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AN EXPERT SYSTEM ADVISOR FOR
MEDICAL EVALUATION BOARDS

THESIS

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AFIT/GIR/DEV/91D-8

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AN EXPERT SYSTEM ADVISOR FOR MEDICAL EVALUATION BOARDS

THESIS

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Captain, USAF

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Captain Jerry S. G. Harrington

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Abstract

Expert system technology has proven itself to be able to improve productivity and decision making in a variety of fields of endeavor. The purpose of this study was to determine if an expert system for medical evaluation boards (MEBs) could improve upon the processing of medical evaluation board cases.

Research was conducted to develop an expert system and measure the capabilities of the system, both in terms of accuracy and timeliness of case completion of the medical evaluation administrators/clerks who were assisted by the system.

The research methodology involved a three - phase approach. The objective of phase one was to chose a problem to be addressed by the expert system and find a domain expert who would provide the knowledge that would be encoded into the system to solve the problem. Phase two, the knowledge engineering phase, involved the extraction of knowledge from the domain expert as well as supporting documentation, to create the knowledge base for the expert system. Phase three, performance evaluation, involved the evaluation of the developed system, to determine the effect it had on the accuracy and timeliness of MEB case completion by medical administrators/clerks.

The expert system developed was titled the Medical

Evaluation Board Advisor (MEBA). MEBA improved the overall accuracy of medical administrators/clerks by nearly 15 percent. There appeared to be a reduction in the timeliness of case completion when using MEBA. This was attributed to the lack of familiarity of the subjects with the system as well as the subjects' lack of familiarity with medical terminology. The ability of the subjects to learn the system indicated that as subjects became more familiar with the system, case preparation time using the system was comparable to manual case preparation time. The results indicated that with the inclusion of MEBA, or a system similar in nature to MEBA, boards can improve the accuracy and timeliness of MEB case preparation. The improved accuracy and timeliness can result in monetary savings to the USAF. MEBA can also act as a continuum of readily available expert knowledge. This study also suggests certain enhancements that can be done to the system and suggests future avenues for research.

AN EXPERT SYSTEM ADVISOR FOR MEDICAL EVALUATION BOARDS

I. Introduction

Medical Evaluation Boards (MEBs) decide if military members are fit for worldwide duty. The board makes critical decisions about medical and psychological health which can dramatically affect a member's military career. The MEB process, although straightforward at the onset, is filled with a myriad of details. With all the details and timing windows, frequent delays in processing MEB cases often arise due to exceptions in administration and testing. Not knowing how to administratively prepare for the MEB can have dramatic effects on the duty performance of the member waiting to be boarded as well as the Air Force. By prolonging the decision to retain or not retain a member, unqualified personnel are sometimes retained while some qualified personnel are boarded by mistake when in fact they never should be boarded at all.

There are several main problem areas that MEB administrators face in the processing of a MEB case. The first is that physicians are sometimes confused on what is boardable and what is not boardable. Another area of confusion that arises even after it has been determined that a condition is boardable is the type of administrative procedures that need to be accomplished in the preparation of a MEB case. Another surrounds the type of specific tests that have to be accomplished for specific boardable conditions.

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The amount of time and money devoted to the preparation of a MEB is dependent upon the type of MEB and the experience of the MEB administrator. MEB administrators who are experienced in the MEB process take less time in preparing cases while inexperienced administrators often require more time to prepare cases. Knowledge about case preparation can be passed down from senior administrators to junior administrators through the use of the mail system or the telephone. This, however, can result in delays due to misunderstandings. If the required knowledge could be made readily available to junior administrators via an expert system, an improvement in the management of MEB cases could result in considerable savings in time, effort, and money to the Air Force.

Expert systems have in fact demonstrated considerable capability for enhancing productivity and decision making. Expert systems are being used in a wide variety of business settings. An article in Dun's Business Month entitled "Computers Think for Business," states:

> Companies in virtually every industry are using expert
> systems and making efforts to disseminate the technol-
> ogy throughout their operations. (8:30)

Expert systems can help the way businesses operate by changing the way people approach problem solving. This technology makes it possible for junior managers to reach effective solutions to problems without having to constantly seek the advice and help of more senior managers. As Harmon and King wrote in their book, Expert Systems: Artificial Intelligence in Business:

Expert systems technology will also help America solve its productivity problems. It will help businesses reorganize themselves into more efficient and effective organizations. It will do this by helping individuals solve problems more quickly and efficiently than they can today. (9:1)

This thesis applies artificial intelligence to MEB preparation to improve the processing of MEB cases. It does this by gathering information, arranging details, organizing the knowledge, and creating a portable tool for use by medical administrators.

Statement of Problem

This research helps to determine how an expert system can be developed to act as a management tool for MEB administrators and therefore shorten the time and increase the accuracy in the preparation of MEB cases.

Research Questions

1. Is MEB preparation a suitable problem for expert system development?

2. Can the knowledge needed to solve the selected problem *be* extracted from a human expert and published literature?

3. Can the requirement to prepare a complete MEB case be encoded using the VPEXPERT software program?

4. How does the expert system affect the MEB process in relationship to accuracy and timeliness?

Scope of Study

The research effort was conducted at the USAF Medical Center at Wright-Patterson Air Force Base in Ohio. The Assistant Director of Hospital Administration and the Director of Medical Information Systems expressed interest in the project and promised the availability of needed personnel and resources. Research is limited to the procedures used at this medical center but should generally apply Air Force wide.

Contributions of the Research

The research could result in increasing the accuracy and timeliness of decision making with regard to MEB preparation. Benefits could result in the areas of monetary savings and time savings in regard to MEB preparation. The devised system may also provide a continuum of knowledge that will be more readily available to all MEB administrators in the USAF.

Organization of the Research Report

This chapter provides the reader with a brief background of expert systems, the research problem, the research questions, and the limitations, assumptions, and contributions of the proposed research. Chapter II provides a literature review of expert system applications. Chapter III provides the methodology of the research. Chapter IV presents the findings and results of the research and Chapter V addresses the conclusions from the research and suggests future avenues of investigation.

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II. Literature Review

Overview

The purpose of this chapter is to review the literature to provide a better understanding of expert systems. This chapter consists of three sections. The first section gives the reader some background information about expert systems. The next section reviews the factors that should be considered when developing expert systems. The final section describes the impact that expert systems can have on organizations.

Background

Expert systems are computer software programs that incorporate the knowledge of an expert, or group of experts, and manipulates that knowledge in such a way that it simulates human performance. Susan Lindsay provides the following description of expert systems:

> They are the software programs that solve problems by mimicking the ways in which human beings solve problems. In the strict terms used by many researchers, expert systems apply expertise; they behave like human experts do whose advanced training or experience equips them to do work of several, and to do it brilliantly every time. (16:12)

The principal components of an expert system are the knowledge base, an inference engine, and a user interface. Figure 1 depicts the basic structure of an expert system. Hart defines the knowledge base as the place where the information is stored (9:27). On the other hand, Mykytyn defines the knowledge base as the part of the system that
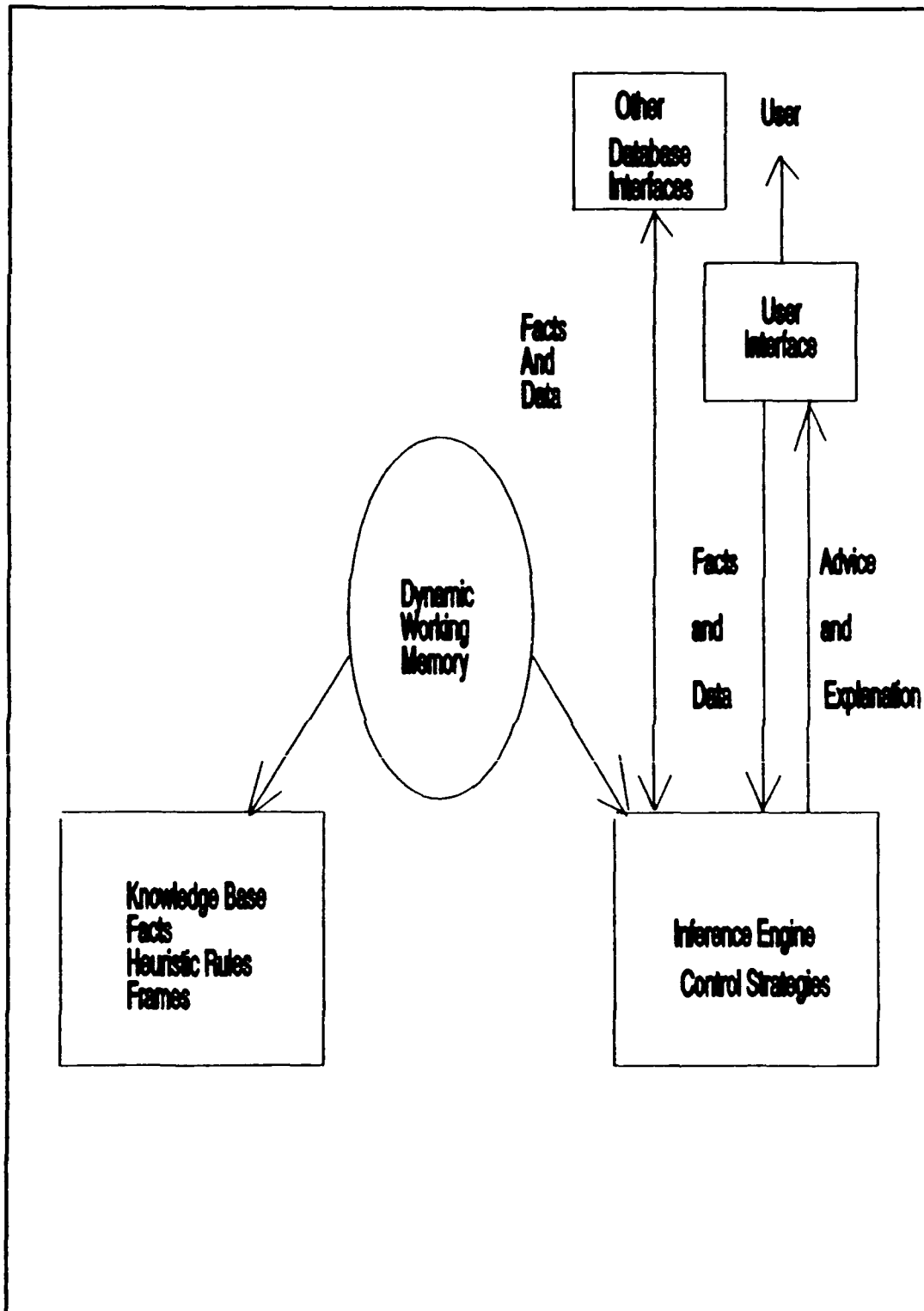
Figure 1.   Basic Structure of An Expert System (2:27)

contains the factual knowledge and the heuristic of the experts (21:28).

The next major component of an expert system is the inference engine. The inference engine manipulates the knowledge base using the appropriate heuristic search techniques. It determines how the rules in the knowledge base are to be applied to a problem (21:28).

Several types of rules are involved in the manipulation of the rules between the knowledge base and the inference engine. The two major types are backward chaining and forward chaining. Backward chaining starts from the desired solution and works backward to find facts that support the solution (3:49). In forward chaining, the system attempts to work with known facts and work forward through the rules until a solution is reached (3:49).

The final component of an expert system is the user interface. This component determines the way in which the user can interact with the knowledge base (11:28). The user interface provides a bidirectional means of communication between the user and the system (21:28). The user must be able to understand the questions posed to him by the system and answer the questions accordingly.

Advantages. Expert systems can offer some advantages over human experts. Humans have difficulty dealing with problems in today's complicated work environment. Faced with ever increasing workloads, budget constraints, and time constraints, people are likely to make more mistakes. Expert

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systems offer the potential to reduce workloads which, although somewhat trivial to some people, are often critical to the successful operation of an organization (2:22).

Expert systems can also act as a continuum of knowledge. Once the heuristics of the expert(s) are encoded into the system, they are available for use even after the human expert(s) are no longer available for consultation. This is extremely important considering that many experts are senior personnel in many organizations and they may be nearing retirement. These developed expert systems can be updated when needed to reflect changes in the domain knowledge as changes occur.

Expert systems are not subject to the frailties of human experts. The human expert can be biased according to emotions, friendships, politics, or personalities. In addition, sickness and death also have a negative impact on the availability of the expert. An automated system can be available 365 days a year, 24 hours a day if needed.

Decision makers are often biased in their information search strategies and this sometimes leads to poor decision making. Jacobs et. al. point out that knowledge based decision aids, such as expert systems, may help decision makers overcome bias in information search and therefore help to improve the quality of their decisions (12:29).

Disadvantages. Unfortunately, expert systems also have some disadvantages. First, the developed system is only as good as the knowledge put into it; in other words, if bad

information or "garbage" goes into the knowledge base, "garbage" comes out.

Another disadvantage is that the actual gathering of expert knowledge can be very time consuming. It requires much patience on the part of the domain expert as well as the knowledge engineer. The knowledge engineer must develop excellent interviewing skills prior to any of the knowledge gathering sessions in order to extract all the necessary information from the expert.

McNamara et. al. ask whether the use of knowledge based systems is merely another example of the familiar pattern of "two steps forward and one step back?" Management is some-times caught between needing to be flexible and needing predictable outcomes. Although expert systems can provide an apparent quick fix to a problem, the systems will only do this if they have been thoroughly researched and developed before they are implemented (18:15).

A final disadvantage of expert systems is that they require updating for the following reasons:

1. Validation and efforts frequently reveal faulty or inconsistent logic.

2. Systems are continually expanded to handle additional tasks.

3. Knowledge in the field evolves.

4. Policies and regulations change.

5. Better ways of performing the task are discovered (2:6).

This background information gives the reader a better

understanding of the research study. The parts of an expert system, some basic information on how a system functions and some advantages and disadvantages are discussed.

Problem Selection

It is important to identify an appropriate problem for expert system development. Figure 2 summarizes the problem domain characteristics that make the development of an expert system possible. One of the important characteristics is that an expert must exist and he or she needs to be able to articulate the methods that will help solve the problem. Another is that the task to be solved therefore needs to be understood and cannot be too difficult to solve. Figure 3 presents a justification for the development of proposed expert systems. According to Harmon, problem selection is divided into the following activities:

> 1. Identifying a problem domain and a specific task.
>
> 2. Finding an expert willing to contribute expertise.
>
> 3. Identifying a tentative approach to the problem.
>
> 4. Analyzing the costs and benefits of the effort.
>
> 5. Preparing a development plan. (9:197)

The following is a checklist developed by Lindsay which can be used in identifying problems for expert system application:

> 1. Should the problem be addressed using expert systems?

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-Can humans solve the problem? System
development will be easier if they can.

-Can humans state the problem and the
solution in words?

-Does an automated system make financial
sense? Will the costs of the system be
justified by the benefits?

2. Should the system be a conventional system or
an expert system application.

-Will a conventional system do the job?

-Which solution is most cost-effective?

-What hardware constraints exist?

3. What applications will be most successfully
addressed with expert systems?

-Do they profit from the benefits of expert
systems?

-Do they eliminate work that people should not
do because of risks, error, etc?

-Do they eliminate work that people would
rather not do?

-Do they require features that expert systems
can supply (consulting feature)?

-Are they big enough that they are worth doing
but not so big that they will never get done?
(16:47)

LaPlante claims that the idea behind system development
is to determine which tasks employees are hired for and which
skills are the most valuable to the organization. The system
is then built to help employees perform their job more
efficiently (14:56).

