Special Communication

Trauma Registry

New Computer Method for Multifactorial Evaluation of a Major Health Problem

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One of the major problems in providing improved care for the injured patient is the lack of a well-defined system of care for the critically injured. Patients are ordinarily taken to the nearest hospital, rather than the one best equipped and staffed to treat them. Many of these patients are later transferred to more appropriate facilities with considerable discomfort, disability, and even death resulting from these unnecessary movements. Many patients are given suboptimal care once they reach an inadequate facility. A major barrier to improving trauma care is the lack of cumulative knowledge and experience in the complex management of severely injured trauma patients. The general inadequacy of the present medical record system further compounds this problem.

In response to this obvious deficiency and at the suggestion of the National Research Council,[1] a computerized Trauma Registry has been developed at the Trauma Unit of the Cook County Hospital, the Department of Surgery of the Abraham Lincoln School of Medicine, and the Research Resources Laboratory of the University of Illinois in Chicago.[2,3] The Trauma Registry has been developed to serve the following objectives: (1) to facilitate and improve patient care by rapidly locating and accurately reproducing significant amounts of clinical information germane to the patient's present clinical problem, (2) to provide on-line clinical summaries of diagnostic and therapeutic methods, (3) to establish a data source for developing at-risk factors for accidental events, (4) to define the variables on which patient morbidity and mortality depend, (5) to determine logistical and manpower requirements for a given community's trauma needs, (6) to estimate cost expenditures for certain injuries and their comprehensive care requirements, and (7) to provide continuous monitoring of project planning for the care of the critically injured. These data will have a wide variety of both short- and long-term uses. The most important of these may be the seventh objective.

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Materials and Methods

The Trauma Registry utilizes a multiple computer-card oriented primary collection process. These 16 format cards are listed below. Information is collected on epidemiologic factors and the extent of anatomical damage, as well as surgical and nonoperative treatment employed and specific complications encountered. The categories given in the *International Classification of Disease* (ICDA), adapted in 1969[4], are integrated into the registry, but a newly devised tabulation system is being utilized as the prime patient indexing and cross-correlating method.

	Cards
Epidemiology and vital statistics	01-04
Gross anatomical profile	05
International Classification of Diseases, adapted, 1969	06
Emergency care evaluation	07
Head-face-neck, operative treatment	08
Thorax, operative treatment	09
Abdomen, operative treatment	10
Cardiovascular, operative treatment	11
Central nervous system-spine, operative treatment	12
Upper and lower extremities, operative treatment	13-15
Readmission data, operative treatment	16

Basic information is recorded directly onto these data-gathering worksheets in both clear text and coded form (Fig 1 and 2). An example of the Abdominal Operative Treatment Program data-gathering form (card 10) is shown in Fig 2. This "fixed field" information collection approach is used to simplify data entry into the registry. Clear text items, eg, registry number, age, and date and time of admission and surgery, are recorded directly in the appropriate areas. Clinical data are recorded by a system that classifies all injuries, therapy, and complications by a semirestricted computer vocabulary. While much of the medical vernacular is extremely rich and difficult to code, physical injuries lend themselves quite well to a more restricted language system. The general format used in the operative treatment programs is to enter the diagnosis in the first column, followed by the treatment in the middle column, and complication of a specific organ or part in the last column. For example, on card 10 (Abdominal Treatment Program), item 15, columns 49, 50, 51 are used for right colon involvement only. In areas where the treatment is often complex, the two middle columns are used for primary and secondary procedures, eg, No. 8 for liver and No. 9, pancreas. To further facilitate this approach, a system of several auxiliary diagnostic and treatment codes, for visceral and structural injuries, has been developed. All data entries

