Designation: F 1629 – 95

Standard Guide for Establishing Operating Emergency Medical Services and Management Information Systems, or Both[1]

This standard is issued under the fixed designation F 1629; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 The Emergency Medical Services Management Information System (EMS-MIS) serves as a framework for the management and linkage of data documenting the complete emergency episode from onset through the pre-hospital, emergency department, and hospital phases to final discharge. This document establishes a standard guideline for the planning, development, and maintenance of an EMS-MIS framework, including linkage among pre-hospital, hospital, and other public safety or government agencies. The resultant EMS-MIS should be capable of monitoring the compliance of an EMS system with its established system standards, and provide an objective basis upon which different EMS systems can be comparatively evaluated.

1.2 *EMS-MIS Goals*:

1.2.1 To manage data regarding response to a medical emergency.

1.2.2 To provide a process for obtaining and documenting objective, reliable data.

1.2.3 To provide information that can be used to affect operational changes in an EMS system leading to the delivery of better quality emergency medical care.

1.2.4 To provide information to guide the rational investment of local, state, and national resources to improve and maintain EMS.

1.3 This guide will standardize data needed for decision making at various levels of the EMS system, and offer suggestions as to the appropriate use of this information.

1.4 This guide comments on several possible configurations for information flow and data processing, recognizing that no one configuration is best suited to all circumstances.

1.5 This guide focuses on pre-hospital medical activities, including emergency responses, scheduled transports, and all interinstitutional transfers.

1.6 This guide addresses EMS-MIS techniques applicable to the internal operations of outpatient and inpatient facilities as well as pre-hospital care providers.

1.7 This guide will not address specialized data systems and applications such as trauma registries, but will allow for interfacing with such applications.

1.8 This guide will not address computer-aided dispatch (CAD) systems, nor system status management (SSM) applications, but will allow for interfacing with such applications.

2. Referenced Documents

2.1 *ASTM Standards:*

E 622 Guide for Developing Computerized Systems[2]

E 623 Guidelines for Developing Functional Requirements for Computerized Laboratory Systems[2]

E 624 Guide for Developing Implementation Designs for Computerized Systems[2]

E 625 Guide for Training Users of Computerized Systems[2]

E 627 Guide for Documenting Computerized Systems[2]

E 730 Guide for Developing Functional Designs for Computerized Systems[2]

E 1113 Guide for Project Definition for Computerized Systems[2]

E 1239 Guide for Description of Reservation/Registration-Admission, Discharge, Transfer (R-ADT) Systems for Automated Patient Care Information Systems[2]

E 1384 Guide for Description of Content and Structure of an Automated Primary Record of Care[2]

F 1177 Terminology Relating to Emergency Medical Services[3]

3. Terminology

3.1 Standard EMS terminology is referenced in Terminology F 1177. Definition of individual data elements is given in 5.3 and 5.4.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *Continuing Medical Education (CME)*—refers to data that identify all continuing medical education activity completed by an EMT in the system.

3.2.2 *Data Flow Diagram (DFD)*—Diagram that partitions system business functions into a series of events that enhances analysis and clarifies the purpose, events, and functions that take place for each process.

3.2.3 *Emergency Medical Services Management Information System (EMS-MIS)*—a framework for the management and linkage of data documenting the complete emergency

[1] This guide is under the jurisdiction of ASTM Committee F-30 on Emergency Medical Services and is the direct responsibility of Subcommittee F30.03 on Organization/Management.

Current edition approved Sept. 10, 1995. Published October 1995.

[2] *Annual Book of ASTM Standards*, Vol 14.01.

[3] *Annual Book of ASTM Standards*, Vol 13.01.

episode from onset through the pre-hospital, emergency department, and hospital phases to final discharge.

3.2.4 *Patient Care Record (PCR)*—refers to the data elements described in 5.3 which are to be completed by each PSO for every patient who is treated or transported, or both.

3.2.5 *Provider Service Organization (PSO)*—any public service or commercial organization that utilizes providers to deliver pre-hospital emergency medical care, and transports patients to healthcare facilities, on either an emergency or prescheduled, non-emergent basis.

3.2.6 *Public Safety Answering Point (PSAP)*—a dispatch center that receives incoming calls for help.

3.2.7 *Regional Emergency Medical Services Organization (REMSO)*—Political users of the EMS-MIS at the regional level. This could include an organizational entity such as a regional EMS council, a multi-county hospital consortium, and so forth, or a regional coordinating division within the prevailing EMS authority.

4. Summary of Guide

4.1 The ability to deliver high-quality, cost-effective pre-hospital care can be enhanced by analysis of information about the EMS system's structure, process, and outcomes. This guide defines a standardized terminology and recommends a conceptual design for a computerized EMS-MIS which can facilitate such analysis.

4.2 This guide is intended to serve as a blueprint for the initiation of such a system in geopolitical areas where computerized EMS-MIS is not available or is being updated and to provide a standard basis for data collection to allow for meaningful comparisons between EMS systems throughout the country. The EMS-MIS's already in operation should give serious consideration to restructuring their databases to be consistent with this guide.

4.3 Fig. 1 defines the major organizational entities involved in day-to-day EMS operations. This diagram is based upon the assumption that these organizations represent the potential sources of all data and policies needed for the EMS-MIS. It shows types of data and reports available from the various entities, and needed by them to optimize their operation.

4.4 Fig. 2 defines the political users of the EMS-MIS. It

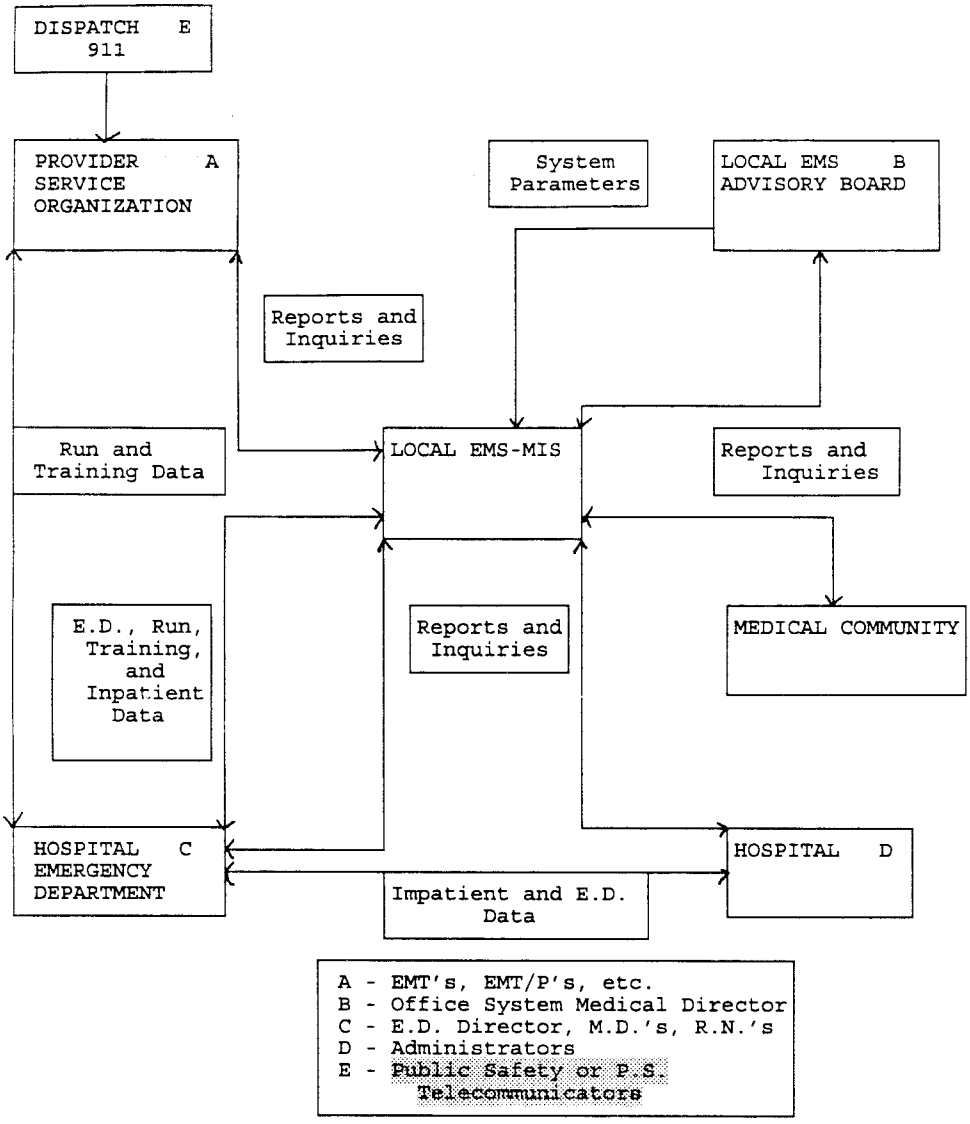

FIG. 1 EMS-MIS Context Diagram I

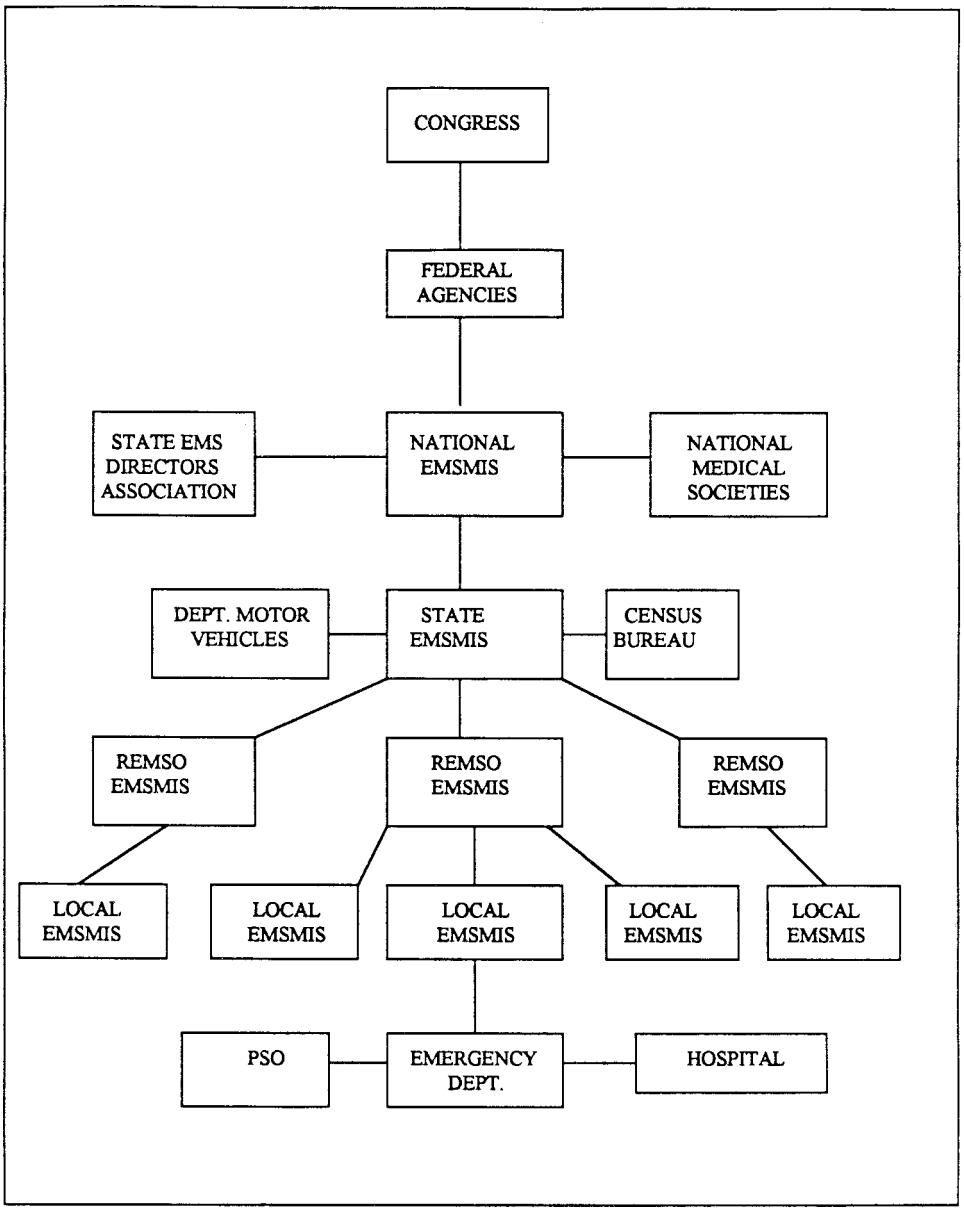

FIG. 2 EMS-MIS Context Diagram II

should be understood that such entities as LOCAL EMS-MIS, REMSO, EMS-MIS, and so forth, do not necessarily refer to distinct organizational entities, but may be coordinating divisions within the prevailing EMS authority.

4.5 The EMS-MIS defined herein recognizes a graduated process of data collection and analysis. This means that data elements collected at the provider and hospital levels may be useful only at the local levels. Emphasis has been given to the ability to capture information in an electromagnetic format as closely as possible to the time/source from which it was generated in order to enhance completeness, validity, reliability, and utilization of data. By observing the linkage parameters defined herein, it should be possible for higher levels of the pyramid to access detailed data through welldefined linkage mechanisms, when and if necessary, without resorting to costly duplication and centralization of all data elements.

4.6 The task group recommends that the data collected by the PSO be aggregated at the various levels that have responsibility for medical quality assurance, planning, and management activities. These levels include but are not limited to the emergency department, hospital(s), regional EMS, and statewide.

4.6.1 The emergency department is an important link between the pre-hospital and inpatient settings.

4.6.2 The medical direction for a PSO, on-line and frequently off-line as well, usually originates in an adjacent hospital emergency department. Analysis of pooled data at this level facilitates medical quality assurance activities and minimizes the necessity for uploading confidential and sensitive data to higher levels of the pyramid.

4.6.3 Access to hospital in-patient data may occur at the hospital or state level. More rapid feedback to medical care providers is possible when the in-patient data are accessed while the patient is hospitalized or shortly after discharge.

Statewide hospital data are usually merged and available within six months after the year's end. These state data are useful for planning and for linkage to nonmedical data.

