

A PLAN FOR A CASUALTY CARE AND TRANSPORTATION PROGRAM

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•SINCE World War II, the public has been hesitant to acknowledge the antiquated state of services available in the United States for the immediate care and transport of the sick and injured. The recent succession of wartime experiences has repeatedly emphasized that prompt and skilled emergency care and evacuation are the primary requisites for diminishing morbidity and lowering mortality, and this very pointedly underlines the chaotic state of civilian emergency care in America. It would seem reasonable that the American in his own country should have the right to emergency care equal to that afforded the serviceman on a foreign battlefield. That the average accident victim in this country should be first treated by well-meaning, but almost completely untrained, personnel who are often incapable of rendering basic first aid seems almost inconceivable in the light of current medical expertise. Perhaps even more astounding is a comparison of the serviceman, who is placed in a vehicle specifically designed and equipped for the proper management of the injured, and the civilian, who is picked up for emergency transport by a hearse and thus rides to his fate in what may be an all too appropriately named vehicle.

To raise the standards of emergency care in the United States to those currently existing in war zones is a challenge that must be met inasmuch as accidental death on our highways far outstrips deaths from wars, pestilence, and pollution.

The major effort in improving emergency care and transportation should first be directed to the planning of the physical location of ambulance services, emergency rooms for primary care, and centers for definitive treatment. Without an overall plan, improvements in the detailed operation of each of these components will be of little avail. This has particular pertinence in rural or sparsely populated areas where a remarkable percentage of vehicular accidents occur.

The need to develop a well-organized system of ground transportation for the sick and injured is basic to any discussion of a sound emergency medical service (EMS) system. Awareness of this has evolved from the authors' research into the current status of emergency care and transport facilities and development of a model program for the state of Missouri. It is recognized that, both in rural areas remote from medical centers and in traffic-congested, densely populated metropolitan centers, air transport can be beneficial, but we will discuss only the fundamental ground system because this can readily be supplemented by aircraft and operational crews as they become available and economically feasible.

Experience has shown that every EMS area differs in economic, manpower, and ancillary support resources and that organization or reorganization must reflect these considerations. Therefore, any independent action taken to develop an EMS area should be a coordinated procedure on a regional or statewide basis so that support will be suitable and continuing. Such cooperative efforts can be highly cost-effective.

It has been documented that a population of 80,000 people is needed to underwrite an ambulance service purely from a financial point of view. In Missouri, only four metropolitan areas can completely support a profit-making emergency medical service. The

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remaining areas will and do require public or private subsidization or volunteer efforts or both. Approximately one-third of the counties in Missouri are without a hospital, and an additional 50 percent of the counties have hospitals with bed capacities of less than 100. In only five counties do the hospitals have all medical specialties represented.

A hospital bed capacity of more than 100 appears to be necessary to sustain a minimally staffed and equipped emergency room on a 24-hour basis; therefore, it is obvious that in 80 percent of the state of Missouri only basic care can be obtained, while comprehensive care in an emergency room can be secured in less than 5 percent of the state. It is unfortunate and often disastrous for people living in rural Missouri and for the considerable numbers of people in transit that the areas without hospital facilities and, thus, those that provide inadequate emergency medical services cover large blocks of the state. With there sometimes being more than 200 miles between emergency rooms, careful planning is imperative to ensuring that there will be adequate mechanisms for immediate care and transport of accident victims.

At present, the basic and most reliable emergency medical transport system is the highway vehicle. Uncertain weather conditions in Missouri and high operational costs would currently preclude an attempt to develop an airborne system. It is possible, however, that air transfer of patients from a primary first aid area to the final treatment center could be incorporated gradually into a well-planned and smoothly functioning regional or statewide ground system. For the present, however, the basic focus must be on the location of ambulance squads, the proper selection and training of ambulance personnel, and the development of appropriate emergency vehicles.

The initial care of an accident victim who is an hour or more away from even basic medical treatment is a greater determinant of consequent morbidity or mortality than is the definitive care that may be only minutes away in a city. In Missouri, as it is throughout the nation, the death rate is four times greater in the country than in the city, even though injuries are usually more extensive in the city.

The life of the injured patient, then, is dependent in large part on the initial care he receives. This, in turn, is dependent on the equipment and type of emergency vehicle available to transport him.

PERSONNEL

The most important elements in an ambulance service are the drivers and attendants. On the basis of a 5-day, 40-hour week, a minimum of nine persons is needed to operate each vehicle, and because of vacations and sick leave an additional person is required.

