

FINAL REPORT

MOBILE INTENSIVE CARE UNIT PILOT PROGRAM

THE EFFECTS OF MICU PARAMEDIC SERVICE IN NEW JERSEY

NEW JERSEY STATE DEPARTMENT OF HEALTH

EMERGENCY MEDICAL SERVICES PROGRAM

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CHAPTER 1

INTRODUCTION

This report has been prepared by the Emergency Medical Service Program of the New Jersey State Department of Health. It is being submitted to the State Legislature by the State Commissioner of Health, Dr. Joanne E. Finley.

The Department was charged with the responsibility of implementing P.L. 1973, Chapter 229 (N.J.S.A. C26: K-1 et al) which provides for the establishment of Mobile Intensive Care Unit (MICU) Pilot Projects. The purpose of this Act was to determine whether MICU service utilizing paramedics could reduce death and disability resulting from medical emergencies. Nine pilot MICU projects were implemented to determine the effects of MICU services.

This report describes the program and summarizes the experience gained in the development of the individual projects. The diversity among the projects enabled the Department to determine the optimal structure for future MICU service within the Garden State.

CHAPTER 2

BACKGROUND

Emergency Medical Services

In 1966, the National Academy of Sciences documented the needless loss of life which was occurring because of deficiencies in emergency medical care.¹ Since that time, Emergency Medical Services (EMS) has been increasingly identified as a unique health care specialty and has become an area of national concern and attention.²

National studies have demonstrated that improvements in emergency medical care save lives.^{3, 4} A recent study by the State Department of Health found a 13% reduction in Newark trauma deaths due to EMS improvements.⁵

In 1973, Congress passed the EMS System Act and established national standards for EMS.⁶ Included in the Act, were standards for ambulance services, other components of emergency medical care and the specific recognition that MICU Service was an integral element of a total EMS System. This recognition has been reaffirmed by the New Jersey experience which clearly demonstrated the strengthening of an EMS System by the addition of MICU Services.

MICU Concept

The validity of the MICU concept was first demonstrated in Northern Ireland in 1966 where a team of physicians responded to patients with acute coronary problems and immediately initiated medical treatment.⁷ The concept of physician response was soon initiated in urban areas of the United States and again proved successful.⁸ It was soon realized that applying MICU techniques to cases other than coronary patients might be life saving for other critical patients and more cost effective. However, the use of physicians responding to emergencies became a limiting factor because of the time needed to travel to and from each patient. There were simply not enough physicians available, particularly in rural areas, to respond to every critical case.

Fortunately, technological improvements permitted expansion and refinement of the MICU concept. Telemetry developed for the space program, which transmitted an astronaut's physiological data to earth, was also capable of transmitting an emergency patient's physiological data to a physician. This development has made possible the use of paramedics acting under medical direction to deliver lifesaving care to the critically ill or injured. As a result, individuals who would otherwise have died, are able to continue to lead fruitful and productive lives.⁹

New Jersey Legislation

The New Jersey Mobile Intensive Care Unit Legislation provided that:

- . Qualified hospitals could conduct pilot programs with the approval of the Department of Health.
- . Paramedics would be certified by the New Jersey Board of Medical Examiners after training in a program accredited by the Commissioner of Health.
- . Certified paramedics could perform certain Advanced Life Support procedures provided they were maintaining direct communication with, and were taking orders from a physician or nurse qualified in emergency cardiac care.

Chapter 3 describes the implementation of the legislation.

CHAPTER 3

IMPLEMENTATION

Department Activity

In order to insure that the MICU Program met acceptable medical standards, an MICU Advisory Committee, composed of leading physicians, including Cardiologists and Emergency Medical Services Specialists, was appointed to assist in program development.

The Department, with the assistance of the Committee:

- . developed "Criteria of Eligibility for Hospitals" to provide MICU service.
- . reviewed and approved applications to implement MICU projects.
- . developed a course curriculum and established MICU Paramedic training courses.
- . established "Pre-requisites for Paramedic Trainees".
- . developed "Communication System Guidelines" for MICU projects.
- . audited and evaluated all facets of the on-going projects.

The Department had two areas of particular concern in establishing the MICU Program. In early 1974, there were several training programs for paramedics ranging from 80 hours to 1,000 plus hours. After reviewing these, the training program developed by the U.S. Department of Transportation, of 480 hours, was adopted with a few modifications. Subsequently, the U.S. Departments of Transportation, Labor, and Health, Education and Welfare jointly selected that training program as the National Training Program for Paramedics.