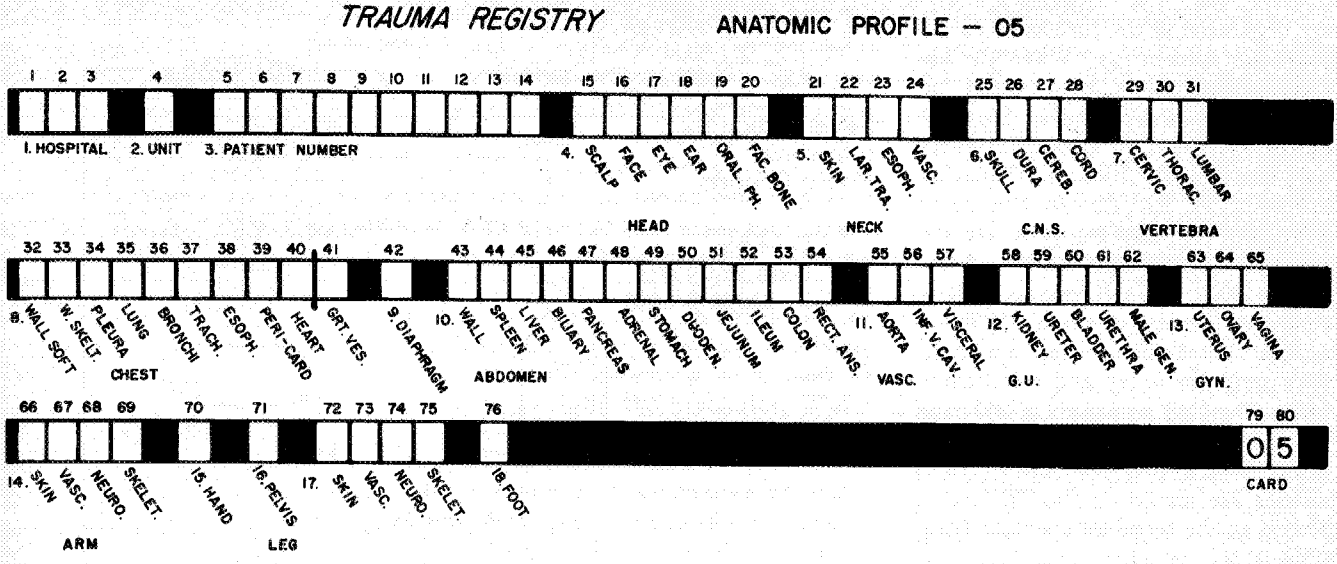

Fig 1.—Gross anatomic profile card (card 05). An entry in column 57 will require by internal computer cleaning a response in appropriate columns on card 10.

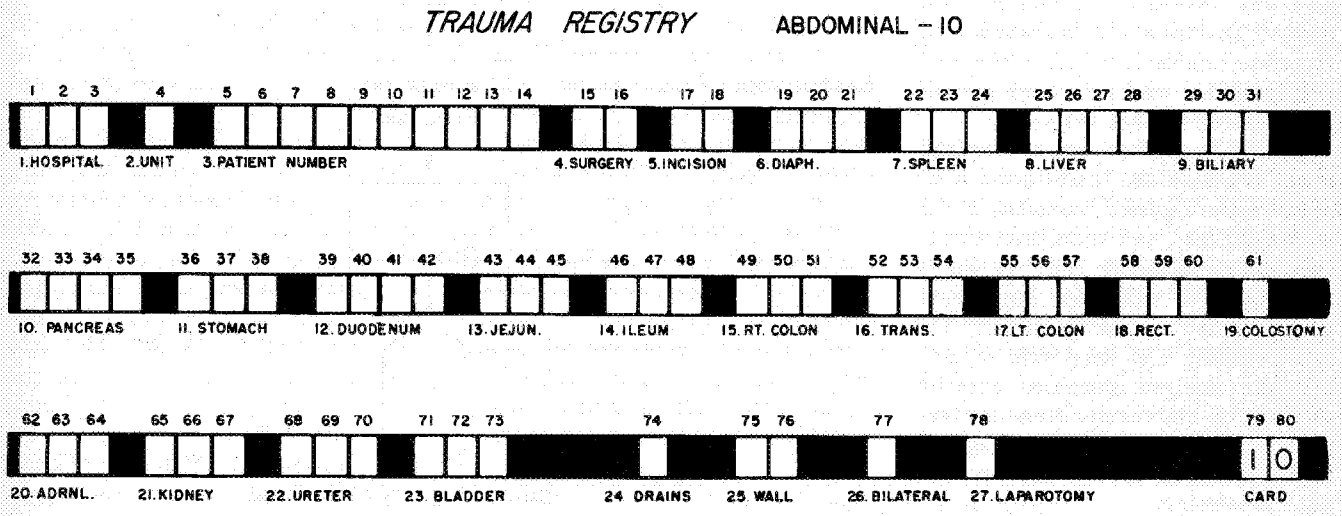

Fig 2.—Abdominal operative treatment card (card 10). Columns 49 to 61 are used for recording coded diagnoses relevant to these anatomic parts. Column 1 records the diagnosis; 2, the treatment; and 3, complications. Special column (61) for colostomy is shown. All entries utilized restricted vocabulary.

are subsequently decoded upon entry to the registry and are stored independent of any computer card sequence. These entries can then be used either for direct recall or retrieval of other coded or clear text information.

