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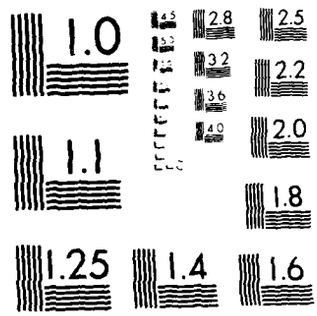

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TO DETERMINE THE BEST MEANS OF PROVIDING A DIAGNOSTIC NUCLEAR MEDICINE CAPABILITY AT U.S. DARNALL ARMY HOSPITAL FORT HOOD, TEXAS

A Problem Solving Project

Submitted to the Faculty of

Baylor University

in Partial Fulfillment of the

Requirements for the Degree

of

Master of Health Administration

by

Major John M. Evans, Jr., ANC

July 1979

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This study was to determine the optimal financial solution to providing a diagnostic medicine capability at U.S. Darnall Army Hospital, Fort Hood, Texas.

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BIOGRAPHICAL SKETCH

Major John M. Evans, Jr. was born September 8, 1941, in Berwick, Pennsylvania. Upon graduation from Central Columbia County Joint Schools in 1959 he served in the United States Navy for four years.

He attended Bloomsburg State College for one year and then entered the nursing program at Pennsylvania Hospital School of Nursing for Men in Philadelphia, Pennsylvania. Following graduation in 1968 he entered the United States Army as a second lieutenant in the Army Nurse Corps. In 1973 he graduated from Russell Sage College, Troy, New York, with a Bachelor of Science in Nursing.

Major Evans has attended the Army Medical Department's Officer Basic Course, Clinical Head Nurse Course, Officer Advanced Course, and the U.S. Army-Baylor University Program in Health Care Administration. Upon completion of his residency at U.S. Darnall Army Hospital, Fort Hood, Texas, he was reassigned to that hospital as the Nursing Methods Analyst.

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I express my appreciation to Major Herman Seefeld, Comptroller, U.S. Darnall Army Hospital and his entire staff for their cooperation during this study. Special acknowledgment is due Mr. Charles A. Beckham, Chief, Management Assistance Branch, for his assistance and patience, without which this study would have been impossible.

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I. INTRODUCTION

Over the past fifteen years many technological developments have surfaced in the health care field and probably one of the most significant areas is that of nuclear medicine. This relatively new field has contributed a great deal to patient care in both its diagnostic and therapeutic modalities. The diagnostic area, especially, has achieved worldwide acceptance, mainly because it allows the physician to greatly increase the scope of his diagnostic ability and arrive at a decision quicker, without submitting the patient to increased trauma, discomfort, or hazard. Many different body organs and functions can now be evaluated with greater ease and accuracy. For example, acute pulmonary embolism involving a major pulmonary artery is the third most common cause of sudden death in the hospital. When symptoms of this complication occur, conventional x-ray techniques can be expected to give positive results in only about 20 percent of severe cases; however, nuclear medicine ventilation and perfusion studies may diagnose pulmonary embolism with 90 to 100 percent accuracy.[1]

The scintillation camera, which detects radioactive tracers, became readily available commercially in 1964, and significantly impacted on the practice of clinical medicine. Living biological systems could now be visualized and regional function measured by the

physician. Much was learned about the basic understanding of the disease process by the use of these non-invasive techniques, as well as in medical diagnosis.[2] Isotope scanning for diagnostic purposes has now became such a routine procedure in hospitals that a nuclear medicine department is on the way to becoming a "must" in any well-organized and efficient community hospital. A patient hospitalized in a facility having a nuclear medicine capability now has about a one in three chance of being examined with this procedure.[3]

The proliferation of nuclear medicine, computed tomography, and other technologies in the health care field, has created much discussion in the past few years. Unlike technology in other industries, which has the effect of reducing manpower and production costs, many of the new technologies in the health field cause increased labor and capital costs. However, in spite of the controversy over costs, a nuclear medicine capability is now so important in diagnosis that it represents "state of the art" and is, therefore, a mandatory adjunct to the delivery of quality health care. Furthermore, this requirement will continue to grow, as evidenced by the World Health Organization's statement, "It is hoped that planners of nuclear medicine facilities will keep in mind that this discipline is rapidly advancing and that allowances should be made for additional space and funds for future modernization."[4]

Hospital History and Setting

The construction of U.S. Darnall Army Hospital was completed in July 1965, at a cost of $6,151,700. The hospital was built with a

design that reflected the trend to outpatient care. It housed 285 inpatient beds and sixteen outpatient clinics, including a fourteen-chair dental clinic, within 220,475 square feet. At the time of completion it was estimated that this facility would be providing primary health care (both inpatient and outpatient) to approximately 40,000 active duty, dependent, and retired personnel.

Over the years the number of eligible beneficiaries who are in the catchment area of the hospital has grown to 160,000. Fort Hood itself has grown tremendously and now reports a post population of 65,000. The total supported population of 160,000 equates to a city the size of Amarillo, Texas, which has three community hospitals and many more physicians. Several years ago, when it became apparent that the existing facility was inadequate to handle the increased workload, authorization was obtained to modernize and enlarge the hospital. In April 1979, construction began which would add 242,985 square feet of new space, and accomplish a complete renovation of existing space at a cost of $47.7 million. The new addition, when completed in 1983, will triple the amount of space for the outpatient clinic and ancillary areas. The number of operating rooms will increase from five to six, and two delivery rooms will be added to make a total of four. A day surgery capability will also be added, utilizing two new operating rooms in the surgical clinic.

While the initial planning provided for a full range of services in both the inpatient and outpatient areas, one important service was overlooked. The mission to provide a nuclear medicine service had

not existed previously, and no plans were made to include it in the new facility, although provisions were made for a day surgery unit and an ultrasound capability which were not available either. Evidently, the nuclear medicine workload that was being sent to other facilities, and the future potential of this service were not fully realized.

Conditions Which Prompted the Study

U.S. Darnall Army Hospital, Fort Hood, Texas, was receiving total support from Brooke Army Medical Center, Fort Sam Houston, Texas, and Scott and White Memorial Hospital, Temple, Texas, in performing its nuclear medicine workload. Approximately 95-100 patients/month were transported from U.S. Darnall Army Hospital to Brooke Army Medical Center for diagnostic scans and about 2-5 patients/month to Scott and White for emergency scans. It should be noted, however, that the number transported to Scott and White did not truly represent the total number of acutely ill patients who required scanning procedures. The only ~~ones~~ patients sent to Scott and White a distance of X miles; were those whom the physician had determined were in stable enough condition to make the trip there and back. Often~~times~~, the patient's condition was so unstable that the physician could not consider transportation to Scott and White and therefore had to do without this potentially valuable diagnostic tool.

This system was definitely an inconvenience to the patient. Patients frequently complained about the bus trip from U.S. Darnall Army Hospital to Brooke Army Medical Center and back, which entailed

a six-hour bus trip and a ten-hour day for an examination that might take an hour or less to do. Some examinations required the patient to be at Brooke Army Medical Center by 0730, so travel had to begin the day before and required an overnight stay. Active duty personnel were housed by the Medical Holding Company at Brooke Army Medical Center, but dependents and retired military personnel were required to arrange and pay for their own lodging. To some of the dependents of junior enlisted members this presented a financial strain. For those inpatients who could not tolerate the bus trip, an ambulance was used to transport them to Brooke Army Medical Center and back. Of the 95-100 patients making this trip each month, approximately 30-35 percent were active duty personnel, which represented a significant amount of duty time lost from units on Fort Hood.

Because the present system had numerous difficulties associated with it, several other methods of providing this service to the U.S. Darnall Army Hospital patients were investigated. The hospital commander made the decision that an in-house nuclear medicine capability would be the best means of providing this service. In order to obtain this new mission for U.S. Darnall Army Hospital, the Office of the Surgeon General required that an economic analysis of the various alternatives be submitted.

Statement of the Problem

The problem is to determine the best means of providing a diagnostic nuclear medicine capability at U.S. Darnall Army Hospital, Fort Hood, Texas.

Factors Bearing on the Problem

The following factors had a bearing on the problem:

1. U.S. Darnall Army Hospital had no nuclear medicine capability within its facility. Therefore, no historical data, other than the number of patients being sent elsewhere for this service, was available.

2. Most of the hospital's physician staff members, including the hospital commander, felt that the only acceptable means of providing this service was by having an in-house capability.

3. There was a difference of opinion between staff personnel at Health Services Command and the Office of the Surgeon General as to the correct format to follow in the preparation of the economic analysis. A copy of the new format (Appendix A) was received and utilized for the preparation of the analysis.

4. Brooke Army Medical Center was performing the majority of U.S. Darnall Army Hospital's nuclear medicine scanning workload and had the personnel and equipment available to continue this support.

Objectives of the Study

The two main objectives of the study were:

1. To identify and gather relevant data on the various cost and manpower elements such as facility, equipment, personnel, maintenance and utilities, contracts, supplies, lost duty time, and transportation.

2. To assimilate the data into the approved format so that the estimated total annual costs and the estimated uniform annual costs for each alternative could be identified.

Criteria

The acceptable alternative should be that which provides U.S. Darnall Army Hospital with a nuclear medicine capability that is both safe and convenient for the patient. It should also be convenient and acceptable to the physician staff. The costs of the proposed alternative should be similar to present day costs; however, if that alternative is more costly, it should also provide significant benefits for both patients and physicians.

Assumptions

The following assumptions were made:

1. The supported troop strength would remain constant at Fort Hood, Texas.

2. Medical care would continue to be authorized and available for all eligible beneficiaries at U.S. Darnall Army Hospital.

3. Sufficient space to accomplish the scanning workload would be available within U.S. Darnall Army Hospital.

4. Nuclear medicine services will continue to be available at Brooke Army Meidcal Center.

5. Contractual nuclear medicine services would be available for an indefinite number of years.

6. Sufficient funds will be available to support the proposed alternative.

7. Nuclear medicine equipment will have no salvage value.

8. Nuclear medicine scanning equipment will need upgrading ten years after purchase and replacement after twenty years.

Definitions

Nuclear medicine.--The use of radioisotopes, that have been entered into the patient's body, for the diagnosis and treatment of human diseases. The majority of the studies performed in nuclear medicine are diagnostic in nature.

Radioisotope/radionuclide.--An isotope that is radioactive. Radioisotopes are taken orally, inhaled, or injected into the body and accumulate in various organs and tissues.

Scintillation camera.--An instrument for indicating the emission of ionizing particles, making possible the determination of the concentration of radioactive isotopes in the body.

