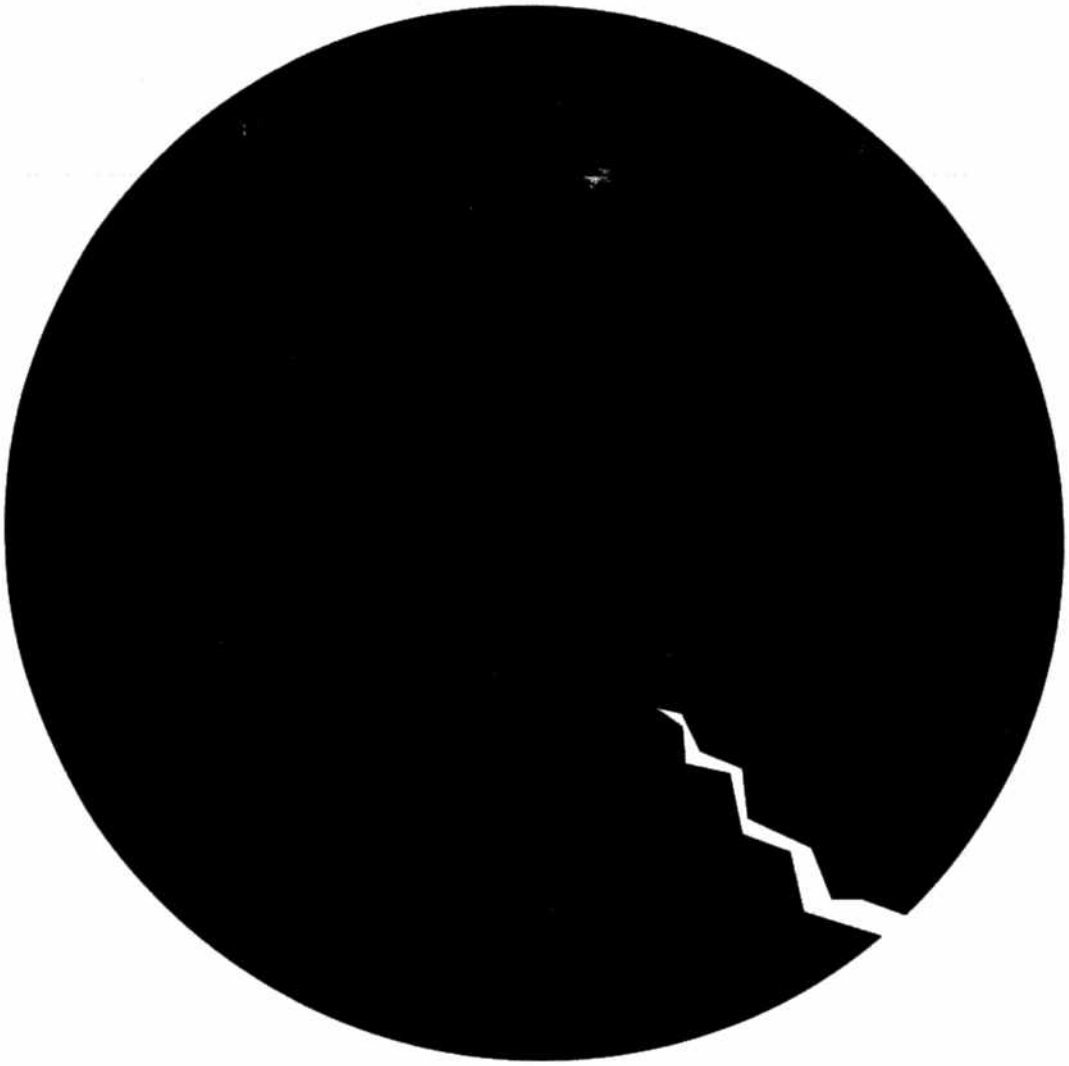

ACCIDENTAL DEATH AND DISABILITY: THE NEGLECTED DISEASE OF MODERN SOCIETY

DIVISION OF MEDICAL SCIENCES
NATIONAL ACADEMY OF SCIENCES NATIONAL RESEARCH COUNCIL

In 1966, the National Academy of Sciences published *Accidental Death and Disability: The Neglected Disease of Modern Society*. The paper revolutionized the way we view and manage injury in America. For many of us, it helped to define our careers. I am happy to announce that the National Highway Traffic Safety Administration has printed a commemorative edition of the original paper. You will find many of the things we take for granted recommended in these pages. Health and safety advocates from all walks of life used it as a resource for change some 30 years ago. Our hope is that, like *Accidental Death and Disability,* the *EMS Agenda for the Future* will be your tool for the next 30 years and help you strengthen the nation's emergency medical safety net.

Whether you are reading it for the first time or recycling that tattered photo copy, I hope you enjoy this testament to the power of vision.

Ricardo Martinez, M. D.
Administrator
National Highway Traffic Safety Administration
December 1997

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ACCIDENTAL DEATH AND DISABILITY: THE NEGLECTED DISEASE OF MODERN SOCIETY

Prepared by the

COMMITTEE ON TRAUMA AND COMMITTEE ON SHOCK
DIVISION OF MEDICAL SCIENCES
NATIONAL ACADEMY OF SCIENCES
NATIONAL RESEARCH COUNCIL

NATIONAL ACADEMY OF SCIENCES NATIONAL RESEARCH COUNCIL
Washington, D. C., September, 1966

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The Neglected Disease of Modern Society.

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PREFACE

During the past three years, Committees on Trauma, Shock, and Anesthesia, and special task forces of the Division of Medical Sciences, National Academy of Sciences–National Research Council, have reviewed with representatives of a large number of organizations the present status of initial care and emergency medical services afforded to the victims of accidental injury. These studies include reviews of ambulance services, voice communication systems, emergency departments and intensive care units of hospitals; appraisal of current research in shock, trauma, and resuscitation; revision of the first aid textbook for the American National Red Cross; preparation of a formal statement on cardiopulmonary resuscitation; and participation in disaster survey studies. A summary of these deliberations and a number of recommendations designed to reduce accidental death and disability are assembled in this paper.

Washington, D. C., September, 1966

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INTRODUCTION

In 1965, 52 million accidental injuries killed 107,000, temporarily disabled over 10 million and permanently impaired 400,000 American citizens at a cost of approximately $18 billion. This neglected epidemic of modern society is the nation's most important environmental health problem. It is the leading cause of death in the first half of life's span.

Although 49,000 deaths in 1965 were due to motor-vehicle accidents, more than this number died from accidents at work, in the home, in other forms of transportation, in public buildings, in recreational activities, etc.

Public apathy to the mounting toll from accidents must be transformed into an action program under strong leadership. This can be accomplished by the methods employed to bring poliomyelitis and other epidemics under control, and to make frontal attacks to conquer cancer, heart disease, and mental disease. Federal and voluntary agencies have mobilized to prevent and treat birth defects, muscular dystrophy, sclerosis, and palsy. Such concerted attacks have been mounted by conduct of national conferences at the Executive level, appropriation of funds by the Congress, pooling of resources by lay and professional groups through voluntary health agencies, expansion of research, and implementation of programs at regional and community levels. Basic to this unified approach is identification of the individual citizen with a means by which he can satisfy the inherent desire to serve his fellow man. Accidental death and disability too, can be attacked by such concerted actions.

This report summarizes current practices and deficiencies at various levels of emergency care. Salient factors which require early solutions are:

The general public is insensitive to the magnitude of the problem of accidental death and injury.

Millions lack instruction in basic first aid.

Few are adequately trained in the advanced techniques of cardiopulmonary resuscitation, childbirth, or other lifesaving measures, yet every ambulance and rescue squad attendant, policeman, fire-

fighter, paramedical worker and worker in high-risk industry should be trained.

Local political authorities have neglected their responsibility to provide optimal emergency medical services.

Research on trauma has not been supported or identified at the National Institutes of Health on a level consistent with its importance as the fourth leading cause of death and the primary cause of disability.

