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MOBILE INTENSIVE CARE BY "UNEMPLOYABLE" BLACKS TRAINED AS EMERGENCY MEDICAL TECHNICIANS (EMT's) IN 1967–69

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The dramatic success and even greater potential of modern resuscitation and life-support techniques challenge the definition of death. Resuscitation experts, looking beyond the confines of hospital walls, seek ways to reduce this country's annually estimated 700,000 sudden deaths by aggressive sophisticated intervention (2, 6, 10).

Studies on available emergency medical response systems demonstrate that few communities are capable of delivering optimal ambulance services (2, 6, 10, 17, 21). Until recently, emphasis in prehospital emergency care rested largely on rapid transportation of the ill and injured. Patient care, where considered, stressed management of trauma victims with less attention paid those suffering from acute medical conditions, such as respiratory failure, myocardial infarction, or coma. Inadequate ambulance design and equipment and inadequately trained personnel precluded early delivery of sophisticated care and limited the assistance a passing physician could offer.

During the past decade concerned citizens, particularly the young, have challenged traditional health care systems, primarily because of appalling conditions among the nation's underprivileged. The Presidential Commission on the causes of civil disorders concluded that the urban riots of 1967 reflected an inability of black ghetto residents to gain dignity and to share in society's material prosperity. The report also cited inadequate jobs, marginal schooling, and relatively inaccessible medical care as causes of discontent in urban riots (14). Emergency medical resources, which are poor in general, tend to become particularly taxed in ghetto districts.

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Working in conjunction with Freedom House Enterprise, Inc. (FHE), whose primary goal is to develop businesses in the ghetto districts of Pittsburgh, the authors undertook a project which attempted: (a) to offer dignified, rewarding employment to ghetto residents; (b) to improve emergency ambulance service in one of Pittsburgh's slums; (c) to demonstrate prehospital life-support in the community by mobile intensive care units (MICU's), with the hope of eventually establishing MICU service areawide; (d) to test curricula for training emergency medical technicians (EMT's) in hospital-based programs as a pilot project for national recommendations (2, 6, 9, 21); and (e) to test the feasibility of newly-defined ambulance design and equipment recommendations (6, 8, 20).

TRAINING

Forty-four blacks, selected from 70 applicants, comprised the first two groups of EMT trainees. They ranged in age from 18 to 60, and all came from Pittsburgh's ghetto areas. Although a physician from the program participated in the screening, he exercised little choice, since the primary goal remained selection of "unemployables." Apparent motivation received more consideration than previous schooling and grades.

Prior to entering the training program, few of these unemployed or underemployed students possessed "marketable" skills, and all reported chaotic employment histories. We considered a person "underemployed" if working part time and looking for full-time employment, or working full time and making less than $3,000 per year (14).

The first group of 25 trainees (23 men and two women) started in October 1967, and the second group of 19 men started in January 1969. We modified the curriculum of the second group

according to experience gained with the first group.

I. GENERAL EDUCATION

Twelve of 25 in the first group and five of 19 in the second group had not completed high school at the beginning of EMT training. The first group devoted approximately half of the initial 8 months to improving their general educational status through adult education courses, given by the local school board. Following these courses, which ran simultaneously with the EMT training courses, examination proved 17 of the 21 students eligible to receive high school equivalency certificates. Funding and administrative limitations prohibited adult education courses for the second group.

II. EMERGENCY MEDICAL TECHNICIANS TRAINING (TABLE I)

For both classes, the basic medical and technical EMT training required at least 3 months, divided into: 1) pre-clinical; 2) clinical; 3) field experience; 4) life-support drill; and 5) administration. Approximately 9 additional months of on-the-job experience and advanced MICU training in arrhythmia control followed later. Students who demonstrated adequate knowledge and skills graduated prior to the 1-year target date.

A. Pre-Clinical Training. Experienced ambulance attendants taught the regular and advanced Red Cross first aid courses (5), using pictures, movies, and X-rays to dramatize actual cases. Problems frequently encountered by ambulance personnel were analyzed and first aid measures were practiced extensively. After examination, all trainees received standard and advanced Red Cross first aid certificates.

Fifty hours of instruction in human anatomy and physiology, presented by the University Hospital School of Nursing, acquainted students with the names, locations, and functions of major organ systems. The course introduced early the study of organ system malfunction induced by disease and trauma, and stressed disorders encountered by EMT's. To stimulate student interest, the course employed laboratory exercises, making extensive use of small animal dissections, manikins, X-rays, and fresh tissue specimens obtained from local meat packing houses. Instruction and guidance by both black and white staff members provided the reassurance and promoted the self-confidence necessary to help the students face a challenging scholastic situation.

Cardiopulmonary resuscitation (CPR) was taught with the American Heart Association CPR Course (3, 4, 19). This included manikin practice to perfection of steps A, B, and C of CPR and resuscitation experience in the laboratory. The instructor, with the students' assistance, resuscitated anesthetized dogs from asphyxia, drug overdose, and ventricular fibrillation. An oscilloscope displayed ECG and arterial pressure. Open and closed chest cardiac compressions were demonstrated and practiced. Principles of managing tension pneumothorax and pericardial tamponade were explained. Anesthesiologists and inhalation therapists presented additional in-depth seminars on ventilation and on initial and long-term care of the airway, as well as circulatory and nervous system disturbances in life-threatening conditions.

