U.S. Department
of Transportation
**National Highway
Traffic Safety
Administration**

DISPLAY COPY
PLEASE DO NOT TAKE

NHTSA
People Saving People
www.nhtsa.dot.gov

DOT HS 809 521

October 2002

The REACT Project:

Rural Enhancement on Access and Care for Trauma

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.

4. Title and Subtitle	5. Report Date
The React Project: Rural Enhancement on Access and Care for Trauma	October, 2002
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
Herbert G. Garrison, MD, MPH; Sallie B. Gough, RN,MSN; Melvin S. Swanson, PhD, and Paul R.G. Cunningham, MD	

9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
East Carolina University Eastern Carolina Injury Prevention Program Department of Emergency Medicine and Surgery Greenville, North Carolina 27858	11. Contract or Grant No. Order #DTNH22-96-H-05246

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
National Highway Traffic Safety Administration Office of Research and Traffic Records Research and Evaluation Division 400 7th Street, S.W., Washington, D.C. 20590	Final Report June 1996 – July 2002 14. Sponsoring Agency Code

15. Supplementary Notes

The Contracting Officer's Technical Representative for this project was Patty Ellison-Potter, Ph.D.

16. Abstract

Preventable mortality refers to deaths that could have been prevented medically under different circumstances. Typically, rural areas have a higher preventable mortality rate than urban regions. This may be due to a number of factors, such as the time elapsed from the emergency call to the arrival of the ambulance at the scene of the incident, the time for the ambulance to reach the trauma center, insufficient experience with certain trauma procedures due to infrequent occurrences, and inadequate training for EMS personnel in rural areas. This project evaluated the impact of a continuous quality improvement system, aimed at pre-hospital and hospital emergency providers of trauma care in rural areas, on the overall preventable mortality rate in rural eastern North Carolina. This program significantly contributed to the decrease in preventable deaths and inappropriate care in north eastern rural North Carolina.

17. Key Words	
EMS, Trauma, rural, preventable mortality	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
		167	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

This project was housed in the Eastern Carolina Injury Prevention Program (ECIPP), which is a joint effort of Pitt County Memorial Hospital and the Brody School of Medicine of East Carolina University. The REACT project was the first major project undertaken by ECIPP. We greatly appreciate the support, encouragement and assistance that ECIPP staff provided to those working directly on this project. We also appreciate the support of the members of the ECIPP Executive Committee, including Nick Benson, MD, Sharon Bradley, RN, MSN, Tom Czaplijski, RN, MSN, Alice Huggins, and Michael F. Rotando, MD.

The Trauma Center of Pitt County Memorial Hospital and University Health Systems of Eastern Carolina generously provided office space for the project. In addition, Kathy Dutton, RN, MSN, Trauma Center Manager, was indispensable. We benefited greatly from her advice and guidance. Thanks also to Bonnie Long-Snyder for her assistance.

The REACT project benefited greatly from the genuine effort and hard work of its part-time staff. Rhonda Dale, RN, Marsha Mernone-Laitinen, RN, Chris Coltrain, EMT-P, and Denise Hankins went above and beyond the call of duty to achieve the project goals.

This project was envisioned and sponsored by the National Highway Traffic Safety Administration. The efforts of three people at NHTSA are praiseworthy. John Chew (retired from NHTSA and now with the EMSTAR Group) was invaluable early on in determining the need for the project and helping design it. Joan Harris served as the original Contracting Officer's Technical Representative; she was always available and her advice was always helpful. Last but not least, we appreciate greatly the patience, advice and support provided by our main COTR, Patti Ellison-Potter.

The health care professionals on the front lines deserve the most credit for major projects involving patients. This project was no exception. The EMS providers, nurse managers and nurses, medical records personnel, administrators, and physicians with the following organizations were instrumental in the success of this project:

Pitt County Memorial Hospital
EastCare Critical Care Service
ECU Div. of Emergency Med. Services
NC Office Of Chief Medical Examiner
Regional Medical Examiner's Office
Lenoir Memorial Hospital
Beaufort County Hospital
Wayne Memorial Hospital
Martin General Hospital
Heritage Hospital
Our Community Hospital
Nash General Hospital
Onslow Memorial Hospital
Carteret General Hospital
Craven Regional Medical Center
Duplin General Hospital
Albemarle Hospital
Halifax Regional Medical Center
Roanoke-Chowan Hospital
Washington County Hospital
Bertie Memorial Hospital
Wilson Memorial Hospital
Chowan Hospital
Pungo District Hospital
Havelock Rescue
Pamlico County EMS
Williamston Fire-Rescue
Kelford Rescue
Bertie Rescue
Lewiston-Woodville Rescue
Nash County EMS

Stoney Creek EMS
Bunn EMS
Mt. Pleasant Rescue
Franklin Co. EMS
Johnston Ambulance
Wendell Rescue
Ayden Rescue
Pink Hill Rescue
Kinston Fire/Rescue
Kenansville Rescue
North Lenoir Volunteer Fire/Rescue
Edgecombe County Rescue
Pinetops Rescue
Lower Currituck Rescue
Crawford Rescue
Pamlico Beach Rescue
Pasquotank-Camden EMS
Perquimans County EMS
Hertford County EMS
Hyde County EMS
Tyrrell County EMS
Northhampton County Ambulance Serv.
Halifax Emergency Medical Services
Conway-Severn Rescue
Gaston Volunteer Rescue Squad, Inc.
Enfield Rescue
Scotland Neck Rescue
Goldsboro Fire-Rescue
Dare County EMS
Snow Hill Rescue
Fort Run Rescue
Castoria Rescue
Maury Rescue
Arba Rescue
Shine Rescue
Hookerton Rescue
Farmville Rescue
Chowan County Emergency Services
Cherry Point EMS
Washington Fire Rescue
Navel EMS (Onslow County)
Onslow County EMS
Williamston Rescue
Oak City Rescue
PCS Phosphate, Aurora
Warsaw Rescue
Faison Rescue
Rose Hill Rescue
Duplin County EMS
Wallace Rescue
Chinquapin Rescue
Mt. Olive Rescue
Union Rescue
Beulaville Rescue
Washington County EMS
Martin General Hospital
Washington County Hospital EMS
Wilson County EMS
Walstonburg Rescue
Trenton Rescue
Maysville Rescue
Pollocksville Rescue
Newport EMS
Morehead City EMS
Atlantic Beach Fire Dept.
Carteret General Hospital EMS
Sea Level Rescue
Wildwood Rescue
Jason Rescue

ABSTRACT

BACKGROUND

The purpose of the Rural Enhancement of Access and Care for Trauma (REACT) project was to reduce episodes of inappropriate emergency medical care and decrease the rate of preventable deaths from injury in rural eastern North Carolina. The project was a follow up to a 1992 National Highway Traffic Safety Administration (NHTSA) sponsored Rural Preventable Mortality Study (RPMS) which found an overall preventable mortality rate for eastern North Carolina of 29%. In response to this high rate, an intervention aimed at enhancing timely access to definitive trauma care and improving the emergency medical care delivered by rural health personnel was implemented and evaluated.

METHODS

Intervention

The intervention centered around STAF, a model continuous quality improvement system composed of *S*tandards of care, *T*raining, *A*nd *F*eedback aimed at prehospital and hospital emergency providers of trauma care in rural areas. The STAF model was implemented for the 29 counties in rural eastern North Carolina served by the trauma service of Pitt County Memorial Hospital. This is the same area in which the 1992 RPMS was conducted. There were three components of the intervention phase of the REACT project: 1) partnership with the Eastern Regional Trauma Coalition to develop trauma care guidelines (standards) for the treatment of trauma patients which addressed the deficiencies identified in the 1992 RPMS study; 2) guideline-focused, in-depth training for emergency medical personnel in the region; and 3) feedback to emergency medical personnel on their conformance to the guidelines.

Evaluation

The evaluation had two components: 1) assessment of the compliance with trauma care guidelines during the intervention phase; and 2) determination of the preventable mortality rate for the region during the intervention year to determine if the intervention had an impact.

RESULTS

Overall, there was improvement with time in the prehospital guideline compliance data although there was no statistical significance in the change. Data collected on emergency department (ED) guideline compliance showed statistically significant improvement from quarter 1 to quarters 3 and 4.

Of the 134 deaths in 1997/98, 2 (1.5%) were judged preventable, 18 (13.4%) possibly preventable, and 114 (85.1%) non-preventable. The overall preventable death rate was 14.9%. In 42 (31.3%) of the cases, some aspect of the care was judged inappropriate. All of the cases judged preventable had inappropriate care compared to 92 (80.7%) of the non-preventable cases (p=.0005).

There were significantly more preventable deaths and inappropriate care in the 1992 preventable mortality study compared to the 1997/98 study (29% preventable deaths and 68% inappropriate care in 1992 vs. 15% preventable deaths and 31% inappropriate care in 1997/98, $p<.01$).

Conclusion

Implementation of the STAF model was associated with a reduction in the rate of preventable trauma deaths compared to the rate found in the 1992 RPMS. The rate for the STAF intervention year was similar to that found in NHTSA-sponsored rural preventable mortality studies conducted previously in Michigan and Montana. We recommend that the STAF model be tested in other locales.

INTRODUCTION

The purpose of the Rural Enhancement of Access and Care for Trauma (REACT) project was to reduce episodes of inappropriate emergency medical care and decrease the rate of preventable deaths from injury in rural eastern North Carolina. The project was a follow up to a 1992 National Highway Traffic Safety Administration (NHTSA) sponsored Rural Preventable Mortality Study (RPMS) which found an overall preventable mortality rate for eastern North Carolina of 29%. In response to this high rate, an intervention aimed at enhancing timely access to definitive trauma care and improving the emergency medical care delivered by rural health personnel was implemented and evaluated.

The 1992 NHTSA-sponsored RPMS conducted in eastern North Carolina found that specific types of inappropriate emergency medical care may have contributed to the high preventable mortality rate for trauma victims. In that study, 151 rural injury deaths from 1992 were reviewed. Of those deaths, a peer-review panel judged 11 as definitely preventable and 32 deaths as possibly preventable. Combined, these rates produced an overall preventable death rate of 29%.

This high eastern North Carolina rate compared unfavorably with the results of similar studies also sponsored by NHTSA. A 1994 Montana study found an overall preventable death rate of 13% (Esposito et al., 1995). A similar study conducted in Michigan in 1996 found an overall preventable death rate of 12.9% (Maio et al., 1996)

In North Carolina, the 1992 RPMS peer review panel identified that 103 of 151 patients reviewed received some type of inappropriate care. Seventy-two patients had inappropriate care in the prehospital setting and 69 in the emergency department (ED). The 1992 study results suggested that emphasis was needed in two specific areas: 1) the training of prehospital providers in airway management; and 2) the training of hospital providers in the importance of reducing the time to definitive care.

To reduce preventable mortality and inappropriate care, the REACT project instituted a model intervention called STAF. The STAF model was designed to be a continuous quality improvement system composed of *S*tandards of care, *T*raining, *A*nd *F*eedback aimed at prehospital and hospital emergency providers of trauma care in rural areas. It was implemented in eastern North Carolina for a one year period. The intent of the system was to correct deficiencies noted in the 1992 North Carolina Rural Preventable Mortality Study.

The STAF model was implemented as designed for the 29 counties in rural eastern North Carolina served by the trauma service of Pitt County Memorial Hospital. This is the same area in which the 1992 RPMS was conducted. There were three components of the intervention phase of the REACT project: 1) partnership with the Eastern Regional Trauma Coalition to develop trauma care guidelines (standards) for the treatment of trauma patients which addressed the deficiencies identified in the 1992 RPMS study; 2) guideline-focused, in-depth training for emergency medical personnel in the region; and 3) feedback to emergency medical personnel on their conformance to the guidelines.

During and following the one-year implementation of STAF, an evaluation was

conducted. The evaluation had two components: 1) assessment of the compliance with trauma care guidelines during the intervention phase; and 2) determination of the preventable mortality rate for the region during the intervention year to determine if the intervention had an impact. The details of the intervention and evaluation are presented herewith.

METHODS

The Methods part of the report is divided into four distinct sections. The first three sections describe the three components of the STAF intervention: Standards of Care, Training and Feedback. In the fourth section, we describe the methods used for the project evaluation.

I. STANDARDS OF CARE

Development

For the standards of care, the main project staff (Principal Investigator and Project Coordinator) drafted trauma care guidelines. Two different sets of guidelines, one for prehospital personnel and one for ED personnel, were drafted. Specific deficits in care identified by the 1992 RPMS were addressed by these guidelines.

In drafting the guidelines, we made sure we adhered to principles in the following references: 1) *Advanced Trauma Life Support Program for Doctors* (American College of Surgeons, 1997); 2) *Basic Trauma Life Support for Paramedics and Advanced EMS Providers* (Campbell, 1995); 3) *Guidelines for the Management of Severe Head Trauma* (Brain Trauma Foundation, 1995); and 4) *Trauma Nurse Core Course Instructor Manual* (Emergency Nurses Association, 1995).

Approval

Initial drafts of the guidelines were presented to the Eastern Regional Trauma Coalition for feedback. This Coalition (now called the Eastern Regional Advisory Council) is composed of hospital administrators, trauma surgeons, emergency physicians, prehospital personnel, and emergency department personnel representing the 29 county referral region. Feedback from this group was incorporated into the final trauma care guidelines, which the Coalition approved in May 1997.

The guidelines approved by the Coalition and used as the Standards for the project are included in Appendix I.

Dissemination

Once the guidelines were approved by the Coalition, copies of the guidelines for both prehospital and emergency department personnel were mailed to medical directors (18), emergency medical services (EMS) directors (30), and EMS squads (141) in the region.

The REACT Coordinator met with the ED managers of the 20 hospitals in the region and members of EastCare critical care transport service. (EastCare is a service of Pitt County Memorial Hospital (PCMH), the hospital that houses the trauma center at which the REACT project was based.) The purpose of these meetings was to explain the project in detail and deliver copies of both sets of guidelines. These meetings were conducted from April through June 1997.

II. TRAINING

The Coalition-approved trauma care guidelines provided the foundation for the training of prehospital providers and ED personnel. EMS educators with EMS experience were hired to assist the REACT Coordinator with providing education to prehospital personnel.

Training Materials

The REACT Coordinator and the main EMS educator developed training materials based on the Coalition-approved trauma care guidelines. Materials included background information from the 1992 RPMS, a description of the REACT project, copies of the trauma care guidelines, and trauma case scenarios to use in practice.

Training Sessions for Prehospital Providers

In an attempt to reach as many rescue squads and EMS personnel as possible, contact was made with the individual responsible for continuing education for county EMS agencies as well as squad captains in each of 29 counties in the region for the project. The 29 North Carolina counties for the project included Bertie, Beaufort, Camden, Carteret, Chowan, Craven, Currituck, Dare, Duplin, Edgecombe, Gates, Greene, Halifax, Hertford, Hyde, Jones, Lenoir, Martin, Nash, Northhampton, Onslow, Pamlico, Pasquotank, Perquimons, Pitt, Tyrrell, Washington, Wayne and Wilson.

The majority of the educational sessions were conducted at squad meetings since we found that continuing education meetings were unavailable because they had been scheduled two years in advance.

We established agreements with continuing education personnel or committees in each county so that continuing education hours could be awarded to squad members who attended REACT training sessions. During the sessions, laminated copies of the guidelines were passed out to squad members. Seventy-six training sessions were conducted in the 29 county region between July 1997 and June 1998. A total of 700 EMS personnel attended these training sessions.

Training of Hospital ED Providers

The REACT Coordinator carried out educational training sessions for the ED staff from regional hospitals at their staff meetings between July 1997 and June 1998. The REACT Coordinator offered to attend staff meetings at each hospital to conduct these sessions. However, it was impossible for her to attend every hospital ED staff meeting. When this was the case, ED managers presented the material after being briefed by the REACT Coordinator. The same material presented at EMS sessions was presented at the hospital ED sessions but with greater emphasis on the ED guidelines.

The REACT Coordinator and EMS educators also conducted four educational sessions for the EastCare critical care transport service. At these sessions, they presented the same material presented at the ED training sessions.

Since the trauma care principles from the Trauma Nurse Core Course were used in the development of the trauma care guidelines, the REACT project also sponsored

the attendance of 20 ED staff nurses from regional hospitals at a Trauma Nurse Core Course held at PCMH. This course was developed by the Emergency Nurses Association to educate ED staff in the basics of trauma care.

Regional Workshops

In addition to training sessions, two regional workshops were held for EMS and ED personnel. At the first workshop, attended by 60 persons from throughout the region, the REACT project was discussed, guidelines were distributed, and education based on the guidelines was presented. The second workshop, attended by 90 persons, consisted of presentations of actual patient scenarios from the region and discussion of the appropriateness of the patient's trauma care. (See Appendix II for copies of the Workshop Brochures.)

Newsletters

Quarterly newsletters were mailed to all EMS squads, medical directors, and EDs in the referral region. The purpose of the newsletter was to keep all project participants informed of the progress of the project. Educational articles were also included in the newsletters. Attempts were made to involve EMS personnel and hospitals in the writing of the newsletters by asking for interesting cases and by asking ED managers to submit a brief article on their hospital. (See Appendix III for copies of Quarterly Newsletters)

III. FEEDBACK

The intent of the feedback component of the STAF model was to provide information on adherence to the trauma care guidelines. Providing feedback was the most challenging portion of the REACT project. In order to provide feedback, data collection forms based on the trauma guidelines were developed and disseminated.

Data Collection Forms

Two data collection forms were developed: a form for the evaluation of prehospital care and one to evaluate care at EDs that referred patients to the PCMH Trauma Center. The ED staff at participating regional hospitals completed the prehospital form. For patients transferred to our trauma center, either the EastCare transport personnel or PCMH ED staff completed the form.

Both forms listed interventions based on the trauma care guidelines and provided space for the data collector to indicate whether the intervention was needed and done; needed but not done; or not needed. There was also space for comments. The prehospital form also requested information on the level of certification of the EMS providers. On the ED care form, additional information included any other interventions done for the patient prior to transfer. On the back of the forms we placed instructions for use of the form and, on the prehospital form, criteria for selecting patients for data collection. The criteria were taken from *Advanced Trauma Life Support Program for Doctors* (American College of Surgeons, 1997). Copies of the prehospital and ED Data Collection Forms are included in Appendix IV.