Potentials of the U. S. Public Health Service programs in accident prevention and emergency medical services have not been fully exploited.

Data are lacking on which to determine the number of individuals whose lives are lost or injuries are compounded by misguided attempts at rescue or first aid, absence of physicians at the scene of injury, unsuitable ambulances with inadequate equipment and untrained attendants, lack of traffic control, or the lack of voice communication facilities.

Helicopter ambulances have not been adapted to civilian peacetime needs.

Emergency departments of hospitals are overcrowded, some are archaic, and there are no systematic surveys on which to base requirements for space, equipment, or staffing for present, let alone future, needs.

Fundamental research in shock and trauma is inadequately supported.

Medical and health-related organizations have failed to join forces to apply knowledge already available to advance the treatment of trauma, or to educate the public and inform the Congress.

Specific recommendations follow discussions of the various levels of emergency care. Major steps toward a total national effort include:

Conduct of National Conferences on Emergency Medical Services

Under medical leadership, national forums should be conducted at the highest levels on all subjects important to total emergency care from the time of receipt of an injury through rehabilitation. The public must be aroused and fully informed of present practices, shortcomings in emergency services, and ways in which optimal care can be assured.

Establishment of a National Trauma Association

Responsible professional and lay organizations should pool their efforts through a voluntary National Trauma Association as a means of stimulating public demand for accident prevention and emergency medical services and satisfying these needs through research, public and professional education, and community services.

Organization of Community Councils on Emergency Medical Services

In each community, coordination of lay and professional responsibilities for emergency medical care should be centralized in a council on emergency services. A council would serve to coordinate teaching programs on basic and advanced first aid of the Red Cross, the Medical Self-Help Program of the Public Health Service, cardiopulmonary resuscitation of the American Heart Association, and others. It would bring together the resources of chapters of the Red Cross and the National Safety Council, committees on trauma of the American College of Surgeons, local and county medical societies of the American Medical Association, health departments, civic bodies, scouts, and others, to procure equipment, construct facilities and ensure optimal emergency care on a day-to-day basis as well as in disaster or national emergency. Councils could serve as active units to implement measures and to share in the contributions and benefits of nationwide programs of a National Trauma Association and other voluntary health and allied agencies devoted to emergency medical services.

Formation of a National Council on Accident Prevention

This report is concerned primarily with emergency care indicated after receipt of an injury and deals only briefly with problems of accident prevention. All pertinent research in this field should be reviewed. An analysis is in order of the several safety acts pertaining to government departments with administrative responsibility in accident prevention. The newly established Department of Transportation deals not only with motor vehicles but also with aviation, railroads, and other forms of transport. Other departments deal with mining, industry, flammable clothing, foods, and drugs. There are many common denominators of human behavior, environment, and mechanization applicable to each of these areas and their identification is essential to a systematic attack on this vital problem.

Creation of a National Institute of Trauma

Appropriated funds should be earmarked in support of the program of research in the therapy of trauma recently announced by the National Institute of General Medical Sciences. This would include processing of grant requests for research related to shock and trauma which are now considered by numerous Institutes. Training for academic careers and fellowships in traumatology should be supported. These combined activities call for establishment under the U. S. Public Health Service of a National Institute of Trauma.

THE MAGNITUDE OF THE PROBLEM

Deaths

Accidents are the leading cause of death among persons between the ages of 1 and 37; and they are the fourth leading cause of death at all ages. Among accidental deaths, those due to motor vehicles constitute the leading cause for all age groups under 75. Since 1903, when the "horseless carriage" toll assumed significance, there have been more than 6,500,000 deaths from accidents in this country, over 1,690,000 involving motor vehicles. In 1965, the accident death toll was approximately 107,000, including 49,000 from motor vehicles, 28,500 at home, and 14,100 at work. Deaths from traffic injuries have increased annually; 10,000 more were killed in 1965 than in 1955, and the increase from 1964 to 1965 was 3 percent. Seventy percent of the motor vehicle deaths occurred in rural areas and in communities with populations under 2500.[1]

Despite increasing mechanization, death rates from work accidents in manufacturing have decreased in the past 33 years, from approximately 37 accidental deaths per 100,000 workers in 1933 to a rate of 20 per 100,000 in 1965.[1] This reduction is due largely to education, training, and surveillance of industrial workers, and elimination of hazardous machinery in industrial plants. Similar efforts should be directed to the increasing millions of drivers and to vehicles.

The tragedy of the high accidental death rate is that trauma kills thousands who otherwise could expect to live long and productive lives, whereas those afflicted with malignancy, heart disease, stroke, and many chronic diseases usually die late in life. Thus many more millions of productive man-years are lost owing to deaths from accidents than from chronic diseases among older persons.

The human suffering and financial loss from preventable accidental death constitute a public health problem second only to the ravages of ancient plagues or world wars. In one year alone vehicle accidents kill more than we lost in the Korean War, and in the past 60 years more Americans have died from accidents than from combat wounds in all of our wars.[1] In the 20-year period

from 1945 through 1964, there were over 97,000 accidental deaths among military personnel, predominantly caused by motor vehicles.[2]

Disability

The total number of nondisabling injuries treated at home, in doctors' offices, in outpatient clinics or in emergency departments is unknown. In 1965, *disabling* injuries numbered over 10,500,000, including 400,000 that resulted in some degree of permanent impairment.[1] It is estimated that the number of United States citizens now physically impaired by injuries is over 11 million, including nearly 200,000 persons who have lost a leg, a foot, an arm, or a hand and 500,000 with varying degrees of impaired vision.[3]

Costs

In 1965, accident costs totaled about $18 billion, including wage losses of $5.3 billion, medical expenses of $1.8 billion, administrative and claim settlements of $3.6 billion, property loss in fires of $1.4 billion, property damage in motor-vehicle accidents of $3.1 billion, and indirect cost of work accidents of $2.8 billion.[1] The total approaches the current national annual appropriation for conducting the war in Vietnam.

Medical Load

The care of accident cases imposes a staggering load on physicians, paramedical personnel, and hospitals. Approximately one of every four Americans suffers an accident of some degree each year. Of the more than 52,000,000 persons injured in 1965, although many were treated at home or at work, most received medical attention in physicians' offices or in outpatient or emergency departments of hospitals. It is estimated that in 1965 more than 2,000,000 victims of accidental injury were hospitalized; they occupied 65,000 hospital beds for 22,000,000 bed-days and received the services of 88,000 hospital personnel. This exceeds the number of bed-days required to care for the 4 million babies born each year or for all the heart patients and it is more than four times greater than that required for cancer patients. Approximately 1 of 8 beds in general hospitals in the United States is occupied by an accident victim.[4]

ACCIDENT PREVENTION

The long-term solution to the injury problem is prevention. The major responsibility for accident prevention rests not with the medical profession, but with educators, industrialists, engineers, public health officials, regulatory officials, and private citizens. Although the physician is concerned primarily with increasing survival and lessening disability of victims after accidents occur, there are many ways in which the medical profession can help to prevent accidents. These include the detection and reporting of health hazards introduced into the environment; calling attention to the relationship of design of vehicles, appliances, houses, and public buildings to types of accidents; and identifying the roles of human behavioral, physical, emotional, and mental defects, acute and chronic illness, alcohol, and drugs in accident liability.

One of the outstanding pieces of evidence of the value of accident prevention is in the improved safety record of employees in private industry as a result of the improved design of power machinery and the teaching of safety measures. Precise standards are followed in the construction of most buildings, equipment and appliances. Paradoxically, the hazards to the consumer in using these products of industry may go undetected or uncorrected. The introduction of a new drug receives close scrutiny and its untoward or "accidental" effects are reported until its use and limitations are well established, but there is little requirement that hazards or limitations of a new machine or an appliance be detected, reported, and corrected early in its use. There seems to be no explanation for the lack of national standards or codes with respect to motor vehicles or their equipment. Thirty states do not even require periodic automobile inspection;[5] they have become dumping-grounds for vehicles that fail to pass inspection in states that do require it. Federal imposition of proved safety standards and of periodic inspection, if applied as vigorously to vehicles engaged in interstate travel as are the regulations that preclude interstate commerce of drugs unapproved by the Food and Drug Administration, could greatly reduce the nation's annual traffic toll.