4.6.4 Laptop/palmtop and other computer technology that permits computerized data entry at the scene facilitates immediate and efficient access to the data by local EMS-MIS in addition to timely export to regional and statewide entities.

4.7 All data element definitions, formats, and data communications protocols herein will be coordinated with those of the ASTM E31.12 Subcommittee on the Computerized Patient Record, the Center for Disease Control Consensus Trauma Registry Minimum Data Set, the NHTSA uniform prehospital EMS data elements, and the Subcommittee on Ambulatory Care Statistics and the Interagency Task Forces of the National Committee on Vital and Health Statistics for the Uniform Ambulatory Care Data Set and the Uniform Hospital Discharge Data Set.

4.8 The EMS-MIS's may wish to include additional data elements in their databases for a variety of purposes. In addition to the sources listed in 4.7, some of the data elements presented in 5.3 were chosen if they met either of the conditions listed as follows:

4.8.1 The data element is necessary for identification/documentation or recall/linkage of the event, or both.

4.8.2 The data element is needed for generation of a useful management report.

4.9 The data list was kept as small as feasible for reasons of practicality, cost, and a better chance of successful implementation of the system as a whole. It reflects the consensus of the Task Group and the 1994 national consensus conference sponsored by the National Highway Traffic Safety Administration. Additions to the standard data set herein will be made by the following procedure: Any person who proposes a data element for inclusion in the data set should submit the following information, in writing, to the F30.03.03 Task Group.

4.9.1 An explicit definition of the element.

4.9.2 The organization in the Level I Context Diagram (Fig. 1) responsible for recording the data element.

4.9.3 The logical database file the element should reside in. (See 5.8.6.7 for the list of database files.)

4.9.4 The organizations that should have possession of the element routinely and optionally.

4.9.5 Those who should have access to the element.

4.9.6 The purpose of the data element and its various uses.

4.10 After review of the information in 4.9.1 to 4.9.6, the task group will vote to include/exclude the element, and so advise Subcommittee F30.03.

4.11 Certain key identifiers must exist in a planned, coordinated manner in order for an EMS-MIS to function efficiently and without ambiguity. There should be a system in each state that allows for the assignment of unique identification or registration numbers to each of the following:

4.11.1 Individual providers.

4.11.2 Provider service organizations (PSO).

4.11.3 Individual vehicles owned or operated by PSO's, or both.

4.11.4 First responder organizations.

4.11.5 Physicians.

4.11.6 Nurses.

4.11.7 Hospitals.

4.11.8 Non-hospital in-patient institutions (nursing homes, rehabilitation facilities, etc.).

4.11.9 A statewide, standard, patient care record. The record may be computerized, or paper, or both. Regardless of the form, the record should be prenumbered or assigned a unique identifier on a real-time basis.

5. Significance and Use

5.1 Data recorded during the patient's pre-hospital phase of care should become a part of the patient's formal emergency department or inpatient medical record, or both. The data elements listed herein are not meant to limit or define the entire scope of information to be elicited during a given patient encounter. These data elements should, however, be documented and subsequently computerized for generation of management reports.

5.2 *Identification of Sources of Data*—Data for the EMS-MIS should be collected from the source organizations listed and shown in Fig. 1 and Fig. 2. The responsibility for collecting the data should rest with the organization as detailed. Responsibility for computerizing the data depend upon the specifics of the individual EMS-MIS design (see 5.8).

5.2.1 *Provider Organization Patient Care Records (PCR), (Run Reports)*:

5.2.1.1 Each provider organization should document every time a vehicle is dispatched regardless of the outcome of the call.

5.2.1.2 Separate PCR's must be completed by each PSO for every patient who is treated or transported, or both. Each patient must be identified by a record number that is unique statewide.

5.2.1.3 Patient care records should be computerized at the local level whenever feasible to promote efficient data access.

5.2.1.4 PCR's should include the applicable data elements as defined in 5.3.2.

5.2.1.5 A process for obtaining the data elements collected by the dispatcher should be established and followed by the provider.

5.2.1.6 The provider should maintain personnel records including the data elements listed in 5.3 and 5.4.

5.2.2 *Hospital Emergency Department Record*:

5.2.2.1 The hospital emergency department should document medical direction. The documentation should include all instances of radio or telephone contact with providers.

5.2.2.2 The hospital emergency department should generate a unique record for each emergency patient visit.

5.2.2.3 Emergency department data should be computerized and also merged at the regional or state level.

5.2.2.4 Data elements listed in 5.4.2 that are usually contained in the emergency department record are important for EMS-MIS evaluation.

5.2.3 *Hospital Discharge Record*:

5.2.3.1 A hospital discharge abstract should be completed for every emergency patient discharged from an inpatient facility.

5.2.3.2 Data elements listed in 5.4.3 that are usually contained in the hospital discharge abstract are important for EMS-MIS evaluation.

5.2.3.3 Hospital discharge data should be computerized and merged statewide.

5.2.3.4 Computerized hospital discharge data should be linked to pre-hospital EMS data in order to document all patients transported by EMS who were admitted and discharged from a hospital.

5.3 *Provider*:

5.3.1 The following data elements should be recorded about the patient by the provider and maintained in its respective "EMS RUN" database file (5.8.6.7(*1*). The following data elements are defined according to the NHTSA definitions for essential and desirable pre-hospital EMS data elements. Essential elements are marked with an asterisk and desirable elements are unmarked. Data elements marked with a bullet represent elements not included among the NHTSA elements but recommended during the ASTM consensus process.

5.3.2 All dates are coded numerically as YYYYMMDD. Time is coded numerically as HHMM. Multiple entries should be possible particularly for patient assessment criteria.

5.3.2.1 *Onset Date*—Date of onset of symptoms or injury date.

5.3.2.2 *Onset Time*—Time of onset of symptoms or injury time.

5.3.2.3 **Date Incident Reported*—Date the call is first received by a public safety answering point (PSAP) or other designated entity.

5.3.2.4 **Time Incident Reported*—Time the call is first received by a public safety answering point (PSAP) or other designated entity.

5.3.2.5 •*Public Safety Incident Number*—The incident number assigned by the PSAP when the call for help is received.

5.3.2.6 **Time EMS Dispatch Notified*—Time of first connection with EMS dispatch.

5.3.2.7 **Incident Number*—Unique number for each incident reported to EMS dispatch. This number is assigned by EMS. If there is a CAD system, this would be the CAD system incident number.

5.3.2.8 **Patient name*—The current name of the patient receiving emergency medical care services for whom the record is being created and about whom data are being collected. The name should be defined to include last name, first name, middle name, initial.

5.3.2.9 *Age*—The patients age:

{3 digits for age in years}
888 Not applicable
999 Unknown
000 For patients up to 1 year of age

5.3.2.10 **Date of birth*—Patient's date of birth.

5.3.2.11 **Gender*—The gender of the patient:

M Male
F Female
U Unknown

5.3.2.12 **Race/Ethnicity*—Patient's ethnic origin including:

1 White non-Hispanic
2 White Hispanic
3 Black non-Hispanic
4 Black Hispanic
5 American Indian/Alaskan Native
6 Asian or Pacific Islander
7 Other
8 Not applicable
9 Unknown

5.3.2.13 *Social Security Number*—Patient social security number:

{9 digit SSN}
888888888 Not applicable
999999999 Unknown

5.3.2.14 *Patient Street Address*—Patient's address of actual residence.

5.3.2.15 **City of Residence*—Patient's city or township of actual residence (if applicable):

{5 digit FIPS code}
88888 Not applicable
99999 Unknown

5.3.2.16 *County of Residence*—Patient's county actual residence (if applicable):

{3 digit FIPS code}
888 Not applicable
999 Unknown

5.3.2.17 *State of Residence*—State, territory, or province, or District of Columbia, where patient resides:

{2 digit FIPS code}
88 Not applicable
99 Unknown

5.3.2.18 **Zip Code of Residence*——Zip code of patient's residence:

{5 digit Zip Code}
88888 Not applicable
99999 Unknown

5.3.2.19 *Telephone Number*—Patient's primary telephone number:

{10 digit telephone number}
8888888888 Not applicable
9999999999 Unknown

5.3.2.20 **Agency/Unit Number*—Number that identifies the agency and unit responding to an incident (state specific).

5.3.2.21 **Patient Care Record Number*—Unique number for each patient care record (PCR) (state specific).

5.3.2.22 **Response Number*—Unique number for each individual response by a response team/vehicle to an incident (team/agency specific).

5.3.2.23 **Service Type*—Type of service requested:

1 Scene
2 Unscheduled interfacility transfer
3 Scheduled interfacility transfer
4 Standby
5 Rendezvous
8 Not applicable
9 Unknown

5.3.2.24 **Vehicle Type*—Type of vehicle that responded to the incident:

1 Ground (transport, non-transport)
2 Rotor craft
3 Fixed wing
4 Other
5 None

5.3.2.25 •*Mileage at Outset*—The mileage at the time the

vehicle is dispatched on a run.

5.3.2.26 •*Mileage at Scene*—The mileage on the vehicle when it arrives at the scene.

5.3.2.27 •*Mileage at Destination*—The mileage on the vehicle when the patient is transferred to the receiving health care facility.

5.3.2.28 •*Mileage at Return*—The mileage when the vehicle returns to its point of outset.

5.3.2.29 **Crew Member One Number*—Personnel certification/license number for crew member who is designated as responsible for the care of the patient. This person will be the signer of the patient care record. The personnel certification/license number should be a unique identifier statewide.

5.3.2.30 **Crew Member One Type*—Type of personnel certification/license for first crew member:

1 First responder
2 EMT basic
3 EMT intermediate
4 EMT paramedic
5 Nurse
6 Physician
7 Other health care professional
8 None of the above
9 Unknown

5.3.2.31 **Crew Member Two Number*—Personnel certification/license number for second crew member. This should be a unique identifier statewide.

5.3.2.32 **Crew Member Two Type*—Type of personnel certification/license for second crew member.

1 First responder
2 EMT basic
3 EMT intermediate
4 EMT paramedic
5 Nurse
6 Physician
7 Other health care professional
8 None of the above
9 Unknown

5.3.2.33 *Crew Member Three Number*—Personnel certification/license number for third crew member. This should be a unique identifier statewide.

5.3.2.34 *Crew Member Three Type*—Type of personnel certification/license for second crew member.

1 First responder
2 EMT basic
3 EMT intermediate
4 EMT paramedic
5 Nurse
6 Physician
7 Other health care professional
8 None of the above
9 Unknown

5.3.2.35 •*Highest Available Level of Care*—This should be determined by the ability to deliver care at the time of the patient encounter whether limited by certification status of the most senior individual or the type of equipment being carried at the time.

1 EMT—paramedic
2 EMT—advanced/intermediate
3 EMT—basic
4 EMT—other

5.3.2.36 •*Initiation of Service Request*:

1 Emergency, 911
2 Emergency, non-911
3 Scheduled transport
4 On-scene request (for example, squad happens to witness accident)
5 Other

5.3.2.37 *Date Unit Notified*—Date response unit is notified by EMS dispatch.

5.3.2.38 **Time Unit Notified*—Time response unit is notified by EMS dispatch.

5.3.2.39 •*Location/Status of Responding Unit*—Coded value to indicate the location/status (primary post, secondary post, enroute back, etc.) of the responding unit when notified by EMS dispatch. This element should be defined according to local dispatch configurations.

5.3.2.40 **Lights and Sirens to Scene*—The use of lights and sirens enroute to scene:

1 Non-emergent, no lights or sirens
2 Initial emergent, downgraded to no lights or sirens
3 Initial non-emergent, upgraded to lights or sirens
4 Emergent, with lights or sirens
8 Not applicable

5.3.2.41 **Time Unit Responding*—Time that the response unit begins physical motion.

5.3.2.42 **Time of Arrival at Scene*—Time EMS unit stops physical motion at scene (last place that the unit or vehicle stops prior to assessing the patient).

5.3.2.43 *Time of Arrival at Patient*—Time response personnel establish direct contact with patient.

5.3.2.44 **Time Unit Left Scene*—Time when the response unit began physical motion from scene.

5.3.2.45 **Time of Arrival at Destination*—Time when the patient arrives at destination or transfer point.

5.3.2.46 **Time Back in Service*—Time response unit back in service and available for response.

5.3.2.47 **Location Type/Scene Description*—Type of location of incident including:

849.0 Home/residence
849.1 Farm
849.2 Mine/quarry
849.3 Industrial place and premises
849.4 Place for recreation or sport
849.5 Street or highway
849.6 Public building
849.7 Residential institution
849.E Educational institution
849.8 Other specified location
849.9 Unspecified location
849.10 Unknown

5.3.2.48 **Incident Address*—Address (or best approximation) where patient was found, or, if no patient, address to which unit responded. Use route numbers and mileposts, or other landmarks, which can be coded in a consistent manner if a street address is not applicable. In maritime areas and in rural and wilderness areas, consideration should be given to use of geographic information system (GIS) coordinates or geographic positioning system (GPS) coordinates corresponding to the location of the incident site.

5.3.2.49 **Incident City*—City or township (if applicable) where patient was found, or to which unit responded (or best approximation):

{5 digit FIPS code}
88888 Not applicable

99999 Unknown

5.3.2.50 **Incident County*—County or parish (if applicable) where patient was found, or to which unit responded (or best approximation):

{3 digit FIPS code}
888 Not applicable
999 Unknown

5.3.2.51 **Incident State*—State, territory, or province, or District of Columbia, where patient was found or to which unit responded:

{2 digit FIPS code}
88 Not applicable
99 Unknown

5.3.2.52 *Factors Affecting EMS Delivery of Care*—Special circumstances affecting the EMS response or delivery of care:

01 Adverse weather
02 Adverse road conditions
03 Vehicle problems
04 Unsafe scene
05 Language barrier
06 Prolonged extrication (>20 min)
07 Hazardous material
08 Crowd control
09 Other
88 Not applicable

5.3.2.53 •*Complaint at Dispatch*—Patient's chief complaint as reported at the time of dispatch.

