study of EMS, Grand Rapids, Michigan

Long backboard immobilization of the trauma patient is the technique most commonly used for stabilizing and preventing injury to the cervical spine. We designed a controlled study to radiographically evaluate the efficacy of the long board technique (LBT) and compare it to two other commercially available devices: the Harrington body splint, and the Ferno head immobilizer.

Thirty-two volunteers were immobilized in the long board and in one of the test devices studied. Cervical movement in the sagittal and frontal planes was measured radiographically. Movement in the horizontal plane was measured directly. An additional anteroposterior (AP) cervical radiograph was taken with the backboard tilted vertically (to simulate the maneuver required to protect the airway during emesis). Two-tailed, paired t-test analysis was performed comparing test devices to the LBT.

The LBT proved to be significantly better ( $p < .05$ ) than the Ferno in restriction of lateral bending but comparable in all other planes of cervical spine motion. There were no significant differences between the LBT and the Harrington body splint. The vertical rotation maneuver resulted in minimal bending of the cervical spine (<5 degrees) and appears to be safe when immobilization devices are applied properly.

### 23) Spinal Instability During Variations of the Log-Roll

#### Maneuver (Thoraco-Lumbar Region)

*Suter RE, Tighe TV*

*Department of Emergency Medicine, Brooke Army Medical Center, San Antonio, Texas, Department of Emergency Medicine, Valley Medical Center, Fresno, California*

#### Purpose

There is a lack of experimental data supporting use of the log-roll maneuver (LRM). We studied variations of the LRM in an effort to identify patient and technique variables that affect thoraco-lumbar motion, as this knowledge could help guide current practice and future research.

#### Methods

Fourteen healthy adults were subjected to up to five LRM variations while A-P radiographs were taken of the lower thoracic and lumbar spine. Variations involved application of axial traction and alterations in subject arm positioning. These were: 1) arms crossed over chest, elbows over epigastrium; 2) arms at side, elbows flexed, palms on epigastrium; and 3) arms extended at side, palms on lateral thighs. Radiographs were evaluated for maximum lateral displacement and qualitative changes in vertebral rotation. Data were analyzed in a cross-comparative manner.

#### Results

Lateral motion ranged from 0-38mm. No substantial rotational differences were noted between techniques. Traction attempts reduced displacement in 59% but increased it in 18%. Arms crossed reduced motion in 29% while it increased in 67%. With arms flexed, these values were 57% and 29%, respectively. Arms extended, however, never increased displacement while it decreased in 80%. The largest reductions occurred in subjects with disproportionate shoulder/pelvis ratios.

#### Conclusions

Substantial thoraco-lumbar motion occurs during the LRM. Traction attempts sometimes increase motion, as do two specific alterations in arm positioning. Victim body habitus also is a factor. In this small sample, lateral motion consistently was minimized by positioning subjects with arms extended at side, palms on lateral thighs. Further studies are needed for definitive recommendations.

### 24) Back Injuries in Urban Emergency Medical Services

#### Personnel

*Pepe PE, Bonnin MJ, Robins E*

*Departments of Medicine and Surgery, Baylor College of Medicine, City of Houston EMS, Houston, Texas*

#### Introduction

Although work-related back injury (WRBI) generally is recognized as a major health and economic problem, published studies that delineate the extent and cost of WRBI in EMS personnel are lacking.

#### Purpose

The purpose of this study was to determine the incidence, cost, and factors contributing to WRBI in an urban EMS system.

#### Methods

All Supervisory, Safety Office, and Workman's Compensation files from an urban EMS program for a period of 43 months (3-1/2 years) were reviewed.

#### Results

During this period, 418 members of the EMS program reported 623 incidents of work-related injury. Nearly half (45%) of these (and most of the serious cases) involved back injury. The mechanism, almost always, involved "lifting" or "carrying" and of the 283 cases of WRBI in which Workman's Compensation was recorded, 135 (48%) were related specifically to stretcher manipulation. The total Workman's Compensation cost (TWCC) for WRBI during this period was \$738,654 and the total annualized cost to the City (TWCC plus approximate cost of lost wages) was nearly a quarter of a million dollars per year. Most importantly, beyond the financial loss, staffing sequelae, chronic pain syndrome, surgical morbidity/risk, and the immediate loss of the equivalent of 4,044 eight-hour workshifts, was the permanent loss of many highly-skilled EMS personnel whose years of experience are irreplaceable.