Harrington notes that expert systems are to be applied to
solve problems in which rules are well defined (10:26). In
addition, she indicates that the developed system needs to

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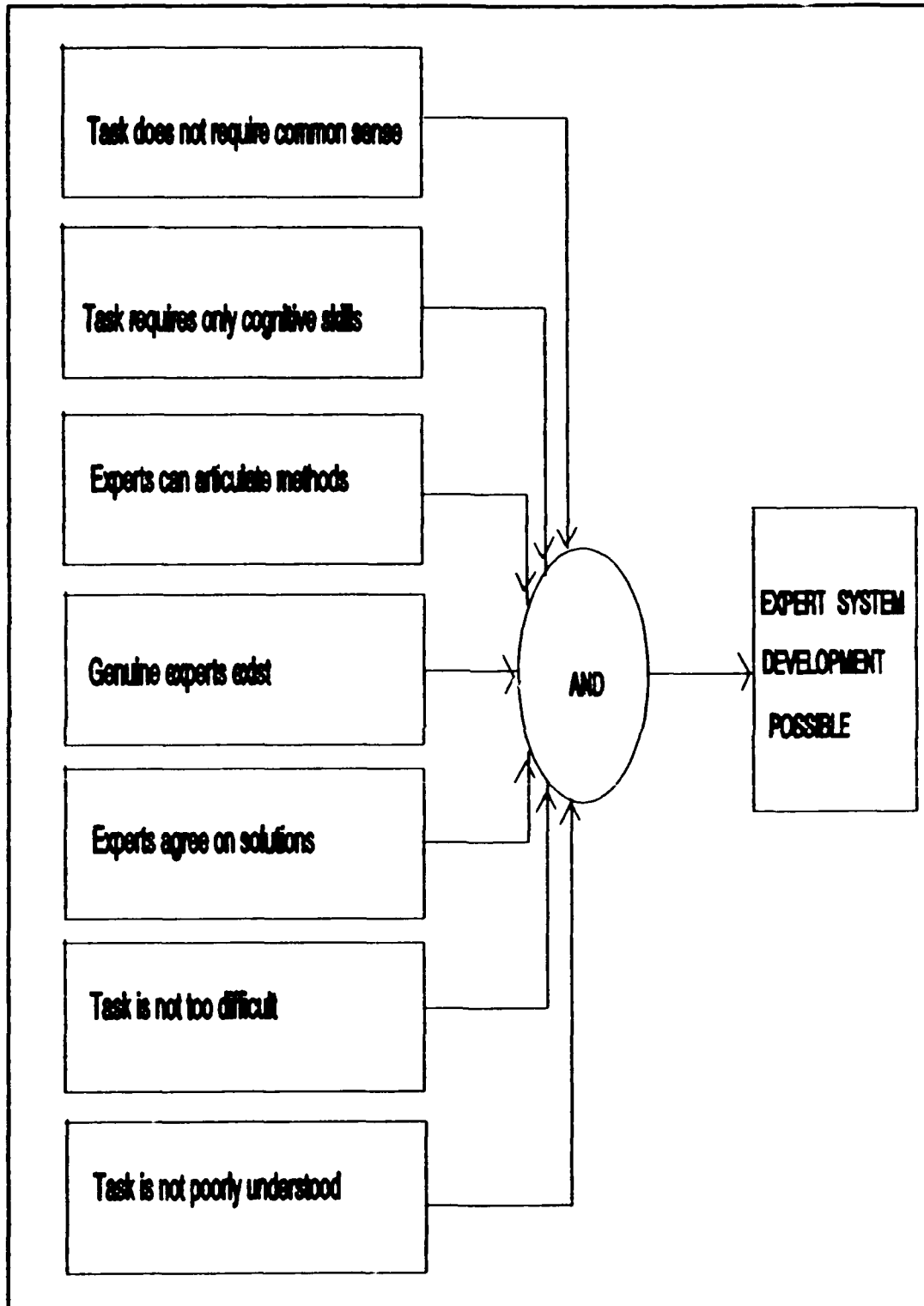
Figure 2.   Requirements Necessary for Expert System
Development (27:129)

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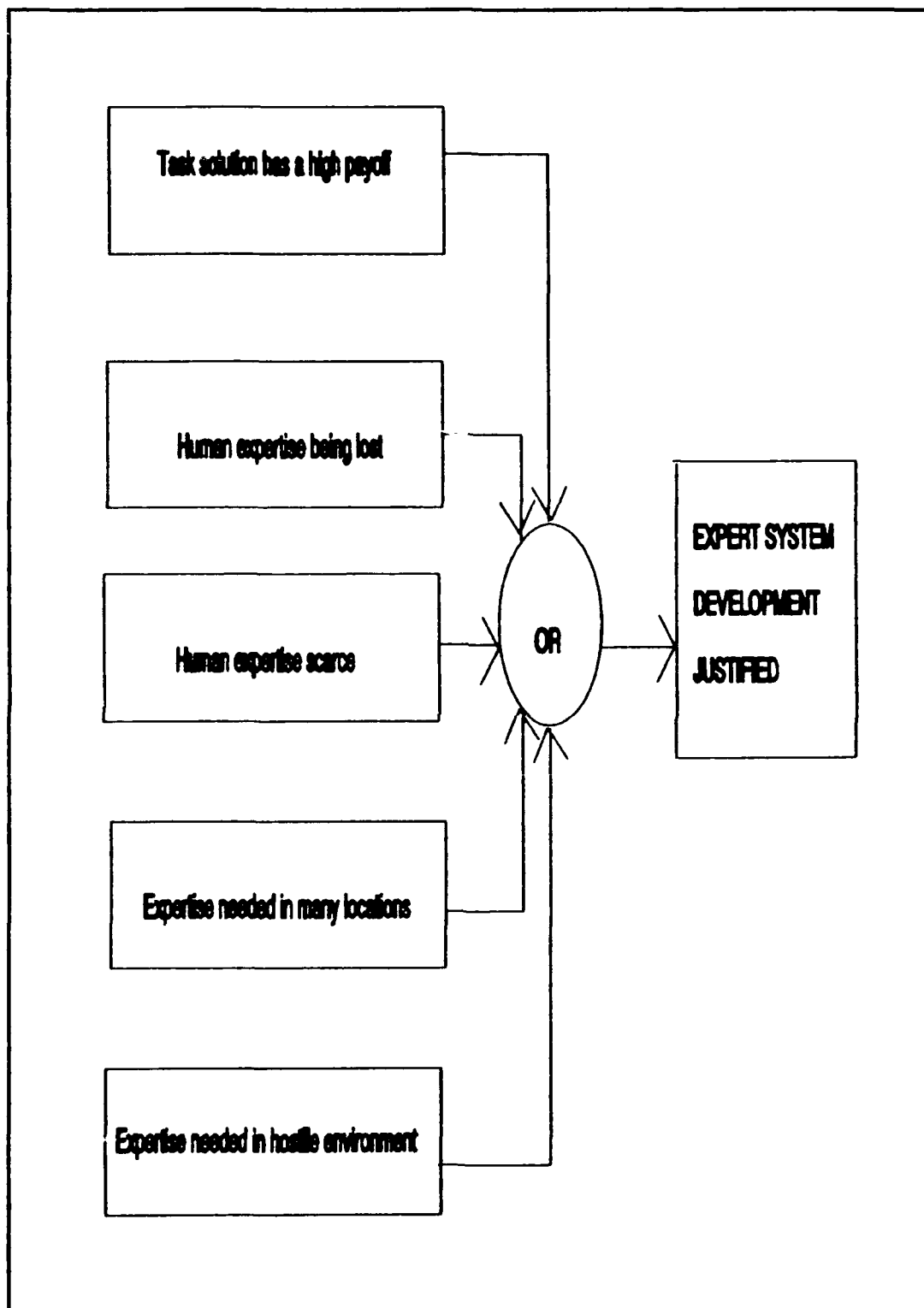
Figure 3. Justification for Expert System
Development (27:130)

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have more than 10, but fewer than 10 thousand rules; the amount of hardware needed will depend upon the number of rules in the knowledge base; the problem to be solved needs to be complex; a domain expert must exist; and the complexity of the system must not exceed the capabilities of the users (10:26).

Carrington, on the other hand, defines the applicability of an expert system by determining an appropriate problem that can be solved by using an expert system. To determine the problem, the following five points are stressed: that the scope and domain are determined to be finite and bounded; the problem and the solution should have a logical structure; the problem should be repetitive, yet sufficiently complicated to warrant expert system creation; the solution needs to be clear cut and not involve opinion, and the expertise must be available to create the system (3:47-48).

Mockler indicates that systems applications are developed by analyzing the situation under study,reformulating the decision situation, and putting the system into the computer (20:8).

Determining Feasibility and Prototyping. Once a problem has been identified that an expert system may be applied to solve, the next step is to determine the feasibility of developing an expert system to solve the problem. Prototyping is essentially a demonstration model of the proposed expert system. The prototype does not contain all the validity checks that may be incorporated in the expert system (3:274).

The feasibility and prototype development can take up to

twenty-two months if only one expert is used in system development (10:27).

Expert system shells are software applications that contain programmed procedures for processing knowledge and developing a complete expert system (20:8). The use of a expert shell can decrease the amount of time required between prototyping, validating the system, and finally the actual implementation of the completed expert system.

Validation and Implementation. Once the prototype has been completed and is successfully tested, the completed system is tested within the organization. This validation step is done within a part of the organization. Once the expert system has been validated, the system can be implemented.

Leonard-Barton suggests that the successful implementation of an expert system is an interactive process that alters the technology to fit the organization and at the same time shapes the user to fully exploit the new technology.

Furthermore, technology managers need to work closely with the users in developing the system. The original owner of the expert system will influence the way it is perceived by the rest of the organization. The success of the expert system can be affected by the resources that are allocated to running it. The bottom line is that the developers and the users of the expert system need to work together to insure the successful implementation of the system (15:7-18).

Meador et. al. present a critique of two different

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successful approaches to expert system implementation. The systems are currently in place at Digital Equipment Corporation and at the DuPont Corporation. The Digital approach to implementation was to develop a corporate center while the DuPont approach was to train its end users to develop their own expert systems. Digital implemented what is termed a specialist approach to system development while DuPont used a dispersed approach. An analysis of the corporate environment and the technical readiness of the business are critical steps that can lead to the use of either of these two approaches (19:64-69).

Impact of Expert Systems on Organizations

Benefits of Using Expert Systems. Expert systems offer several benefits to organizations. Ryan indicates that expert systems can have an impact on power roles of leaders and managers. These systems can greatly enhance the ability of top management to evaluate information more effectively without the need of many layers of middle management. This will allow top managers to exercise more direct control over their organizations (23:30-32).

Salmone looks at the problem of shortages of skilled workers in network organizations and the use of expert systems in helping to provide a way to confer expert knowledge to nonspecialists. These nonspecialists can then effectively solve minor problems and free up the experts to concentrate on the more complex network problems. Expert systems are also

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found to improve the efficiency of workers. Organizations that are faced with shortages of network experts include college campuses, computer companies, and communications companies (24:38-44).

In the area of human resources management, expert systems can be used to assist in decision making when selecting potential employees and when determining training needs (7:10).

A specific expert system, XCON, was used to help configure customer orders for computers to determine the physical placement and interconnection of parts needed to assemble a computer having a specified grouping of optional features (26:128).

Keller indicates that PC based expert systems can be used to prepare businesses and professional organizations to accept large expert systems (13:36). He claims that expert systems are very effective at helping people learn to organize their thinking around a rule based protocol; making acceptable the idea of using computers to make expert decisions; and helping personnel come on line with the new technology of the organization (13:36). Other benefits of expert systems include improvement of productivity, increases in revenue, the preservation of expertise; and saved resources (13:37).

Problems Sometimes Encountered When Using Expert Systems. Problems with expert systems often arise when the end product does not meet the expectations of the expert or the using organization. Problems can also arise if the knowledge

engineer and the expert who developed the system leave an organization without leaving proper documentation on how to work with and update the knowledge base within the expert system. It is imperative that the knowledge base be kept up-to-date (10:50). The fact that a system is in place does not mean that it can maintain itself. The organization is required to ensure that the system is kept current to meet the changing needs of the organization.

Legal Ramifications of Using Expert Systems. A fairly new area of concern with the use of expert systems is determining who is legally responsible for decisions that are made by using the systems. Since expert systems are in use in many fields such as medicine and law, who can be found responsible if a wrong decision is made because of using the system? Mykytyn et. al. indicate that legal actions could possibly be taken against developers and users of faulty systems (21:29-32).

Summary

The objective of Chapter II was to review the literature in order to get a better understanding of the processes involved in the development of an expert system. Factors that need to be considered in expert system development were discussed. Finally, a brief review was presented of some of the current benefits and drawbacks of expert systems.

III. Methodology

Overview

This chapter describes answering and testing the research questions:

1. What written procedures are involved in MEB preparation?

2. What unwritten rules need to be considered during the preparation of an MEB?

3. How will the expert system prototype affect the MEB process in relation to productivity and decision making?

The research consisted of three phases: problem selection, knowledge engineering and performance measurement. Each of these phases is discussed in turn in each of the following sections.

The research methodology is similar to that used by Capt Steven McCain in his development of an expert system for asset reconciliation in 1987 (17:63-87).

Problem Selection

The objective of this section of the research was to select a problem to be addressed by the expert system and to choose the domain expert whose knowledge was to be encoded into the system to solve the selected problem. This initial section consisted of five steps.

Step 1 - Task Selection. MEB preparation was chosen for research due to the perceived number of rules involved in MEB preparation, less than 200, and the time constraints of the

Air Force Institute of Technology curricula. The Assistant Director of Administration at the Wright-Patterson Medical Center and the Director of Medical Information Systems demonstrated an interest in expert system development at the graduate information resource management colloquium held on 21 August 1991 at the Air Force Institute of Technology.

Step 2 - Domain Analysis. It is important to be familiar with the MEB administrator's environment. Familiarization included a review of the regulations and directives that govern MEB preparation. The domain expert made available to the researcher the USAF Regulation entitled Administration of Medical Activities to review the responsibilities of the medical board administrator/clerk (4:392-408). The USAF Regulation entitled Medical Examination and Medical Standards was also made available in order to review the medical problems that could result in a person being referred to a medical board (5:29-43). In addition to the USAF Regulations, the expert also made available the Veterans Administration's Schedule for Rating Disabilities to review the terminology required in the narrative summary of a MEB case file (6). The next step involved the development of a series of questions that are presented to the expert regarding the task environment. These questions are fashioned after the questions prepared by Dr. Mary K. Allen for her 1986 doctoral research on the development of an expert system for item managers. The questions that were presented to the expert prior to and during the knowledge engineering session(s) can be found in

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Appendices A & B. This was done to stimulate ideas from the expert prior to and during the knowledge engineering sessions.

Step 3 - Initial Project Meeting. The researcher met with key personnel at the Medical Center to describe the research effort. When the expert system would be ready for delivery and what type of resources would be needed were discussed.

Expected products included:

1. A prototype expert system for MEB preparation.

2. Complete documentation of the expert system.

Expected resources included:

1. Human expert's time: two hours a day for a total of ten working days.

2. Work space in the medical center for knowledge engineering sessions and a site for expert system testing if needed.

3. Problem domain information about the preparation of MEBs. This includes regulations, pamphlets, and any other pertinent written documentation.

4. Fifteen MEB cases for evaluation of the prototype expert system.

Step 4 - Domain Expert Selection. The domain expert has twelve years of experience in MEB preparation. He has coauthored various pamphlets on MEB preparation and has contributed information that has been included in the USAF regulations that cover MEB preparation. He was referred to the researcher by the Chief of Medical Information Systems.

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Activity	Date
Domain Familiarization	2 Jan-8 Mar, 1991
VP Expert programming class	2 Jan-8 Mar, 1991
Knowledge Engineering, Session 1	25 Feb-1 Mar, 1991
Design of Initial Prototype	2 Mar-11 Mar, 1991
Knowledge Engineering, Session 2	23 Apr-24 May, 1991
Evaluation of System Performance	20 Jul-25 Jul, 1991

Figure 4. Calendar of Events

Knowledge Engineering

This part of the research extracted knowledge from the MEB expert and created a knowledge base for the prototype expert system.

Step 1 - Case Collection. The expert chose fifteen MEB cases that were on file. Five cases were used for the determination of accuracy and timeliness between the two methods of evaluation. The other ten cases were used for a comparison of mean timeliness.

Step 2 - Knowledge Engineering Sessions. The decision rules used by the expert to solve the MEB tasks were obtained during this step. The expert first generated ideas in writing. Once this was accomplished, the researcher reviewed the ideas with the expert and the conversation was recorded on paper and a tape recorder. Ideas presented by the expert were prioritized during this time.

The first meetings were spent developing an understanding

of the problem task. The expert was asked to answer five questions regarding the MEB process:

1. What is a MEB in general terms?

2. What do you consider to be the most difficult part of the MEB process?

3. What are the most common mistakes made during the MEB process?

4. Do certain cases require different procedures? If so, what kind of MEB cases and how are the procedures different?

The expert was asked to select two typical MEB cases from the thirty cases previously selected. The expert writes down in detail how he would process the cases and where he would find the information required to process the cases.

The second meeting with the expert developed a more detailed analysis of the questions that needed to be asked during the MEB process. In this part of the research, the expert was asked to answer questions about a case posed to him by a less experienced administrator. The expert responded to the administrator's questions in the same way as an expert system might respond, by offering solutions and further actions. All questions and answers were recorded.

Step 3 - Building the Working Prototype. The recorded sessions were carefully reviewed by the researcher. The original knowledge base consisted of the facts and rules obtained from the original knowledge engineering sessions.

On the final day of the initial series of knowledge

engineering sessions, a simple expert system prototype for MEB
preparation was demonstrated to the expert. This acted to
stimulate further ideas from the expert and showed him how the
system worked. The researcher selected the VPEXPERT expert
system shell for prototype development (22).

Step 4 - Expanding and Verifying the System. During this
set of meetings with the expert, the expert system prototype
received an initial verification.