The Health Center School for Inhalation Therapists presented a course in respiratory care and vital system function which examined in depth concepts of respiratory and cardiovascular anatomy, physiology, and pathology. Instructors demonstrated safe handling of compressed gases and oxygen delivery systems, as well as effective use of artificial ventilation devices. Extensive practice of techniques proved essential for developing manual dexterity with equipment.

The University Hospital's Department of Nursing, In-Service Training Division, presented seminars on ethics, interpersonal relationships, safety and comfort measures, and other nursing topics. The students learned chains of command and responsibility, the layout of patient care areas, and the deportment expected in these areas. Nursing instructors arranged demonstrations and practical experience when appropriate.

All students took the Defensive Drivers' Training Course provided by the regional representative of the Pennsylvania Department of Health. Although this showed the students how to drive defensively, it did not teach operation of an emergency vehicle. For this purpose, we need a course similar to that given State Police recruits.

B. Clinical Experience. Having completed their preclinical training, students began clinical rotations of approximately 1 week (at least

TABLE I

FHE Emergency Medical Technicians' Training Curriculum
(12 Months)

I, II, and III overlapping	Time
I. General Education (high school equivalent test)	Individualized
II. Emergency Medical Technician's Training	(approx. 3 months)
A. Preclinical (lectures, seminars, laboratory sessions)	
1. First aid, standard and advanced American Red Cross Course	35 hr
2. Anatomy, physiology	50 hr
3. Resuscitation	Over 20 hr
American Heart Association CPR Course (steps A, B, and C)	4 hr
Animal laboratory	2 hr
CPR manikin practice to perfection	Over 2 hr
Life support in life-threatening emergencies (seminar and drill)	12 hr
4. Inhalation therapy	30 hr
5. Nursing arts and professional adjustments	14 hr
6. Defensive driver's training	7 hr
B. Clinical (172 hr)	
1. Practical experience (6 weeks, 5 half-days each)	
a. Operating room/anesthesiology (airway care, IPPV, oxygenation)	
b. Postanesthesia recovery room (monitoring, venous infusion)	
c. Intensive care unit (monitoring, care of intubated patients)	
d. Morgue (anatomy, role of medical examiner)	
e. Emergency room (observation and help)	
f. Delivery room (observation)	
g. Inhalation therapy	
h. Patient ward (observation, moving patients)	
2. Lectures (1 hr each)	
Childbirth	
Neonate and infant	
Wounds/general	
Skull and scalp wounds	
Facial wounds	
Chest wounds	
Abdominal wounds	
Genitourinary tract	
Environmental emergencies	
Internal medicine	
Emotional disturbances	
Legal rights (2 hr)	
C. Guided field experience (with urban and/or rural ambulance service) (1 week)	40 hr
1. Rescue, extrication, communication, operation of emergency vehicle	
D. Resuscitation and life support drill during simulated transport with special manikins (1 week)	40 hr
Ambulance service administration (seminars, 1 hr each)	8 hr
Professional adjustment	
Public relations	
Operating ambulance service	
Hospital studies	
Community-wide emergency medical services	
Operation of emergency vehicle	
Social service	
Forms and communications	
III. On-the-job experience	(approx. 9 months)
Riding ambulance under physician supervision with debriefing and weekly case discussions	
IV. Advanced training in arrhythmia recognition and control, including telemetry in progress	

one-half day, daily) in each area listed in Table I. Small groups of two or three rotated to avoid disturbing clinical care areas and to make optimal use of available practical experience opportunities. We found it extremely important to assign specific instructors for each clinical rotation.

Rotation through the operating rooms proved a key experience in learning life-support techniques. Under the instruction and immediate control of anesthesiologists, students gained first-hand experience in upper airway management and artificial ventilation, as well as oxygenation and monitoring of anesthetized patients. By delivering an anesthetic mixture through a self-refilling Laerdal bag-valve-mask unit with reservoir tube, the students performed respiratory support with equipment they would eventually be expected to use in the ambulance. Practice included insertion of oropharyngeal tubes, upper airway suctioning, and ventilation via mask and tracheal tube.

Tracheal Intubation. We undertook a pilot study of teaching tracheal intubation. Although in most patients a patent airway can be provided without a tracheal tube, it is difficult for two attendants to maintain a patent airway during transportation over stairs and rough streets, particularly if artificial ventilation and cardiac compression are also required. Under such circumstances, regurgitation and aspiration are common. A tracheal tube makes airway care and ventilation easier. It also protects the airway and allows for suctioning of the tracheobronchial tree if aspiration has already occurred.