Form Approval

These data collection forms were presented to the Eastern Regional Trauma Coalition for their feedback and approval. Feedback from this group was incorporated into the final data collection forms, which the Coalition approved in May 1997.

Form Dissemination

Data collection forms for both prehospital and ED care were included in the initial mailings of the guidelines to the medical directors, EMS directors, and prehospital providers. The data collection forms (prehospital and ED) were shared at the initial meetings with the ED managers. A contact person was designated by each institution and the EastCare transport service to ensure completion of the data forms and to mail or fax completed forms to the REACT coordinator.

Providing Feedback

Emergency departments at each of the referring hospitals designated an individual to receive feedback based on the data collected. In most cases, the nurse manager received both the prehospital and ED feedback. The ED manager shared feedback on prehospital care with the appropriate EMS personnel.

The initial plan was to provide feedback by telephone to regional hospitals within 72 hours of patient admission to the trauma center. The REACT coordinator attempted to meet this goal initially; however, difficulties were frequently encountered in reaching the contact person at referring hospitals by telephone within this time frame. Additionally, data forms often were not faxed or mailed to the REACT coordinator until several days after patient presentation. Many referring hospitals found it easier to have one person collect the data during chart reviews and mail or fax the information in bulk. The EastCare transport staff also found this method easier and usually provided data collection forms once per month.

The REACT coordinator reviewed completed data collection forms. Any major issues identified were discussed with the principal investigator and attempts were made to contact the appropriate hospital by telephone. Feedback on routine matters was provided in writing to each of the 20 referring EDs each quarter of the intervention year. The REACT coordinator met with the contact person at each of the 20 institutions at least once (in addition to the initial visits) during the intervention phase to provide as well as receive feedback. Information on compliance with the trauma care guidelines was provided to each hospital using percentages (percent needed and done; percent needed but not done; and percent not needed) for each item on the data collection forms. Hospital-specific data for prehospital care and ED care was provided. Information on patient outcome data was also provided to the hospitals. In addition, regional data for each point on the prehospital and ED forms were included to aid referring facilities in comparing themselves to the region.

Attempts were made to provide feedback directly to prehospital personnel on prehospital care; however, numerous obstacles were encountered. Often the names of specific squads were omitted from the prehospital forms. In many cases, volunteers staffed the squads and there was no one to receive the feedback by telephone.

Specifically, the project coordinator placed 10 calls to prehospital providers to provide feedback and in almost every case a message was left and the call was not returned.

The project coordinator provided written feedback via letter to several squads on the care they delivered in the same format used for sending feedback to the regional hospitals. About 25 letters were sent to local rescue squads throughout the region with feedback. However, some of the squad members indicated they would prefer to receive feedback in person rather than by letter. At that point a decision was made to provide general feedback during training classes. Feedback was delivered during the remaining 45 training classes that took place from November 1997 through June 1998.

IV. EVALUATION

The Evaluation section begins with a brief description of our method for evaluating compliance with the trauma care guidelines. That is followed by a description of the preventable mortality study. The data for the methods described below are provided in the Results section of the Report.

Guideline Compliance

As described in the feedback section, during the intervention year we asked participating hospitals to complete data collection forms on prehospital trauma patients. In addition, personnel of the PCMH trauma center and the EastCare transport service completed the data collection forms for "scene run" and transferred trauma patients.

Preventable Mortality Study (PMS)

In order to evaluate the effectiveness of the STAF model in improving the trauma preventable mortality rate, a rural preventable mortality study was conducted. To allow comparison of the results to the prior PMS, the 1992 PMS methods were replicated (Cunningham, 1995).

Selection of PMS Patients

The Office of the Chief Medical Examiner (OCME) for North Carolina was asked to provide a list of trauma deaths for the region during year two (intervention year) of the project using the same criteria as the 1992 study. The main criteria consisted of a list of external cause of injury codes (e-codes) for mechanical trauma deaths. As in the study of 1992 deaths, we also excluded suicides (since they are almost always gunshot wounds and result in immediate death) and deaths which occurred at the scene prior to any medical care. A list of the e-codes used for patient selection is in Appendix V. The 29 North Carolina counties for the PMS were the same as for the project (see training section above). The names of the North Carolina counties for the PMS were provided to the OCME.

The goal was to have 150 deaths to study; 75 from each half of the intervention year. A total of 134 records were obtained for review using the following process:

The list of deaths from the OCME was examined to ensure that the patients met inclusion and exclusion criteria. The final working OCME list was comprised of 104

names from July 1-December 31, 1997 and 66 names from January 1 - June 30,1998. Seventy-five records were selected at random from the 1997 list for initial review. Medical records personnel at each hospital were contacted and asked to provide copies of the medical records for patients seen at their institution. In many cases, the records were unavailable or were incomplete and could not be used. Once the list of 75 records was exhausted, the working list was again consulted and the decision was made to request the remainder of the records on the list. Seventy three complete records were obtained for review from 1997.

The initial 1998 OCME list did not include all trauma deaths due to the amount of time allowed for reporting deaths to the OCME. The OCME was contacted later in the evaluation and asked to provide another list of deaths from January 1, 1998 through June 30, 1998. At about that time the OCME was changing databases and was unable to provide a list in a timely manner due to glitches with their new software. Therefore, all 66 records on the OCME list were requested from the involved hospitals. Again, there were several records that local hospitals were unable to locate or were so incomplete they were not useful. In an effort to identify additional trauma deaths that met inclusion criteria, the regional medical examiner's office was contacted. They provided a list of eight additional names that met the criteria. The Trauma Service at Pitt County Memorial was also contacted and provided a list of trauma deaths during the designated time period. Two names from that list were used. A total of 61 complete records were available and selected for review for 1998.

Preparation of Records

As with the 1992 study, the medical records were redacted to insure patient confidentiality. Two copies of each were made. Each copy was divided into sections and separated by tabs: prehospital; ED 1; prehospital 2; ED 2; OR; ICU/Floor; and medical examiner's (ME) report.

The information for each PMS patient was compiled from the following sources: prehospital call reports (available for 86% of the PMS patients); hospital medical records (100% available); medical examiner reports (99% available, two deaths were not reviewed by the medical examiner); and autopsy reports (conducted on 64%).

Record Summaries

The REACT coordinator summarized records. Included in the summaries were the following data from all institutions that provided care for the patient: age; mechanism of injury; chief complaint; safety information if available; prehospital care; prehospital arrival, scene, and transport times; prehospital level of certification; ED care; care during transfer; trauma center care; OR care; and ICU care.

Review Panel

The review panel consisted of three trauma surgeons, two ED physicians, two prehospital personnel, an anesthesiologist, and a forensic pathologist. Attempts were made to recruit a nurse panel member without success. All members participated in the 1992 project as reviewers. With the exception of the regional medical examiner, all were from outside of the project region. Here is a list of the panel members:

Thomas V. Clancy, MD, Trauma Surgeon at New Hanover Regional Medical Center, Wilmington;

Mary G. F. Gilliland, MD, Forensic Pathologist at East Carolina University and Regional Medical Examiner, Greenville;

Cary McDonald, MD, EMS Medical Director and Emergency Physician at Wake Medical Center, Raleigh;

Richard Moon, MD, Anesthesiologist at Duke Medical Center, Durham;

Dale Oller, MD, Trauma Surgeon at Wake Medical Center, Raleigh;

Jeffrey Runge, MD, Emergency Physician at Carolinas Medical Center, Charlotte

Michael Sutton, Paramedic, UNC Air Care, Chapel Hill;

Michael Thomason, MD, Trauma Surgeon, Carolinas Medical Center, Charlotte; and

Kevin Wilson, Paramedic, Durham County Emergency Medical Services, Durham.

Review Checklist

Panel members used a review checklist similar to the one used for the 1992 study to record their interpretations. A few minor revisions were made in the organization of the form with the data points remaining the same. (A copy of the Review Checklist is included in Appendix VI.)

Review Sessions

Four meetings were conducted to review PMS records. All were held in the central part of North Carolina. The dates for the meetings were: October 15, 1998; December 3, 1998; February 25, 1999; and May 6, 1999.

At each session, all panel members were given binders containing the summaries of all cases to be reviewed during the session. The first half of each meeting was devoted to individual record review: each complete record was reviewed separately by two panel members who recorded their findings on the data forms. In addition, each panel member read the summaries for all the cases. Each completed data form (two for each case) was copied onto a transparency to be projected via overhead projector for discussion by the group. Both data forms for the case under review were projected simultaneously and panel members asked to discuss their observations. A consensus was then reached by the panel on the preventability or non-preventability of the death as well as the appropriateness of care delivered at each level.

The method of review differed from the 1992 RPMS in which two panel members worked together to review their assigned cases rather than individually as in the REACT PMS.

RESULTS

DATA ANALYSIS

Most of the data collected in the PMS consisted of frequency counts. The data analysis focused on describing the characteristics of the study sample with frequency distributions of mechanism of injury and types of inappropriate care. In addition, cross tabulation tables were generated for relating categories of preventable death and appropriateness of care to such variables as time of death, cause of death, phase of inappropriate care, and other trauma indicators.

In a before and after fashion, the results of this study were compared with findings of the 1992 PMS. Comparisons of proportions in the cross tabulation tables between this study and the 1992 findings were made with the chi-square test (Tables 4, 14, 15, and 16) and, where appropriate, with Fishers Exact test (Tables 6, 17, 18, 19, 20, 21, and 22). The independent t test was used to compare age and time to death between this study and the 1992 PMS (Table 17). A P value less than .05 was used to define statistical significance.

GUIDELINE COMPLIANCE

Data collected on compliance with the Coalition-approved trauma care guidelines during the intervention year is presented below. Local hospital personnel and EastCare personnel collected the prehospital data on 336 trauma patients. (There is no denominator data available on how many trauma patients were cared for by the prehospital personnel.) The ED data was collected on 548 (53%) of the 1,041 trauma transfers received by the PCMH Trauma Center in the intervention year. The following chart details by hospital the number of prehospital forms submitted and the number of trauma transfer patients for which an ED data collection form was completed.

HOSPITAL	NUMBER OF PREHOSPITAL FORMS	NUMBER OF TRAUMA TRANSFERS
Albermarle	0	2
Beaufort	8	33
Bertie	11	19
Carteret	29	12
Craven	6	8
Chowan	14	14
Duplin	16	62
Eastcare	20	NA
Halifax	11	34
Heritage	24	34
Lenoir	2	64
Martin	7	21
Nash	6	22
Onslow	0	23
Pitt	68	0
Pungo	1	18
Roanoke-Chowan	4	31
Washington	17	26
Wayne	87	90
Wilson	5	21
Totals	336	548

Overall, there was improvement with time in the prehospital data although there

was no statistical significance in the change (Tables 1 and 2). Data collected on ED care showed improvement from quarter 1 to quarters 3 and 4 that was statistically significant (Tables 3 and 4).

Table 1. REACT Quarterly and Overall Prehospital Intervention Assessment

Intervention	Percent Accomplished				
	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Average
Airway Secured	62.5	44.4	50.0	63.6	55.9
Cervical Spine Immobilized	93.0	97.2	92.7	90.9	93.6
Oxygen Delivered at 100%	80.2	84.0	86.0	91.4	84.3
Chest Tube Inserted/Decompressed			00.0	100.0	75.0
Hemorrhage Controlled	93.0	88.9	80.4	70.0	75.4
Vascular Access Obtained	76.4	74.2	80.4	70.0	75.4
Injured Extremities Splintered	77.2	63.0	83.3	78.3	75.6
Wounds Covered	75.6	71.0	76.5	84.4	75.7

Table 2. REACT Mean Quarterly Prehospital Intervention Assessment

Quarter	Number of Observations	Mean Percent Accomplished	Standard Error
1	127	82.4	1.92
2	84	81.5	2.35
3	66	85.5	2.99
4	59	84.8	2.96
Total	336	83.2	1.22

Table 3. REACT Quarterly and Overall Hospital Intervention Assessment

Intervention	Percent Accomplished				
	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Average
Airway Secured	80.0	85.7	81.0	89.1	84.0
Cervical Spine Immobilized	84.0	88.5	90.8	97.3	90.0
Oxygen Delivered at 100%	77.2	76.9	91.4	68.7	77.2
Chest Tube Inserted/Decompressed	84.6	100.0	100.0	90.0	93.8
Hemorrhage Controlled	94.3	96.0	98.1	96.7	96.2
Vascular Access Obtained	99.3	97.6	97.3	98.7	98.3
Injured Extremities Splintered	80.3	84.8	92.3	90.9	86.1
Gastric Tube Inserted	35.2	51.7	58.2	53.5	48.4
Foley Catheter Inserted	77.2	79.1	94.9	86.1	83.7
Wounds Covered	78.0	80.0	90.6	95.0	84.8
Tetanus Documented	83.5	90.1	83.6	96.9	88.1
Antibiotics Given	66.7	75.9	88.5	95.6	79.5

Table 4. REACT Mean Quarterly Hospital Intervention Assessment

Quarter	Number of Observations	Mean Percent Accomplished	Standard Error
1	151	78.8 *	1.64
2	131	84.2	1.70
3	115	88.7 *	1.79
4	153	85.4 *	1.44
Total	550	84.0	0.83

* QUARTER 1 VS. QUARTER 3, P = .0005; QUARTER 1 VS. QUARTER 4, P = .018

FINDINGS OF THE PREVENTABLE MORTALITY STUDY

Sample

The sample consisted of 134 mechanical trauma deaths. There were 93 (69.4%) males and 41 (30.6%) females. The ethnic breakdown included 74 (55.2%) Caucasian, 50 (37.3%) African-American, 8 (6.0%) Hispanic, and 2 Asian. Mean age was 45.6 years (range 6 months - 93 years). There were 109 (81.3%) unintentional and 25 (18.7%) intentional injuries. Blunt injuries occurred in 113 (84.3%) of the deaths and penetrating injuries in 21 (15.7%). Table 5 presents the mechanism of injury. Approximately 80% of the injuries involved motor vehicle crashes (38.8%), falls (21.6%), gunshot wounds (12.7%), or pedestrians being struck (6.7%).

Table 5. Mechanism of Injury

Mechanism	N	%
Motor Vehicle Crash	52	38.8
Fall	29	21.6
Gunshot	17	12.7
Pedestrian Struck	9	6.7
Construction	6	4.5
Assault	4	3.0
Motorcycle Crash	4	3.0
Bicycle Crash	4	3.0
Stab Wound	4	3.0
Carbon Monoxide	2	1.5
Lightning	1	<1.0
Watercraft	1	<1.0

Preventable Deaths and Inappropriate Care

In Table 6 we present the type of care by preventable death rate for all cases. Of the 134 deaths, 2 (1.5%) were judged preventable, 18 (13.4%) possibly preventable, and 114 (85.1%) non-preventable. The overall preventable death rate was 14.9%. In 42 (31.3%) of the cases, some aspect of the care was judged inappropriate. All of the cases judged preventable had inappropriate care compared to 92 (80.7%) of the non-preventable cases (p=.0005)

Table 6. Type of Care by Preventable Death Rates for All Causes

Type of Care	Preventable		Possibly Preventable		Non Preventable		Total	
	N	%	N	%	N	%	N	%
Appropriate	0	0.0	0	0.0	92	80.7	92	68.7
Inappropriate	2	100.0	18	100.0	22	19.3	42	31.3
Total	2	1.5	18	13.4	114	85.1	134	100.0

Preventable death rate stratified by time to death, age, and cause of death is presented in Tables 7 and 8. Death occurred within 48 hours in 95 (70.9%) of the fatalities, and 85 (63.4%) of the fatalities occurred in patients less than 55 years of age. Over 70 percent of the deaths were related to central nervous system (CNS) injuries, hemorrhage, or airway injuries. For these causes of death, 4 (26.7%) of the airway, 4 (17.8%) of the hemorrhages, and 3 (9.2%) of the CNS related injuries were judged preventable or possibly preventable.

Table 7. Preventable Death Rate by Survival Time and Age

Preventable Death Rate	Time to Death				Age			
	<48 Hrs		≥48 Hrs		<55		≥55	
	N	%	N	%	N	%	N	%
Preventable	1	1.0	1	2.6	2	2.4	0	0.0
Possibly Preventable	11	11.6	7	17.9	10	11.8	8	16.3
Non-Preventable	83	87.4	31	79.5	73	85.8	41	83.7
Total	95	70.9	39	29.1	85	63.4	49	36.6

Table 8. Preventable Death Rate and Cause of Death

Cause of Death	Preventable		Possibly Preventable		Non Preventable		Total	
	N	%	N	%	N	%	N	%
CNS Injury	0	3.7	3	5.5	52	94.5	55	41.0
Hemorrhage	1	6.7	3	11.1	23	85.2	27	20.2
Airway	1	6.7	3	20.0	11	73.3	15	11.2
Sepsis	0	0.0	1	20.0	4	80.0	5	3.7
Indeterminate	0	0.0	3	20.0	12	80.0	15	11.2
Other	0	0.0	5	29.4	12	70.6	17	12.7

In Table 9 we present the preventable death rate by the place of death. Only 13 (9.7%) of the total fatalities occurred in the operating room or hospital floor, and only two of those were judged preventable. Of the remaining 18 preventable deaths, 9 occurred in the emergency department and 9 in the intensive care unit.

Table 9. Preventable Death Rate by Place of Death

Place of Death	Preventable		Non Preventable		Total	
	N	%	N	%	N	%
ED	9	45.0	51	44.7	60	44.8
OR	1	5.0	6	5.3	7	5.2
ICU	9	45.0	52	45.6	61	45.5
Post ED	1	5.0	5	4.4	6	4.5

In Table 10 we present the phase of inappropriate care and the preventable death status for those cases. About one-third of the patients had inappropriate care administered at more than one phase of their treatment. Inappropriate care occurred at the emergency department in 19 (45.2%) of the cases, at the prehospital phase or emergency department in 10 (23.8%) of the cases, and the intensive care unit in 4 (9.5%) of the cases.