The Department was also concerned that a program of 480 hours duration would be too lengthy for volunteer ambulance personnel to attend. However, the Department was confident, and subsequent events proved, that many of the volunteers would have the dedication to complete the training.

The College of Medicine and Dentistry of New Jersey was selected to provide the didactic portion of the paramedic training. Didactic courses were provided at Newark, Trenton, and Woodbury to accommodate trainees.

The Department, established a Uniform MICU Reporting System as part of the evaluation activities. These reports served as the primary basis for evaluating the efforts of individual projects.

The Board of Medical Examiners had the legislated responsibility to certify paramedics and after review, accepted the Department's Training Program as the required education for paramedics. Paramedic graduates of the Training Program received certification if they successfully completed written and oral examinations administered by the College of Medicine and Dentistry of New Jersey.

MICU Projects

Nine projects were selected competitively to provide MICU services. Each of the projects met the minimal initial criteria, served varied areas and populations, and had different management structures, services, and philosophies. They provided ideal models to determine the effect of different means of delivering services, and offered the possibility of demonstrating the most effective means to structure the statewide MICU Program at the end of the pilot phase.

The hospitals selected to establish MICU projects and their primary service areas were:

Burlington County Memorial Hospital

- . To serve Burlington County within a ten mile radius of the hospital

Hackensack Hospital

- . To serve the City of Hackensack

Jersey City Medical Center

- . To serve Jersey City

Middlesex General Hospital

- . To serve the City of New Brunswick

Overlook Hospital

- . To serve portions of Essex, Morris, Somerset, and Union Counties

St. Elizabeth Hospital

- . To serve the City of Elizabeth
- Helene Fuld Medical Center

- . To serve Mercer County

Underwood Hospital

- . To serve Gloucester County within a ten minute response time of the hospital

West Jersey Hospital

- . To serve Camden County and portions of Burlington and Gloucester County

Tables 1 and 2 list some of the differences between the projects.

Each project was responsible for implementing the services proposed in their applications. Project activities included:

- . establishment of a management structure.
- . development of funding sources.
- . selection of paramedic trainees.
- . procurement of equipment.
- . provision of clinical training to paramedic trainees.
- . provision of services.

As noted in Table 1, the projects differed in size, population, geographic location, number of control and receiving hospitals, availability of basic life support and MICU vehicles (transport and non-transport type), and sponsorship.

TABLE 1

MICU Project Areas and Related Characteristics

As of 8/31/78

PROJECT	SERVICE AREA		TYPE OF AREA	CENTRAL DISPATCH	HOSPITALS		BASIC LIFE SUPPORT		MICU VEHI- CLE	ADMINISTRATIVE CONTROL BY
	POP.	MILES			CONTROL	REC.	SQUADS	VEHICLES		
Burlington	250K	380	RURAL	YES	1	4	24	50	1	Hospital
Elizabeth	115K	8	URBAN	YES	1	2	1	3	1	Non-Hospital
Hackensack	55K	5	URBAN	NO	1	0	1	3	2	Non-Hospital
Jersey City	250K	13	URBAN	NO	1	2	1	3	1	Hospital
Mercer	320K	200	URBAN/RURAL	NO	5	0	18	54	10	Non-Hospital
New Brunswick	50K	6	URBAN	NO	1	1	1	-	-	Non-Hospital
Overlook	300K	88	URBAN	NO	1	3	20	34	2	Hospital
Underwood	103K	260	RURAL	NO	1	1	30	38	1	Hospital
West Jersey	485K	220	URBAN/RURAL	YES	1	9	28	82	3	Hospital
TOTAL	1,948K	1,179	-	-	13	22	424	271	21	-

TABLE 2

MICU ACTIVITY SUMMARY

As of 8/31/78

PROJECT	SERVICE		NO. OF RESPONSES	NO. OF PATIENTS TREATED	MICU SAVES *		MARKED IMPROV- MENT	AVG. NO. PATIENTS TREATED MONTHLY	AVG. RESPONSE TIME IN MINUTES
	INITIATED	24 hr. LEVEL			INITIAL	LONG TERM			
Burlington	1/78	7/78	664	499	10	6	N/A	71	10
Elizabeth	-	-	-	-	-	-	-	-	-
Hackensack	4/78	4/78	263	207	4	3	12	60	3.5
Jersey City	6/78	10/78	70	70	10	N/A	15	150	7.5
Mercer	1/77	7/77	2324	1762	59	26	359	111	6.0
New Brunswick	-	-	-	-	-	-	-	-	-
Overlook	3/76	3/76	3536	3323	76	39	484	140	6.2
Underwood	10/77	2/78	515	485	20	10	55	62	7.5
West Jersey	4/77	9/77	3710	1700	47	20	502	175	7.5
TOTAL	-	-	11,082	8,046	226	104	1,427	769	6.9

*MICU Saves: Persons who were clinically dead, (Pulseless/breathless) before MICU intervention.