#### Conclusion

Back injury education and prevention should be a priority for EMS system managers.

**25) Impact of Implementation of an EMS Risk Management Program: The Perspective of EMS Administration and EMS Medical Direction**  
*Wainscott MP, Postma RM, Atkins JM*  
*University of Texas Southwestern Medical Center, Dallas, Texas,*  
*Texas Tech University Regional Academic Health Center, El Paso, Texas*

In October, 1988, El Paso EMS adopted a formalized Risk Management Program (RMP). This program included definitions of critical and non-critical patient care incidents (PCI), an outline of the flow of incident investigation/management, an incident investigation worksheet, a medical director summary sheet, a list of potential incident findings, a list of potential indicated actions, and a written explanation of the program.

Eighteen months following implementation, EMS administration and EMS medical direction were surveyed to assess the RMP and its impact (9 or 75% were returned). Results of the assessment section of the survey show that nine (100%) felt the important steps to PCI investigation were specified, the medical director was involved effectively, and feel the RMP is a valuable part of the prehospital care system; eight (90%) thought the RMP increased their knowledge of prehospital risk management; and seven (77%) believe they are able to effectively use the RMP to manage PCI's. Six respondents were involved with PCI management before and after implementation of the RMP, and completed the second section of the survey - an evaluation of the impact of the RMP.

Results show that six (100%) feel the RMP is an improvement and the flow of documentation is defined more clearly; five (83%) believe PCI management is more objective, more consistent, and more fair to EMS field personnel, there is more emphasis on evaluating all potential causes of an incident, and they are better able to manage PCI's overall. However, four (67%) think EMS field personnel view the RMP negatively.

This study demonstrates a positive impact of a formalized EMS Risk Management Program on EMS from the perspective of administration and medical direction.

**26) Methods of Medical Control and Quality Assurance Used in EMS Systems**

*Davis EA*  
*Prehospital Care, Medical College of Pennsylvania, Allegheny Campus, Pittsburgh, Pennsylvania*

The subjects of medical control and quality assurance are receiving increasing attention as the need for proper direction and evaluation of EMS systems has become recognized. No standards exist that define actual methods to implement a plan to evaluate those methods currently used by EMS systems. We mailed an extensive survey to all emergency medicine residency programs (N=75) and major hospitals from the fifty largest metropolitan areas (N=249) in the United States. The purpose of this study was to report on the type of methods used, their relative frequency, and if differences exist between academic and non-academic emergency institutions.

In most categories, both residency and non-residency programs were similar including the percentage with an emergency physician as medical director (88.3 vs. 74%), provision of on-line command (87.7 vs. 75.6%), use of physicians for on-line command (87.3 vs. 89.2%), public education (85.7 vs. 87.3%), paramedic/EMT training (92.9 vs. 87.3%), use of field triage (91.2 vs. 87.5%), performance of trip sheet audit (75.5 vs. 62%), participation of medical director in QA (87.7 vs. 72.5%), and dispatch review (45.6 vs. 37.3%). Both sections reported that prehospital personnel were responsible for field triage (59 vs. 65.9%) and helicopter utilization (73.9 vs. 70.4%) decisions in the majority of cases.

Statistical differences ( $p < .05$ ) were found in the percentage with a person dedicated to EMS administration (80.7 vs. 61.5%), provision of prehospital CME (98.2 vs. 81%), field time (91.2 vs. 59%), and number of institutions that record communications (44.3 vs. 75.7%).

In addition, data were collected on both the specifics of the above methods as well as system composition. The majority provide ALS (58.7%), are primarily paid (87.8%), utilize telemetry (67.9%), and helicopters (79.3%).

This study delineates the methods most commonly used for quality assurance and medical control. Further research is needed to examine their effectiveness.