Research Methodology

The Commander of U.S. Darnall Army Hospital was given a list of the various means of providing a nuclear medicine service. From this list, four alternatives were selected for evaluation of their respective costs and benefits. In order to develop the cost data for the U.S. Darnall Army Hospital alternative a decision had to be made on the type procedures to be accomplished and the amount of equipment needed to perform these procedures. Once this was determined, a Manpower Survey Report - Schedule X - was completed to identify the number and types of personnel required to support an in-house nuclear medicine service. U.S. Darnall Army Hospital had no in-house nuclear medicine capability and therefore no historical cost data was available, so another U.S. Army Hospital, of a similar size and having

a comparable nuclear medicine service, was selected so that the necessary data required for analysis could be developed.

Two of the alternatives selected required that space be provided within U.S. Darnall Army Hospital to accommodate a nuclear medicine service. The hospital was about to start an extensive renovation and new construction program and the existing plans had no provision for nuclear medicine. Because of the impact these two alternatives would have on the construction program, the reviewing personnel at both Health Services Command and the Office of the Surgeon General directed that the time period of comparison for the economic analysis would be twenty-five years.

Finally, the estimated total annual cost for each of the four alternatives was determined. Then the investment and/or operating costs for each alternative was inflated and discounted over a twenty-five year period in order to determine the estimated uniform annual cost. The two most cost-effective alternatives were then evaluated to determine which one provided the most benefits for both U.S. Darnall Army Hospital and its patient population.

Review of the Literature

A review of the literature indicates that the use of radioisotopes to assist in the diagnosis of disease is one of the fastest growing areas in medicine today.[5,6,7] Over the past twenty years this field has become an integral part of diagnostic medicine because of

its ability to provide the physician with more information earlier and with less trauma to the patient than conventional methods.[8] Bender[9] and Armstrong[10] consider radioisotope scanning to be so important that within a few years nuclear medicine departments will be required in community-sized hospitals and that these departments will achieve a status equal to that of existing radiology departments. Recognition of nuclear medicine's permanence in the medical field is evidenced by the Joint Commission on Accreditation of Hospital's requirement that every hospital have a mechanism for providing this service.[11] Although the Joint Commission on Accreditation of Hospitals does not require every hospital to have a nuclear medicine department, many community-size hospitals are finding it advantageous to have this capability existing within their facility.[12]

Predicting the number and types of nuclear medicine procedures that a hospital would perform is difficult because of the many variables present. The related but different diagnostic imaging modalities such as ultrasound and computerized tomography may have some negative effect on the growth rate of nuclear medicine procedures. However, if newer radioisotopes are developed which are even more organ specific, this growth rate may not be altered.[13] Other factors such as hospital location, physician training, availability of technicians, type of equipment, reliability of equipment, and demand will also have an impact upon the number of procedures that will be done. However difficult this process may be, realistic plans for the service's budget, staff, equipment, and space cannot be developed until

some projection is made of the workload that this service will support. Studies done by Harris and Bennett[14] point out that a community hospital would experience a ratio of 5.3 to 7.5 nuclear medicine imaging procedures per hospital bed with an average of 1,225 procedures for a two hundred bed facility. This study also revealed that brain scans and liver scans would constitute 50 percent of the workload, thyroid scans 22 percent, and other scans such as lung, bone, and kidney the remainder.

Once the projected workload has been determined, the next step involves making a decision as to the amount of equipment and personnel needed to accomplish the workload. These two direct costs are especially important to consider because they will consume approximately 55 to 65 percent of the operating budget.[15] While the number of scintillation cameras and nuclear medicine technicians will vary according to hospital size and the numbers of procedures performed, additional factors such as financial support, technical competence of the staff, facilities for maintenance, and the degree of specialization of the units must be taken into account. For a community size hospital one to two scintillation cameras plus two to four technicians are generally recommended.[16, 17]

The final costs that have to be considered are those for overhead, radioisotopes, film, and miscelleaneous supplies. These costs will also vary according to the facility and procedures performed, therefore 35 to 45 percent of the budget should be allocated for them.[18]

Following the identification and evaluation of the cost aspect, the next step in the analysis process is to evaluate the benefits offered. The analysis will be most effective when the benefits are quantitatively measured; however, when the benefits are nonquantifiable they should be accurately defined and measured in terms of relative benefit.[19] While this approach would be ideal, it must be emphasized that the measurement of relative benefit has not been adequately investigated in the nuclear medicine field.[20] The cost/benefit analysis is difficult to accomplish because of the problems involved in trying to attach a financial value to the successful diagnosis and treatment of a patient, or in determining the cost of failing to diagnose and treat a patient successfully.[21] Valid cost/benefit studies, in addition to being difficult to design, also take a long time to complete and are rather expensive.[22]

During the last decade there has been a technological explosion in the field of medicine which has greatly improved the general level of medical care. However, this proliferation of new technology, plus a rapidly increasing inflation rate, have resulted in a dramatic rise in the cost of medical care over a relatively short period of time. In this high cost atmosphere new technologies and new services are being scrutinized more than ever before and the needs of the patient and the health care facility are in danger of receiving too little emphasis in the decision making process. It must be realized that investments in diagnostic technology can be considered as investments for the future. The information gained from the different diagnostic methods enables

researchers to make more appropriate therapies possible and thus improve future health outcomes.[23] It is, therefore, important that the decision maker maintain a broad perspective when evaluating any new health care system and not allow any specific element to cloud the issues related to the decision making process.[24]

FOOTNOTES

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[21]World Health Organization, p. 44.

[22]H. David Banta and Barbara J. McNeil, "Evaluation of the CAT Scanner and Other Diagnostic Technologies," Health Care Management Review (Winter, 1978), p. 17.

[23]Ibid., p. 17.

[24]Roger A. Ritvo, "Implications of Technological Decision Making," Hospital and Health Services Administration (Summer, 1978), p. 47.

II. DISCUSSION

Selection of the Alternatives

In order to determine the best means of providing a nuclear medicine capability for the patient population of U.S. Darnall Army Hospital, four alternatives were selected for evaluation; they were (1) to continue the present system of sending patients for routine scans to Brooke Army Medical Center, San Antonio, Texas, and selected emergencies to Scott and White Memorial Hospital, Temple, Texas, (2) to provide a diagnostic nuclear medicine capability within U.S. Darnall Army Hospital, (3) to enter into contract with Scott and White Memorial Hospital, Temple, Texas, for all routine and emergency nuclear medicine scans, and (4) to enter into contract with San Antonio Nuclear Services, San Antonio, Texas, for a nuclear medicine scanning capability within U.S. Darnall Army Hospital.

Selection of Diagnostic Procedures

The selection of the exact types of diagnostic procedures to be performed had to be identified in order to compare their costs among the four alternatives. An evaluation of all the different types of scanning procedures being done revealed that brain, bone, lung, liver/spleen, renal, and thyroid scans made up the majority of the total scanning workload and these six were used for identifying the workload and comparing costs.

Estimated Total Annual Cost for Alternative One

This alternative involved the system that was present when the study began. U.S. Darnall Army Hospital was sending approximately 100 patients per month to Brooke Army Medical Center for routine diagnostic scans and three per month to Scott and White Memorial Hospital for emergency scans. Patients were being transported to Brooke Army Medical Center either by a military bus or ambulance, depending on their medical condition, and by military ambulance to Scott and White Memorial Hospital. Approximately 30 percent of the patients receiving nuclear medicine scans each month were active duty personnel. (Appendix B).

The Nuclear Medicine Department at Brooke Army Medical Center had both therapeutic and diagnostic services, but cost figures for the separate services were not available. In order to obtain the estimated cost to Brooke Army Medical Center for performing U.S. Darnall Army Hospital's nuclear medicine workload, all operating costs, minus the expenses for therapy, were multiplied by 20 percent. The 20 percent represents U.S. Darnall Army Hospital's share of Brooke Army Medical Center's scanning workload.[1] No costs for the existing facility and equipment were used because they are considered "sunk costs" and are not to be included in the cost calculations.[2]

The total operating costs were arrived at by identifying all the applicable elements of expense as outlined in paragraph 11 of Appendix B. The final figure for this alternative amounted to $84,009. (Appendix F).

Estimated Total Annual Cost for Alternative Two

This alternative would provide a diagnostic nuclear medicine capability within U.S. Darnall Army Hospital on a twenty-four hour basis. No such capability existed within the facility, therefore space would have to be provided, equipment and supplies purchased, and personnel obtained. The initial workload would consist of those patients being transported to Brooke Army Medical Center and Scott and White Memorial Hospital, however an increase of approximately 50 percent could be expected over a two year period once this service was present within the facility. This expected increase in workload is based on historical data from the Nuclear Medicine Department at Fort Bragg, North Carolina, which serves a population similar to that of Fort Hood, Texas.

Additional costs under the Facility/Equipment heading (para 7, Appendix C) were identified because they would require an outlay of funds at some future point in time. These first year costs, $29,930, plus $101,268 in annual operating costs produced a total cost of $131,198 for this alternative. (Appendix F).

Estimated Total Annual Cost for Alternative Three

The third alternative would provide U.S. Darnall Army Hospital with diagnostic nuclear medicine services via a contractual arrangement with Scott and White Memorial Hospital in Temple, Texas, which is located thirty miles from Fort Hood. The majority of patients requiring scanning procedures would be transported to and from Scott and White Memorial Hospital by military van and a few transported by

military ambulance. This service would be available twenty-four hours a day, seven days a week; however, some patients could not be moved from U.S. Darnall Army Hospital because of their unstable condition. (Appendix D).

The estimated total annual cost for this alternative was $162,242. (Appendix F). The charges for the tests alone would amount to $146,640 a year.[3] The total cost was substantially higher ($78,000) than for alternative one, even though transportation costs and lost duty time were reduced by $12,600. It was also somewhat higher ($31,000) than alternative two.

Estimated Total Annual Costs for Alternative Four

This alternative would provide U.S. Darnall Army Hospital with an in-house diagnostic nuclear medicine capability five days a week. Contractual arrangements would be made with San Antonio Nuclear Services, San Antonio, Texas, to provide a mobile gamma camera, trained technicians, and all the necessary accessories to perform the desired tests. U.S. Darnall Army Hospital would have to provide space within its facility for the equipment, plus a physician to interpret the test results. (Appendix E).

The total annual charges for the individual tests would be less ($18,500) under this alternative than for alternative three; however, the additional costs of providing space within the hospital plus various administrative and professional costs, make it the most expensive alternative. The total annual estimated cost was $165,000. (Appendix F).

Estimated Uniform Annual Costs

The estimated uniform annual costs of the four alternatives were calculated in addition to the estimated total annual costs because the analysis of the alternatives involved long range programs having different time horizons with similar benefits. The uniform annual cost would focus on the cost profile of each alternative over time, and reflect future cash flows in terms of their present value. This adjustment would also show the cost of capital and would be useful in the overall planning effort.