The expert reviewed a copy of the knowledge base code
with the researcher. The logic and the syntax used by the
system to reach conclusions was also explained. The expert
attempted to improve the interaction of the system with the
user. He corrected or added any information that may have
been overlooked during the first knowledge engineering
sessions. Any changes that needed to be made to the system
were made at this time.

Following the verification, the expert ran several
consultations and determined if the system was ready for
formal testing.

Performance Measurement

This phase of the research determined if the prototype
expert system increased the productivity of the medical
administrators/clerks who were able to use the system.
Several research questions were considered during this time.
The questions considered were:

1. Does the developed expert system prototype affect

the accuracy of MEB case preparation?

2. Does the developed expert system prototype affect the timeliness of MEB case preparation?

Step 1 - Experimental Design. One experiment was used to measure the effective difference between using the manual case preparation method and the expert system case preparation method. An analysis of variance determined if there was difference between the accuracy scores and the timeliness scores when using and not using the system. A Greco Latin Square was used to insure that the subjects randomly received test cases. The design used is seen in Figure 5.

The test subjects were given a evaluation report, see Appendices C & D, for each case and determined either manually or with the assistance of the expert system, the answers to the seven questions about the validity of the MEB package. The test subject's answers were compared to the correct answers as determined by the expert. The subjects could attain between 0 and 100 percent on the accuracy portion of the evaluation. Timeliness was measured as the time required to complete an evaluation either manually or using the expert system.

Step 2 - Test Case Selection. This step involved the selection of cases to be used for the testing of the expert system. A common case was defined as one that was often encountered and a uncommon case was one that is seldom encountered. The expert selected a common and a uncommon case from the MEB cases previously chosen. These cases were run through the prototype expert system to make sure the system

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MEIA	SEC	MEC	SHC	MHI
SHI	MEIA	SHC	MHC	SEC
MHC	MHIA	SEI	SHC	MEC
SHC	MHC	SHI	MEIA	SEC
MEC	SHC	MHC	SEI	MHIA

Row labels (top to bottom): Novice, Expert, Intern, Intern, Intern

Legend:

M - Manual

E - Easy

C - Complete

S - System

H - Hard

IA - Incomplete Administration

I - Incomplete Test
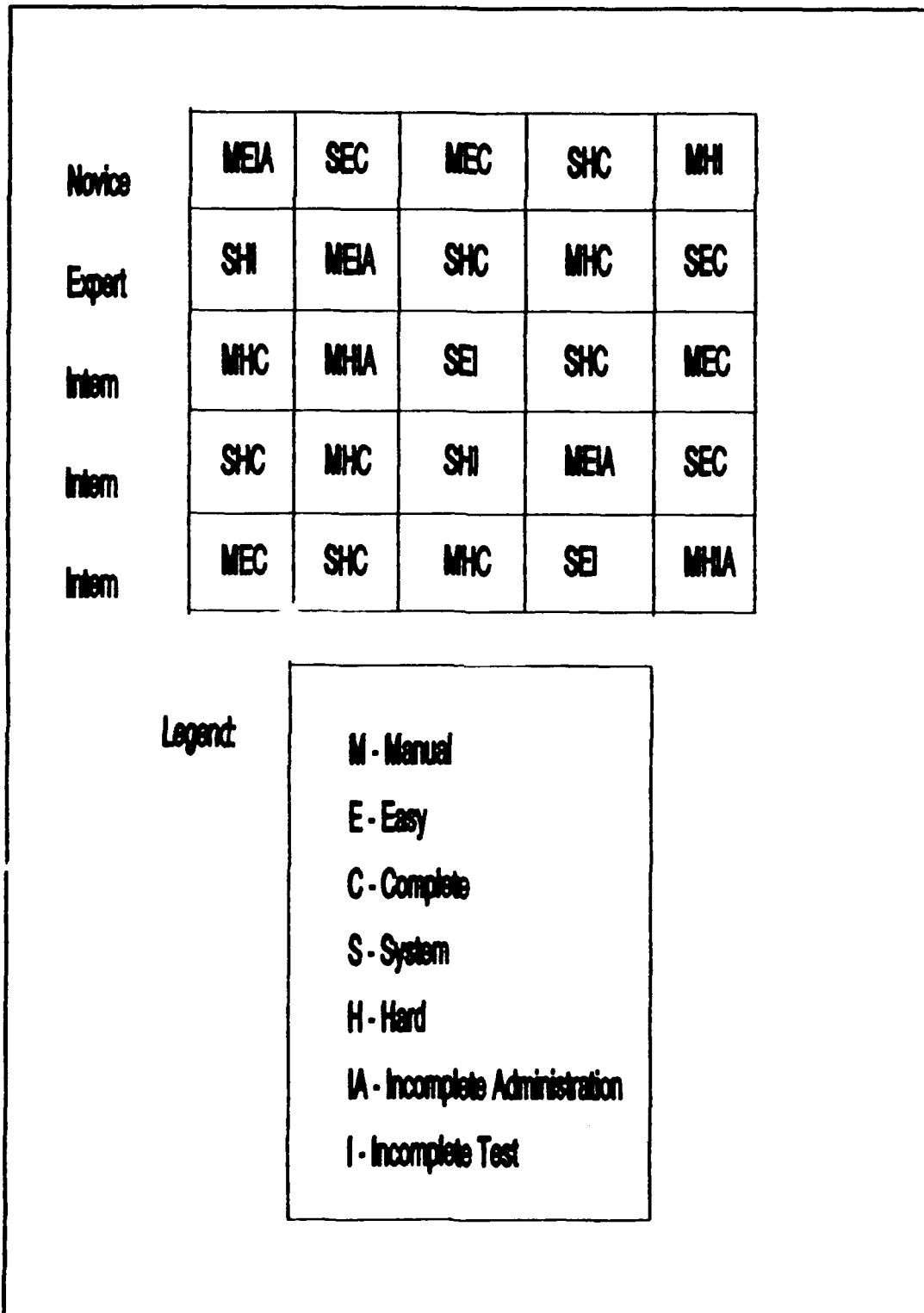
Figure 5.   Greco Latin Square

could solve the cases.

Step 3 - Test Key Development. A test key was developed in order to measure the effectiveness of the test. The knowledge gathered from was used to determine the correct information for each MEB case. Test subjects answers were compared against these answers during the system evaluation. Subjects were given scores of between 0 and 100 which was determined by the number of correct answers chosen during a case evaluation.

Step 4 - Test Administration. The test was conducted at the AFIT School of Systems and Logistics. Prior to the evaluation, each subject was required to fill out a question-naire that asked their level of MEB experience. Both written instructions and verbal instructions were provided to the subjects prior to the beginning of the evaluation.

Each person evaluated was given either a common case or uncommon case to solve without the assistance of the expert system. Time allotted for this phase of the test was 15 minutes. At the end of the time period, cases were collected, and redistributed in such a manner as to allow each person to work on another type of case. For example, during the first session person A worked on a common case. In the next session a person worked on a uncommon case. At the end each session, tests were again collected and redistributed to according to the experimental design. Each person alternated between the manual evaluation method and the expert system evaluation method.

The test subjects' performance were measured by comparing their answers and the correct answers and the time taken to solve the cases with and without the use of the expert system. Scores were issued according to the percentage of correct answers versus incorrect answers. An analysis of variance was performed to determine if there was any difference between solving the MEB cases without the use of the expert system prototype versus solving the cases using the prototype. Areas assessed were the time taken to complete the case and the number of correct answers made.

The test subjects' previous experience with hardware and software and the expert systems user friendliness were factors that affected the amount of time required to complete a case evaluation.

The test subjects filled out a critique of each case that they evaluated. An example of the critique can be found in Attachment E.

Summary

This chapter discussed the methodology used to develop and test the proposed expert system for MEB preparation. Knowledge engineering questions that were given to the expert can be seen Appendices A and B. Instructions that were provided to the test subjects during the performance testing of the system can be found in Appendices C and D. The test questionnaire used for the evaluation of MEB cases can be seen in Appendix E. The computer code of the MEBA system can be

found in Appendix F. The methodology was similar to that of Capt McCain in his development of a system for asset reconcil-iation (17:63-87).

IV. Results, Findings, and Analysis

Overview

This chapter presents the results of the analysis of the accuracy and timeliness experiments. Data collected during the accuracy and timeliness testing sessions was first submitted to a statistical test to determine the normality of the data. The Shapiro-Wilk Test was performed since the sample size was less than 2000 (25:119). The accuracy data and the timeliness data show probabilities of normality of approximately 90.0 and 94.8 percent respectively, therefore both sets of data are said to be normally distributed. The results of the normality test for the accuracy data is found below in Table 1.

TABLE 1

NORMALITY TEST FOR ACCURACY DATA

Variable=ACCURACY

Moments

N	25	Sum Wgts	25
Mean	72	Sum	1800
Std Dev	22.01704	Variance	484.75
Skewness	-0.131	Kurtosis	-1.18846
USS	141234	CSS	11634
CV	30.57922	Std Mean	4.403408
T:Mean=0	16.35097	Prob>｜T｜	0.0001
Num ^= 0	25	Num > 0	25
M(Sign)	12.5	Prob>｜M｜	0.0001
Sgn Rank	162.5	Prob>｜S｜	0.0001
W:Normal	0.900894	Prob<W	0.0188

The results of the normality test for the timeliness data can found in Table 2.

TABLE 2

NORMALITY TEST FOR TIMELINESS DATA

Variable=TIMELINESS

Moments

N	25	Sum Wgts	25
Mean	6	Sum	150
Std Dev	3.41565	Variance	11.66667
Skewness	0.531896	Kurtosis	-0.31314
USS	1180	CSS	280
CV	56.9275	Std Mean	0.68313
T:Mean=0	8.783101	Prob>|T|	0.0001
Num ^= 0	25	Num > 0	25
M(Sign)	12.5	Prob>|M|	0.0001
Sgn Rank	162.5	Prob>|S|	0.0001
W:Normal	0.947856	Prob<W	0.2351

Accuracy Scores

With normally distributed data, the investigator performed a two sample t-test and a one-way analysis of variance test at the 10 percent significance level. Test results can be found in Table 3.

The mean score for accuracy using the manual method of evaluating a case was determined to be 64.85. The mean score for accuracy using the expert system was 79.75. The analysis of variance test (ANOVA) indicated that the difference in means was significant at the 10 percent level with a Pr>F value of 0.0911. Note specifically that the overall accuracy of the test subjects assisted by the expert system was increased by nearly 15 percent.

The percentage of correct answers was determined for each question using the expert system method of evaluation and the

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TABLE 3

STATISTICAL ANALYSIS OF ACCURACY DATA

T-TEST

Variable: ACCURACY

Method	N	Mean	Std Dev	Std Error	Minimum	Maximum
Manual	13	64.846	22.270	6.177	29.000	100.000
System	12	79.750	19.763	5.705	43.000	100.000

Variances	T	DF	Prob>¦T¦
Unequal	-1.7725	23.0	0.0896
Equal	-1.7637	23.0	0.0911

For HO: Variances are equal, F' = 1.27   DF = (12,11)
Prob>F'=0.6993

ANOVA TEST FOR COMPARING ACCURACY DATA

Variable: ACCURACY

Analysis of Variance for Accuracy Data

Dependent Variable: ACCURACY

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	1386.058	1386.058	3.11	0.0911
Error	23	10247.942	445.563		
Corrected Tot	24	11634.000			

R-Square	C.V.	Root MSE	ACC Mean
0.119139	29.31716	21.108356	72.000000

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Method	1	1386.0577	1386.0577	3.11	0.0911

manual evaluation method. The results can be seen below in Figure 6.
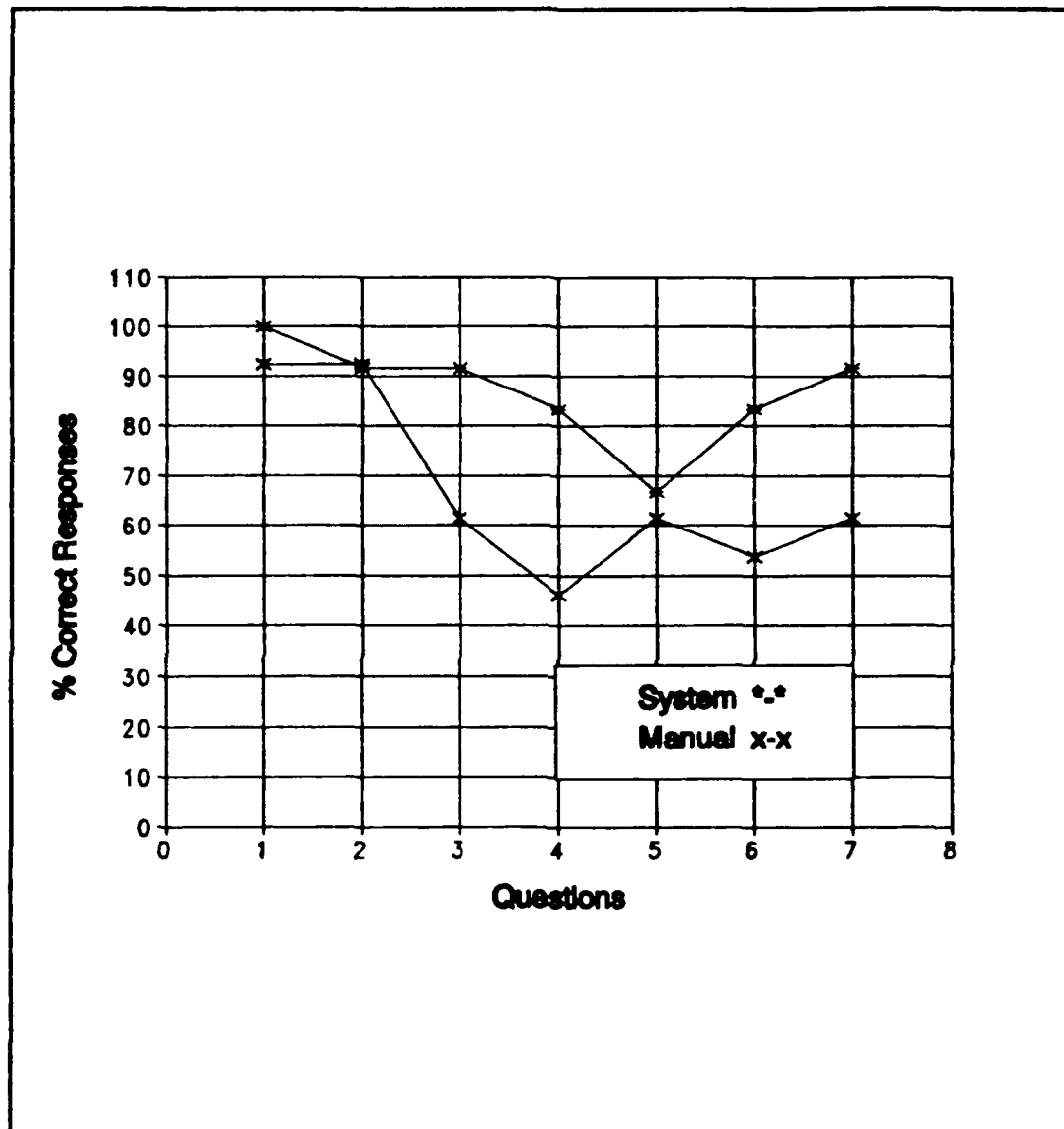
Figure 6. Questions and Percent Correct Responses

Timeliness Scores

A two sample t-test and a one-way analysis of variance test was performed at the 10 percent significance level on the timeliness data. The results can be found in Table 4.

The mean score for timeliness using the manual method was 4.154 while the mean score for timeliness using the expert system was 8.083. The ANOVA test resulted in a Pr>F value of 0.0009, indicating that this difference was significant. The overall time to completion increased by nearly 4 minutes when the expert system was used.

Learning Study

Ten additional cases were used to examine the ability of the subjects to learn how to use the expert system. Test cases were distributed to the subjects. They evaluated each case using only the expert system and the time taken to complete each evaluation was recorded. The times taken by the subjects to complete a case were added together and the average time for case completion was determined. The natural logarithm was taken for each individual case time as well as the average time and plotted to examine the subjects ability to learn how to use the expert system. The plot of these values can be found in Figure 7.

Results indicated that as the number of cases evaluated increased and the subjects "learned" how to use the system, the time required to complete the evaluation decreased. After ten evaluations the average time required to complete an MEB case while assisted by the expert system was approximately four minutes. Note that the mean time to complete a MEB case manually during the timeliness study was found to be approximately four minutes.