Table 10. Preventable Death Rate by Phase of Care When Care Was Inappropriate (N = 42)

Phase of Care	Preventable		Non Preventable		Total	
	N	%	N	%	N	%
ED Only	8	40.0	11	50.0	19	45.2
Prehospital Only	0	0.0	5	22.7	5	11.9
Prehospital and ED	3	15.0	2	9.1	5	11.9
ICU Only	4	20.0	0	0.0	4	9.5
Other Phase Combinations	5	25.0	4	18.2	9	21.4

In Tables 11, 12, and 13, we present the type of inappropriate care at the prehospital, emergency department, and post emergency department phases of care. During the prehospital phase, airway management was the leading type of inappropriate care. Other types of inappropriate care included air medical transport access, oxygen/ventilation problem, fluid resuscitation, and unnecessary or deleterious medication. The most frequently documented types of inappropriate care occurring in the emergency department included airway control, failure to recognize an injury, fluid resuscitation problems, chest injury treatment, and delay in going to surgery. During the post-emergency department stage of care, the most frequent type of inappropriate care was related to oxygen/ventilation.

Table 11. Inappropriate Care at the Prehospital Stage (N = 11)

Type of Inappropriate Care*	N	%
Airway Management	6	54.5
Air Medical transport Access	1	9.1
Oxygen/Ventilation	1	9.1
Fluid Resuscitation	1	9.1
Unnecessary/Deleterious Medications	1	9.1
Other	1	9.1

*Patients can have more than one type of inappropriate care.

Table 12. Inappropriate Care at the Emergency Department Stage (N = 27)

Type of Inappropriate Care*	N	%
Airway Control	7	25.9
Failure to Recognize Injury	7	25.9
Fluid Resuscitation	5	18.5
Chest Injury Treatment	5	18.5
Delayed Surgery	5	18.5
Oxygen/Ventilation	4	14.8
Other Stablization/Treatment	4	14.8
Unnecessary/Deleterious Medications	3	11.1
Failure to use Xray/CT	3	11.1
Surgeon Notified	2	7.4
Inappropriate Operation	2	7.4
Failure to Use Peritoneal Lavage	1	3.7
Labs Sent	1	3.7
Other Operative	1	3.7

*Patients can have more than one type of inappropriate care.

Table 13. Inappropriate Care at the Post Emergency Department Stage (N = 13)

Type of Inappropriate Care*	N	%
Oxygen /Ventilation	4	30.8
Other	4	30.8
Unnecessary/Deleterious Medications	2	15.4
Treatment of Re-bleeding	1	7.7
Monitoring/Management of Head Injury	1	7.7
Ventilatory Care	1	7.7

*Patients can have more than one type of inappropriate care.

In Table 14, we present the association between where the fatality occurred and whether treatment was provided by a trauma center, rural hospital, or at a trauma center after treatment occurred elsewhere. Initial treatment at a trauma center occurred in 32 (24%) of the cases, at a rural hospital in 55 (41%) of the cases, and 47 (35%) were transferred to a trauma center. Over 90 percent of all the deaths occurred in either the emergency department or the intensive care unit. There were significantly more deaths in the intensive care unit for transfer cases as compared to trauma center or rural hospital intensive care unit deaths.

Table 14. Place of Care by Place of Death

Place of Death	Trauma Center		Rural Hospital		Transfer to Trauma Center		Total	
	N	%	N	%	N	%	N	%
ED	10	31.3	42	76.4	8	17.0	60	44.8
OR	4	12.5	3	5.5	0	0.0	7	5.2
ICU	14	43.8	8	14.5	39	83.0	61	45.5
Post ED	4	12.5	2	3.6	0	0.0	6	4.5
Total	32	23.9	55	41.0	47	35.1	134	100.0

In Tables 15 and 16, we compare preventable death rate, type of care, and phase of inappropriate care between trauma center, rural hospital, and transfer cases. Although there were no statistically significant differences, there were more preventable deaths in the rural hospital cases, and more inappropriate care in the rural hospital and transfer cases. In terms of where the inappropriate care occurred, the rural hospitals had more problems during the prehospital care and in the emergency department, while the transfer cases had most of their problems in the emergency department and intensive care unit.

Table 15. Place of Care by Preventable Death Rate and Type of Care

Place of Death	Trauma Center		Rural Hospital		Transfer to Trauma Center	
	N	%	N	%	N	%
Preventable	3	9.4	8	14.5	9	19.1
Non-Preventable	29	90.6	47	85.5	38	80.9
Type of Care						
Appropriate	25	78.1	40	72.7	27	57.4
Inappropriate	7	21.9	15	27.3	20	42.6

Table 16. Place of Care by Phase of Inappropriate Care

Phase of Inappropriate Care	Trauma Center		Rural Hospital		Transfer to Trauma Center	
	N	%	N	%	N	%
Prehospital	2	6.3	8	14.5	1	2.1
ED	4	12.5	10	18.2	13	27.7
OR	0	0.0	1	1.8	4	8.5
ICU	0	0.0	2	3.6	5	10.6
Post ED	2	6.3	0	0.0	1	2.1

Comparison of the 1992 and 1997/98 Preventable Mortality Studies

As Table 17 shows, the two study samples were similar in racial distribution, gender, average age, and time when death occurred.

Table 17. Patient Characteristics by Year of Study

Characteristic*	Year 92 N = 151	Year 97/98 N = 134
Race		
% Caucasian	51.7	55.2
% African American	45.0	37.3
% Other	3.3	7.5
Gender		
% Male	68.9	69.4
% Female	31.1	30.6
Age		
Mean	40.2	45.6
Range	7 months – 93 years	6 months – 93 years
Time to Death		
% <48 Hours	74.8	70.9
% ≥48 Hours	25.2	29.1

*There were no statistical differences.

In Table 18, we show the mechanism of injury in the two studies. The two studies were almost identical in the number of motor vehicle crashes (37.7% vs. 38.8%), while the 1992 study had significantly more deaths related to violence (30% vs. 19%, p=.04).

Table 18. Mechanism of Injury by Year of Study

Mechanism	Year 92		Year 97/98	
	N	%	N	%
Motor Vehicle Crash	57	37.7	52	38.8
Gunshot Wound	28	18.5	17	12.7
Fall	22	14.6	29	21.6
Pedestrian Struck	16	10.6	9	6.7
Stab Wound	11	7.3	4	3.0
Assault	7	4.6	4	3.0
Other	10	6.6	22	16.4

In Table 19, we show a comparison of preventable death rates and, in Table 20, a comparison of inappropriate care for the two studies. There were significantly more preventable deaths and inappropriate care in the 1992 PMS study compared to the 1997/98 study (29% preventable deaths and 68% inappropriate care in 1992 vs. 15% preventable deaths and 31% inappropriate care in 1997/98, $p<.01$).

Table 19. Preventable Death Rate by Year of Study

Preventable Death Rate	Year 92		Year 97/98	
	N	%	N	%
Total Preventable	43	28.5	20	14.9
Possibly Preventable	32	21.2	18	13.4
Preventable	11	7.3	2	1.5
Non-Preventable	108	71.5	114	85.1

Table 20. Type of Care by Year of Study

Type of Care	Year 92		Year 97/98	
	N	%	N	%
Appropriate	48	31.8	92	68.7
Inappropriate	103	68.2	42	31.3

In Table 21, we show a comparison for the phase of treatment where the inappropriate care occurred. The 1992 study found that both the prehospital and emergency department accounted for over 65% of the inappropriate care, while the 1997/98 study found that the emergency department and post emergency department care were responsible for most of the inappropriate care. There were significantly more incidents of inappropriate prehospital care in 1992 compared to 1997/98 (70% vs. 26%, p=.005).

Table 21. Phase of Inappropriate Care by Year of Study

Phase of Care	Year 92		Year 97/98	
	N	%	N	%
Prehospital	72	69.9	11	26.2
ED	69	67.0	24	57.1
Post ED	35	34.0	17	40.5

In Tables 22 and 23, we show a comparison of the type of inappropriate care at the prehospital and emergency department stages of care. During the prehospital stage, the major type of inappropriate care in both studies was related to airway management. There was significantly more inappropriate airway management in the 1992 study compared to 1997/98 (83% vs. 55%, $p < .05$). Comparing the types of inappropriate care in the emergency department, airway control, delayed surgery, and failure to recognize an injury were problem areas in both studies. In 1992, too much time in the emergency department or waiting for an X-Ray was found in almost half of the inappropriate cases, while in 1997/98 this was not a problem in any of the inappropriate cases

Table 22. Inappropriate Care at the Prehospital Stage by Year of Study

Type of Inappropriate Care	Year 92 N = 72	Year 97/98 N = 11
Airway Management	83.3%	54.5%
Fluid Resuscitation	15.3%	9.1%
C-Spine Protection	13.9%	0.0%
Oxygen/Ventilation	11.1%	9.1%
Excessive Scene Time	8.3%	0.0%
Air Medical Transport Access	4.2%	9.1%
Unnecessary/Deleterious Medications	0.0%	9.1%

Table 23. Inappropriate Care at the Emergency Department Stage by Year of Study

Type of Inappropriate Care	Year 92	Year 97/98
	N = 69	N = 27
Too Much Time in ED/X-Ray	47.8%	0.0%
Airway Control	21.7%	25.9%
Delayed Surgery	20.3%	18.5%
Failure to Recognize Injury	17.4%	25.9%
Excessive Resuscitation	17.4%	0.0%
Unnecessary/Deleterious Medications	14.5%	11.1%
Chest Injury Treatment	14.5%	18.5%
Diagnostic Resources	13.0%	0.0%
Surgeon Notified	11.6%	7.4%
Oxygen/Ventilation	11.6%	14.8%
Fluid Resuscitation	7.2%	18.5%
Failure to Use X-Ray/CT	5.8%	11.1%
Other Stabilization/Treatment	0.0%	14.8%

DISCUSSION

Overall, the REACT project was a success. While there was negligible improvement in guideline compliance among prehospital providers, the hospital EDs improved their compliance over time. There was also a reduction in the preventable mortality rate during the 1997/98 REACT intervention year compared to the 1992 rate for the same region. These results, their implications and project limitations are discussed below. In addition, we have provided a discussion of how this study fits with recent perspectives on the utility of peer review panels for assessing the effectiveness of trauma care.

GUIDELINE COMPLIANCE

Prehospital

There was no significant improvement over time in the prehospital compliance data, which may be due to the large numbers of prehospital providers in the study region. In order to reach the prehospital providers, we conducted as many prehospital education sessions as possible throughout the region. Seventy-six education sessions were conducted and approximately 700 prehospital providers attended these sessions. However, many of the prehospital providers are volunteers and their other commitments make it difficult for them to attend education sessions.

A paucity of experience may also explain the lack of improvement in the prehospital data. Many of the volunteers may only care for one severely injured patient in a year. On the one hand, this lack of exposure is good in that it means the trauma problem remains relatively rare. But it keeps the rural prehospital providers from developing and practicing their trauma care skills.

The feedback to prehospital providers on their compliance with the guidelines was limited. This was because there was only one full-time staff member for the project and, because of all her other project duties, she had inadequate time to devote to providing feedback. Prehospital compliance results perhaps could have been better if the prehospital providers had received more direct feedback.

Hospital EDs

The guideline compliance results suggest that there were improvements over time in the care delivered in regional emergency departments. The improvement was likely related to the education sessions as well as the feedback on guideline compliance sent to all EDs participating in the project. In the majority of the emergency departments participating, the feedback was shared with the ED staff. In some EDs, the feedback information was used as a part of their internal quality improvement programs.

PREVENTABLE MORTALITY STUDY

Implications of the Results

Compared to 1992, there was a significant ($p<0.01$) decrease in the overall preventable mortality rate as well as a significant ($p<0.01$) decrease in the related

episodes of inappropriate care given the preventable mortality study patients. The results suggest that implementing the STAF model decreased the preventable mortality rate.

The overall preventable mortality rate of nearly 15% is closer to that found in comparable rural-based trauma preventable mortality studies. A Montana study conducted in 1994 found a preventable death rate of 13% (Esposito et al., 1995). A similar study conducted in Michigan about the same time found an overall preventable death rate of 12.9% (Maio et al., 1996). These rates are higher than those of urban systems where sophisticated trauma systems have been implemented. For one urban system, the preventable mortality rate went from 13.6% to 2.7% after trauma system implementation (Shackford SR, 1986).

Despite significant decreases in episodes of inappropriate care, compared to the 1992 study, the results suggest a need for continued emphasis in training in the following areas: airway control; oxygenation/ ventilation management; injury recognition; chest trauma management; and the management of shock. Since physicians are the primary decision-makers and treatment managers, an intervention directed specifically at them would be helpful. The REACT project intervention was restricted in this regard as it was aimed primarily at prehospital providers and ED staffs.

There are many reasons that might explain the higher rural preventable mortality rates. These include different patient populations and injury patterns; and longer discovery and transport times (Rogers, 1997). Rural trauma is one of the remaining major challenges in trauma care. Rogers and colleagues have recently (1999) illuminated the many important issues that need to be addressed in order to improve the prospects for rural trauma patients. These include: better definition of "rural" trauma patients; combined federal and professional efforts; a national rural trauma database; and increased public awareness.

The major contributor to rural trauma deaths rates is the motor vehicle crash. This work was no exception as nearly 50% of all deaths studied were related to events on the highway. The improved results suggest that the STAF model had an effect in reducing motor vehicle crash deaths. The implication is that prehospital emergency medical care should have a definite role in any highway safety plan.

Contributing Factors

Other factors may have contributed to the overall reduction in the preventable mortality rate found in this study. These are discussed briefly below.

Differences in the populations of the 1992 and 1997/98 preventable mortality studies could be a factor. However, analysis of the composition of the study samples with regard to demographic variables and mechanisms of injury failed to reveal any statistically significant differences.

The significant decrease in the overall preventable death rate could be related to a decrease in the number of mechanical trauma deaths in the region. Injury prevention efforts such as seatbelt and child restraint laws and advances in vehicle driver and passenger safety. However, as illustrated by Table 24, the trauma death rate has not declined over the intervening years in the study area.

Table 24. Population and Rate of Mechanical Trauma Deaths for Eastern North Carolina

Year	Total Population	Mechanical Trauma Deaths* No. (%)
1992	1164098	646 (5.55%)
1993	1178425	657 (5.58%)
1994	1185312	631 (5.32%)
1995	1197336	583 (4.87%)
1996	1208557	666 (5.51%)
1997	1215319	629 (5.18%)
1998	1223421	634 (5.18%)

*MECHANICAL TRAUMA DEATHS ARE DEFINED BY E-CODES USED FOR THE 1992 PMS AND 1997-98 PMS

Another factor which may have played a part in reducing the preventable mortality death rate is the general increase in knowledge about trauma patients and trauma care. Advances in trauma care have been made over the years between the two studies. As health providers at all levels are made aware of changes and advance through continuing education or word of mouth, these may be incorporated into practice. Therefore, the preventable death rate may have decreased without the implementation of the STAF model. However, since a part of STAF is training and education, it can also be argued that REACT was perhaps responsible for making new information available to practitioners.

Further development and acceptance of the trauma center and trauma systems concept in eastern North Carolina can also be credited with contributing to the decline in the preventable mortality rate. Transfer rates from regional hospitals to the trauma center have increased steadily over the past few years. In 1992, 45% of the trauma admissions to our trauma center were transfer patients. In 1998, transfers constituted 52% of the admissions. There has also been an increase in the number of out-of-county scene runs for the aeromedical transport service for the trauma center. Research validates that implementation of a trauma system results in a 15 to 20% improved survival rate among seriously injured patients (Mullins and Mann, 1999).

Utility of the Peer Review Panel Method

The use of peer review panels to evaluate improvement in trauma care defined as a decrease in the preventable death rate has been reviewed recently. MacKenzie (1999) identified four major issues with panel reviews. The first of these involves the definition of a preventable or possibly preventable death and the separation of judgments regarding appropriate versus inappropriate care. Criteria for the determination of preventable death rate should be clearly defined. Although it is logical to assume that acts of inappropriate care are directly related to preventable death rate, determinations regarding the appropriateness of care should be made independently of preventable death rate. Not all acts of inappropriate care result in a preventable death. The second issue deals with the study population. Often, prehospital deaths are excluded from these studies since information regarding their care is limited. If these deaths are excluded, the only real care that can be evaluated fully is hospital care as opposed to trauma system care. Therefore, to fully evaluate the

effectiveness of an intervention or trauma system, all patients should be included. A third issue relates to the composition of the review panel. A panel should be multidisciplinary so that all aspects of care can be reviewed fully. The fourth issue is the review process itself. Independent review with a unanimous decision regarding preventable death rate provides the most reliable results, according to MacKenzie.

In this study, the issues identified by Mackenzie as affecting the validity of the panel findings were addressed. Judgments as to the preventable death rate were made independently of determinations of appropriateness of care. Criteria for determining preventable death were the same as those used in the 1992 study and were well defined. Appropriateness of care decisions were based on ATLS, TNCC, and BTLS guidelines. A multidisciplinary review panel was used, composed of trauma surgeons, emergency physicians, an anesthesiologist, and a forensic pathologist. Decisions as to preventable death and appropriateness of care were made after an independent review of the records and a discussion by the panel. Unanimous decisions were required for a determination of preventable death. Patients dying as a result of mechanical trauma were randomly selected for inclusion. Only patients pronounced dead at the scene and receiving no prehospital care were excluded. All others would have been transported to an emergency department in the current EMS system.

LIMITATIONS

Guideline Compliance Data

The methods used for data collection, which were based on available resources, explains the limitations related to the guideline compliance data. The major limitation is that data collection was done by numerous people in many different settings. Also, data collectors were of different education and experience levels. In many cases, the data collection forms were completed at a later date rather than while the patient was present in the ED. Therefore, the information entered would have been based on documentation rather than actual observation.

Because of the limited resources, we were unable to hire project staff for every location or even for the regional trauma center to be available 24 hours a day to monitor and collect guideline compliance data on every single trauma patient in the 29-county region. We were relying on the voluntary efforts of the personal in the hospitals and trauma center to complete the forms. The rates of data collection were relatively high, however, because we maintained frequent contact with the personnel at the hospitals. Still, since this is a convenience sample which fails to have data on every single patient during the study period, the reader is cautioned to avoid comparing this data with that on inappropriate care from the Preventable Mortality Study.

Preventable Mortality Study

To allow comparison of the 1992 and 1997/98 studies, we used the same peer review panels. While these panelists were from North Carolina they were not from the region that was being studied. They may have been biased, however, by not being blinded to the purposes of the project.