5.3.2.54 **Cause of Injury*—External cause of injury (E code):

81x.x Motor vehicle traffic crash
814.x Pedestrian traffic accident
82x.x Motor vehicle non-traffic crash
826.x Bicycle accident
83x.x Water transport accident
84x.x Aircraft related accident
85x.x Accidental drug poisoning
86x.x Accidental chemical poisoning
88x.x Accidental falls
890.x Fire and flames
890.2 Smoke inhalation
900.x Excessive heat
901.x Excessive cold
905.x Venomous stings (plants, animals)
906.x Animal Bites
907.x Lightning
907.x Lightning
910.x Drowning
913.x Mechanical suffocation
919.x Machinery accidents
925.x Electrocution (non-lightning)
925.x Electrocution (non-lightning)
926.x Radiation exposure
955.x Firearm self-inflicted (intentional)
960.1 Rape/sexual assault
965.x Firearm assault
966.x Stabbing assault
967.x Child assault/abuse

Other assault:

985.x Firearm injury (accidental)
000.8 Not applicable
000.9 Unknown
Other (Record as narrative)

5.3.2.55 **Safety Equipment*—Safety equipment in use by the patient at time of the injury.

00 None
01 Shoulder belt only used
02 Lap belt only used
03 Shoulder and lap belt device
04 Child safety seat
05 Helmet used
06 Airbag, not deployed
07 Airbag deployed, no belt used
08 Airbag deployed, shoulder belt used
09 Airbag deployed, lap belt used
10 Airbag deployed, lap and shoulder used
11 Airbag deployed, child safety seat used
12 Eye protection used
13 Protective clothing used
14 Personal flotation device used
15 Protective clothing/gear used
88 Not applicable
99 Unknown

5.3.2.56 **Suspected Alcohol/Drug Use*—Suspected alcohol or drug use by patient:

1 Alcohol, yes
2 Drugs, yes
3 Alcohol/Drugs, yes
8 Not applicable
9 Unknown

5.3.2.57 *Injury Intent*—Intent of individual inflicting injury:

1 Intentional, self
2 Intentional, other
3 Unintentional
8 Not applicable
9 Unknown

5.3.2.58 •*First Responder Organization Identification Number*—This should be a unique alphanumeric sequence assigned by the state which identifies each first responder organization in the state, and should be listed on the provider run PCR if a trained first responder was present at the scene.

5.3.2.59 •*Bystander Assistance*—This should indicate which type of first aid was administered by a non-first responder at the scene and be coded as:

1 Extrication
2 Airway assistance/Heimlich maneuver
3 Bleeding control
4 CPR
5 Multiple
6 Automatic external defibrillator
7 Other

5.3.2.60 *Chief Complaint*—Statement of problem by patient or other person to provider.

5.3.2.61 *Provider Impression*—Provider's clinical impression that led to the management given to the patient (treatments, medications, procedures):

789.00 Abdominal pain/problems
519.80 Airway obstruction
995.30 Allergic reaction
780.09 Altered level of consciousness
312.90 Behavioral
427.50 Cardiac arrest
427.90 Cardiac rhythm disturbance
786.50 Chest pain/discomfort
250.90 Diabetic symptoms (hypoglycemia)
994.80 Electrocution
780.60 Hyperthermia
785.59 Hypovolemia/shock
987.90 Inhalation injury (toxic gas)
798.99 Obvious death
977.90 Poisoning, drug ingestion
659.90 Pregnancy/OB delivery
799.10 Respiratory arrest
786.09 Respiratory distress
780.30 Seizure
959.90 Sexual assault/rape

987.90 Smoke inhalation
989.50 Stings/venomous bites
991.60 Hypothermia
436.00 Stroke/CVA
780.20 Syncope/fainting
959.90 Traumatic injury
623.80 Vaginal hemorrhage
623.80 Vaginal hemorrhage
000.77 Other
000.88 Not applicable
000.99 Unknown

5.3.2.62 •*Initial Assessment Acuity*—Coded value to indicate the initial assessment of patient acuity by provider at the scene before care is rendered. This data element should be defined according to local standards to facilitate quality assurance and managed care activities. The definition should be consistent with the definition for 5.3.2.99.

5.3.2.63 *Preexisting Condition Source of Data*—Source of information about the patient's preexisting condition recorded in 5.3.2.64:

01 Patient
02 Relative/Friend
03 Central monitoring agency (for example, private security organization storing health records)
04 Physician/patient provider
05 Other

5.3.2.64 **Preexisting Condition*, Preexisting medical conditions known to the provider:

493.90 Asthma
239.90 Cancer
585.00 Chronic renal failure
518.81 Chronic respiratory failure
250.00 Diabetes
492.80 Emphysema
401.90 Hypertension
312.90 Psychiatric problems
780.30 Seizure convulsions
V44.00 Tracheostomy
011.90 Tuberculosis

5.3.2.65 **Signs and Symptoms Present*—Signs and symptoms reported to or observed by provider:

789.00 Abdominal pain
724.50 Back pain
578.10 Bloody stools
786.09 Breathing difficulty
427.50 Cardiorespiratory arrest
786.50 Chest pain
933.10 Choking
558.90 Diarrhea
780.40 Dizziness
388.70 Ear pain
379.91 Eye pain
780.60 Fever/hyperthermia
784.00 Headache
401.90 Hypertension
787.00 Nausea
344.90 Paralysis
785.10 Palpitations
659.90 Pregnancy/childbirth/miscarriage
780.30 Seizures/convulsions
780.20 Syncope
780.09 Unresponsive/unconscious
Uncontrolled bleeding
623.80 Vaginal bleeding
787.00 Vomiting
780.70 Weakness (malaise)
991.60 Hypothermia

5.3.2.66 **Systolic Blood Pressure*—Patient's systolic blood pressure:

{Systolic BP}
888 Not obtained
999 Unknown

5.3.2.67 *Diastolic Blood Pressure*—Patient's diastolic blood pressure:

{Diastolic BP}
888 Not obtained
999 Unknown

5.3.2.68 **Pulse Rate*—Patient's palpated or auscultated pulse rate expressed in number per minute:

{Pulse rate}
888 Not obtained
999 Unknown

5.3.2.69 **Respiratory Rate*—Unassisted patient respiratory rate expressed as number per minute:

{Respiratory rate}
888 Not obtained
999 Unknown

5.3.2.70 *Respiratory Effort*—Patient's respiratory effort (this field is essential for children 18 years or less):

0 Normal
1 Increased, not labored
2 Increased and labored or decreased and fatigued
3 Absent
9 Not assessed

5.3.2.71 *Skin Perfusion*—Patient skin perfusion, expressed as normal or decreased (this field is essential for children 18 years or less):

1 Normal
2 Decreased
9 Not assessed

5.3.2.72 *Treatment Authorization*—Indicates the type, if any, of treatment authorization:

01 Protocol (standing orders)
02 On-line (radio telephone)
03 On-scene
04 Written orders (patient specific)
88 Not applicable
99 Unknown

5.3.2.73 •*Initiation of ALS*—Coded as:

Before contact with medical direction
After contact with medical direction
No ALS initiated

5.3.2.74 •*On Line Medical Direction Facility Number*—This should be the unique identification number of the radio resource facility, regardless of whether or not the radio resource/medical control facility ultimately received the patient.

5.3.2.75 •*Time on-line Medical Direction Established*—Best estimate of time medical director contacted or protocol implemented.

5.3.2.76 *Time of First CPR*—Best estimate of time of first CPR.

5.3.2.77 *Provider of First CPR*—Person who performed first CPR on patient:

1 Bystander
2 EMS responder
3 Not applicable
9 Unknown

5.3.2.78 *Time CPR Discontinued*—Time at which medical

control or responding EMS unit terminated resuscitation efforts (chest compressions and CPR) in the field.

5.3.2.79 •*Time of Witnessed Cardiac Arrest*—Time of witnessed cardiac arrest.

5.3.2.80 *Witness of Cardiac Arrest*—Person who witnessed the cardiac arrest:

1 Bystander
2 EMS responder
3 Not applicable
9 Unknown

5.3.2.81 *Time of First Defibrillatory Shock*—Time of first defibrillatory shock.

5.3.2.82 *Return of Spontaneous Circulation*—Whether a palpable pulse or blood pressure was restored following cardiac arrest and resuscitation in the field:

1 Yes
2 No
8 Not applicable

5.3.2.83 *Initial Cardiac Rhythm*—Initial monitored cardiac rhythm as interpreted by EMS personnel:

01 Sinus rhythm
02 Other rhythm from 60–100 (not otherwise listed)
03 Paced rhythm
04 Bradycardia
05 Extrasystole
06 Narrow complex tachycardia
07 Wide complex tachycardia
08 Ventricular fibrillation
09 Asystole
10 Pulseless electrical activity
88 Not applicable
99 Unknown

5.3.2.84 *Rhythm at Destination*—Monitored cardiac rhythm upon arrival at destination:

01 Sinus rhythm
02 Other rhythm from 60–100 (not otherwise listed)
03 Paced rhythm
04 Bradycardia
05 Extrasystole
06 Narrow complex tachycardia
08 Ventricular fibrillation
07 Wide complex tachycardia
09 Asystole
10 Pulseless electrical activity
88 Not applicable
99 Unknown

5.3.2.85 **Glasgow Coma Score, Eye*—A one-digit number denoting the eye component of the patient's Glasgow coma score at the time of the provider's arrival on scene.

1 None
2 Opens eyes in response to painful stimulation
3 Opens eyes in response to verbal stimulation
4 Opens eyes spontaneously
9 Unknown

5.3.2.86 **Glasgow Coma Score, Verbal*—A one-digit number denoting the verbal component of the patient's Glasgow coma score at the time of the provider's arrival on scene:

For patients >5 years:

1 None
2 Nonspecific sounds
3 Inappropriate words
4 Confused conversation or speech
5 Oriented and appropriate speech
9 Unknown

For patients 2–5 years:

1 None
2 Moans, whimpers, unintelligible sounds
3 Inappropriate words
4 Confused conversation or speech
5 Appropriate words or speech
9 Not assessed

For patients 0–23 months:

1 None
2 Moans, whimpers
3 Irritable cry words
4 Cries but inconsolable
5 Cries appropriately to stimulus, smiles, coos, fixes, and follows
9 Not assessed

5.3.2.87 **Glasgow Coma Score, Motor*—A one-digit number denoting the motor component of the patient's Glasgow coma score at the time of the provider's arrival on scene.

For patients >5 years:

1 None
2 Extensor posturing in response to painful stimulation
3 Flexor posturing in response to painful stimulation
4 General withdrawal in response to painful stimulation
5 Localization of painful stimulation
6 Obeys commands with appropriate motor response
9 Unknown

For patients up to 5 years:

1 None
2 Extensor posturing in response to painful stimulation
3 Flexor posturing in response to painful stimulation
4 General withdrawal in response to painful stimulation
5 Localization of painful stimulation
6 Spontaneous or purposeful movement
9 Not assessed

5.3.2.88 *Glasgow Coma Score Total*—A two-digit number denoting the patient's first GCS to be automatically calculated at the time of computerization.

5.3.2.89 *Revised Trauma Score*—Patient's revised trauma score.

Respiratory Rate Component:

4 10–29 min
3 >29 min
2 6–9 min
1 1–5 min
0 None spontaneous

Systolic Blood Pressure Component:

4 >89 mm Hg
3 76–89 mm Hg
2 50–75 mm Hg
1 1–49 mm Hg
0 No pulse

Neurologic Component:

4 Glasgow coma score 13–15
3 Glasgow coma score 9–12
2 Glasgow coma score 6–8
1 Glasgow coma score 4–5
0 Glasgow coma score 3

5.3.2.90 •*Other Severity Measures Implemented at the Scene*—Coded value to indicate severity determined from other measures, such as blood sugar, etc. This data element should be defined locally to support quality improvement activities.

5.3.2.91 **Injury Description*—Clinical description of injury type and body site to be organized as a matrix for data collection:

Body Sites:

A External (including burns)
B Head only (excluding neck, cervical, spine, and ear)
C Face (including ear)
D Neck
E Thorax (excluding thoracic spine)
F Abdomen (excluding lumbar spine)
G Spine
H Upper extremities
I Lower extremities or bony pelvis
J Body region unspecified

Injury types:

01 Amputation
02 Blunt injury
03 Burn
04 Crush
05 Dislocation/fracture
06 Gunshot
07 Laceration
08 Pain without swelling/bruising
09 Puncture/stab
10 Soft tissue swelling/bruising

5.3.2.92 **Medication Name*—Medication name, time, and identification of provider giving the medication. The medications include but are not limited to:

1.1 Diphenhydramine
2.1 Atropine
3.1 Albuterol
3.2 Terbutaline
3.3 Dopamine
3.4 Epinephrine
3.5 Isoproterenol
3.6 Metaproterenol
4.1 Succinylcholine
5.1 Heparin
6.1 Adenosine
6.2 Bretylium tosylate
6.3 Lidocaine
6.4 Procainamide
6.5 Verapamil
6.6 Nifedipine
7.1 Amyl nitrate
7.2 Nitroglycerin
8.1 Aspirin
9.1 Meperidine
9.2 Morphine
10.1 Naloxone
11.1 Acetaminophen
12.1 Diazepam
13.1 Magnesium sulfate
14.1 Lorazep
15.1 Sodium bicarbonate
16.1 Calcium chloride
16.2 Calcium gluconate
17.1 Dextrose and water (50 %)
18.1 Furosemide
18.2 Mannitol
18.3 Bumetanide
19.1 Charcoal, activated
20.1 Ipecac
21.1 Metoclopramide
22.1 Dexamethasone
22.2 Methylprednisolone
23.1 Glucagon
24.1 Thiamine

5.3.2.93 **Procedure or Treatment Name*—Procedure or treatment name, time, and identification of provider giving the medication. The procedures include but are not limited to:

96.70 Assisted ventilation (positive pressure)
93.59 Backboard
39.98 Bleeding controlled
93.57 Burn care
99.60 Cardiopulmonary resuscitation
93.52 Cervical immobilization
31.10 Cricothyrotomy
89.51 ECG monitoring
96.04 Endotracheal intubation
99.63 External cardiac massage
99.62 External defibrillation (includes auto)
38.93 Intravenous catheter
41.92 Intraosseous catheter
99.29 Intravenous fluids
93.58 MAST (military antishock trousers)
96.01 Nasopharyngeal airway insertion
96.05 Nasogastric tube insertion
73.59 Obstetrical care (delivery)
96.02 Oropharyngeal airway insertion
93.96 Oxygen by mask
93.96 Oxygen by cannula
93.54 Splint of extremity
93.54 Traction splint

5.3.2.94 *Procedure Attempts*—Total number of attempts for each procedure attempted, regardless of success.