Teachability studies have shown that lay people can be taught head positioning, clearing of the mouth, ventilation, and external cardiac compression (22). Our study attempted to carry this one step further by training 13 of the EMT trainees who had previously mastered CPR to perform endotracheal intubation. We first instructed the students with lectures and slides in the anatomy of the larynx, equipment to be used, and the technique to be employed (18). The Laerdal infant intubation manikin and the only adult intubation manikin available at the time, which was unrealistic, were used to demonstrate technique. The men were given ample opportunity to master the technique on both manikins. When proficiency with the manikin had been attained, they were taken into the operating room individually for a period of 2 weeks for demonstration and coached tracheal intubation practice on "healthy" (Physical Status I and II), anesthetized, curarized, hyperoxygenated patients, who were undergoing elective surgical procedures which required a tracheal tube. Twenty-five per cent of the patients were edentulous. Two weeks was considered the maximum feasible training period. To minimize resentment of anesthesia and operating room personnel, the anesthesiologist conducting the training used his own patients for instruction. After the instructor had demonstrated the anatomy of the larynx and the intubation procedure step by step, each student was given up to 60 sec to intubate the trachea with a maximum of three attempts on each patient. Each student had a total of seven to 14 attempts on five to 7 patients each. Coaching to perfection was only during the first attempt. Only 30% of these 1-min attempts resulted in successful intubation. Only six of the 13 students successfully intubated the trachea without coaching on the final day of the 2-week period.

Fear of injuring the patient impaired the efficiency of those who could not successfully intubate. While they did well with the manikin, they became apprehensive when confronted with a live patient.

Difficulty with scheduling, and reluctance of morgue personnel to expose bodies to possible facial disfigurement, hampered attempts to teach tracheal intubation on cadavers. Unscheduled and necessarily hurried attempts at teaching four additional trainees to intubate the tracheas of corpses in the emergency room likewise failed. In this country, lack of legally required autopsies and pressure from funeral directors make scheduled teaching sessions in the morgue almost impossible.

While months of preceptorship-type training on a one-to-one basis apparently can prepare medical corpsmen to intubate the trachea (12), this proved unfeasible when a great number of EMT's permit only 2 weeks of training. Need for practice on patients with various physical characteristics of the upper airway, shortage of instructors, resentment by operating room personnel, legal considerations, and the nonexistence of a realistic adult intubation manikin at the time combined to limit tracheal intubation training so far. Our results suggest, however, that

with sufficient time, an improved manikin,* and much effort on the part of the instructor, the more intelligent EMT trainees in our program can be taught successfully to intubate the trachea. Experience has shown that personnel, once trained, who do not have the opportunity for frequent practice subsequently, should not use this mode of airway care unless all other methods have failed.

In the postanesthesia recovery room, students practiced caring for unconscious intubated patients and monitoring blood pressure, heart rate, and breathing. They gained exposure to various techniques of airway maintenance; mechanical artificial ventilation; monitoring devices; pleural, gastric, and bladder drainage systems; and nursing care arts.

Intravenous infusion. Starting and maintaining venous infusions is part of National Research Council recommendations for EMT Training, because infusion of blood substitutes may be life-saving in injured patients, particularly in prolonged transportation. Attempts to teach venous infusion in the operating rooms were hampered by delays of the schedule. In the recovery room, there was a limited number of patients suitable for practice because most arrived with a venous catheter in place. Therefore seminars and demonstrations on the assembly of equipment and the technique of venipuncture were followed by practice to perfection on a venipuncture arm model. Thirteen students received closely supervised instruction on recovery room patients and with the intravenous team, both with metal and plastic needles. Percutaneous insertion of short venous catheters was considered important, since metal needles became easily dislodged during transportation. Seven students successfully started infusion when given sufficient time. Performance with catheter-outside-needles was better than expected. A more realistic infusion manikin is required.

In the intensive care unit they observed and learned care of the intubated and tracheotomized patient. Sophisticated ICU techniques were beyond the scope of this basic EMT training effort.

* The new realistic Laerdal Adult Intubation Manikin, which has become available since the end of this project, permits practice of oro- and nasotracheal intubation, lung inflation, and recognition of gastric and bronchial intubation.

Experience at the county morgue proved valuable. When working with morgue personnel throughout the community, students learned about the roles of the Coroner and the Medical Examiner; responsibilities to the deceased and their relatives; protection of evidence at the scene; and protocol to be followed in Coroner's cases. When assisting morgue personnel at the autopsy table, the students reviewed normal and pathologic anatomy.

Since fewer than 5% of emergency room admissions are patients with life-threatening conditions, emergency room rotation did not prove valuable for learning life-saving and life-supporting measures. Moreover, practicing on patients who need resuscitation could be disastrous for both patient and student. Life support, therefore, is better learned in the operating room/anesthesiology department rotation than in the emergency room. The emergency room, however, served as an area in which the student became familiar with the types of cases transported and the condition of patients on arrival. The EMT's also learned emergency room procedures and helped the team of physicians and nurses in resuscitation cases.

