An Improved Online Mental Status Examination System and Mental Health Diagnostic System

Hajar Mat Jani, Rozita Yati Masri

Abstract

In this really hectic and complex world, quite a number of people are exposed to situations where mental stress is unavoidable. This leads to people having all kinds of mental health problems that eventually may turn to chronic mental disorders. People with mental health problems normally have the tendency of not admitting their health problems because of the stigma attached to these kinds of illnesses. Most of them are in denial state. This situation may cause very serious social problems since people with mental problems will develop some kind of mental disorders, and as a result, they might be harmful to others around them, especially to their family members. People with mental health problems must receive proper treatments and medications so that their conditions get better. If their mental status can be assessed and examined easily, then most probably their mental problems can be detected at a very early stage, and can be easily controlled and cured. The above scenarios become the motivation for conducting this research. This research paper presents some findings on mental health and disorders on past research work’s results and also proposes an online mental status examination (MSE) system that examines individuals' mental health status. The result of the MSE system is used in determining whether the respective person needs to undergo a more detailed diagnosis for more specific mental disorders. If the patient's mental status is not normal, then a complete diagnosis of the patient's mental health is done using the Mental Health Diagnostic System, which uses a rule base for deriving a conclusion. An improvement is made to a previous paper by integrating the two systems into one complete system that is useful in determining the mental status and the severity level of a person’s mental disorder(s) in one shot. In addition, a complete report of the patient’s mental health condition is provided. It is hoped that the outcomes of this research study are able to assist new psychotherapists and psychiatrists in examining and diagnosing those who are affected by some kind of mental disorders in a more efficient manner. Direct results of this research will improve the diagnosis process and treatment for those with mental disorders.

Keywords: Mental Disorders, Mental Status Examination, Mental Health Diagnostic System

1. Introduction

Most of us take our health, in particular our mental health, for granted until something goes very wrong, and may be by that time it’s already too late. In the past, scientist defined health as “an absence of disease or illness [1].” However, in 1948, the World Health Organization (WHO) defined health as “a complete state of physical, mental and social well-being and not merely the absence of disease or infirmity [1].” The Surgeon General’s Report on Mental Health defined mental health as “the successful performance of mental function, resulting in productive activities, fulfilling relationships with other people, and the ability to adapt to change and cope with adversity [1].” Another common definition of mental health is as follows: “Mental Health is the balance between all aspects of life - social, physical, spiritual and emotional [2].” It is important to remember that mental health is far more than the absence of mental illness/disorder and has got something to do with various aspects of our lives including [2], how we feel about ourselves and others, and how we are able to meet the demands of life.

If a person is not mentally healthy, then he or she is having a mental illness, a term that “refers to all mental disorders [1].” Mental disorders are common to all countries in the world and they have caused enormous suffering to many people. Normally, people with mental problems are often subjected to isolation, poor quality of life and increase mortality [3]. Hundreds of millions of the world population...
are affected by mental, behavioral, neurological, and substance use disorders, and as a result approximately 877,000 people died by suicide every year [3]. Moreover, one in every four patients visiting a health center has at least one mental, neurological, or behavioral disorder, but most of these disorders are not being diagnosed and treated at their early stage [3].

A lot of studies have been carried out with the goal of reducing the burden of mental disorders worldwide. In fact, there exist websites [4] that are accessible to everyone that allows an individual to diagnose his or her mental health status. If the result indicates that the individual has some kind of mental disorder, he or she will be advised to seek professional help.

Some online diagnostic programs can be used to diagnose the following categories of mental disorders [4]:
- Adjustment disorders
- Alcohol-related disorders
- Anxiety disorders
- Drug-related disorders
- Eating disorders
- Infancy, childhood, and adolescence disorders
- Mood disorders
- Personality disorders
- Psychotic disorders

2. Motivation

More than 450 million people worldwide are affected by mental and neurological disorders [5]. These mental health disorders bring about significant hardship to those who suffer from them and also to their caretakers. The costs for caring and treating the mentally-ill people are overwhelming and can no longer be neglected. Other issues such as social problems are also growing as a result of the lack of proper healthcare resources especially in developing countries [5].