Prevention of accidents involves training in the home, in the schools, and at work, augmented by frequent pleas for safety in

the news media; first aid courses and public meetings; and inspection and surveillance by regulatory agencies. Hazards involved in fabrication and utilization of vehicles, highways, appliances, farm implements, homes, and public buildings, or arising from participation in sports, or from fire, natural disaster, or national emergencies concern practically every segment of modern society. Of the nearly 52 million nonfatal accidental injuries in 1965, only 7 percent were caused by motor vehicles. Accident prevention must be directed to the 43 percent which occurred in the home, the 16 percent in industry and the 34 percent in public places, recreation, other forms of transportation, etc.[6]

There is need for an advisory agency in the form of a National Council on Accident Prevention, with representation from appropriate government agencies, industry, engineering, architecture, insurance, public health, education, the behavioral sciences, and medicine. Its major mission would be to ascertain the causes of accidental injury and to recommend or initiate measures necessary for their control or elimination. It would coordinate the findings and regulations now prescribed by industry and by the numerous federal safety laws dealing with many industries and administered by government departments whose primary missions are directly or indirectly related to health. It would identify needs and enlist federal and private support of research and of programs in federal departments, states and communities, and specialized research laboratories in the epidemiology and prevention of accidents. Some of these needs and many of the problems and their solutions have been identified by the Division of Accident Prevention of the U. S. Public Health Service and by the National Safety Council. The National Traffic Safety Advisory Committee, as provided for in the Highway Safety Act of 1966, affords for the first time a means by which preventive measures and standards can be delineated for all transport vehicles, including not only highway vehicles but also railroad, aviation, and coast guard conveyances. More than half of the accidental deaths, disabilities, and costs are unrelated to transportation, and factors peculiar to highways, vehicles and drivers constitute but a part of the total accident prevention problem.

RECOMMENDATION

Formation of a National Council on Accident Prevention at the Executive level for coordination of information and advice on implementation of measures and regulations now vested in scattered private, industrial, and federal agencies, and for research, public education, and development of improved standards in accident prevention.

EMERGENCY FIRST AID AND MEDICAL CARE

Successive steps in total emergency care involve local authorities and lay citizens for initial care and transportation, and medical and paramedical personnel under medical supervision for definitive treatment. With few exceptions, the role of the physician in the care of victims of accidental injury begins at the emergency department of the hospital. Only rarely is he available at the scene of injury.

One of the serious problems today in both the lay and the professional areas of responsibility for total care is the broad gap between knowledge and its application. Expert consultants returning from both Korea and Vietnam have publicly asserted that, if seriously wounded, their chances of survival would be better in the zone of combat than on the average city street. Excellence of initial first aid, efficiency of transportation, and energetic treatment of military casualties have proved to be major factors in the progressive decrease in death rates of battle casualties reaching medical facilities, from 8 percent in World War I, to 4.5 percent in World War II, to 2.5 percent in Korea, and to less than 2 percent in Vietman.[7]

Reduction of the time lag from receipt of injury to initiation of medical care is one of the important elements in prevention of death and permanent disability in the combat zone. Probably no American community can lay claim to maintenance of a model of first aid, sorting, communication, and transportation comparable to that of the Armed Services.

First Aid

Beyond the fifth grade of elementary school, every American citizen should be trained in basic first aid. Since initiation of the American National Red Cross first aid training program in 1909, over 28,000,000 students have been certified by qualified instructors (who currently number over 73,000).[8] This course should be, but is not, universally required as a prerequisite to the more advanced training of lifeguards, rescue squad personnel, ambulance attendants, policemen, firemen, personnel in public health and industrial clinics, and attendants at sports events. The Medical

Self-Help Program of the U. S. Public Health Service, designed to ensure care in a national emergency when the services of a psysician are not available, also provide basic first aid training. Only in the American National Red Cross training program and in the Medical Self-Help Program are nationally acceptable textbooks and standardized courses of instruction provided. There is need for equally acceptable textbooks and courses of instruction to meet the special requirements of rescue squad personnel and of ambulance attendants. A manual recently published by the Committee on Trauma of the American College of Surgeons provides guidance for uniformity in such training courses.[9]

RECOMMENDATIONS

1. Extension of basic and advanced first aid training to greater numbers of the lay population.
2. Preparation of nationally acceptable texts, training aids, and courses of instruction for rescue squad personnel, policemen, firemen, and ambulance attendants.

Ambulance Services

A review of ambulance services in the United States indicates a paucity of information and a limited framework for the collection of data on and the evaluation of current ambulance services. Research aimed at improvement of these services is equally limited. The available information shows a diversity of standards, which are often low, frequent use of unnecessarily expensive and usually ill-designed equipment and generally inadequate supplies.

Adequate ambulance services are as much a municipal responsibility as firefighting and police services. If the community does not provide ambulance services directly, the quality of these services should be controlled by licensing procedures and by adequate surveillance of volunteer and commercial ambulance companies. Ambulance services should not only be adequate for local needs, but should also be integrated within cities and among neighboring communities to ensure efficient utilization in natural disasters or national emergencies.

Very few communities provide sufficient financial support for adequate ambulance services. Where they are provided, they are usually maintained by the fire or police department. Many volunteer, nonprofit rescue squads and local ambulance groups provide commendable service and in many small communities this system would seem to meet basic, but usually only minimal needs. Approximately 50 percent of the country's ambulance services are provided by 12,000 morticians, mainly because their vehicles

can accommodate transportation on litters. But in most instances, as in the case of many privately owned ambulances, the vehicles are unsuitable for active care during transportation, equipment and supplies are incomplete, and the attendants are not properly trained.

First class ambulance service exists in few cities. Some, such as Baltimore, employ highly trained full-time ambulance attendants with up-to-date vehicles and equipment as a separate mission of the fire department. Central screening and dispatching ensure open traffic lanes, communication en route, and distribution of casualties to assigned hospitals. In some cities, ambulance services are provided by the police department, some with ambulances and some with modified patrol station wagons.

In contrast to the days when an intern accompanied every ambulance on emergency call, the pendulum may have swung much too far toward total dependence on ambulance personnel. There is complete lack of information on the number who die at the site of injury or during transportation who might have been saved by professional attention. Calls for ambulance services should be screened by a responsible agent under medical supervision so that, when medical attendance is required, a physician can be dispatched and an ambulance properly equipped to his needs made available immediately. A number of foreign countries have demonstrated that these measures save many lives.

There are no generally accepted standards for the competence or training of ambulance attendants. Attendants range from unschooled apprentices lacking training even in elementary first aid to poorly paid employees, public-spirited volunteers, and specially trained full-time personnel of fire, police, or commercial ambulance companies. Certification or licensure of attendants is a rarity. In a recent survey, it was found that over 48 different courses of instruction are provided with at least a score of different books and brochures being used as texts. There is no standard or uniformity in these courses, though the standard and advanced Red Cross courses are prerequisites for most. There is need for delineation of a standard course of instruction, a more generally acceptable text, and training aids to ensure training beyond that of the Red Cross program in first aid.

No manufacturer produces from the assembly line a vehicle that can be termed an ambulance. The bodies and fixed equipment of ambulances and rescue vehicles are produced by conversion of passenger-type vehicles or are fabricated completely to fit assembly

line chassis, and are usually expensive in outward appearance, but impractical for resuscitative care. Although the Committee on Trauma of the American College of Surgeons has published recommendations on ambulance equipment, there are no acceptable standards for vehicle design, and most ambulances used in this country are unsuitable, have incomplete fixed equipment, carry inadequate supplies, and are manned by untrained attendants.