The first step was to compute the present value costs by applying a discount rate to the time-phased expenditures, which had been multiplied by the appropriate inflation indices, so that all figures were in 1979 constant dollars. A present value figure was calculated for both the Operations and Maintenance Army (OMA) and the Military Personnel Act (MPA) operating costs because the inflation index was the same for ~~each; however~~, the Other Procurement Army (OMA) and the Military ~~Consctuction~~ CONSTRUCTION Sp Army (MCA) costs had to be calculated separately because of the different inflation indices. After the present value totals were obtained, they were divided by the sum of the discount figures used for the twenty-five year period. The result was the uniform annual costs for each alternative.

Alternative one

The present value figure for the Operation and Maintenance Army (OMA) plus Military Personnel Act (MPA) operating costs amounted to $1,246,153. The Other Procurement Army (OPA) costs, which included a

replacement of two cameras in project year seven and one camera in project year nineteen, plus one camera upgrade in project year nine and two in project year seventeen, amounted to $280,677. After these two present value figures were adjusted and discounted, a total uniform annual cost of $136,737 was obtained. (Appendix G)

Alternative two

The present value totals of this alternative amounted to $1,464,588 for Operational and Maintenance Army (OMA) plus Military Personnel Act (MPA) operating costs. The Other Procurement Army (OPA) costs amounted to $249,658. They consisted of the initial gamma camera purchases in the first project year, one upgrade at year eleven, and replacement at the end of the second ten year period. A present value figure of $9,540 was also included because of the $10,000 redesign cost. The total uniform annual cost was $180,995. (Appendix H)

Alternative three

The present value of this alternative for Operational and Maintenance Army (OMA) operating costs was $2,406,626. When this figure was discounted a uniform annual cost of $252,691 was reached, making it the most costly alternative. (Appendix I)

Alternative four

A present value figure of $2,269,044 was obtained for the Operational and Maintenance Army (OMA) operating costs. This produced a uniform annual cost of $238,245. This alternative was the second most costly alternative. (Appendix J)

Benefit Elements

Generally, patients and physicians place a high value on any procedure that has a beneficial effect on the course of a disease, is associated with minimal risk, and has a reasonable cost.[4] However, in the military environment, where the consumer is provided health care services at little or no out of pocket expense, availability and accessibility are usually more of a concern than cost. In addition, most physicians practicing in a community size hospital demand that a full range of "state of the art" equipment be readily available for their use. In light of these perceptions, the two least costly alternatives were evaluated for the benefits they offered to the patient, the physician, and the hospital.

Alternative one

The availability of a full range of nuclear medicine services at Brooke Army Medical Center provided both the patient and physician with a high quality diagnostic capability. This service was provided to U.S. Darnall Army Hospital at little or no cost and eliminated the need to provide extra space, such as a scanning room and hot lab, which would require some alteration of the existing facility. Under this alternative U.S. Darnall Army Hospital would not have to compete with other military hospitals for the personnel and financial resources necessary to support a nuclear medicine service.

Alternative two

An in-house nuclear medicine diagnostic capability would provide U.S. Darnall Army Hospital, its patient population, and physicians

numerous benefits. This diagnostic service would complement existing services and allow the hospital to provide the full range of services found in most civilian community hospitals. Continuity of care would be enhanced because the physician would not have to refer the patient to outside sources to obtain a rather routine diagnostic exam. More patients could look upon U.S. Darnall Army Hospital as a facility able to support the majority of their health care needs, rather than a facility which provides more of a triage function.

Patient care would be enhanced greatly because of the twenty-four hour availability. Those patients whose condition was such that transportation to another facility would be unsafe could obtain a diagnostic exam that otherwise would not be available. For the other patients travel time would be reduced significantly and the expenses for overnight lodging eliminated.

The physicians working at U.S. Darnall Army Hospital would be less critical of the existing facility, knowing that a full range of "state of the art" diagnostic measures was available to support them in their daily practice. Diagnostic scans could be ordered for each and every patient who needed one, not just for those who could be transported. More rapid results could be obtained, which would allow the physician to arrive at a diagnosis sooner. In some critical cases this could mean the difference between life and death.

Summary of Major Findings

The major findings of this study consisted of the following:

1. The two least costly alternatives of providing a diagnostic

nuclear medicine capability for U.S. Darnall Army Hospital were alternative one (Brooke Army Medical Center), and alternative two (U.S. Darnall Army Hospital), with alternative one being the least expensive.

2. Alternative two provided U.S. Darnall Army Hospital with substantially more benefits than alternative one.

FOOTNOTES

[1]Interview with LTC George Dunson, Nuclear Medicine Department, Brooke Army Medical Center, San Antonio, Texas, August 24, 1978.

[2]Defense Economic Analysis Council, Economic Analysis Handbook, (Washington, D.C.: Government Printing Office, 1975), p. 20.

[3]Interview with Jim Taylor, Assistant Administrator of Clinics, Scott and White Memorial Hospital, Temple, Texas, August 17, 1978.

[4]E. James Potchen, Gale I. Harris, William R. Schonbein, and Nicholas J. Rashford, "Value Measurement of Nuclear Medicine Procedures," Financial Operation and Management Concepts in Nuclear Medicine, ed. James L. Bennington (Baltimore: University Park Press, 1977), p. 2.

III. CONCLUSIONS AND RECOMMENDATIONS

Conclusion

The best means of providing a diagnostic nuclear medicine capability at U.S. Darnall Army Hospital, Fort Hood, Texas, is by having an in-house nuclear medicine service.

Recommendations

The following recommendations are made:

1. That U.S. Darnall Army Hospital proceed with the application to the Office of the Surgeon General and Defense Health Council to have diagnostic nuclear medicine added to its mission.

2. That future planning efforts be strengthened at all command levels to insure that military hospitals are provided with the capability of offering "state of the art" services to their patient populations.

APPENDIX A

Economic Analysis Report

ECONOMIC ANALYSIS REPORT
(Cover Sheet)

TITLE:

DATE:

AUTHOR:_____ TELEPHONE:_____

REVIEWED AND VALIDATED BY: _____
(MACOM ACTION)

The views, opinions, and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other official documentation.

ECONOMIC ANALYSIS REPORT

1. Background:

2. Purpose:

3. Objectives:

4. Constraints:

5. Facts:

6. Assumptions:

7. Alternatives: (Discrete/Exclusive)

8. Cost/Benefits Summary

   *a. Cost (total all appns)

      (1) Alternative 1 $_____

      (2) Alternative 2 $_____

      (3) Etc. $_____

   *b. Benefits (define effectiveness)

      (1) Tangible

      (2) Intangible

*9. Analysis Summary (analysis & comparison of alternatives by cost benefits, sensitivity, risk analysis and priorities).

10. Recommendation:

*Must be supported by attachments. Attachments completed must provide source/computation/methodology information. Audit trails must be available.

COST/BENEFITS ATTACHMENT
(Complete for Each Alternative, Status Quo, 1391 Proposal, etc.)

Alternative: _____

BENEFIT ELEMENTS:

1. Mission

2. Clinical TEMPLATE

3. Population/Demand

4. Organization

5. Functional Systems

6. Others (list) (Examples: Comprehensiveness of Care, Availability of Care, Cost to Government, Mobilization Capacity, Impact on Civilian Providers, Current Resource Availability, Impact on Demand for Military Medical Resources, Operating Efficiency, Maintainability, Flexibility, Manageability, Reliability)

COST AND MANPOWER ELEMENTS:

7. Facility/Equipment

   a. HSC OMA

   b. HSC OPA

   c. Host Installation OMA

   d. Host Installation OPA

   e. MCA

   f. Amortization Period

   g. Salvage Value

   h. Terminal Value

8. Manpower/MY Equivalent

9. Workloads

10. Work Units/Composites

11. Operating Cost

    a. HSC - OMA

       EOE 10

       EOE 21

       EOE 22

       EOE 23

       EOE 24

       EOE 25

       EOE 26

       EOE 31

    b. HSC BASOPS (alpha accts)

    c. HSC MPA

    d. Host Installation-OMA

       EOE XX

       EOE XX

    e. Host Installation BASOPS
       (Alpha Accts)

NOTE: Line entries must be supported by inclosures providing detail of computations, source of data, audit trails must be available.

APPENDIX B

Cost/Benefits Attachment for Alternative One

COST/BENEFITS ATTACHMENT

Alternative #1

To continue sending patients who require routine nuclear medicine scans to Brooke Army Medical Center, Fort Sam Houston, TX

BENEFIT ELEMENTS:

1. Mission. The mission of the Fort Hood MEDDAC is to provide health care services to authorized personnel at Fort Hood, other satellite installations, and activities as directed or by agreement.

2. Clinical TEMPLATE. US Darnall Army Hospital does not have a nuclear medicine capability at this time. Nuclear medicine support is provided by Brooke Army Medical Center.

3. Population/Demand. The Fort Hood MEDDAC provides health care services to a total population of 163,316 as of October 1978. This includes 44,368 active duty military personnel (page 36). The Fort Hood MEDDAC is currently sending 100 patients per month to Brooke Army Medical Center. An average of 30 percent of these patients are active duty military personnel (page 37).

4. Organization. NA.

5. Functional Systems. Fort Hood patients requiring nuclear medicine scans are transported to Brooke Army Medical Center by military bus and ambulance. Selected emergency cases are transported by ambulance to Scott and White Memorial Hospital and Clinic.

6. Others.

a. The present system of transporting patients to BAMC provides comprehensive care to authorized beneficiaries on a routine basis four days per week.

b. The cost to the US Government to provide this service at BAMC is less than contracting with civilian sources. (Appendix F).

c. BAMC has full nuclear medicine capability.

COST AND MANPOWER ELEMENTS:

7. Facility/Equipment

a. HSC OMA NA

b. HSC OPA NA

c. Host Installation OMA NA

d. Host Installation OPA NA

e. MCA NA

f. Amortization Period NA

g. Salvage value NA

h. Terminal value NA

8. Manpower/MY Equivalents. The present staffing includes 1 LTC, 1 E6, 1 E5, 1 GS-11, 2 GS-9, and 2 GS-4.

9. Workload. The present USDAH workload is 100 patients per month and represents 20 percent of Brooke Army Medical Center's Nuclear Medicine workload. Active duty personnel account for 30 percent of this monthly workload (page 37)

10. Work Units/Composites. Nuclear medicine work units will be counted the same as radiology clinic visits.

11. Operating Cost

a. HSC - OMA - $36,960 (Health Services Command - Operational and Maintenance - Army)

EOE 10 $18,158 (page 38) (Civilian Pay Expense)

EOE 21 NA

EOE 22 NA

EOE 23 NA

EOE 24 NA

EOE 25 NA

EOE 26 $18,802 (page 39) (Supply Expense)

EOE 31 NA

b. HSC BASOPS NA

c. HSC MPA $13,300 (page 38) (Military Salary Expense)

d. Host Installation OMA $12,900 (page 40)(Fort Hood - Operational and Maintenance Army - Transportation Expense)

e. Host installation BASOPS NA

f. Lost duty time $15,300 (page 37)

g. Host Installation OMA $5,549 (page 39) (Ft Sam Houston) (Utilities and Maintenance Cost)

TAB 1A

POPULATION

This economic analysis used Fort Hood statistics as of 31 October 1978. This information is prepared by the III Corps and Fort Hood Comptroller.