5.3.2.95 **Destination Determination*—Reason a transport destination was selected:

01 Closest facility (none below)
02 Patient/family choice
03 Patient physician choice
04 Managed care
05 Law enforcement choice
06 Protocol
07 Specialty resource center
08 On-line medical direction
09 Diversion
10 Other
88 Not applicable
99 Unknown

5.3.2.96 **Lights or Sirens, or both, Used from Scene*—Use of lights or sirens, or both, from the scene:

1 Non-emergent, no lights or sirens
2 Initial emergent, downgraded to no lights or sirens
3 Initial non-emergent, upgraded to lights or sirens
4 Emergent, with lights or sirens
8 Not applicable

5.3.2.97 **Destination/Transferred to*—Health care facility or pre-hospital unit/home that received patient from EMS responder providing this record. Facilities will be recorded by unique identification numbers.

01 Home
02 Police/jail
03 Medical office/clinic
04 Other EMS responder (ground)
05 Other EMS responder (air)
06 Hospital
07 Morgue
08 Free-standing emergency center
09 Nursing Home
88 Not applicable

5.3.2.98 **Incident/Patient Disposition*—End result of EMS response.

01 Treated, transported by EMS
02 Treated, transferred care
03 Treated, transported by private vehicle
04 Treated and released
05 No treatment required
06 Patient refused care
07 Dead at scene
08 Canceled
88 Not applicable
99 Unknown
00 No patient found

5.3.2.99 •*Insurance Class*——This should reflect the patients payer classification as determined by the crew members.

01 Commercial insurance
02 Subscription to ambulance
03 Medicare
04 Champus
05 Workers compensation
06 State Medicaid
07 Public/county assistance
08 Self-pay or uninsured
09 No charge
10 Managed health care plan
11 Other

5.3.2.100 •*Change of Condition*—Coded value to indicate the level of change in the patient's condition upon arrival at the destination. This data element should be defined according to local standards to facilitate quality assurance and managed care activities.

5.3.3 The following data elements should be recorded for each EMS provider in the "EMS Training/Skill" Database File (5.8.6.7(*2*))

5.3.3.1 *Last Name*—The last name of the individual provider employed by the PSO observing the conventions.

5.3.3.2 *First Name*—The first name of the provider employed by the PSO.

5.3.3.3 *Address*—The mailing street address where the provider resides.

5.3.3.4 *City*—The city in which the provider resides.

5.3.3.5 *State*—The two letter state abbreviation as determined by the Postmaster General where the provider resides.

5.3.3.6 *Zip Code*—The five-digit code in which the provider resides.

5.3.3.7 *Phone Number*—The area code and phone number where the provider resides.

5.3.3.8 *State License or Certification Number*—This should be a unique identifier for each provider.

5.3.3.9 *Current Training Level*—This should describe the highest current certification for the crew member:

EMT—paramedic
EMT—advanced/intermediate
EMT—basic
EMT—defibrillation

5.3.3.10 *Most Recent Certification Date*—The certification date of the provider's current license.

5.3.3.11 *Most Recent Expiration Date*—The expiration date of the provider's current license.

5.3.3.12 *Most Recent ACLS Expiration Date*—The expiration date of the provider's ACLS certification.

5.3.3.13 *Most Recent BCLS Expiration Date*—The expiration date of the provider's BCLS certification.

5.3.3.14 *Other Certification One*—Other pertinent certification that the provider holds.

5.3.3.15 *Other Certificate Date One*—The expiration date of certification listed in 5.3.3.13.

5.3.3.16 *Other Certification Two*—Other pertinent certification that the provider holds.

5.3.3.17 *Other Certification Date Two*—The expiration date of certification listed in 5.3.3.15.

5.3.4 The following data elements should be recorded by the provider and maintained in a log recording continuing medical education (CME) (5.8.6.7.(*3*)).

5.3.4.1 *Last Name*—The last name of the provider who attended a CME course.

5.3.4.2 *First Name*—The first name of the provider who attended a CME course.

5.3.4.3 *State License Number*—The state license number of the provider who attended the CME course.

5.3.4.4 *Course Title*—The title of the CME course taken by the provider.

5.3.4.5 *Course Date*—The date of the CME course taken by the provider.

5.3.4.6 *Number of Hours*—The number of credit hours awarded for successful completion of the CME course.

5.3.4.7 *Type of Course*—A number describing the type of CME course completed:

1 Certification
2 Recertification
3 Continuing Education
4 Clinical Rotation
5 Other

5.3.4.8 *Sponsoring Agency*—The name of the agency or person sponsoring the CME course.

5.3.4.9 *Certifying Agency*—The name of the agency or person certifying the CME course.

5.4 *Hospital*:

5.4.1 *Medical Direction*—The following data elements should be logged at the emergency department and maintained, as appropriate, in a "Medical Direction" database file (5.8.6.7.(*4a*)).

5.4.1.1 *Medical Direction Document Number*—An internal control number that logs a request for on line medical direction or documents notification to the hospital of an impending patient arrival.

5.4.1.2 *Date Call Received*—The date that the request for on-line medical direction was received by the hospital.

5.4.1.3 *Time Call Received*—The time that a request for on-line medical direction was received by the hospital.

5.4.1.4 *PSO/Run Number*—The PSO identification number of the provider requesting on-line medical direction.

5.4.1.5 *Medical Direction Physician Number*—The state license number of the physician responsible for the episode of on-line medical direction.

5.4.1.6 *Medical Director Number*—The individual's state license number for anyone other than the responsible physician who gave on-line medical direction.

5.4.1.7 *Age*—The age of the patient being transported.

5.4.1.8 *Sex*—The sex of the patient being transported:

Male
Female
Unknown

5.4.1.9 *Chief Complaint*—The reason the patient accessed the EMS system.

5.4.1.10 *Type Injury/Illness*—As defined in 5.3.1.61.

5.4.1.11 *Allergies*—Known patient indication of allergies.

5.4.1.12 *Current Medications*—Known medications currently being taken by the patient.

5.4.1.13 *Initial Systolic Blood Pressure*—As defined in 5.3.2.65.

5.4.1.14 *Initial Diastolic Blood Pressure*—As defined in 5.3.2.66.

5.4.1.15 *Initial Pulse*—As defined in 5.3.2.67.

5.4.1.16 *Initial Respiratory Rate*—As defined in 5.3.2.68.

5.4.1.17 *Glasgow Coma Score*—As defined in 5.3.2.87.

5.4.1.18 *First Cardiac Rhythm*—As defined in 5.3.2.82.

5.4.1.19 *Last Cardiac Rhythm*—As defined in 5.3.2.83.

5.4.1.20 *Treatments*—As defined in 5.3.2.92.

5.4.1.21 *Medication*—As defined in 5.3.2.91.

5.4.1.22 *Call Disposition*—As defined in 5.3.2.96.

5.4.1.23 *Receiving Hospital Identification Number*—As defined in 5.3.2.96.

5.4.1.24 Flag to identify cases, such as major trauma, medication errors, unusual occurrence, and so forth, for quality assurance/improvement review.

5.4.2 *Emergency Outpatient Patient Record*:

5.4.2.1 Outcome information describing the status of patients after arrival at an emergency outpatient facility is needed to evaluate the structure, process, and outcome of emergency medical services delivered at the scene and enroute. For this type of evaluation to be successful, it is important to access information that describes the population receiving care and the population not receiving care prior to arrival.

5.4.2.2 The following data elements represent a subset of the information collected for the emergency patient receiving outpatient care. They have been chosen because of their usefulness for evaluating the effectiveness of the EMS system response and patient care at the scene and enroute and for linkage to other medical records. The data element specifications should be compatible with the variables listed in 5.3.2. These variables are referred to as "Emergency Department Patient Record" database file (5.8.6.7(*4b*)) in the logic model presented later and include the following:

Patient name
Address
City
State
Zip code
Telephone
Age
Gender
Medical record number
Arrival means
Arrival means
EMS agency number
Treating emergency physician
Date of visit
Time of arrival
Chief complaint
Severity
Vital signs
Procedures
Discharge diagnosis narrative
ICD-9-CM dx1-n
E code
V code
Date of discharge from ED
Time of discharge from ED
Disposition
Payer classification

5.4.3 Similar information is needed about emergency patients who receive treatment as an inpatient in order to evaluate the structure, process, and outcome of emergency medical services delivered at the scene and enroute.

5.4.3.1 The following data elements represent a subset of the information collected for the emergency inpatient receiving acute care. They have been chosen because of their usefulness for evaluating the effectiveness of the EMS system response and patient care at the scene and enroute and for linkage to other medical records. The following data elements are maintained in the "Hospital Discharge" file (5.8.6.7.(*4c*)):

Patient inpatient record number
Date of admission
Hour of admission
Attending physician
Principal surgeon
Discharge diagnosis codes (ICD-9-CM)
Procedure codes (ICD-9-CM)
Date of discharge
Disposition
Diagnosis related group
Major diagnosis category at discharge

5.5 *Procedure for Adoption of Statewide Minimum EMS Data Set*:

5.5.1 Establishment and utilization of a standard medical emergency data set should be encouraged to simplify EMS-MIS feedback at the state, regional, and local levels.

5.5.2 The standardized data to be collected should be relative to the goals and capabilities of the EMS-MIS system.

5.5.2.1 Some of the goals of standardization include:

(1) Enhancement of documentation of patient care.

(2) Enhancement of patient information reporting from the scene, enroute, and at the time of patient arrival at the receiving facility.

(3) Efficient and appropriate data capture.

(4) Enhancement of statistical analysis.

(5) Linkage of data elements for uploading to higher level data collection systems.

5.5.2.2 Some of the benefits of standardization include:

(1) Improved system resource allocation.

(2) Improved medical and legal documentation.

(3) Improved provider skill monitoring and feedback.

(4) Elimination of peripheral documentation.

(5) Improve EMS billing and collections.

5.5.3 Initial planning for standardization should allow the inclusion of the data elements in 5.3.2 to satisfy data requirements for local and higher level reporting needs.

5.5.4 The process for determining what information should be standardized should include consideration of the following:

5.5.4.1 Data collection should be efficient.

5.5.4.2 Data should be recorded in a logical sequence that parallels the process of dispatch, patient evaluation, treatment, and transport.

5.5.4.3 A narrative section should be included to record descriptive data deemed helpful by the provider. This section should be computerized if feasible.

5.5.4.4 Basic and advanced life support provider service organizations should be part of the same EMS-MIS system for both emergency or prescheduled calls.

5.5.4.5 Data elements should be congregated according to classification or usage.

5.5.4.6 The elements should include data collected at the scene, enroute, and at the hospital.

5.5.4.7 The data should be easily coded and computerized.

5.5.5 The development of the local EMS-MIS should be a collaborative process, involving a representative cross-sectional group of those individuals who own and use the

information being collected including:

5.5.5.1 State or federal EMS representatives.

5.5.5.2 Regional EMS administrators.

5.5.5.3 Local EMS administrators.

5.5.5.4 Providers of emergency care (pre-hospital, hospital).

5.5.5.5 Injury control and other health organizations/agencies.

5.5.6 Drafts of the proposed EMS-MIS should be submitted for review to a broader representative sample of the group in 5.5.5 and appropriate suggestions and comments incorporated.

5.5.7 When a comprehensive draft of the proposed EMS-MIS has been developed, it should be submitted to representatives of other groups interested in EMS for additional scrutiny:

5.5.7.1 Medical records personnel.

5.5.7.2 Law enforcement officials.

5.5.7.3 Fire services.

5.5.7.4 Medical examiners.

5.5.8 The proposed EMS-MIS should be tested in a pilot study prior to statewide implementation.

5.5.9 After adoption, the EMS-MIS should be reviewed yearly by the group in 5.5.5 to measure its effectiveness and implement any needed changes.

5.5.10 Statewide legislation mandating compliance with the EMS-MIS by all PSOs has many benefits in areas of cost reduction and gaining 100 % participation.

5.6 *Confidentiality and Security of Data*:

5.6.1 The policies and procedures to protect confidentiality of individual patients and their families, hospitals, and ambulance services are extremely important and require special attention. Security requirements involve a number of issues, including:

5.6.1.1 Privacy rights of the patients.

5.6.1.2 Liability.

5.6.1.3 Potential inaccuracies.

5.6.1.4 Media coverage.

5.6.1.5 Ownership of data.

5.6.2 All formulated policies and procedures must be written taking into account any state laws pertaining to such matters. Efforts should be made to enact state legislation which deems EMS-MIS information non-discoverable.

5.6.3 A system should be based upon the supposition that users will have access to the data and information which they generated and to comparative local, regional, and state averages and totals for comparison.

5.6.4 Systems must provide an appropriate level of data security.

5.6.5 Security should be developed to protect aggregated data from unauthorized use.

5.6.5.1 The data collection center or its agent shall not make data available to any party other than the owner of the data without prior written consent by the owner.

5.6.5.2 The center, in collaboration with the data owner, shall disseminate summaries of the data that do not provide information identifying specific individuals or organizations, or both.

5.6.5.3 Written data release policies will include severe penalties for users who violate them.

5.6.6 A blanket confidentiality statement should preface all documents, procedures, and policies prepared or implemented by the EMS-MIS. An example blanket statement is as follows:

5.6.6.1 All information identifying an individual obtained by any central data collection center shall be held confidential and shall not be divulged without the individual's consent, except as may be required by law, or as may be necessary to provide service to the individual. Information may be disclosed in summary statistical or other form that does not identify particular individuals.

5.6.7 The following technical features should be incorporated in the system design as appropriate.

5.6.7.1 Individual user identification and password protection should be employed.

5.6.7.2 Confidentiality of patient data must be maintained during all phases of data collection, processing, and analysis.

5.6.7.3 Terminal identification should exist within a network, and terminal lock-out and time-out features should be incorporated.

5.6.7.4 File and record access should be uniquely identified and separately restricted.

5.6.7.5 Security violations should be reported at the central processing site and reported to the appropriate authority and involved organizations.