Computer Methods.—In order to ensure an ability to respond to changing requirements, the registry has been made modular in nature and contains three basic subsystems. These subsystems are linked together by a common master data file, so that modifications can be made independently of each other. These subsystems are classified as follows: (1) Data Entry Subsystem, (2) On-Line Retrieval Subsystem, and (3) Statistical Evaluation Subsystem.

The Data Entry Subsystem contains those programs designated for the collection and verification of all data and their addition to the master file. The On-Line Retrieval Subsystem utilizes a generalized information retrieval system to allow both random and rapid access to any of the information contained in the master file. The Statistical Evaluation Subsystem provides for the incorporation into the Registry of any reporting functions desired for either short-term research purposes or ongoing reporting to the physician, hospital, and municipal, state, or federal agencies.

DATA ENTRY SUBSYSTEM.—This subsystem provides the mechanism for the collection, verification, and addition of data to the master file. This subsystem is programmed to be (*a*) capable of rapidly acquiring data from a large number of reporting centers (40 in Illinois alone); (*b*) reasonably economical to operate; and (*c*) easily used by medical supportive personnel, including physicians, nurses, record librarians, and allied health personnel, with a minimum of training.

These necessary restrictive operational criteria have resulted in an extremely conservative approach to data entry through the use of card-image format input. A trauma patient's medical record is abstracted onto the registry worksheets which

are organized in the format of an 80-character card-image.[3] When the abstracted data are in "card format" on some of the 16 worksheets, they are easily converted to a machine-readable medium. For those participating hospitals in the Illinois Statewide Trauma Program, the data are entered on-line through the use of Hazeltine 2000 video terminals.[5] These computer remote terminals (CRT) are on-line via telephone couplers with direct computer entry and recall capability. The CRT transmits at 300 baud (30 characters per second) over dial-up, voice-grade telephone lines. Data entries are placed on the CRT video screen as the terminal operator transcribes the primary data from the format card worksheets. Visual verification is performed by the operator and any necessary corrections are made. The data are then transmitted from the remote terminal to the central computer where they are temporarily stored on disk (Fig 3).

Where a computer remote terminal is not available, the "card formatted" data on the registry worksheets can be keypunched and submitted on either data processing cards or magnetic tape. In this way, any emergency facility can use the registry for batch loading and long-term reporting and analysis purposes without utilizing on-line remote computer terminals. The schematic flow diagram in Fig 3 shows the two options for data processing.

All data are verified by a "data cleaning" process after being entered via terminals and temporarily held on a disk. They are then merged with any keypunched data available, sorted, and placed onto magnetic tape. This tape is then used as input to the first of two "cleaning" programs. This program checks each card-image to ensure that only "legal" (acceptable) codes have been entered. Cross-checks for data consistency within an individual card-image are also performed at this stage. There are presently more than 500 computer cleaning checks used in the data processing sequence.

As a result of this individual card-image cleaning, the original input data are divided into two files for the "clean" and the "dirty" data. The clean data file is passed on for further processing. The dirty file is currently