### 27) A Paramedic Peer-Review Quality Assurance Audit

*Swor RA, Bocka JJ*

*Department of Emergency Medicine, William Beaumont  
Hospital, Royal Oak, Michigan*

A daily EMS audit was performed to assess whether a paramedic peer-review audit would improve the quality of documentation and radio communications in cases transported to do a single receiving facility. EMS runsheets and run tapes were reviewed for adherence to standards developed for the county EMS system. Items evaluated were runsheet documentation of care and paramedic radio presentation. Checklists were used and multiple variables evaluated for each case. Two periods, 1987-88 and 1989 were compared to evaluate the effectiveness of this system. Statistical analyses were performed using the Chi Square test. Data from each case were tabulated and a profile, average number of deficiencies per run, was calculated for each paramedic.

Care rendered by a total of 106 paramedics was evaluated. Sixty-three percent (63%) of all days were audited by practicing paramedics in 1987-88 and 80% in 1989. A total of 4,175 runsheets and tapes were audited for the period 1987-88 with an average number of deficiencies per run of .27. For 1989, a total of 1,980 runsheets and tapes were reviewed with a deficiency per run rate of .22, indicating a statistically significant improvement ( $p < .003$ ). Four paramedics were identified as performing worse than two standard deviations from the mean in 87-88. All improved in 1989, with performance within one standard deviation of the mean. Twelve paramedics were not auditors in 1987-88, but audited in 1989. The numbers of deficiencies/run decreased from .13 to .08 ( $p < .01$ ).

A peer review audit in our system appears to be effective in improving documentation and radio performance as well as identifying those paramedics whose performance deviated significantly from the mean. Paramedic performance also improved when they served as auditors.

### 28) Ground Transfer EMS (G-TrEMS): A 3 Year

**Analysis of Liability Claims in an Urban Service**

*Weltge A*

*Division of Emergency Medicine, Department of Surgery,  
University of Texas Medical School at Houston, Texas*

While literature exists on aeromedical transfer and the safety of transfer in selected clinical cases, little information exists on risk to the service and Off-Line Medical Control (OLMC) for inter-facility transfer by ground EMS (G-TrEMS). This study analyzes three years of non-workman's compensation (non WC) liability claims for a five city, urban, G-TrEMS system which utilizes a risk reduction plan.

The service averaged over 48,000 transfers per year. Approximately 30% of the transfers occurred in one large metropolitan area. Less than 1% consisted of primary responses to the scene. Eighty-five percent of the runs were staffed by paramedics. A Risk Reduction Plan included pre-employment testing and orientation. The one large urban system included a driver safety education program and an on-board driver monitor. Insurance records for all non-WC claims for a three-year period (1986-1989) were reviewed.

Of the 41 claims filed (13.6/year), 30 were settled, and 11 are still pending (9 involved bodily or alleged patient injury). Of these, 27 (66%) involved motor vehicle accidents (MVA) (5 with bodily injury), two (5%) involved non-MVA vehicle damage (floodwaters), and 12 (29%) involved alleged patient injury (7 pending).

Of the settled cases, approximately 8% of the dollar loss was for bodily injury during MVA, and 2% to patient injury. Four of the 12 alleged patient injuries were settled without payment, six involved musculoskeletal or minor soft tissue injury during patient movement or transport, one involved alleged delay in arrival, and one involved alleged failure to transport patient who was under arrest. No claim was filed against a medical director or involved the medical therapy provided during transport.

The risk of liability and litigation involving the off-line medical control physician is small. Further, liability risk is related directly to ambulance motor vehicle accidents during transfer, moving patients on and off stretchers, or securing patients in the ambulance.

**29) Analysis of Hospital Ability to Provide Trauma Services: A Comparison Between Teaching and Community Hospitals**

*Neely K, Norton R, Barthus E, Schriver J  
Oregon Health Sciences University, Portland, Oregon*

**Hypothesis**

Teaching hospitals (TH) more consistently can maintain the American College of Surgeons Committee on Trauma (ACSCOT) criteria for Level 1 trauma care than can community hospitals (CH).

