

**Emergency Medical Services  
Mobile Intensive Care Units  
Data Base Management System**

## Introduction

The advent of organized Emergency Medical Service systems in the prehospital care setting has resulted in a demand for methods of keeping detailed records - records not only of the number of calls to which a system responds, but also of the types of illnesses or injuries encountered and treatment provided.

Another reason for needing reliable comprehensive data is to show that EMS systems benefit all categories of emergency problems, not just the myth of "the old person having a heart attack".

The need for a system that provides detailed, dependable, readily interpreted statistical data is apparent. Thus, at some point, every provider of prehospital care, especially at the ALS level, must develop a method for gathering information and presenting it in a meaningful format<sup>1</sup>

It has become clear that the hand processing method of keeping records and preparing statistical reports is no longer going to be sufficient. This method is not only time-consuming, but usually requires a person with some special training to interpret forms completed on each call.

Compilation of EMS statistical data is a twofold task: the gathering of raw data; and, the subsequent processing of this raw data into a useful format. Each aspect of the task is of equal importance.

The purpose of this package is to provide the Emergency Medical Service (EMS) Advanced Life Support (ALS) and/or Basic Life Support (BLS) system with a user operated data collection and evaluation system utilizing microcomputer technology.

This package is to accomplish the following:

1. The establishment of a stand-alone microcomputer system to be used by the EMS system.
2. To provide a cost effective data processing system and to keep recurring data processing costs to a minimum.
  - A. The package is a low cost alternative to leased data processing services.
  - B. No need for leased line expenses.
  - C. No batch processing delays or charges.
3. To improve the accuracy, completeness and usefulness of the ALS/BLS ambulance service activity reporting system.

There are several considerations in the development of the EMS data handling system.

Ease of use: The system should be simple enough

1. See Table #1

that it can be operated by an existing staff of non-medical personnel. The need to employ additional people with high level training would make the system less feasible, especially for smaller EMS systems. The microcomputer system is operated by a number of people - none of whom has had formal training in computer operation. Input data is obtained from detailed report forms generated by the ambulance personnel. Despite the technical nature of this data, the data handling system is programmed in such a way as to permit input by any person with limited training.

Once the program is in use it requires only an understanding of the keyboard to operate the system. Built into the software is protection against errors which result in aborting of the program and loss of data already entered.

The operator needs only to input data as it is asked for on the display screen - as soon as an input has been completed the computer indicates the next piece of data needed. This is called "prompting". A person with minimal experience operating the system can input an entire report form in 10 to 20 seconds.

Versatility: As important as statistics are to EMS, the value of a data handling system is enhanced if it can be utilized for other purposes, such as training, accounts receivable, and inventory control.

This is actually a product of software. It could produce mailing labels for the material you send out, etc.

Undoubtedly, each user would come up with ways to best use their system to their advantage. As the number of systems grows, a forum could be provided to encourage the exchange of ideas for new applications.

Dependability: A data system which requires frequent maintenance would present problems to users in areas at a distance from major cities.

There are two factors that affect dependability: the likelihood of a component failure, or the possibility of computer error in program execution.

The fact that the majority of the system is solid state adds significantly to its dependability. As with most electronic devices, failures most often occur within the first two to four weeks, well within the warranty period.

As for computer program execution errors, we are not aware of any such errors not directly attributable to operator error. The early use of a new program is sometimes fraught with errors, but these are worked out when the program is completed and in daily use.

Validity: Input to the system must be as objective

as possible. Information from many sources will be used and the data should not be subject to the interpretation of the system operator.

Would five people inputting data from the same source obtain the same result? This, too, is mostly a product of programming. By carefully designing the ambulance report form we attempted to provide a method that assures accurate recording of every aspect of the EMS system response.

Environment: In this context, the surroundings of the system. The ideal system would require little, if any, special considerations such as space or air conditioning.

A very real consideration must be the ability of the system to exist without expensive modifications to the user's physical plant or environmental control system. The space required for the system is minimal. The entire microcomputer system occupies as much desk space as an electric typewriter. Power consumption is minimal and existing wall outlets are usually sufficient.