It is imperative that the turnover of employees be kept to an absolute minimum because appropriate training not only is difficult to provide on a continuing basis but also is very time-consuming. Because driver-attendants are given such grave responsibilities, very careful and well-planned selection procedures are necessary. We believe that a driver-attendant should be more than 21 years old and have no record of moving traffic violations; no police record for other than simple misdemeanors; a high school diploma; evidence of maturity, stability, and dependability as accrued from work records, financial records, church attendance, and community efforts; and good physical health.

We have found that intelligence testing and other commonly used written evaluation procedures are quite disappointing in governing the selection of ambulance personnel inasmuch as these scores tend to reflect learned material rather than innate intelligence. Assuming the previously mentioned qualifications, we feel that a personal in-depth interview is a much more satisfactory way of assessing the applicant's suitability. Because this vocation seems to attract people with various types of personality problems, the interviewer should inquire specifically why the applicant desires this type of employment. The replies, though not always factual, can certainly help in eliciting the more blatant of the undesirable traits that can so seriously affect the individual's ability to function in emergencies.

The applicant should have a thorough physical examination. Persons suffering from heart disease, hypertension, diabetes, seizures, or other conditions that might interfere with proper handling of a vehicle or a patient should be considered undesirable.

The applicant must have a chauffeur's license to operate the ambulance, but it is also desirable that he attend the National Safety Council's course in defensive driving because all too frequently the driver will need to operate the vehicle under difficult circumstances.

Salaries for drivers and attendants are the largest single item in the overall budget. Because it is futile to attempt to develop a sophisticated emergency medical service without able, well-trained attendants, the positions must be made sufficiently attractive financially to secure people who are deeply interested in and satisfied with their careers. Salaries for these positions will necessarily be higher than those usually proposed under present conditions and should be commensurate with those offered registered nurses.

Inasmuch as the financial requirements for salaries alone are considerable, only a few areas in the state can fully support an emergency service system operated by career driver-attendants. Under these circumstances and, of course, dependent on the level of services required and on available financing, various combinations of personnel may be the only appropriate solution.

In areas of low population density, there may not be sufficient moneys available to support salaried personnel even on a tax-supported basis. Here the service may need to depend almost exclusively on volunteers. Because of business and other everyday commitments of volunteers, a minimum of 30 people should be trained for such an operation. Duty schedules must be arranged well in advance with backup personnel available, and these schedules should be rigidly adhered to. If properly planned, this approach can be publicized and can actually become a valued and rewarding civic duty that carries considerable prestige for the participants. Whenever possible, the service should include one salaried full- or part-time member who would arrange schedules, order supplies, secure vehicle maintenance, and perform other continuing duties of an administrative nature.

In some communities, the county hospital can consider the inclusion of an ambulance service as part of its operation; it is possible to lower costs materially by assigning ambulance personnel to other duties in various areas of the hospital between ambulance calls. Appropriate duties would be in emergency rooms, intensive care units, recovery rooms, and inhalation therapy and delivery units. The training and expertise of these individuals would make their services invaluable in these areas. It is an important requisite that such duties not interfere with the primary function of these individuals or prevent their immediate departure on an ambulance call. The drivers and attendants should carry pocket pagers to permit immediate contact with them. Ancillary hospital duties can be rewarding for ambulance personnel; such duties would fulfill, at least partially, the need for continuing education under supervision.

It is clear that the proportion of salaried and volunteer personnel will vary considerably depending on local requirements and financing, but it is vital that a similar quality of training be given to all.

Combining emergency medical service planning with the operations of other emergency services has been successful in some areas. In our opinion, a combination with the police is undesirable because, following an accident, the duties of policemen in traffic diversion and participation in the mechanics of wrecker operations do not give them the needed freedom to join the immediate management and transport of the injured. Combined operations with fire departments appear to be more reasonable because there are fewer coincidences of fires and accidents.

During the past 10 years, many programs have been proposed for training ambulance attendants. In our opinion, however, the majority have serious deficiencies. In most instances, attempts have been made to train attendants in a 3- or 4-day period because it has been almost completely erroneously assumed that these individuals had some previous knowledge of the subject. Even after exposure to the current basic and advanced first aid courses, there are few attendants who can be expected, after so brief a training program, to act promptly, rationally, and without supervision in the variety of emergent life and death situations that they are likely to encounter.