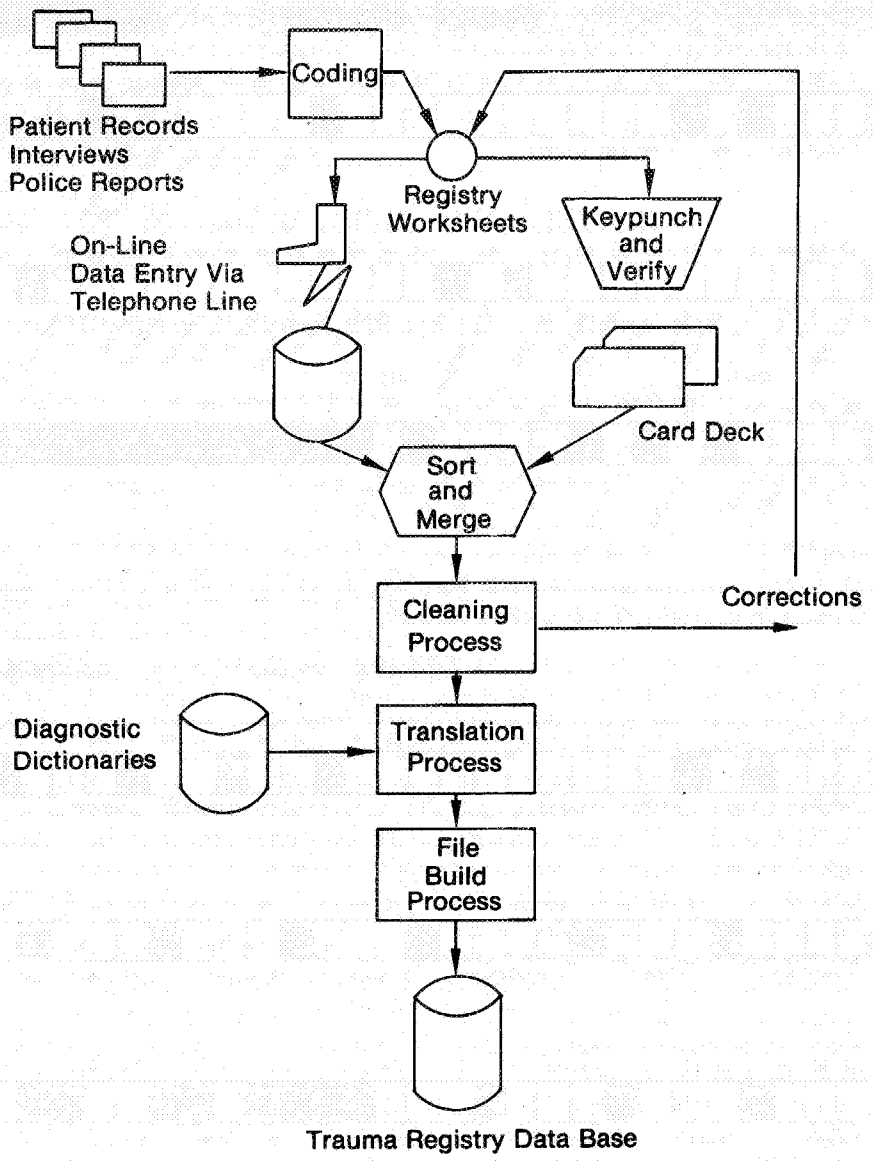

Fig 3.—Schematic computer flow pattern for patient medical record storage.

rejected for processing. Future programming will allow for on-line editing of the dirty file and thereby eliminate the need for reentering incorrect card-images. Figure 3 shows the general flow of this portion of the Data Entry Subsystem. A hold file is dynamically maintained by the system in which patient records are awaiting some corrections.

An example of these cleaning tests is as follows: the Gross Anatomic Part fields of card 05 (Anatomic Profile Card) are checked against the Operative Treatment Program (cards 8-15). The purpose of this cross-checking is to minimize the entry of incomplete data and to ensure consistency within a patient's record. A typical cross-check would be as follows:

If an organ in the Abdominal Area of card 05 (Gross Anatomic Profile) is marked, one or more of the Abdomen Organs on card 10 must be classified as to type of involvement. For each of the organs on card 05 marked as being involved in the injury, the appropriate diagnosis, treatment, and complication information must appear on card 10, Abdominal Operative Treatment card (Fig 1 and 2).

Through the use of these tests, a high level of validity can be achieved. Upon completion of the individual card-image cleaning programs, a file of good card-images is created.

ON-LINE RETRIEVAL SUBSYSTEM.—This subsystem provides for high-speed, on-line inquiry into the master file. It utilizes a commercially available software package which is designed for operation on an IBM Sys-

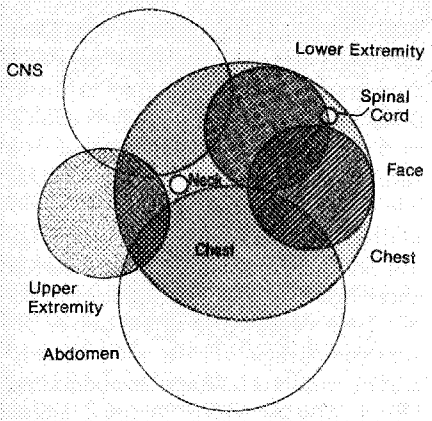

Fig 4.—Venn diagram showing interrelationships of organ involvement in patients' deaths of years 1966 and 1969 in the Trauma Unit. Central nervous system indicated by CNS.

tem/360 or System/370 under a full OS operating system. The Series-100 Information Retrieval Software System (IRS) consists of two programs: the File Build Processor and the Retrieval Program. The Retrieval Program has associated with it a "programming language" similar to the File Build Processor. The File Build Language is assembly language in nature and batch-processing oriented. The User Retrieval Language is an extremely high-level language designed primarily for interactive terminal use. This subsystem provides for on-line retrieval of stored information; outputting retrieved data in any format desired; updating or deleting old information; and storing small amounts of new information.