TABLE 4

STATISTICAL ANALYSIS OF TIMELINESS DATA

T-TEST

Variable: TIME

Method	N	Mean	Std Dev	Std Error	Minimum	Maximum
Manual	13	4.000	2.236	0.620	1.000	8.000
System	12	8.167	3.186	0.920	3.000	13.000

Variances	T	DF	Prob>¦T¦
Unequal	-3.7561	19.0	0.0013
Equal	-3.8098	23.0	0.0009

For H0: Variances are equal, F' = 2.03 DF = (11,12)
Prob>F' = 0.2393

ANOVA TEST FOR COMPARING TIMELINESS DATA

Variable: TIMELINESS

Analysis of Variance for Timeliness Data

Dependent Variable: TIMELINESS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	108.333	108.333	14.51	0.0009
Error	23	171.667	7.4638		
Corrected Tot	24	280.000			

R-Square	C.V.	Root MSE	MIN Mean
0.386905	45.53316	2.7319898	6.000000

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Method	1	108.333	108.333	14.51	0.0009
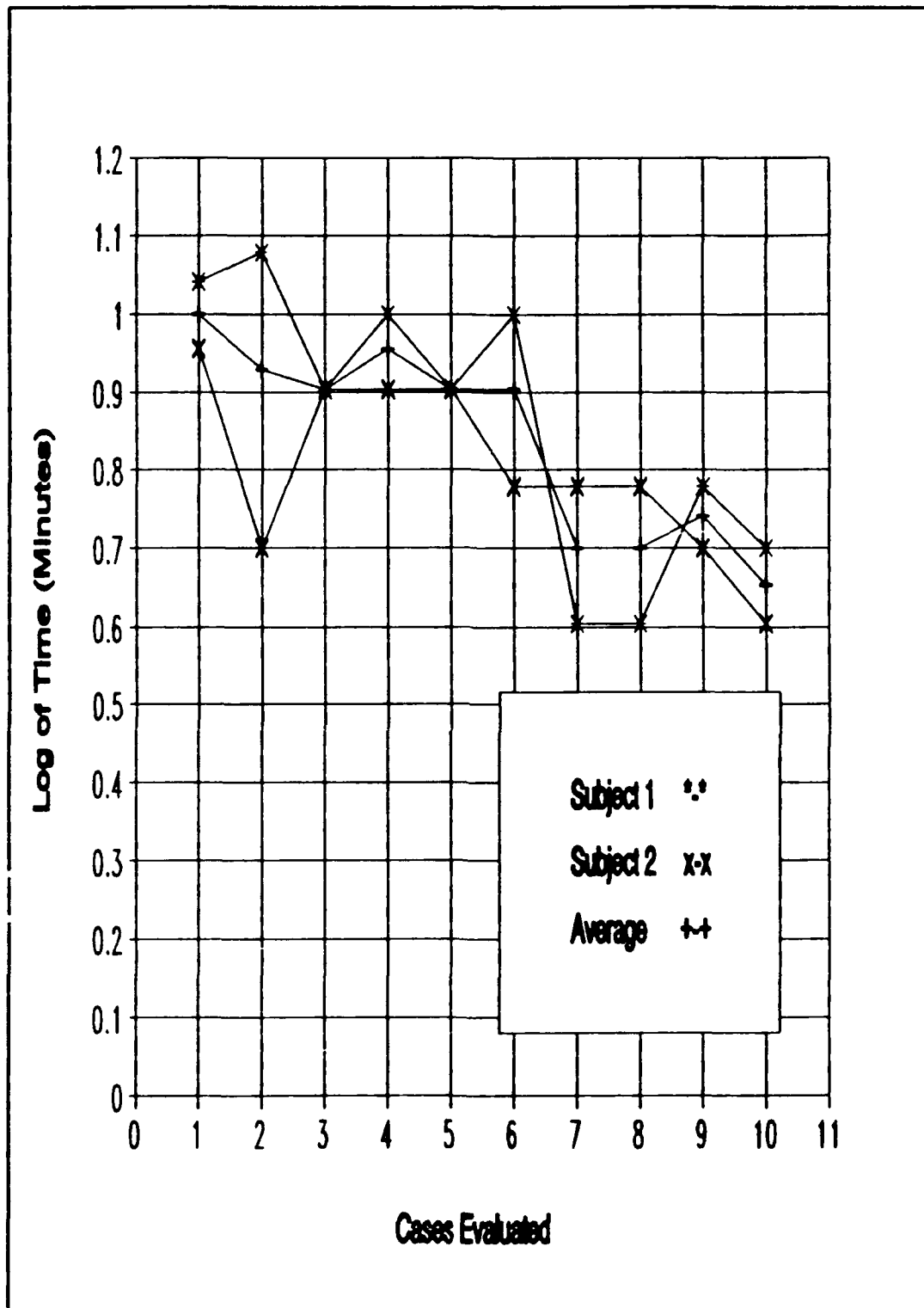
Figure 7. Cases and Completion Times

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Other Findings

One finding for which no formal research questions were established was encountered. The finding concerned definition of the term "lymphoma"by one of the test subjects during the one of the case evaluations. He did not know that a lymphoma is a type of tumor or malignancy as defined in AFR 160-43. Although the expert system has a heading "Tumor or Malignancy" in one of the pull-down menus, the subject did not know to choose that heading to evaluate the case he was working on and this resulted in a time delay in completing the case.

Summary

Chapter IV presented the results and other findings of this research project. The accuracy of the test subjects who were assisted by the expert system was higher than the accuracy of the test subjects not assisted by the expert system. A nearly 15 percent improvement in accuracy of MEB case completion was noted. A comparison was also done between the percentage of correct answers while using the expert system evaluation method and the manual evaluation method. It was noted that the system produced a higher percentage of correct answers than the manual method of case evaluation.

The time to complete an evaluation case by the test subjects who used the expert system was longer than the time to complete an evaluation by test subjects who performed the evaluation manually. An increase of approximately 4 minutes for test completion for subjects was noted.

The ability of the subjects to learn how to use the expert system was also studied. The results indicated that as the number of cases increased, the time required to complete the evaluation while assisted by the system decreased. In fact, the average time for completion of a case was found to be approximately 4 minutes, which was essentially equal to the manual case completion time during the timeliness testing.

V. Summary, Conclusions, and Recommendations

Overview

The purpose of this chapter is to provide an overview of the entire research project. The research conclusions will be addressed and suggestions for further study presented. The first section is a summary of the main objective of the research, the methodology, and the research findings. The next section discusses conclusions drawn from the research and the contributions made by the study. The final section gives some recommendations for future research.

Summary of Research

This section provides a quick review of the research objective, methodology, and findings.

Research Objective. The objective of this research was to determine if an expert system can be used to increase the accuracy and timeliness of medical evaluation board (MEB) case preparation. The development of an expert system for MEB preparation increased the accuracy of the MEB section personnel by nearly 15 percent validated the accuracy objective. By increasing the accuracy in case preparation, savings could ultimately result for the government due to fact that all the required documentation for an MEB case will be present in the case initially without having to go back and accomplish missing medical tests or administrative paperwork.

Research Methodology. The methodology was divided into problem selection, knowledge engineering, and performance

measurement. The objective of the problem selection phase was to determine a problem that could be addressed by expert system development and to find an individual to act as a domain expert in order to gather the knowledge to be used in the development of the knowledge base. The purpose of the knowledge engineering phase was to gather the pertinent information from written sources and the domain expert that needed to be incorporated into the expert system's knowledge base. The final phase was the performance measurement of the expert system. This was carried out to determine if the expert system could in fact increase the productivity of the MEB section personnel using the system.

The research findings are grouped according to accuracy and timeliness. The overall accuracy of the medical board section personnel was increased by approximately 15 percent. The overall timeliness, the time to complete a test case, was increased by approximately 4 minutes when assisted by the expert system. The learning study revealed that as the subjects became more familiar with the system, the amount of time that they required to complete an MEB case decreased. In fact, the average time required to complete the final case was approximately four minutes. This was essentially equal to the amount of time used to complete an MEB case manually during the timeliness test. One finding for which there was not a research question established in advance was the fact that one of the MEB section personnel had problems determining the meaning of a given diagnosed problem.

Conclusions

The conclusions discussed in this section are related to the four research questions addressed in the study.

Research Question 1: Is MEB case preparation a suitable problem for expert system development?

Conclusion 1: MEB case preparation was determined to be a suitable problem for expert system development. MEB case preparation met the problem selection criteria as described in Chapter II. The use of expert system technology in solving MEB evaluation cases increased the accuracy of case preparation by nearly 15 percent over the accuracy of MEB case preparation without the use of the expert system. The increased accuracy in case preparation supports the assumption that the MEB case preparation task is appropriate for the development of an expert system.

Research Question 2: Can the knowledge needed to solve the selected problem be extracted from the literature and an expert?

Conclusion 2: The finding that the test subjects that were assisted by the expert system had higher accuracy scores suggests that the knowledge required to prepare an MEB case can be extracted from the literature and an expert. Medical board section personnel commented that the expert system helped to increase their understanding as to the peculiarities of particular case requirements.

Research Question 3: Can the rules needed to prepare a MEB case be encoded into the VPEXPERT software program?

Conclusion 3: The VPEXPERT software program was capable of incorporating the rules needed to perform the task of MEB case preparation. The expert system developed, the Medical Evaluation Board Advisor, contained 153 rules and demonstrated the ability to aid the MEB section personnel in the preparation of various cases.

The ability of the expert system to interphase with a data base program, dbase III Plus, enables potential users to update the information in the data base easily if and when the requirements change.

Research Question 4: How does the developed expert system prototype affect the accuracy and timeliness of the users? This question is broken into two specific questions. The first question: Does the expert system increase the accuracy of MEB case preparation?

Conclusion 4: The expert system affected the users by increasing their accuracy in MEB case preparation by nearly 15 percent. This increase in accuracy in case preparation could result in a large savings in government funds by making sure the proper administrative procedures and medical tests are included in the case. Inclusion of the required tests and administrative documentation results in a timely processing of the MEB case at the local level and precludes the return of the case from Randolph AFB due to missing administrative documentation or medical tests. Properly processed cases ensure fair processing of the individual being boarded.

The second specific question: Does the use of the expert

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system reduce the time needed by the MEB section personnel to complete the MEB case preparation?

Conclusion 5: The research findings indicated that the MEB section personnel assisted by the expert system took approximately 4 minutes longer to complete the preparation of an MEB case. The poor performance in timeliness in case preparation was attributed to several reasons. First, the lack of user familiarity with the system. Second, the test subjects lack of knowledge in regards to medical terminology.

Subjects tested were given a five minute introduction regarding expert system consultations. The consultation involved the following areas: the processing of a specific problem area and determining if it was a boardable problem or not; the determination of proper administrative documentation and medical tests that needed to be performed; the proper format of the narrative summary; and finally the time allotted to process the MEB case. This was the first time that the test subjects were exposed to the format and it was assumed that this lack of exposure to how the expert system ran played a role in negatively impacting the timeliness of case completion.

Conclusion 6: The learning study indicated that as the subjects became more familiar with the system, their time to complete an MEB case decreased. As the subjects learned how to use the expert system, the amount of time required to evaluate a case decreased. In fact, the average case evaluation time of the tenth case was approximately equal to the

manual case evaluation time found during the timeliness study.

Recommendations for Future Research

The extension of this research would be to include a larger sampling of medical administrators in order to look at the role that the administrator's experience and case difficulty plays in predicting accuracy and timeliness of MEB case completion.

Further expansion of this prototype expert system would be to include the administrative procedures required once the MEB case is returned from the physical evaluation board (PEB) section at Randolph AFB. Another possible avenue would be to include a hypertext feature that could be used if administrators have questions about medical terminology. Finally a section could be added to compute pay and retirement benefits if the patient is determined to be unfit for duty worldwide and is to be separated from the service.

Expert systems will continue to have a substantial impact on the roles played by medical administrators. The research conducted provides a base of knowledge regarding expert systems and the roles they can play in the field of medical administration.

Appendix A: <u>Letter</u> <u>To</u> <u>Expert</u>

AFIT/LSA
Wright-Patterson, OH 45433

7 January 1991

Mr. John R. Downey, DAFC
Medical/Physical Evaluation Board Liaison Officer
USAF Medical Center/SGRM
Wright-Patterson AFB, OH   45433-5300

Dear Mr. Downey:

The following list of questions are provided in order to help you generate some ideas as to what type of information can be used in an expert system for medical evaluation board (MEB) preparation at the local level. Please take the time to review the questions and jot down some notes on each one prior to our first knowledge engineering session.

1.   What are the types of things that MEB officers do (generic subtasks)?

2. Which of these tasks require expertise on the part of the MEB officer?

3.   What is the nature of this expertise?

4.   What are the characteristics of a good MEB officer?

5.   What are some specific problems that MEB officers are frequently required to solve?

6. Prioritize the problems you listed in question # 5 in terms of frequency of occurrence with # 1 assigned to the problem that occurs most frequently.

7.   Prioritize these problems in terms of importance to successful accomplishment of the MEB officer's task, again with # 1 representing the most important problem.

8. Talk through a flow chart of the MEB officer's tasks. How do these tasks relate to one another?

9. What are the exceptions to the normal process? What would lead to these deviations?

I would like to thank you in advance for your cooperation

in this research. The time and effort you are investing in this project will be a definite benefit to both experienced and inexperienced MEB officers throughout the Air Force. If you have any questions in regard to the project, please feel free to contact me at 513-255-4437 (work) or 513-427-0824 (home). Thanks again for all your help.

Sincerely,

JERRY S. G. HARRINGTON, Capt, USAF   cc: WPAFB Med Ctr/SGI
Expert System Project Officer   AFIT/LSM

Appendix B: Knowledge Engineering

Questionnaire for Knowledge Engineering

Please answer the following questions. Be as specific as possible. Read all questions before answering.

1. Describe in general terms the medical administrator's responsibility in regards to the medical evaluation board (MEB) process.

2. What do you consider the most difficult part of the administrator's role in the MEB process?

3. What is the most common mistake made during the preparation of the MEB?

4. Do certain medical reasons require different administrative procedures during the preparation of a MEB? If so, what type of reasons and how are the procedures different.

5. Once the AFF 570 has been processed and the person entered into the MEB system, what other forms are required to be processed by the medical administrator? Are there any peculiarities in the forms that could result in time delays?

Appendix C: <u>Written</u> <u>Directions</u> <u>Provided</u> <u>to</u> <u>Test</u> <u>Subjects</u>

DIRECTIONS PROVIDED TO SUBJECTS
WHEN ASSISTED BY EXPERT SYSTEM

The purpose of this exercise is to field test the Medical Evaluation Board Advisor (MEBA) Expert System. This system was developed to assist medical administrators in the preparation of MEB cases. This evaluation is designed to see if medical administrators do a better job preparing a MEB case when assisted by MEBA.

To use MEBA, simply answer the questions when they are presented to you. In some questions you only need to choose between 'Yes' and 'No' choices. In others you will have to pick choices from menus that will be provided to you. Based upon your choices, MEBA will provide you with a listing of items that need to be accomplished for the MEB case.

Before beginning work on each case, first annotate the start time on the line next to the STARTING TIME block. Upon completion of each case annotate the time of completion on the line next to the FINISHING TIME block. Once this is done, please turn to page 2 and complete the CASE REVIEW QUESTION-NARIE. If you finish before the allotted time is up, simply raise your hand and the evaluator will pick up the case. Follow this procedure for each case. When you have completed all cases you may leave the evaluation room. Leave quietly since others may still be working. Please adhere to the following rules during the evaluation:

1. Do not write in or remove items from the case folders.

2. Do not talk with anyone about the cases or what you believe are the correct answers.

3. Do not be concerned with others finishing before you. You all will be given 15 minutes to complete each case. As mentioned before, if you finish earlier simply annotate the time on the line next to the FINISHING TIME block of your MEBA EVALUATION REPORT.

4. Please do not take anything out of the room until the evaluation is done.

DIRECTIONS PROVIDED TO SUBJECTS WHEN
NOT ASSISTED BY EXPERT SYSTEM

The purpose of this exercise is to field test the Medical Evaluation Board Advisor (MEBA) Expert System. This system was developed to assist medical administrators in the preparation of MEB cases. This evaluation is designed to see if medical administrators do a better job preparing a MEB case when assisted by MEBA.

Before beginning work on each case, first annotate the start time on the line next to the STARTING TIME block. Upon completion of the case, please annotate the time of completion on the line next to the FINISHING TIME block. Once this is done, please turn to page 2 and complete the CASE REVIEW QUESTIONNAIRE. If you finish before the allotted time is up, simply raise your hand and the evaluator will pick up the case. Follow this procedure for each case. When you have completed all the cases, you may leave the evaluation room. Please leave quietly since others may still be working.

Please adhere to the following rules during the evaluation:

1. Do not write in the case folder.

2. Do not talk with anyone about the case or what you believe are the correct answers.

3. Do not be concerned with others finishing before you. You all will be given 15 minutes to complete each case. As mentioned before, if you finish earlier simply annotate the time on the line next to the FINISHING TIME block on your

questionnaire.