While the same panelists were used for both studies and in both studies they

used the same review form, there was one aspect of the 1997/98 review that was different from 1992. That is, in 1992 the two panelist assigned to a case worked together to review their assigned cases rather than reviewing and reporting individually as they did in the 97/98 REACT PMS. We do not believe this had any significant bearing on the different results in the two studies.

One possible significant limitation with the 97/98 PMS related to the list of names from the Office of the Chief Medical Examiner for the second half of the study. This caused us to have a smaller list than in the 1992 study and, therefore, a smaller number of deaths. We believe there was no selection bias, though, since the project investigators did not control which deaths were available for study. Other factors that may have affected the results other than the intervention are discussed in the Contributing Factors section above.

RECOMMENDATIONS

THE STAF MODEL

The use of the STAF model was associated with a reduction in preventable trauma mortality. *We recommend that the STAF model be implemented and tested in other locales.*

EDUCATION

The results indicate that education played a role in improving care, especially at the hospital level. All personnel involved in the care of trauma patients should have access to educational sessions aimed at providing up-to-date information for all levels of providers. Efforts need to be directed at involving physicians in this educational process. *We recommend that further work be conducted on the role of education in trauma care.*

FEEDBACK

Feedback is a necessary part of any improvement system. Ideally, there should be dedicated personnel at every hospital to collect, enter and track feedback data. However, the resources needed to fund such a feedback data program are immense. The development of electronic patient records may help, but this technology is still being developed. We envision a time in the future when statewide electronic prehospital and emergency department data systems include the identity of the medical providers treating the patient, the treatments received by each patient and edit checks to ensure complete and accurate data collection. With these electronic systems, routine reports could be generated as needed to indicate compliance with guidelines for different categories of patients, or for specific patients. These reports could summarize "compliance" by specific providers or by teams of providers in order to provide feedback to them when their treatment patterns are inconsistent with guidelines. *We recommend that funding be directed toward the development of innovative, consistent, and inexpensive methods for delivering feedback to all providers, both prehospital and hospital, in a trauma care system. We further recommend that development plans for statewide electronic prehospital and emergency department data systems be encouraged and supported.*

REVIEW PANELS

Implementation of regular multidisciplinary review panels could further contribute to the education of physicians, nurses, and prehospital personnel and the improvement of trauma care. All trauma deaths and severe injuries without death should be reviewed concurrently to ensure that current practice is being followed. These panel findings would also be useful to direct efforts aimed at improving outcomes for trauma patients. *We recommend that all trauma care systems establish peer review panels as part of their quality improvement processes.*

FUTURE RESEARCH

The results of this project imply many opportunities and needs for research. The

first is to simply replicate the project to see if the STAF model has an effect in a different setting. In addition, work is needed to determine how best to implement different components of staff. *We recommend that funding be directed to stimulate further research of the STAF model.*

REFERENCES

American College of Surgeons. 1997. *Advanced Trauma Life Support*, 6th edition. Chicago, IL: American College of Surgeons.

Brain Trauma Foundation, American Association of Neurological Surgeons, and Joint Section on Neurotrauma and Critical Care. 1995. *Guidelines for the Management of Severe Head Trauma.* Park Ridge, Illinois: Brain Trauma Foundation.

Campbell JE. 1995. *Basis Trauma Life Support*, 3rd edition. Englewood Cliffs, NJ: Brady.

Cunningham PRG. 1995. *Rural Preventable Mortality Study, With Inter-Rater Reliability Modifications.* Washington, DC: US Department of Transportation.

Emergency Nurses Association: *Trauma Nurse Core Course*, 4th edition. Parkridge, Illinois: Emergency Nurses Association.

Esposito TJ, Sanddal ND, Hansen JD, Reynolds S. 1995. Analysis of preventable trauma deaths and inappropriate trauma care in a rural state. *Journal of Trauma.* 39:955-962.

MacKenzie EJ. 1999. Review of evidence regarding trauma system effectiveness resulting from panel studies. *Journal of Trauma: Injury, Infection and Critical Care.* 47:S34-S40.

Maio RF, Burney RE, Gregor MA, Baranski MG. 1996. A study of preventable trauma mortality in rural Michigan. *Journal of Trauma.* 41:83-90.

Mullins RJ, Mann NC. 1999. Population-based research assessing the effectiveness of trauma systems. *Journal of Trauma: Injury, Infection and Critical Care.* 47:S59-S66.

Rogers FB, Shackford SR, Hoyt DB, Camp L, Osler TM, Mackerside RC, Davis JW. 1997. Trauma deaths in a mature urban vs rural trauma system. A comparison. *Archives of Surgery.* 132:376-381.

Rogers FB, Shackford SR, Osler TM, Vane DW, Davis JH. 1999. Rural trauma: The challenge for the next decade. *Journal of Trauma: Injury, Infection and Critical Care.* 47:802-821.

Shackford SR, Hollingsworth-Fridlund P, Cooper GF, Eastman B. 1986. The effect of regionalization upon the quality of trauma care as assessed by the concurrent audit before and after institution of a trauma care system: A preliminary report. *Journal of Trauma.* 26:812-820.

APPENDIX I: TRAUMA CARE GUIDELINES

REACT

Guidelines for the Care of Trauma Patients

Prehospital Phase

All trauma patients should be assessed using primary and secondary survey procedures. Priorities of care are airway with cervical spine control, respirations, oxygenation, and vascular access. **The use of interventions outlined in the following guidelines should be based on patient assessment, level of training, and local protocols.**

AROPE

A: Airway with C-spine control
R: Respiration
O: Oxygenation
P: Perfusion
E: Evacuation with Stabilization

AIRWAY WITH C-SPINE CONTROL

An airway should be secured for all trauma patients using the appropriate intervention

1. Open airway while maintaining C-spine control
2. Suction for debris, secretions, vomitus, and other debris
3. Nasopharyngeal airway* for patients with a decreased level of responsiveness but with an intact gag reflex
4. Oral airway for unresponsive patients
5. Tracheal intubation for patients in danger of airway compromise, those not breathing on their own or with ineffective respirations
6. Needle cricothyroidotomy for patients who cannot be intubated due to airway/facial trauma

*Contraindicated with facial trauma or suspected basilar skull fracture

RESPIRATION

Appropriate interventions to ensure respiration and ventilation should be performed.

1. Ambu bag with reservoir for patients with ineffective or absent respirations
2. Needle decompression for tension pneumothorax
3. Dressing secured on three sides for open chest wound

OXYGENATION

All major trauma patients require supplemental oxygen at 100% using the appropriate method.

1. Non-rebreather mask for patients who are spontaneously breathing
2. Ambu bag with reservoir and mask (or attached to tracheal tube) for patients with ineffective or absent respirations

*Never withhold oxygen from a patient who needs it but use with caution in patients with a history of COPD

PERFUSION

Appropriate measures for tissue perfusion should be performed.

1. Control of hemorrhage with direct pressure and/or pressure dressings
2. Vascular access
3. CPR for patients in full arrest

EVACUATION with STABILIZATION

Trauma patients should be transported to the appropriate medical facility as rapidly as possible. Consider air medical transport if situation merits. Stabilization measures (splinting, wound care) should be completed during transport.

These guidelines have been reviewed and approved by the Eastern Regional Trauma Coalition.
REACT: Rural Enhancement of Access and Care for Trauma
For information, Please call Project Manager: Sallie Gough, RN, MSN, 919-816-8687 Fax 919-816-7890

REACT

Guidelines for the Care of Trauma Patients

Emergency Department Phase

All trauma patients should be assessed using primary and secondary survey procedures. Priorities of care are airway with cervical spine control, respirations, oxygenation, and vascular access. The use of interventions outlined in the following guidelines should be based on patient assessment, level of training, and local protocols.

AROPE

AIRWAY WITH C-SPINE CONTROL

An airway should be secured for all trauma patients using the appropriate method.

1. Tracheal intubation for patients in danger of airway compromise, those not breathing on their own or with ineffective respirations
2. Cricothyroidotomy for patients who cannot be intubated due to airway/facial trauma

*Head injured patients require close observation for neurological deterioration. To allow for observation, neuromuscular blockade should be used with caution although it may be necessary for safe transport.

RESPIRATION

Appropriate interventions to ensure respiration and ventilation should be performed.

1. Ambu bag with reservoir for patients with ineffective or absent respirations
2. Transport ventilator for intubated patients
3. Chest tube insertion for patients with a pneumo- and/or hemothorax

OXYGENATION

All trauma patients should be administered supplemental oxygen at 100% using the appropriate method.

1. Non-rebreather mask for patients who are spontaneously breathing
2. Ambu bag with reservoir attached to tracheal tube for patients with ineffective or absent respirations
3. Transport ventilator

*Never withhold oxygen from a patient who needs it but use with caution in patients with a history of COPD.

PERFUSION

Appropriate measures for tissue perfusion should be performed.

1. Control of hemorrhage with pressure dressings for external hemorrhage; operative intervention for internal hemorrhage control
2. Vascular access
3. CPR for patients in full arrest
4. Pericardiocentesis for patients with suspected cardiac tamponade

EVACUATION with STABILIZATION

Trauma patients should be transferred to the appropriate medical facility as rapidly as possible. The following stabilization measures should be considered.

1. Injured extremities splinted
2. Gastric tube inserted
3. Foley catheter inserted
4. Wounds covered
5. Tetanus status documented
6. Antibiotics given

APPENDIX II: REGIONAL WORKSHOP BROCHURES

16th Annual

East Coast *EMERGENCY MEDICINE* Seminar

September 12-14, 1997

Crystal Coast Civic Center
Morehead City, North Carolina

Sheraton Resort
Atlantic Beach, North Carolina

SPECIAL CONCURRENT EVENT

CRITICAL INCIDENT STRESS DEBRIEFING
Basic Training Workshop

sponsored by the
Eastern Carolina Critical Incident
Stress Management Association

September 12 - 13, 1997

Division of Emergency Medical Services
Department of Emergency Medicine
East Carolina University School of Medicine
Gre , North Carolina 27858-4354

GENERAL SESSIONS

FRIDAY (Classes begin 7:30pm)

◆*Future Directions in EMS* — Robert Swor, MD

◆*Critical Incident Stress Management* — Grady Bray, PhD

SATURDAY (Classes begin 8:30am)

◆*How Young People Die: An Eye Opening Look at Trauma* — Kathy Dutton, RN, MSN

SUNDAY (Classes begin 8:30am)

◆*EMS Does Make A Difference* — Bob Bailey, Chief, NCOEMS

EMS SESSIONS

SATURDAY (Classes begin 8:30am)

◆*Documentation* — Dwight Polk, MS, EMT-P

◆*Northern Exposure: Canadian EMS Systems* — Scott Anderson, MD

◆*The Dropsy, The Grip, and Diseases You Know By Heart* — Robert W. Davis, EMT-P

◆*Myths of Assessment* — Baxter Larmon, PhD

◆*Tactical EMS* — John Whitney, EMT-P

◆*Neurologic Emergencies: Update in Emergency Stroke Management* — J. Griffith Steel, MD

◆*The REACT Project: Trauma Care Guidelines* — Herbert G. Garrison, MD, Sallie Gough, RN, MSN

◆*Pediatric Airway Management* — Laurie Jano, RRT

SUNDAY (Classes begin 8:30am)

◆*...And I Take A Fluid Pill Every Day.* — Robert W. Davis, EMT-P

◆*Case Studies in Autonomic Emergencies* — Walter C. Robey, MD

◆*HIV and AIDS* — Dwight Polk, MS, EMT-P

◆*Pharmacology Review* — Robert P. Jano, EMT-P

SPECIAL SUNDAY SESSIONS

◆*Issues and Controversies in EMS* — Scott A. Blecke, EMT-P

◆*The Fire and Life Safety E[illegible]rogram*

FRIDAY (Classes begin 7:30pm)

◆*Future Directions in EMS* — Robert Swor, MD

◆*Neurologic Emergencies: Update in Emergency Stroke Management* — J. Griffith Steel, MD

SATURDAY (Classes begin 8:30am)

◆*How Young People Die: An Eye Opening Look at Trauma* — Kathy Dutton, RN, MSN

◆*Cases Studies in Autonomic Emergencies* — Walter C. Robey, MD

◆*Improving Quality in EMS* — Robert Swor, MD

◆*Identifying Elder Abuse & Neglect* — E. Jackson Allison, Jr., MD/MPH

◆*Prehospital Care Research* — Baxter Larmon, PhD

SUNDAY (Classes begin 8:30am)

◆*The REACT Project: Trauma Care Guidelines* — Herbert G. Garrison, MD, Sallie Gough, RN, MSN

◆*The OPALS Trials: A Critical Appraisal From A Practical Perspective* — Scott Anderson, MD

◆*EMS Does Make A Difference* — Bob Bailey, Chief, NCOEMS

EMERGENCY NURSING SESSIONS

SATURDAY (Classes begin 8:30am)

◆*Identifying Elder Abuse & Neglect* — E. Jackson Allison, MD/MPH

◆*Pediatric Airway Management* — Laurie Jano, RRT

◆*Effective Listening: The Art of History Taking* — Ken Carter, MD

◆*Hostage and Assault Situations in the ED* — John Whitney, EMT-P

SUNDAY (Classes begin 8:30am)

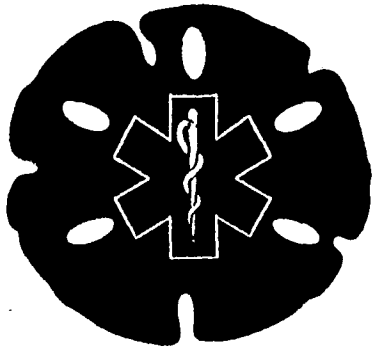
◆*The Emergency Nurses C.A.R.E. Program* — Kathy Dutton, RN, MSN

Division of Research
Department of Emergency Medicine
East Carolina University School of Medicine
Greenville, North Carolina 27858-4354

17th Annual East Coast Emergency Medicine Seminar

April 23-25, 1999

Outer Banks Resort & Conference Center
Ramada Inn
Kill Devil Hills, North Carolina



Special Concurrent Event :

NC Association of Paramedics Meeting

Friday April 23, 1999

7:30 pm	Body Piercing: How it can effect pre-hospital care. Rhonda Dale, RN, EMT-P
8:45 pm	Domestic Violence/Trauma Peggy E. Goodman, MD, FACEP

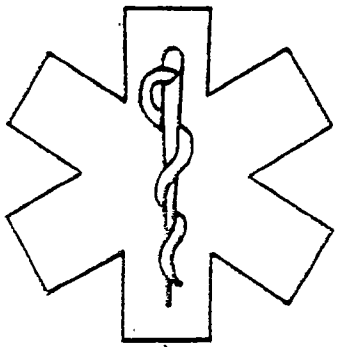
Saturday-April 24, 1999

8:30 am	Taking Care of Number One Dwight Polk, MSW, NREMT-P
9:45 am	AED's Andy Hunt, BS, EMT-P
	Coma Cocktail: Straight Up or With a Twist? Aaron (Zack) Royston, BS, NREMT-P
	Marine Emergencies John E. (Jack) Gough, MD, FACEP
11:00 am	Helicopters: Do they really make a difference? Stephen H. Thomas, MD, FACEP
	Managing Psychotic Patients Dwight Polk, MSW, NREMT-P
	Better Living Through Modern Chemistry Mark Stover, NREMT-P
1:00 pm	Are we missing something? Dan Ozimek, EMT-P
	Prehospital Pain Management Stephen H. Thomas, MD, FACEP
	Rural Enhancement of Access and Care for Trauma (REACT) Herb Garrison, MD, MPH, FACEP and Sallie Gough, RN, MSN
2:15 pm	Vehicle Rescue for Dummies Robert Davis, EMT-P
	Baby Blues Dan Ozimek, EMT-P
	EMS Literature Review N. Heramba Prasad, MD, FACEP Lawrence Brown, EMT-P
3:30 pm	NC Association of Paramedics meeting
8:00 pm-Midnight	Enjoy the social Ramada Inn-Kill Devil Hills Live DJ. Dancing. Cash Bar

Sunday-April 25, 1999

8:30 am	Aneurysms James A. Luna, MD

APPENDIX III: QUARTERLY NEWSLETTERS



REACT

RURAL ENHANCEMENT OF ACCESS AND CARE FOR TRAUMA

QUARTERLY NEWSLETTER FOR JULY, AUGUST, SEPTEMBER 1997

REACT

REACT, Rural Enhancement of Access and Care for Trauma, is a National Highway Traffic Safety Administration-funded demonstration and evaluation project developed in an attempt to improve trauma care in the eastern region of North Carolina. The project is a follow-up to the Rural Preventable Mortality Study (RPMS) conducted in 1995 by the Trauma Service at Pitt County Memorial Hospital. Results of the RPMS suggested that approximately 29% of the trauma deaths that were reviewed for the study were preventable. Factors identified as contributing to the deaths were broken down into prehospital and hospital factors. Primary prehospital components identified were airway management, chest trauma management, and fluid resuscitation. Some of the major hospital concerns identified were too long in the ED or X-ray before definitive treatment, airway management, and chest trauma management. REACT was initiated to address these areas.

The components of the REACT project are data collection, feedback based on the data collected, and education. Trauma care guidelines have been developed for both the prehospital and hospital settings that address the concerns identified above. Data collection sheets have also been developed based on these guidelines. As of July, 1997, area emergency departments that are participating in the project are collecting data about the care provided to trauma patients by prehospital personnel. If a patient is transferred to the PCMH Trauma Center, the ED staff at PCMH or EastCare staff will document care rendered at the referring hospital on a data collection form. The project coordinator will contact the designated person from the ED to advise them of the status of transferred patients. On a quarterly basis, the project coordinator will meet with ED and EMS personnel to provide a summary of trauma patient care for that area and discuss any education issues. Additionally, we will be contacting the EMS continuing education coordinator for each county to set up educational sessions about REACT and trauma care that will meet some of the mandatory objectives for trauma education.

Beginning in July, 1998, the Rural Preventable Mortality Study will be repeated. A decrease in the number of preventable deaths will indicate that the demonstration-evaluation process was a success.

REACT IS A PROJECT OF THE EASTERN CAROLINA INJURY PREVENTION PROGRAM, THE PITT COUNTY MEMORIAL HOSPITAL TRAUMA SERVICE, AND THE EAST CAROLINA UNIVERSITY DEPARTMENT OF EMERGENCY MEDICINE. REACT IS SUPPORTED BY THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION. FOR INFORMATION, CALL SALLIE GOUGH, RN, MSN REACT PROJECT COORDINATOR 919-816-8687.