5.6.7.6 Software maintenance control should be enforced.

5.6.7.7 Report distribution procedures should be developed and followed.

5.7 Data Processing System Configurations:

5.7.1 Methodology for Data Collection:

5.7.1.1 Data capture must occur in a timely, efficient, complete manner if meaningful information about the system as a whole is to be generated.

5.7.1.2 Data capture involves the following sequences of events, as shown in Fig. 3.

5.7.2 *Data and Information Timeliness*:

5.7.2.1 Data capture will occur most reliably when the data are entered into the computer and validated as soon as possible after the event that generated the data. Ideally, this would be done by the observer who actually recorded the data, thereby eliminating delays due to report form illegibility, incompleteness, and lost forms.

5.7.2.2 Timely entering of data allows for faster generation of useful information and its return to managers who will utilize such information.

5.7.3 *Methods of Data Recording and Data Entry*:

5.7.3.1 In most circumstances, recording of data will involve the generation of handwritten records as diagrammed in Fig. 4, and subsequent computer entry of data from the records.

5.7.3.2 In some instances, portions of the records generated in Fig. 4 may be completed on a form that can be read by an optical scanning device. The optical scanner converts the coded information to electromagnetic format automatically. Advantages of this method are:

(1) That the forms are easy to enter into the computer thereby reducing transcription error.

(2) Data entry costs are minimal after the initial purchase of the scanner.

5.7.3.3 Disadvantages of this method are:

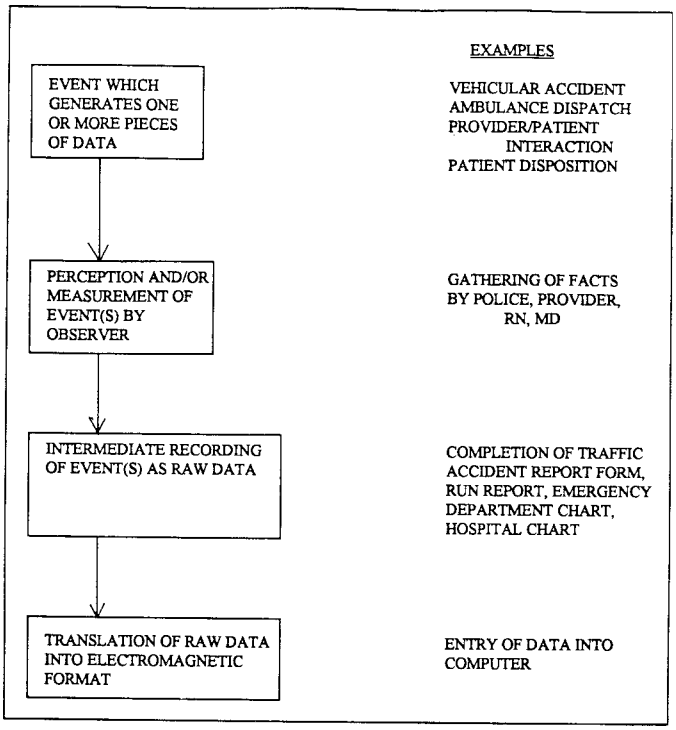

FIG. 3 Data Capture

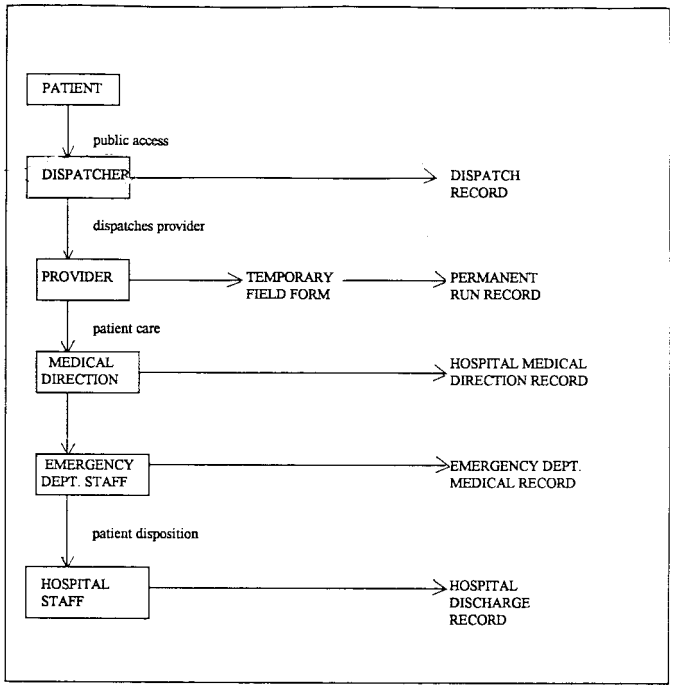

FIG. 4 Methods of Data Recording and Data Entry

(1) Cost of the forms is high because of the quality of paper needed.

(2) Alphanumeric data are difficult to enter.

(3) The form is cumbersome to fill out.

(4) The form is difficult to read.

(5) Forms must be collected and sent to a central input facility and are subject to loss.

(6) Staff are necessary to correct errors on records that have been rejected.

5.7.3.4 Keyboard entry of handwritten records has been a common and familiar data entry method.

5.7.3.5 Keyboard entry can be simplified by programmed menu-driven systems that allow the operator to choose from predefined options by a single keystroke.

5.7.3.6 Light pen/palm top/laptop computers provide a method to computerize data at the scene. Rapid developments in technology are making this option more costeffective.

5.7.3.7 Voice entry of data may be feasible in the future.

5.7.4 *Auditing the Accuracy of Data Entry*:

5.7.4.1 The EMS-MIS should include some means of measuring the accuracy of data entry. This is especially important in systems using keypunched or optically scanned data input.

5.7.4.2 Each organization that provides information to the EMS-MIS should routinely audit 5 % of its hard copy records on a quarterly basis for verification against the database. The transcription error rate should be compared with that of other similar organizations and a cause sought for any unusually high results. Well-functioning systems should have less than a 2 % transcription error rate.

5.7.5 Compliance with data collection and reporting is a major obstacle to successful operation of any EMS-MIS. Compliance issues are most important with safety personnel, providers, and emergency department staff because the bulk of data must be obtained during their activities or it will be difficult to capture retrospectively. Methods to improve compliance include:

5.7.5.1 Routine monitoring of an individual's compliance rate as part of job performance appraisal.

5.7.5.2 Financial incentives/disincentives based on compliance for both the individual and the organizations.

5.7.5.3 Provision of timely and useful reports that illustrate the desirability of good compliance.

5.7.5.4 Utilization of feedback information into training programs.

5.7.5.5 Maintenance of satisfactory compliance rate as a requirement of certification or licensing, or both.

5.8 *Centralized Versus Decentralized Data Processing*:

5.8.1 Data recording must take place in all levels of the EMS-MIS. However, options exist as to where data entry, data processing, and report generation take place. To illustrate, we will take an example of an EMS-MIS dealing only with provider run sheets.

5.8.2 In a purely centralized data processing model, all completed handwritten run sheets would be sent to the State Data Processing Center, where an operator would enter the information into the computer. After all run sheets from across the state for a one-month period were entered, reports could be generated summarizing various types of activity for each provider organization, local EMS agency, REMSO, and the entire state. Reports would be sent back to the appropriate individuals.

5.8.3 In a purely decentralized data processing model, all data obtained by a provider would be initially handwritten or entered directly into a hand held computer at the time of observation and then input locally into the provider's own

personal computer. Reports concerning the provider's internal operations would be generated on a daily basis or as frequently as desired. Periodically, the provider would upload certain designated data elements about each run to the local EMS agency computer, which would collect information from all local, and generate local aggregate summary reports. With the exception of the copy of the run sheet inserted into the patient's record, the actual run sheets would never leave the provider. Selected data from various local EMS agency computers would be uploaded to REMSO computers for generation of regional reports, and REMSO computers would upload a state computer for generation of statewide reports.

5.8.4 *Combination Centralized and Decentralized Models*:

5.8.4.1 In a combination model, flexibility would exist so that providers could utilize either the centralized or decentralized approach. Low-volume providers would probably opt to submit their records to a central facility (at either the local EMS agency or REMSO levels) for data entry, and would receive all their reports back from the central facility. Larger-volume providers, or any provider with the interest, would have the ability to locally enter their own data, run internal reports, upload selected data, and receive back aggregate summaries. Providers would be able to enter their own data on either an in-house personal computer and generate internal reports with it, or enter data on a remote access terminal to the central computer but have less ability to generate reports. This model allows providers to participate in the EMS-MIS initially by submitting handwritten records, and to develop computer capability at their own pace should they so desire.

5.8.5 *Logical Model*:

5.8.5.1 The following section describes a logical design prototype for an EMS-MIS. The data elements to be tracked are listed and defined in 5.3 and 5.4. The suggested output reports are detailed in 5.11. Implementation of this logical design may be accomplished with a variety of hardware/software combinations depending upon local preference and preexisting resources.

5.8.5.2 This design was developed through the use of structured analysis techniques. This approach uses a context diagram, data flow diagrams, procedure narratives, and a data dictionary to depict a conceptual design. This analytical process uses a top-down approach that begins by identifying major system functions during the conceptual design phase and decomposes the conceptual design to structure charts, process qualifications, and detail data definition in the detail design phase.

5.8.5.3 The Data Flow Diagrams (DFDs) are a way of partitioning system functions into a series of events that enhances analysis and clarifies what is being developed. Most important is that these models highlight business functions, as opposed to traditional flow charting of computer logic.

5.8.5.4 The logical model for the conceptual EMS-MIS includes the following:

(1) Context Diagram—Identifies the users of the system.

(2) Level 0 Diagram—Identifies the major system processes and data flows that are developed for the system under study. It also identifies the logical files and major system events for each process.

(3) Level 1 Diagram—Identifies the data flows of each type of process contained within the system. These business events are the initial indication of the physical components of the system in terms of computer programs, files, and reporting requirements.

(4) Brief Narratives—(DFD-Data Flow Diagrams)—Identifies the purpose, events, and functions that take place for each process.

5.8.5.5 The following graphic conventions have been used in the documentation:

(1) Process Event—Rectangle—These action-released boxes describe the procedures that act on data. Each process is numbered so they can be broken down from generalized functions into detailed ones. Each numbered event represents a process that must be developed. In the conceptual design phase, they are only decomposed to Level 1; however, during detail design, they will be converted to structure charts and programming specifications detailed in terms of specific events and data elements.

(2) Data Stores—Open-Ended Rectangle—These boxes represent the files necessary to store the information required by the system.

(3) Data Flow—Lines with Arrows—These lines depict the movement of data from one process to the next. If no definition is given, it is assumed to be an obvious one. As the level of data flows are broken down, (two and greater), the amount of information on these lines tends to be more explicit.

5.8.5.6 These structured techniques assist in developing streamlined efficient computer systems that meet user requirements. The use of these techniques reduces the amount of technical jargon and interference, allowing members to concentrate on business functionally and process control.

5.8.5.7 The key issue identified with the narratives are part of this methodology. The intention is to identify issues from early on in the project, which tend to be more user and policy related, and continue to raise issues throughout detail design. As the project progresses, these issues need to be resolved by project participants.

5.8.6 *Level 0 Diagram—System Overview*—This data flow diagram (Fig. 5) presents the major events which will occur within the system. It identifies major processes that must be developed to meet the system objectives.

5.8.6.1 *Enter Data*—This procedure will provide for the entering of, emergency department, patient, and EMT data into the EMS-MIS. It is designed to accommodate various types of input media, such as, source, on-line, electronic files, and computer. Unique procedures are defined for type of entry process and user group for data integrity and to provide consistent controls. Although not shown here, internal system files will be used to control and process the various types and formats of input that will be coming into the system.

5.8.6.2 *Record Skill Used*—The recognition of EMT skills performed will be an internal system process that is automatically maintained once entered with the run information. This data will be physically maintained on a separate file with restricted access.

5.8.6.3 *Generate Standard Reports*—This reporting process is designed as a series of events that will control to whom and

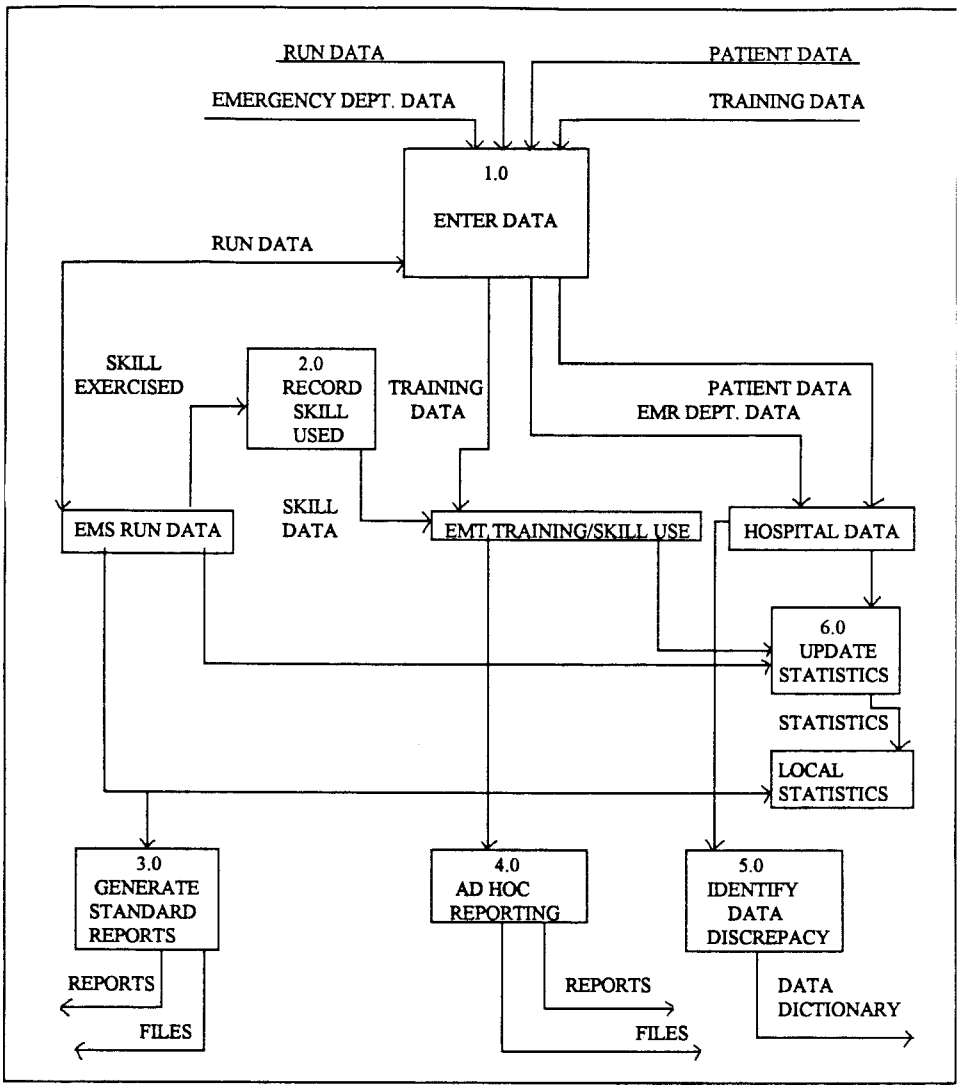

FIG. 5 EMS-MIS Level 0 Diagram

how information gets distributed. A report file will be created that is linked with pre-defined table information so authorization, distribution, copies, and hard copy or transmitted medium controls, can be placed on the reporting process. This process will produce all standard reports and special job requests. It will also include the creation of files to be used as input to other systems or personal computers.