**Methods**

A retrospective analysis of 2,091 trauma system patients was done to determine if THs in an urban area are better able to meet the criteria for Level 1 trauma care than CHs. During the study period, a voluntary trauma plan existed among five hospitals, two THs as defined by the Liaison Committee for Medical Education and three CHs. A hospital could accept patients that met trauma system entry criteria as long as, at that moment, that facility could provide the resources specified by ACSCOT. No hospital was required to maintain ACSCOT resources. However, they were required to accurately report their current resources. A centralized communications center maintained a computerized inter-hospital link which continuously monitored the availability of all participating hospitals. Trauma system protocols required paramedics to transport system patients to the closest available trauma hospital that had all the required resources available. Nine of the required ACSCOT Level 1 trauma center criteria were monitored for each institution; emergency department (ED), trauma surgeon (TS), operating room (OR), angiography (ANG), anesthesiologist (ANE), intensive care unit (ICU), on-call surgeon (OCS), neurosurgeon (NS), and CT scanner (CT) available at the time of each trauma system entry.

**Results**

With the exception of OR, TH generally maintained the required staff and services more successfully than did CH. Further, less day to night variation in the available resource levels occurred at the TH. Specifically, ANE, ICU, TS, NS, and CT were more available both day and night at TH than CH. However, OR was less available at TH than CH during both day and night. (all P values <0.01)

**Conclusions**

In our community, TH provide a greater availability of trauma services than did CH. This study supports the designation of TH as trauma centers. A similar availability analysis can be performed in other communities to help guide trauma center designation.

**30) Use of Decision Rules to Improve Validity and Reliability of Abstracted Prehospital Care Data**

*Maio RF, Buey RE  
University of Michigan Medical Center, Division of Emergency Services, Department of Surgery, Ann Arbor, Michigan*

It has been suggested that a significant amount of the variation between EMS systems in survival from out-of-hospital cardiac arrests, can be explained by methodological inconsistencies. Our experience suggests that, even with standard definitions and inclusion criteria, information contained on ambulance report forms may be abstracted inconsistently. A method of improving consistency in data gathering, such as the use of written decision rules, could help EMS research and evaluation efforts.

**Hypothesis**

We hypothesized that the use of written decision rules would further improve agreement between paramedics abstracting prehospital cardiac arrest records.

**Methods**

Sixty-three (63) ambulance reports were selected in a random sampling of all patients having an out-of-hospital cardiac arrest. Four paramedics abstractors were each given a set of definitions to use abstracting for data and one pair, randomly assigned, also was given a set of decision rules. Abstractors recorded whether there was: 1) arrest from cardiovascular disease; 2) a witnessed arrest; 3) bystander CPR; and 4) the presenting rhythm. The choices of rhythm were "vfib/vtach," "other," and "missing" (insufficient to make a decision). Responses for other variables were "yes," "no," and "missing." Paramedics individually were instructed to work independently, using only the materials given. Agreement between pairs of abstractors was determined by computing "kappa" values. A value of 1.00 indicates complete agreement; values greater than .75 represent excellent agreement beyond chance, below .40 poor agreement.

**Results**

Kappa values (0.95 Confidence Intervals):

Variable	With	Without
	Decision Rules	Decision Rules
Cardiovasc. Dis.	0.33 (0.15 - 0.51)	0.23 (-0.18-0.62)
Witnessed Arrest	0.41 (0.25 - 0.57)	0.39 (0.19-0.59)
Bystander CPR	0.66 (0.54 - 0.78)	0.43 (0.29-0.57)
Rhythm	0.80 (0.55 - 1.05)	0.65 (0.47-0.83)

These data suggest that decision rules can improve agreement between paramedic abstractors, but that this effect varies with the data to be abstracted.

**Conclusion**

The addition of decision rules to variable definitions and case inclusion criteria is worthwhile but does not ensure good or excellent levels of agreement in data abstracted by paramedics. Methods need to be developed which enhance agreement between abstractors. Also, investigators should discuss how inter-rater reliability affects their studies.

### 31) The Natural Outcome of Patients Refusing

#### Prehospital Transportation

Sucov A, Verdile VP, Garrettson D, Paris PM

Affiliated Residency in Emergency Medicine, Division of Emergency Medicine, University of Pittsburgh School of Medicine, Bureau of EMS, Division of Public Safety, City of Pittsburgh, Pennsylvania

To study the natural outcome of patients refusing prehospital transportation (PT), we studied 180 consecutive competent patients who refused PT in an urban, ALS, EMS system. One investigator reviewed all trip sheets for a 20-day period and made a maximum of three telephone attempts to contact each patient at home within 72 hours of the refusal.