FEATURE HOSPITAL...

Roanoke-Chowan Hospital

Roanoke-Chowan Hospital, located in Ahoskie, NC, is an affiliate of Pitt County Memorial Hospital (University Health Systems). RCH serves Bertie, Gates, Hertford and Northampton Counties in rural northeastern North Carolina. The combined population of these counties is approximately 73,385. Licensed for 124 beds, RCH has 33 physicians on its active medical staff and an annual budget of $30 million. Approximately 20,000 people are served in the Emergency Department of RCH each year. The average length of stay is approximately two hours. Visitors may also take advantage of the Quick Care service. The ED is served by EMS responders from all four of the counties in our catchment area. The hospital is excited about participating in the REACT project and looks forward to the results.

Patti Llewellyn, RN
Nurse Manager, ED
Roanoke Chowan Hospital

EMS Case Presentation

On May 7, 1997 Halifax EMS responded to a bicyclist struck by a motor vehicle in Roanoke Rapids. At 2104 EMS 603 was en route and arrived on the scene at 2108. Upon arrival on the scene, EMT-Paramedics found a 43 year old male lying prone in the middle of the street some 50 feet from his bicycle. The patient was breathing and had a pulse but was unresponsive to voice and pain. C-spine control was maintained as the patient was log rolled onto a long spine board and cervical collar placed. The patient's head was immobilized with towel rolls and secured with tape. A load and go situation was recognized and the patient was loaded into the unit.

EMS 603 was en route to Halifax Memorial Hospital at 2112. En route the patient was placed on a non-rebreather mask at 15LPM. He required aggressive airway management due to a large amount of bright red blood coming from his nose and mouth. Almost constant suctioning of the oropharynx was required to maintain a patent airway. Bag valve mask and intubation equipment was readied just in case it was needed. Vital signs taken were BP 90 by palpation, pulse 114 and regular with the cardiac monitor showing sinus tachycardia without ectopy. The respiratory rate was 18 with clear and equal breath sounds. The skin was warm, moist and pink. An IV of Normal Saline was started with a #14 catheter in the right antecubital vein and run at a wide open rate. The subject responded to the IV stick and he became combative. Injuries noted to the patient were a three inch laceration to the top of his head, copious amounts of blood coming from the nose and mouth, and a large abrasion to the left clavicular region. Deformity was noted to the mandible, left forearm and both lower extremities below the knees.

At 2118, EMS 603 had arrived at Halifax Memorial Hospital. Patient care was assumed by the Emergency Department staff. Due to the patient's facial trauma, it was felt that the airway needed to be controlled. Initial attempts were unsuccessful due to patient biting the blade. Paralytics were then used and the patient was intubated without difficulty. Four liters of fluid were infused, as well as, two units of blood. Vital signs on arrival were BP 103/68, pulse 120, respiratory rate 16, SaO2 on non-rebreather was 99%. The blood pressure dropped to 59/37 at one point, but had stabilized before transport.

University Medical Center Trauma Service was contacted to receive the patient and helicopter transport was requested. EastCare was currently on a run and LifeFlight arrived and readied the patient for transport. At approximately 2305, the patien left Halifax Memorial Hospital en route to University Medica Center.

Upon arrival at University Medical Center, the patient was evaluated for multiple trauma. He required an open laparotomy to determine the extent of his internal injuries which included removal of his spleen and repair of his small bowel and lacerated liver. He also required later surgeries to repair fifteen facial fractures and orthopedic injuries to his left arm and both legs. The patient also suffered a moderate to severe closed head injury which did not require surgical intervention.

The patient was discharged to Pitt Rehab on June 12, 1997 where he is currently undergoing therapy for his head and orthopedic injuries. He still suffers from problems with orientation and has a feeding tube. His progress has been slow and recovery prognosis is uncertain at this time.

Overall, the patient received prompt, efficient care in the prehospital, referring hospital, and trauma center settings.

Phil Ricks, Director
EMS Consortium, Roanoke Rapids

Eastern Regional Trauma Coalition Update

The Eastern Regional Trauma Coalition was initiated in 1996 to provide a forum for trauma care providers to establish a coordinated, efficient trauma system in eastern North Carolina. A trauma system is comprised of key components such as training, triage, medical direction, prehospital care, transportation, hospital care, and rehabilitation. Attention to research, quality management, and injury prevention is also important.

Eastern North Carolina would especially benefit from a trauma system due to its rural nature. Factors such as delays in discovery, poor road conditions, and prolonged transport times add up to increased death and complication rates. The overall purpose of a well integrated system is to ensure each trauma patient receives timely and expert care and is well positioned for rapid recovery and return to their community.

Over the last couple of years, emergency medicine physicians, surgeons, emergency department nurses, hospital administrators, and prehospital providers and leaders have met to determine the needs of the region and establish action plans. The group has been capably chaired by Dr. Robert Timmons, a retired neurosurgeon. He will be succeeded by Dr. Deanna Boyette, an orthopedic surgeon in Greenville. Dr. Terry Grant, an emergency medicine physician at Wayne Memorial Hospital in Goldsboro, and Dr. Price Monds, an emergency medicine physician at Albemarle Hospital in Elizabeth City, have served as chairs of the Prehospital and Hospital Subcommittees.

The Coalition plans to have a planning retreat at Christinne's at Ironwood on January 30, 1998 from 9:00 a.m. to 4:00 p.m. An educational session will be provided by Lynn Eastes. She will share key experiences from the state of Oregon, which implemented a trauma system a decade ago. The Coalition members will work with a strategic planner to map out the mission and actions that will guide the Coalition. The goal is to move from an informational, networking group to an action-oriented group that has an impact on trauma outcomes for eastern North Carolina. Information regarding registration or the Coalition can be obtained by calling 919-816-5706.

Kathy Dutton, RN, MSN
Trauma Program Manager

Seat Belt Law

Legislation currently pending before the North Carolina General Assembly could save a hundred lives per year, prevent 800 people from suffering serious injury, and save all of us $100 million a year. The bill is very simple. It increases the fine for not using a seat belt to $50, requires anyone under 16 to be properly buckled up, and requires all children under age 5 to be in a child restraint system and in the back seat - if there is a back seat and a place for a child safety seat. In addition citizens groups are urging that the bill include stronger measures that were deleted from the original bill - adding driver license points to the penalty and ensuring that adults are buckled up in the back seat. At the middle of July, the bill was in review by the Senate Judiciary Committee.

Passage of this bill is crucial. As trauma care providers, we know all too well what a difference proper seat belt and child safety restraint use can make. North Carolina's seat belt and child passenger safety laws have been saving lives and preventing injuries since October of 1985. But there are still people who don't use their seat belts.

The fact is that you and I are paying for those who don't use seat belts - in lives, injuries and money. Non-seat belt users in North Carolina are more likely to drive after drinking, follow too closely, run red lights, and drive at high illegal speeds. They are also less likely to have proper health care coverage. A survey of non-seat belt users indicates they would be more likely to use seat belts if driver license points were part of the penalty.

I urge everyone to support passage of this bill and urge our legislators to make it law as soon as possible. Anyone wanting additional information may call the North Carolina Passenger Safety Association at 1-800-977-8882.

Paul R.G. Cunningham, MD, FACS

The North Carolina Trauma System

Trauma is a major public health problem. It is the leading cause of death in Americans younger than age 40. More than 100,000 Americans are killed every year and another 18 million are temporarily or permanently disabled. The cost is staggering, estimated at more than $400 billion in 1994 alone! Death due to violence alone results in more years of lost life than all cancers. This scourge has affected virtually every family in the nation.

That's the bad news. The good news is that trauma deaths have decreased during the past twenty years. Specifically, there has been a significant decrease in the numbers of motor vehicle related fatalities. When the data are analyzed, it becomes apparent that primary prevention, reducing auto wrecks, is not a significant component of this trend. Air bags and car design, and trauma care, have led to those modest gains. In fact, compelling data suggest that these gains result from the availability of trauma care systems.

In North Carolina, the first tentative steps toward the creation of a trauma system took place in the mid 1970's. After implementation of the NC Emergency Medical Services Act of 1973, the newly formed NC Office of Emergency Medical Services (OEMS) asked hospitals to categorize themselves with regard to their ability to care for patients suffering trauma, burns, and spinal injuries. In 1980, OEMS developed criteria for Level I and Level II trauma centers and implemented a statewide voluntary system of designation.

As a result, there are five Level I and four Level II centers in North Carolina today. The Level I Trauma Centers are Carolinas Medical Center in Charlotte, Duke University Medical Center in Durham, North Carolina Baptist Hospital in Winston-Salem, UNC Hospital in Chapel Hill and Pitt County Memorial Hospital in Greenville. Level II centers are of Memorial Mission Hospital in Asheville, Moses H. Cone Memorial Hospital in Greensboro, New Hanover Regional Medical Center in Wilmington and Wake Medical Center in Raleigh. Level III criteria were developed in 1990 and the first Level III center, Cleveland Regional Medical Center, was designated in 1997.

Dr. George Johnson, chair of the State EMS Advisory Council, convened a trauma system task force and charged it with developing a statewide trauma system after a comprehensive assessment was conducted. As a result of these recommendations, the Trauma System Act of 1993 was passed by the North Carolina Legislature. The Trauma Systems Task Force was then reconvened and charged with further duties: to update trauma center criteria and trauma designation processes and enforcement procedures, and to design the state trauma system.

The basic building blocks of the proposed new trauma system was to be the Regional Advisory Committees (RACS), groups representing trauma care providers and communities that would be affiliated with a Level I or II trauma center. RAC s would plan, establish, and maintain a coordinated regional trauma system. Each hospital would choose its RAC affiliation, and the RAC would then implement prehospital triage and air medical protocols, and transfer agreements and regional plans for education, training, prevention, and quality assessment.

If the rules progress through the legislative process smoothly, they will become effective at the earliest August 1998.

What will the product be in summer 1998 after nearly two decades of development? We anticipate that North Carolina will have a statewide framework on which to build an exemplary system of care for the state's injured patients; that it will be inclusive and yet adaptable to the changing alliances, affiliations, and mergers that will shape the future of heath care; that it will have a set of common triage, transport, and treatment protocols formulated by regional consensus; and most importantly, that the system will improve primary, secondary, and tertiary injury prevention. The plague of injury cannot be eradicated, but its impact on the citizens of North Carolina can be minimized by optimizing care for the trauma patient

Sharon Baker Rhyne, MHA, MBD, CHE
Hosptial Specialist, NC Office of EMS

Safe Waters Network

The Safe Waters Network (SWN), was founded in July 1995. In addition to local concern related to the increasing number of personal watercraft (PWC) injuries, our colleagues in other hospitals in the region also expressed increasing alarm related to the increasing volume and severity of injuries seen. Because of their proximity to water, Edwin Loftin, ED Nurse Manager at Carteret General Hospital and LeAnn Fulcher, ED Nurse Manager at Beaufort County Hospital were especially interested in dealing with the problem. (During the summer of 1995, a telephone survey revealed 76 water related injuries between Memorial Day weekend and July 4th weekend in eastern North Carolina community hospitals or this trauma center.) The goal of the SWN is to reduce the incidence and severity of PWC injuries. The interdisciplinary group consists of medical center representatives as well as state wildlife officers, insurance agents, boating retailers and enthusiasts, and a media specialist. The network has taken an active role in collecting and analyzing data related to personal watercraft injury and death, providing a coordinated media campaign, displaying at seminars, malls, and schools, and providing a forum to discuss and impact issues of PWC safety in eastern North Carolina.

The group recognizes that there are a growing number of PWC's on the state's waterways and that many of the PWC injured drivers/passengers are often younger than the legal age for driving a car. In order to collect information throughout the region (which may someday assist with legislative changes related to the operation of a PWC), a personal watercraft injury reporting form was developed in the spring of 1996. Information collected includes mechanism of injury, injury severity, protective gear worn, training and experience of the driver, alcohol involvement, and patient demographics. The group collected and reported data back to the region in 1996 and continues to do so in 1997. As of September 30, 1997, 68 cases of injury for 1997 have been reported to the SWN. Patient ages ranged from 7-49 with 22% of the patients identified as less than 16 years of age.

The Safe Waters Network believes that children are most vulnerable to injury. This is due to limited parental supervision, lack of age specification in North Carolina boating laws, and inexperience in operating these powerful watercrafts. The SWN submitted a grant in 1996 and was funded by the Children's Miracle Network of Eastern North Carolina to develop a health education exhibit and teaching center at Adventures in Health in Greenville. An interactive water safety display was developed and constructed to teach pre-kindergarten through fifth grade children the importance of wearing a personal floatation device and basic water safety tips. This exhibit opened in May 1997.

For more information or questions related to the SWN, contact Jamie Walker at 919-816-5853. The committee welcomes individuals who are interested in helping us to identify and reduce injuries in the waterways of eastern North Carolina.

Jamie Walker RN, MSN
Clinical Nurse Specialist - Trauma, PCMH
Chair, Safe Waters Network

Case Presentation

L.R. is a 15 year old female admitted to the Trauma Service after sustaining a jetski blast to the rectum. The patient was a passenger who fell off the back of the watercraft. She was vacationing in eastern North Carolina in an area approximately one and a half hours away from this Level I Trauma Center. She was taken to the local coastal hospital for initial evaluation and treatment and appropriately transferred here by air ambulance for definitive treatment. It was noted that she had an episode of hypotension prior to transfer that responded to fluid resuscitation.

She was hemodynamically stable on arrival, was noted to have rectal bleeding and no rectal tone. The patient was taken to the operating room after initial evaluation by the Trauma Team in the Emergency Department. A rigid sigmoidoscopy was performed in the operating room. Loops of small bowel could be visualized through the injured colon. Next, an exploratory laparotomy was done. The patient was noted to have peri-rectal lacerations and ruptured bowel. The surgeon noted that stool was spread throughout the tissue within the intra abdominal cavity as if sprayed with a pressure gun. A colostomy with mucous fistula was performed and a presacral drain was placed after extensive washing out of the intra-abdominal cavity.

Post-operatively the patient did well. She was placed on a seven day course of IV antibiotics and was without temperature spikes or other signs of infection. She underwent delayed primary closure of her abdominal incision four days post-operatively. An enterstomal therapy consult was initiated to assist with patient/family education related to management of the colostomy after discharge. The patient was also scheduled to follow-up with a colo-rectal surgeon for studies to asse sphincter tone and evaluate the likelihood of return of sphin ter function.

Although the patient's hospital course went well and was without complications, there certainly are opportunities for primary prevention and education that specifically relate to safety. Suddenly a 15 year old girl is now learning to take care of a colostomy. There continues to be an increasing number of young people injured in the waterways of eastern North Carolina while operating or riding a PWC. Legislation is needed related to age specification in boating laws. Additionally, there may need to be some re-engineering of personal watercraft. Whereas these recreational vehicles automatically shut off when the driver falls off, this safety feature is not in place for passengers; a mechanism by which this injury could have potentially been prevented. As trauma care providers, let us never miss the opportunity to look for ways to avoid and prevent injury!

Jamie Walker RN, MSN

Current Trends and Controversies in Prehospital Trauma Care

There are many current trends and controversies in the prehospital management of the injured patient. Several of these will be discussed.

Aggressive Fluid Management

A 32 year old male is involved in an MVC. car vs. pole incident. The paramedics find him with GCS of 11. pulse of 130, and with labored respirations at a rate of 28. The blood pressure is palpated at 70 systolic. What will be the interventions by the EMS providers?

At the present time, the EMS provider will assess the patient quickly, establish or maintain the airway, provide good oxygenation and obtain at least two large bore IV accesses. There has been some concern about the length of scene time, but we all agree that the less time spent at the scene, the better it is for the patient.

Lately, aggressive fluid management in the prehospital setting or in the emergency department has come under a lot of scrutiny. A few hallmark studies seem to suggest that ANY fluid management prior to controlling the internal hemorrhage may be detrimental. There is growing evidence to suggest that the patient in the above scenario is better off without fluid resuscitation until he is in the operating room of a trauma center.

Imagine the medical direction advising the EMTs to establish a saline lock and NOT to infuse any fluids! Yet, if the studies continue to support this idea, in a few years that is precisely what will happen.

MAST

What about MAST trousers? It is safe to say, that currently there is no indication for application of MAST in traumatic hemorrhagic shock. Will prehospital fluid resuscitation face the same fate?

Cervical Spine Immobilization

The patient described in the above scenario will need to have his cervical spine immobilized. How about the myriads of MVC victims with minor injuries with or without alcohol ingestion?

Fear of the unknown makes us say that we should probably immobilize them just to be on the safe side. Lately, the literature seems to favor the concept of not immobilizing a blunt trauma victim unless a few specific parameters are present.

Confusion regarding cervical immobilization extends to other related issues as well. Which cervical collar is better? None, at present satisfies all requirements. Is in-line immobilization effective during intubation? The answer is no, not really, but currently we need to weigh the pros and cons . Which immobilization device is better? Rigid boards cause more morbidity especially in the elderly. Vacuum splints may be more comfortable and better immobilizers, but they may not allow enough room for unexpected medical interventions. Furthermore, experience with them is limited.

Airway Management

Endotracheal intubation is the gold standard in airway management. In the very near future, all paramedics will start using neuromuscular blockade for intubation. This not only protects against rising intracranial pressure, it also makes intubation and further patient management easier. Additionally, it helps with cardiovascular response to intubation.

Blind insertion of airways was popular for a short time in a few EMS systems, but it is just about on the way out. A new, promising blindly inserted airway is the laryngeal mask airway (LMA). It is easy, safe and tolerated by the patients well. It is popular with the anesthesiologists in the hospital. I think that in the very near future, they will be popular in the prehospital phase too.

Needle cricothyrotomy was thought to be a safe alternative to surgical cricothyrotomy. But current opinion favors the use of surgical cricothyrotomy in the field. It is being used in the prehospital phase by flight nurses and a few paramedic systems, and it takes about the same amount of time as needle cricothyrotomy. The earlier fears that the infection rates will be high are proving to be wrong. In most instances, if endotracheal intubation cannot be established, the EMS provider will opt for surgical cricothyrotomy.