FORT HOOD STATISTICS
As of 31 October 1978

1. SIZE OF POST - 216,915 Acres (339 Square Miles)

2. MANEUVER TRAINING AREA - 131,704 Acres (206 Square Miles)

3. MAJOR CONSTRUCTION -
   a. Under Construction $77,049,000
   b. Approved for Construction 0

4. UTILITIES -

	Miles
a. Gas Distribution	208
b. Electrical Distribution	543
c. Water Distribution	313
d. Sanitary Distribution	219

5. GROUNDS -

	Acres
a. Improved	20,646
b. Unimproved	196,269

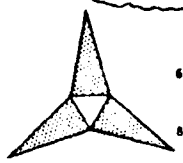
6. ROADS -

	Miles
a. Paved	334
b. Dirt	390

7. BUILDINGS -

	Number	Square Feet
a. Active	4,623	21,447,373
b. Inactive	0	0

8. FAMILY QUARTERS -
   a. Officers 6,238
   b. NCO 897
   4,341



9. PRIVATELY OWNED VEHICLES REGISTERED ON POST - 61,807

10. BOOK VALUE OF LAND AND IMPROVEMENTS - $445,306,700

11. MONTHLY EXPENDITURES - $52,111,813

a. Military Pay	39,916,428
b. Civilian Pay	3,587,058
c. Contracts	106,801
d. Local Purchases	4,069,945
e. PX Salaries	663,980
f. PX Purchases	2,871,014
g. NAF Salaries	242,749
h. NAF Purchases	653,838

12. CURRENT POST POPULATION - 67,018

a. Total Military	44,368
(1) Officers	(3,418)
(2) Warrant Officers	(808)
(3) Enlisted Personnel	(40,142)
b. DA Civilians	3,440
c. PX Employees	751
d. Construction Contractor's Employees	1,005
e. Other Employees, NAF, etc.	1,917
f. Dependents	15,537

13. MILITARY STRENGTH -

	AUTHORIZED	ASSIGNED
a. Totals	47,363	44,368
b. III Corps Units	4,913	4,321
c. 13th COSCOM	5,158	4,707
d. 1st Cavalry Division	15,495	14,647
e. 2d Armored Division	16,990	16,191
f. 6th Cavalry Brigade	2,725	2,463
g. Other Units/Activities	1,398	1,401
h. General Support Forces	684	838

14. MILITARY DEPENDENTS - 48,439
   a. Residing Off Post 32,902
   b. Residing On Post 15,537

15. MILITARY PERSONNEL WITH DEPENDENTS RESIDING OFF POST - 16,451

16. SUPPORTED POPULATION - 163,316

(Includes Items 12 and 14a plus 63,396 retired personnel and their dependents and survivors in Fort Hood's 179 county support area)

17. RELIGIOUS ACTIVITIES -
   a. Chapel Attendance Per Week (Average) 4,402
   b. Religious Education Attendance Per Week (Average) 1,214

18. DEPENDENTS OF MILITARY OR FORT HOOD CIVILIAN EMPLOYEES ENROLLED IN KILLEEN AND COPPERAS COVE INDEPENDENT SCHOOL DISTRICTS - 18,922

(Total Enrollment 22,804)

19. YOUTH ACTIVITIES -
   a. Number of Activities 13
   b. Youth Participation (Manhours) 47,185
   c. Adult Volunteer Participation (Manhours) 7,118

Prepared by: Comptroller
14 November 1978

TAB 1B

The average number of 30 to 35 percent active duty personnel was obtained from monthly workload figures maintained by BAMC Department of Radiology.

The average monthly diagnostic scanning workload at BAMC is 550 per month. In FY 78 a total of 6,603 scans were done. Data obtained from BAMC nuclear medicine service monthly workload sheets. USDAH workload represents 20 percent of this total.

LOST DUTY TIME

Lost duty time computed by utilizing average grade of all ranks as E5.

One E5 @ $5.31 per hour.

360 patients annually utilizing eight hours per visit.

360 X $42.50 = $15,300

TAB 1C

MILITARY AND CIVILIAN PERSONNEL COSTS

To arrive at the military and civilian personnel costs associated with the USDAH scanning workload, the total enlisted and civilian personnel costs were computed and then multiplied by 20 percent. This assumes that if the USDAH workload is 20 percent of BAMC's total, then 20 percent of personnel time would be for USDAH's scans.

The base figures for military and civilian pay were obtained from the CITF office, Fort Hood, Texas. These figures were then adjusted according to guidance in AR 11-28.

LTC, M.D. (14 years service plus variable incentive bonus).

Composite hourly salary $21.72 x .25 = $5.43 + $21.72 = $27.15
Estimated he spends 5 hours/week reading USDAH scans

5 x 48 weeks x $27.15 = $ 6,516

Military composite enlisted pay

1 - E6 $11,078 x .40 = $4,431 + $11,078 = $15,509
1 - E6 $13,151 x .40 = $5,260 + $13,151 = $18,411

0.2 x $15,509 = $ 3,102
0.2 x $18,411 = 3,682
$13,300

Civilian pay

1 GS-11/4 $21,189 x .181 = $3,835 + $21,189 = $25,024
2 GS-09/4 $35,026 x .181 = $6,340 + $35,026 = $41,366
2 GS-04/4 $20,660 x .181 = $3,739 + $20,660 = $24,399

0.2 x $25,024 = $ 5,005
0.2 x $41,366 = $ 8,273
0.2 x $24,399 = $ 4,880
$18,158

TAB 1D

SUPPLIES, UTILITIES AND MAINTENANCE EXPENSE

Operating Supplies ($95,511 - $1,500 x .2) $1,500 is therapeutic supply expense	=	$18,802
Utilities (5,605 sq ft x $0.60/sq ft)	=	3,363
Maintenance (5,605 sq ft x $0.39/sq ft)	=	2,186

Cost data for supplies, utilities, and maintenance obtained from BAMC Comptroller Office

Cost for therapeutic supplies obtained from LTC Dunson, BAMC Nuclear Medicine Service

It is assumed that 0.2 of BAMC's supply cost is for USDAH's workload.

TAB 1E

TRANSPORTATION COSTS

Bus - 57¢/mile x 300 miles = $171/trip

208 trips/year = $35,568

Nuclear medicine patients account for 0.2 of busload

$35,568 x 0.2 = $7,114

Ambulance - 20¢/mile x 300 miles = $60/trip

Approximately 96 trips/year = $ 5,760

	$ 7,114	
	5,760	
Yearly transportation cost	$12,874	- $12,900

Transportation costs obtained from Transportation and Services Division, Directorate of Industrial Operations , III Corps and Fort Hood.

Ambulance workload figure from Evacuation Section, USDAH.

APPENDIX C

Cost/Benefits Attachment for Alternative Two

COST/BENEFITS ATTACHMENT

Alternative #2

To provide a diagnostic nuclear
medicine capability within USDAH.

BENEFIT ELEMENTS:

1. Mission. To provide an in-house capability of performing diagnostic nuclear medicine procedures on a twenty-four hour basis.

2. Clinical TEMPLATE. The in-house diagnostic nuclear medicine capability will enable this MEDDAC to provide routine and emergency nuclear medicine scans twenty-four hours daily. The existing military and civilian contract radiologists will be utilized to interpret nuclear medicine scans.

3. Population/Demand. The Fort Hood MEDDAC provides health care services to a total population of 163,316 as of November 1978. This includes 44,368 active duty military personnel(page 45). The current nuclear medicine workload is approximately 100 patients per month.

4. Organization. The Radiology Department will excercise supervisory control over the nuclear medicine service.

5. Functional Systems. This diagnostic service will allow scanning of such organs as the brain, lung, liver, spleen, bone, kidney, and thyroid. This service will be available to both outpatients and inpatients who could not otherwise be transported.

6. Others. This in-house capability will provide means to accomplish scans twenty-four hours per day. This service will be available to all types of acutely ill patients. This in-house service will allow better medical management of patients requiring this service. This in-house service will permit better operating efficiency in that scheduling of patients and return of interpretations will be available to the requesting physician with a minimum of delay. The lost duty time for active duty personnel will be greatly reduced in that personnel will not have to be transported long distances for this service.

COST AND MANPOWER ELEMENTS:

7. Facility/Equipment

a. HSC OMA NA

b. HSC OPA. Other Procurement Army funds will amount to $19,930 for the gamma camera and accessory equipment. This amount is a one year cost (page 46).

c. Host Installation OMA NA

d. Host Installation OPA NA

e. MCA. $10,000 (page) (Military Construction Army)

f. Amortization period. Ten years on camera and accessory equipment.

g. Salvage value NA

h. Terminal value NA

8. Manpower/MY Equivalents. Based on present workload and by assigning weighted values in minutes for the various procedures, as utilized by the manpower survey teams, the staffing requirements would be: three nuclear medicine technicians; and one clerical person (page 49).

9. Workload. The present workload is 100 patients per month. Active duty personnel account for 30 percent of this monthly workload. In addition, two to three patients are sent to Scott and White Memorial Hospital and Clinic for emergency diagnostic nuclear medicine scans monthly.

10. Work Units/Composites. Nuclear medicine work units will be counted the same as radiology clinic visits.

11. Operating Costs (annual)

a. HSC OMA $60,498 (Health Services Command - Operational and Maintenance Army)

EOE 10 $29,107 (page 49) (Civilian Pay Expense)

EOE 21 NA

EOE 22 NA

EOE 23 NA

EOE 24 NA

EOE 25 $16,080 (page 54) (Contract Expense)

EOE 26 $15,311 (page 55) (Supply Expense)

EOE 31 NA

b. HSC BASOPS NA

c. HSC MPA $33,921 (page 53) (Military Salary Expense)

d. Host Installation OMA $3,026 (page 56) (Fort Hood - Operational and Maintenance Army. Utilities and Maintenance Expense)

e. Host Installation BASOPS NA

f. Lost duty time $3,823 (page 57).