One hundred eighty-eight patients refused PT, 77 (41%) were male, and the average age was 51 years. Patients were entered into the study group only once. Only 94 (50%) patients could be reached. Nine (10%) patients had abnormal vital signs (systolic BP <90 or >180 mmHg, HR <50/min. or >110 BPM, RR >20/min.), 31 (33%) had cardiopulmonary complaints (chest pain, syncope, SOB), 7 (7%) had an altered level of consciousness (seizure, slurred speech, intoxication), 10 (11%) were involved in accidents (MVA, falls with head injury) and 7 (7%) had abdominal pain. The remainder (32%) of the refusals were relatively minor in nature. Six (6%) patients were admitted to the hospital, 3 (3%) received ALS treatment by the paramedics (Narcan, 50% dextrose, Albuterol) and then refused conveyance and 31 (33%) either saw or contacted a physician. Consultation with an EMS physician was initiated for 8 (8.5%) of the refusals. Of the patients contacted, 6% needed PT for hospitalization.

We believe this probably underestimates the true number of patients requiring PT, as only 50% of patients refusing could be reached. Telephone follow-up is an inadequate means of determining the natural outcome for this patient population. The ALS nature of many of the complaints combined with the lack of consistent physician consultation exposes the EMS system to an as yet undefined medico-legal liability risk.

### 32) On-Scene Time for Patients Initially Refusing

#### Treatment or Transport

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#### Hypothesis

Time spent by paramedics on-scene (OS) with patients initially refusing (PIR) either treatment or transportation is significantly longer than OS time for other call types. The nature of the calls in the PIR subgroup influences OS time.

#### Population

In our urban EMS system, paramedics must contact a single base station to document PIR cases. Of the 1715 on-line physician consultations during the six-month study, 169 (10%) were PIR cases. We were able to review 128 (76%) of these patients' records.

#### Methods

A retrospective study of paramedics' run sheets was conducted. Data analyzed included age, sex, nature of call, vital signs, police involvement, length of time OS, if meds were given, and whether the patient ultimately was transported. The data were subjected to analysis of variance.

#### Results

The mean value for OS time for PIR cases was significantly longer than for non-refusal cases (30.3 versus 14.0 minutes). Values for OS times varied from 6 minutes for a trauma related case to 118 minutes for two hypothermic hikers. Mean OS time for the various types of PIR cases differed; the greatest difference between trauma related PIR ( $22.4 \pm 13.1$  minutes) and altered mental status PIR ( $35.6 \pm 17.2$  minutes) OS time. The OS times did not correlate with age, sex, or systolic blood pressure.

#### Conclusions

Paramedic time OS with PIR is significantly longer than time OS for other types of patients. Less time OS is spent with trauma related PIR calls.



**33) Prehospital, Non-traumatic, Cardiac Arrest in Young Patients: An Urban EMS Experience**

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**Purpose**

To determine the etiologies of cardiac arrest (CA) in young patients.

**Methods**

One hundred and one consecutive cases of non-traumatic CA in young patients (ages 2-35) were studied. Patients were entered into the study only if they sustained a CA prior to arrival at the emergency department. A retrospective computer search of EMS trip sheets during a six-year period (calendar years 1982-1987) identified 101 cases that met the criteria for entrance into the study population. This report is unique because it includes all prehospital cases, including 20 patients who were declared dead in the field. Similar reports only included patients transported to the hospital, or only those patients admitted to specific hospital services.

**Results**

A definitive diagnosis was established in 66 cases (66%). Where a definitive diagnosis was not made, an autopsy usually was not performed. Of the 66 cases in which a diagnosis was made, 22 patients (33%) were exposed to toxins and/or drugs, 18 (27%) were cardiac, 16 (24%) were pulmonary, 6 (9%) involved acute CNS pathology, and 4 (6%) were miscellaneous. Only 2 patients survived.