In the delivery room, we attempted to introduce the students to normal and complicated deliveries as well as routine and resuscitative care of the newborn. Reluctance of nursing personnel, the small number of teaching cases and spontaneous deliveries (without forceps), and lack of a full-time instructor for the obstetrical training experience, combined to limit the effectiveness of this rotation.

There was an additional tenure with the inhalation therapy department, learning cleaning and sterilization of equipment, accompanying the therapist on rounds, and responding to stat calls.

On patient wards, students observed hospital practices and gained experience in moving patients.

In conjunction with clinical rotations, the students attended clinical lectures by physicians, experienced ambulance attendants, and lay specialists. Table I (B/2) lists the topics of these lectures (11, 16).

Instruction in obstetrics, pediatrics, and treatment of poisoning and burns included film showings with question/answer periods conducted by physicians. The lecture on burns and poisoning

included methods used in the community, so that aid rendered became the first step in locally accepted treatment. The lecture on childbirth covered reassurance of the mother, resuscitation of the newborn, and complicated deliveries. Discussion of the infant included heat loss, respiratory resuscitation, use of the incubator, oxygenation, humidification, fever, and convulsions.

Instructors taught control of hemorrhage with wound moulages. The concept of quantitating blood loss was demonstrated by pouring outdated blood on white sheets. Treatment of fractures emphasized those of skull, spine, pelvis, hip, and thigh which present major threats to life. Students practiced with a variety of splints, including those to be available in their vehicle.

The lecture in internal medicine incorporated early treatment of heart attack, pulmonary edema, insulin shock, and diabetic coma. The lecture on emotional disorders included the handling of the acutely disturbed patient with emphasis on recognizing hysteria. The lecture on legal rights included the legal limitations on moving a patient, and the roles of courts, police, family, and State.

C. Guided Field Experience. The first group obtained 1 week of field experience with the Baltimore Fire Department Ambulance Service, a commercial funeral home ambulance service in Pittsburgh, or a rural ambulance service in Indiana, Pennsylvania. The second group of students gained their field experience with the FHE Service staffed by graduates of the first group. Field experience stressed practice in rescue, extrication and communication under simulated and actual conditions. The trainees accompanied trained attendants on as many trips as feasible, and learned the missions of the rescue squad.

D. Resuscitation and Life Support Drill. Toward the end of the 3-month period, the students were again exposed to life-saving and life-supporting drills. These drills stressed recognition of airway obstruction, apnea, hypoxemia, and pulselessness, as well as airway care, ventilation, oxygenation, and CPR. Coached practice to perfection, with trainee volunteers and manikins as subjects, was followed by individual practice and repetition. Some trainees required as many as 80 hr of practice before achieving satisfactory skill levels. Such demanding drills may lead to serious morale problems if students do not receive frequent encouragement and reassurance. We stressed the importance of perfectly performing life-saving measures under difficult and unpredictable field conditions.

Finally, we required the students to demonstrate CPR during simulated transfer of a weighted Resuscianne manikin over stairways and in the moving ambulance, using both manual technique (with a special backboard designed for this purpose) and a CPR machine. The controlled comparison of "ventilation" and "heart pressures" obtained with both methods revealed that the manual technique can be instituted more quickly, while the mechanical technique provides more uninterrupted CPR en route (D. M. Benson, R. Davis, P. Safar, unpublished data).

E. Ambulance Service Administration. In seminars, ambulance leaders of the community discussed the administrative aspects of running an ambulance service. Special emphasis was placed on teaching trainees to communicate well in speaking and writing and in using two-way radio and telephone. Emergency medical services were described in the light of total provision of health care.

III. ON-THE-JOB EXPERIENCE

Students who passed the main portion of the EMT training course received an internship-like experience of on-the-job training for the remainder of the year. This entailed staffing the newly established physician-supervised, hospital-stationed FHE/MICU Ambulance Service. In-service training, during this period and during the subsequent service time, included immediate debriefing by crew chiefs and weekly case discussions with the physician director.

IV. ADVANCED TRAINING IN CARDIAC CARE

The great number of pre-hospital deaths in myocardial infarction (1, 7, 15) makes arrhythmia recognition and control, and the "Definitive Therapy" part of CPR (including electric defibrillation) an essential part of mobile intensive care. It is not considered feasible in the USA at this time for physicians to ride ambulances (1, 7, 15). The possibility of EMT's performing these tasks under the direction of physicians, aided by two-way radio plus ECG telemetry (13), has been explored. EMT's at least should be effective as physician helpers outside the hospital and, under certain circumstances, inside

TABLE II
Preparations of Drug Injections
Average Time Required (Average Number of Mistakes)

	No.	Trial 1	Trial 2	Trial 3	Trial 4
Registered nurses	4	6′44″ (0.75)	5′10″ (0)	—	—
Student nurses	2	8′12″ (0.5)	7′49″ (0)	—	—
EMT's	4	11′10″ (6.25)	9′36″ (1.75)	8′22″ (1.25)	8′7″ (2.25)

Upper figure: average time required, minutes and seconds.
Lower figure (in parentheses): average number of mistakes.

the hospital. Therefore we have initiated postgraduate training in arrhythmia control for a selected number of our EMT's as part of their continuing education.