Authority now exists under the National Traffic and Motor Safety Act of 1966 (P.L. 89-563) to set national standards for ambulance design and construction. Authority also now exists under the Highway Safety Act of 1966 (P.L. 89-564) for the establishment of national standards for used motor vehicles, for motor vehicle inspection and for emergency services.

Through the efforts of the Joint Action Program of the American College of Surgeons, the American Association for the Surgery of Trauma, and the National Safety Council, a model ordinance has been developed for regulation of ambulance services. But in a recent survey of 16 state capitals, only seven were found to have ambulance ordinances. While most ambulance calls involve non-emergency cases, the justification for speeding, the use of sirens, and violation of local traffic regulations is debatable. It is the consensus of representatives of the Joint Action Program that more injuries and deaths are produced by improper control of ambulances than would be produced by delays occasioned by compliance with regulations. Helicopters have proved so successful as ambulances in combat theatres that they should be adopted for selected use in this country. They have proven to be necessary to move physicians and equipment to the accident site and to evacuate casualties from major highways, from remote areas, or from a community hospital to a more specialized center. Highway safety standards should include helicopter evacuation, which calls for landing pads at selected hospitals on a regional pattern.

RECOMMENDATIONS

1. Implementation of recent traffic safety legislation, to ensure completely adequate standards for ambulance design and construction, for ambulance equipment and supplies, and for the qualifications and supervision of ambulance personnel.
2. Adoption at the state level of general policies and regulations pertaining to ambulance services.
3. Adoption at district, county, and municipal levels of ways and means of providing ambulance services applicable to the conditions of the locality, control and surveillance of ambulance services, and coordination of ambulance services with health departments, hospitals, traffic authorities, and communication services.

4. Pilot programs to determine the efficacy of providing physician-staffed ambulances for care at the site of injury and during transportation.

5. Initiation of pilot programs to evaluate automotive and helicopter ambulance services in sparsely populated areas and in regions where many communities lack hospital facilities adequate to care for seriously injured persons.

Communication

Although it is possible to converse with the astronauts in outer space, communication is seldom possible between an ambulance and the emergency department that it is approaching.

It is important to recognize that major accidents, including disasters, provoke community response not only of first aid workers, ambulances, and hospital emergency departments but also authorities concerned with traffic, fire, security, utilities, civil defense, and others, and that communication facilities involve functions pertinent to each responding agency. Although these facilities must be designed for specific needs, they must be sufficiently flexible to ensure rapid and efficient cross communication, with medical components necessary to emergency care. It would be a mistake, therefore, for those concerned with the medical aspects of the problem to plan strictly medical response systems in parallel with or in isolation from the transportation and communication networks upon which they should be based. Since these two basic systems are in most parts of the country just beginning to be developed, it is essential that provision for the medical components be incorporated.

A need exists for prompt voice communication between emergency departments and those at the site of an accident or disaster, not only to plan for the reception of casualties at the hospital but also to dispatch physicians, when needed at the site of the accident. Communication facilities are essential to mobilize rescue equipment, clear traffic lanes, advise ambulance attendants on the management of complications en route, notify hospitals of the number and types of patients to be expected, and distribute patients among hospitals in accordance with the adequacy of space, facilities, and personnel.

With rare exceptions, current ambulance radio installations provide communication only between dispatcher and drivers, with no provision for direct or tie-in contact with hospital emergency departments, traffic control authorities, or civil defense agencies. Moreover, many existing communication systems are reserved for use only in case of disaster or national emergency. Voice com-

munication should be used for day-to-day needs; should be under medical supervision; and should provide direct communication between the accident site, ambulances, and hospitals, and access to police, traffic control, fire, and civil defense agencies.

Although the Federal Communications Commission has allotted an adequate number of radiofrequency channels for the health field and industry has provided appropriate telephone and radio equipment, these facilities are rarely used to ensure voice communication between the site of an accident, ambulances, hospital emergency departments, fire departments, traffic control officials, and civil defense authorities. Usually a hospital is notified of a disaster through local radio or television or by telephone communication from police, or by the walking wounded. Certainly, the seriously ill and the injured deserve centralized screening and dispatching communication facilities as efficient as those used by taxicabs and in the coordination of personnel and equipment in fire fighting, forestry service, or highway maintenance.

At present, experience with radio communication in emergency medical situations is inadequate to serve as a basis for guidance of communities that would install and operate such facilities. Although available standardized equipment may be suitable for most communities, the organizational needs of the local community, geographic problems in radio transmission, and the size of the area to be served dictate variations of design and installation. Ready solutions to most of these problems are available through the radio industry. There is need at the national level for the preparation of a manual delineating the available radiofrequency channels, types and costs of equipment, and modifications of installation necessitated by local conditions. This is a function which should be the responsibility of the new National Highway Safety Agency in cooperation with the Federal Communications Commission, industry, and related groups. This Agency is charged with the responsibility for establishing standards for all aspects of state highway safety programs, of which communications is an essential element.

Under many circumstances, especially in remote areas or in the absence of telephones, delay and frustration are encountered in calling for an ambulance. It would seem feasible to designate a universal, easily remembered number for all dial telephones throughout the nation. Compared to European expressways, the scarcity of public telephones on our national highways represents a significant oversight in planning.

RECOMMENDATIONS

1. Delineation of radiofrequency channels and of equipment suitable to provide voice communication between ambulances, emergency departments, and other health-related agencies at community, regional, and national levels.
2. Pilot studies across the nation for evaluation of models of radio and telephone installations to ensure effectiveness of communication facilities.
3. Day-to-day use of voice communication facilities by the agencies serving emergency medical needs.
4. Active exploration of the feasibility of designating a single nationwide telephone number to summon an ambulance.

Emergency Departments

For decades the "emergency" facilities of most hospitals have consisted only of "accident rooms," poorly equipped, inadequately manned, and ordinarily used for limited numbers of seriously ill persons or for charity victims of disease or injury. Very few hospitals have met the needs imposed since World War II for the vast expansion of facilities, equipment, and personnel demanded by society, poor and rich, for routine off-hour treatment of non-emergency conditions and of the steadily increasing numbers of accidental injuries. Society now looks to the hospital emergency department as a community center for outpatient care. More than two-thirds of the 40,000,000 "emergency room" visits in 1966 cannot be classified as emergencies. Past and projected estimates of this increasing load are as follows:[10]

YEAR	ESTIMATED TOTAL NUMBER OF HOSPITAL OUTPATIENT VISITS (in Millions)	ESTIMATED EMERGENCY ROOM VISITS (in Millions)
1958	84.5	18.0
1960	91.9	23.0
1962	99.4	28.5
1968	121.6	44.1
1970	129.0	49.3

This social change has been paralleled by a decrease in the number of house calls and by more adherence to physicians' regular office hours.

Although over 90 percent of the more than 7000 accredited hospitals in the United States list emergency rooms, most such services operate at a financial loss. In contrast to staff coverage of the "accident room" by a hospital attendant and perhaps by an intern, minimal demands call for around-the-clock staffing by permanently assigned physicians and paramedical personnel

trained in all aspects of the care of trauma. Wings need to be added to hospitals, highly specialized equipment is required, and additional personnel must be trained. Currently four national organizations are conducting "surveys" of emergency departments, with no evidence of pooling of their resources or knowledge, resulting in piecemeal approaches to problems that, if solved by concerted effort, would provide factual grounds for Hill-Burton funds for facilities and equipment.

New patterns of staff coverage of emergency departments are evolving. These include contractual relationships between the hospital and a group of physicians, usually general practitioners, who undertake all emergency care and staffing requirements for the emergency department. Some hospitals require that all medical personnel, regardless of specialty, share emergency department responsibility, including night coverage. No longer can responsibility be assigned to the least experienced member of the medical staff or solely to specialists who by the nature of their training and experience cannot render adequate care without the support of other staff members.

