

AD _____

Award Number: MIPR 3GD3E73091

TITLE: Expert System Utilization for Behavioral Health

PRINCIPAL INVESTIGATOR: LTC Gregory A. Gahm

CONTRACTING ORGANIZATION: Madigan Army Medical Center
Tacoma, Washington 98431

REPORT DATE: June 2003

TYPE OF REPORT: Midterm

PREPARED FOR: U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

DISTRIBUTION STATEMENT: Approved for Public Release;
Distribution Unlimited

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

20040319 076

REPORT DOCUMENTATION PAGEForm Approved
OMB No. 074-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503

1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE June 2003	3. REPORT TYPE AND DATES COVERED Midterm (17 Mar 03-17 Jun 03)	
4. TITLE AND SUBTITLE Expert System Utilization for Behavioral Health			5. FUNDING NUMBERS MIPR 3GD3E73091	
6. AUTHOR(S) LTC Gregory A. Gahm				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Madigan Army Medical Center Tacoma, Washington 98431 E-Mail: gregory.gahm@nw.amedd.army.mil			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Medical Research and Materiel Command Fort Detrick, Maryland 21702-5012			10. SPONSORING / MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for Public Release; Distribution Unlimited			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 Words)				
14. SUBJECT TERMS No subject terms provided.			15. NUMBER OF PAGES 7	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT Unlimited	

Mid-Term Report



PROPOSAL NO.: 2002011035

TITLE: Expert System Utilization for Behavioral Health

ACCOMPLISHMENTS

In behavioral health (BH), considerable resources are allocated to the basic, standard processes of conducting initial evaluations. Patients present to BH clinics much like they do to an emergency room or sick call; problems range from minor to severe, urgent to routine, administrative to medical needs. Triage patients is required to determine an appropriate immediate disposition. The critical yield of the evaluation is actuarial data used to predict risk. Historically, this has not been optimized for either resource allocation or quality of care, resulting in delays in service, additional cost to provide care, and inconsistent scientific application of BH.

This project originally proposed to apply decision algorithms to an automated intake system to directly address quality, cost and access limitations. The key tasks were:

1. Defining an explicit knowledge base used to make triage and assessment decisions.
2. Providing a detailed analysis of current best practices and evidence-based decision-making criteria.
3. Creating symbolic logic using the identified criteria.
4. Designing output that is useful to providers.
5. Systematically evaluating the decisions and logic against clinician judgment.
6. Integrating the outcome of the project with larger initiatives (BHAVRS, DCSP, CHCSII).

It was planned to accomplish this application of AI technology to BH triage by providing a detailed analysis of current best practices and evidence-based decision-making criteria, and by systematically presenting the results to a panel of experienced providers. The providers would then be guided by a knowledge developer to elicit the decision points factors that would apply in various clinical scenarios. These findings would be incorporated into an Expert System to enhance the business process of BH triage.

The first step to develop the expert system was to define the knowledge base used for making triage and risk assessment decisions. Therefore, it was necessary to develop a formal model of the decision algorithms that are used in triage situations. Several prototypes for the flow of decision factors were developed and subsequently presented to the expert panel of providers, thus beginning of the process for eliciting decision points for the expert system. The models presented were based upon empirical research, clinical practice guidelines for depression, suicide, deployment health and post-traumatic stress disorder. Upon presentation of the models, the providers participated in semi-structured interviews in order to elicit quantifiable feedback. Feedback was considered in model revisions.

Concurrent with model evaluation, the development of the Artificial Intelligence (AI) technology was also initiated. Research in the field of expert systems identified a knowledge acquisition and automation expert system shell called Exsys CORVID. This software is a development package that aids in applying human knowledge in a specific area of expertise to make decisions, typically to solve a problem or make a recommendation. CORVID was tested, and it satisfied the technological needs to reach the stated goals of this project, so it was acquired.

Though validation of the decision process continues, the creation of symbolic logic representing the decision models and expert input has begun. CORVID is designed to develop a rule-based expert system that will ultimately allow symbolic representation of the logic and decision process, and will support integration with a clinical encounter that is derived from the interaction between a patient and the computer. CORVID is also capable of interfacing with electronic records and database technologies, offering potential for a greater level of data driven decision support, and further supporting the goals of the project. The first system prototype is scheduled for completion for pilot testing and further feedback gathering at the approximate time of this mid term report.

PI Evaluation: Project Accomplishments Match Proposal

PROBLEMS/ISSUES

The project has encountered some problems/issues as of the date of the report. In the original proposal, it was explained that an electronic record would provide a critical enabling platform for an expert system because both providers and patients can be expected to directly input information into the record. The CBHRS was identified as a prototype for an enabling platform for the decision system program while the larger coordination issues for the BH enterprise record were addressed. At present there is no integrated electronic record system in use in Army BH clinics. Continuing efforts in the Military Health System to develop an integrated electronic record have produced multiple prototypes. It seems that the CBHRS platform may be at the point of being

phased out of use, in favor of other interim solutions. As a result, the exploration of an electronic record as an enabling platform now requires assessment of which prototype to use, and this has set the project back, due to the additional effort this will require. At the present time we are exploring the ability of this product to function with ICDB and the Fusion effort as well as with CHCSII.

PI's Evaluation: Project Accomplishments Close to Proposal
Project encountered no significant problems/issues

Second Half Project LifeCycle

It was identified in the original proposal that it would be essential for the project's success to have adequate development of the technology and a phased implementation plan.

Plans for the second half of the project are:

Finish the initiated development and definition of the explicit knowledge base and decision process model.

Using CORVID, complete the creation and implementation of the symbolic logic based on the elicited expert knowledge.

Evaluate the decisions and logic against clinician judgment.

Design output that is useful to providers. Explore and evaluate possibilities for interfacing the expert system with electronic records, as well as other initiatives.

PI's Evaluation: Project Plan is according to Proposal.

Deliverable Update

We originally proposed to measure two general categories of outcome metrics for this project: user acceptance/satisfaction and "cost" savings. User acceptance of the

technology was to be measured as demonstrated both by subjective report and system utilization. At this point in the project, we are not able to provide data for either metric, as we have not yet implemented the deployment phase of the project. The metrics are still deemed to be appropriate to the project. So far, there has been a general acceptance on the part of providers in regards to the expert system development, and there has been polite cooperation with the systems analyst in the process of gathering the expert knowledge. It is still a concern that as the project reaches implementation phases, resistance may be encountered. However, it is believed that our phased implementation plan, along with our emphasis on provider validation, will alleviate any significant ambivalence that may arise.

PI's Evaluation: Deliverable is on schedule, per Proposal

Expenditures

Element of Resource (EOR)	3Q FY 01 Apr 1 - May 31	4Q FY 01 Jun 1 - Sep 30
Travel 2100	4,488.05	0.00
Shipping 2200	0.00	0.00
Rent & Communications 2200	0.00	0.00
Contract for Services 2500	161,974.24	0.00
Supplies 2600	20,037.71	0.00
Equipment 3100	0.00	0.00

Financial Narrative

Travel was required for the PI to attend a course in AI. In addition, travel was required to attend training in the software system.

Contracts for services were purchased for a Knowledge Developer, a CORVID programmer, and a Research Assistant.

Supplies in the form of software were purchased, including CORVID, AI Trilogy, and Copernic Agent Pro. CORVID is the expert system shell, AI Trilogy is another AI product that was explored, but will not be used in the initial phase of this project, and Copernic Agent Pro is a tool that monitors research, and was purchased to facilitate the process of gathering knowledge.

PI's Evaluation: Budget and Resources in line with Proposal

*** * * END OF REPORT * * ***