The first phase consisted of testing the ability of four EMT's to learn aseptic preparation of drug injections (Table II). All had high school degrees or equivalents. They were given a 1-hr lecture, including conversions from milligrams to milliliters, and demonstrations including sterile handling of drugs, syringes, and needles, and the drawing of drugs into the syringes. They were coached in practicing to perfection once, with written and mental calculations, and drawing the required dosage into a syringe. The test required correct drawing into a syringe, as rapidly as possible, the volume of solutions containing the required doses of eight arbitrarily chosen drugs (atropine 0.5 mg/ml; lidocaine 1% and 2%; decadron 4 mg/ml; doxapram 20 mg/ml; succinylcholine 20 mg/ml; d-tubocurarine 3 mg/ml; neostigmine 1 mg/ml; metaraminol 10 mg/ml). Each candidate had four trials. He was timed and mistakes were counted, one each for incorrect labeling, volume drawn, sterility in technique, size of syringe chosen, and bubble in syringe. The same test was given to four registered and two student nurses (Table II).

As expected, students experienced difficulties in figuring out dosages, in understanding the metric system, in measuring correct quantities of drugs, and in preparing bubble-free, aseptic injections. EMT's were slowest, and made an average of 1.75 mistakes at the second trial. The nurses made no mistakes then. Incorrect drug dosage accounted for 27 of 50 mistakes, and a large bubble for 12 of 50 mistakes. Atropine dosage needed a decimal conversion, and was the most frequently missed, the only one missed by nurses. There was no case of incorrect drug choice.

The diversity in quality and quantity of our nation's public school curricula was apparent in our EMT's. For instance, it is disappointing that in a nation with the highest peak performance in medicine, physics, and space exploration, the majority of high school graduates have never learned about the metric system.

The pre-hospital preparation of drugs by EMT's apparently calls for more intensive (nursing school type) training. Although some EMT's could be successfully taught to start venous infusions, teaching intramuscular injections is easier. Therefore we recommend intramuscular injections of essential drugs by EMT's. These should be single dose, prepackaged, aseptic injections, and would be administered only on physician's orders by radio.

The second phase of this project was in arrhythmia recognition. This included 6 hr of seminar teaching with slides of the normal ECG and five life-threatening arrhythmias (premature ventricular contractions, ventricular tachycardia, ventricular fibrillation, bradycardia, asystole). Some EMT's also practiced with Arrhythmia-Anne. They learned easily how to apply the electrocardioscope electrodes, and were encouraged to monitor patients' ECG's en route. They could also readily learn proper application of external defibrillating electrodes. However, at the conclusion of the course, only 50% of the students who attended could identify promptly all five major arrhythmias.

Therefore the third phase, ECG telemetry, which had to be postponed because of lack of funds, is being initiated now.

RESULTS

TRAINING RESULTS

Both written and practical examinations were administered for each portion of the course. Ten of the 44 trainees dropped out during the 3-month basic course. Twenty of 25 in the first group and 14 of 19 in the second group finished the course and passed the final Level I examination. This covered material of the National Research Council Level I EMT Curriculum of ap-

FIG. 1. Police van borrowed from Pittsburgh Police Department and equipped according to national recommendations.

proximately 70 hr (11), which was part of the 3-month course (Table I, B, I–V). A review board invited trainees of both groups to appear for examination during their on-the-job training period if they wished to be certified as Level II EMT's (all material listed in Table I). One of the 34 who took the examination qualified. The majority showed reluctance to take this more stringent examination at the one time it was given, although most had passed its technical parts during the course.

The FHE Ambulance Service still employs 25 of the 34 graduates who resulted from the two training courses. Six of the 25 started college while continuing to work on shifts of the MICU service. Only two of the nine who left took better-paying jobs outside of the health professions.

The main improvement of the training program for the second group consisted in more intensified practical drills and more clinical hospital-based involvement in patient care as members of the health care team.

AMBULANCE DESIGN AND EQUIPMENT

While awaiting delivery of specially designed MICU vehicles, we borrowed police vans from the Pittsburgh Police Department and equipped them according to national recommendations (6, 8, 20) (Fig. 1). Portable items include: a small oxygen cylinder with semi-open plastic O_2 inhalation mask; a Laerdal self-refilling bag-valve-mask unit with O_2 reservoir tube for artificial ventilation and oxygenation; a portable Laerdal suction machine; regular pharyngeal airways and S-tubes; tongue blades; dressings; burn pack; obstetrical pack; splints; extrication board; and a short backboard modified for CPR. A physician's box contained material for tracheal intubation, venous cutdown, percutaneous venous infusion, injection of drugs, and pleural drainage.

In January 1969, this service began using specially modified Ford Econoline Vans designed to meet national recommendations. In addition, they carried a portable, battery-powered, external defibrillator-electrocardioscope, and a heart-lung resuscitation machine for use inside or outside the vehicle. Details are described elsewhere (20).