The number of physicians experienced in the treatment of multiple injuries is very limited. The need is now recognized for special training in immediate care and in the overall direction of emergency departments, of a calibre commensurate with that attained by only a few individuals in active military field units caring for combat casualties. Medical undergraduate and residency training programs are generally inadequate in traumatology and mass casualty care.

In recent years the Committee on Trauma of the American College of Surgeons has provided recommendations on architectural design and equipment of emergency departments and manuals on the treatment of fractures and soft-tissue injuries, the prevention of tetanus, and the initial management of burns. These commendable efforts of the medical profession are but a beginning. There remains a serious lag in application of the minimal standards, but of even greater importance is the dearth of basic research in resuscitation, shock, and other immediate and long-range problems in therapy.

Accreditation and Categorization of Emergency Departments

The current dictum that an ambulance should deliver a patient to the nearest emergency unit is no longer acceptable. It is essential that road maps and roads signs, at appropriate locations, designate

routes to hospitals and emergency departments. The patient must be transported to the emergency department best prepared for his particular problem. In the absence of a descriptive categorization of the level of care that might reasonably be expected at a facility, neither the patient nor the ambulance driver can judge which facility is adequate to the immediate need. It is usually taken for granted by the general public that every emergency room can render full care for injuries of all magnitudes. There is the obligation to the severely injured patient as well as to the lone physician, to the small staffs of remote hospitals, and to institutions with minimal emergency department facilities, that the public be thoroughly informed of the extent of care that can be administered at emergency departments of varying levels of competence. A categorization of emergency departments would serve to indicate the level of care that a patient might reasonably expect. Current check lists used by the Joint Commission on Accreditation of Hospitals are not sufficiently comprehensive for this purpose.

In a given population, whether within a large city, a small community, or a sparsely settled area, the average number of patients requiring emergency care is generally stable, except under conditions of natural disaster or national emergency. Within a given region, it is uneconomical and impractical to expect that every emergency department deal with all degrees of severity of injury.

Hospital emergency departments should be surveyed in a number of differing geographical areas, to determine the numbers and types of emergency facilities necessary to provide optimal emergency treatment for the occupants of each region. Provision must be made for the expected doubling of population within a few decades. Once the required numbers and the types of treatment facilities have been determined, it may be necessary to lessen the requirements in some institutions, increase them in others, and even redistribute resources to support space, equipment, and personnel in the major emergency facilities. Until patient, ambulance driver, and hospital staff are in accord as to what the patient might reasonably expect and what the staff of an emergency facility can logically be expected to administer, and until effective transportation and adequate communication are provided to deliver casualties to proper facilities, our present levels of knowledge cannot be applied to optimal care and little reduction in mortality or lasting disability can be expected.

Emergency units might be categorized as follows:

Type 1. The Advanced First Aid Facility Information now available indicates that most emergency departments across the country are in this category. They do not have a full-time physician staff, and frequently not even a full-time nursing staff. Only modest first aid equipment is available and, although minor conditions and emergency resuscitation might be satisfactorily handled in this setting, it would be unfair to the patient as well as to the staff to expect or demand adequate care of the critically injured.

Type 2. The Limited Emergency Facility This type is found in many hospitals whose emergency departments function 24 hours daily, chiefly as outpatient clinics or first aid facilities, but are nevertheless often confronted with the need to render major emergency care beyond their capabilities. A nurse and perhaps a physician are available at all times. Because of limitations of equipment and facilities, problems of full-time physician coverage, and limited access to specialists, complete care cannot always be provided to the critically injured.

In sparsely populated areas and small communities and many urban hospitals, facilities of this type are essential, and, by proper sorting, large numbers of medical and surgical patients can be adequately handled and removed from the chain of evacuation. It is in the rural areas and the towns of fewer than 2500 people, however, that 70 percent of the traffic fatalities occur. The dedicated staffs of *limited* emergency departments recognize that the needs of the critically injured patients frequently exceed the capabilities of their facilities and personnel. To expect highly specialized care under these circumstances is unfair both to the patient and to the physician. Emphasis on resuscitation, expenditure of time and effort in thorough preparation before movement, and rapid and efficient transportation to *major* emergency facilities would lower morbidity and mortality rates. It is here that helicopter ambulances would be most effective. There have been no extensive surveys in either rural or urban areas to establish the number of either *limited* or *major* emergency facilities required or to define models of rapid transport.

Type 3. The Major Emergency Facility The need for major emergency facilities adequate to render complete care to the severely injured or the seriously ill is well recognized. Few such facilities exist. Most emergency departments of large hospitals have not yet met the space or personnel needs of outpatient and

nonemergency cases, and few have the funds to construct, equip, and man adequate facilities. To carry out their mission, the number and location of major emergency facilities must be in keeping with the numbers of patients to be treated from day to day, with provision for expansion in disaster. They must be so located as to serve precisely designated rural areas or districts in densely populated areas. Major emergency facilities require 24-hour staffing by highly competent medical and paramedical personnel trained in resuscitation and other lifesaving measures before transfer of the casualty to the operating room, intensive care unit, or hospital ward. Bloodbanks, complete resuscitative equipment, X-ray facilities (including those for angiography), constantly available well-developed clinical laboratory services, and ready accessibility to operating rooms are essential. The director of a unit of this type should be experienced in the overall care, triage, and determination of priorities of treatment of victims of severe trauma. Nursing, paramedical, and administrative personnel should be assigned to the emergency department permanently or at least for protracted periods. Specialized consultants must be available at all times. The need for ready availability of highly qualified specialists in all branches of medicine and surgery and of laboratories devoted to clinical support and research strongly supports the view that the major emergency facility should be an integral element of large hospitals and university medical centers, rather than an isolated facility devoted solely to emergency care. Such a clinic is essential to proper training in trauma.

Type 4. The Emergency Facility Combined with a Trauma Research Unit This is designed to be the ultimate goal in combining the highest development of patient care with research facilities that permit investigation in support of therapy. These units are discussed in the section of this report on research in trauma.

RECOMMENDATIONS

1. Initiation of surveys and pilot programs to establish patterns of and the numbers and types of emergency departments necessary for optimal care of emergency surgical and medical casualties in a selected number of cities, groups of small communities, and sparsely populated areas.

2. Development of a mechanism for inspection, categorization, and accreditation of emergency rooms on a continuing basis.

3. Federal fund support to design, construct, and, in part, operate model emergency facilities of each type.

Interrelationships between the Emergency Department and the Intensive Care Unit

In planning emergency facilities for the future and in redesigning current facilities, it would seem advantageous to transfer certain protracted functions of resuscitation out of the emergency rooms and integrate them closely into the operation of the intensive care unit. Recent developments have made the intensive care unit the focal point of nursing and medical care in many large hospitals. Concentrated in this area are resuscitation equipment, monitors, respirators, defibrillators, pacemakers, suction devices, and, above all, the highly trained personnel needed for the care of the severely ill medical case or the injured patient.

RECOMMENDATION

Expansion of intensive care programs to ensure uninterrupted care beyond the immediate measures rendered in emergency departments.

THE DEVELOPMENT OF TRAUMA REGISTRIES

Emergency case records are often inadequate. Sufficient thought has not been given to extracting information concerning the nature of the accident, the clinical condition during transportation and at the time of entry to the emergency department, the resuscitative measures used, the response of the patient, the initial laboratory and X-ray records, and, finally, the ultimate outcome with or without temporary or permanent disability. This information is vital on several scores. It is essential in recreating the circumstances of the accident and in relating the mechanism of trauma to accident prevention. It is necessary for clinical analysis, for improvement of therapy, and for appraisal of emergency facilities. Finally, it could provide a basis for determining the duration, nature and degree of disability and the long-term, natural history of specific injuries. An example of the need for long-term records of this type is that of a patient in whom the ultimate manifestation of damage to the femoral artery accompanying a fracture of the femur was not apparent until 34 years later when generalized arteriosclerosis developed, and thrombosis of the involved femoral artery necessitated amputation. Information of this type on a broad scale could be obtained by the development of *trauma registries* within the

hospital, similar to those established and maintained for many years in the cancer field. The vast pool of information available from such registries might provide guidelines for more objective definition of degrees of disability on which to base judgment in compensation cases.