5.8.6.4 *Ad Hoc Reporting*—This process is specifically designed so end users can obtain information as soon as possible. They can write their own customized reports or request predefined system reports. This interactive process allows a user to extract authorized data from the EMS-MIS database and create customized files. These files can be downloaded into a personal computer where conventional software or internal applications can process the data. Operation control requirements should be designed into the system to prevent abuse or the tying up of the system based on run time or file contention.

5.8.6.5 *Identify Data Discrepancy*—These procedures will be developed to enhance the integrity and completeness of the database. Processes can be built to compare data for reasonableness or discrepancies based on the different methods that data is compiled. It is not intended to provide a complex, analytical tool, but to list and report to end users for their subsequent follow up and individual correction. For example, if the run file indicates one treatment administered and the hospital indicates a different procedure, one could report this discrepancy in the information to both the hospital and the EMT provider, allowing them to resolve and correct the data. Queues containing data integrity issues will be held in suspense until resolved.

5.8.6.6 *Update Statistics*—Because of the complexity and potential for error, this function has been separated and made an internal system process. Statistics will be collected from each record in the system and maintained on a separate file. This file will not be maintainable through normal interactive file access, thereby the internal control procedures within the system will directly affect the accuracy of local statistical information.

5.8.6.7 *System Files*, The logical files that store the information in the EMS-MIS database, which are all related by keys, are summarized as follows:

(1) EMS RUN FILE—This is a unique file for each EMS provider which maintains the pre-hospital patient care record information (see 5.3.2).

(2) EMS TRAINING/SKILL USE FILE—This file identifies each EMT in the system, his qualifications, certifications, training, and skills utilized (see 5.3.3).

(3) EMS CONTINUING MEDICAL EDUCATION FILE—This file identifies all continuing medical education activity for each EMT in the system (see 5.3.4).

(4) HOSPITAL DATA FILES—These are unique files for each hospital that contain patient information, including emergency department and inpatient data.

(*a*) EMERGENCY DEPARTMENT MEDICAL DIRECTION FILE—This file contains data about on line medical direction given by E.D. personnel, regardless of whether or not the patient was transported to their institution (see 5.4.1).

(*b*) EMERGENCY DEPARTMENT PATIENT RECORD FILE—This file contains data about all E.D. patients, regardless of whether they used the EMS system or not (see 5.4.2).

(*c*) HOSPITAL DISCHARGE FILE—This file contains data about EMS system patients who were eventually admitted (see 5.4.3).

(5) STATISTICS FILE—This is a separate file where all raw data will be maintained for statistical reporting.

(6) TABLE FILES—During the detailed design phase, many user and system controlled tables will be created. The information in these tables will be used to control functions, provide unique user procedures, and be used as a means to easily change common routines instead of building them into computer program logic.

5.8.6.8 *Data Flow Name—1.0a Enter Run Data (*Fig. 6*)*—This process allows the EMS provider to select the method of inputing run data into the system. The EMS provider will be restricted to updating only run information related to his unit. These personnel will not be restricted from using any EMS-MIS terminal to which they have authorized access.

5.8.6.9 Enter run data on line in an interactive, userfriendly, menu-driven environment. Immediate validation and error reporting would be available to the person keying. Weekly log reports will be distributed which identify the activities of each run, which will then be verified by the EMT for accuracy.

5.8.6.10 Send run data to the central facility for key entry. These source documents will be tagged and logged for system control and verification purposes.

5.8.6.11 Special data entry procedures will be developed to accommodate multiple users and system control procedures at a centralized facility.

5.8.6.12 Transmit run data, using an existing non-EMS-MIS network or a direct computer-to-computer link.

5.8.6.13 Edit and validate electronic records submitted as input to the system. Ensure that only authorized, valid data in the proper format is accepted for processing.

5.8.6.14 Update the database in a controlled, organized process that does not interfere with other system processes or could destroy data.

5.8.6.15 Transfer run data on electronic media (tape, diskette, etc.).

5.8.6.16 *Key Issues*:

(1) Should an EMT be allowed to modify run data after it has been uploaded to the database?

(2) Does the EMT need to have access to the hospital patient information?

5.8.7 *Data Flow Name 1.0b—Enter Emergency Department Data (EDD)*—This process permits the emergency department to choose how it will submit patient or run information. Because of the unique environment and management approaches that exist within the hospitals and municipalities, a flexible approach is required for the computerization of EMS-MIS data. A hospital will have the ability to start to use the system using one method, while having the ability to select another at a later point, to better accommodate its needs.

5.8.7.1 Enter EDD data on-line in an interactive, userfriendly, menu-driven process. Validation and error reporting will be immediate to enhance the integrity of the system.

5.8.7.2 Collect, tag, log, and transfer EDD data to the central processing center.

5.8.7.3 Provide unique data entry procedures that accommodate the controls and special handling processes required at the central facility.

5.8.7.4 Provide temporary record storage for all data transmitted to the system prior to updating the EMS-MIS database.

5.8.7.5 Edit and validate electronic records submitted as input to the system. Ensure that only authorized, valid data in the proper format is accepted for processing.

5.8.7.6 Update the database in a controlled, organized process that does not interfere with other system processes or would destroy data.

5.8.7.7 Transfer EDD data on electronic media (tape, diskette, and so forth).

5.8.7.8 *Key Issues*:

(1) Should the emergency department be allowed to modify patient outcome data after the patient has been transferred to another department?

(2) Should the EDD department be allowed to modify run data whether or not the EMT provider uses the hospital to input its data?

5.8.8 *Data Flow Name 1.0c Enter Patient Data*—This process (Fig. 7) describes how hospital personnel can enter patient data into the system. These data entry procedures are uniquely defined for patient information entered by hospital employees as opposed to the emergency department staff or emergency medical technicians. This will facilitate linkage of pre-hospital, emergency department, and in-patient data, as well as uploading and downloading of aggregated data. This process allows the hospital flexibility in the manner it chooses to submit selected patient information to the EMS-MIS. The design of the information processing procedures was developed to ensure timeliness and accuracy of the data being recorded. These methods use a consistent approach to transferring data, as well as uploading and downloading of aggregated data.

5.8.8.1 Enter patient data using an on-line terminal. These interactive sessions limit access by hospital file and individual functions. The screens should be menu-driven and provide immediate feedback as to the results of the data entered. All activity is logged, summarized, and reported.

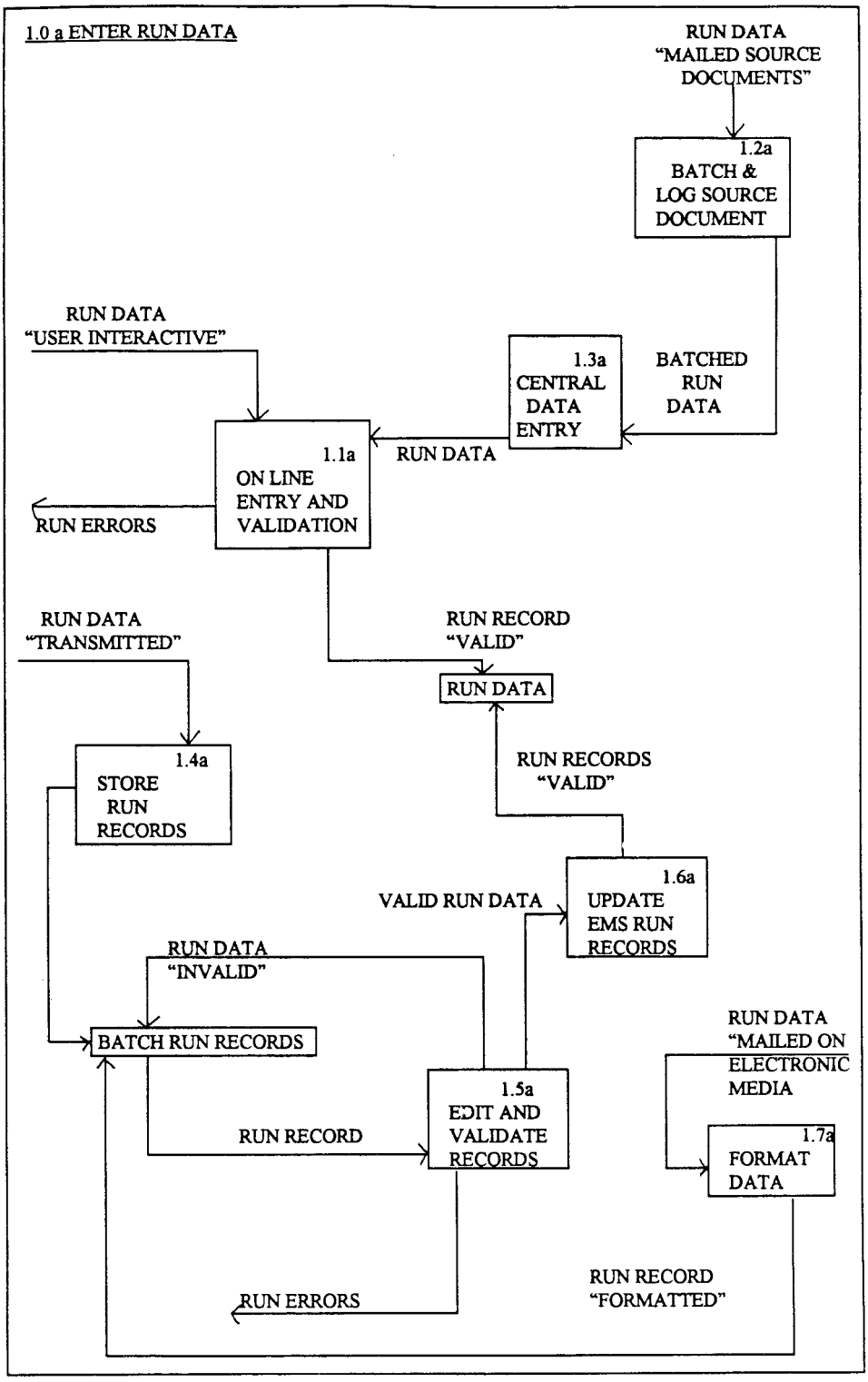

FIG. 6 EMS-MIS Level 1 Diagram

5.8.8.2 Transfer patient source document to the central facility to be tagged and logged by their staff.

5.8.8.3 Unique data entry procedures to accommodate processing controls at central processing site.

5.8.8.4 Transmit patient data, using an existing network or a computer-to-computer link, possibly through hospital emergency department.

5.8.8.5 Edit and validate electronic records submitted as input to another system. Ensure that only authorized, valid data in the proper format is accepted.

5.8.8.6 Update the database in a controlled, organized process that does not interfere with other system processors or destroy data.

5.8.8.7 Transfer patient data on electronic media (tape,

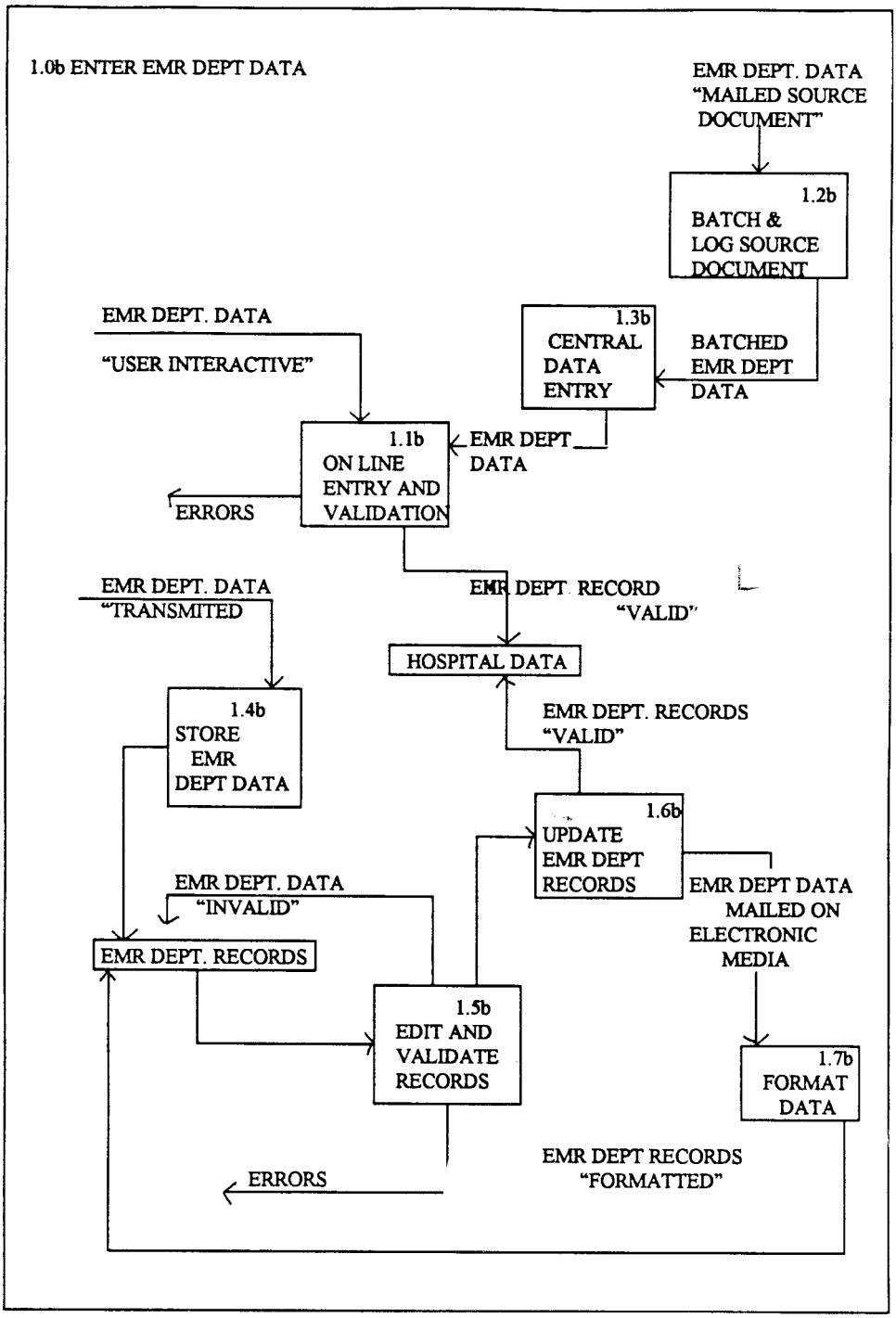

FIG. 7 EMS-MIS Level 1 Diagram

diskette, and so forth).