The 50- or 60-inch internal height of the patient compartment permits an attendant in the

sitting or kneeling position to care for the patient.

A seat at the patient's vertex allows the attendant to care for the patient in a position similar to that of the anesthetist in the operating room (Fig. 1). Space for a kneeling attendant at one side of the stretcher facilitates performance of external cardiac compression and other maneuvers. Nurses or physicians assisting the transfer of critically ill patients usually direct the procedure from a position beside the stretcher. From this location, they can read the electrocardioscope-monitor and administer external electric defibrillation.

Installations include: automobile-engine-powered suction with wall outlets and controllable suction pressure and flow; an M-size oxygen cylinder with two wall-outlets, one for inhalation mask or Laerdal resuscitation unit and the other for an Elder demand-inflation valve; air conditioning; carpeting; and storage space for backboards under the floor. We prefer wall-wells to cabinets for storage. Portable items include all those mentioned above, and in addition some rescue equipment. A jump kit (knapsack) which can be slung over the attendant's shoulder, freeing his hands, contains "first line" equipment.

COMMUNICATIONS

The dispatching and administrative center of the FHE MICU Ambulance Service operates from the Presbyterian-University Hospital Emergency Room area, with a satellite station located at Mercy Hospital close to Pittsburgh's main business district.

Requests for service originate from two sources: 1) a direct telephone line for the City Police dispatcher, and 2) two lines from the General Telephone Exchange. The MICU dispatcher may link requests for service received via the General Telephone Exchange with the physician advisor by activating an extension telephone located in the hospital ICU. Attendants in the field carrying walkie-talkies may communicate via two-way radio with the advising physician in the hospital ICU. This link also travels by way of the FHE dispatcher.

While the communication system generally performed well, some problems arose. 1) Calls coming from the police dispatcher could not be connected with the physician advisor. 2) Attendants in the field could not talk directly via radio to the caller. 3) Locating the addresses of callers was sometimes difficult, in spite of help from the Police Department and the availability of city maps and directories. One potential solution for all three problems might be installation of a link between the MICU radio network, the general telephone system, and the police dispatcher. In addition, improved methods for familiarizing trainees with the geography of the area are needed.

SERVICE RESULTS

In July 1968, the newly-trained EMT's started as employees of the FHE hospital-based MICU Ambulance Service. First the service covered all emergency calls in two of Pittsburgh's police districts, according to a contract with the city government, and responded to any emergency call from other areas which could be reached. The number of hospital-to-hospital transfers increased, particularly for patients who required life-support during transportation, although FHE undertook no promotional efforts to expand this type of service.

During the first 12 months of operation, the Service received 5,868 calls and transported 4,647 patients (Table III). The ambulances arrived at the scene 2 to 10 min after the dispatcher received the call. On many calls presenting as emergencies, patients either refused service or had already departed for the hospital by other means. The service conducted almost 600 interhospital and convalescent transfers, and transported 25 infants from outlying hospitals to the health center's neonatal ICU. Physicians accompanied the ambulance crews on 39 calls. Forty patients received cardiopulmonary resuscitation, and five of these 40 survived and left the hospital with intact central nervous systems. We deliberately failed to report service data after the summer of 1969, since they would be misleading. For financial reasons, the service had to take on an excessive number of elective transfers of convalescent patients.

ORGANIZATIONAL, SOCIOLOGIC, FINANCIAL, AND POLITICAL CONSIDERATIONS

Bureaucratic obstacles associated with funding of the first training program left no time for preparing curricula, faculty, and facilities. In order to complete the extensive preparations re-

quired before courses began, an administrative staff should have been procured, indoctrinated, and established well in advance of the first class day. Federal funding agencies did not appreciate the need for a starting-up time required to find competent faculty and facilities. We therefore had to improvise.

Organization of the training program encountered many problems calling for continuous anticipation and adaptation of the technical director (G.E.) and the medical co-ordinator (D.B.). Every moment of the students' time had to be carefully planned well in advance of the first class day. Students at first unfamiliar with usual hospital protocol created awkward situations. Violations of established hospital customs occurred, but were usually due to ignorance rather than malice. With ingenuity, areas of potential misunderstanding were anticipated.

Since students' fundamental behavior patterns and skills in observing, communicating, and writing may not meet required standards, because of neglect in their prior education, the program had to offer opportunity for training in these areas in addition to the medical and technical curricula. It became obvious that standards for personal appearance and social relationships, as well as hospital customs and protocols, had to be explained and reasonably enforced.

Avenues of communication between students and staff have to be kept open to avoid misunderstandings that may grow from latent hostility and suspicion. Counseling services, prepared to assist with personal problems, were made available as the program progressed. Early recognition and discussion of real or imaginary grievances could abort problems which, when ignored at first, became serious difficulties.

Abuse of narcotics and other dangerous drugs proved a significant but not widespread problem. Loss of needles and syringes carried aboard the MICU's stopped when supplies were placed in sealed boxes in the jump kit. Unauthorized breaking of the seals resulted in immediate suspension. Most trainees with a history of involvement in illicit drug traffic left the program, but three remained after rehabilitation.