TAB 2A

POPULATION

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FORT HOOD STATISTICS
As of 31 October 1978

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2. MANEUVER TRAINING AREA - 131,704 Acres (206 Square Miles)

3. MAJOR CONSTRUCTION -
   a. Under Construction $77,049,000
   b. Approved for Construction 0

4. UTILITIES -

	Miles
a. Gas Distribution	208
b. Electrical Distribution	547
c. Water Distribution	373
d. Sanitary Distribution	279

5. GROUNDS -

	Acres
a. Improved	20,646
b. Unimproved	196,269

6. ROADS -

	Miles
a. Paved	334
b. Dirt	390

7. BUILDINGS -

	Number	Square Feet
a. Active	4,623	21,447,373
b. Inactive	0	0

8. FAMILY QUARTERS -
   a. Officers 897
   b. NCO 4,341

9. PRIVATELY OWNED VEHICLES REGISTERED ON POST - 61,807

10. BOOK VALUE OF LAND AND IMPROVEMENTS - $445,306,700

11. MONTHLY EXPENDITURES - $52,111,813
   a. Military Pay 39,816,628
   b. Civilian Pay 3,587,058
   c. Contracts 106,801
   d. Local Purchases 4,069,945
   e. PX Salaries 663,980
   f. PX Purchases 2,871,014
   g. NAF Salaries 242,749
   h. NAF Purchases 653,838

12. CURRENT POST POPULATION - 67,018
   a. Total Military 44,368
      (1) Officers (3,418)
      (2) Warrant Officers (808)
      (3) Enlisted Personnel (40,142)
   b. DA Civilians 3,440
   c. PX Employees 751
   d. Construction Contractor's Employees 1,005
   e. Other Employees, NAF, etc. 1,917
   f. Dependents 15,537

13. MILITARY STRENGTH -

	AUTHORIZED	ASSIGNED
a. Totals	47,363	44,368
b. III Corps Units	4,033	4,321
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d. 1st Cavalry Division	15,495	14,847
e. 2d Armored Division	16,990	16,191
f. 6th Cavalry Brigade	2,725	2,463
g. Other Units/Activities	1,398	1,401
h. General Support Forces	664	638

14. MILITARY DEPENDENTS - 48,439
   a. Residing Off Post 32,902
   b. Residing On Post 15,537

15. MILITARY PERSONNEL WITH DEPENDENTS RESIDING OFF POST - 16,451

16. SUPPORTED POPULATION - 163,316

(Includes Items 12 and 14a plus 83,396 retired personnel and their dependents and survivors in Fort Hood's 179 county support area)

17. RELIGIOUS ACTIVITIES -
   a. Chapel Attendance Per Week (Average) 4,402
   b. Religious Education Attendance Per Week (Average) 1,214

18. DEPENDENTS OF MILITARY OR FORT HOOD CIVILIAN EMPLOYEES ENROLLED IN KILLEEN AND COPPERAS COVE INDEPENDENT SCHOOL DISTRICTS - 16,522

(Total Enrollment 22,804)

19. YOUTH ACTIVITIES -
   a. Number of Activities 13
   b. Youth Participation (Manhours) 47,185
   c. Adult Volunteer Participation (Manhours) 2,118

Prepared by: Comptroller
14 November 1978

TAB 2B

EQUIPMENT COST

Large field of view camera	$125,000
Selectascan - M whole body attachment, includes colimator, rails, electronics	16,000
Computer with 16 bit 16K memory Disk Drive Analog to digital convertors Light pen Silent printer System software Remote switch Display scope Paper tape reader	35,000
Thyroid uptake probe	5,000
Patient scanning table	3,300
Xenon capability	5,000
Health physics equipment (includes dose calibrator)	10,000
	$199,300

This equipment was given an economic life of ten years following guidance from DoD Economic Analysis Handbook

$199,300 ÷ 10 = $19,930

MANPOWER SURVEY REPORT -SCHEDULE X - MANPOWER AND WORKLOAD DATA

For use of this form, see AR 570-4; the proponent agency is the Office of the Assistant Chief of Staff for Force Development.

REPORTS CONTROL SYMBOL CSFOR-76

MAJOR STAFF ELEMENT	DIVISION	BRANCH	SECTION OR UNIT	SHEET NO.	LINE NO.
MEDDAC, Fort Hood, TX	Darnall Army Hospital	Dept of Radiology	Nuclear Medicine	6	2

DESCRIPTION OF WORK PERFORMED

YARDSTICK CODE: 557-62

WORK UNIT: Local Appraisal (Procedures)

SECTION A - SUMMARY OF MANPOWER

	OFF a	WO b	ENL c	US CIV d	NON-US CIV e	TOTAL MAN-POWER SUBJ TO ALLOC f	OTHER MANPOWER US g	OTHER MANPOWER NON-US h	TOTALS i
1. ALLOCATION									
2. ACTUAL STRENGTH									
3. RECM BY CO			2	2		4			4
4. RECM BY SURVEY TEAM									

YARDSTICK ALLOWANCE COMPUTATION

SECTION B - PERFORMANCE DATA (See Incl 1 & 2)

YEAR AND MONTH 19 ___ a	MANPOWER: AVG STR b	MANPOWER: TOTAL MAN-HOURS WORKED c	MANPOWER: HRS OP IN MO d	MANPOWER: EQUIV MAN-MONTHS (c ÷ d) e	WORKLOAD: NO. OF WORK UNITS f	WORKLOAD: W/L PER PERSON (f ÷ e) g

1. WORKLOAD USED AS BASIS OF APPRAISAL
2. AVERAGE PRODUCTIVITY
3. MANPOWER ALLOWANCE

SURVEY WORKLOAD (1) ( ) / AVG PRODUCTIVITY (2) ( ) = ____ × 1.11 = ____

SECTION C - MANPOWER

ALLOC STR a	RANK OR GRADE b	ACTUAL STR c	RANK OR GRADE d	JOB TITLE e

AMS CODE: 847711.14210

TDA PARA:

DA FORM 1 NOV 73 140-4

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE.

TAB 2C

SECTION D - SPECIFIC REMARKS

COMMANDER

1. The Nuclear Medicine Service does not presently exist at this hospital and the data used to complete BAMC Form 345 is based on input from Department of Radiology and Department of Pharmacy personnel who have had some experience with nuclear medicine services. The initial nuclear medicine capability would include brain, lung, liver, spleen, bone and thyroid scans.

2. Approximately 100 patients requiring routine nuclear medicine diagnostic procedures are sent each month on an outpatient basis to Brooke Army Medical Center, San Antonio, Texas. According to verbal statements made during a radiology consultant team visit, the workload would definitely increase once this service is available locally. The present Chief, Department of Radiology, DAH, estimates that the current workload of five patients per day would increase to 8-10 per day with the largest increases in the areas of liver, spleen, lung, renal, and thyroid scans.

3. The staffing required for this service was determined by assigning weighted values in minutes to estimated work units. The total unit value of 27,085 (See Incl 1) was determined by application of verified workload figures obtained for January 1978.

a. Administration:

(1) $\frac{100 \text{ patient visits} \times 30 \text{ min}}{60 \text{ min}} = \frac{50 \times 1.11}{168 \text{ MH per mo}} = 33 \text{ person}$

(2) Acts as a receptionist, schedules appointments, files charts, and transcribes doctors' dictation.

(3) A projected workload of 160 patients within one year would justify one fulltime clerical person. This individual would also support the ultrasound service which currently has a workload of over 100 patients per month.

b. Nuclear Medicine Technicians:

(1) $\frac{27{,}085}{60 \text{ min}} = \frac{451 \times 1.11}{168 \text{ MH per mo.}} = 2.98 \text{ persons.}$

(2) Assist nuclear medicine physician in the application of radioisotope materials and perform all diagnostic scans. Responsible for calibration of individual doses and nuclear medicine equipment.

(3) One of the nuclear medicine technicians will also supervise the administration and technical operation of the clinic.

RAW DATA TALLY WORKSHEET FOR NUCLEAR MEDICINE

PERIOD January 1978
(Month) (Year)

Procedures	Raw Work Unit/ Procedures Processed	Weight Value In Minutes	Unit Value (Col B x C)
A	B	C	D
Administrative			
I Administrative #pts	100	30 min ea	3,000
Includes time spent to: a. Receive & log-in patients b. Prepare new or pull old records c. Schedule all patients d. File charts and lab data e. Prepare dose cards f. Type study reports g. Order Isotopes (Clerical) h. Order supplies i. Distribute study results to referring M.D.			
TOTAL----------See I			3,000
II Radiopharmacy & Health Physics			
Receipt of New Isotope Shipment	4	15 min	60
Generator Elution	40	30	1,200
Molybdenum - 99 Assay	40	15	600
Technetium - 99 m Kit Prep	100	15	1,500
Prepare Individual Patient Dose	120	10	1,200
Radiochromatography (Radiochemical Purity Control) QC	100	60	6,000
Spectrum Analysis (Radionuclidic Purity Control) QC		30	
Sterility Testing (Quality Control)	24	60	1,440
Pyrogen Testing (Limulus Amocbocyte Lysate Test) QC	24	60	1,440
INCL 1 BAMC Form 345 (OT) 1 Jun 76	49		

SCHEDULE X (Sheet 6, Line 2) Continuation Sheet
SECTION D - SPECIFIC REMARKS

d. Pharmacy Staffing:

Pharmacist support to the nuclear medicine service is estimated to be approximately 60 hours per month. This includes supervision and training of the nuclear medicine technicians in pharmaceutical aspects plus kit preparation and quality control DAH presently has a qualified radionuclearpharmacist assigned, serving as the Chief, Pharmacy Department.