A few institutions have proposed a 2-year course leading to an associate degree in emergency nursing, and this, followed by a 1-year internship, would seem to be quite adequate for training of career personnel. In the first year, basic science courses

would be offered, followed by a year of clinical science and supervised clinical practice. With such a background, the career status of the emergency medical technician would, in all probability, be ensured. A course similar to the one offered LPNs for a 12- to 18-month period might be acceptable but would really be less desirable. In any event, the basic science courses should be similar to those offered in regular nursing courses, whereas during the clinical experience emphasis should be placed on emergency situations such as accidents, intensive care problems, cardiac arrest, childbirth, and acute psychiatric syndromes. Upon graduation, the technician would be accepted as a competent worker in the emergency or critical care areas of the hospital as well as in the out-of-hospital ambulance program.

Training of this sort undoubtedly will not be generally available in the near future, and certain adjustments will need to be made to conform to present realities. To provide quality instruction at present, the physicians who see the patient initially in the emergency rooms must be recruited and proselytized to act as preceptors in a continuing in-service program for all attendants. This type of training should continue even when more formal educational facilities and opportunities become available. Refresher courses eventually should be required for renewal of the technician's license.

For the present, the minimum requirements should include basic and advanced Red Cross training or a recognized equivalent and a minimum additional program of instruction designed and administered by the state medical society. Attendants should be licensed only upon the successful completion of these courses and after passing written and oral examinations. Standards could be raised as improved training methodology is designed and made available so that adequate emergency care could become generally available.

Although some ambulance operations designate ambulance personnel as either drivers or attendants and prescribe differing pay scales, it is our opinion that, because of unavoidable errors of scheduling and illnesses, all personnel should be trained to perform in both categories. If this were not done, it is conceivable that two drivers or two attendants could find themselves on duty at the same time.

THE EMS SYSTEM

To effectively and efficiently utilize the resources available, the state should be divided into EMS regions without regard for current political boundaries. A hospital in the center city of each region would serve as the coordinating base for all emergency services in that area. It is hoped that this hospital would be staffed with all necessary specialists and would have appropriate equipment. The EMS region could include 10 to 20 counties. Within each region, smaller ambulance districts consisting of two to eight counties could be organized so that each could have at least a minimally equipped and staffed emergency or first aid station. The basic unit of ambulance service would be the local unit, which should service an area with a radius of approximately 20 miles.

In time of disaster, district and regional areas would function in the coordination of services, routing patients where facilities and other support were most available. On a routine basis, each county within a district could act as a backup organization for neighboring counties. Obviously, district operations will need to be relatively fluid so that assistance and support can go where needed without depleting any one area completely. Such elasticity is practicable only with a well-planned and coordinated communications system.

Inasmuch as tax rates and other resources vary from county to county and even within counties, the EMS system should logically be set up as a statewide operation quite similar to the state police arrangement. Under these circumstances, there would be no contra-indication to the crossing of city or county limits, which at present has a deleterious influence on the provision of care. In actuality, a national system in which state boundary areas would no longer be roadblocks could provide high-caliber emergency service. Although a national system is theoretically workable, a basic obstacle is the scarcity of local physicians and emergency rooms. Until more regional centers are developed, this drawback will have to be overcome by a well-organized communication system.

Despite the fact that an ideal EMS system may be years in the future, proper planning and state supervision can ensure that the present situation be improved with a very modest investment of time and money.

THE EMS AMBULANCE

An ambulance must be an extension of the emergency room in terms of life-saving equipment and trained personnel. The vehicle has two compartments: one for the driver and the other for patient care. In the patient compartment, sufficient space is required for two or more victims, a seat for the attendant, adequate room (both height and width) for rendering care and for medical supplies and equipment. Because accident victims may require extrication by the ambulance crew prior to initial treatment, the ambulance should contain some basic equipment for this in areas of the state where there are no rescue squads. If equipment is placed where access can be gained from the outside of the vehicle, the limited storage space within the vehicle can be increased.

In 1968, the Emergency Health Services Branch of the U.S. Public Health Service (PHS) published a list of minimal requirements for the internal dimensions of an ambulance. These were listed as height, 54 in.; width, 72 in.; and length, 110 in. It is obvious from these minimum dimensions that the vehicle loses the sleek look of the limousine. Of the vehicles currently available, the chassis-mount camper truck and the van type of truck are those most easily converted for ambulance use. The vehicle should be chosen based on whether the terrain to be used is urban or rural, so that with proper internal design for load placement the patient may have a comfortable ride. In addition, the vehicle should provide the driver the room and power (two- or four-wheel drive) that may be required by local topographic considerations (poor secondary roads or off-the-road operation). The disadvantage of such a vehicle is its length. This could be reduced if a cab-over-engine vehicle were manufactured for the class of weight chassis required. The eye height of the driver would be raised advantageously, but over-cab storage would be reduced.