Physician-controlled rather than bureaucracy-controlled selection of trainees might have anticipated and therefore avoided some of these problems.

Most trainees strove for excellence in performing specific tasks if they were made to understand the relevance of these tasks in patient care. Instructors learned to proceed through the curriculum slowly, with frequent explanations relating the problems at hand to future functions of the EMT's.

TABLE III

FHE MICU Ambulance Service First 12 Months (1968/1969)

Patients	
Called	5,868
Total transported	4,647
Convalescents and intrahospital transfer	697
Life-threatening conditions	235
Respiratory insufficiency	191
Myocardial infarction suspect	65
Cardiac arrests	40
Burns	21
Poisoning	5
Cerebral vascular accidents	77
Obstetric cases	122
Newborn infant transfer	25
Trauma	324
Head	167
Chest	12
Spine	34
Extremities	86
	2,101
Treatments	
O_2 inhalation	1,393
IPPV	191
CPR	40
Survived with intact CNS	5
Physician staffing	39
	1,668

The service of the University Hospital-based (not owned) MICU ambulances is under the administrative control of Freedom House Enterprises, Inc. (FHE), a private, non-profit corporation of the black community with a Board of Trustees of which the medical director is a member. Because of its nonmedical orientation, some EMT's have been distrustful of the FHE administration.

The service is managed by a white businessman. The associate manager and supervisory positions are filled by graduates of the training program. Recently FHE has hired white ex-armed forces corpsmen (four so far) who are working and learning side by side with the black

EMT's without difficulty. We are aiming for a racially integrated service.

An anesthesiologist is medical director who holds weekly sessions to review operational and patient care problems, and to update skills and introduce innovations. The weekly seminars became well attended only after they were made part of paid service time.

The EMT's adapted well to medical problems, and most exhibited common sense in actions and when reporting cases. Their ability to communicate improved steadily. With few exceptions, they showed loyalty toward the service and pride in their work.

Racial prejudice played a role in some cases, where bigotry hampered patient acceptance of the EMT's at first encounter. After demonstration of skills and life-saving capability, however, the reputation of this team in the community made acceptance possible in most areas of operation, irrespective of the resident's race or economic status.

The national reputation of the service was enhanced by an exhibit, co-sponsored by the American Society of Anesthesiologists, the American Medical Association, and the University of Pittsburgh, which stimulated improvements in community-wide emergency medical services and helped promote nationally the sociologic and medical concepts of this program.

A grant from the Richard King Mellon Foundation supplied funds to purchase the three fully-equipped MICU vehicles at a cost of $13,000 each. This included the $2,800 defibrillator/electrocardioscope, but not the radio equipment.

While funds for training were made available by federal government grants (Office of Economic Opportunities and MDTA of the U. S. Department of Labor), requests for funds to support the MICU Service were unrelentingly denied by national agencies, both governmental and private. Repeated promises and assurances, followed eventually by refusals, intensified the frustrations. Confidence of the EMT's in themselves and their leaders avoided dissolution of the team at an early stage. Finally, at the last moment, support from local and national philanthropic organizations (Falk Foundation, Ford Foundation, Scaife Foundation, Kaufmann Foundation, Pittsburgh Foundation, and Allegheny Conference) allowed the service to remain operational for a while. Subsequently the city of Pittsburgh entered into a contract with FHE to provide ambulance service to the ghetto and several other city districts. Uncertainty about availability of the city contract until the last moment made employment of the second group of trainees questionable. Some reacted with a defeatist attitude, since they had known failure all too often before.

The necessity of paying more than a living wage to attract and hold high-caliber EMT's on a 24-hr basis makes operation of an MICU service expensive. Pilot projects with MICU ambulances elsewhere have been supported by grants or hospitals. Nevertheless our MICU service operates on a budget not larger than that of a general full-time urban emergency ambulance service without sophisticated MICU life-support capability, namely about $120,000 per year per vehicle.* One full-time vehicle, which can cover all the emergency calls of approximately 100,000 inhabitants in urban areas, requires eight to 10 full-time attendants on the payroll to allow two men per shift for around-the-clock staffing. In rural areas, part-time employment by the hospital to which the service is attached should be considered.

Insurance coverage for intensive care outside the hospital does not exist, and most patients transferred by our service could not afford the $40 per trip cost. Any future meaningful health insurance should include pre-hospital emergency care. The high cost of quality ambulance services must be borne at least in part by the community.

At present, the need to survive financially has forced the FHE Service into contracts for mere transportation which could be done by less qualified personnel. The men are unhappy for not being fully utilized in the job for which they were trained. The service's primary goal, namely answering calls for aid in potentially life-threatening cases throughout the area, is being pursued by the Allegheny County Community Council on Emergency Medical and Health Services. We applied through the Council for a grant from the Department of Transportation which would finance Council, communications, a school for EMT's, and a telemetry pilot project.

* U. S. Department of Transportation: Economics of highway emergency ambulance services. Accession No. PB 178837 and PB 178838. 1969.