4. Summary of personnel requires: Nuclear Medicine Service

1 Enl	NCOIC, Nuclear Medicine Technician (91W)
1 Enl	Nuclear Medicine Technicial
1 Civ	Nuclear Medicine Technicial
1 Civ	Clerk-Dictating Machine Transcriber
4	

RAW DATA TALLY WORKSHEET FOR NUCLEAR MEDICINE

PERIOD January 1978
(Month) (Year)

Procedures	Raw Work Unit/ Procedures Processed	Weight Value In Minutes	Unit Value (Col B x C)
A	B	C	D
II Radiopharmacy & Health Physics			
Laboratory Surveys Total Lab Area	4	120 min	480
Area Monitoring	2	15	30
Personal Bioassay and Contamination Checks	1	240	240
Radiopharmaceutical Preparation (NOT using Kits) Medcen	4	120	480
Radiopharmaceutical Kit Manufacture - Medcen	1.5	360	540
I-131 Therapy Dose: Thyrotoxicosis		40	
I-131 Therapy Dose: Thyroid Cancer		120	
P-32 Therapy Dose: Intracavitary or interstital		90	
P-32 Therapy Dose: Intravenous		40	
AU-198 Therapy Dose: Intracavitary or Interstital		120	
Miscellaneous:			
a. Dispensing Indiv Pt Dose	100	10 min ea	1,000
b. Explain Study to Patient			
c. Clinical Protocol Forms			
d. Equipment Calibration	20	30 min da	600
TOTAL---------Sec II			16,810

RAW DATA TALLY WORKSHEET FOR NUCLEAR MEDICINE

PERIOD January 1978
(Month) (Year)

Procedures	Raw Work Unit/ Procedures Processed	Weight Value In Minutes	Unit Value (Col B x C)
A	B	C	D
III Imaging Studies			
Brain 4 views less than 2 hr posting		45 min	
Brain 4 views more than 2 hr posting	67	70	4,690
Brain extra views (delayed)	20	20	400
Bone Images (Total Body) per view	10	15	150
Bone Images extra views	2	20	40
Cisternogram per view		20	
Cardiac (gated images)		180	
Cardiac blood pool		45	
Liver-Spleen (6 views w/99mTc-colloid)	5	60	300
Liver-Spleen extra view	1	15	15
Liver - Rose Bengal		60	
Liver-Lung (6 views w/colloid & MAA)		60	
Liver-Lung extra views		15	
Liver-Lung transmission/image		15	
Lung-perfusion 4 views	6	60	360
Lung-perfusion extra views	12	15	180
Lung-ventilation	2	60	120
Spleen w/labeled RBC		60	
Pancreas		120	
Renal	5	90	450

RAW DATA TALLY WORKSHEET FOR NUCLEAR MEDICINE

PERIOD January 1978
(Month) (Year)

Procedures	Raw Work Unit/ Procedures Processed	Weight Value In Minutes	Unit Value (Col B x C)
A	B	C	D
III Imaging Studies			
Renal function dynamic images	5	60 min	300
Parotid - Function		120	
Parotid - Mass		90	
Placenta (Ant & Lat)		40	
Thyroid	6	45	270
Total body images		60	
Blood pool		15	
Other: Spec actual time spent on study			
TOTAL----------Sec III			7,275

TAB 2D

COMPOSITE PAY

GS-7/4	$14,316					
GS-4/4	10,330					
	$24,646	x	.181	=	$ 4,461	
					24,646	
						$29,107
E6	$13,151					
E5	11,078					
	$24,229	x	.40	=	$ 9,692	
					24,229	
						$33,921

The base figures for military and civilian pay were obtained from the CITF office, Fort Hood, Texas. These figures were then adjusted according to guidance in AR 11-28.

TAB 2E

MILITARY CONSTRUCTION ARMY, AND CONTRACT COSTS

1. The new area to which nuclear medicine would be moved in 1982 would have to be redesigned at a cost of approximately $10,000. This figure provided by COL N.H. Walls, SGFP-ZA. This is considered to be the only MCA cost and would be obligated during FY 79.

2. Reading of 804 scans annually @ $20 by civilian contract is $16,080.

TAB 2F

SUPPLY COSTS

Radionuclides

	Per Proc		# of Proc		
I-131	$ 1.06	X	6	=	$ 6.36
Bone	1.57	X	10	=	15.70
Brain	1.24	X	67	=	83.08
Liver	1.62	X	5	=	8.10
Lung	21.60	X	6	=	129.60
Renal	4.05	X	5	=	20.25
					$263.09/month

Radionuclide generator 840.00/month

$1,103.09/month

Polaroid Film (Cost $0.36 each)

	# Per Proc	Cost Per Proc		# of Proc		
Bone	2	$0.72	X	10	=	$ 7.20
Brain	5	1.80	X	67	=	120.60
Liver	5	1.80	X	5	=	9.00
Lung	8	2.88	X	5	=	14.40
Renal	8	2.88	X	6	=	17.28
Thyroid	2	0.72	X	6	=	4.32
						$172.90/month

$1,103.09
172.80

$1,275.89

12 x 1,275.89 = $15,311/year Supply expense

Cost figures obtained from SGT Allen, Nuclear Medicine Department, Fort Bragg, North Carolina.

TAB 2G

UTILITIES AND BUILDING MAINTENANCE COST

These cost figures for utilities and building maintenance were obtained from Directorate of Facilities Engineering, III Corps and Fort Hood, Fort Hood, Texas.

Utilities

Water	.48761 per sq ft per year
Sewer	
Electric	
Natural Gas	
Building Maintenance	.26851 per sq ft per year

.48761 x 650 =	$318
.26851 x 650 =	175
	$493

650 sq ft used for existing space in which nuclear medicine could be placed today.

Actual cost of renovation to existing facility is $7,600. Amortized over three years, $2,533 is the annual cost. Three year amortization used because a new facility would be available in 1982.

$ 493
2,533
$3,026

TAB 2H

LOST DUTY TIME

One E5 @ $5.31 per hour

360 patients annually utilizing two hours per visit.

360 x $10.62 = $3,823

APPENDIX D

Cost/Benefits Attachment for Alternative Three

COST/BENEFIT ATTACHMENT

Alternative # 3

To transport patients requiring nuclear medicine scans to Scott and White Hospital and Clinic on a contractual basis.

BENEFIT ELEMENTS:

1. Mission. The mission of the Fort Hood MEDDAC is to provide health care services to authorized personnel at Fort Hood, other satellite installations, and activities as directed by agreement.

2. Clinical TEMPLATE. The Fort Hood MEDDAC proposed to contract with Scott and White Memorial Hospital and Clinic for nuclear medicine services. Patients requiring this service will be transported to Scott and White Memorial Hospital, Temple, Texas (30 miles one way) by military van and ambulance, as required.

3. Population/Demand. The Fort Hood MEDDAC provides health care services to a total population of 163,316 as of November 1978. This includes 44,368 active duty personnel (page 61).

4. *Organization. NA.*

5. Functional systems. At the present time only selected emergency cases are transported by ambulance to Scott and White Memorial Hospital and Clinic.

6. Others.

a. This alternative will provide comprehensive care to authorized beneficiaries on a routine and emergency basis seven days per week.

b. Scott and White Memorial Hospital and Clinic has the medical resource capatility to provide this service.

c. Under this alternative the lost duty time of active duty personnel would be reduced.

COST AND MANPOWER ELEMENTS:

7. Facility/Equipment

a. HSC OMA NA

b. HSC OPA NA

c. Host Installation OMA $7,956 (page 63) (Fort Hood - Operation and Maintenance Army)(Transportation Expense)

d. Host Installation OPA NA

e. MCA NA

f. Amortization period NA

g. Salvage value NA

h. Terminal value NA

8. Manpower/MY Equivalents NA

9. Workload. The present workload of 100 patients per month will be transported to Scott and White Memorial Hospital and Clinic, Temple, Texas.

10. Work Units/Composites. NA

11. Operating Cost

a. HSC OMA $146,640 (page 62) (Health Services Command - Operational and Maintenance Army)

EOE 10 NA

EOE 21 NA

EOE 22 NA

EOE 23 NA

EOE 24 NA

EOE 25 $146,640 (page 62) (Contract Expense)

EOE 26 NA

EOE 31 NA

b. HSC BASOPS NA

c. HSC MPA NA

d. Host Installation OMA $7,956 (page 63) (Fort Hood - Operational and Maintenance Army) Transportation Expense)

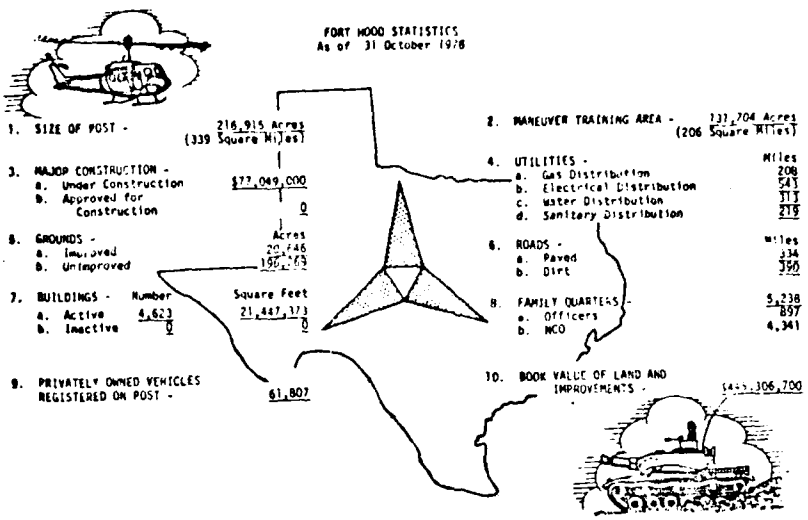
e. Host Installation BASOPS NA

f. Lost duty time $7,646 (page 64)

TAB 3A

POPULATION

This economic analysis used Fort Hood statistics as of 31 October 1978. This information is prepared by the III Corps and Fort Hood Comptroller.



11. MONTHLY EXPENDITURES - $52,711,833
- a. Military Pay 39,916,428
- b. Civilian Pay 3,587,058
- c. Contracts 106,801
- d. Local Purchases 4,069,945
- e. PX Salaries 663,980
- f. PX Purchases 2,871,014
- g. NAF Salaries 242,749
- h. NAF Purchases 653,838

12. CURRENT POST POPULATION - 67,018
- a. Total Military 44,368
  - (1) Officers (3,418)
  - (2) Warrant Officers (808)
  - (3) Enlisted Personnel (40,142)
- b. DA Civilians 3,440
- c. PX Employees 751
- d. Construction Contractor's Employees 1,005
- e. Other Employees, NAF, etc. 1,917
- f. Dependents 15,537

13. MILITARY STRENGTH -

	AUTHORIZED	ASSIGNED
a. Totals	47,363	44,368
b. III Corps Units	4,935	4,321
c. 13th COSCOM	5,158	4,707
d. 1st Cavalry Division	15,495	14,647
e. 2d Armored Division	16,990	16,191
f. 6th Cavalry Brigade	2,725	2,463
g. Other Units/Activities	1,398	1,401
h. General Support Forces	664	638

14. MILITARY DEPENDENTS - 48,439
- a. Residing Off Post 32,902
- b. Residing On Post 15,537

15. MILITARY PERSONNEL WITH DEPENDENTS RESIDING OFF POST - 16,451

16. SUPPORTED POPULATION - 183,316

(Includes items 12 and 14a plus 63,396 retired personnel and their dependents and survivors in Fort Hood's 179 county support area)

17. RELIGIOUS ACTIVITIES -
- a. Chapel Attendance Per Week (Average) 4,402
- b. Religious Education Attendance Per Week (Average) 1,214

18. DEPENDENTS OF MILITARY OR FORT HOOD CIVILIAN EMPLOYEES ENROLLED IN KILLEEN AND COPPERAS COVE INDEPENDENT SCHOOL DISTRICTS - 16,522

(Total Enrollment 22,804)

19. YOUTH ACTIVITIES -
- a. Number of Activities 13
- b. Youth Participation (Manhours) 47,185
- c. Adult Volunteer Participation (Manhours) 7,112

Prepared by: Comptroller
14 November 1978

TAB 3B

SCOTT AND WHITE PRICE LIST

Brain	67	@ $125	=	$ 8,375
Bone	10	@ 120	=	1,200
Lung	6	@ 175	=	1,050
Renal	5	@ 80	=	400
Liver/Spleen	5	@ 125	=	625
Thyroid	6	@ 95	=	570
				$12,220/month

12 x 12,220 = $146,640 annual cost

Price quotes obtained from Mr. Jim Taylor, Assistant Administrator, Clinics, Scott and White Memorial Hospital, Temple, Texas.

