COMPUTER-SUPPORTED ASSESSMENT AND CONSULTATION FOR EMOTIONAL CRISIS IN A SUBMARINE ENVIRONMENT

Jane S. Levin, Ph.D., James L. Hedlund, Ph.D., and Bruce W. Vieweg, M.S.

Department of Psychiatry and Missouri Institute of Psychiatry
University of Missouri-Columbia, School of Medicine
5400 Arsenal Street, St. Louis, Missouri 63139

Abstract

This is a preliminary report on the development of a computer-assisted consultation program for the assessment and treatment of emotional and behavioral problems on board nuclear submarines. It discusses the early development of a brief structured interview, some of the guiding principles utilized in the development of this consultation system, and rules which relate interview profiles and corpsman observations to treatment recommendations.

Introduction

In the past decade, there has been an increasing interest in developing computer applications to assist both professionals and para-professionals in medical and psychiatric decision-making. Computer-assisted evaluation and treatment suggestions may be particularly useful for paraprofessional decision-making in locations where physicians are not immediately available. One such location involves U.S. Navy nuclear submarines, where, since 1972, medical responsibilities have been assumed by a senior enlisted Navy Hospital Corpsman. Henderson, Ryack, Moeller, Post and Robinson point out that questions of diagnosis, prognosis and treatment during submarine patrols not only materially affect the quality of patient care, but also significantly impinge on the mission of the submarine. "This is especially true when management of the patient requires that he be evacuated to a primary care facility (MEDEVAC). Because a MEDEVAC exposes the submarine's position, its mission is for a period comprised.... Thus, the national defense can be affected by a MEDEVAC" (p.1).

Development of a computer-assisted diagnostic system for use on board nuclear submarines was first suggested by Ryack, Moeller, Ross, Smock and Arsu. This system would provide the corpsman with diagnostic, prognostic and treatment guides for patient management. The development of such a system, MEDIC, began in the area of acute abdominal pain, since these patients are most often candidates for evacuation. A modification of deDombal's computer program for abdominal pain was developed and tested on board nuclear submarines. Results of seatrials using this program suggest its effectiveness in aiding the corpsman in both diagnosis and treatment of acute abdominal pain. This system is currently undergoing extensive field testing. Other MEDIC modules currently in development include consultation programs for chest pain and orthopedic problems.

It is the purpose of this paper to describe the development of a fourth module for MEDIC, a computer-assisted consultation program for the assessment and short-term treatment of emotional and behavioral problems on board nuclear submarines. A brief structured patient interview, consisting of verbatim questions and probes, is being developed for use by medical corpsmen. Results of this interview, along with the corpsman's own observations about each patient, will be entered in an on-board microcomputer, and specific management and treatment suggestions which are consistent with the corpsman's trained skills will be computer-generated. This paper will identify the target symptoms involved, describe the initial development of a structured interview and the associated rules for treatment recommendations, and discuss some of the issues and guiding principles regarding this system.

Target Symptoms

Gunderson's research on emotional problems in extremely isolated groups suggests that acute emotional disturbances may quickly occur in otherwise psychologically healthy individuals who are placed in isolated groups. The actual incidence of emotional problems among naval submariners is not fully known, predominately due to a reluctance to label problems as emotional.

However, a number of reports have contributed to our knowledge of the incidence of psychiatric attrition during submerged nuclear submarine missions. As summarized by Weybrew and Noddin, estimates of the gross incidence rates for emotional and behavioral problems range from four to fifty per 1,000 submariners.

Using data from a sample of 261 submariners referred for psychiatric consultation, Weybrew and
Noddin\textsuperscript{11} calculated the relative frequency of various symptoms. As summarized in Table 1, these data suggest that anxiety and depression are the most frequently occurring emotional symptoms among submariners, with interpersonal problems ranked the most prevalent behavioral symptom.