**Conclusions**

This is the first report which examines all consecutive cases of non-traumatic prehospital CA in young patients. The etiology, in most cases, was non-cardiac (73%) with drugs and toxins being the most common cause. Considering the unique etiologies and dismal outcome of CA in young patients, studies are urgently needed to examine the therapeutic approaches to these patients.

**34) Advanced Life Support for Hypotensive Trauma Patients**

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The care of 199 consecutive trauma patients injured by gunshot (GSW), stab, or motor vehicle crash (MVC) and having a systolic blood pressure of  $\leq 90$ mmHg prior to admission to the emergency department (ED) were studied. They were admitted to eight hospitals including 3 trauma centers. Patients with no vital signs both in the field and in the emergency department (ED) were not included. Patients were compared by system times (response times, RT; scene time, ST; and transport time, TT), and procedures (intravenous lines, IV; endotracheal tube, ETT, CPR; MAST, immobilization, IMMOB). Age, ISS, field RTS, and improvement in RTS from the field to the emergency department. Percent predicted mortality (PMED%), percent observed mortality (ObsM%) and Z scores also were compared. Predicted mortalities derived from field RTS and ED RTS were compared using the paired T-test.

**Results**

Summaries of the data are:

	n	Patients			System Times		
		RTS	ISS	AGE	RT	ST	TT
GSW	78	6.3	23.5	29.4	3.8*	10.2	7.0
STAB	44	6.1	15.9	32.1	6.0	11.9	6.1
MVC	77	5.7	24.1	34.5	5.7	18.8*	7.8

	Procedures					Outcome			
	IV	ETT	CPR	MAST	IMMOB	PMF%	PMED%	ObsM%	Z
GSW	88.5	6.4	1.3	65.4	26.9	18.5	19.9	24.2	-1.77
STAB	75.0	4.5	4.5	56.8	6.8	13.5	15.2	18.2	-1.09
MVC	81.8	7.8	7.8	44.2	88.3	24.6*	20.9	16.0	+0.04

\*p = <0.05; PMFD: based on field RTS; PMED: based on ED RTS.

All patient groups improved their mean RTS's from the field to the ED. Although all groups showed low mortality rates for patients found in shock, the MVC patients had the greatest improvement in RTS and the ObsM% compared to PMED%. Also, only MVC patients showed a significant reduction in predicted mortality based on the ED RTS compared to the field RTS.

**Conclusions**

These results suggest that in caring for patients in shock, ALS is more beneficial for patients from MVC than for patients with stabs and GSW's.

### 35) Opportunity for Seat Belt Usage by ALS Providers

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#### Purpose

Prehospital care providers commonly indicate that they cannot wear seat belts owing to their need to be unrestrained while delivering care to the patient in the back of the ambulance. Each year, providers are injured in situations in which seat belts have been shown to be protective. Are ALS providers able to wear a seat belt and provide care in an ambulance?

#### Methods

ALS providers were asked to complete a form following calls during which they rode with the patient in the back of an ambulance. They indicated the amount of time which they felt they would have needed to have been unrestrained by seat belts and the reasons. There were no attempts to regulate or quantify actual seat belt usage. Additional information was gathered from the trip report.

#### Results

The percentage of the time of each trip during which they felt they needed to be unrestrained was calculated for each trip. The mean was 41%. The mean transport time was 14.7 minutes. Subgroupings by protocol type showed that for cardiac arrest patients, providers felt they needed to be unrestrained for 82% of the duration of transport, for patients with "chest pain or cardiac dysrhythmia" 63%, for "shortness of breath" 38% and for trauma patients 41%. Excluding cardiac arrest patients, the nine patients which were assigned by the providers to have the most critical level of case severity required unrestrained time of 72%. Those nine patients with the lowest severity level required that the provider be unrestrained only 18% of the time. Management of intravenous line and patient assessments most frequently were cited as reasons for needing to be unrestrained.

#### Conclusion

Perceived need of ALS providers to be unrestrained varied with respect to the type of call, with cardiac arrest patient transports having the greatest need to be unrestrained. However, on the average, providers felt they needed to be unrestrained only 41% of the time; markedly less on some types of calls. ALS providers should be able to wear their seat belts for at least part of the time, on most ALS calls.