STATISTICAL EVALUATION SUBSYSTEM.—Statistical evaluation is performed with the UCLA Biomedical Statistics Package.[6] Information maintained in the Trauma Registry data base can be automatically evaluated and manipulated. Standard statistical procedures as well as more complex analysis can be performed automatically or after obtaining hard copy readouts and secondary calculations. Data converted to a digital form can be utilized for an unlimited number of statistical purposes. Also, data bases can be interchanged and used for frequency diagrams, histograms and special graphic displays. The Trauma Registry is now being programmed to provide demographic readouts of accident occurrences and the distribution of patient transfers.

Results

The following is a series of examples of how the Trauma Registry can be utilized.

Computerized Patient Record.—A legible patient record can be generated from the data base, and the advantages of this capability are obvious. In this record significant facts are systematically recorded. Where such information is not available, a response indicating such must be entered into the computer. These records are readily accessible at the CRT by using the patient's name, hospital, identification number, or by any clinical event, diagnosis, treatment, or complication recorded in the master file. Names or hospital numbers of patients with a specific diagnosis can be recalled, along with any of the other 800 possible informational fields. These are displayed on the remote-terminal video screens and can be written out simultaneously by a teletype device for a hard print copy. These summaries are written in natural English language and are comprehensible to professional, administrative, and allied health personnel.

Clinical Summaries.—On-line sequential clinical surveys can be maintained by assessing the data base. Any informational field can be requested, and from this data vantage point any of the other 800 fields can

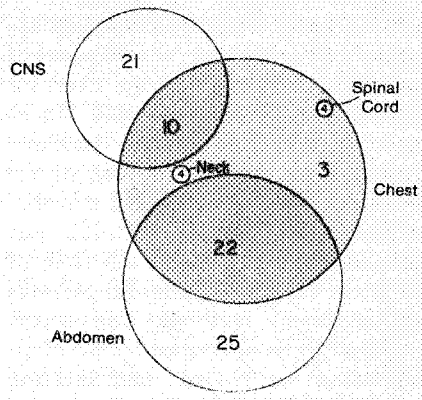

Fig 5.—Venn diagram shows quantitative interrelationships of 1966 and 1969 deaths, between central nervous system (CNS), chest, neck, spinal cord, and abdomen injuries. Area representing chest injuries is inordinately large and not redrawn for better visual comparison.

be searched, counted, and read out. The scope of the readout is limited only by the width of the recording device. Therefore, one can automatically request the number of injuries, by type, to a specific organ or part and simultaneously obtain the chosen associated variables of this event. For example, when a readout was requested for those patients injured by multiple gunshot wounds who sustained trauma to their right colon,[7] the report included the identification number, organ diagnosis, basic treatment, type of colostomy utilized, time

Epidemiology of Trauma Deaths

	Time (Hours)		Distance (Miles)*		Patients Transported	
	Injury to Initial Care	Transfer	Initial	Transfer	Vehicle	No. (%)
1966						
Direct admissions (No.-23)	3.7	...	1.4	...	Police van	18 (72)
					Private ambulance	4 (16)
					Rescue squad	1 (4)
					Other	2 (8)
Transfer admissions (No.-21)	1.7	2.4	1.7	7.4	Police van	19 (91)
					Private ambulance	2 (9)
1969						
Direct admissions (No.-36)	2.0	...	2.5	...	Police van	28 (78)
					Private ambulance	3 (8)
					Rescue squad	4 (11)
					Other	1 (3)
Transfer admissions (No.-26)	1.2	2.3	1.5	6.0	Police van	13 (50)
					Private ambulance	9 (35)
					Other	4 (15)

*Time and distance averages for group.

of emergency surgery, abdominal approach, complications, development of peritoneal abscess, and the need for reoperation. Similar requests can be developed at any remote terminal (CRT). Such clinical files can be reevaluated on-line as clinical material accumulates. Clinical material can also be separated as to the time of input to enable periodic comparisons of treatment methods. Comparison studies can be developed by use of alternating or coded identification numbers.