RECOMMENDATIONS

1. Establishment of trauma registries in selected hospitals as a mechanism for the continuing description of the natural history of the various forms of injuries.

2. Subsequent consideration of establishment of a national computerized central registry.

3. Studies on the feasibility of designating selected injuries to be incorporated with reportable diseases under Public Health Service control.

HOSPITAL TRAUMA COMMITTEES

Trauma committees, as standing committees of hospital staffs, might serve several useful purposes. As multi-specialty groups, they would set the standards of care, supervise staffing and function of the emergency department, maintain the trauma registry, and conduct training programs for staff, paramedical and ambulance personnel in cardiopulmonary resuscitation and other advanced techniques. They should be prepared to coordinate research programs and to organize follow-up studies on the long-term effects of trauma as well as the treatment itself. An important function would be a continuing analysis of the physical status of patients on delivery to the emergency department, as a guide to correction of deficiencies in first aid and transportation, and of the extent to which physician care is indicated in advance of the hospital.

RECOMMENDATION

Formation of hospital trauma committees, on a pilot basis, in selected hospitals.

CONVALESCENCE, DISABILITY, AND REHABILITATION

At a meeting of a local Committee on Trauma of the American College of Surgeons, a theoretical problem was presented to approximately 50 distinguished surgeons as to when a young man should resume heavy labor following specific injury. The estimates of duration of disability ranged from 2 weeks to a year, with little concentration of the estimates in between. There is little scientific basis on which to predict or measure convalescence or disability. Rehabilitation should begin immediately after injury and its goals should be to prevent disability or shorten its duration and degree and to return the patient to a useful economic status. Rehabilitation should not be reserved for those with established permanent disabilities.

RECOMMENDATIONS

1. Development of additional studies on the quantitation of degrees of disability and the stages of convalescence at which return to productive work is indicated.
2. Development of studies on rehabilitation with emphasis on measures to be initiated in the earliest phases of treatment.

MEDICOLEGAL PROBLEMS

The courtroom sequelae of accidents are often, perhaps generally, dealt with in a manner below the general standards of the medical and legal professions. The courts for settlements of disability claims in some areas are provided with inadequate or inexpert evidence, and judgment may well reflect response to social, emotional, or political pressures, rather than to sound medical testimony. In this respect both lawyers and physicians for the claimants and for the defending insurance companies too often produce prejudiced medical testimony, diametrically and predictably contradictory. "Expert medical testimony" under these circumstances has commonly lacked clinical expertise. A system has been adopted by the judiciary in a number of localities to provide

impartial evaluation of disability by a panel of physicians who are expert in their given fields and paid either by the court or jointly by the parties involved. This mechanism has proved to be of great value, and should be more universally employed. It is imperative that the physician's role be uninfluenced by socioeconomic pressures.

In the final analysis, compensation for disability is a drain on every citizen through federal taxation, withholdings from earnings, and the increasing upward spiral of premiums on disability insurance. All these costs could be reduced if the demonstrated fairness and objectivity in categorizing degrees of disability employed by the Armed Forces and the Veterans Administration were applied by the medical profession and the courts to persons disabled by accidental injury or disease. In the military services, processing begins at the time a member incurs an injury or disease that may be temporarily or permanently disabling. Findings are referred by a medical committee to a physical evaluation board and reviewed at the highest levels, with the benefit of counsel at all stages, providing an objective determination of degrees of disability to serve as a basis for compensation. Society concurs in the fairness of this system and the care with which the Veterans Administration and the Armed Forces protect the rights of the nearly 2,000,000 persons who receive service-connected disability compensation among the 21,800,000 veterans of military service.[11] The same objectivity and fairness can be applied to the rest of the population through optimal medical care to prevent disability, a hospital trauma committee to judge disability, and impartial medical panels to serve the courts. Systems for rapid and uniform processing and compensation of the injured with minimal recourse to the courts should be applied nationally.

Forensic medicine constitutes a medical specialty of high order and only when a sufficient number of specialized physicians are available to carry out this work will important information, now needed, become available. Unfortunately, most coroners in this country are political appointees, mostly laymen, frequently funeral directors; but this situation is being gradually corrected by establishment of medical examiner systems in several cities, some counties, and a few states. Progress in this area must be accompanied by the training of more pathologists in forensic medicine.

With the expansion of the role of the medical examiner, implementation of a uniform code for reporting accidents and accidental deaths, and mandatory autopsy of fatal cases, to include tests for

alcohol and drugs, an opportunity exists to study effectively the specific causes and mechanisms of injury of all magnitudes and to establish base lines against which to measure the efficacy of control measures.

RECOMMENDATIONS

1. Judicial application of the principle of seeking impartial medical advice in the determination of disability.
2. Replacement, on a national scale, of lay coroners by medical examiners who are not only physicians but also qualified pathologists experienced in medicolegal problems.

AUTOPSY OF THE VICTIM

The exact cause of death in many of the injured can be learned only from complete autopsy examination. Especially in multiple injuries, priority of treatment may have been directed toward obvious, or overt, injuries, but covert injuries, such as laceration of major vessels, retroperitoneal hemorrhage, or fat embolism may have been the primary cause of death. Although it is the responsibility of the coroner to direct autopsy examination, this is not routinely performed. If this opportunity to ascertain the specific cause of death is to be grasped, complete autopsies must be performed routinely on those who have died as the result of injury. Furthermore, the findings in large numbers of autopsies must be critically analyzed in order to point the way to necessary changes in treatment. One such study, of 950 consecutive autopsies of accident cases, revealed an unexpected finding: in 38 percent of those who died in the hospital or after returning home following fracture of the hip, the primary cause was pulmonary embolism. Yet in a large number of similar patients who had not been autopsied, pulmonary embolism was the recorded cause of death in only 2 percent.[12] This is but one example of the value of careful autopsy examination. Such findings are important to alert emergency department staffs to the incidence of covert injuries that might well dictate first priority care, as well as the care and prophylactic measures that must be observed during definitive care and rehabilitation.

RECOMMENDATION

Routine performance and analysis of complete autopsies of accident victims.

CARE OF CASUALTIES UNDER CONDITIONS OF NATURAL DISASTER

It is apparent that the problems of care of disaster victims differ from those of the care of individually injured persons in that they are concerned with unexpected expansion of first aid, rescue, communication, sorting, distribution, and medical care. No plan for emergency care in disaster is likely to succeed unless it provides for an orderly utilization of currently functioning facilities. For this reason, emphasis should be placed on employment of all elements of disaster services on a day-to-day basis so that they will be functioning smoothly when the load of casualties suddenly increases.

Because disasters occur repeatedly in this country and because progress has been slow in solving problems of caring for mass civilian casualties, medical problems encountered in disaster should be under continued study and analysis by multi-disciplinary groups. The need for integration of public resources in coping with material damage in disaster is apparent, but the community role in handling human casualties is less well prescribed. The Disaster Research Group of the Division of Anthropology of the National Academy of Sciences-National Research Council, in its extensive studies from 1951 to 1963 for the Office of Civil Defense, and the Ohio State University Disaster Research Center, established in 1963, have both concentrated on responses of local, state, and federal agencies to the stresses imposed by unexpected disaster with emphasis on behavioral and sociological problems. Efforts of the American College of Surgeons to encourage members to report on casualty care in disasters have added little substantive information on which to improve results. The Committee on Disaster Medical Care of the American Medical Association has attempted to identify potentials for improved care, but no national action program has been implemented. An *ad hoc* Committee on Disaster Medical Care of the National Academy of Sciences-National Research Council finds no evidence of effort by these groups, or by independent workers or federal organizations, toward pooling of resources to assemble substantial data or to analyze medical management in a sufficient number of disasters

of different types. In no single large disaster do we have precise information on the causes of death, the numbers and types of injuries of survivors, or the rewards of efficiency and the penalties of inefficiency in rescue, first aid, transportation, and medical care. A pattern exists in the organization and functions of the Office of Emergency Planning of the Executive Office of the President for gaining this type of information and for implementing improvements in management and care that would result from its analysis. Trained disaster specialists based at eight federal centers throughout the nation move out at first warning to areas imperiled by disaster. On the basis of their assessments, the President can declare a major disaster; under the direction of the Office of Emergency Planning 24 agencies would then be automatically authorized to provide assistance.[13] These are concerned mainly with supplies, equipment, and personnel to clear debris; provide food, medicine, and shelter; restore utilities; enforce law and order; and render financial assistance and welfare services. Many communities are unaware of the way to secure outside assistance in rescue, first aid, and medical help available through the American National Red Cross, the U. S. Public Health Service, civil defense agencies, and field units of the Armed Forces. Better utilization of these resources could be ensured if in each community or area a recognized committee or council on emergency medical services would assume the role of coordination of the efforts of these agencies. Physicians thoroughly familiar with the missions of the 24 federal agencies and versed in local medical problems in disaster should be included on the teams of trained disaster specialists of the eight federal centers.