Cost: The most sophisticated data handling system would not be cost effective if two people could accomplish the same task by hand in the same amount of time; or, if the acquisition cost or long-term operating costs were high, it would be out of the reach of smaller EMS systems.

We have saved the best for last, the cost of the hardware and software for this system is under \$8,000.00.

The microcomputer system configuration and costs are as follows:

**Hardware**

1 - Apple II Plus with 48K memory	\$1495.00
1 - Apple Disk II floppy drive w/controller	595.00
1 - Apple Disk II floppy drive w/o controller	495.00
1 - Video monitor	250.00
1 - Microbuffer II w/32K Centronics compatible	335.00
1 - Texas Instruments model 810 printer with variable forms control, compressed print, Centronics interface, and forms stand.	
	2500.00
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Fixed hardware total	\$5670.00

NOTE: The hardware configuration above is for typical use. There are systems where use is heavier, that an additional Apple II and pair of disk drives are used for data entry. The exact system for your needs will have to be determined in a case-by-case manner.

**Software Costs**

For data entry and associated programs and report  
generating programs.

\$2000.00

**Supplies**

Mini (5 1/4") floppy diskettes for data storage. Prices vary depending on source, type, and quantity from \$30 to \$55 per box of 10.

Printer paper - approximately \$25.00 per box of 3500 sheets.

**Optional Equipment and Software**

Modem interface board - Allows remote troubleshooting and access to other computers and databases via phone lines. Novation Apple Cat II with various options approximately \$475.00

Solid State Disk Emulator - Systems with a large number (greater than 700) of paramedics, a larger work space is required in processing paramedic activity reports. Smaller systems can benefit from this board due to faster execution of report. Synetix SSD 294K board \$950.00.

Mailling List software - There are a variety of mailing list programs that range in price from \$50.00 to \$300.00.

Word Processing program - For generation of letters, documentation, or form letters. These programs vary in cost from \$75.00 to \$350.00.

Generalized Data Base Management - These programs can be used for mailing lists, inventory, and other miscellaneous record keeping. \$75.00 to \$750.00

The general parameters of the system are as follows:

1. Input Data

- A. Initial data<sup>2</sup> is collected from the Ambulance Service Report Form shown in this package.
  - 1. The preprinted form number as well as the shaded portions of the Report Form are entered as shown in Table #3 and are put onto the form by the ambulance service personnel at the time of the incident.
  - 2. The original copy remains with the ambulance service, the second sheet is returned to the EMS System, the third and fourth sheets are left at the hospital receiving the patient.
- B. Follow up data<sup>3</sup> is collected from the last page of the Report Form which is filled in and returned to the processing center by the hospital that received the patient.
- C. The number of items under each Data Code category are shown in Table #3. The verbal descriptions or names can be changed to suit each EMS system's needs.
- D. The maximum number of Ambulance Report forms is approximately 105,000 incidents a year.
- E. If the system has more than 15 services, the programs will handle the data in batches (ie. ambulance services 1-15, 16-30 etc.)

2. Output Reports

- A. The existing reports are shown in samples included in this package.
- B. Each report is generated for each ambulance service as well as a system total copy.
- C. Due to the content and structure of the input data base, almost any form of evaluation, based on those entered items, could be developed in the future.

2. See items 1 thru 21 Table #2  
3. See items 22 thru 25 Table #2

## I. Reasons Your E.M.S. System Should Be Evaluated.

## A. Information Obtained By On-Going Evaluation Is Needed In Areas Of:

1. Quality Control - medical - logistical
2. Needs assessment
3. Utilization of equipment, manpower, resources
4. Administration decisions regarding
  - a. staffing
  - b. unit locations
5. Budgeting
6. Justification of funds expenditures

II. General Information To Be Collected & Analyzed  
(for details, see Table #2)

## A. Calls

1. Location
2. Nature - emergency vs. non-emergency
3. Advanced Life Support vs. Basic Life Support

## B. Medical Aspects of Calls

1. Conditions encountered
  - a. chief complaint - nature of call
  - b. probable diagnosis - services rendered for
  - c. outcome of service
2. Treatment provided
  - a. basic life support procedures
  - b. advanced life support procedures
  - c. arrhythmias seen and/or treated
  - d. medications administered