Clinical Studies.—The first report entitled "A Critical Review of Management of Right Colon Injuries"[7] showed the effectiveness of being able to look at an injured organ and automatically relate many other factors to a specific injury. From this study it was apparent that simple repair alone was not as satisfactory as exteriorization of the colon. The pelvic abscess (41%) and wound infection rates (41%) were inordinately high when simple repair was performed. There were no intra-abdominal abscesses, and only 22% had wound infections when the injured colon was exteriorized. Repaired right colons remained in the hospital 21.0 days or seven days longer than the exteriorization group in this series.

In a larger study of 392 colon and rectal injuries also evaluated with the aid of the registry, it was shown that there was a higher rate of intra-abdominal abscess in right colon (13:5), transverse colon (5:3), left colon (5:3), and rectal (1:0) injuries when simple repair was done. Also, the hospital stay was longer for each repair group when compared to the exteriorized group.

These and other studies can be continuously updated as new clinical experience develops. At present all colon injuries treated at the Trauma Unit, Cook County Hospital, are in a clinical double-blind antibiotic study. At the termination of this study it will be relatively easy to match patients not only for the type of antibiotic used but also to their associated injuries. It will be possible to exclude readily those patients with other significant causes of septic complications.

Risk Factors for Trauma.—A satisfactory outcome after major injury is dependent on two major factors: (1) the quality of initial and definitive care and (2) the time interval between injury and the delivery of this care. Experience at the Cook County Hospital Trauma Unit has shown that the care given prior to admission may be a critical determinant of final outcome.[8] Trauma Registry cards 01-04 record significant epidemiologic events including the time intervals that describe the emergency care delivery. Evaluation of deaths in the Trauma Unit in 1966 and 1969 show that over 72% and 78% of all directly admitted patients were transported by police van (Table). Most transfer patients were also brought to the Cook County Hospital by police van (91% in 1966 and 50% in 1969). The distance of referral appears to have decreased slightly over this three-year interval. An adequate explanation of this change is not now apparent. The continuation of police-van ambulance transportation for transferring patients in this critically ill group is unacceptable as there is no resuscitative capability in these vehicles.

These types of problems can be approached as they are identified in any specific community with the use of the registry. Each community has unique sociogeographic factors that will lend themselves to analysis by similar epidemiologic investigations. The effectiveness of instituted changes in the emergency health-care delivery system can be evaluated by those professionals in a community as problems are identified.

Morbidity and Mortality Factors.—The incidence of fatality related to any organ or anatomic part involved in injury is often difficult to determine. This is especially true in multiple systems injuries when the major contributing cause is not easily defined. The frequency distribution of multiple associated organ injuries is not readily accessible without repeated and exhaustive medical chart review. By constructing tables of cross-tabulation for those injuries recorded in card 05 (Gross Anatomic Profile), one can develop a graphic demonstration of these complex mortality relationships. In Fig 4 and 5, Venn diagrams display the interrelationship of the major anatomic parts for the 127 Trauma Unit patient-deaths experienced in 1966 and 1969. Overlapping areas represent combined or associated injuries, while free areas relate to isolated injuries. Simplification of this display is shown in Fig 5, where involvement of the face and upper and lower extremities has been deleted. The chest area remains inordinately large in this Figure as there are only three isolated chest injuries. The Venn diagram has not been redrawn to allow better visual comparison. There were 21 central nervous system and 25 abdominal lethal injuries which occurred alone. There were ten central nervous system and 22 abdominal injuries that occurred with chest injuries. The four spinal cord and neck injuries also occurred with chest trauma. These relatively simply constructed Venn diagrams can demonstrate at a glance what complex tally counts and statistical tabulations may obscure.

Logistic Requirements.—Specialty care requirements for any type of trauma are obtainable from the Trauma Registry data base. The level of specialty care delivery, eg, consultation, minor or major surgery, medical care, long-term care and rehabilitation are recorded for each patient and are easily retrievable.

Care requirements can be determined by the frequency of injury patterns at any trauma care center. In a recent study it was found that, at the Cook County Hospital Trauma Unit, patients dying within the first hour of admission usually needed a general or thoracic surgeon or both.[8] Those patients who died later required more neurosurgical or other specialty attention. The use of specific diagnostic procedures during the first 24 hours and early postinjury period are also programmed and retrievable. These types of data will be useful when developing new or modifying established trauma care facilities.