How does one verify the tube position? End-tidal CO2 monitors (ET-CO2) may be good but they are known to fail at times. Esophageal Detector Device (EDD) is a simple aspiration method that seems to be gaining popularity. Some studies point out that it is slightly better than the ET-CO2. Direct visualization of the tube position is still the best method; when it is not possible, a combination of ET-CO2 and EDD together, is acceptable.

Oxygen Carriers

What in the world is DCL-Hb? Diaspirin -Cross linked Hemoglobin, an oxygen carrier, has a prolonged shelf life and can be kept unrefrigerated, unlike other blood products. Crystalloids and colloids may maintain circulatory volume but they do not improve tissue oxygenation. Hemoglobin carriers may solve this problem. This is a promising development, but I am not sure what the impact on EMS will be. At the beginning of this article I mentioned that prehospital fluid resuscitation may be dangerous in uncontrolled hemorrhage. Would resuscitation with DCL-Hb cause the same problems? Probably so. Perhaps judicious slow administration of oxygen carriers in a few selected situations (such as VERY prolonged prehospital time) may be beneficial. The research in this regard is still in the early stages; therefore, it is too soon to draw any definite conclusions.

What type of fluid would you use? This used to be a controversial issue a few years ago. In the wake of the discovery that ANY fluid resuscitation can result in bad outcomes, this becomes somewhat of a moot point. In a nut shell, hypertonic solutions and crystalloids have no role in prehospital fluid resuscitation.

Trauma Arrest

Scenario:
28 year old male in a high velocity collision; in cardiorespiratory arrest.

Do they survive? Many consider that a resuscitation effort is an exercise in futility. One thing is for certain: there is no need for helicopter transport of trauma arrest victims who are undergoing CPR. We are a very long way from prehospital thoracotomy. Occasionally, resuscitative thoracotomies have been performed by physicians in the field.

Does the prospect of organ donation justify prolonged CPR? The current answer is no.

Does it justify scene flights? Again, the current answer is no.

The controversy of Air vs. Ground transport

Who should activate air medical services? The first crew member at the scene should. It is too time consuming to have the base station or medical director to do this.

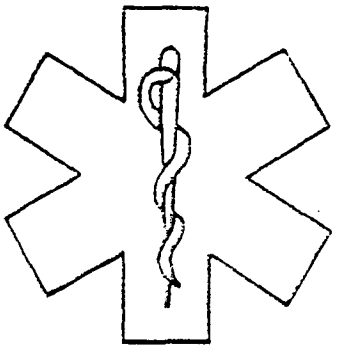
Finally I want to share with you the results of a recent article. Trauma victims taken to the hospital in private vehicles had a better survival rate compared to those taken by the paramedics! Something MUST be wrong with this study! In all seriousness, this study had limitations, but it makes one pause....

There are a variety of related issues that need to be considered as well. Among them are: Is MAST dangerous? Is there a role for prehospital nasotracheal intubation? Prehospital photos: are they helpful? Lights an sirens: should we or should we not use them? What i the future of EMS if the outcome studies do not show any benefit? What exactly is the optimal prehospital time?

N. Heramba Prasad
Associate Professor and Chief EMS, ECU

Printed with nonstate funds on recycled paper.

REACT
Eastern Carolina Injury Prevention Program
Suite 300 BB&T Bldg.
Greenville, NC 27858-4354



REACT

RURAL ENHANCEMENT OF ACCESS AND CARE FOR TRAUMA

QUARTERLY NEWSLETTER FOR OCTOBER, NOVEMBER, DECEMBER 1997

REACT UPDATE

The previous three months have been extremely busy for REACT. As of December 31, 1997, we have collected data on 396 patients (prehospital and hospital data). Our preliminary results suggest that the problems identified by the Rural Preventable Mortality Study done in 1995 still exist. Airway, oxygenation, c-spine control and venous access continue to be areas of concern based on our prehospital data. Oxygenation, c-spine control, gastric tube insertion and foley insertion in major trauma patients are the issues identified in our hospital data. During the month of December, the project coordinator visited the participating hospitals and shared a summary of the data from the first quarter of the project.

The EMS educators and project coordinator have also been conducting education sessions at local EMS squads. During the sessions, the project is discussed, feedback based on data collected for the squad is provided (if available) as well as a summary of the prehospital data collected for the region, and the trauma care guidelines developed for the project are reviewed. As of December 31, 1997, 36 educational sessions have been conducted. We will continue these sessions until June 30, 1998. The next sessions will be focused on trauma scenarios.

On February 21, 1998, a REACT session will be held in conjunction with the ECU EMS Seminar. We plan to share the first 6 months of data for the project and get some input from EMS and hospital personnel on what we have found so far.

REACT DATA SUMMARY

Prehospital Care

July - December, 1997

N=213

Intervention	Yes	No	N/A
Airway Secured (Intubation)	9 (4.2%)	8 (3.8%)	196 (92%)*
100% Oxygen Administered	156 (73.6%)	35 (16.5%	21 (9.9%)
Vascular Access Obtained	117 (55.2%)	38 (17.9%)	57 (26.9%)**
Chest Decompressed	0 (0%)	0 (0%)	212 (100%)
Hemorrhage Controlled	106 (51%)	10 (4.8%)	92 (44.2%)
C-Spine Controlled	175 (82.9%)	10 (4.7%)	26 (12.3%)
Extremities Splinted	61 (29.8%)	23 (11.2%)	121 (59%)
Wounds Covered	109 (52.2%)	39 (18.7%)	61 (29.2%

*includes levels not trained to perform intubation
**includes levels not trained to perform venipuncture

continued on page 4
*with **Emergency Department Care Summary***

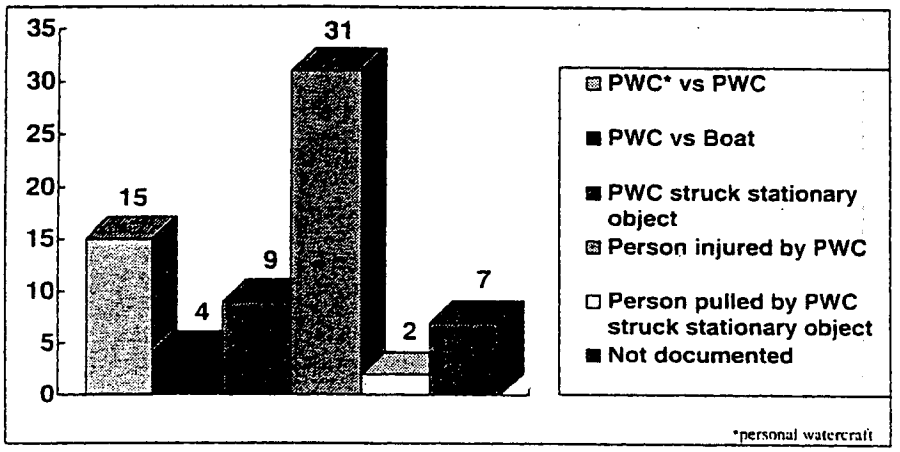
REACT IS A PROJECT OF THE EASTERN CAROLINA INJURY PREVENTION PROGRAM, THE PITT COUNTY MEMORIAL HOSPITAL TRAUMA SERVICE, AND THE EAST CAROLINA UNIVERSITY DEPARTMENT OF EMERGENCY MEDICINE. REACT IS SUPPORTED BY THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION. FOR INFORMATION, CALL SALLIE GOUGH, RN, MSN REACT PROJECT COORDINATOR 919-816-8687.

Safe Waters Network Update

As discussed in the last newsletter, the Safe Waters Network (SWN) was established in 1995. An annual update was mailed to Emergency Department nurse managers throughout the region in November 1997. Other interested individuals may contact Jamie Walker at 919-816-5853 for the annual update. Two of the graphs from the update are included in this newsletter.

Jamie Walker, RN MSN
Clinical Nurse Specialist - Trauma

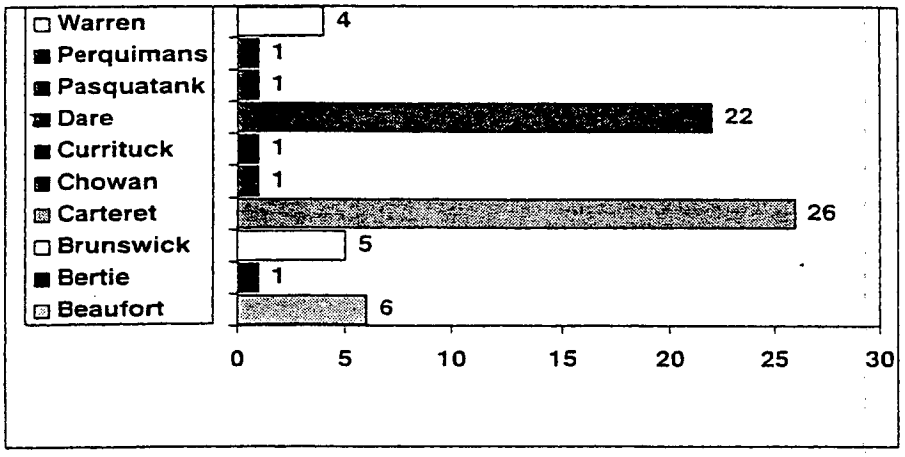
Mechanism of Injury



On a national level most incidents are due to a PWC vs PWC. A revision in our data collection form would enable us to better capture mechanism of injury.

CISS 11/97 Safe Waters Network, PCMH 1996/1997

Location of Incident



Approximately 38% of PWC injuries were reported from Carteret County with an additional 32% from Dare County. These coastal counties are flooded with tourists/vacationers and have rental PWCs available for public use. Many operators are likely to be inexperienced.

CISS 11/97 Safe Waters Network, PCMH 1996/1997

Prevention of Bicycle-Related Injuries: The PEDAL Initiative

During the past five years for which data is available (1991-1995), 790 people from Pitt County were treated at Pitt County Memorial Hospital for injuries related to bicycle crashes. More than two-thirds of bicycle incidents resulting in serious injury occurred in Greenville. A substantial number of local bicyclists who were seriously injured sustained a head injury. Head injuries account for one-third of emergency room visits, two-thirds of hospital admissions and three-fourths of deaths associated with bicycling. Of 130 injured bicyclists seen in the PCMH emergency department in 1995, only 6% were recorded as wearing a helmet.

The bicycle injury situation led the Pitt County Safe Communities Coalition to conceive the P.E.D.A.L. initiative as a strategy for preventing bicycle injuries. The P.E.D.A.L. initiative complements the bicycle safety activities many Greenville and Pitt County groups are already conducting. The P.E.D.A.L. acronym represents the objectives of the Coalition's strategy for preventing bicycle injuries. Those objectives are:

- Parental involvement in their chilren's bicycle riding practices;
- Education of children, students and parents on bicycle safety;
- Distribution of bicycle helmets to those who cannot afford them;
- Access to safe areas for bicycle riding; and
- Legislature requiring helmet use.

Since head injuries account for so many of the hospitalizations and deaths related to bicycle crashes, P.E.D.A.L. has an emphasis on improving helmet use. Combining community education programs and legislation requiring helmet use with efforts to reduce helmet costs has been shown to increase helmet use by 50% and reduce head injuries requiring hospital care by an equal amount.

EMERGENCY MEDICAL SERVICES ADVANCED LIFE SUPPORT EMS RULES SCHEDULED FOR REVISION

Proposed revisions to the rules governing advanced life support (ALS) emergency medical services (EMS) programs are scheduled for implementation August 1, 1998. The proposed revisions are primarily the result of recommendations of an EMS Task Force appointed by the State EMS Advisory Council. The EMS Task Force solicited input for more than two years from the EMS community throughout North Carolina.

Prior to final approval, the rules must be approved by a rules committee in the North Carolina Legislature. The Office of Emergency Medical Services (OEMS) will mail updated rules along with a summary of the revisions to the EMS community once final rule approval occurs.

A summary of the major revisions are as follows:

- A representative of county government must be included on the ALS program's audit and review committee. This individual may provide input to the selection of the ALS medical director as well as other issues that directly effect the county such as funding, ambulance placement, etc.

- The terms "physician assistant" and "nurse practitioner" are defined in rule. Physician assistants and nurse practitioners will be allowed to issue orders to ALS professionals once they complete certain educational and approval requirements. The addition of these terms replace the term "medical direction assistant."

- An added responsibility of the audit and review committee will be to make recommendations to the sponsor hospital administratively responsible for the program regarding the appointment of the medical director for the ALS program.

- The plan for participating hospitals including the designation of the administratively responsible hospital in an ALS program will be approved for a period not to exceed four years. At the end of the approval period, the ALS program must submit an updated plan for approval.

- During the clinical portion of an approved educational program while caring for patients in the sponsor hospital or other facility approved by the medical director and the Office of Emergency Medical Services ALS professional students may be supervised by a physician, registered nurse, physician assistant and nurse practitioner. This revision clarifies that physician assistants and nurse practitioners may serve as a preceptor in EMS educational programs.

- Medications and intravenous fluids currently listed in the rules will be removed from the rules and referenced in a document entitled "North Carolina EMS Medication Formulary." This revision will provide a much faster mechanism for updating the fluids and medications for all EMS levels. The process for updating may occur two times a year and will include receiving recommendations from ALS programs and presenting the recommendations to the State EMS Advisory Council for review and action.

- Additional skills at the EMT-Paramedic level were moved to a "standing order" status if approved by the local medical director and referenced in protocols approved by the OEMS. The additional skills are 1) perform chest decompression by needle thoracotomy, 2) perform cricothyrotomy, and 3) perform rapid sequence endotracheal intubation. This revision was made as a result comments received at the public hearing conducted by the North Carolina Medical Board.

- Additional advanced level skills were added at the EMT-Paramedic level when caring for a patient who has been physically evaluated by a physician, physician assistant or nurse practitioner and who has critical or life threatening clinical situations as defined in the patient care protocols established by the sponsor hospital of the ALS program, an approved air ambulance program or approved critical care transport program.

- The EMT-Advanced Intermediate level of certification is scheduled to be repealed on August 1, 1998. Existing EMT-AIs will need to either revert to lower certification level or advance to the EMT-P level. Information regarding bridge courses to accomplish the upgrade will be mailed to all currently certified EMT-AIs.

- Mobile intensive care nurses, physician assistants and nurse practitioners while functioning under the direction of a physician in the sponsor hospital of an approved ALS program, may direct ALS professional to perform actions as defined by the sponsor hospital for the ALS program. This revision will allow these individuals to deviate from protocol if approved the ALS program medical director.

- Persons affiliated with an approved first responder organization which functions as part of an approved ALS program will be eligible for certification at an EMT-P or EMT-I level if all other certification requirements have been accomplished. The major change with this revision is that ambulance provider affiliation is not required for certification as an EMT-P or EMT-I, therefore enhancing the possibility of earlier care by an EMT-P or EMT-I.

- As a reminder the OEMS will mail updated rules along with a summary of the revisions to the EMS community once the rules are approved by the rules committee of the North Carolina Legislature.

Ed Browning
Assistant Chief, Education
Office of EMS, Raleigh

EMS: Past to Present

Kathy Dutton, RN, MSN
(Based on Videotape Produced by JEMS)

Emergency Medical Services has progressed rapidly since its inception in America in the 1920's. I would like to take you on a trip covering the past to the present of EMS. Hopefully, this overview will allow you to fully appreciate modern EMS. It will also reinforce the pride you should have as a person involved in the delivery of emergency services in our region.

The earliest documented emergency medical service was in the 1790's during war time in France. The idea was to simply carry the victim from the scene to medical care. Pioneers such as Clara Barton continued this concept during subsequent wars. Outside the military environment, the civilian population had no organized approach. The injured were at the mercy of anyone who could offer a ride, by car or buggy, to a hospital. Patients who suffered from heart attacks basically had death sentences.

continued from page 1

REACT DATA SUMMARY

Emergency Department Care

July - December, 1997

N=282 patients

Intervention	Yes	No	N/A
Airway Secured (Intubation)	72 (25.6%)	15 (5.3%)	194 (69%)
100% Oxygen Administered	178 (64.3%)	53 (19.1%)	46 916.6%)
Chest Decompressed	23 (8.2%)	2 (.7%)	255 (91.1%)
Vascular Access Obtained	269 (95.4%)	4 (1.4%)	9 (3.2%)
C-Spine Controlled	192 (70.1%)	31 (11.3%)	51 (18.6%)
Hemorrhage Controlled	114 (41.6%)	6 (2.2%)	154 (56.2%)
Gastric Tube Inserted	62 (23.2%)	86 (32.2%)	119 (44.6%)
Foley Inserted	156 (57.6%)	44 (16.2%)	71 (26.2%)
Extremities Splinted	77 (29.2%)	17 (6.4%)	170 (64.4%)
Wounds Covered	123 (48.4%)	33 (13%)	98 (38.6%)
Tetanus Documented	150 (61.7%)	24 (9.9%)	69 (28.4%)
Antibiotics Administered	93 (39.7%)	39 (16.7%)	102 (43.6%)

In 1928, a man from Roanoke Virginia named Julian Wise established the nation's first rescue agency. He called it the Roanoke Lifesaving and First Aid Crew. This program got a lot of publicity and within a few years hundreds of rescue agencies were formed primarily along the eastern seaboard.

By the 1950s, thousands of communities and rescue agencies had formed and they had become an essential part of public safety.

An innovative thinker and physician at Johns Hopkins Hospital started experimenting in the late 50s with a technique called mouth to mouth rescue breathing. He recruited an anesthesiologist from Maryland to help him with his research. This doctor enlisted the help of the Baltimore Fire Department to test out a variety of techniques to sustain life through artificial breathing. Many of the firefighters agreed to be paralyzed with Curare for up to 2 hours so the researchers could use these techniques to maintain blood gas levels. They were also successful in getting physicians and nurses to be paralyzed so lay people could try out the techniques. The procedure that worked best was mouth to mouth breathing. Within a few years, the concept had spread, but was brought to a halt by the American Red Cross who did not approve of the technique.

In 1959, the Johns Hopkins group also conducted experiments and developed the first defibrillator. It weighed 45 pounds! CPR was introduced as a stop gap measure for the lay public to use to buy time for the patient. It was not until 15 years later that the American Heart Association and American Red Cross developed standards to support the use of CPR.