Initial: Arrived at hospital with circulation and breathing restored.

Long Term: Discharged from hospital alive.

CHAPTER 4

FINDINGS

Clinical Impact

MICU is a clinical service designed to affect a broad group of problems such as heart attacks, acute heart failure, severe trauma, burns, strokes, diabetic emergencies, drug overdoses, and asthmatics or other respiratory emergencies. The major question to be answered is:

"Does the MICU Program have a clinical impact:
does it save lives?"

The Uniform MICU Reporting System provides clinical data needed to answer this question. It is based on the care rendered.

Analysis of this data indicates that MICU services provided clinical treatment to over eight thousand patients through August 31, 1978. Table 2 indicates when the nine pilot projects began and when they achieved 24 hour coverage status. Three categories of patients were treated: 226 with immediate life threatening problems who were saved prior to hospitalization - 104 of whom were discharged alive; 1,427 patients with conditions (such as coronary problems, strokes, trauma, burns, drug overdoses, diabetic emergencies, respiratory emergencies, etc.) that would have seriously worsened and possibly died without MICU services but were significantly benefited; and 5,196 other patients for whom treatment, while beneficial, was precautionary and specific MICU lifesaving cannot be claimed.

At present, the pilot MICU projects serve approximately 25% of the State's population. Using data from this sample to extrapolate, the potential of statewide MICU services may be predicted as follows:

<u>Outcome Measures</u>	<u>Monthly Average MICU Projects*</u>	<u>Potential Monthly Average Statewide</u>	<u>Potential State-wide Annually</u>
Saves	22 patients	88 patients	1,056 patients
Significantly benefited	155 patients	620 patients	7,440 patients
Precautionary	<u>819 patients</u>	<u>3,276 patients</u>	<u>39,312 patients</u>
TOTAL	996 patients	3,984 patients	47,808 patients

*Based on the average number in all MICU projects during three or more consecutive months of full operation.

Paramedics

The favorable clinical impact demonstrated indicates that paramedics operating under a physician's remote direction can provide lifesaving care. The results are also a measure of the quality of Paramedic Training and the value of the "National Training Course for Paramedics" used by the Board of Medical Examiners to certify the paramedics. Certification by an independent board which authorizes the practice of medicine and nursing has insured the quality and educational integrity of the Training Program and the status of the paramedics.

Paramedic trainees were selected by each MICU Project using broad guidelines established by the Department. However, 40% of the selected trainees did not complete the training which indicates a need to improve the selection process.

Paramedics in the pilot projects were exposed to varying numbers of patients. In those projects where paramedics saw few patients the paramedic's ability to administer care significantly declined. This decline is called skill decay and must be prevented if patients are to receive adequate attention.

During the initial implementation of most projects, the MICU vehicle was often staffed by one paramedic and one non-paramedic (rather than two paramedics). While this staffing pattern was only temporary until additional paramedics could be trained, it offered the opportunity to learn if one on-duty paramedic would suffice for an MICU. It was soon apparent that patient care was excessively delayed since one paramedic simply could not perform all the critical tasks fast enough.

Ultimate Responsibility

The national MICU experience indicates that strong central coordination and standardized training with statewide paramedic certification is a key to quality care. In those states where reliance is placed on local initiatives alone serious questions have been raised as to whether MICU Programs meet acceptable medical standards.

By contrast, expert medical opinion and clinical data from the Uniform MICU Reporting System indicate that the New Jersey MICU Program meets acceptable medical standards.

Medical Control

Medical control is necessary to direct paramedics activity to ensure that the MICU service meets acceptable standards for emergency medical care. Medical control is provided by the qualified physician staff of a qualified hospital for the total coordination of emergency medical services and is accomplished through dispatch, treatment and triage protocols; on line medical direction; and communication technology.

Within New Jersey, as elsewhere in the nation, the quality of medical control was seriously diluted when several hospitals shared the responsibility for medical control. The preferable pattern was one hospital with final responsibility for medical control of a MICU service. Such a hospital is commonly called a resource hospital. Other hospitals, where appropriate, may provide medical direction of paramedic activities under the medical control of a resource hospital. Such hospitals are commonly called associate hospitals.