Cost Expenditures.—Every patient in the registry has a cost account or medical provider number. Correlations of cost expenditures for comprehensive trauma care can be evaluated. These include the time spent in a special care unit, the number of diagnostic tests, as well as long-term follow-up and readmission expenditures for a patient, group of patients, or a trauma care center.

Project Monitoring.—The Illinois Statewide Trauma Program[5,9] is

based on the concept of developing specific treatment centers for the care of the critically injured. These centers, of which five have been operational since July 1, 1971, with the sixth inaugurated in late August of that year, are the only designated trauma care centers within a community. The critically injured in these communities and surrounding region are being admitted and treated in these centers. The increasing patient load and the change in patient flow patterns to these centers have been recorded in the Trauma Registry. The clinical aspects previously discussed are recorded and available for recall at these centers through dataphone remote computer linkups. On-going community-wide and clinical investigations are being pursued. Implementation of the Illinois Trauma Program is being monitored by the registry. Special problems, such as the lack of certain specialists in a given local area and the prospective case load for these specialists, are being documented.

The total patient load of the six regional trauma centers over the first six-month period was 4,811. The number of patient transfers is steadily increasing in certain centers. Also, the number of direct admissions from longer distances is being observed. The overall mortality rate for the statewide program during the first six months has been 2.0%. The lowest mortality rate (0.7%) was recorded at the Cook County Hospital Trauma Unit; the highest (6.5%) is the experience of a recently established center. This high mortality rate is a reflection of the preponderance of persons with injuries in automobiles at high speeds and severe multiple-systems trauma now being admitted to this center.

The registry is being used to help implement the 25 local, 8 areawide, and 9 regional trauma care facilities in the overall state plan. These centers, once established, will join the data collection system for further program evaluation.

Comment

Every member of our complex society faces the risk of accidental death or serious disability after a major traumatic event. Very few in our population can be considered immune to a possible major traumatic injury. There are more than 100,000 deaths and more than 400,000 permanently disabled people in the United States every year.[10] Last year, in the state of Illinois, there were 7,000 accidental deaths.[11] In attempting to cope with the problem of accidental death and disability, areawide planning is the most appealing and practical. At present, there is no unified plan in most communities for the distribution and intensive management of the critically injured. The Illinois Statewide Plan for Trauma Centers is a new approach to community health planning for care of the accident victim.[8] Difficulties in area project planning for the care of the injured are due in part to the lack of "hard core" information about this problem in a given locale.

A partial solution to this major health problem is the development of a trauma registry. The National Academy of Sciences-National Research Council, in their bulletin *Accidental Death and Disability*,[1] also suggested that regionally oriented trauma data collection systems be devised and implemented. These registries should be developed for use in both urban and metropolitan areas and linked to a national data accumulator. This trauma registry should be programmed for general basic questions and should be flexible enough to evaluate the efficacy of projected major health care adaptions, such as helicopter evacuation services and hospital trauma centers. It must be intelligible to and utilizable by both professionals and allied health personnel. It must anticipate unrecognized problems and most of all, it must not be too complex for day-to-day usage.

In response to this obvious nationwide deficiency in the existing emergency services delivery system and with the advances in the information sciences, a Trauma Registry has been developed which is providing a means for thorough investigation of the epidemiologic, clinical and administrative aspects of this problem.[2,3] A central Trauma Registry, based at the Trauma Unit of the Cook County Hospital and Research Resources Laboratory of the University of Illinois, is now being used in the state of Illinois to collect and analyze accident information from six Regional Trauma Centers. Patient indexing methods for specific diseases, such as cancer,[12] burns,[13] and military vascular injuries,[14] have been developed previously.

This first systematic attempt to obtain and collect casualty and medical information was instigated after an order by Joseph Lovell, Surgeon General, on April 21, 1818.[15] This order directed that all reports, returns, and communications of the US Army Medical Department be forwarded to the Surgeon General's office and the first health report issued to the Secretary of War was dated Nov 1, 1818. These reports were maintained quarterly and were eventually published after 1822 and continuously without interruption, except during the Mexican War. These reports served to improve the health care of the troops which included the abolition of the whiskey ration which supposedly had made drunkards of many of the troops. These vital statistics were also instrumental in improving the diet, water supply, housing, clothing, and working conditions in the army.[15]

During the Mexican hostilities, the exigencies of the war caused a diminution of the completeness of medical reporting and resulted only in the vital statistics of death that occurred from diseases and battle injuries. These reports were used especially to maintain the adequacy of combat forces.