### 36) Survey of Emergency Medical Technicians'

#### Management of Prehospital Deaths

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#### Purpose

To determine whether Emergency Medical Technicians (EMTs) find management of prehospital deaths difficult and to identify those factors which contribute to that difficulty.

#### Methods

The study population was a random sample of certified EMTs (Levels I-IV) in one state. A blinded, self-administered survey was completed by 551 EMTs outlining their training, demographic characteristics, and attitudes. Attitudes and behaviors related to notification of survivors and management of prehospital deaths were measured using a Likert scale. Spearman's Rank correlation was used to correlate attitudes with respondent characteristics ( $p < 0.05$ ).

#### Results

Respondents had a mean age of  $35.5 \pm 8.3$  yr.; 83% were men. Their level of training was: 4% EMT I, 43% EMT II, 18% EMT III, and 33% EMT IV. They saw an average of 9.3 deaths/year and spent an average of  $20.4 \pm 16.3$  minutes with survivors. 61% found managing a dying or dead patient difficult. 68% reported receiving training for dealing with death. Factors associated with greater difficulty notifying the family of a prehospital death include: fewer hours worked/month, working in a smaller community, lower level of EMT training, being male, and fewer deaths seen during the previous year. A practice of beginning resuscitation on a patient obviously dead correlated with more hours worked/month, larger community of practice, higher level of EMT training, being male, increasing age, and more deaths seen during the previous year. Difficulty managing a dying patient correlated with the tendency to begin resuscitation on a patient clearly dead ( $p < 0.0001$ ).

#### Conclusions

EMTs have difficulty dealing with prehospital deaths. Protocols, on-line medical control, training, and continuing education should address their issues.

### 37) Development and Evaluation of Criteria Allowing Paramedics to Treat and Release Patients Presenting with Hypoglycemia: A Retrospective Study

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The prehospital management of hypoglycemic patients has not been studied adequately. A retrospective study of patients transported by paramedics to a community teaching hospital was conducted.

During a 12-month period, 60 patients with an altered level of consciousness were encountered. Hypoglycemia [blood sugar (BS) <80mg/dl, mean  $27 \pm 13$ mg/dl] was documented in 27/60 patients (45%). Two additional patients were assumed to be hypoglycemic (history of insulin-dependent diabetes mellitus [IDDM], became alert after D5O, and refused transport to the hospital). Eighty-nine percent of the (24/27) patients were discharged from the emergency department (ED) and 3/27 (11%) patients admitted. Criteria were developed to identify patients who could be treated and released safely in the field: 1) history of IDDM or non-insulin-dependent diabetes mellitus; 2) pretreatment (BS <80mg/dl); 3) post-treatment (BS >80mg/dl); 4) absence of complicating factors (i.e., chest pain, etc.), and 5) return to normal mental status within 10 minutes of treatment.

These criteria were applied retrospectively to 27 hypoglycemic (mean BS  $28 \pm 14$ mg/dl) patients seen during a different 10 month period. Two additional patients refused transport after D5O was administered and were excluded from the study. Eighty-five percent (85%), 23/27 patients, were discharged from the ED. Study criteria correctly identified 70% (16/23) of discharged patients. No admitted patient would have been treated and released in the field.

In conclusion, many hypoglycemic diabetic patients may be treated safely and released in the field without transport to a hospital. A larger prospective study must be conducted before this can be recommended for general practice.

### 38 Prehospital Detection of Hypoglycemia

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#### Introduction

Previous studies examining the use of reliability of reagent strips for the purposes of ruling out hypoglycemia (HYPO) in the prehospital environment have had mixed results. However, one recent study using the Chemstrip bG<sup>R</sup> (CS) method did show 100% sensitivity in detecting HYPO, but the same size (n=9) of confirmed HYPO patients limited the assurance of routine safety.

#### Purpose

Our purpose was to study a much larger sample of HYPO patients in order to improve clinical confidence in this methodology.