5.8.9 *Data Flow Name—Enter Training Data (*Fig. 8*)*—This process describes how the EMT profile information will be entered into the system. This is the process that identifies an EMT to the system, defines his background and qualifications, and reports his complete training. It is not the method of tracking EMT skill utilization defined in Process 2.0. This would contain his previous employment, qualifications, and possible practicing skills. Record training courses and the date completed, track recertification dates, and maintain continuing education credits. Since this process is temporary in nature, it is recommended that the inputing of information be limited to two methods: (*1*) on-line entry by an EMS provider unit, or (*2*) batch entry at the EMS-MIS center. The ability to maintain this information will be limited by department and individual. The qualification and training information is defined on a separate file to enhance the file security features and extend the individual protection of the EMT personnel.

5.8.9.1 Enter EMT information on-line from the service provider he is employed by. Access will be limited to only

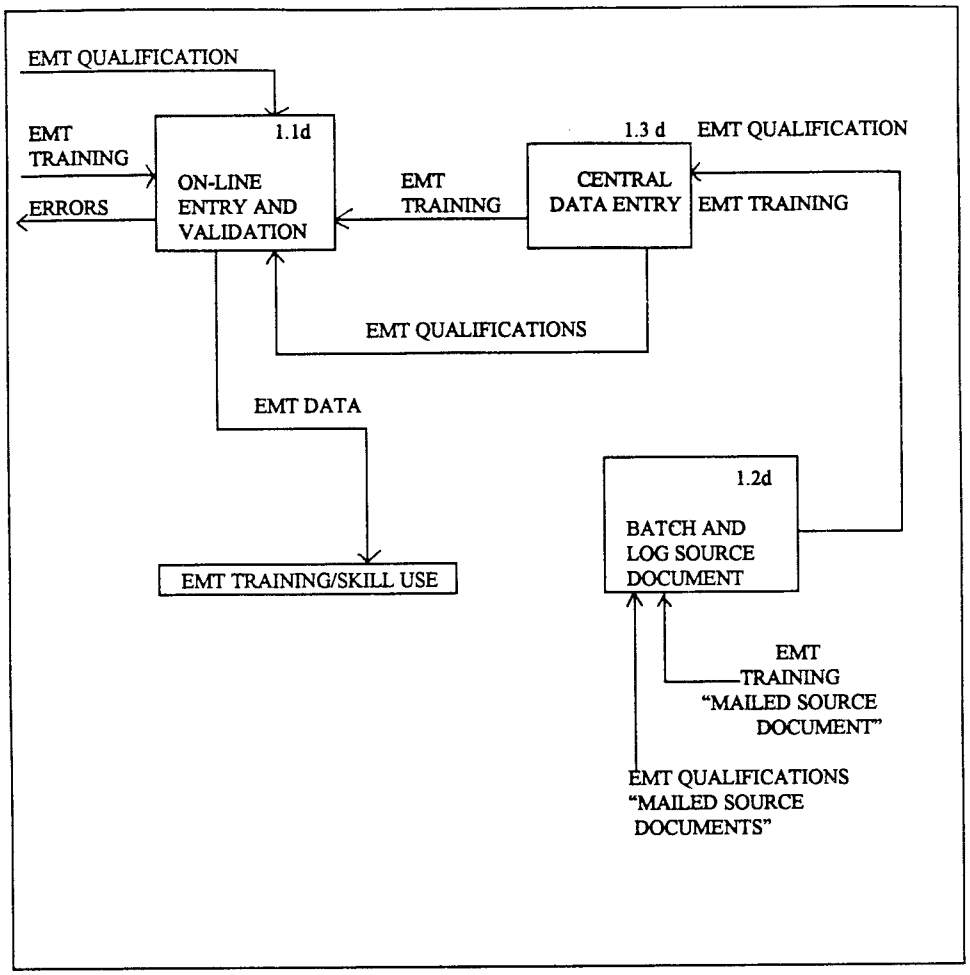

FIG. 8 EMS-MIS Level I Diagram

those authorized to maintain this information.

5.8.9.2 Transfer EMT data to the EMS-MIS center for entry.

5.8.9.3 Provide special key entry procedures for EMT data entered at the central facility.

5.8.9.4 *Key Issues*:

(1) Can this process be incorporated into the standard personnel procedures for each provider department?

5.8.10 *Data Flow Name 3.0 Generate Standard Reports (*Fig. 9*)*—This process describes how the system will provide users with standard information. All reports will be created on a special reports file so the system will have a mechanism to authorize and control report distribution. All reports will be defined in a table for each user. This allows each user to choose his reports, number of copies, define where they are to be sent, and determine the report distribution media. Minimum reporting will be a predefined requirement to ensure that all system controls and procedures are followed. This report file will contain associated distribution information to ensure reports are routed correctly and prevent unauthorized report distribution.

5.8.10.1 Produce weekly reports for system control purposes that reflect the activity recorded by all EMS-MIS system users. Weekly reports should be distributed to all departments that have activity as a means to ensure that the information recorded is accurate, and errors or missing data are corrected in a timely fashion.

5.8.10.2 More extensive monthly reports will be distributed for analytical and management purposes. The system will also generate its monthly fee report for all users based on their system utilization.

5.8.10.3 Semiannual reporting process.

5.8.10.4 Yearly reporting process.

5.8.10.5 Special reporting requirements can be set up as a normal process to accommodate individual reporting needs.

5.8.10.6 Selected files can be created to interface with other systems for information sharing or to enhance productivity where automated application already exists.

5.8.10.7 Print reports using the predefined distribution and authorization rules.

5.8.10.8 For users who request their reports to be transmitted, write the format and transmission protocols so the reports can be sent.

5.8.10.9 *Key Issues*:

(1) Should ad hoc (user report writer) reporting be processed through the report file procedure, or should interactive reporting based on individual access levels be allowed?

5.8.10.10 *Data Flow Name—Ad Hoc Reporting (*Fig. 10*)*—This process describes how end users can retrieve information

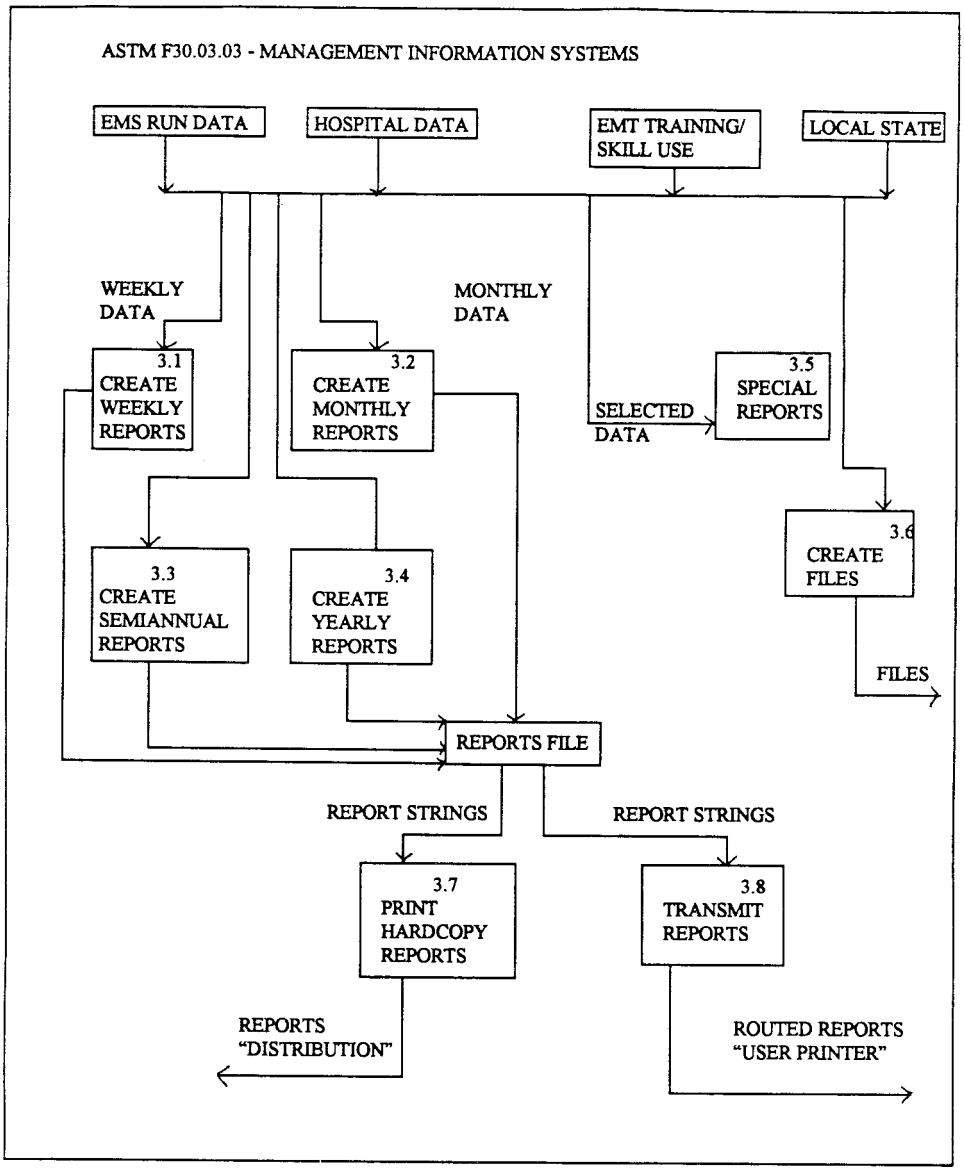

FIG. 9 EMS-MIS Level 1 Diagram

from the EMS-MIS databases. The process will be designed to allow flexible reporting from the user community, but at the same time, permit operation restrictions to ensure that information is extracted in a manner that does not degrade or significantly tie up the system. All access for ad hoc reporting and file creation will follow the predefined information security rules, in accordance with 5.6. Even though the process provides a means to easily extract information, the user will only be able to access data that is authorized.

5.8.10.11 The system should provide the ability to extract data by designing custom reports with an on-line query language. Another consideration is the ability to write generalized reports that could easily be modified for an individual's own use. A library process should be developed so custom, written reports can be stored and need not be rewritten for any future request.

5.8.10.12 The design has been developed to allow the user to request any job or predefined system report on an asneeded basis. In trying to put the information in the hands of the user community at his request, special control and scheduling processes must be designed to prevent unnecessary system abuse. Without an authorized job request and schedule performance criteria, users could tie up the network or incur extensive billing costs.

5.8.10.13 This process will allow individual users to request and schedule jobs as seen fit. The individual will also be able to receive the information based on the job run time and the fastest sport distribution available.

5.8.10.14 Provide a special report writing process for ad hoc reporting.

5.8.10.15 The system design incorporates the ability to create a file to be downloaded into the user's computer. Based on the user's information access level, the system can create files from the EMS-MIS database to be utilized by the user's computer and application software.

5.8.10.16 This feature permits specific information to be

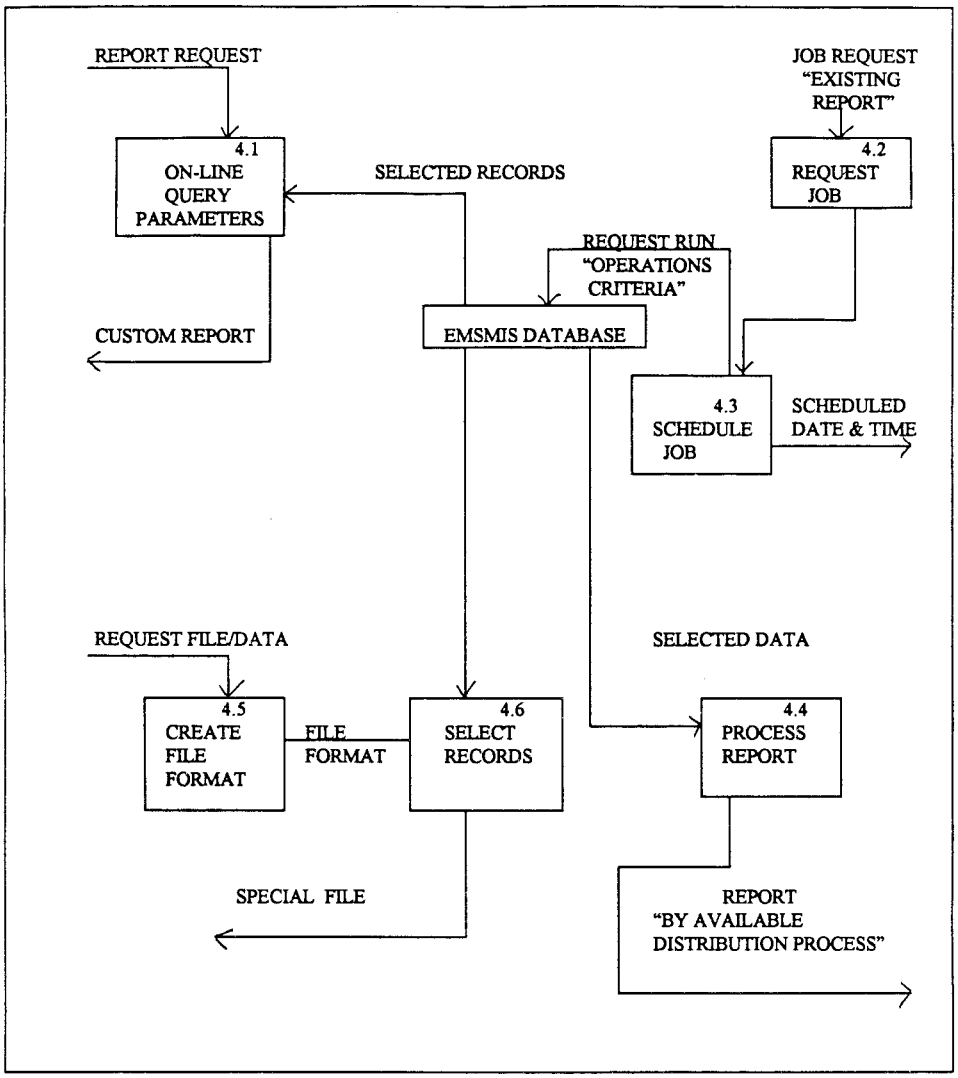

FIG. 10 EMS-MIS Level I Diagram

extracted in a format that could enhance or simplify unique reporting needs.