TAB 3C

TRANSPORTATION COSTS

Bus	57¢ per mile
Ambulance	20¢ per mile
Van	17¢ per mile

Transportation to Scott and White 900 miles per week at .17 per mile.

52 weeks x 900 miles x .17 = $7,956 per year.

Transportation cost obtained from Transportation and Services Division, Directorate of Industrial Operations, III Corps and Fort Hood, Fort Hood, Texas.

TAB 3D

LOST DUTY TIME

One E5 @ $5.31 per hour

360 patients annually utilizing four hours per visit.

360 x $21.24 = $7,646

APPENDIX E

Cost/Benefits Attachment for Alternative Four

COST/BENEFIT ATTACHMENT

Alternative # 4

BENEFIT ELEMENTS:

1. Mission. To contract for in-house nuclear medicine services with San Antonio Nuclear Service, San Antonio, Texas.

2. Clinical TEMPLATE. The prospective contract, San Antonio Nuclear Services, will provide a mobile gamma camera, trained technician, and all necessary accessories and equipment to perform nuclear medicine studies as requested. US Darnall Army Hospital will provide space to perform the studies and a physician/radiologist to interpret them. (TAB 4A.)

3. Population/Demand. The Fort Hood MEDDAC provides health care services to a total population of 163,316 as of November 1978. This includes 44,368 active duty military personnel (page 70). The current nuclear medicine workload is 100 patients per month.

4. Organization. The Radiology Department mission would be expanded to include diagnostic nuclear medicine service.

5. Functional systems. This concept will permit an in-house diagnostic nuclear medicine capability. The military radiologist, if assigned, will be utilized to interpret one-third of the diagnostic nuclear medicine scans. The contract radiologist will be utilized to interpret two-thirds of the nuclear medicine scans. The above described workload (film reading) distribution is currently being accomplished in the Radiology Department. The addition of interpretation of diagnostic nuclear medicine scans will require an amendment to the existing radiology contract.

6. Others. The in-house contract capability provides comprehensive care fice days per week. The lost duty time for active duty personnel is greatly reduced. For example, utilizing the composite pay of an E5, $11,078, or $42 per day, it is estimated that a diagnostic nuclear medicine scan could be accomplished in approximately two hours of duty time at a lost duty time cost of $10.62, or an annual approximation of $3,823 for 360 active duty personnel. This represents a savings of $11,340 of active duty time compared to alternative 1 (BAMC). The current military radiologist and civilian contract radiologist have the qualifications required to support this service.

COST AND MANPOWER ELEMENTS:

7. Facility/Equipment

a. HSC OMA NA

b. HSC OPA NA

c. Host Installation OMA NA

d. Host Installation OPA NA

e. MCA $10,000 (design cost to provide required space in new facility. Same for Alternative #2.)

f. Amortization period NA

g. Salvage value NA

h. Terminal value NA

8. Manpower/MY Equivalent. The military radiologist, if assigned, will be utilized to interpret one-third of the diagnostic nuclear medicine scans. The contract radiologist will be utilized to interpret two-thirds of the diagnostic nuclear medicine scans.

9. Workloads. The existing workload of 100 patients per month is expected to continue.

10. Work units/Composites. Nuclear medicine work units will be counted the same as radiology clinic visits.

11. Operating costs (annual)

a. HSC OMA $151,677 (Health Services Command - Operational and Maintenance Army)

EOE 10 NA

EOE 21 NA

EOE 22 NA

EOE 23 NA

EOE 24 NA

EOE 25 $151,677 (page 71) (Contract Expense)

EOE 26 NA

EOE 31 NA

b. HSC BASOPS NA

c. HSC MPS NA

d. Host Installation OMA NA

e. Host Installation BASOPS NA

f. Lost duty time $3,823 (page 72)

TAB 4A

SAN ANTONIO NUCLEAR SERVICES

12020 Radium Drive, San Antonio, Texas 78216 -- 512-349-3253

August 5, 1977

RE: LETTER OF AGREEMENT

SAN ANTONIO NUCLEAR SERVICES will provide a mobile gamma camera and all necessary accessories and equipment to perform nuclear medicine studies on dates mutually agreeable.

SAN ANTONIO NUCLEAR SERVICES will include the services of a trained technician to perform all the necessary studies and the delivery of a hard copy of the results and other data as may be required for retention by the hospital as a permanent record.

SAN ANTONIO NUCLEAR SERVICES will not be responsible for any services that must be rendered by a physician.

HOSPITAL will make available adequate space to perform the studies, assistance in identification of patient, linens for patient, and patient studies, storage and safe keeping for any radio-pharmaceuticals that must be delivered ahead of time, and the services of a nurse when necessary to administrate isotopes before the arrival of the equipment.

SAN ANTONIO NUCLEAR SERVICES will bill the hospital as per the enclosed fee schedule. Bills that are paid by the 10th of the month following billing will be allowed a 2% discount.

This agreement will be effective only upon receipt of the certificate of need through the Texas Health Facilities Commission and may be terminated by either of the parties with 30 days written notice.

/s/_____
Jeanette Lawrence, Business Manager

TAB 4B

POPULATION

This economic analysis used Fort Hood statistics as of 31 October 1978. This information is prepared by the III Corps and Fort Hood Comptroller.

FORT HOOD STATISTICS
As of 31 October 1978

1. SIZE OF POST - 216,915 Acres (339 Square Miles)

2. MANEUVER TRAINING AREA - 131,704 Acres (206 Square Miles)

3. MAJOR CONSTRUCTION -
   a. Under Construction $77,049,000
   b. Approved for Construction 0

4. UTILITIES - Miles
   a. Gas Distribution 200
   b. Electrical Distribution 543
   c. Water Distribution 313
   d. Sanitary Distribution 219

5. GROUNDS - Acres
   a. Improved 20,646
   b. Unimproved 196,269

6. ROADS - Miles
   a. Paved 334
   b. Dirt 395

7. BUILDINGS - Number / Square Feet
   a. Active 4,623 / 21,447,373
   b. Inactive 0 / 0

8. FAMILY QUARTERS -
   a. Officers 5,238
   b. NCO 897 / 4,341

9. PRIVATELY OWNED VEHICLES REGISTERED ON POST - 61,807

10. BOOK VALUE OF LAND AND IMPROVEMENTS - $445,306,700

11. MONTHLY EXPENDITURES - $52,111,813
   a. Military Pay 39,916,428
   b. Civilian Pay 3,587,058
   c. Contracts 106,801
   d. Local Purchases 4,069,945
   e. PX Salaries 863,980
   f. PX Purchases 2,871,014
   g. NAF Salaries 242,749
   h. NAF Purchases 653,838

13. MILITARY STRENGTH -

	AUTHORIZED	ASSIGNED
a. Totals	47,363	44,368
b. III Corps Units	4,333	4,121
c. 13th COSCOM	5,158	4,707
d. 1st Cavalry Division	15,495	14,647
e. 2d Armored Division	16,970	16,191
f. 6th Cavalry Brigade	2,[illegible]	2,463
g. Other Units/Activities	1,398	1,401
h. General Support Forces	644	638

15. MILITARY PERSONNEL WITH DEPENDENTS RESIDING OFF POST - 16,451

17. RELIGIOUS ACTIVITIES -
   a. Chapel Attendance Per Week (Average) 4,402
   b. Religious Education Attendance Per Week (Average) 1,214

19. YOUTH ACTIVITIES -
   a. Number of Activities 13
   b. Youth Participation (Manhours) 47,185
   c. Adult Volunteer Participation (Manhours) 7,118

12. CURRENT POST POPULATION - 67,018
   a. Total Military 44,368
      (1) Officers (3,418)
      (2) Warrant Officers (808)
      (3) Enlisted Personnel (40,142)
   b. DA Civilians 3,440
   c. PX Employees 751
   d. Construction Contractor's Employees 1,005
   e. Other Employees, NAF, etc. 1,917
   f. Dependents 15,537

14. MILITARY DEPENDENTS - 48,439
   a. Residing Off Post 32,902
   b. Residing On Post 15,537

16. SUPPORTED POPULATION - 163,316

(Includes Items 12 and 14a plus 63,396 retired personnel and their dependents and survivors in Fort Hood's 179 county support area)

18. DEPENDENTS OF MILITARY OR FORT HOOD CIVILIAN EMPLOYEES ENROLLED IN KILLEEN AND COPPERAS COVE INDEPENDENT SCHOOL DISTRICTS - 16,522

(Total Enrollment 22,804)

Prepared by: Comptroller
14 November 1978

TAB 4C

ELEMENT OF EXPENSE (EOE) #25 COSTS

Brain	67 @ $109	=	$ 7,303
Bone	10 @ $116	=	1,160
Lung	6 @ $114	=	684
Renal	5 @ $ 92	=	460
Liver/Spleen	5 @ $ 87	=	435
Thyroid	6 @ $105	=	630
			$10,672/month

12 x $10,672 = $128,064 annual cost*

Price quotes obtained from Jeanette Lawrence, San Antonio Nuclear Services, San Antonio, Texas.

*This fee does not include reading of results by a radiologist.

Reading of 804 scans annually @ $20 by civilian contract = $16,080.

The cost of renovating existing space in the Radiology Department for this method is $7,600. $7,600 ÷ 3 years = $2,533

Additional costs will be incurred to provide the professional and administrative functions described on page 69. The professional estimate of these costs is $5,000 per year.

$128,064
16,080
2,533
5,000
$151,677

TAB 4D

LOST DUTY TIME

One E5 @ $5.31 per hour

360 patients annually utilizing two hours per visit.