### Table 1

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>% Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety</td>
<td>50</td>
</tr>
<tr>
<td>Interpersonal Problems</td>
<td>39</td>
</tr>
<tr>
<td>Depression</td>
<td>29</td>
</tr>
<tr>
<td>Sleep Problems</td>
<td>25</td>
</tr>
<tr>
<td>Performance Decrement</td>
<td>17</td>
</tr>
<tr>
<td>Claustrophobia</td>
<td>15</td>
</tr>
<tr>
<td>Suicidal Ideation</td>
<td>13</td>
</tr>
<tr>
<td>Non-specific, &quot;Man not adapt&quot;</td>
<td>11</td>
</tr>
<tr>
<td>Motivational Decrement</td>
<td>10</td>
</tr>
<tr>
<td>Eating Problems</td>
<td>10</td>
</tr>
<tr>
<td>Drug/Alcohol Abuse</td>
<td>9</td>
</tr>
<tr>
<td>Fragile Reality Contact</td>
<td>9</td>
</tr>
<tr>
<td>Disciplinary Problems</td>
<td>8</td>
</tr>
<tr>
<td>Psychosomatic Signs</td>
<td>8</td>
</tr>
<tr>
<td>Gastrointestinal</td>
<td>6</td>
</tr>
<tr>
<td>Headaches</td>
<td>6</td>
</tr>
<tr>
<td>Excessive Muscle Tension</td>
<td>5</td>
</tr>
<tr>
<td>Impulsive Behavior</td>
<td>4</td>
</tr>
<tr>
<td>Confused Thought Patterns</td>
<td>3</td>
</tr>
<tr>
<td>Speech-related Problems</td>
<td>3</td>
</tr>
</tbody>
</table>

*from Weybrew and Noddin\textsuperscript{11}*

While the incidence of emotional and behavioral problems may be relatively low, the corpsman has a particular need for assistance in this area, having received only minimal training in the treatment of psychiatric disorders.\textsuperscript{13} Results of a study designed to investigate corpsmen's skills in observing behaviors possibly indicative of psychopathology also suggest that, although corpsmen tend to evaluate patients as more normal than do experienced psychologists and psychiatrists, corpsmen are able to identify major signs and symptoms of psychopathology.\textsuperscript{13}

#### Development of a Structured Interview

Hedlund and Vieweg\textsuperscript{14} have recently reviewed a number of structured psychiatric interviews, some of which have been developed for use by nonphysicians and/or for use with nonpsychiatric patients. Computer programs have been written for some, particularly the Diagnostic Interview Schedule\textsuperscript{16} and the Current and Past Psychopathology Scales\textsuperscript{17}, such that the interview results lead directly to computer diagnosis. Many studies have indicated that the proper use of such interviews can significantly improve the reliability of psychiatric diagnosis, even with nonphysician interviewers.\textsuperscript{18}

Existing structured psychiatric interviews and clinical rating scales were reviewed to determine their applicability for use by the corpsman in the submarine setting. None of the current interviews or scales appeared to be appropriate for direct use by submarine medical corpsmen either because they are too lengthy, too complex, required sophisticated clinical judgment, or have narrow or inappropriate clinical content. However, existing interview schedules and clinical rating scales were useful in generating a potential "item pool" for each target symptom. The variability in coverage of major symptom areas by the various standard instruments led to the development of the following principles and explicit criteria for the selection of interview items:

1. The overall interview is to be brief -- approximately thirty minutes. Although it was believed initially that this essentially ruled out a formal (DSM III) diagnostic approach, in favor of assessment procedures and treatment/management decisions that would be made on a more problem-specific basis, it became evident that medical decisions (especially treatment with psychotropic drugs) are very closely linked to diagnostic judgments. Thus, although the number of interview items had to be kept minimal, they nonetheless had to adequately address broader issues of differential diagnosis as well as specific symptoms and complaints.

2. The interview questions should target relatively simple, behaviorally explicit problems or symptoms for which the patient can provide direct information. Thus, the amount of clinical judgment required by the corpsman is minimized.

3. The interview questions must be appropriate to the setting. That is, they should key on target symptoms most frequently associated with prior submarine experience, while omitting unnecessary sensitive questioning or probing. They should also take into account any unique aspects of the submarine environment that may affect emotional and behavioral problems (e.g., confinement, sleep deprivation, isolation, required procedural compulsivity).

4. Interview items must be specifically and/or differentially relevant to the range of treatment available. Questions should contribute relatively directly to an unequivocal understanding of severity of the problem and/or to differential treatment decisions.

5. Although emphasis should be placed on collecting as objective information as possible from the patient, certain observations and judgments by the medical corpsman are critical to the assessment and treatment decision to be made.

6. Both individual interview items and the structured interview process as a whole must have clinical credibility (i.e., have face validity both for the patient and for trained clinical experts).
Mode of Presentation

Initial selections of interview items were developed as an interactive computer application. It was thought that this mode would facilitate construction and modification of the structured interview. Optimal use could be made of branching techniques to help insure that the interview would be brief, efficient and appropriate for any given patient, and still conceptually cover a wide range of emotional and behavioral problems. The goal was to include a full range of basic screening questions for all patients, and to branch to more detailed inquiry only when a screening question was answered positively or when the patient's previous pattern of responses suggested the appropriateness of more detailed or "sensitive" questioning.