#### Methods

Defining HYPO as a laboratory-measured blood glucose (GLU<sub>L</sub>) of  $\leq 60$  mg/dl, we compared paramedic CS readings to the GLU<sub>L</sub> using the same prehospital blood sample obtained from those with unexplained unconsciousness or diabetics with altered mental status. To remove clinical bias and to confirm inter-observer reliability, the CS for the first 30 patients' also was read subsequently by a single, independent, "blinded" reader.

#### Results

Of 73 patients studied, the CS was read as HYPO in 44, 35 of whom had HYPO subsequently confirmed by GLU<sub>L</sub>. All confirmed HYPO patients were detected by CS, even when higher defined limits (GLU<sub>L</sub>  $\leq 80$  mg/dl) were used (n=37). All of the first 30 CS readings were duplicated uniformly by the blinded observer.

#### Conclusion

These data, which quadruple the number of previous sample sizes, further confirm the reliability (100% sensitivity) of paramedic detection of hypoglycemia using the Chemstrip bG<sup>R</sup> method.

### 39) Paramedic Skills and Medications: Practice Options Utilized by Local Advanced Life Support Medical Directors

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Local, prehospital, advanced life support (ALS) system medical directors in North Carolina choose those skills and medications they want utilized in their jurisdiction from a list of options authorized by the State Board of Medical Examiners. We surveyed all 35 medical directors of paramedic providers in the state to determine which optional skills and medications local medical directors allow and, therefore, how they tailor their prehospital practices. Information concerning the urban or rural status of the paramedic service area, annual call volume, and the specialty classification of the medical director also was obtained.

All medical directors surveyed responded. Twenty-one (60%) of the paramedic service areas were rural and 14 (40%) urban. Twenty-three physicians (66%) listed emergency medicine as their primary specialty. Annual call volumes ranged from 580 to 33,500 calls. Skills allowed by the majority ( $\geq 80\%$ ) of the medical directors include: drawing blood, insertion of esophageal and endotracheal airways, defibrillation, cardioversion, and starting intravenous fluids prior to hospital contact. The majority permit the administration of bretylium, dopamine, NaCl injection, sodium bicarbonate, furosemide, sublingual nitroglycerin, diazepam, diphenhydramine, and morphine. The majority do not allow use of positive-pressure ventilators, and do not allow administration of dobutamine, nifedipine, procainamide, propranolol, local procaine, isoetharine, metaproterenol, nitroglycerin paste, 10% dextrose, methylprednisolone, mannitol, phenytoin, meperidine, and nitrous oxide. Nitroglycerin paste and dexamethasone were significantly ( $p < .05$ ) more likely to be allowed in rural areas than urban settings. No differences in utilization by medical director specialty classification or call volume were detected.

The results suggest that, when given a choice, local ALS system medical directors select a limited prehospital practice. Further study is warranted to determine why available skill and medication options are not utilized.

### 40) The Effectiveness of Interactive Videodisc as an Instructional Instrument for Paramedic Students

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#### Introduction

Interactive videodisc instruction (IVD) is a computer-assisted method of education that allows both graphic and video displays to be utilized; it has practical advantages for training paramedics in that it allows for individual learning rates at convenient times. We attempted to determine the relative effectiveness of IVD in providing primary instruction in endotracheal intubation to paramedic students versus the traditional (lecture and demonstration) methods of instruction.

#### Methods

Twenty-nine paramedic students were assigned randomly to either the control group (traditional instruction) or the experimental group (IVD, Actronics<sup>R</sup> Learning System, Inc.). After four hours of instruction in either of the two modes (lecture or IVD), a cognitive written post-test was administered to each group to determine knowledge acquisition. In addition, three months later a second test specifically designed to measure retention of factual knowledge was administered to all subjects. Scores were compared using Student's t-test, with the alpha error rate set at 0.05.

#### Results

A mean score of 25.3 was attained by the group receiving computer instruction and 25.8 for the group trained using traditional methods ( $p = 0.726$ ). On the test of retentive ability, the mean scores for the computer assisted group and the traditional group were respectively 26.1 and 26.4 ( $p = .749$ ).

#### Conclusion

The IVD format is an effective means of providing instruction for endotracheal intubation to paramedic students when compared to traditional methods. The IVD may have certain advantages in terms of convenience and cost effectiveness. No significant differences in either cognitive acquisition or remote retention were observed.