Other requirements as listed by the PHS are separate driver and patient compartments, illumination adequate for medical treatment, separate temperature control of patient area, two-way radio, warning devices, and design and equipment that permit treatment of at least one patient during transportation. The ideal vehicle should reflect, in its size and equipment, the capability for life saving and a reduction of morbidity. It is envisioned that, as more sophisticated medical emergency equipment becomes available and training in its use is more extensive, the present minimum dimensions will not be adequate. Nationally, we face the problem of designing and manufacturing the variety of vehicles that will be needed for the different types of terrain encountered in this country.

THE RADIO COMMUNICATIONS SYSTEM

The radio communications system for EMS should be a reliable link of the ambulance to the emergency room, law enforcement agencies, and physicians in remote rural areas. Unfortunately, radio communication is limited to approximately a 20-mile radius from the base station, and changes in topography can severely restrict transmission and reception. The local radio system functions to direct the ambulance to the scene of the emergency, to relay calls to and from law enforcement agencies, to contact various emergency rooms in the areas regarding available facilities, and to indicate the number and time of arrivals of casualties. It can also be life saving when used to direct the treatment given by the attendant at the scene and en route to the emergency room.

Extreme care must be taken in the selection of a radio system inasmuch as over-zealous salesmen may attempt to sell a product far too powerful for the needs of the area. This can result in poor local reception and even "skipping" into distant areas with a resultant block of their systems. Before any system is purchased, it is preferable that the alternatives be discussed with groups who already have installed a program. The state government also may have consultants who can serve as advisers.

One of the prime defects in present EMS systems is the lack of treatment facilities at the local level. At the present time, there are 39 counties in Missouri without a

hospital, and there are 26 counties with hospitals with less than 50 beds. Realistically, an adequate emergency room in a hospital of this size cannot be expected; therefore, in at least half of the state, emergency care will not be readily available locally. It follows, therefore, that, in cases requiring more sophisticated immediate medical attention than that that the attendant can render, some provision will need to be made for stabilization of the patient's condition prior to transportation to the medical center. In these areas, physicians could be equipped with pocket radios, and the ambulance attendant could then arrange to meet the physician at his office or in the first aid center where initial treatment could be begun. As soon as the patient's condition is stabilized, he could then be transferred to the hospital for definitive care.

It is apparent that, in any EMS system, smooth functioning of the operation is to a great extent dependent on the communication system. In metropolitan areas, paid operators will be needed to operate the radio on a 24-hour basis. In rural areas, however, the dispatcher can readily be based in the local sheriff's office or at the telephone company. No matter what the size or the population of the area involved, it is imperative that the EMS operation be on a continuous 24-hour basis.

Ambulance drivers will be aided greatly in reaching the site of an emergency if they are furnished with maps with coordinates. In this manner, "an accident on Route 7" is translated to "13-C," which pinpoints the site to which the vehicle is directed.

Each EMS communication system should be equipped with four frequencies: the first for routine day-to-day operations within the system, the second for routine between-service operations, the third for contact with law enforcement agencies, and the fourth reserved for disaster operations only. This last frequency would be common to all emergency services within the area. Although such a system would initially be more expensive, subsequent savings realized from such a coordinated service would soon offset the initial investment.

ROUTINE MEDICAL TRANSPORTATION

To complement the emergency transportation service and to secure continuous utilization of its components require that the use of the ambulances for the nonemergency patient on routine trips from home to hospital or clinic and the transfer of patients between hospitals and convalescent homes be readily and profitably incorporated into the operation. In these circumstances, the patient could be of the semi-ambulatory, wheel chair, or stretcher case. In more densely populated areas, this service might require two or more special vehicles: a van type for the walking and wheel chair out-patients and an ambulance similar to that used by the local EMS for the stretcher patients. In less densely populated rural areas, backup ambulances would be needed to ensure that transportation would be available for the EMS patient when the prime vehicle is involved in other services. All of these ambulances should have a radio, medical supplies, and equipment.