## C. Response Times

1. by ambulance service
2. by level of service ALS/BLS
3. by time periods
4. overall

## D. Patient Information

1. Age
2. Sex
3. Destination - Hospital distribution

## III. Sources of Information To Be Collected

- A. Ambulance Service Report Form\*
- B. Follow-up sheet from hospitals receiving patient

4. See attached sample.

- C. Source of all patient related data
  - 1. Must be
    - a. objective
    - b. properly completed
    - c. frequently reviewed
  - 2. Also serves as:
    - a. medical records
    - b. excellent source for medical quality control
  
- D. Hospital Follow-up
  - 1. Number of and where patients are transported
  - 2. Treatments at the emergency department
  - 3. Resulting diagnosis and disposition

#### IV. Reporting Methods

- A. Major Faults Of Many Data Collection Efforts Presently Being Done
  - 1. Time consuming manual tabulations
  - 2. Every system does it's "own thing"
  - 3. Data is so inconsistent that it is impossible to compare system, areas, regions
  
- B. Methods To Correct This Problem
  - 1. Cost effective in-house data processing
  - 2. Standardized data input format
  - 3. Standardized report generating formats



**INFORMATION COLLECTED FROM AMBULANCE FORM THAT WILL BE  
USED FOR PROCESSING**

1. Preprinted form #	6 digits
2. Date	6 digits
3. Ambulance Service	2 digits
4. Unit # + ALS or BLS 1 letter	3 digits,
5. Age and Sex 1 digit	2 digits,
6. Nature of Call	3 digits
7. Services rendered for	3 digits
8. Initial EKG and/or treatment up to 9 digits	1 letter,
9. Secondary EKG and/or treatment up to 9 digits	1 letter,
10. Hospital contacted and method of contacted 1 digit	2 digits,
11. Case Severity	1 digit
12. Patient status enroute	1 digit
13. Hospital transported to	2 digits
14. Results of service	1 digit
15. Outcome of run	1 digit
16. Time call received	4 digits
17. Time arrived at scene	4 digits
18. Time back in service	4 digits
19. 1st Paramedic # and service rendered codes up to 10 letters	3 digits,
20. 2nd Paramedic # and service rendered codes up to 10 letters	3 digits,
21. 3rd Paramedic # and service rendered codes up to 10 letters	3 digits,
22. 4th Paramedic # and service rendered codes up to 10 letters	3 digits,
23. Follow-up: E.R. disposition	1 digit
24. Follow-up: Discharge date	8 digits
25. Follow-up: Discharge status	1 digit
26. Follow-up: Discharge diagnosis (ICDA-8)	4 digits

AMBULANCE FORM CODE DETAILS

1. Preprinted form #
2. Date
3. Ambulance Service  
01 thru 99  
List of services may be modified by user.
4. Unit # & ALS or BLS
5. Age and Sex
6. Nature of Call
  - 101 Accident Traffic
  - 102 Accident Home
  - 103 Accident Industrial
  - 104 Accident Miscellaneous
  - 105 Accident Sports
  - 106 Animal Bite
  - 107 Assault, or Fight
  - 108 Drowning, or Near
  - 109 Cardiac Complaint
  - 110 Homicide, or Attempt
  - 111 Mental, or Emotional
  - 112 Obstetric
  - 113 Respiratory Problem
  - 114 Cancelled Call
  - 115 Overdose, or Poisoning
  - 116 Sick Call (Misc. Illness)
  - 117 Stroke
  - 118 Suicide, or Attempt
  - 119 Unclassified - other
  - 120 DDA
  - 121 False
  - 122 Fire/Explosion
7. Services Rendered For
  - 201 Asphyxiation
  - 202 Burns
  - 203 Convulsions or Seizure
  - 204 Drowning or Near
  - 205 Drug Reaction, OD, Poison
  - 206 Electric Shock
  - 207 Fever
  - 208 Gun Shot or Knifing
  - 209 Cardiac Problem
  - 210 Hemorrhage
  - 211 Injury
  - 212 Intoxication, App.
  - 213 Mental or Emotional
  - 214 Obstetric
  - 215 Respiratory Problem
  - 216 Stroke
  - 217 Suffocation
  - 218 Unclassified - Other
  - 219 Unconsciousness
  - 220 No Treatment Needed
  - 221 No Patient
  - 222 Diabetic
  - 223 Internal Injury