4. Please do not take anything out of the room until the evaluation is done.

Appendix D: <u>Cover Sheet for Evaluation Testing</u>

COVER SHEET FOR EVALUATION TESTING

NAME:_____   ASSIGNED SUBJECT #:_____

DUTY TITLE:_____

FREQUENCY OF DOING MEBs (Circle only one of the following
answers please): Never, Weekly, Monthly, Quarterly, Yearly

YEARS OF EXPERIENCE IN DOING MEBs:_____

SELF-CLARIFICATION OF PROFICIENCY (Please put an (x) next to
the response that applies to you):

_____ I have very little experience doing MEBs.

_____ I can do them but find some difficult.

_____ I can do most without assistance.

_____ I am an expert in doing MEBs.

Appendix E: Test Questionnaire

MEBA EVALUATION REPORT

CASE #:_____

EVALUATION METHOD: Expert System

STARTING TIME:_____

Directions: Please use this form to report your evaluation of
the MEB case. Review the case using the method indicated
above. For the expert system method, answer the questions
asked by the expert system as well as the questions below.
(Note: Please circle your answers below.)

Question 1: Is this case boardable?
Answer 1: Yes, No.

Question 2: Given the patient's problem, are the conditions
that make it a boardable problem according to USAF regulations
present in the case?
Answer 2: Yes, No.

Question 3: Are all the preliminary administrative procedures
that need to be accomplished present in the case?
Answer 3: Yes, No.

Question 4: Are all the tests for the problem present in the
case?
Answer 4: Yes, No.

Question 5: When reviewing the Narrative Summary, are the
factors that need to be considered in the evaluation of
disability considered in the write-up?
Answer 5: Yes, No.

Question 6: Are all the required Narrative Summary Headings
included?
Answer 6: Yes, No.

Question 7: Once initiated, how much time do you have to
process a case of this type?
Answer 7: 90 Days, 120 Days, Call Peblo Now, Within 90 Days,
Within 1 Year.

FINISHING TIME:_____

CASE REVIEW QUESTIONNAIRE

If you finish before the allotted time is up, please take the time to complete the following questions. Simply put an (x) before the statement that you believe best applies. Mark only one statement for each question.

If you finish after the allotted time is up, please raise your hand and the evaluator will pick up the case.

You may begin working on the next case as soon as soon the evaluator has distributed it to you. Thank you.

Comments about this MEB case:

1. Case Difficulty?

   __ I felt this was a very simple case to evaluate.

   __ I felt this was an average case to evaluate.

   __ I felt this was a difficult case to evaluate.

2. Accuracy of Review?

   __ I feel very comfortable with my evaluation.

   __ I feel my evaluation was correct.

   __ I'm not quite sure of my evaluation.

Appendix F: <u>Computer Code for Expert System</u>

```
!**************************************************************
!                    ATTENTION PROGRAMMERS
!          Please read this block before changing the code
!
!This program has been written    using    the    Professional
!Version  of VP Expert, Release 2.2.  This software supports
!multiple  chaining of knowledge bases but does not support
!nested loops.  The structure of the rules is rigid - there-
!fore  please do not change the sequence of the rules block(s).
!
!**************************************************************
!      Purpose of Program
!
!The purpose   of this expert system is to aid the medical
!evaluation board (MEB)  clerk/administrator in  the  prepara-
!tion of MEBs.  The areas addressed in the system include the
!type of  medical problems that may result in board referral,
!the administrative procedures that need to be accomplished,
!the type of medical  tests that need to be accomplished, the
!format and key words that are to be present in the Narrative
!Summary, and the allotted time to accomplish the MEB for given
!problems.
!**************************************************************
EXECUTE;                              !Begins consultation
ENDOFF;                        !Eliminates need to press 'End'
RUNTIME;                        !Eliminates display of logic
BKCOLOR=3;                        !Sets bkcolor to light blue
!**************************************************************
!Actions Block

ACTIONS                            !Beginning of Actions block
CLS                                        !Clears screen
COLOR=15                          !Sets text color to bright white
WOPEN 1,2,3,15,73,1                      !Defines 1st marquis
ACTIVE 1                              !Activates 1st marquis
DISPLAY "


              ***********************************
              THE MEDICAL EVALUATION BOARD ADVISOR
              ***********************************


        This Expert System Will Help You Prepare For Your Next
Medical Evaluation Board.


              Press Any Key To Begin The Consultation....~"
                                         !Displays message
WCLOSE 1                                 !Closes 1st marquis
CLS                                        !Clears screen
```

```
FIND Option                                    !Finds goal variable
WHILETRUE Option=Problems THEN                     !Sets up a loop
CLS                                           !Clears the screen
CHAIN B:\PROBLEMS                        !Chains to 'Problems' kbs
RESET Option                             !Resets goal variable
END                                                !Ends loop

WHILETRUE Option=Time THEN                         !Sets up a loop
CLS                                           !Clears the screen
CHAIN B:\TIME_LIM                      !Chains to 'Time Limit' kbs
RESET Option                             !Resets goal variable
END                                                !Ends loop

WHILETRUE Option=Summary THEN                      !Sets up a loop
CLS                                           !Clears the screen
CHAIN B:\SUMMARY                        !Chains to 'Summary' kbs
RESET Option                             !Resets goal variable
END;                                               !Ends loop
!******************************************************************
!Statements Block

ASK Option: "What  Information  Do  You  Need  To  Know  About
MEB(s)?";                                  !Asks 'option' variable
CHOICES Option: Problems,Summary,Time,None;
                                          !Gives variable choices


!******************************************************************
ENDOFF;              !Eliminates the need to press 'End'
RUNTIME;             !Eliminates the display of logic
AUTOQUERY;           !Addresses value of goal variable
EXECUTE;                           !Begins consultation
BKCOLOR=3;                  !Sets bkcolor to light blue
!******************************************************************
!Actions Block

ACTIONS                              !Beginning of Actions block
    CLS                                    !Clears the screen
    TRUTHTHRESH=1                !Sets truththresh value to 1
    COLOR=15                   !Sets text color to bright white
WOPEN 2,2,3,15,73,1                     !Defines 2nd marquis
ACTIVE 2                                !Activates 2nd marquis
DISPLAY "

              ************************************
              THE MEDICAL EVALUATION BOARD ADVISOR
              ************************************
```

        This Knowledge Base Helps You To Determine If The
Reason For A Patient Being Referred To A MEB Meets The
Criteria According To The Governing USAF Regulations. It
Also Finds Required Administrative Procedures That Need To Be
Completed And Tests That Are Required For Specific Problems.

```
Press Any Key To Continue The Consultation....~"
                                            !Displays message
WCLOSE 2                                     !Closes 2nd marquis

FIND Next                                   !Finds goal variable
WHILETRUE Next=Complaint THEN                    !Sets up a loop
    RESET ALL                   !Resets all values to unknown
    MENU Problem,ALL,B:\PROBLEM,Areal !Generates options menu
    FIND Action                         !Finds goal variable
    MRESET Problem                              !Resets menu
    GET Problem=Areal,B:\PROBLEM,ALL !Retrieves dbase values
    CLS                                 !Clears the screen
    COLOR=15                 !Sets text color to bright white
    WOPEN 3,1,6,20,67,4             !Defines the 3rd marquis
    ACTIVE 3                          !Activates 3rd marquis
    DISPLAY "{Problem} MEB Warrented If Any Apply:
************************************************************
{PROB1}
{PROB2}
{PROB3}
{PROB4}
{PROB5}
{PROB6}
{PROB7}
{PROB8}
{PROB9}
{PROB10}
{PROB11}
{PROB12}
{PROB13}
{PROB14}
{PROB15}
Press Any Key To Continue The Consultation....~"
                                            !Displaysmessage
WCLOSE 3                                  !Closes 3rd marquis
CLOSE B:\PROBLEM                               !Closes dbase
CLS                                          !Clears screen
RESET ALL                           !Resets goal variable
FIND Next                           !Finds goal variable
CLS                                          !Clears screen
END                                             !Ends loop
FIND Reasonl                        !Finds goal variable
Continue=Administration
WHILETRUE Reasonl=Yes AND Continue=Administration THEN
                                             !Sets up loop
MENU Patient,ALL,B:\PATIENT,Branch   !Generates options menu
FIND Patient                        !Finds goal variable
MRESET Patient                              !Resets menu
GET Patient=Branch,B:\PATIENT,ALL   !Retrieves dbase values
CLS                                          !Clears screen
COLOR=15                 !Sets text color to bright white
WOPEN 4,1,6,20,67,1                   !Defines 4th marquis
```

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```
ACTIVE 4                                      !Activates 4th marquis
DISPLAY "             These Procedures Apply For {Patient}:
*******************************************************************
{PAPER1}
{PAPER2}
{PAPER3}
{PAPER4}
{PAPER5}
{PAPER6}
{PAPER7}
{PAPER8}
{PAPER9}
{PAPER10}
{PAPER11}
{PAPER12}
{PAPER13}
{PAPER14}
{PAPER15}
Press Any Key To Continue The Consultation....~"
                                              !Displays message
WCLOSE 4                                      !Closes 4th marquis
CLOSE B:\PATIENT                                   !Closes dbase
CLS                                             !Clears screen
RESET Patient                              !Resets goal variable
RESET Continue                             !Resets goal variable
COLOR=15                        !Sets text color to bright white
FIND Continue                             !Finds goal variable
CLS                                            !Clears screen
END                                           !Ends the loop