Both the national and the New Jersey MICU experience has clearly demonstrated that not all hospitals have the necessary qualifications to provide either medical control or medical direction. Qualifications include: a hospital of adequate bed size with an Emergency Department and Intensive or Coronary Care Units, a history of staffing and training capabilities appropriate for MICU services and documented willingness and capability to participate in MICU services.

The quality of medical direction at each hospital varied based on the training and knowledge of the involved physicians. Where physicians were certified in Advanced Life Support and were familiar with the MICU project and equipment, medical direction was promptly provided. Elsewhere, physicians were reluctant to provide medical direction with corresponding delays in patient care.

Administrative Control

"No man can serve two masters" proved to be a truism in the MICU projects. Some units were under the administrative control of an agency other than the hospital providing medical control. In those instances, provision of services tended to be fragmentated and uncoordinated. The division between medical and administrative control contributed to breakdowns and confusion in the chain of command, ineffective use of resources, poor paramedic morale and, on occasion, mutually contradictory practices.

At times patients were not treated because:

- MICU supplies were understocked.
- Vehicle preventative maintenance was not provided.
- Biomedical equipment could not be maintained or could not be recharged in the field.

These problems were minimized where administrative control and quality of technical services available to each project was high. Those hospitals which provided the strongest administrative control developed a management structure which included a medical director, an administrative director, a MICU coordinator, a training coordinator, and provided administrative and technical support services. This management structure appears to be the optimal means to provide hospital based administrative control of MICU services.

Quality Assurance

Every provider of medical services is morally and legally obligated to provide appropriate medical care. An on-going inhouse evaluation program is an essential mechanism to ensure that quality medical care is actually provided.

In those projects where medical and administrative control were provided by different agencies, evaluation efforts were poor and fragmentary. Naturally, combined administrative and medical control produced better evaluation efforts. The best evaluation program resembled the Professional Standards Review Organization (P.S.R.O.) System.

In a few instances, non-MICU ambulances failed to provide appropriate care. Where such instances did occur, the project would encourage corrective action. However, such problems should be prevented rather than corrected through on-going evaluation programs to ensure and document that all pre-hospital EMS segments provide appropriate care.

Telecommunications

Telecommunications systems were a key factor in the delivery of service. In those projects where the public was able to easily request emergency care, paramedic responses were high. The national MICU experience strongly suggests that a 9-1-1 number with central dispatch is the optimal way to deliver services.

The New Jersey Legislature's 1976 County and Municipal Study Commission identified the need for 9-1-1 and recommended:

"Municipalities throughout the State should strive to place their police, fire, and emergency squad services on the universal 9-1-1 emergency number." 10

In 1977, the Attorney General appointed the Statewide Police Emergency Network Task Force to assess all New Jersey police telecommunications. The Task Force is preparing a report on their findings and indicates it will recommend that

". . . it be the policy of the State of New Jersey . . . that 9-1-1 be implemented as soon as possible . . ."

and that . . .

"negotiation be conducted between New Jersey telephone companies and the highest level of state government to establish a plan for the implementation of 9-1-1." 11

New Jersey's experience with biomedical telemetry differed from the national MICU experience. Elsewhere in the nation, MICU projects encountered equipment which did not work, radio congestion and, at times, receipt of the wrong patient data. By contrast, the New Jersey projects, while experiencing some problems, had a highly efficient biomedical telemetry system. This is directly attributed to the state-level involvement in the design and installation of this equipment. Significantly, the New Jersey projects assisted in the development of prototype telemetry equipment now coming into use throughout the nation.

Community Support

The majority of the projects solicited and developed community support early in their planning stages. In some instances however, municipalities and local ambulance squads declined MICU services during the initial phase of paramedic operations. Naturally, this was a cause of confusion and adversely affected MICU services.

Most projects were able to mobilize local resources to implement paramedic services. However, some projects had difficulty in securing support and the provision of services was delayed. There was one instance where local support was inadequate and the project had great difficulty in providing sustained service. There is a correlation between the ability to secure local support and the project's success.

In New Jersey, the "save rate" was twice as good when citizens began Cardio-Pulmonary Resuscitation (CPR), then when the ambulance personnel began CPR. King County, Washington also found a 55%

increase in "saves" when citizens initiated CPR. The reason is simple, the citizen could begin CPR immediately while the ambulance was still responding.

Operating Practices

The method of patient transportation differed between the projects. MICU ambulances treated and transported patients in some projects. In other projects, MICU's treated, but non-MICU ambulances transported patients.

Non-transport of patients by MICU's is preferable. MICU ambulances often transported patients who did not require MICU treatment. If these patients had been transported by a non-MICU ambulance, the MICU could have provided service to other patients.