Although the clinical computer literature would support a patient interactive strategy, both in terms of user acceptance and the clinical usefulness of results, other considerations have resulted in a decision to modify the mode of presentation. One potential problem with the interactive computer interview had to do with the location of submarines' microcomputers; it is uncertain whether a terminal will be available in a location that is suitable for patient involvement. Also, it is highly desirable, perhaps critical, that the corpsman be in a position to make clinical observations about each patient's description of his problem, preferably as a part of the interview process. Therefore, we have chosen an interpersonal mode of presentation, in which the corpsman will conduct a structured interview by following a detailed paper-and-pencil format. Although this decision has necessarily limited the use of complex branching techniques, the basic concept of screening questions and simple branching to more detailed probes whenever positive responses are given is still being used.

Corpsman Clinical Observations

Questions concerning the corpsman's clinical observations regarding specific interview items will be listed on the structured interview forms, so that the corpsman can note these observations before they are forgotten or contaminated with other information. Other, more general behavioral observations will be elicited during the computer entry of the patient's structured interview responses, after the corpsman has had an opportunity to observe the patient more fully. Thus, the corpsman will provide additional information that cannot reasonably be obtained directly from the patient. The corpsman will corroborate or challenge information given by the patient, and he will be able to provide specific collateral information, such as information about past medical complaints and treatment during the current cruise, work history, and relationships with other crew members.

An interactive mode of presentation for the corpsman's general behavioral observations offers several advantages. First, this mode allows for the inclusion of a wide range of possible questions with the flexibility to ask the corpsman only those questions which are relevant to a specific patient's interview profile. Second, immediate entry of responses into the computer avoids the duplication of recording responses on paper and then entering them into a terminal. Third, it is hoped that with repeated use, the corpsman will become more aware of those patient behaviors which are clinically significant and, therefore, become more proficient in his clinical observation skills.

Developing Rules for Treatment Recommendations

Rules for relating interview profiles (defined by the presence and/or absence of specific symptoms) with treatment recommendations are initially being developed rationally, based on clinical judgment and the clinical research literature. Since the use of psychoactive medication is likely to be one of the primary treatment tools for the most frequently observed emotional emergencies, special care is being taken to include interview items which will help make differential drug treatment choices. Only well-agreed-upon, conservative principles are being utilized in linking the presence or absence of specific symptoms with drug treatment recommendations. Information for the corpsman concerning possible side-effects, amount of time normally required for treatment effects, necessary follow-up procedures and considerations associated with changes in drug dosages will also be provided in these treatment recommendations.

Although other computer-based medical decision-making models will be explored, including the Bayesian model used with MEDIC's abdominal pain module, it would appear that relatively simple rationally derived rules may provide the most effective basis for treatment recommendations. This approach meets the admonition to keep decision-making procedures as simple as possible and avoids problems associated with having inadequate empirical information for conditional probabilities for all possible symptoms and treatments. It also provides a fully "visible" procedure that enhances the likelihood of clinical credibility and acceptance.

Only those treatment or management options which are within the range of the medical corpsman's skills will be recommended. The range of treatment/management options includes: no special treatment seems to be indicated; psychological support using nondirective listening; providing factual or reassuring information about the patient's symptoms; direct behavioral management (e.g., relaxation instructions, placement in restraints or seclusion); environmental manipulation (e.g., recommended change of duty assignment); use of psychoactive medication (particularly, hypnotics for relaxation or sleep, or minor tranquilizers); and the recommendation for evacuation. At this point, it is unknown whether antidepressants and major tranquilizers will be authorized for use on board nuclear submarines. Such medications are less desirable options in this environment because: 1) they are often slow to act therapeutically, and 2) crewmen who are taking psychoactive medication are not permitted
to stand duty for the duration of the drug treatment regimen.

Closing Comment

At the present time, a draft of the basic structured interview and prototype for the computer-generated diagnosis/treatment recommendations have been completed. Considerably more work is required before a formal clinical evaluation can begin. Such an evaluation will consist of a systematic review and critique of the interview and all rules which relate interview profiles to specific treatment and management suggestions. Several mental health experts will be engaged as consultants for this aspect of the project.

As currently conceptualized, automation of the system will include batch input of the corpsman's clinical observations, computer generated treatment and management recommendations, and computer-aided consultation/instruction concerning treatment implementation. Permanent storage, retrieval and updating of this clinical information for review and evaluation of individual patient care will also be an important part of this medical consultation system.

References