FIND Reason2                              !Finds goal variable
Again=Yes
WHILETRUE Reason2=Yes AND Again=Yes THEN          !Sets up loop
MENU Problem,ALL,B:\TESTER,Areal       !Generates menu options
FIND Problem                              !Finds goal variable
MRESET Problem                                   !Resets dbase
GET Problem=Areal,B:\TESTER,ALL        !Retrieves dbase values
CLS                                        !Clears the screen
COLOR=15                        !Sets text color to bright white
WOPEN 5,1,6,20,67,5                       !Defines 5th marquis
ACTIVE 5                                  !Activates 5th marquis
    DISPLAY "These Tests/Documents For {Problem}:
*******************************************************************
{TEST1}
{TEST2}
{TEST3}
{TEST4}
{TEST5}
{TEST6}
{TEST7}
{TEST8}
{TEST9}
{TEST10}
```

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Press Any Key To Continue The Consultation....~"
                                        !Displays message
WCLOSE 5                                !Closes 5th marquis
CLOSE B:\TESTER                         !Closes dbase
CLS                                     !Clears screen
RESET Problem                           !Resets goal variable
RESET Again                             !Resets goal variable
COLOR=15                      !Sets text color to bright white
FIND Again                              !Finds goal variable
CLS                                     !Clears screen
END                                     !Ends loop
COLOR=15                      !Sets text color to bright white
WOPEN 6,2,3,15,73,1                 !Defines the 6th marquis
ACTIVE 6                           !Activates the 6th marquis
DISPLAY "
            ***********************************
            THE MEDICAL EVALUATION BOARD ADVISOR
            ***********************************


      You Have Had A Chance To Review The Problems, The
Administrative   Procedures,  And  The   Necessary   Tests  &
Documents For Problems That Qualify For an MEB.


       Press Any Key To Continue The Consultation....~"
                                        !Displaysmessage
WCLOSE 6                                !Closes 6th marquis

CHAIN B:\SUMMARY;                  !Chains to 'Summary' kbs
!*******************************************************************
!Rules Block

RULE 1                                  !Mandatory rule label
IF      DUTY_STATUS=Army AND                    !Condition
        REFERRAL=USAF_570                       !Condition
        OR REFERRAL=Medical_Board_Slip          !Condition
        AND PROBLEM=Head                        !Condition
THEN    ACTION=Refer_to_MEB              !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";
RULE 2                                  !Mandatory rule label
IF      DUTY_STATUS=Air_Force AND               !Condition
        REFERRAL=USAF_570                       !Condition
        OR REFERRAL=Medical_Board_Slip          !Condition
        AND PROBLEM=Head                        !Condition
THEN    ACTION=Refer_to_MEB              !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 3                                  !Mandatory rule label
IF      DUTY_STATUS=Navy AND                    !Condition
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            REFERRAL=USAF_570                        !Condition
            OR REFERRAL=Medical_Board_Slip           !Condition
            AND PROBLEM=Head                         !Condition
THEN        ACTION=Refer_to_MEB              !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 4                                      !Mandatory rule label
IF      DUTY_STATUS=Marines AND                      !Condition
        REFERRAL=USAF_570                            !Condition
        OR REFERRAL=Medical_Board_Slip               !Condition
        AND PROBLEM=Head                             !Condition
THEN        ACTION=Refer_to_MEB              !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 5                                      !Mandatory rule label
IF      DUTY_STATUS=Coast_Guard AND                  !Condition
        REFERRAL=USAF_570                            !Condition
        OR REFERRAL=Medical_Board_Slip               !Condition
        AND PROBLEM=Head                             !Condition
THEN        ACTION=Refer_to_MEB              !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 6                                      !Mandatory rule label
IF      DUTY_STATUS=Army AND                         !Condition
        REFERRAL=USAF_570                            !Condition
        OR REFERRAL=Medical_Board_Slip               !Condition
        AND PROBLEM=Mouth_Nose_Pharynx_Larynx_Trachea
                                                     !Condition
THEN        ACTION=Refer_to_MEB              !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 7                                      !Mandatory rule label
IF      DUTY_STATUS=Air_Force AND                    !Condition
        REFERRAL=USAF_570                            !Condition
        OR REFERRAL=Medical_Board_Slip               !Condition
       AND PROBLEM=Mouth_Nose_Pharynx_Larynx_Trachea
                                                     !Condition
THEN        ACTION=Refer_to_MEB              !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 8                                      !Mandatory rule label
IF      DUTY_STATUS=Navy AND                         !Condition
        REFERRAL=USAF_570                            !Condition
        OR REFERRAL=Medical_Board_Slip               !Condition
       AND PROBLEM=Mouth_Nose_Pharynx_Larynx_Trachea
                                                     !Condition
THEN        ACTION=Refer_to_MEB              !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 9                                      !Mandatory rule label
IF      DUTY_STATUS=Marines AND                      !Condition
        REFERRAL=USAF_570                            !Condition
        OR REFERRAL=Medical_Board_Slip               !Condition
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        AND PROBLEM=Mouth_Nose_Pharynx_Larynx_Trachea
                                               !Condition
THEN    ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 10                               !Mandatory rule label
IF      DUTY_STATUS=Coast_Guard AND            !Condition
        REFERRAL=USAF_570                      !Condition
        OR REFERRAL=Medical_Board_Slip         !Condition
        AND PROBLEM=Mouth_Nose_Pharynx_Larynx_Trachea
                                               !Condition
THEN    ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 11                               !Mandatory rule label
IF      DUTY_STATUS=Army AND                   !Condition
        REFERRAL=USAF_570                      !Condition
        OR REFERRAL=Medical_Board_Slip         !Condition
        AND PROBLEM=Ears                       !Condition
THEN    ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 12                               !Mandatory rule label
IF      DUTY_STATUS=Air_Force AND              !Condition
        REFERRAL=USAF_570                      !Condition
        OR REFERRAL=Medical_Board_Slip         !Condition
        AND PROBLEM=Ears                       !Condition
THEN    ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 13                               !Mandatory rule label
IF      DUTY_STATUS=Navy AND                   !Condition
        REFERRAL=USAF_570                      !Condition
        OR REFERRAL=Medical_Board_Slip         !Condition
        AND PROBLEM=Ears                       !Condition
THEN    ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 14                               !Mandatory rule label
IF      DUTY_STATUS=Marines AND                !Condition
        REFERRAL=USAF_570                      !Condition
        OR REFERRAL=Medical_Board_Slip         !Condition
        AND PROBLEM=Ears                       !Condition
THEN    ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 15                               !Mandatory rule label
IF      DUTY_STATUS=Coast_Guard AND            !Condition
        REFERRAL=USAF_570                      !Condition
        OR REFERRAL=Medical_Board_Slip         !Condition
        AND PROBLEM=Ears                       !Condition
THEN    ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";
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RULE 16                                     !Mandatory rule label
IF      DUTY_STATUS=Army AND                 !Condition
        REFERRAL=USAF_570                    !Condition
        OR REFERRAL=Medical_Board_Slip       !Condition
        AND PROBLEM=Dental                   !Condition
THEN    ACTION=Refer_to_MEB                  !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 17                                     !Mandatory rule label
IF      DUTY_STATUS=Air_Force AND            !Condition
        REFERRAL=USAF_570                    !Condition
        OR REFERRAL=Medical_Board_Slip       !Condition
        AND PROBLEM=Dental                   !Condition
THEN    ACTION=Refer_to_MEB                  !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 18                                     !Mandatory rule label
IF      DUTY_STATUS=Navy AND                 !Condition
        REFERRAL=USAF_570                    !Condition
        OR REFERRAL=Medical_Board_Slip       !Condition
        AND PROBLEM=Dental                   !Condition
THEN    ACTION=Refer_to_MEB                  !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 19                                     !Mandatory rule label
IF      DUTY_STATUS=Marines AND              !Condition
        REFERRAL=USAF_570                    !Condition
        OR REFERRAL=Medical_Board_Slip       !Condition
        AND PROBLEM=Dental                   !Condition
THEN    ACTION=Refer_to_MEB                  !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 20                                     !Mandatory rule label
IF      DUTY_STATUS=Coast_Guard AND          !Condition
        REFERRAL=USAF_570                    !Condition
        OR REFERRAL=Medical_Board_Slip       !Condition
        AND PROBLEM=Dental                   !Condition
THEN    ACTION=Refer_to_MEB                  !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 21                                     !Mandatory rule label
IF      DUTY_STATUS=Army AND                 !Condition
        REFERRAL=USAF_570                    !Condition
        OR REFERRAL=Medical_Board_Slip       !Condition
        AND PROBLEM=Eyes                     !Condition
THEN    ACTION=Refer_to_MEB                  !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 22                                     !Mandatory rule label
IF      DUTY_STATUS=Air_Force AND            !Condition
        REFERRAL=USAF_570                    !Condition
        OR REFERRAL=Medical_Board_Slip       !Condition
        AND PROBLEM=Eyes                     !Condition
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THEN      ACTION=Refer_to_MEB                        !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 23                                             !Mandatory rule label
IF        DUTY_STATUS=Navy AND                       !Condition
          REFERRAL=USAF_570                          !Condition
          OR REFERRAL=Medical_Board_Slip             !Condition
          AND PROBLEM=Eyes                           !Condition
THEN      ACTION=Refer_to_MEB                        !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 24                                             !Mandatory rule label
IF        DUTY_STATUS=Marines AND                    !Condition
          REFERRAL=USAF_570                          !Condition
          OR REFERRAL=Medical_Board_Slip             !Condition
          AND PROBLEM=Eyes                           !Condition
THEN      ACTION=Refer_to_MEB                        !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 25                                             !Mandatory rule label
IF        DUTY_STATUS=Coast_Guard AND                !Condition
          REFERRAL=USAF_570                          !Condition
          OR REFERRAL=Medical_Board_Slip             !Condition
          AND PROBLEM=Eyes                           !Condition
THEN      ACTION=Refer_to_MEB                        !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 26                                             !Mandatory rule label
IF        DUTY_STATUS=Army AND                       !Condition
          REFERRAL=USAF_570                          !Condition
          OR REFERRAL=Medical_Board_Slip             !Condition
          AND PROBLEM=Lungs_&_Chest_Wall             !Condition
THEN      ACTION=Refer_to_MEB                        !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 27                                             !Mandatory rule label
IF        DUTY_STATUS=Air_Force AND                  !Condition
          REFERRAL=USAF_570                          !Condition
          OR REFERRAL=Medical_Board_Slip             !Condition
          AND PROBLEM=Lungs_&_Chest_Wall             !Condition
THEN      ACTION=Refer_to_MEB                        !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 28                                             !Mandatory rule label
IF        DUTY_STATUS=Navy AND                       !Condition
          REFERRAL=USAF_570                          !Condition
          OR REFERRAL=Medical_Board_Slip             !Condition
          AND PROBLEM=Lungs_&_Chest_Wall             !Condition
THEN      ACTION=Refer_to_MEB                        !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 29                                             !Mandatory rule label
IF        DUTY_STATUS=Marines AND                    !Condition
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          REFERRAL=USAF_570                            !Condition
          OR REFERRAL=Medical_Board_Slip               !Condition
          AND PROBLEM=Lungs_&_Chest_Wall               !Condition
THEN      ACTION=Refer_to_MEB                   !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 30                                       !Mandatory rule label
IF        DUTY_STATUS=Coast_Guard AND                 !Condition
          REFERRAL=USAF_570                            !Condition
          OR REFERRAL=Medical_Board_Slip               !Condition
          AND PROBLEM=Lungs_&_Chest_Wall               !Condition
THEN      ACTION=Refer_to_MEB                   !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 31                                       !Mandatory rule label
IF        DUTY_STATUS=Army AND                         !Condition
          REFERRAL=USAF_570                            !Condition
          OR REFERRAL=Medical_Board_Slip               !Condition
          AND PROBLEM=Heart                            !Condition
THEN      ACTION=Refer_to_MEB                   !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 32                                       !Mandatory rule label
IF        DUTY_STATUS=Air_Force AND                    !Condition
          REFERRAL=USAF_570                            !Condition
          OR REFERRAL=Medical_Board_Slip               !Condition
          AND PROBLEM=Heart                            !Condition
THEN      ACTION=Refer_to_MEB                   !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 33                                       !Mandatory rule label
IF        DUTY_STATUS=Navy AND                         !Condition
          REFERRAL=USAF_570                            !Condition
          OR REFERRAL=Medical_Board_Slip               !Condition
          AND PROBLEM=Heart                            !Condition
THEN      ACTION=Refer_to_MEB                   !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 34                                       !Mandatory rule label
IF        DUTY_STATUS=Marines AND                      !Condition
          REFERRAL=USAF_570                            !Condition
          OR REFERRAL=Medical_Board_Slip               !Condition
          AND PROBLEM=Heart                            !Condition
THEN      ACTION=Refer_to_MEB                   !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 35                                       !Mandatory rule label
IF        DUTY_STATUS=Coast_Guard AND                 !Condition
          REFERRAL=USAF_570                            !Condition
          OR REFERRAL=Medical_Board_Slip               !Condition
          AND PROBLEM=Heart                            !Condition
THEN      ACTION=Refer_to_MEB                   !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";
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RULE 36                                     !Mandatory rule label
IF      DUTY_STATUS=Army AND                        !Condition
        REFERRAL=USAF_570                           !Condition
        OR REFERRAL=Medical_Board_Slip              !Condition
        AND PROBLEM=Vascular_System                 !Condition
THEN    ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 37                                     !Mandatory rule label
IF      DUTY_STATUS=Air_Force AND                   !Condition
        REFERRAL=USAF_570                           !Condition
        OR REFERRAL=Medical_Board_Slip              !Condition
        AND PROBLEM=Vascular_System                 !Condition
THEN    ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 38                                     !Mandatory rule label
IF      DUTY_STATUS=Navy AND                        !Condition
        REFERRAL=USAF_570                           !Condition
        OR REFERRAL=Medical_Board_Slip              !Condition
        AND PROBLEM=Vascular_System                 !Condition
THEN    ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 39                                     !Mandatory rule label
IF      DUTY_STATUS=Marines AND                     !Condition
        REFERRAL=USAF_570                           !Condition
        OR REFERRAL=Medical_Board_Slip              !Condition
        AND PROBLEM=Vascular_System                 !Condition
THEN    ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 40                                     !Mandatory rule label
IF      DUTY_STATUS=Coast_Guard AND                 !Condition
        REFERRAL=USAF_570                           !Condition
        OR REFERRAL=Medical_Board_Slip              !Condition
        AND PROBLEM=Vascular_System                 !Condition
THEN    ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 41                                     !Mandatory rule label
IF      DUTY_STATUS=Army AND                        !Condition
        REFERRAL=USAF_570                           !Condition
        OR REFERRAL=Medical_Board_Slip              !Condition
    AND PROBLEM=Blood_Forming_Tissue_Immune_System !Condition
THEN    ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 42                                     !Mandatory rule label
IF      DUTY_STATUS=Air_Force AND                   !Condition
        REFERRAL=USAF_570                           !Condition
        OR REFERRAL=Medical_Board_Slip              !Condition
    AND PROBLEM=Blood_Forming_Tissue_Immune_System !Condition
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THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 43                                      !Mandatory rule label
IF      DUTY_STATUS=Navy AND                     !Condition
        REFERRAL=USAF_570                        !Condition
        OR REFERRAL=Medical_Bord_Slip            !Condition
    AND PROBLEM=Blood_Forming_Tissue_Immune_System !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 44                                      !Mandatory rule label
IF      DUTY_STATUS=Marines AND                  !Condition
        REFERRAL=USAF_570                        !Condition
        OR REFERRAL=Medical_Board_Slip           !Condition
    AND PROBLEM=Blood_Forming_Tissue_Immune_System !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 45                                      !Mandatory rule label
IF      DUTY_STATUS=Coast_Guard AND              !Condition
        REFERRAL=USAF_570                        !Condition
        OR REFERRAL=Medical_Board_Slip           !Condition
    AND PROBLEM=Blood_Forming_Tissue_Immune_System !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 46                                      !Mandatory rule label
IF      DUTY_STATUS=Army AND                     !Condition
        REFERRAL=USAF_570                        !Condition
        OR REFERRAL=Medical_Board_Slip           !Condition
        AND PROBLEM=Psycho_Psychoneuro_Other     !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 47                                      !Mandatory rule label
IF      DUTY_STATUS=Air_Force AND                !Condition
        REFERRAL=USAF_570                        !Condition
        OR REFERRAL=Medical_Board_Slip           !Condition
        AND PROBLEM=Psycho_Psychoneuro_Other     !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 48                                      !Mandatory rule label
IF      DUTY_STATUS=Navy AND                     !Condition
        REFERRAL=USAF_570                        !Condition
        OR REFERRAL=Medical_Board_Slip           !Condition
        AND PROBLEM=Psycho_Psychoneuro_Other     !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 49                                      !Mandatory rule label
IF      DUTY_STATUS=Marines AND                  !Condition
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          REFERRAL=USAF_570                        !Condition
          OR REFERRAL=Medical_Board_Slip           !Condition
          AND PROBLEM=Psycho_Psychoneuro_Other     !Condition
THEN      ACTION=Refer_to_MEB                  !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 50                                  !Mandatory rule label
IF        DUTY_STATUS=Coast_Guard AND             !Condition
          REFERRAL=USAF_570                        !Condition
          OR REFERRAL=Medical_Board_Slip           !Condition
          AND PROBLEM=Psycho_Psychoneuro_Other     !Condition
THEN      ACTION=Refer_to_MEB                  !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 51                                  !Mandatory rule label
IF        DUTY_STATUS=Army AND                     !Condition
          REFERRAL=USAF_570                        !Condition
          OR REFERRAL=Medical_Board_Slip           !Condition
          AND PROBLEM=Abdomen_&_Gastro_Condition   !Condition
THEN      ACTION=Refer_to_MEB                  !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 52                                  !Mandatory rule label
IF        DUTY_STATUS=Air_Force AND                !Condition
          REFERRAL=USAF_570                        !Condition
          OR REFERRAL=Medical_Board_Slip           !Condition
          AND PROBLEM=Abdomen_&_Gastro_Condition   !Condition
THEN      ACTION=Refer_to_MEB                  !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 53                                  !Mandatory rule label
IF        DUTY_STATUS=Navy AND                     !Condition
          REFERRAL=USAF_570                        !Condition
          OR REFERRAL=Medical_Board_Slip           !Condition
          AND PROBLEM=Abdomen_&_Gastro_Condition   !Condition
THEN      ACTION=Refer_to_MEB                  !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 54                                  !Mandatory rule label
IF        DUTY_STATUS=Marines AND                  !Condition
          REFERRAL=USAF_570                        !Condition
          OR REFERRAL=Medical_Board_Slip           !Condition
          AND PROBLEM=Abdomen_&_Gastro_Condition   !Condition
THEN      ACTION=Refer_to_MEB                  !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 55                                  !Mandatory rule label
IF        DUTY_STATUS=Coast_Guard AND              !Condition
          REFERRAL=USAF_570                        !Condition
          OR REFERRAL=Medical_Board_Slip           !Condition
          AND PROBLEM=Abdomen_&_Gastro_Condition   !Condition
THEN      ACTION=Refer_to_MEB                  !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";
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RULE 56                                    !Mandatory rule label
IF       DUTY_STATUS=Army AND                   !Condition
         REFERRAL=USAF_570                      !Condition
         OR REFERRAL=Medical_Board_Slip         !Condition
         AND PROBLEM=Abdomen_&_Gastro_Surgery   !Condition
THEN     ACTION=Refer_to_MEB               !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 57                                    !Mandatory rule label
IF       DUTY_STATUS=Air_Force AND              !Condition
         REFERRAL=USAF_570                      !Condition
         OR REFERRAL=Medical_Board_Slip         !Condition
         AND PROBLEM=Abdomen_&_Gastro_Surgery   !Condition
THEN     ACTION=Refer_to_MEB               !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 58                                    !Mandatory rule label