Remember at this time, even though there were rescue agencies, there was no neck immobilization or back boards, no traction for fractures, and no intubation or IVs in the field. Providers were not usually allowed to carry stethoscopes! Gas powered aspirators were used for suction and Emerson resuscitators weighing over 50 pounds were used on non breathing patients. There was no formal training or certification exams for providers. The providers ranged from enthusiast volunteers to funeral home workers. The funeral home workers were especially helpful since they had the perfect means to transport victims .... their hearses!

In 1965, surgeons began seeking solutions to the loss of life due to trauma, especially due to motor vehicle crashes. That year alone, over 50,000 Americans died in highway crashes. President Johnson proposed a Highway Safety Act and the development of the National Highway Traffic Safety Administration. The mission for this agency was to deal with impaired drivers and engineering issues, but also to improve EMS. Federal funds were allocated for training programs and improving communication systems.

Another important study, commonly referred to as the White Paper, was released the following year in 1966. This paper recognized accidental death and disability as the neglected disease of modern society. Problems sited included no standards for ambulance personnel, a lack of basic training in first aid, and an unaware public. It was also noted that while we could communicate with man in space, the ambulance could not communicate with the closest hospital. There was no 911, all areas had separate seven digit, not well publicized emergency numbers. The telecommunicators

were often disabled police officers or firemen. They received information and wrote messages by hand, which was passed on to another person for dispatch.

The development of NHTSA, the White Paper, and the belief that federal funding solves problems worked to usher us into the world of modern EMS.

As a result of federal funding, statewide trauma systems were organized in Illinois and Maryland. Dr. Cowley defined the "golden hour of trauma". The first mobile cardiac care unit was started in the late 60s. It was equipped with an EKG monitor, Oxygen, cardiac drugs, and a defibrillator. The technology to transmit an EKG to the hospital was developed. As a result of this program, which was originally staffed by physicians, the first paramedics started practicing in Miami.

There is a success story that came out of this cardiac transport program. Paramedics arrived at the scene and found Dan Jones, a habitual drinker and frequent flyer of their service, in V-fib. They successful defibrillated him and he was released from the hospital a few days later. The patient visited the fire department several times, always sober, well dressed and thankful. For a while the paramedics thought that maybe electrical shock was the cure for alcoholism!

In 1968, AT&T reserved the number 911 as the universal emergency number and the first call was from Haleyville, Alabama!

Paramedics were also trying to accommodate the glass vials and ampules of medications and dealt with constant breakages. A resourceful nurse came up with the idea of using a fishing tackle box to house the medications. This idea definitely caught on!

In 1971, the EMT curriculum was introduced as well as the need for a systems approach to EMS. Perhaps the monumental event of that year, and decade for EMS, was the visit of a producer to a fire department in Los Angeles. He had the idea for a show on EMS and he called it Emergency. Many of us grew up on Saturday nights watching Roy and Johnny. This program did a lot to promote the system and advanced life support. At that point in time, there were still only 12 paramedic staffed units in the country. Ten years later, more than half of all Americans were within ten minutes of a paramedic.

The 1970's were also when air medical transportation grew rapidly. Of course, it had been used in the military setting successfully for years. St. Anthony's Hospital in Denver pioneered hospital based helicopter programs.

The National Highway Traffic Safety Administration developed the EMS Star of Life as a symbol to distinguish EMS. Many of you know the serpent and staff are signs of healing. You may not know what the six crosses represent: detection, reporting, response, on scene care, care in transit, and transfer to definitive care.

In 1972, the National EMS Systems Act was created. It defined components of the EMS system and provided funding to create 300 regional systems throughout the nation. Although the bill was vetoed by Nixon in 1973, it was passed by Ford in 1974. The concept of "bringing the ED to the patient" was realized. One of the controversies of the act was a conclusion that the station wagons used to transport patients were not appropriate due to no head room and the lack of storage. Eventually they were replaced with the modular versions we use today. In NC, the Office of EMS was created and given the responsibility for developing a comprehensive EMS program. At this point, the state was well funded by the federal government and the NC Governor's Highway Safety Program also provided matching grants for the purchase of rescue vehicles, training, and communications.

The Federal Communications Commission saw the need to develop a nationwide design for EMS communications so rescue vehicles did not have to compete with taxi cabs for radio frequencies.

By the end of the 70's, Emergency medicine was recognized as a specialty and JEMS was introduced.

The 1980s were threatening to EMS due to the Reagan administration's goal of replacing the National EMS Development Program with block grants to states. Even though President Reagan benefitted from a well organized system after being shot, the funding for EMS was decreased significantly.

Other significant events of the 1980s included the initiation of emergency medical dispatching, the impact of personal computers, the escalating problem of AIDS, the introduction of AEDs, and the increase in homeless people which was adding significant stress to EMS providers. By the end of the 80s, the professional status of EMS providers was being discussed; EMS were having to deal with law suits, and rerouting or diversions from hospitals were taking place.

The 1990s has been an interesting decade for EMS. Many of the changes in the health care market have impacted EMS and forced changes in the system. An expanded scope of practice including primary care is being considered for EMS. In some areas, EMS professionals are issued body armor to deal with the epidemic of intentional violence. Even in NC the issue of whether providers could carry pepper spray has been discussed. The Trauma Care Systems Planning and Development Act was enacted with barely enough funding to staff a federal office. There has been an increased prevalence of blood borne and air borne pathogens, calling for EMS to pay close attention to their own health and safety. The private ambulance industry has undergone major change with the development of AMR (American Medical Response).

And with all these challenges, EMS continues to progress. The heroic efforts of EMS during the Oklahoma City bombing in 1995 will forever be in the minds of American citizens. Although not always as dramatic, the heroic efforts of providers in local communities are not forgotten either.

In NC, there are several current issues that I'd like to mention. The first is the NC Trauma Systems Act. If these trauma rules continue to progress, they will be law next summer. These rules legislate trauma center criteria and also call for the development of regional coalitions, spearheaded by trauma centers, to improve trauma care.

Just recently, the NC Medical Board determined that the AED is not longer a medical device. The American Heart Association is requiring exposure to this device in all courses as of January. The widespread distribution and use of the AED has great potential to impact cardiac care in NC.

continued on page 6

EMS, from page 5

The NC Trauma Registry is now 10 years old, and contains information on thousands of injured patients. This registry is available to you to access for benchmarking or research purposes.

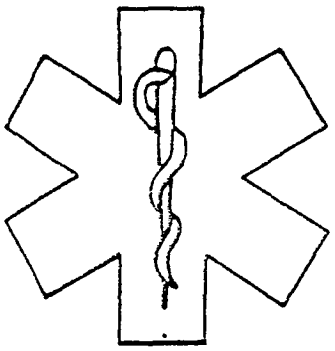
Proposed changes in EMS rules include: deletion of the EMT-AI level, increasing skills for EMT-D and EMT-I, removing meds from the rules to a formulary, and expanding skills for paramedics in transport programs.

The EMS for Children program has provided education around the state on the care of the child. They are working to ensure providers have the appropriate equipment and knowledge.

Prevention is also a key issue for EMS professionals. A consensus statement on the role of EMS in primary injury prevention emphasized the need for EMS to be involved in activities such as the collection of injury data, interaction with media to promote prevention, and planning and implementing prevention activities.

Throughout its 70 year history, EMS has not wavered for its central purpose, caring for others at their time of greatest need. It is this purpose as well as the value placed on the life and dignity of individuals that will send EMS rocketing into the 21st century.

REACT
Eastern Carolina Injury Prevention Program
Suite 300 BB&T Bldg.
Greenville, NC 27858-4354



REACT

RURAL ENHANCEMENT OF ACCESS AND CARE FOR TRAUMA

QUARTERLY NEWSLETTER FOR JANUARY, FEBRUARY, MARCH 1998

EastCare Announces Satellite Service

EastCare, the air/ground transport service of University Health Systems, has recently placed into service three critical care satellite trucks in an effort to better serve the needs of the region. Staffed with a registered nurse and an EMT-paramedic for patient care and en EMT driver, the satellite units are located in Carteret, Halifax, and Chowan Counties. These units are strictly, interfacility transport - they do not respond to accident scenes as does the helicopter, nor will they provide primary or mutual aid EMS. Currently, the Carteret satellite is in service during the day Monday through Friday, and the Halifax and Chowan satellites are in service during the three days a week as remaining staff is hired and trained. Transport requests will still be handled through EastCare Communications at 800-672-7828.

REACT UPDATE

We have completed the third quarter of the intervention phase of the REACT project. Several more education sessions have been conducted for EMS personnel. The reponse to these classes has been excellent. There are still a few counties that we have not had opportunity to visit yet, but we plan to make sure that we do a program in those counties by the end of June. Please let us know if you would like additional sessions or if you would like more information.

We have also been doing education sessions for hospitals. By the end of April, we will have provided funds for 40 participants from hospitals in our regions to attend a Trauma Nurse Education Course.

Data collection has been going well. Over 500 patients have been entered into our data base. A comparison of data from the three quarters completed shows an overall improvement at both the prehospital and ED levels. Summary tables are included in this newsletter. We would like to thank everyone for their hard work in completing the data collection forms. Only one more quarter to go!

continued on page 2 with Data Summary Tables

REACT DATA SUMMARY

Prehospital Data

July - September, 1997

N=61

Intervention	Yes	No	N/A
Airway Secured (Intubation)	3 (4.9%)	7 (11.5%)	51 (83.6%)*
100% Oxygen Administered	35 (57.4%)	18 (29.5%)	8 (13.1%)
Vascular Access Obtained	26 (42.6%)	12 (19.7%)	23 (37.7%)**
Chest Decompressed	0 (0%)	1 (1.6%)	60 (98.4%)
Hemorrhage Controlled	28 (46.7%)	4 (6.7%)	28 (46.7%)
C-Spine Controlled	52 (85.2%)	3 (4.9%)	6 (9.8%)
Extremities Splinted	26 (42.6%)	7 (11.5%)	28 (45.9%)
Wounds Covered	31 (50.8%)	12 (19.7%)	18 (29.5%)

*includes levels not trained to perform intubation

**includes levels not trained to perform venipuncture

REACT DATA SUMMARY

Prehospital Data

October - December, 1997

N=84

Intervention	Yes	No	N/A
Airway Secured (Intubation)	4 (5%)	5 (6%)	75 (89%)*
100% Oxygen Administered	63 (75%)	12 (14%)	9 (11%)
Vascular Access Obtained	49 (58.3%)	17 (20.2%)	18 (21.5%)**
Chest Decompressed	0 (0%)	0 (0%)	84 (100%)
Hemorrhage Controlled	40 (48%)	5 (6%)	38 (45%)
C-Spine Controlled	69 (82.1%)	2 (2.4%)	13 (15.5%)
Extremities Splinted	17 (20%)	10 (12%)	55 (65%)
Wounds Covered	44 (52.4%)	18 (21.5%)	21 (25%)

*includes levels not trained to perform intubation

**includes levels not trained to perform venipuncture

REACT DATA SUMMARY

Emergency Department Care

July - September, 1997

N=67

Intervention	Yes	No	N/A
Airway Secured (Intubation)	14 (20.9%)	9 (13.4%)	44 (65.7%)
100% Oxygen Administered	29 (43.3%)	22 (32.8%)	16 (23.9%)
Chest Tube Inserted	2 (3%)	2 (3%)	63 (94%)
Vascular Access Obtained	64 (95.5%)	2 (3%)	1 (1.5%)
C-Spine Controlled	37 (55.2%)	14 (20.9%)	16 (23.9%)
Hemorrhage Controlled	28 (41.68%)	4 (6%)	35 (52.2%)
Gastric Tube Inserted	9 (14.1%)	26 (40.6%)	29 (45.3%)
Foley Inserted	32 (50%)	14 (21.9%)	18 (28.1%)
Extremities Splinted	17 (25.4%)	6 (9%)	44 (65.7%)
Wounds Covered	32 (48.5%)	11 (16.7%)	23 (34.8%)
Tetanus Documented	36 (56.3%)	11 (17.2%)	17 (26.6%)
Antibiotics Administered	19 (31.7%)	15 (25%)	26 (43.3%)

REACT DATA SUMMARY

Emergency Department Care

October - December, 1997

N=131

Intervention	Yes	No	N/A
Airway Secured (Intubation)	36 (27%)	6 (5%)	89 (68%)
100% Oxygen Administered	83 (63%)	25 (19%)	22 (17%)
Chest Tube Inserted	12 (9%)	0 (0%)	119 (91%)
Vascular Access Obtained	121 (92.4%)	3 (2.3%)	7 (5.3%)
C-Spine Controlled	92 (70%)	12 (9%)	24 (18%)
Hemorrhage Controlled	48 (37%)	2 (2%)	79 (60%)
Gastric Tube Inserted	31 (24%)	29 (22%)	65 (50%)
Foley Inserted	68 (52%)	18 (14%)	41 (31%)
Extremities Splinted	28 (21%)	5 (4%)	88 (67%)
Wounds Covered	52 (40%)	13 (10%)	47 (34%)
Tetanus Documented	64 (49%)	7 (5%)	38 (29%)
Antibiotics Administered	41 (31%)	13 (10%)	53 (40%)

REACT DATA SUMMARY

Prehospital Data

January - March, 1998

N=57

Intervention	Yes	No	N/A
Airway Secured (Intubation)	3 (5.3%)	3 (5.3%)	51 (89.5%)*
100% Oxygen Administered	44 (77%)	7 (12.3%)	6 (10.5%)
Vascular Access Obtained	37 (65%)	8 (14%)	10 (17%)**
Chest Decompressed	0 (0%)	1 (2%)	56 (98%)
Hemorrhage Controlled	29 (51%)	2 (4%)	24 (42%)
C-Spine Controlled	46 (80%)	2 (4%)	9 (16%)
Extremities Splinted	18 (32%)	4 (7%)	34 (60%)
Wounds Covered	24 (42%)	7 (12.3%)	20 (35%)

*includes levels not trained to perform intubation

**includes levels not trained to perform venipuncture

REACT DATA SUMMARY

Emergency Department Care

January - March, 1998

N=111

Intervention	Yes	No	N/A
Airway Secured (Intubation)	34 (31%)	8 (7%)	68 (61%)
100% Oxygen Administered	72 (65%)	6 (5%)	24 (22%)
Chest Tube Inserted	11 (10%)	0 (0%)	98 (88%)
Vascular Access Obtained	107 (96%)	2 (2%)	1 (1%)
C-Spine Controlled	66 (59%)	7 (6%)	38 (34%)
Hemorrhage Controlled	50 (45%)	1 (1%)	57 (51%)
Gastric Tube Inserted	30 (27%)	23 (21%)	56 (50%)
Foley Inserted	71 (64%)	4 (4%)	34 (31%)
Extremities Splinted	35 (32%)	2 (2%)	65 (59%)
Wounds Covered	47 (42%)	4 (4%)	37 (33%)
Tetanus Documented	46 (41%)	7 (6%)	27 (24%)
Antibiotics Administered	42 (38%)	6 (5%)	40 (36%)

Trauma Systems Act

Kathy Dutton, RN, MSN
Trauma Program Manager, PCMH

North Carolina is progressive in the area of EMS and Trauma. Our progress will continue on August 1, 1998 when our state will implement a set of rules governing trauma care. The rules and regulations are contained in 10NCAC 3D .2000.

The most significant part of the rules are the requirement for Level I and II trauma centers to facilitate the development of Regional Advisory Committees (RAC). A RAC is a group representing trauma care providers and the community, affiliated with a Level I or II trauma center, for the purpose of regional trauma planning, establishing and maintaining a coordinated trauma system. Most of these trauma centers will sponsor a RAC individually.

Each hospital in the state will choose a RAC by January 31, 1999 to affiliate. While a hospital may choose to align with more than one RAC, each hospital will have to identify one RAC as its administrative RAC for the purposes of state correspondence and data submission.

The RAC must include, at a minimum, the following: Trauma Medical Director, Trauma Nurse Coordinator, Emergency Physician, EMS provider representative, Hospital representative, community representatives (prevention specialists, attorneys, clergy, educators, law enforcement, etc.), and an advanced life support medical director. Additional health care members may include surgeons, emergency department nurse managers, hospital administrators, outreach coordinators, rehabilitation representatives, insurance providers, etc. Three year staggered terms are suggested for all members, with the exception of the Trauma Medical Directors.

Each RAC will hold an extensive organizational meeting to discuss the trauma system concept, review the new rules, and develop a plan. The Eastern Regional Trauma Coalition has already completed a good portion of the work that will be required of the RAC.

RACs will identify system weaknesses, issues and obstacles to care when establishing their plans. It will also be imperative to establish a means to evaluate the effectiveness of the system. The key issue of confidentiality must also be addressed. Although data submission will be on a voluntary basis, it is anticipated that a minimum data set will be established for analysis.

The trauma leaders in the state are anticipating that the development of RACs will greatly enhance the system of trauma care in NC. While some states have chosen to develop statewide systems, it was felt that a regional approach would be best suited to NC. In eastern NC, there are significant opportunities for impacting the preventable mortality and morbidity rates for trauma patients. The trauma rules will be the catalyst to deal with the issues.

Upgrading North Carolina's Occupant Restraint Laws

Occupant Restraint Laws Save Lives

More than 1,700 lives have been saved, and thousands of injuries prevented, since North Carolina's seat belt and child passenger safety laws went into effect in October 1985. But more must be done to protect drivers and passengers from death and devastating injury.

The provisions of House Bill 344 will save more lives and further reduce injuries and health care costs by requiring that all motor vehicle occupants in all seating positions use an age-appropriate passenger restraint. This proposed legislation was produced by a partnership working together for stronger highway safety laws. The partners are AAA Carolinas, the North Carolina Medical Society, the North Carolina Child Fatality Task Force, and th e North Carolina Governor's Highway Safety Commission.

What is Being Proposed?

Seat Belt Law

- Asses. two (2) driver license points for a driver's fail ure to use a seat belt and/or failure to en sure that passenger s under age 16 are appropriately r estrained.
- Increase the fine from $25 to $50.
- Cover persons 16 years old and older in rear seating positions for vehicles designed to carry 10 passengers or fewer.