RECOMMENDATION

Development of a center to document and analyze types and numbers of casualties in disasters, to identify by on-site medical observation problems encountered in caring for disaster victims, and to serve as a national educational and advisory body to the public and the medical profession in the orderly expansion of day-to-day emergency services to meet the needs imposed by disaster or national emergency.

RESEARCH IN TRAUMA

Current Status of Research Support

Research in trauma has suffered from the lack of recognition of trauma as a major public health problem. This is, in part, due to the present practice of evaluation of research support requests by study sections or other advisory committees of granting agencies identified with "disease" entities, rather than those related to "accidents," "injuries," or "trauma." An analysis of grants in 1965 identifies only $5 million in support of research related to trauma by six of the Institutes of the National Institutes of Health and other bureaus of the U.S. Public Health Service. National expenditures for all medical research in 1964 were estimated to be $1675 million of which $1134 million was from Government, $395 million from industry, and $146 million from private sources.[14] On the basis of these vast sums, it is estimated that current research expenditures by the National Institutes of Health and the Division of Chronic Diseases of the U.S. Public Health Service for fiscal year 1963 were 50 cents for each of the 10 million persons disabled by accidental injury, $220 for each of the estimated 540,000 cancer cases, and $76 for each of the estimated 1,420,000 cardiovascular cases. The 1966 federal budgets for research on cancer and cardiovascular diseases alone are estimated to be in excess of $280 million.[15]

There remains no doubt that society is reaping dividends from investments devoted to research in disease, and that this effort deserves continued support and expansion. Lack of a proportionate degree of support in accident prevention and care of the victims of trauma cannot be ascribed to unwilling legislators or directors of voluntary and philanthropic organizations. The most obvious reason for current lack of emphasis on the kinds of research required and the ways and means of utilizing knowledge we already have is that there is no unified mechanism, federal or nonfederal, to present the full picture of needs, to identify and encourage necessary research, to enlist financial support, to serve as a clearinghouse for information, or to offer advice and consultation.

During the years of expansion of the National Institutes of Health and other federal agencies and voluntary organizations

concerned with national health problems, emphasis has been properly focused on fundamental research. A charge of the President to his Commission on Heart Disease, Cancer, and Stroke was to recommend practical steps to reduce the heavy losses exacted by these diseases, not only through the development of new scientific knowledge, but also through the use of lifesaving medical knowledge we already possess but fail to bring to so many stricken American families. The dispatch with which the program was defined and was supported by Congress was due in large part to the knowledge gained in recent years through generous support of basic research and to the wealth of information and assistance available through the American Cancer Society and the American Heart Association, both of which recognized years ago the necessity of joint participation of professional and lay organizations and of the general public, and which have pioneered for decades in the support of health research, public education, training of physicians and allied personnel, and direct service to patients. The need for such organized effort in the field of trauma is apparent.

Potentials in Fundamental and Clinical Research

To determine accurately the physiological changes produced by trauma alone, studies must be initiated promptly on persons who are otherwise healthy at the moment the stresses of trauma are imposed. Only by this approach can the hemodynamic, metabolic, ultrastructural, and other changes of diseases be compared with or differentiated from the hypoxia, collapse, and other effects of trauma as the sole etiological factor.

Relatively little has been done in fundamental studies on acutely injured subjects on wound healing; wound infection; hemodynamic, metabolic, cardiac, and respiratory changes following trauma; ultrastructural alterations in injury and shock; the effects of head, spinal cord, and nerve injuries; paralytic ileus; posttraumatic renal insufficiency; fracture healing; resuscitation, and many other areas of basic importance. To a limited extent these problems are now under investigation in laboratories devoted to studies on acute and chronic disease and malignancy, but rarely in relation to trauma specifically.

Many of the most important advances in surgery have evolved from discoveries at the war front. Wounds from high velocity missiles and the environmental factors that prevail in military combat areas produce changes that cannot be simulated in civilian life. Although contributions to the care of military casualties can

be made through research in noncombat medical centers, there is as great a need for contributions that can be made only by sophisticated research in military front line medical installations. The opportunity should be fully grasped in Vietnam, as it was in Korea, to improve the care of the injured throughout the world by seeking, in an organized manner, improved ways of treating the critically injured person.

Specialized Centers for Clinical Research in Shock and Trauma

In the very recent past, owing in large part to stimulation and encouragement of the Committee on Shock of the National Academy of Sciences-National Research Council and with the support of federal and private granting agencies, basic and clinical scientists have been installed in highly sophisticated laboratories devoted to studies in shock and trauma in human patients in a limited number of medical centers. It is a tribute to the profession that these pioneer groups of investigators willingly devote long hours to research in trauma, a disease predominantly of nights and weekends. These units are designed to combine the highest development of patient care with research facilities that enable investigation to proceed without hampering therapy. For example, in one institution the space previously occupied by three surgical wards has been converted to laboratories to support intensive care and study of not more than four patients at a time. In this and other units the basic scientists in physiology, microbiology, biochemistry, electronics, isotopes, engineering, etc., collaborate with clinicians in carrying out highly complex studies in man that were previously limited to animal studies. Repetitive observations are rapidly computed and relayed to the clinician, providing moment-to-moment hemodynamic and biochemical measurements. The improved therapy that results from these studies is gradually modifying previous concepts of irreversibility in those suffering from hemorrhage, burns, and sepsis.

Units of this type must be adapted to measure and treat the overall effects of trauma, sepsis, or critical nonsurgical conditions, but additional studies might take one of several directions, depending on patient load and local research interests and talent. For example, a 10- or 12-bed burn unit might embrace the whole panorama of the burn problem, from the time of injury through rehabilitation. Another unit might be geared toward early hemodynamic or metabolic changes, shifts in the various body fluid compartments, oxygen utilization, or energy production. Others

might center on severe head injuries, or abdominal injuries, or fractures. To date, no unit of this type has been developed for research in head and neck injuries, and such units are vitally needed.[16]

Such facilities might include ancillary equipment for hemodynamic measurements in the emergency department, so that the earliest possible changes as well as the response to resuscitative fluids and other therapeutic agents could be measured. These observations would then be continued in the operating room, the intensive care unit, or the special research unit for uninterrupted study throughout all phases of response to injury and recovery. Research on the acutely injured requires numerous personnel of many disciplines. The critical nature of the illness is such that research must continue around the clock. Nursing and laboratory personnel requirements are costly.

Numerous studies now point convincingly to the conclusion that moment-to-moment hemodynamic and biochemical measurements in the acutely ill or severely injured patient offer the best available guidelines for improved therapy. Information gained by these units proves valuable guidance for the treatment of injured patients in other less specialized hospitals where research is not feasible.

These clinical research units involve very specialized facilities with unusual demands for staffing and equipment, and for parallel facilities for animal experimental studies. The survival of critical medical and surgical cases has been increased, and many useful techniques have been adopted in other areas of the hospital.