360 x $10.62 = $3,823

APPENDIX F

Cost Analysis Summary

APPENDIX F

COST ANALYSIS SUMMARY

	ALTERNATIVE			
	One	Two	Three	Four
Contract Cost			146,640	128,064
Contract Physician Fee		16,080		16,080
Facility Modification		2,533		2,533
Redesign Cost		10,000		10,000
Military Personnel Services	13,300	33,921		
Civilian Personnel Services	18,158	29,107		
Other Personnel Costs				5,000
Materials, Supplies, Utilities	22,165	15,269		
Maintenance, Repair	2,186	175		
Camera and Equipment		19,930		
Lost Duty Time	15,300	3,823	7,646	3,823
Transportation	12,900		7,956	
Total Annual Costs	84,009	131,198	162,242	165,500

APPENDIX G

Uniform Annual Costs for Alternative One

ALTERNATIVE 1
(Brooke Army Medical Center)
Operating Costs (OMA and MPA)

Project Year	79 Constant Dollars	X	Inflation Index	X	Inflated Dollars	X	Discount Factor	=	Adjusted Dollars
1	$84,009		1.0000		$ 84,009		0.954		$ 80,145
2	84,009		1.0600		89,050		0.867		77,206
3	84,009		1.1236		94,393		0.788		74,381
4	84,009		1.1865		99,677		0.717		71,468
5	84,009		1.2530		105,263		0.652		68,632
6	84,009		1.3231		111,152		0.592		65,802
7	84,009		1.3972		117,377		0.538		63,149
8	84,009		1.4755		123,955		0.489		60,614
9	84,009		1.5581		130,894		0.445		58,248
10	84,009		1.6454		138,228		0.405		55,983
11	84,009		1.7375		145,966		0.368		53,715
12	84,009		1.8348		154,140		0.334		51,483
13	84,009		1.9375		162,767		0.304		49,481
14	84,009		2.0460		171,882		0.276		47,440
15	84,009		2.1606		181,510		0.251		45,559
16	84,009		2.2816		181,675		0.228		43,702
17	84,009		2.4094		202,411		0.208		42,102
18	84,009		2.5443		213,744		0.189		40,398
19	84,009		2.5443		213,744		0.172		36,764
20	84,009		2.5443		213,744		0.156		33,344
21	84,009		2.5443		213,744		0.142		30,342
22	84,009		2.5443		213,744		0.129		27,573
23	84,009		2.5443		213,744		0.117		25,008
24	84,009		2.5443		213,744		0.107		22,871
25	84,009		2.5443		213,744		0.097		20,733
							Present Value		$1,246,153

ALTERNATIVE 1
Projected OPA Costs

Project Year	79 Constant Dollars	X	Inflation Index		Inflated Dollars	X	Discount Factor	=	Adjusted Dollars
7	$250,000 replace 2 cameras	X	1.3840	=	$346,000	X	0.538	=	$186,148
9	$ 25,000 upgrade 1	X	1.5376	=	$ 38,440	X	0.445	=	17,106
17	$ 50,000 upgrade 2	X	2.3418	=	$117,090	X	0.208	=	24,355
19	$125,000 replace 1 camera	X	2.4683	=	$308,538	X	0.172	=	53,068
							Present Value		$280,677

1979

Camera Cost $125,000

Upgrade $25,000

ALTERNATIVE 1
Cash Flow Summary

Total OMA and MPA operating costs for USDAH workload in 1979 adjusted dollars	$1,246,153		
Uniform annual cost $1,246,153 ÷ 9.524		=	$130,843
Total OPA costs in 1979 adjusted dollars	$280,677		
Adjusted to .20 USDAH workload $280,677 x .2 = $56,135			
Uniform annual cost $56,135 ÷ 9.524		=	5,894
Total uniform annual cost			$136,737

APPENDIX H

Uniform Annual Costs for Alternative Two

ALTERNATIVE 2
(US Darnall Army Hospital)
Operating Costs (OMA and MPA)

Project Year	79 Constant Dollars	X	Inflation Index	X	Inflated Dollars	X	Discount Factor	=	Adjusted Dollars
1	$98,735		1.0000		$ 98,735		0.954		$ 94,193
2	98,735		1.0600		104,659		0.867		90,739
3	98,735		1.1236		110,939		0.788		87,420
4	98,735		1.1865		117,149		0.717		83,996
5	98,735		1.2530		123,715		0.652		80,662
6	98,735		1.3231		130,636		0.592		77,737
7	98.735		1.3972		137,953		0.538		74,218
8	98,735		1.4755		145,683		0.489		71,239
9	98,735		1.5581		153,839		0.445		68,458
10	98,735		1.6454		162,459		0.405		65,796
11	98,735		1.7375		171,552		0.368		63,131
12	98,735		1,8348		181,159		0.334		60,507
13	98,735		1.9375		191,299		0.304		58,155
14	98,735		2.0460		202,012		0.276		55,755
15	98,735		2.1606		213,327		0.251		53,545
16	98,735		2.2816		225,274		0.228		51,362
17	98,735		2.4094		237,892		0.208		49,482
18	98,735		2.5443		251,211		0.189		47,479
19	98,735		2.5443		251,211		0.172		43,208
20	98,735		2.5443		251,211		0.142		35,672
21	98,735		2.5443		251,211		0.142		35,672
22	98,735		2.5443		251,211		0.129		32,406
23	98,735		2.5443		251,211		0.117		29,392
24	98,735		2.5443		251,211		0.107		26,880
25	98,735		2.5443		251,211		0.097		24,367
							Present value		$1,464,588

ALTERNATIVE 2
OPA Costs

1979 Project Year	79 Constant Dollars	X	Inflation Index	Inflated Dollars	X	Discount Factor	=	Adjusted Dollars
1	$199,300	X	1.0000	$199,300	X	0.954	=	$190,132
11	$ 25,000 upgrade	X	1.7081	$ 42,702	X	0.368	=	15,714
21	$125,000	X	2.4683	$308,538	X	0.142	=	43,812
						Present Value		$249,658

1979 Camera and equipment cost	$199,300
Camera Cost	$125,000
Upgrade Cost	$ 25,000

ALTERNATIVE 2
MCA Costs

Project Year	79 Constant Dollars	X	Inflation Index	X	Inflated Dollars	X	Discount Factor	=	Adjusted Dollars
1	$10,000*	X	1.000		$10,000	X	0.954	=	$9,540

*Redesign Cost

ALTERNATIVE 2
Cash Flow Summary

Total OMA and MDA 1979 adjusted dollars.	$1,464,588		
Uniform annual cost.	$1,464,588 ÷ 9.524	=	$153,779
Total OPA 1979 adjusted dollars	$ 249,658		
Uniform annual cost.	$ 249,658 ÷ 9.524	=	26,214
Total MCA 1979 adjusted dollars.	$ 9,540		
Uniform annual cost.	$ 9,540 ÷ 9.524	=	1,002
	Total uniform annual costs		$180,995

APPENDIX I

Uniform Annual Costs for Alternative Three

ALTERNATIVE 3
(Scott and White Memorial Hospital)
Operating Costs (OMA)

Project Year	79 Constant Dollars	X	Inflation Index	X	Inflated Dollars	X	Discount Factor	=	Adjusted Dollars
1	$162,242		1.0000				0.954		$ 154,779
2	162,242		1.0600				0.867		149,104
3	162,242		1.1236				0.788		143,649
4	162,242		1.1865				0.717		138,023
5	162,242		1.2530				0.652		132,545
6	162,242		1.3231				0.592		127,080
7	162,242		1.3972		$226,685		0.538		121,956
8	162,242		1.4755		239,388		0.489		117,061
9	162,242		1.5581		252,789		0.445		112,491
10	162,242		1.6454		266,952		0.405		108,116
11	162,242		1.7375		281,895		0.368		103,738
12	162,242		1.8348		297,682		0.334		99,426
13	162,242		1.9375		314,344		0.304		95,561
14	162,242		2.0460		331,947		0.276		91,617
15	162,242		2.1606		350,540		0.251		87,986
16	162,242		2.2816		370,171		0.228		84,399
17	162,242		2.4094		390,906		0.208		81,308
18	162,242		2.5443		412,792		0.189		78,018
19	162,242		2.5443		412,792		0.172		71,000
20	162,242		2.5443		412,792		0.156		64,396
21	162,242		2.5443		412,792		0.142		58,616
22	162,242		2.5443		412,792		0.129		53,250
23	162,242		2.5443		412,792		0.117		48,297
24	162,242		2.5443		412,792		0.107		44,169
25	162,242		2.5443		412,792		0.097		40,041
							Present Value		$2,406,626

ALTERNATIVE 3
Cash Flow Summary

Total OMA costs in 1979 adjusted dollars	$2,406,626
$2,406,626 ÷ 9.524 = Uniform annual cost	$ 252,691

APPENDIX J

Uniform Annual Costs for Alternative Four

ALTERNATIVE 4
(San Antonio Nuclear)
Operating Costs (OMA)

Project Year	79 Constant Dollars	X	Inflation Index	X	Inflated Dollars	X	Discount Factor	=	Adjusted Dollars
1	$152,967		1.0000		$152,967		0.954		$ 145,931
2	152,967		1.0600		162,145		0.867		140,580
3	152,967		1.1236		171,874		0.788		135,436
4	152,967		1.1865		181,495		0.717		130,133
5	152,967		1.2530		191,668		0.652		124,967
6	152,967		1.3231		202,391		0.592		119,815
7	152,967		1.3972		213,725		0.538		114,984
8	152,967		1.4755		225,703		0.489		110,369
9	152,967		1.5581		238,338		0.445		106,060
10	152,967		1.6454		251,692		0.405		101,935
11	152,967		1.7375		265,780		0.368		97,807
12	152,967		1.8348		280,664		0.334		93,742
13	152,967		1.9375		296,374		0.304		90,098
14	152,967		2.0460		332,970		0.276		86,380
15	152,967		2.1606		330,501		0.251		82,956
16	152,967		2.2816		349,010		0.228		79,574
17	152,967		2.4094		368,669		0.208		76,660
18	152,967		2.5443		389,194		0.189		73,558
19	152,967		2.5443		389.194		0.172		66,941
20	152,967		2.5443		389,194		0.156		60,714
21	152,967		2.5443		389,194		0.142		55,266
22	152,967		2.5443		389,194		0.129		50,206
23	152,967		2.5443		389,194		0.117		45,536
24	152,967		2.5443		389,194		0.107		41,644
25	152,967		2.5443		389,194		0.097		37,752
							Present value		$2,269,044

ALTERNATIVE 4
Cash Flow Summary

Total OMA costs in 1979 adjusted dollars.	$2,269,044
$2,269,044 ÷ 9.524 = Uniform annual cost.	$ 238,245

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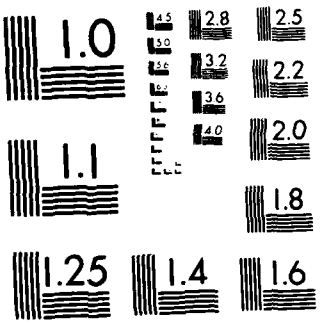

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