Child Restraint Law

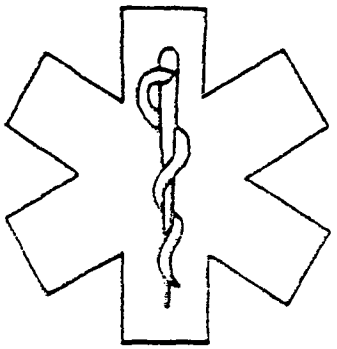
- Raise age from under 4 years old to under 5 years old (or less than 60 pounds) for mandatory use of a child restraint system.
- Require child to be appropriately restrained in the back seat, if the back seat will accommodate a child restraint system.
- Raise requirement from under 12 years old to under 16 years old for children to be in either a child restraint system or seat belt.

Why are Tougher Laws Needed?

- Increasing seat belt use from 80 percent to 90 percent should lead to an estimated 79 lives saved and 784 serious injuries prevented per year in North Carolina.
- Increasing rear seat belt use from 50 percent to 80 per cent should lead to an estimated four lives saved and 32 serious injuries prevented per year in North Carolina.
- Non-belt users in North Carolina are more often involved in high-risk behaviors, such as drinking and driving, are less likely to have health insurance coverage, and are up to 35 percent more likely to be involved in crashes.

Nonprofit Org.
U.S. Postage
PAID
Permit #110
Greenville, NC

REACT
Eastern Carolina Injury Prevention Program
Suite 300 BB&T Bldg.
Greenville, NC 27858-4354



REACT

RURAL ENHANCEMENT OF ACCESS AND CARE FOR TRAUMA

QUARTERLY NEWSLETTER FOR APRIL, MAY, JUNE 1998

REACT UPDATE

Phase II of the REACT project concluded June 30, 1998. During this phase, we conducted trauma education sessions for approximately 76 EMS squads in our region. We also conducted two regional workshops. Based on our attendance estimates, this means that we provided information about REACT and trauma care to approximately 800 EMS providers in the 29 county referral region of Pitt County Memorial Hospital Trauma Center. Feedback received on the sessions indicates that prehospital personnel found them useful and frequently asked when more sessions could be held.

Additionally, three Trauma Nurse Core Courses, a program developed by the Emergency Nurses Association which covers the basics of trauma care, were held for emergency department nurses in the region. All three courses conducted in conjunction with REACT were well attended. In all instances, the evaluations were positive.

We also collected prehospital and hospital data on trauma care during this past year. Data was collected on 740 patients from the region. The tables accompanying this article summarize information collected from the region. A common issue identified in both the prehospital and ED care data is oxygen administration. Our data suggests that in many cases, trauma patients are not receivng oxygen as they should. Another area suggesting the need for further investigation in the prehospital data is vascular access. Included in the "Needed but not Done" column are responses indicating that venipuncture was attempted but unsuccessful. The ED care data suggests that a closer look is warranted in evaluating the need for gastric tubes and foleys in trauma patients.

We would like to thank all of the prehospital providers who participated in the education sessions and all of the emergency department and EastCare staff members who collected data for us. Our goal is to improve trauma care in eastern North Carolina. The data that you collected as well as the feedback that we received during meetings and sessions has provided us with an idea of where we need to go from here.

REACT IS A PROJECT OF THE EASTERN CAROLINA INJURY PREVENTION PROGRAM, THE PITT COUNTY MEMORIAL HOSPITAL TRAUMA SERVICE, AND THE EAST CAROLINA UNIVERSITY DEPARTMENT OF EMERGENCY MEDICINE. REACT IS SUPPORTED BY THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION. FOR INFORMATION, CALL SALLIE GOUGH, RN, MSN REACT PROJECT COORDINATOR 252-816-8687.

REACT DATA SUMMARY
Prehospital Care
July 1997 - June 1998
N=336

Intervention	Needed and Done	Needed but not Done	Not Needed
Airway Secured (Intubation)	19 (5.7%)	15 (4.5%)	302 (89.9%)*
100% Oxygen Administered	258 (76.8%)	48 (14.3%)	30 (8.9%)
Vascular Access Obtained	193 (58.1%)	63 (19%)	76 (22.9%)**
Chest Decompressed	3 (.9%)	1 (.3%)	331 (98.8%)
Hemorrhage Controlled	170 (52.3%)	13 (4%)	142 (43.7%)
C-Spine Controlled	276 (82.4%)	19 (5.7%)	40 (11.9%)
Extremities Splinted	99 (30.6%)	32 (9.9%)	193 (59.6%)
Wounds Covered	162 (50.9%)	52 (16.4%)	104 (32.7%)

*includes levels not trained to perform intubation
**includes levels not trained to perform venipuncture

REACT DATA SUMMARY
Emergency Department Care
July 1997 - June 1998
N=548

Intervention	Needed and Done	Needed but not Done	Not Needed
Airway Secured (Intubation)	147 (26.9%)	28 (5.1%)	372 (68%)
100% Oxygen Administered	342 (64.3%)	101 (19%)	89 (16.7%)
Chest Tube Inserted	45 (8.3%)	3 (.6%)	496 (91.2%)
Vascular Access Obtained	528 (96.4%)	9 (1.6%)	11 (2%)
C-Spine Controlled	370 (68.8%)	41 (7.6%)	127 (23.6%)
Hemorrhage Controlled	225 (42.2%	9 (1.7%)	299 (56.1%)
Gastric Tube Inserted	140 (26.5%)	149 (28.2%)	240 (45.4%)
Foley Inserted	329 (61.7%)	64 (12%)	140 (26.3%)
Extremities Splinted	143 (28.1%)	23 (4.5%)	343 (67.4%)
Wounds Covered	228 (48.1%)	41 (8.6%)	205 (43.2%)
Tetanus Documented	258 (58.8%)	35 (8%)	146 (33.3%)
Antibiotics Administered	182 (40.5%)	47 (10.5%)	220 (49%)

The Rural Preventable Mortality Study - REACT Phase III

Preparations for repeating the Rural Preventable Mortality Study began July 1, 1998. This study will serve as an evaluation method for phase II of REACT (education, data collection and feedback). The RPMS will be conducted in the same way that it was done the first time in 1995. A panel of trauma care experts will be recruited (the same panel from the previous study) consisting of physicians, nurses, and prehospital providers. This panel will review the medical records, ambulance call reports, autopsies, and medical examiner reports of 150 patients who died as a result of trauma between July 1, 1997 and June 30, 1998. The panel will be looking for any deaths that were preventable or were possibly preventable. In addition, they will be looking for any instances of inappropriate care from the prehospital, emergency department, and hospital phases of care.

When the study is completed in June of 1999, results will be published by the National Highway Traffic Safety Administration in Washington DC.

REACT
Eastern Carolina Injury Prevention Program
Suite 300 BB&T Bldg.
Greenville, NC 27858-4354

APPENDIX IV: DATA COLLECTION FORMS

REACT TRAUMA CARE CHECKLIST- PREHOSPITAL/LOCAL EMS

FOR PATIENTS MEETING MAJOR TRAUMA CRITERIA
RECORD INTERVENTIONS DONE PRIOR TO ARRIVAL AT YOUR ED
SEE BACK FOR FURTHER INSTRUCTIONS

PATIENT'S NAME: _____ HOSPITAL: _____

TODAY'S DATE: _____ TIME OF ASSESSMENT: _____

*PATIENT CONFIDENTIALITY WILL BE MAINTAINED AT ALL TIMES *

INTERVENTION	NEEDED AND DONE	NOT NEEDED	NEEDED BUT NOT DONE	COMMENTS
AIRWAY SECURED (TRACHEA INTUBATED)				
CERVICAL SPINE IMMOBILIZED				
OXYGEN DELIVERED AT 100%				
CHEST DECOMPRESSED				
HEMORRHAGE CONTROLLED				
VASCULAR ACCESS OBTAINED				
INJURED EXTREMITIES SPLINTED				
WOUNDS COVERED				

LEVEL OF EMS CERTIFICATION: PLEASE CIRCLE THE HIGHEST LEVEL OF CERTIFICATION OF THE EMS PERSONNEL TRANSPORTING THE PATIENT TO YOUR FACILITY.

EMT EMT-D EMT-I EMT-AI EMT-P

SQUAD: _____

TIMES (MILITARY)
TIME OF INJURY _____ TIME OF ED ARRIVAL _____

TIME OF REQUEST FOR TRANSFER TO TRAUMA CENTER _____ TIME OF ARRIVAL AT TRAUMA CENTER _____

INJURIES

COMMENTS

DOCUMENTING NURSE:

REACT: RURAL ENHANCEMENT OF ACCESS AND CARE FOR TRAUMA
FOR INFORMATION, PLEASE CALL PROJECT MANAGER: SALLIE GOUGH, RN, MSN, 919-816-8687 FAX 919-816-7890

Instructions for Completing the Checklist

Prehospital Care

1.Please complete a checklist for each trauma patient meeting these criteria:

GCS<14 or RR<10 or>29 or PTS<9 or Systolic BP<90 or RTS<11
Pelvic fractures
Flail chest
2 or more proximal long bone fractures
Combination trauma with burns of 10% or inhalation injuries
All penetrating injuries to head, neck, torso, and extremities proximal to elbow and knee
Limb paralysis
Amputation proximal to wrist/ankle
Ejection from automobile
Death in same passenger compartment
Pedestrian thrown or run over
High speed crash: Initial speed >40 mph, Velocity change>20 mph, Auto deformity > 20", Intrusion into passenger compartment >12"
Extrication time > 20 min.
Falls > 20 ft.
Roll over
Auto-pedestrian injury with >5mph impact
Motorcycle crash > 20mph or with separation of rider and bike
Age <5 or >55
Known cardiac disease, respiratory disease or psychotics taking medication, insulin dependent diabetics, cirrhosis, malignancy, obesity or coagulopathy
Any other patient suspected of sustaining major trauma

2. **Indicators refer to interventions performed prior to ED arrival.**

3. Please check " needed and done" for each intervention needed and performed.

4. Please check "not needed" if an intervention was not needed based on the patient's condition.

5. Please check "needed but not done" for each intervention that should have been done based on the patient's condition but that was **NOT** done.

6. The "injured extremities splinted" indicator includes MAST applied for pelvic and/or lower extremities fractures.

7. Under the item " times" please list the times indicated if available.

8. The injuries section at the bottom is for any information that you can provide about injuries and/or mechanism of injury.

9. The comments section at the bottom is for any information that you feel is important in explaining or clarifying checklist responses.

10. If the patient is transferred to PCMH Trauma Center, please send this form with other transfer materials or please fax (see front for number) or mail it to REACT Project, ECIPP, Suite 300 BB&T Bldg., Greenville, N. C. 27834.

We appreciate your time and help in providing this information.

REACT TRAUMA CARE CHECKLIST- TRAUMA TRANSFERS

TO BE USED ON ALL TRAUMA TRANSFERS TO PCMH TRAUMA CENTER
RECORD INTERVENTIONS DONE PRIOR TO ASSUMPTION OF CARE BY EASTCARE OR PCMH TRAUMA CENTER

SEE BACK FOR FURTHER INSTRUCTIONS

PATIENT'S NAME: _____ REFERRING HOSPITAL: _____

TODAY'S DATE: _____ TIME OF ASSESSMENT: _____

PATIENT CONFIDENTIALITY WILL BE MAINTAINED AT ALL TIMES

INTERVENTION	NEEDED AND DONE	NOT NEEDED	NEEDED BUT NOT DONE	COMMENTS
AIRWAY SECURED (TRACHEA INTUBATED)				
CERVICAL SPINE IMMOBILIZED				
OXYGEN DELIVERED AT 100%				
CHEST TUBE INSERTED				
HEMORRHAGE CONTROLLED				
VASCULAR ACCESS OBTAINED				
INJURED EXTREMITIES SPLINTED				
GASTRIC TUBE INSERTED				
FOLEY CATHETER INSERTED				
WOUNDS COVERED				
TETANUS DOCUMENTED				
ANTIBIOTICS GIVEN				

ADDITIONAL INTERVENTIONS AT REFERRING HOSPITAL

TIMES (MILITARY)
TIME OF INJURY _____ TIME OF ARRIVAL AT REFERRING ED _____

TIME OF REQUEST FOR TRANSFER TO TRAUMA CENTER _____ TIME OF ARRIVAL AT TRAUMA CENTER _____

INJURIES

COMMENTS

DOCUMENTING NURSE:

REACT: RURAL ENHANCEMENT OF ACCESS AND CARE FOR TRAUMA.
FOR INFORMATION, PLEASE CALL PROJECT MANAGER: SALLIE GOUGH, RN, MSN, 919-816-8687
FAX 919-816-7890

Instructions for Completing the Checklist

Trauma Transfers

1. Please complete a checklist for each trauma patient transferred from another facility.

2. **Indicators refer to interventions done prior to assumption of care by Eastcare or PCMH Trauma Center.**

3. Please check " needed and done" for each intervention needed and performed.

4. Please check "not needed" if an intervention was not needed based on the patient's condition.

5. Please check "needed but not done" for each intervention that should have been done based on the patient's condition but that was **NOT** done.

6. The "hemorrhage controlled" indicator includes operative intervention for internal hemorrhage control as well as measures to control external hemorrhage. Please document operative procedures under the "comments" section.

7. The "injured extremities splinted" indicator includes MAST applied for pelvic and/or lower extremities fractures.

8. The additional interventions section is for listing interventions other than those already identified.

9. Under the item "times" please list the times indicated if available.

10. The injuries section at the bottom is for any information that you can provide about injuries and/or mechanism of injury.

11. The comments section at the bottom is for any information that you feel is important in explaining or clarifying checklist responses.

We appreciate your time and help in providing this information.

APPENDIX V: E-CODES FOR PMS PATIENTS

E-Codes

800-807	Railway incidents
810-819	Motor vehicle traffic incidents
820-825	Motor vehicle non-traffic incidents
826-829	Other road vehicle incidents
830-838	Water transport incidents
840-844	Air transport incidents
846-849	Vehicle incident, not elsewhere classifiable
870-879	Misadventures to patients during surgical or medical care (only wher injury occurs as a result of prehospital trauma)
880-888	Unintentional falls
913-915	Injuries caused by mechanical suffocation and foreign bodies
916-923	Other incidents
955-959	Suicide and self-inflicted injury (excluding gunshot wounds to the he
960-969	Homicide and injury purposely inflicted by other persons (excluding by corrosive or caustic substance, poisoning, hanging or strangulati drowning)
970-976	Legal intervention (excluding legal intervention by gas)
985-989	Injury undetermined whether unintentionally or purposely inflicted

APPENDIX VI: REVIEW CHECKLIST

ECU 1998 Rural Preventable Mortality Study

Case Review Checklist

Case No. _____ Reviewer _____

Check all INAPPROPRIATE items that apply:

	Phase I	Phase II
PREHOSPITAL CARE		
1. Air Medical Transport Access	☐	☐
2. Airway Management	☐	☐
3. Oxygenation/Ventilation	☐	☐
4. Bleeding Control	☐	☐
5. Fluid Resuscitation	☐	☐
6. Unnecessary/Deleterious Medications	☐	☐
7. Fracture Stabilization	☐	☐
8. Use of MAST trousers	☐	☐
9. C-Spine Protection	☐	☐
10. Other	☐	☐
_____		
_____		
EMERGENCY DEPARTMENT		
<u>Stabilization/Treatment:</u>		
11. Surgeon Notified	☐	☐
12. Airway Control	☐	☐
13. Oxygenation/Ventilation	☐	☐
14. IV Access (i.e. delayed)	☐	☐
15. Unnecessary/Deleterious Medications	☐	☐
16. Fluid Resuscitation	☐	☐
17. Use of Pressors	☐	☐
18. Use of MAST Trousers	☐	☐
19. Chest Injury Tx	☐	☐
20. Other	☐	☐
_____		
_____		
<u>Diagnosis:</u>		
21. Failure to use X-Ray/CT	☐	☐
22. Failure to use Peritoneal Lavage	☐	☐
23. Failure to Recognize Injury	☐	☐
24. Laboratory Tests	☐	☐
OPERATIVE		
25. Inappropriate Operation	☐	☐
26. Delayed Surgery	☐	☐
27. Other	☐	☐
_____		
_____		
POST OP/POST ED CARE		
28. Oxygenation/Ventilation	☐	☐
29. Treatment of Infections	☐	☐
30. Treatment of Re-bleeding	☐	☐
31. Unnecessary/Deleterious Medications	☐	☐
32. Fluid Management	☐	☐
33. Monitoring/Management of Head Injury	☐	☐
34. Ventilatory Care	☐	☐
35. Other	☐	☐
_____		
_____		

	Phase I	Phase II
TIME		
36. Delay in EMS Response (> 15 mins.)	☐	☐
37. Excessive Scene Time (> 15 mins.)	☐	☐
38. Too Much Time in ED/X-Ray	☐	☐
39. Diagnostic Procedure Delay	☐	☐
40. Delay in Going to OR	☐	☐
UTILIZATION OF RESOURCES		
41. Prehospital Resources	☐	☐
42. Transportation Resources	☐	☐
43. Resuscitation Effort Excessive	☐	☐
44. Diagnostic Resources	☐	☐
45. Surgical Resources	☐	☐
46. Other	☐	☐
_____		

CAUSE OF DEATH/PREVENTABILITY

A. *For deaths within 48 hrs., the Primary Cause of death was due to (check one):*

47. Airway/Respiratory	☐
48. CNS Injury	☐
49. Exsanguination (includes burns)	☐
50. Indeterminant	☐
51. Pre-existing Condition	☐
52. Other	☐

_____

B. *For deaths after 48 hrs., the Primary Cause of death was due to (check one):*

53. Airway/Respiratory	☐
54. Hemorrhage	☐
55. Sepsis/Infection	☐
56. CNS Injury	☐
57. Indeterminant	☐
58. Renal Failure	☐
59. Other	☐

_____

C. *Death was (check one):*

60. Preventable	
Care Appropriate	☐
Care Inappropriate	☐
61. Possibly Preventable	
Care Appropriate	☐
Care Inappropriate	☐
62. Non-Preventable	
Care Appropriate	☐
Care Inappropriate	☐

D. *Phase responsible for Inappropriate Care (check all that apply):*

63. Prehospital	☐
64. ED	☐
65. OR	☐
66. ICU	☐
67. Hospital Floor	☐

DOT HS 809 521
October 2002

U.S. Department
of Transportation
**National Highway
Traffic Safety
Administration**

People Saving People
www.nhtsa.dot.gov