In some projects response to the patient was delayed since paramedics were stationed away from the MICU or could not easily be summoned.

Cost

MICU services are intrinsically expensive and can only be provided when they are affordable. The present pilot projects relied on sizable donations, grants and municipal contributions to begin service. It is questionable whether donations of such magnitude will again be available either to continue service or to begin new service.

In addition, cost effectiveness was not a consideration in the development of the present projects. The ratio of MICU vehicles to population ranged from a low of 1 per 27,500 residents to a high of 1 per 250,000 residents.

Size of Future MICU Service Areas

The size of future service areas is clearly influenced by the medical needs of the citizens, the recommendations for paramedics to treat an appropriate number of patients, economics of scale and other requirements such as span of control.

New Jersey experience indicates that one MICU vehicle can adequately serve 100,000 - 125,000 residents. This appears to be the optimal ratio to maintain adequate service and high paramedic skill in a cost effective manner.

This ratio of one MICU per 100-125,000 residents must be used with some weighting for areas which:

- . routinely experience peak hour demands greater than 10% of the average daily demand
- . serve disproportionately large segments of elderly citizens (who have a much greater need for MICU services than younger citizens)
- . experience substantial seasonal increase in - population which might require increased MICU service. (Atlantic, Cape May and Ocean Counties attract a great number of summer vacationers.) The demand for ambulance service greatly increases during summer months. However, it is not known if the severe cases, requiring MICU's, correspondingly increase.

Some areas of the State have low population densities. In those areas, MICU vehicles at the ratio of 1 per 100-125,000 residents would have such a lengthy response time to reach a patient that MICU services would be valueless. In addition, the total service time would be so lengthy, that the MICU vehicle would not be available to treat additional patients as it would still be involved with the first patient. It is questionable how MICU services can be provided to rural areas at an affordable cost and without sacrifice of quality.

New Jersey experience indicates that one hospital can routinely provide on-line medical direction to at least two MICU vehicles simultaneously. This means one vehicle per 100,000 to 125,000 persons, and one MICU control hospital for each 200,000 - 250,000 residents. National MICU experience indicates that a resource hospital can provide medical control of at least six MICU's and 2 or 3 associate hospitals with an acceptable span of control. Thus MICU service should consist of one resource hospital for each 750,000 resident population.

CHAPTER 5
RECOMMENDATIONS

1. MICU services should be provided on a 24 hour/7 day per week basis to all New Jersey citizens consistent with medical and cost effectiveness requirements. New legislation proposed by the Department should be enacted as soon as possible to allow the service to expand.
2. MICU services should be organized to encompass a region with a population base sizable enough to ensure economics of scale, provide adequate paramedic exposure to patients, and provide a broad base of community support. The MICU service should document the region's suitability for, and willingness to participate in, MICU services.
3. Medical control must be provided by a qualified resource hospital which has complete medical control of all facets of MICU service. Medical direction and administrative control should be provided by either the resource or qualified associate hospital.
4. Resource and associate hospitals should be competitively selected based on their qualifications and documented community support.
5. The management structure for MICU services must include a medical director, an administrative director, a training coordinator, a MICU coordinator, and medical, administrative, and technical support services.
6. Standard statewide treatment protocols should be provided for all to use. Physicians and nurses who operate the base station must be thoroughly familiar with its operation and must be certified by the Board of Trustees of the hospital with the concurrence of the medical staff. These physicians and nurses must be extremely knowledgeable about the capabilities of the paramedics.
7. Paramedic candidates should be stringently screened and should be subject to physical and psychological testing. The responsibilities of a prospective paramedic should be thoroughly explained to all potential trainee candidates.

8. Paramedic training should utilize the "National Training Course for Paramedics." Stronger Clinical Guidelines should be developed to ensure compliance with the National Training Course and additional emphasis should be placed on patient assessment during didactic training. Those involved in teaching paramedics should be thoroughly familiar with the MICU program.
9. Paramedics should be certified annually by the New Jersey State Board of Medical Examiners. Field evaluation should be an integral part of the board certification.
10. MICU's should be staffed by at least two paramedics. Non-transport type vehicles should be used whenever possible. On duty paramedics should be based with the unit and readily available.
11. All patient care equipment should meet national standards. Communication equipment should be in accordance with the "Statewide EMS Telecommunication Plan" and be approved before purchase, during installation, and prior to use after installation.
12. In order to achieve the full life-saving potential of MICU services, plans should be developed and implemented to provide: Central Dispatch, 9-1-1, assured quality non-MICU ambulance service, Public CPR education (Cardiac Defender), and on-going evaluation within each MICU service areas.

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