The most significant obstacle at present is the lack of long-term funding. Unpredictability of financial support hinders recruitment of competent scientists and technicians, retention of key personnel, and procurement of necessary equipment.

The few clinical research units for the study of the acutely injured have been supported mainly by the National Institute of General Medical Sciences, the Medical Research and Development Command of the Army, and the John A. Hartford Foundation. Very recently the National Institute of General Medical Sciences, recognizing a need for coordination and identification of research needs in trauma, conducted a workshop conference on the management of trauma, including hospital arrangements and training; the physiology of shock, considered from the systems and organ level; and study of trauma at the cellular and subcellular levels. This Institute has now appointed a director for development of a program of research in the therapy of trauma, and is encouraging

expansion of support in this direction. The needs for research in resuscitation, shock, trauma, and emergency conditions related to acute and chronic illness, for academic career training and fellowships in traumatology, for improved facilities and equipment, and for experimental and clinical laboratories in direct support of emergency departments and intensive care units warrant serious consideration of establishment of a National Institute devoted to trauma and emergency medical care.

RECOMMENDATIONS

1. Increased federal and voluntary financial support of basic and applied research in trauma.
2. Long-term financial support of specialized centers for clinical research in shock and trauma.
3. Expansion of clinical research in war wounds.
4. Expansion within the U. S. Public Health Service of research in shock, trauma, and emergency medical conditions, with the goal of establishing a National Institute of Trauma.

SPECIFIC RECOMMENDATIONS

ACCIDENT PREVENTION

Formation of a National Council on Accident Prevention at the Executive level for coordination of information and advice on implementation of measures and regulations now vested in scattered private, industrial, and federal agencies, and for research, public education, and development of improved standards in accident prevention.

EMERGENCY FIRST AID AND MEDICAL CARE

First Aid

Extension of basic and advanced first aid training to greater numbers of the lay population.

Preparation of nationally acceptable texts, training aids, and courses of instruction for rescue squad personnel, policemen, firemen, and ambulance attendants.

Ambulance Services

Implementation of recent traffic safety legislation to ensure completely adequate standards for ambulance design, and construction, for ambulance equipment and supplies, and for the qualifications and supervision of ambulance personnel.

Adoption at the state level of general policies and regulations pertaining to ambulance services.

Adoption at district, county, and municipal levels of ways and means of providing ambulance services applicable to the conditions of the locality, control and surveillance of ambulance services, and coordination of ambulance services with health departments, hospitals, traffic authorities, and communication services.

Pilot programs to determine the efficacy of providing physician-staffed ambulances for care at the site of injury and during transportation.

Initiation of pilot programs to evaluate automotive and helicopter ambulance services in sparsely populated areas and in regions where many communities lack hospital facilities adequate to care for seriously injured persons.

Communication

Delineation of radiofrequency channels and of equipment suitable to provide voice communication between ambulances, emergency departments, and other health-related agences at community, regional, and national levels.

Pilot studies across the nation for evaluation of models of radio and telephone installations to ensure effectiveness of communication facilities.

Day-to-day use of voice communication facilities by the agencies serving emergency medical needs.

Active exploration of the feasibility of designating a single nationwide telephone number to summon an ambulance.

Emergency Departments

Initiation of surveys and pilot programs to establish patterns of and the numbers and types of emergency departments necessary for optimal care of emergency surgical and medical casualties in a selected number of cities, groups of small communities, and sparsely populated areas.

Development of a mechanism for inspection, categorization, and accreditation of emergency rooms on a continuing basis.

Federal fund support to design, construct, and, in part, operate model emergency facilities of each type.

Interrelationships between the Emergency Department and the Intensive Care Unit

Expansion of intensive care programs to ensure uninterrupted care beyond the immediate measures rendered in emergency departments.

THE DEVELOPMENT OF TRAUMA REGISTRIES

Establishment of trauma registries in selected hospitals as a mechanism for the continuing description of the natural history of the various forms of injuries.

Subsequent consideration of establishment of a national computerized central registry.

Studies on the feasibility of designating selected injuries to be incorporated with reportable diseases under Public Health Service control.

HOSPITAL TRAUMA COMMITTEES

Formation of hospital trauma committees, on a pilot basis, in selected hospitals.

CONVALESCENCE, DISABILITY AND REHABILITATION

Development of additional studies on the quantitation of degrees of disability and the stages of convalescence at which return to productive work is indicated.

Development of studies on rehabilitation with emphasis on measures to be initiated in the earliest phases of treatment.

MEDICOLEGAL PROBLEMS

Judicial application of the principle of seeking impartial medical advice in the determination of disability.

Replacement, on a national scale, of lay coroners by medical examiners who are not only physicians but also qualified pathologists experienced in medicolegal problems.

AUTOPSY OF THE VICTIM

Routine performance and analysis of complete autopsies of accident victims.

CARE OF CASUALTIES UNDER CONDITIONS OF NATURAL DISASTER

Development of a center to document and analyze types and numbers of casualties in disasters, to identify by on-site medical observation problems encountered in caring for disaster victims, and to serve as a national educational and advisory body to the public and the medical profession in the orderly expansion of day-to-day emergency services to meet the needs imposed by disaster or national emergency.

RESEARCH IN TRAUMA

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Long-term financial support of specialized centers for clinical research in shock and trauma.

Expansion of clinical research in war wounds.

Expansion within the U. S. Public Health Service of research in shock, trauma, and emergency medical conditions, with the goal of establishing a National Institute of Trauma.

REFERENCES

1. National Safety Council. Accident Facts. 1966. 96 p.
2. Stapp, J. P. Traffic safety. Part 2. Hearings before the Committee on Interstate and Foreign Commerce, House of Representatives, on H. R. 13228, p. 1150. Government Printing Office: Washington, D. C., 1966.
3. Public Health Service. Health Statistics from the U. S. National Health Survey. Selected impairments by etiology and activity limitation, U. S., July 1959-June 1961. Public Health Service Publication No. 584-B-35, October 1962.
4. Public Health Service. Division of Accident Prevention. Accidental death and injury statistics. October 1963.
5. U. S. Senate. Committee on Public Works. Senate Report No. 1302, p. 12. June 23, 1966.
6. Public Health Service. Division of Accident Prevention. Unpublished data.
7. Heaton, L. D. Army medical service activities in Viet Nam. (Guest Editorial) Milit. Med. 131:646-647, 1966.
8. American National Red Cross. Office of Administrative Analysis, Information, and Statistics. Annual report. June 1966.
9. Kennedy, R. H., Ed. Emergency Care of the Sick and Injured. A manual for law-enforcement officers, fire-fighters, ambulance personnel, rescue squads and nurses. Committee on Trauma, American College of Surgeons. W. B. Saunders Co.: Philadelphia, 1966. 128 p.
10. Public Health Service. Division of Hospital and Medical Facilities. Facts and trends on hospital outpatient services. June 1964.
11. Administrator of Veterans Affairs. Annual report, p. 1, 246. U. S. Government Printing Office: Washington, D. C., 1965. 373 p.
12. Fitts, W. T., H. B. Lerh, R. L. Bitner, and J. W. Spelman. An analysis of 950 fatal injuries. Surgery 56:663-668, 1964.
13. Office of Emergency Planning. Executive Office of the President. Federal disaster assistance. A pocket guide to disaster help. U. S. Government Printing Office: Washington, D. C., January 1966. 22 p.
14. U. S. Government Printing Office. Basic data relating to the National Institutes of Health Office of Program Planning. Jan. 1965.
15. Bureau of States Services. Health and Economics Branch, No. 5. Economic costs of cardiovascular diseases and cancer. 1962.
16. Caveness, William F., and A. Earl Walker, Eds. Head Injury, Conference Proceedings. (Head Injury Conference held at the University of Chicago, Feb. 6-9, 1966) Philadelphia: J. B. Lippincott Co., 1966. 589 p.

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