5.8.10.17 *Key Issues*:

(1) Should the system allow any type of report writer languages available to be used, or only one to be available to enhance controls?

(2) Who will determine the operations criteria for scheduling jobs?

(3) What role or level of commitment will be required by the technical staff to effectively support the ad hoc reporting?

(4) Should all reporting go through one reporting process, or should it be based on individual access as needed?

5.8.11 *Linkage Among Sources of Data*—Patient-based outcome evaluation requires linking multiple databases in order to trace the patient from the scene to final disposition. The EMS data are collected at different points of time and at different locations by the different providers responsible for the emergency victim. Some of the data, usually nonclinical, are routinely computerized and aggregated into statewide databases which can be linked. Many barriers to linkage exist. These include lack of standardization of definitions, measures, and formats used by the different data sources. Linkage of data sets is further impeded by incompatibilities in computer hardware and software systems. Data entry errors and omissions are common. Data may not be readily shared because of incompatible reporting periods and proprietary concerns. Additional administrative problems further limit linkage, specifically, cost and data management considerations. Sources of data may be linked directly or indirectly using single or multiple variables, respectively. The purpose of linking two EMS databases is to expand the usefulness of each database. Thus, for example, linkage of the accident report to the run report provides outcome data for highway safety analyses and mechanism of injury data to EMS analyses. The ultimate purpose is to trace an emergency patient from the scene, to discharge, and eventually through the rehabilitation phase in order to generate descriptive data describing what happens to the emergency victim, process data describing how well the system responded during the various phases of the emergency, and patient outcome data describing the effectiveness of EMS on mortality and morbidity. Data linkage makes it possible to perform tracer studies on large groups of patient (such as,

motor vehicle injured), to use statewide data to describe how well the EMS system functions (such as, Sensitivity Index Project), and to create permanent patient registries for monitoring overtime (Trauma Registry).

5.8.11.1 Linkage is facilitated by the use of unique identifiers. Common unique identifiers include:

(1) Patient name.

(2) Social security number.

(3) Unique record number.

(4) Universal health identifier (not currently available).

(5) Ambulance run report number for each patient injured.

(6) Inpatient record number for each patient admitted.

(7) Insurance claim number.

(8) Coroner's report/death certificate number.

(9) Crash report number.

(10) Unique record number of any database.

(11) Provider License Number.

5.8.11.2 Unique identifiers identify a specific person.

5.8.11.3 Data collection forms must each be designed to collect the unique identifier and the data must be recorded accurately for linkage to be successful. Accurate recording of unique identifiers may be difficult if the identifier is not available at the time of primary data collection when the patient is being treated. For example, if the ambulance leaves the scene early, the policeman may have to obtain the run report number from the hospital to which the patient is transported. Also in most states, accident reports are not prenumbered but numbered later at the time of data entry.

5.8.11.4 Unique identifiers are useful for linking primary patient records or for linking databases, or both, consisting of abstracted (secondary) records (trauma registry, and so forth) when data quality is good.

5.8.12 Indirect linkage variables must be combined to identify a specific person. The data and the linkage process must be computerized except when volume is low enough to be managed manually.

5.8.12.1 Missing/inaccurate data (particularly age and time), multiple patients with the same age matched to the same record, and multiple records in the database for the same patient complicate linkage with a combination of indirect variables.

5.8.12.2 Unique identifiers reduce the need for manual verification but increase the probability of unmatched records when the linkage data are missing or are inaccurate, or both.

5.8.12.3 Systems with low volume have the option of developing manual verification procedures to increase the percentage of matches. Systems with high volume should consider using probability-based methods of recording linkage.

(1) Probabilistic linkage techniques do not require an exact match among the attributes of the linkage variables in order to identify valid matches. Values are assigned according to the frequency of occurrence among valid matched pairs and by chance agreement.

(2) The EMS researchers must be careful to evaluate the potential for false positives and false negatives before using the linked state for small area variation analyses. For example, a paramedic run report matched to a crash occurring in an area without paramedic service is more visible in small area analyses than in a statewide total.

(3) Linkage files should consist primarily of records which have the potential of linkage. Ineligible records should be eliminated whenever possible to increase the efficiency of the matching process without incurring systematic bias.

(4) Identifiers to be used for indirect matching should be chosen based on their capability to limit the need for verification of the match.

(5) The most common indirect identifiers are age/birth date, sex, date, location (injury, hospital destination).

(*1a*) Birthdate is more restrictive than age but is frequently computerized on only one file.

(*2a*) Race, when accurately recorded on both files, is also useful.

(*3a*) Times usually have a high rate of discrepancy, the inevitable result of multiple providers at different locations some of whom forget to use military time. Probabilistic linkage matches times within a predetermined range and prorates the weight accordingly.

(6) Sets of indirect identifiers found to be successful for linking crash to EMS patient care data:

(*1a*) Patient care record number.

(*2b*) Age/birth date.

(*3b*) Sex.

(*4b*) Date of crash/EMS run.

(*5b*) Crash location (FIPS geographical code)/EMS pickup location.

(7) Sets of indirect identifiers for linking the crash data directly to hospital discharge data:

(*1c*) Age/birth date.

(*2c*) Sex.

(*3c*) Date of crash/date of admission (may vary by one day if crash occurs after 9 a.m.).

(*4c*) Location of crash/hospital service area.

(*5c*) Time of crash/time of admission (use range from 1 to 4 h as match range).

(8) Sets of indirect identifiers for linking the EMS patient care data to the hospital discharge data

(*1d*) Age/birth date.

(*2d*) Sex.

(*3d*) Date of run/date of admission (may vary by one day if accident occurs after 9 p.m.).

(*4d*) The EMS destination/hospital identification.

(9) Sets of indirect identifiers for linking death certificate data and crash report:

(*1e*) Name.

(*2e*) Date of accident.

(10) Sets of indirect identifiers for linking death certificate data and EMS patient care data.

(*1f*) Age/birth date.

(*2f*) Sex.

(*3f*) Date of onset (usually not computerized)/date of run.

(*4f*) Hour of onset (usually not computerized)/time of run.

(11) Sets of indirect identifiers for linking death certificate data and hospital discharge data:

(*1g*) Age/birth date.

(*2g*) Sex.

(*3g*) Location of death/hospital identification.

(12) Sets of indirect identifiers for linking census data with crash or EMS data:

(*1h*) The FIPS geographical code.

5.9 *Generation of Management Information Reports*:

5.9.1 *Frequency*—Reports should be generated depending on:

5.9.1.1 The nature of the event or process being studied. Low-frequency events can only be assessed over relatively long periods of time in order to collect a large enough sample to study.

5.9.1.2 The frequency of the need for feedback to the users of the system. Large, complex PSOs, emergency department, and EMS systems may benefit from daily reporting to assist in day-to-day management. Smaller organizations may only require periodic review of operation for strategic planning or evaluation purposes, or both.

5.9.1.3 The nature of the report itself. Reports dealing with incomplete data or data discrepancies should be generated rapidly and frequently to maximize the changes of recovering accurate data.

5.9.1.4 The lag time necessary to obtain all needed data for the report. Reports describing hospital outcome will have a longer lag time than reports dealing with purely pre-hospital or emergency department phenomena.

5.9.1.5 Cost of production and distribution in terms of time, materials, and labor.

5.9.2 *Distribution of Routine Reports*—Once an EMS-MIS has decided which reports should be generated on a regular basis, distribution policies should be determined in accordance with the concern addressed in the confidentiality section (5.6).

5.9.2.1 Who is to receive the report on a regular basis.

5.9.2.2 The method by which the report will be sent (hard copy, electronic file, on-line availability).

5.9.2.3 Who may request a report on a nonroutine basis.

5.9.3 *Ad Hoc Reports*—The particulars of the software/hardware chosen to implement the conceptual design will affect the ease and practicality with which ad hoc reports can be generated.

5.9.3.1 Highly decentralized systems utilizing microcomputer offer end users the ability to analyze their own data in a timely and unlimited fashion. Opportunities for more extensive analysis exist at the local level since nonsensitive area-wide data can be downloaded as needed.

5.9.3.2 Centralized systems offer less flexibility due to potential cost issues (5.9.1.4) at the central processing center, and delays caused by insufficient personnel resources.

5.9.3.3 Generation of ad hoc reports must take into account data confidentiality concerns (5.6).

5.9.3.4 Policies must be established that define the process to be followed in requesting and distributing ad hoc reports, as well as the log to be completed recording all such activity.

5.10 *Utilization of Information*—The suggested management reports defined in 5.11 and 5.12 are designed to be used at the individual PSO, emergency department, and local EMS-MIS level. They can all be generated using the minimum recommended data set defined in 5.2 and 5.3. The information needs at higher levels in the EMS-MIS "pyramid" (REMSO, State, and National Context Diagram I) may be satisfied with a subset of the data elements necessary for local operations. In order to provide maximum benefit and to enhance compliance with data collection, the EMS-MIS must be geared to the day-to-day needs of those involved with patient care.

5.11 *Provider Reports*:

5.11.1 *Basic Run Information*—Transports, non transports, refusals, and so forth.

5.11.2 *Response Time Analysis*—By 3 to 15-min intervals, addressing nine basic time intervals (call received to dispatch, dispatch to enroute, enroute to on scene, on scene to destination, destination to back in service, total time call received to arrival at scene, total pre-hospital time, total out of service time).

5.11.3 Response time by geographical indicator.

5.11.4 Response time or cardiac arrests.

5.11.5 Runs by day and time.

5.11.6 Patient disposition by hospital.

5.11.7 Receiving hospital profile of transported patients by squad at 1.2.3—Average miles per call by squad.

5.11.8 On line medical direction by hospital per squad.

5.11.9 Illness/injury category by squad.

5.11.10 Mechanism of injury.

5.11.11 Pre-hospital procedures attempted/performed.

5.11.12 Drugs/IV's administered.

5.11.13 First cardiac rhythm.

5.11.14 Last cardiac rhythm.

5.11.15 Case severity—at dispatch versus scene.

5.11.16 Glasgow Coma Scale on arrival at scene.

5.11.17 Trauma score on scene.

5.11.18 Defibrillation success/failure in field.

5.11.19 CPR success/failure—none, first responder, bystander.

5.11.20 Disposition of patients from emergency department.

5.11.21 The CPR case disposition from emergency department.

5.11.22 Trauma score on scene by death versus discharge.

5.11.23 Trauma score by patient outcome and disposition.

5.11.24 Patient outcome by response time for major trauma.

5.11.25 Patient outcome by response time for cardiac arrest.

5.11.26 Individual paramedics by skills performed.

5.11.27 Drug administration by paramedics.

5.11.28 Individual paramedic practice profile.

5.11.29 Paramedics/EMT training profile.

5.11.30 Patient distribution by age and sex.

5.11.31 Call response by presenting problem.

5.11.32 Time on scene by presenting problem.

5.11.33 Medical communications summary.

5.11.34 Calls per 1000 population by FIPS area.

5.11.35 Simultaneous call analysis.

5.11.36 Response mode summary.

5.11.37 Arrivals by PSO.

5.11.38 On-line medical direction summary.

5.12 *System Funding Consideration*:

5.12.1 The most successful and cost-effective EMS-MIS will be flexible to respond to needs and be supported at the state, regional, and local levels.

5.12.2 System design should allow for as much decentralization as possible in order to reduce the costs of data entry.

5.12.3 Funds invested in an EMS-MIS will be justified by more efficient and effective resource allocation.

5.12.4 The cost of emergency patient care data collection is the responsibility of the physician outpatient, EMS, and hospital providers and is passed on to the patient as part of the cost of patient care.

5.12.5 The cost of computerizing, merging, linking, and analyzing emergency patient care data should be shared by the owners and users of these data.

5.12.6 Various funding strategies include:

5.12.6.1 Government subsidy at the federal, state, or local level.

5.12.6.2 Direct fees to system users.

5.12.6.3 Direct fees to third-party carriers.

5.12.6.4 Surcharges on license plates, moving violations, and so forth.

5.12.6.5 Subscription programs.

5.12.6.6 Donations.

5.12.7 Financial justification for EMS-MIS costs may be found in:

5.12.7.1 Documentation and evaluation of EMS activity for legislative bodies and state and federal funding agencies.

5.12.7.2 Availability of data to support state EMS regulatory functions such as training, licensing of personnel, and vehicles, etc.

5.12.7.3 On-going training and equipment needs based on run review information.

5.12.7.4 Licenses to local PSOs based on-call demand/needs assessment for the area to be served.

6. Keywords

6.1 data system; emergency medical services; EMS-MIS; Management Information Systems