IF       DUTY_STATUS=Navy AND                   !Condition
         REFERRAL=USAF_570                      !Condition
         OR REFERRAL=Medical_Board_Slip         !Condition
         AND PROBLEM=Abdomen_&_Gastro_Surgery   !Condition
THEN     ACTION=Refer_to_MEB               !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 59                                    !Mandatory rule label
IF       DUTY_STATUS=Marines AND                !Condition
         REFERRAL=USAF_570                      !Condition
         OR REFERRAL=Medical_Board_Slip         !Condition
         AND PROBLEM=Abdomen_&_Gastro_Surgery   !Condition
THEN     ACTION=Refer_to_MEB               !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 60                                    !Mandatory rule label
IF       DUTY_STATUS=Coast_Guard AND            !Condition
         REFERRAL=USAF_570                      !Condition
         OR REFERRAL=Medical_Board_Slip         !Condition
         AND PROBLEM=Abdomen_&_Gastro_Surgery   !Condition
THEN     ACTION=Refer_to_MEB               !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 61                                    !Mandatory rule label
IF       DUTY_STATUS=Army AND                   !Condition
         REFERRAL=USAF_570                      !Condition
         OR REFERRAL=Medical_Board_Slip         !Condition
         AND PROBLEM=Genitourinary              !Condition
THEN     ACTION=Refer_to_MEB               !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 62                                    !Mandatory rule label
IF       DUTY_STATUS=Air_Force AND              !Condition
         REFERRAL=USAF_570                      !Condition
         OR REFERRAL=Medical_Board_Slip         !Condition
         AND PROBLEM=Genitourinary              !Condition
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THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 63                                          !Mandatory rule label
IF        DUTY_STATUS=Navy AND                       !Condition
          REFERRAL=USAF_570                          !Condition
          OR REFERRAL=Medical_Board_Slip             !Condition
          AND PROBLEM=Genitourinary                  !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 64                                          !Mandatory rule label
IF        DUTY_STATUS=Marines AND                    !Condition
          REFERRAL=USAF_570                          !Condition
          OR REFERRAL=Medical_Board_Slip             !Condition
          AND PROBLEM=Genitourinary                  !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 65                                          !Mandatory rule label
IF        DUTY_STATUS=Coast_Guard AND                !Condition
          REFERRAL=USAF_570                          !Condition
          OR REFERRAL=Medical_Board_Slip             !Condition
          AND PROBLEM=Genitourinary                  !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 66                                          !Mandatory rule label
IF        DUTY_STATUS=Army AND                       !Condition
          REFERRAL=USAF_570                          !Condition
          OR REFERRAL=Medical_Board_Slip             !Condition
          AND PROBLEM=Neurologic_Disorders           !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 67                                          !Mandatory rule label
IF        DUTY_STATUS=Air_Force AND                  !Condition
          REFERRAL=USAF_570                          !Condition
          OR REFERRAL=Medical_Board_Slip             !Condition
          AND PROBLEM=Neurologic_Disorders           !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 68                                          !Mandatory rule label
IF        DUTY_STATUS=Navy AND                       !Condition
          REFERRAL=USAF_570                          !Condition
          OR REFERRAL=Medical_Board_Slip             !Condition
          AND PROBLEM=Neurologic_Disorders           !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 69                                          !Mandatory rule label
IF        DUTY_STATUS=Marines AND                    !Condition
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          REFERRAL=USAF_570                          !Condition
          OR REFERRAL=Medical_Board_Slip             !Condition
          AND PROBLEM=Neurologic_Disorders           !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 70                                    !Mandatory rule label
IF        DUTY_STATUS=Coast_Guard AND            !Condition
          REFERRAL=USAF_570                          !Condition
          OR REFERRAL=Medical_Board_Slip             !Condition
          AND PROBLEM=Neurologic_Disorders           !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 71                                    !Mandatory rule label
IF        DUTY_STATUS=Army AND                   !Condition
          REFERRAL=USAF_570                          !Condition
          OR REFERRAL=Medical_Board_Slip             !Condition
          AND PROBLEM=Upper_Extremities              !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 72                                    !Mandatory rule label
IF        DUTY_STATUS=Air_Force AND              !Condition
          REFERRAL=USAF_570                          !Condition
          OR REFERRAL=Medical_Board_Slip             !Condition
          AND PROBLEM=Upper_Extremities              !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 73                                    !Mandatory rule label
IF        DUTY_STATUS=Navy AND                   !Condition
          REFERRAL=USAF_570                          !Condition
          OR REFERRAL=Medical_Board_Slip             !Condition
          AND PROBLEM=Upper_Extremities              !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 74                                    !Mandatory rule label
IF        DUTY_STATUS=Marines AND                !Condition
          REFERRAL=USAF_570                          !Condition
          OR REFERRAL=Medical_Board_Slip             !Condition
          AND PROBLEM=Upper_Extremities              !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 75                                    !Mandatory rule label
IF        DUTY_STATUS=Coast_Guard AND            !Condition
          REFERRAL=USAF_570                          !Condition
          OR REFERRAL=Medical_Board_Slip             !Condition
          AND PROBLEM=Upper_Extremities              !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";
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RULE 76                                          !Mandatory rule label
IF       DUTY_STATUS=Army AND                     !Condition
         REFERRAL=USAF_570                        !Condition
         OR REFERRAL=Medical_Board_Slip           !Condition
         AND PROBLEM=Lower_Extremities            !Condition
THEN     ACTION=Refer_to_MEB                   !Rule conclusion
BECAUSE  "In Accordance with AFR 160-43 and AFR 168-4";


RULE 77                                          !Mandatory rule label
IF       DUTY_STATUS=Air_Force AND                !Condition
         REFERRAL=USAF_570                        !Condition
         OR REFERRAL=Medical_Board_Slip           !Condition
         AND PROBLEM=Lower_Extremities            !Condition
THEN     ACTION=Refer_to_MEB                   !Rule conclusion
BECAUSE  "In Accordance with AFR 160-43 and AFR 168-4";


RULE 78                                          !Mandatory rule label
IF       DUTY_STATUS=Navy AND                     !Condition
         REFERRAL=USAF_570                        !Condition
         OR REFERRAL=Medical_Board_Slip           !Condition
         AND PROBLEM=Lower_Extremities            !Condition
THEN     ACTION=Refer_to_MEB                   !Rule conclusion
BECAUSE  "In Accordance with AFR 160-43 and AFR 168-4";


RULE 79                                          !Mandatory rule label
IF       DUTY_STATUS=Marines AND                  !Condition
         REFERRAL=USAF_570                        !Condition
         OR REFERRAL=Medical_Board_Slip           !Condition
         AND PROBLEM=Lower_Extremities            !Condition
THEN     ACTION=Refer_to_MEB                   !Rule conclusion
BECAUSE  "In Accordance with AFR 160-43 and AFR 168-4";


RULE 80                                          !Mandatory rule label
IF       DUTY_STATUS=Coast_Guard AND              !Condition
         REFERRAL=USAF_570                        !Condition
         OR REFERRAL=Medical_Board_Slip           !Condition
         AND PROBLEM=Lower_Extremities            !Condition
THEN     ACTION=Refer_to_MEB                   !Rule conclusion
BECAUSE  "In Accordance with AFR 160-43 and AFR 168-4";


RULE 81                                          !Mandatory rule label
IF       DUTY_STATUS=Army AND                     !Condition
         REFERRAL=USAF_570                        !Condition
         OR REFERRAL=Medical_Board_Slip           !Condition
         AND PROBLEM=Spine_Scapulae_Sacroiliac    !Condition
THEN     ACTION=Refer_to_MEB                   !Rule conclusion
BECAUSE  "In Accordance with AFR 160-43 and AFR 168-4";


RULE 82                                          !Mandatory rule label
IF       DUTY_STATUS=Air_Force AND                !Condition
         REFERRAL=USAF_570                        !Condition
         OR REFERRAL=Medical_Board_Slip           !Condition
         AND PROBLEM=Spine_Scapulae_Sacroiliac    !Condition
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THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 83                                         !Mandatory rule label
IF        DUTY_STATUS=Navy AND                   !Condition
          REFERRAL=USAF_570                      !Condition
          OR REFERRAL=Medical_Board_Slip         !Condition
          AND PROBLEM=Spine_Scapulae_Sacroiliac  !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 84                                         !Mandatory rule label
IF        DUTY_STATUS=Marines AND                !Condition
          REFERRAL=USAF_570                      !Condition
          OR REFERRAL=Medical_Board_Slip         !Condition
          AND PROBLEM=Spine_Scapulae_Sacroiliac  !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 85                                         !Mandatory rule label
IF        DUTY_STATUS=Coast_Guard AND            !Condition
          REFERRAL=USAF_570                      !Condition
          OR REFERRAL=Medical_Board_Slip         !Condition
          AND PROBLEM=Spine_Scapulae_Sacroiliac  !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 86                                         !Mandatory rule label
IF        DUTY_STATUS=Army AND                   !Condition
          REFERRAL=USAF_570                      !Condition
          OR REFERRAL=Medical_Board_Slip         !Condition
          AND PROBLEM=Endocrine_Metabolic        !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 87                                         !Mandatory rule label
IF        DUTY_STATUS=Air_Force AND              !Condition
          REFERRAL=USAF_570                      !Condition
          OR REFERRAL=Medical_Board_Slip         !Condition
          AND PROBLEM=Endocrine_Metabolic        !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 88                                         !Mandatory rule label
IF        DUTY_STATUS=Navy AND                   !Condition
          REFERRAL=USAF_570                      !Condition
          OR REFERRAL=Medical_Board_Slip         !Condition
          AND PROBLEM=Endocrine_Metabolic        !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 89                                         !Mandatory rule label
IF        DUTY_STATUS=Marines AND                !Condition
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          REFERRAL=USAF_570                           !Condition
          OR REFERRAL=Medical_Board_Slip              !Condition
          AND PROBLEM=Endocrine_Metabolic             !Condition
THEN      ACTION=Refer_to_MEB                     !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 90                                     !Mandatory rule label
IF        DUTY_STATUS=Coast_Guard AND               !Condition
          REFERRAL=USAF_570                         !Condition
          OR REFERRAL=Medical_Board_Slip            !Condition
          AND PROBLEM=Endocrine_Metabolic           !Condition
THEN      ACTION=Refer_to_MEB                   !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 91                                     !Mandatory rule label
IF        DUTY_STATUS=Army AND                      !Condition
          REFERRAL=USAF_570                         !Condition
          OR REFERRAL=Medical_Board_Slip            !Condition
          AND PROBLEM=Systemic_Diseases             !Condition
THEN      ACTION=Refer_to_MEB                   !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 92                                     !Mandatory rule label
IF        DUTY_STATUS=Air_Force AND                 !Condition
          REFERRAL=USAF_570                         !Condition
          OR REFERRAL=Medical_Board_Slip            !Condition
          AND PROBLEM=Systemic_Diseases             !Condition
THEN      ACTION=Refer_to_MEB                   !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 93                                     !Mandatory rule label
IF        DUTY_STATUS=Navy AND                      !Condition
          REFERRAL=USAF_570                         !Condition
          OR REFERRAL=Medical_Board_Slip            !Condition
          AND PROBLEM=Systemic_Diseases             !Condition
THEN      ACTION=Refer_to_MEB                   !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 94                                     !Mandatory rule label
IF        DUTY_STATUS=Marines AND                   !Condition
          REFERRAL=USAF_570                         !Condition
          OR REFERRAL=Medical_Board_Slip            !Condition
          AND PROBLEM=Systemic_Diseases             !Condition
THEN      ACTION=Refer_to_MEB                   !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 95                                     !Mandatory rule label
IF        DUTY_STATUS=Coast_Guard AND               !Condition
          REFERRAL=USAF_570                         !Condition
          OR REFERRAL=Medical_Board_Slip            !Condition
          AND PROBLEM=Systemic_Diseases             !Condition
THEN      ACTION=Refer_to_MEB                   !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";
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RULE 96                                     !Mandatory rule label
IF       DUTY_STATUS=Army AND                       !Condition
         REFERRAL=USAF_570                          !Condition
         OR REFERRAL=Medical_Board_Slip             !Condition
         AND PROBLEM=Tumors_&_Malignancies          !Condition
THEN     ACTION=Refer_to_MEB                 !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 97                                     !Mandatory rule label
IF       DUTY_STATUS=Air_Force AND                  !Condition
         REFERRAL=USAF_570                          !Condition
         OR REFERRAL=Medical_Board_Slip             !Condition
         AND PROBLEM=Tumors_&_Malignancies          !Condition
THEN     ACTION=Refer_to_MEB                 !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 98                                     !Mandatory rule label
IF       DUTY_STATUS=Navy AND                       !Condition
         REFERRAL=USAF_570                          !Condition
         OR REFERRAL=Medical_Board_Slip             !Condition
         AND PROBLEM=Tumors_&_Malignancies          !Condition
THEN     ACTION=Refer_to_MEB                 !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 99                                     !Mandatory rule label
IF       DUTY_STATUS=Marines AND                    !Condition
         REFERRAL=USAF_570                          !Condition
         OR REFERRAL=Medical_Board_Slip             !Condition
         AND PROBLEM=Tumors_&_Malignancies          !Condition
THEN     ACTION=Refer_to_MEB                 !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 100                                    !Mandatory rule label
IF       DUTY_STATUS=Coast_Guard AND                !Condition
         REFERRAL=USAF_570                          !Condition
         OR REFERRAL=Medical_Board_Slip             !Condition
         AND PROBLEM=Tumors_&_Malignancies          !Condition
THEN     ACTION=Refer_to_MEB                 !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 101                                    !Mandatory rule label
IF       DUTY_STATUS=Army AND                       !Condition
         REFERRAL=USAF_570                          !Condition
         OR REFERRAL=Medical_Board_Slip             !Condition
         AND PROBLEM=Sexual_Diseases                !Condition
THEN     ACTION=Refer_to_MEB                 !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";

RULE 102                                    !Mandatory rule label
IF       DUTY_STATUS=Air_Force AND                  !Condition
         REFERRAL=USAF_570                          !Condition
         OR REFERRAL=Medical_Board_Slip             !Condition
         AND PROBLEM=Sexual_Diseases                !Condition
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THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 103                                         !Mandatory rule label
IF        DUTY_STATUS=Navy AND                   !Condition
          REFERRAL=USAF_570                      !Condition
          OR REFERRAL=Medical_Board_Slip         !Condition
          AND PROBLEM=Sexual_Diseases            !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 104                                         !Mandatory rule label
IF        DUTY_STATUS=Marines AND                !Condition
          REFERRAL=USAF_570                      !Condition
          OR REFERRAL=Medical_Board_Slip         !Condition
          AND PROBLEM=Sexual_Diseases            !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 105                                         !Mandatory rule label
IF        DUTY_STATUS=Coast_Guard AND            !Condition
          REFERRAL=USAF_570                      !Condition
          OR REFERRAL=Medical_Board_Slip         !Condition
          AND PROBLEM=Sexual_Diseases            !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 106                                         !Mandatory rule label
IF        DUTY_STATUS=Army AND                   !Condition
          REFERRAL=USAF_570                      !Condition
          OR REFERRAL=Medical_Board_Slip         !Condition
          AND PROBLEM=Older_Than_6_Mos           !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 107                                         !Mandatory rule label
IF        DUTY_STATUS=Air_Force AND              !Condition
          REFERRAL=USAF_570                      !Condition
          OR REFERRAL=Medical_Board_Slip         !Condition
          AND PROBLEM=Older_Than_6_Mos           !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 108                                         !Mandatory rule label
IF        DUTY_STATUS=Navy AND                   !Condition
          REFERRAL=USAF_570                      !Condition
          OR REFERRAL=Medical_Board_Slip         !Condition
          AND PROBLEM=Older_Than_6_Mos           !Condition
THEN      ACTION=Refer_to_MEB                    !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 109                                         !Mandatory rule label
IF        DUTY_STATUS=Marines AND                !Condition
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          REFERRAL=USAF_570                          !Condition
          OR REFERRAL=Medical_Board_Slip             !Condition
          AND PROBLEM=Older_Than_6_Mos               !Condition
THEN      ACTION=Refer_to_MEB                     !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 110                                  !Mandatory rule label
IF        DUTY_STATUS=Coast_Guard AND            !Condition
          REFERRAL=USAF_570                          !Condition
          OR REFERRAL=Medical_Board_Slip             !Condition
          AND PROBLEM=Older_Than_6_Mos               !Condition
THEN      ACTION=Refer_to_MEB                     !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 111                                  !Mandatory rule label
IF        DUTY_STATUS=Army AND                   !Condition
          REFERRAL=USAF_570                          !Condition
          OR REFERRAL=Medical_Board_Slip             !Condition
          AND PROBLEM=Skin_&_Cellular                !Condition
THEN      ACTION=Refer_to_MEB                     !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 112                                  !Mandatory rule label
IF        DUTY_STATUS=Air_Force AND              !Condition
          REFERRAL=USAF_570                          !Condition
          OR REFERRAL=Medical_Board_Slip             !Condition
          AND PROBLEM=Skin_&_Cellular                !Condition
THEN      ACTION=Refer_to_MEB                     !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 113                                  !Mandatory rule label
IF        DUTY_STATUS=Navy AND                   !Condition
          REFERRAL=USAF_570                          !Condition
          OR REFERRAL=Medical_Board_Slip             !Condition
          AND PROBLEM=Skin_&_Cellular                !Condition
THEN      ACTION=Refer_to_MEB                     !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 114                                  !Mandatory rule label
IF        DUTY_STATUS=Marines AND                !Condition
          REFERRAL=USAF_570                          !Condition
          OR REFERRAL=Medical_Board_Slip             !Condition
          AND PROBLEM=Skin_&_Cellular                !Condition
THEN      ACTION=Refer_to_MEB                     !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";


RULE 115                                  !Mandatory rule label
IF        DUTY_STATUS=Coast_Guard AND            !Condition
          REFERRAL=USAF_570                          !Condition
          OR REFERRAL=Medical_Board_Slip             !Condition
          AND PROBLEM=Skin_&_Cellular                !Condition
THEN      ACTION=Refer_to_MEB                     !Rule conclusion
BECAUSE "In Accordance with AFR 160-43 and AFR 168-4";
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!*********************************************************
!Statements Block

ASK DUTY_STATUS: "What  Branch Of The Service Is The Patient
In?";                                    !Asks 'duty status'variable
CHOICES DUTY_STATUS: Army,Air_Force,Navy,Marines,Coast_Guard;
                                    !Gives choices for 'duty status'

ASK REFERRAL: "What Is The Method Of REFERRAL?";
                                         !Asks'referral'variable
CHOICES REFERRAL: USAF_570,Medical_Board_Slip;
                                    !Gives choices for 'referral'

ASK PROBLEM: "What Is The Patient's PROBLEM?";
                                         !Asks 'problem' variable

ASK Next: "Press 'Complaint' To Determine If Patient  Should
Be Referred To MEB Or 'Procedures' To Determine The Required
Preliminary Administrative Procedures For The Patient's Duty
Status.";                                !Asks 'next' variable
CHOICES  Next:Complaint,Procedures; !Gives choices for 'next'

ASK Reason1:"Is The Patient On Active, Reserve, Or Guard
Status?";                                !Asks 'reason1' variable
CHOICES Reason1:Yes,No;           !Gives choices for 'reason1'

ASK Patient:"Choose The Patient's Duty Status.";
                                         !Asks 'patient' variable

ASK Continue:"Press 'Administration' If You Want To Know The
Appropriate Administrative Procedures For Another Patient Or
'Medical' To Review The Medical Tests And Documents For A
Problem.";                               !Asks 'continue' variable
CHOICES Continue:Administration,Medical;
                                    !Gives choices for 'continue'

ASK Reason2:"Do You Want To Review The Medical Tests/Documents
For The Diagnosed Problem?";             !Asks 'reason2' variable
CHOICES Reason2: Yes,No;           !Gives choices for 'reason2'

ASK Again:"Do You Want To Review The Medical Tests/Documents
For Another Diagnosed Problem?";         !Asks 'again' variable
CHOICES Again:Yes,No;              !Gives choices for 'again'

!*********************************************************
AUTOQUERY;                    !Addresses value of goal variable
EXECUTE;                                !Begins consultation
RUNTIME;                      !Eliminates the display of logic
ENDOFF;                       !Eliminates the need to press 'End'
BKCOLOR=3;                             !Sets bkcolor to light blue
!*********************************************************
!Actions Block
ACTIONS                               !Beginning of Actions block
```