Assigning routine scheduled medical transportation to area morticians permits the development of a local EMS system initially without great expense. Unfortunately, the time required for transportation of individuals for tests, treatment, or admittance at a medical center is often excessive. Experience in rural areas indicates that the round trip usually requires 2 or 3 hours, and often almost one working day is consumed because of waiting time at the center. Proper planning must incorporate arrangements to either hospitalize, treat, or discharge the patient within a given length of time; otherwise, the waiting time will increase the cost of the services.

Although many authorities wish to separate routine and emergency medical transportation completely, we feel that this is only feasible in the large metropolitan areas. The routine transportation vehicle affords vital backup in any instance when more than the usual number of emergency vehicles are needed.

Two accidents occurring simultaneously at opposite ends of the district or a single accident in which three or four persons are injured can easily overwhelm almost any emergency system. It is mandatory, therefore, that morticians be encouraged to provide standby equipment and coverage for the emergency service should they not desire to continue actively in emergency care themselves. It should be stressed that all

Table 1. General requirements for emergency medical service.

General Requirement	Items
Medical bag	Drugs and IV fluids deemed necessary for treatment of burns, blood loss, and shock
Medical equipment	Oxygen and masks, airways, sphygmomanometers, stethoscopes, splints, stretchers, back boards, surgical instruments
Medical supplies	Bandages, adhesive tape, IV fluids, surgical gloves, urinals, emesis basins
Radio communications and administration	Portable transmitter and personal portables, patient tag forms, supply forms
Power and lighting	Generator, light bulbs, cables, light and power sockets, battery chargers
Personnel equipment	Coveralls, hard hats with head lamps, work gloves, boots
Rescue equipment	Ropes, short scaling ladders, portable-power tool kit, sledges, pry bars, basket litters
Other	Water supply, electric heater, coffee pot and coffee

personnel, in routine or emergency transportation, should be as well trained as circumstances permit.

THE MOBILE EMS STATION

A medical disaster may be defined as any event resulting in injury or death to more persons than can be accommodated easily by a local emergency room. A disaster situation occurring in a small hospital would be no more than routine in a larger facility. Disasters are caused not only by hurricanes, atom bombs, and airplane crashes. Bus wrecks, fires, or even food-poisoning in a nursing home can mean disaster to a small treatment facility. In short, any event that suddenly and completely overwhelms the emergency facilities is a disaster. Certain disasters have occurred because of lack of coordination of facilities, when all patients were brought to one medical center while other centers were not used at all, even though they were closer to the accident scene. To avoid such a calamity, we propose the construction of a light trailer, designed and equipped to act as a triage station. A trailer, equipped with a power generator, rescue tools, radio communication, and medical supplies, could be pulled to the accident scene by either the ambulance or an automobile and also could serve as a base for search and rescue and coordination of patient flow into surrounding medical centers, as well as a triage operation.

The crew, including volunteers, would be responsible for the power, equipment set-up, search and rescue, communication, clerical, transportation, and supply operations. Due to the variety of specialties needed and the high probability that at any one time some members of the team might not be available, three times the needed complement should be trained. It would be advisable to have hospital personnel not connected with the emergency room to be trained for this operation, since they would be more readily available. All ages and sexes could be employed, and, if needed, a 24-hour operation could be maintained if all members responded to call on a shift basis. Dual training would reinforce manpower needs. It would be necessary in remote areas to request that distant emergency medical centers send supplies in returning ambulances or on their initial trips. The equipped trailer should be suitably housed, the generator frequently checked, and supplies rotated at specified intervals to prevent deterioration. A quarterly or semi-annual drill for training purposes would be suggested. The housing of the trailer would be the responsibility of the ambulance organization, on either a district or regional basis. The vehicle itself could be stored by either the organization or an appointed individual in a heated enclosure that would be available for immediate access by the person responsible for towing it to the accident scene. The supplies might vary, but Table 1 gives a list indicative of what might generally be required.

SUMMARY

A general plan for organizing and initiating a medical emergency service program has been outlined. For competent and economical operation, it is imperative that preliminary planning of the entire operation be carried out on a statewide basis to prevent wasteful duplication and to ensure that each area has adequate facilities available. The

selection of personnel, their training, and their salaries will be the largest single item of the service. No system can function efficiently without well-trained, career personnel.

The system is dependent on a coordinated communications system with links from the local areas to district and regional bases. Intercommunication with law enforcement and other emergency personnel is also vital.

An outline for vehicle design has been presented in addition to suggestions for an auxiliary trailer to be used in disaster conditions.

With proper overall planning for emergency care and with integration of existing facilities, we believe that any given area in this country can move smartly ahead in the rendering of adequate aid to its accident victims.