Following the Civil War, these field medical records served as the basis of decisions for compensation claimants. The difficulty of these decisions was compounded by the need to refer continuously to the primary data recorded in field register books. In 1883 an initial attempt was made to abstract these records onto large sheets for improved pension processing, as well as compilation of vital statistics. Within the decade, all records were transcribed on cards and assembled in alphabetical order. This further improved efficiency and lessened the political assertions that certain constituents were not receiving their due.

In 1892 the Diagnostic Tag was authorized. This diagnosis was attached to the wounded soldier in the battlefield or at the first treatment station. Later a carbon copy of this original

tag was submitted to the permanent record system. Confusion during the evacuation of casualties during the Spanish-American War and the failure to fully utilize this system led to the future enforcement of the field tagging technique. In 1904, transfer report cards (3½ × 8 inches) were fixed to patients and improved the continuity of patient care and medical recording because the cards were submitted to the Surgeon General on a monthly basis.

These innovations proved their worth in 1914 at Vera Cruz where such vital data became crucial and daily medical reports were used to show accurate numbers of casualties, communicable illness, and hospital-bed status. This basic form has since been used with some modification until current times.

The excellent recording system became unwieldy when conscription produced the 4 million men chosen to serve in World War I. After 1912, the Bureau of Medicine and Surgery of the Navy Department helped to develop the International List of Causes of Death. This allowed for more uniform diagnostic categories, which made the handling of large quantities of data more practical. As technology became available, mechanical sorting equipment aided in this process. The Census Bureau had already utilized Dr. Herman Hollerith's[16] Electrical Machine Tabulator in their 1910 survey. This original two-card sorter system progressed subsequently to card punching counters and sorter boxes to include more than 20 patents by 1920. The patent rights for this were later sold to the International Business Machine Company (IBM).

Gibson et al[17] in their study of emergency medical services in the Chicago area stated that most hospital transfers to Cook County Hospital were mainly because of the lack of specialized medical resources in the referral facility. This, they thought, was especially true when dealing with major trauma, when the smallest hospitals (less than 200 beds) and those without resident teaching program transferred the greatest proportion of cases (5.5%) to Cook County Hospital. At Cook County Hospital approximately 30% of all admissions were considered to be urgent and 19% were for trauma-related problems. In 1969, 6,863 patients were admitted directly to the Trauma Unit. There were only 75 deaths which occurred in this special intensive care area where patients are kept through their entire acute posttraumatic period. In 1966, 5,090 patients were admitted and 44 died. This mortality rate of 0.8:1.1 compares favorably with that of the acute resuscitation and evacuation military field hospitals of Vietnam.

The outcome after a given injury is dependent on the availability of competent medical care, the distance and time required to obtain this care and many other considerations. The Trauma Registry is designed to store a vast amount of significant data to allow for the multifactorial analysis of traumatic events. These factors include the efficacy of the therapy, time, cost, and personnel requirements. Despite the amount of useful information being recorded, the Trauma Registry is not an attempt to construct an encyclopedia of injury. It has been developed with currently significant questions in mind. The improvement of medical record capability with computer methods has been shown by Slack et al.[18] The utilization of a restricted vocabulary has made the computer management of medical terms easier. The uniformity of data retrieval in a readable and comprehensive style has been one of the most important rewards of this system.

By utilizing remote video-tape terminals, the trauma surgeon now has direct access to an improved medical record for trauma patients. The development of an on-line data base has important and far-reaching possibilities in the solution of numerous clinical problems of trauma care. Inquiries to the central computer for the results and complications of a diagnostic method or surgical procedures are practical uses of the Trauma Registry. There is no comprehensive data source for clinical surveys of major injuries at this time. This is particularly true as it relates to a specific community experience.

The serious limitations of our information system for accidental death and disability are one of the prime reasons for the current "emergency health crisis." Across the nation, in almost every community, essential information is not available to evaluate the quality, efficacy and cost of the present system of care of the injured. It is therefore important that while changes are planned in the health delivery system, we simultaneously measure our effectiveness. This will be helpful to plan effectively and allocate resources where they can be optimally utilized. The Trauma Registry will provide a compatible information base for comprehensive areawide emergency medical care planning and implementation and statistical evaluation of the effectiveness of these programs will be possible.

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