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CLS                                         !Clears the screen
TRUTHTHRESH=1                               !Sets truththresh value to 1
COLOR=15                                    !Sets text color to bright white
WOPEN 7,2,3,15,73,1                         !Defines 7th marquis
ACTIVE 7                                    !Activates 7th marquis
DISPLAY "


              ************************************
              THE MEDICAL EVALUATION BOARD ADVISOR
              ************************************


        This Knowledge Base Will Help You To Determine What To
Look For In The Narrative Summary.


Press Any Key To Continue The Consultation....~"
                                            !Displays message
WCLOSE 7                                    !Closes 7th marquis
CLS                                         !Clears the screen
FIND Reason.3                               !Finds goal variable
Next=Yes
WHILETRUE Reason.3=Yes AND Next=Yes THEN         !Sets up a loop
RESET All                                   !Resets all values to unknown
MENU Problem,ALL,B:\NARRATIV,Area           !Generates options menu
FIND Decision                               !Finds goal variable
MRESET Problem                              !Resets menu
GET Problem=Area,B:\NARRATIV,All            !Retrieves dbase values
CLS                                         !Clears the screen
COLOR=15                                    !Sets text color to bright white
WOPEN 8,1,6,20,67,6                         !Defines 8th marquis
ACTIVE 8                                    !Activates 8th marquis
      DISPLAY "
The Following Needs To Be Addressed In The Narrative Summary:
********************************************************************
                   {PROPERTY1}
                   {PROPERTY2}
                   {PROPERTY3}
                   {PROPERTY4}
                   {PROPERTY5}
                   {PROPERTY6}
                   {PROPERTY7}
                   {PROPERTY8}
                   {PROPERTY9}




        Press Any Key To Continue The Consultation....~"
                                            !Displays message
WCLOSE 8                                    !Closes 8th marquis
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CLOSE B:\NARRATIV                              !Closes dbase
CLS                                            !Clears the screen
RESET All                               !Resets all values to unknown
FIND Next
CLS                                            !Clears the screen
END                                             !Ends the loop
CLS                                            !Clears the screen
COLOR=15                            !Sets text color to bright white
WOPEN 9,1,6,20,67,1                          !Defines 9th marquis
ACTIVE 9                                   !Activates 9th marquis
DISPLAY "
        Make Sure The Narrative Summary Contains The Following
              Information And Is In The Following Order:
******************************************************************

A. Chief Complaint           J. Final Diagnosis
B. History Present Illness    K. Other Diagnoses
C. Past History              L. Operations,Procedures
D. Current Medications       M. Recommendations
E. Review Of Systems         N. Current Profile
F. Physical Examination      O. Worldwide Duty
                                Qualifications
G. Lab,Radiology (If Apply)  P. Administrative Line Of Duty
H. Hospital Course (If Apply) Q. Duty AFSC & Length Of
                                Service
I. Consultations (If Apply)  R. Worldwide Eligibility
                                Statement

              S. Patient's Statement

        Press Any Key To Continue The Consultation....~"

                                               !Displays message
WCLOSE 9                                    !Closes 9th marquis
CHAIN B:\TIME_LIM;                    !Chains to 'Time Limit' kbs
!****************************************************************
!Rules Block

RULE N1                                   !Mandatory rule label
IF Problem=Joints                              !Condition
THEN Decision=Narrative                     !Rule conclusion
BECAUSE "In Accordance With The VA Schedule For Rating
Disabilities";

RULE N2                                   !Mandatory rule label
IF Problem=Muscle_Groups                       !Condition
THEN Decision=Narrative                     !Rule conclusion
BECAUSE "In Accordance With The VA Schedule For Rating
Disabilities";

RULE N3                                   !Mandatory rule label
IF Problem=Sacroiliac_Joint                    !Condition
THEN Decision=Narrative                     !Rule conclusion
```

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```
BECAUSE "In Accordance With The VA Schedule For Rating
Disabilities";

RULE N4                                  !Mandatory rule label
IF Problem=Ears                                     !Condition
THEN Decision=Narrative                        !Rule conclusion
BECAUSE "In Accordance With The VA Schedule For Rating
Disabilities";

RULE N5                                  !Mandatory rule label
IF Problem=Heart_&_Vascular                         !Condition
THEN Decision=Narrative                        !Rule conclusion
BECAUSE "In Accordance With The VA Schedule For Rating
Disabilities";

RULE N6                                  !Mandatory rule label
IF Problem=Abdomen_&_Gastro                         !Condition
THEN Decision=Narrative                        !Rule conclusion
BECAUSE "In Accordance With The VA Schedule For Rating
Disabilities";

RULE N7                                  !Mandatory rule label
IF Problem=Neurologic_Disorders                     !Condition
THEN Decision=Narrative                        !Rule conclusion
BECAUSE "In Accordance With The VA Schedule For Rating
Disabilities";

RULE N8                                  !Mandatory rule label
IF Problem=Varicose_Veins                           !Condition
THEN Decision=Narrative                        !Rule conclusion
BECAUSE "In Accordance With The VA Schedule For Rating
Disabilities";

RULE N9                                  !Mandatory rule label
IF Problem=Muscle_Weakness                          !Condition
THEN Decision=Narrative                        !Rule conclusion
BECAUSE "In Accordance With The VA Schedule For Rating
Disabilities";

RULE N10                                 !Mandatory rule label
IF Problem=Foot_Deformities                         !Condition
THEN Decision=Narrative                        !Rule conclusion
BECAUSE "In Accordance With The VA Schedule For Rating
Disabilities";

RULE N11                                 !Mandatory rule label
IF Problem=Hands                                    !Condition
THEN Decision=Narrative                        !Rule conclusion
BECAUSE "In Accordance With The VA Schedule For Rating
Disabilities";

RULE N12                                 !Mandatory rule label
IF Problem=Systemic_Diseases                        !Condition
```

```
THEN Decision=Narrative                            !Rule conclusion
BECAUSE  "In  Accordance  With  The  VA  Schedule  For  Rating
Disabilities";

RULE N13                                 !Mandatory rule label
IF Problem=Musculoskeletal                         !Condition
THEN Decision=Narrative                            !Rule conclusion
BECAUSE  "In  Accordance  With  The  VA  Schedule  For  Rating
Disabilities";

RULE N14                                 !Mandatory rule label
IF Problem=Genitourinary_System                    !Condition
THEN Decision=Narrative                            !Rule conclusion
BECAUSE  "In  Accordance  With  The  VA  Schedule  For  Rating
Disabilities";

RULE N15                                 !Mandatory rule label
IF Problem=Epilepsy                                !Condition
THEN Decision=Narrative                            !Rule conclusion
BECAUSE  "In  Accordance  With  The  VA  Schedule  For  Rating
Disabilities";

RULE N16                                 !Mandatory rule label
IF Problem=Phlebitus                               !Condition
THEN Decision=Narrative                            !Rule conclusion
BECAUSE  "In  Accordance  With  The  VA  Schedule  For  Rating
Disabilities";

RULE N17                                 !Mandatory rule label
IF Problem=Muscle_Pattern                          !Condition
THEN Decision=Narrative                            !Rule conclusion
BECAUSE  "In  Accordance  With  The  VA  Schedule  For  Rating
Disabilities";

RULE N18                                 !Mandatory rule label
IF Problem=Arthritus                               !Condition
THEN Decision=Narrative                            !Rule conclusion
BECAUSE  "In  Accordance  With  The  VA  Schedule  For  Rating
Disabilities";

RULE N19                                 !Mandatory rule label
IF Problem=Eyes                                    !Condition
THEN Decision=Narrative                            !Rule conclusion
BECAUSE  "In  Accordance  With  The  VA  Schedule  For  Rating
Disabilities";

RULE N20                                 !Mandatory rule label
IF Problem=Respiratory                             !Condition
THEN Decision=Narrative                            !Rule conclusion
BECAUSE  "In  Accordance  With  The  VA  Schedule  For  Rating
Disabilities";

RULE N21                                 !Mandatory rule label
```

```
IF Problem=Rheumatic_Heart                              !Condition
THEN Decision=Narrative                            !Rule conclusion
BECAUSE "In  Accordance  With  The  VA  Schedule  For  Rating
Disabilities";


RULE N22                                    !Mandatory rule label
IF Problem=Endocrine_System                             !Condition
THEN Decision=Narrative                            !Rule conclusion
BECAUSE "In  Accordance  With  The  VA  Schedule  For  Rating
Disabilities";


RULE N23                                    !Mandatory rule label
IF Problem=Psycho_Psychoneuro_Other                     !Condition
THEN Decision=Narrative                            !Rule conclusion
BECAUSE "In  Accordance  With  The  VA  Schedule  For  Rating
Disabilities";


RULE N24                                    !Mandatory rule label
IF Problem=Tumors_&_Malignancies                        !Condition
THEN Decision=Narrative                            !Rule conclusion
BECAUSE "In  Accordance  With  The  VA  Schedule  For  Rating
Disabilities";


!******************************************************************
!Statements Block

ASK Reason.3: "Do You Want To Receive Information About The
Requirements Of The arrative Summary?";
                                    !Asks 'reason.3' variable
CHOICES Reason.3: Yes,No;      !Gives choices for 'reason.3'

ASK Problem: "Choose The Problem Area That You Need Informa-
tion About.";               !Asks 'problem' variable

ASK Next: "Do You Want To Use The System Again To Get More
Information About The Narrative Summary Requirements?";
                                    !Asks 'next' variable
CHOICES Next: Yes,No;               !Gives choices for 'next

!******************************************************************
EXECUTE;                    !Begins consultation immediately
ENDOFF;                     !Eliminates the need to press End key
RUNTIME;                    !Eliminates the display of logic
BKCOLOR=3;                          !Bkcolor of light blue
!******************************************************************
!Actions Block
ACTIONS                             !Required block heading
TRUTHTHRESH=1       !Any level of confidence above 0 is good
COLOR=15                    !Sets text color to bright white
WOPEN 1,2,3,15,73,1 !Defines  marquis to announce the module
ACTIVE 1                            !Activates marquis
DISPLAY "
            **********************************
```

THE MEDICAL EVALUATION BOARD ADVISOR
****

This Knowledge Base Will Give You The Amount Of Time That You Have To Complete The Processing For A Specific MEB Case File.


```
Press Any Key To Continue The Consultation.....~"    !Openning
WCLOSE 1                                    !Closes the marquis
CLS                                         !Clears the screen
FIND Next                                   !Finds goal variable
WHILETRUE Next=Time THEN                        !Sets up a loop
     RESET ALL              !Resets all variables to unknown
     MENU Problem,ALL,B:\TIME,Area     !Generates options menu
     FIND Action                            !Finds goal variable
     MRESET Problem                              !Resets menu
     GET Problem=Area,B:\TIME,ALL     !Retrieves dbase values
     CLS                                    !Clears the screen
     COLOR=15               !Sets text color to bright white
WOPEN 2,5,5,10,70,0            !Create a marquis to show results
ACTIVE 2              !Causes text to be displayed in window
DISPLAY"
```


                    ****{Time}****


```
             Press Any Key To Continue The Consultation....~
"
WCLOSE 2                                    !Closes the marquis
CLOSE B:\TIME                                !Closes the dbase
CLS                                         !Clears the screen
RESET ALL                       !Resets all values to unknown
FIND Next                                   !Finds goal variable
END                                           !Ends the loop
CLS                                         !Clears the screen
COLOR=15                    !Set text color to bright white
WOPEN 3,2,3,15,73,1                         !Defines marquis
ACTIVE 3                                    !Activates marquis
DISPLAY "
```


                 This Is The End Of The Program

             Thanks For Using The MEDICAL EVALUATION BOARD ADVISOR

             Press Any Key To Return To The Main Menu Then Choose
The 'None' Option To Exit The Program....~" !Displays message

WCLOSE 2

```
!Closes marquis
CHAIN B:\MENU;          !Chains back to the MENU knowledge base
!*******************************************************************
!Rules Block

RULE 1                                  !Mandatory rule label
IF Problem=Myocardial_Infarction                !Condition
AND Episode=1                                   !Condition
THEN Action=Limit                          !Rule conclusion
BECAUSE "In Accordance With AFR 160-43";

RULE 2                                  !Mandatory rule label
IF Problem=Myocardial_Infarction                !Condition
AND Episode>1                                   !Condition
THEN Action=Limit                          !Rule conclusion
BECAUSE "In Accordance With AFR 160-43";

RULE 3                                  !Mandatory rule label
IF Problem=Tumors_&_Malignancies                !Condition
THEN Action=Limit                          !Rule conclusion
BECAUSE "In Accordance With AFR 160-43";

RULE 4                                  !Mandatory rule label
IF Problem=Spinal_Cord_Injury                   !Condition
THEN Action=Limit                          !Rule conclusion
BECAUSE "In Accordance With AFR 160-43";

RULE 5                                  !Mandatory rule label
IF Problem=Reconstructive_Surgery               !Condition
THEN Action=Limit                          !Rule conclusion
BECAUSE "In Accordance With AFR 160-43";

RULE 6                                  !Mandatory rule label
IF Problem=Diabetes                             !Condition
THEN Action=Limit                          !Rule conclusion
BECAUSE "In Accordance With AFR 160-43";

RULE 7                                  !Mandatory rule label
IF Problem=Imminent_Death                       !Condition
THEN Action=Limit                          !Rule conclusion
BECAUSE "In Accordance With AFR 160-43";

RULE 8                                  !Mandatory rule label
IF Problem=Neurologic_Disorders                 !Condition
THEN Action=Limit                          !Rule conclusion
BECAUSE "In Accordance With AFR 160-43";

RULE 9                                  !Mandatory rule label
IF Problem=Established_Career                    !Condition
THEN Action=Limit                          !Rule conclusion
BECAUSE "In Accordance With AFR 160-43";

RULE 10                                 !Mandatory rule label
```

```
IF Problem=Hospitalized_90_Days                        !Condition
THEN Action=Limit                          !Rule conclusion
BECAUSE "In Accordance With AFR 160-43";


RULE 11                                    !Mandatory rule label
IF Problem=Psycho_Psychoneuro_Other               !Condition
THEN Action=Limit                          !Rule conclusion
BECAUSE "In Accordance With AFR 160-43";


RULE 12                                    !Mandatory rule label
IF Problem=Systemic_Diseases                      !Condition
THEN Action=Limit                          !Rule conclusion
BECAUSE "In Accordance With AFR 160-43";


RULE 13                                    !Mandatory rule label
IF Problem=Abdomen_&_Gastro_Sur                   !Condition
THEN Action=Limit                          !Rule conclusion
BECAUSE "In Accordance With AFR 160-43";


RULE 14                                    !Mandatory rule label
IF Problem=Abdomen_&_Gastro_Con                   !Condition
THEN Action=Limit                          !Rule conclusion
BECAUSE "In Accordance With AFR 160-43";


!***********************************************************
!Statements Block


ASK Next: "Press 'Time' To Determine The Allotted Time Or
'End' To Stop The Consultation.";    !Asks 'next' variable
CHOICES Next: Time,End;              !Gives variable choices

ASK Problem: "Which One Of These General Problem Areas
Apply?";                           !Asks 'problem' variable

ASK Episode: "How Many Episodes?";!Asks 'episode' variable
```

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Appendix G: Instructions on How to Use MEBA Expert System

The following instructions are provided to help you use the MEBA expert system.

STEP 1.   Install VPEXPERT Version 2.2 according to the instructions provided in your VPEXPERT Manual.

STEP 2.   Insert the MEBA disk in your floppy drive.

STEP 3.   Select the PATH option on the bottom of the VPEXPERT main menu screen.   Change the PATH to A: or B: depending on where your floppy drive is located.

STEP 4.   Select the CONSULT option.

STEP 5.   Select the MENU.KBS.   It acts as the starting point for all consultations.

STEP 6.   Select the PROBLEMS.KBS.   MEBA first asks you to tell it the patient's service branch.   Next you are asked to provide the method of MEB referral.   MEBA then provides you with a menu of medical problems that can result in a MEB referral.   It also provides you with the types of administrative procedures and medical tests that are required for specific medical problems.

STEP 7.   Once you have determined if the problem is boardable along with it's accompanying administrative procedures and medical tests, the system allows you to determine if another problem is boardable or it chains to the SUMMARY.KBS.

STEP 8.   Once in the SUMMARY.KBS, MEBA asks you if you need to receive information about the narrative summary.   If you choose "yes" MEBA then provides a menu of problems that can be found in the narrative summary.   Once you choose the problem that applies, MEBA responds with pertinent infr mation that is required in the narrative summary for that particular problem. If you choose "no" MEBA moves you to the final screen in this knowledge base that displays the most current headings of a narrative summary.   You are then allowed to move on to the TIME.KBS.

STEP 9.   Once in the TIME.KBS, MEBA asks you if want to determine the time allotted for a boardable problem or end the consultation.   If you choose to determine the time, MEBA provides a menu of boardable problems.   Once you choose the problem that applies, MEBA responds with the time you have to process the MEB case file.   If you choose "end", MEBA notifies you that your consultation has ended.   You then are forwarded to MEBA's main menu where you can choose the "none" option to exit the system.

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        The purpose of this research was to determine
if artificial intelligence could improve the processing of medical
evaluation board (MEB) cases. An expert system was developed and
evaluated in regards to the affect it had on the timeliness and
accuracy of MEB case preparation. The results indicated that the
subjects who were assisted by the expert system increased their
accuracy of MEB case preparation by nearly 15 percent. Timeliness
of case preparation while using the expert system was longer at
first, but as the subjects learned how to use the expert system,
their case preparation times decreased.

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    a. Highly   b. Significant   c. Slightly   d. Of No
       Significant   Significant   Significance

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Position or Title   Address