8. Initial EKG Treated and/or Treatment  
 Rhythm  
 A. None of these  
 B. Normal Sinus Rhythm  
 C. PVC  
 D. Vent. Tachycardia  
 E. Vent. Fibrillation  
 F. Asystole (witnessed)  
 G. Asystole (unwitnessed)  
 H. Sinus Arrhymia  
 J. Sinus Bradycardia  
 K. Sinus Tachycardia  
 L. Sinus Arrest  
 M. PAC  
 N. PAT  
 P. Atrial Flutter  
 Q. Atrial Fibrillation  
 R. 1° Heart Block  
 S. 2° Heart Block  
 T. 2° Block Mobitz II  
 U. 3° (complete block)  
 V. Junctional Rhythm  
 W. Idiovent. Rhythm  
 Treatment  
 01 thru 50  
 List of treatment may be modified by user.
9. Final or Transport EKG and Treatment  
 Same as #8, or if none may be ignored.
10. Hospital Contacted and Method of Contact  
 Hospital  
 01 thru 50  
 List of hospitals may be modified by user.  
 Method of Contact  
 -. No contact attempted  
 0. Contact unable to establish  
 1. UHF good quality  
 2. UHF fair quality  
 3. UHF poor quality  
 4. MERCI good quality  
 5. MERCI fair quality  
 6. MERCI poor quality  
 7. Phone Patch  
 8. Telephone  
 9. SOP only
11. Case Severity  
 -. No Patient  
 1. Minor  
 2. Moderate  
 3. Severe  
 4. Died enroute
12. Patient Status Enroute  
 -. No Patient  
 1. Improved  
 2. Unchanged  
 3. Worsened  
 4. Died enroute

13. Hospital Transported To
  - . No Transport
  - 01 thru 50
  - List of Hospitals same as #10
14. Results of Service
  - . No Patient
  - 1. Condition improved
  - 2. Condition unchanged
  - 3. Condition worsened
  - 4. Died during call
  - 5. Dead on arrival at scene
  - 6. Successful resuscitation
  - 7. Unsuccessful resuscitation
  - 8. No service rendered
  - 9. Services refused
15. Outcome of Run
  - . No patient or transport
  - 1. Treat/Transport
  - 2. Treat/non-transport
  - 3. Transport only
  - 4. Refused aid
  - 5. Advised to see private MD
  - 6. Transfer
  - 7. Cancelled
  - 8. Could not find
  - 9. Other

SYSTEM CONFIGURATION

This report displays the current list of active ambulance services, hospital names, and medication or treatment names. Except for system name and printer interface type, the user can modify the System Configuration to suit conditions as they change.

MONTHLY ACTIVITY REPORT

This report sums up the nature of calls and services rendered for all and individual services.

RESPONSE TIME SUMMARY

This report gives the breakdown of ALS vs. BLS call responses. Average Response Time (ART) and Average Length of Call (ALC) are computed along with percentages of calls handled by service. The number of calls is also displayed in six time frames matched to average response times within those time frames. A graph is produced to show percentage of calls within set response times.

AID GIVEN PATIENT

Aid given patient is matched to results of service. Results of service and Outcome of run is matched to ALS/BLS.

HOSPITAL CONTACT

Hospitals and the method they were contacted are totaled.

EKG RHYTHMS

EKG rhythms are totaled with the results of service.

TREATMENT

The user selected treatments or medications are totaled with the results of service.

PARAMEDIC ACTIVITY MAP

This report is generated by the Paramedic Monthly Activity Report. It shows the runs performed by service and the numbers of the paramedics working for the services.

PARAMEDIC ACTIVITY

This report shows the activity of the paramedics per service. This report may be month or year summary.

INDIVIDUAL PARAMEDIC ACTIVITY

This report follows the Paramedic Activity Report and gives the activity totals for an individual paramedic and totals activity if spread over more than one service. Training hours credit is computed based on a table internal to the program for the 26 activities and is displayed under 'TOTALS'. This report is either month or year summary.