The money became available in July 1969, but the County government refused to accept it because of lobbying from the 2,500 volunteer fire department ambulance men of Pittsburgh's suburbs, who feared competition.

So far, co-ordination and upgrading of ambulance services have been stifled nation-wide by the lack of a sound, uniformly financed health care system which includes pre-hospital emergency medical services.

CONCLUSIONS

Hard-core unemployed and underemployed men and women can be trained to operate an MICU service skillfully and efficiently. They can develop manual dexterity, professional demeanor, and an ability to solve vexing problems of field management.

Highly efficient MICU vehicles can be built from standard vans at a cost competitive with the prevalent unsatisfactory hearse-type ambulance.

Since ambulance services are, of their nature, rarely self-supporting, funding should be planned accordingly. There should be community-wide planning and co-ordination of all ambulance services to permit maximal utilization of specially trained EMT's, who should be mobilized by the dispatcher either primarily or secondarily in all calls suspect of life-threatening conditions.

Improvements in emergency medical services through National Research Council Level I and II training programs are possible using previously disadvantaged citizens as a manpower source. A community commitment for job availability and security after training is essential.

SUMMARY

This pilot project, which trained 44 "unemployables" as Emergency Medical Technicians (EMT's) for a mobile intensive care unit (MICU) type ambulance service, was motivated by: 1) the gap between knowledge in life support and its application; and 2) the increasing awareness of the need for meaningful occupations for educationally and racially disadvantaged citizens.

Since some students had not completed secondary schooling, adult education courses prepared them for high school equivalence examination. The basic EMT course of 3 months was hospital-based and included: a) pre-clinical training; b) clinical training; c) field experience; d) life-support drill; and e) administration. Nine additional months with on-the-job experience and training in arrhythmia control followed. Teachability tests included cardiopulmonary resuscitation during transport, tracheal intubation, venous infusion, handling of drugs, and recognition of arrhythmias. Training stressed simplicity, repetition, and practice to perfection in life-saving and life-support measures.

Ten of the 44 trainees dropped out during the first 3 months. Twenty-five of the 34 EMT's who completed the program still staff the Freedom House Enterprises, Inc. (FHE) University Hospital-based MICU service. They perform resuscitation and transportation with considerable skill and judgment.

Inexpensive vans were modified as MICU's and equipped to exceed national recommendations. The total cost of each was $13,000, including defibrillator/cardioscope.

The success of the service was frustrated by unkept promises and bureaucratic controls of national granting agencies, until local philanthropic organizations rescued FHE from financial failure; and by local "politics" which prevented these EMT's from concentrating on life-threatening emergencies county-wide.

This medical-sociological project 1) served as a pilot project for National Research Council Recommendations on Emergency Medical Technicians' Training (Levels I and II) and Ambulance Design and Equipment; and 2) showed that motivation rather than past accomplishments indicates the professional success underprivileged citizens of ghettos may hope to achieve when allowed the chance to prove themselves.

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ADDENDUM

Since original preparation of this manuscript, the number of patients transported annually has increased from 5,000 to approximately 8,000; the number of ambulances has increased from three to five (three of which have the mobile intensive care unit configuration), and the operating costs per unit have fallen from $125,000 to $75,000.

While the project still aims to provide employment opportunity for disadvantaged blacks, vacant positions are sometimes filled with qualified non-blacks. Intraorganizational and com-

munity racism is far less a problem than it once was.

At least two separate studies (1, 2) and many spontaneous comments from medical personnel and patients have testified to the high level of care delivered by FHE crews.

DMB

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ACCIDENT SERVICE IN GREAT BRITAIN

Injury, the British Journal of Accident Surgery, devotes part of its January 1972 issue (Vol. 3, No. 3) to a section on "Accident Services Today," with articles on emergency care in Bradford, Stoke-on-Trent, North Bedfordshire, and Belfast. The introductory editorial states:

"The authors whose papers were solicited were asked to describe the problems of their environment that presented before an organization was planned, the details of the service as operating at the moment, how far the problems had been met, and their views about future developments, both locally and nationally.

"It is proposed, in future issues, to present accounts of ambulance services and of accident units from appropriate centres abroad. It is hoped that comparisons between different organizations will help in establishing a modicum of standardization while allowing for special requirements demanded by different regional situations. Invitations have been sent to surgeons responsible for accident services in specific areas, but others who have developed such accident units will be welcome to submit papers directly or to write to the Editor who will provide guidelines for the preferred format, so that some comparisons can be made between different organizations."

Each article describes the physical plant and the equipment of the emergency facilities, with their advantages and disadvantages. Medical and paramedical personnel, training requirements, division of responsibilities, and working hours are detailed. The geographical area served, triage of patients, types of injuries, X-ray and laboratory services, and follow-up clinical care are also outlined.

The Royal Victoria Hospital, Belfast, judging by a floor plan and several illustrations, has an extensive and well-equipepd emergency department. The article notes that "it is never necessary to move an accident patient to another hospital, for all the services and specialties which could be needed are present somewhere on the campus."