In the past, several papers focused on the need to find an effective way for early discovery of health risks, as being researched in [6]. In this paper, the authors introduced a software architecture of a modern telehealth care system that implemented semantic reasoning approach [6]. The telecare system’s main objective was to support patient personalization and context awareness. Semantic reasoning was proposed for handling the increase in data amount and for tackling complexity in health care systems.

Salman et al. [7] stressed on the importance of iconic user interfaces in medical information systems with the intention of improving the quality of service and also for providing better patient care. Here, they introduced an iconic medical information system for Tablet PC by implementing a user-centered development methodology that can reduce system complexity and increase usability.

In another work [8], the researchers implemented an “expert system using back-propagation (neural network) to support the diagnosis of citizens in Ubiquitous Health (U-Health) system.”

Based on the above research, it is quite clear that nowadays we need very user-friendly, efficient, effective, and accurate healthcare systems that can perform the diagnosis of any health problems at the level of an expert. All these reasons become the basis of our proposed integrated MSE system and Mental Health Diagnostic System.

3. Approach

In order to make a correct diagnosis regarding a person’s mental health, the history of the concerned person and his or her mental status examination’s results are required by a psychiatrist or psychotherapist [9]. In fact, the Mental Status Examination (MSE) can be considered as a tool on its own that is used in evaluating a person’s mental health status, and it is an integral portion of the psychiatric interview [10]. The MSE serves as a snapshot of the person being assessed, and plays a very important role of the clinical assessment process in psychiatric practice [11]. Its main objective is to obtain a comprehensive “cross-sectional description of the patient’s mental state that when
combined with the biological and historical information of the psychiatric history, allows the clinician to make an accurate diagnosis and formulation, which are required for coherent treatment planning [11].

In other words, MSE is a structured way of determining a patient’s current “state of mind”, under the domains of appearance, attitude, behavior, mood and affect, speech, thought process, thought content, perception, cognition, insight, and finally judgment [11][12]. It includes all of the important observations and findings that a psychiatrist gathers during a meeting or an interview with the patient. The main result of the MSE is the patient’s “mental status or state”. This provides information to the psychiatrist in determining if further diagnosis has to be carried out, and finally assists in proposing the most appropriate set of treatments and medications to be given to the patient. The MSE’s result, together with the biographical and social information of the psychiatric history, are used to generate a diagnosis, a psychiatric formulation, and a treatment plan setting for a patient [11].

The MSE is a core or basic skill of psychiatrists/ psychotherapists, nurses, and other mental health providers, and it is considered as a key part of the initial psychiatric assessment in psychiatric hospital setting [11]. The objective is to collect evidence symptoms and signs of mental disorders, including any indications of danger to self and others, which are present at the time of the interview.

Figure 1. The Mental Status Examination (MSE) framework

In the past, psychiatrists do not really perform a structured mental health examination on their patients, and they do not follow any rigid steps in assessing the patients’ mental status. Most of the information relevant to the mental status assessment is obtained indirectly through a normal (informal) interview [13] that is conducted with the patient and also those who are close to the patient. Their evaluations are mainly based on their own experience in dealing with people around them, and also through the knowledge that they have acquired.
The psychiatrists/psychotherapists have come into contact with many individuals in their lives, and also have dealt with so many patients with mental problems, and from the various interactions, they continually meet with people who have significantly impaired cognitive abilities, altered capacity for memory, disordered thought processes, and also other kinds of abnormal mental status [13]. The observers (psychiatrists/ psychotherapists) must be able to note or detect when these abnormalities exist, and then categorize them as specifically as possible so that they can be given the right diagnosis and also the correct treatments or medications.

Based on the gathered knowledge on how mental status examination is normally performed on a patient, a more structured approach to examining mental status or state is proposed here. Basically, the approach used within this research study in performing the mental status examination is depicted in Fig. 1 [14].

As listed in Fig. 1, there are altogether 11 basic components or domains of the MSE that are used in the evaluation of a patient’s mental state. They are briefly described below [9][10][11][12][13]:

- **Appearance**: This describes how the patient looks, smells, behaves, speaks, establishes eye contact, and etc. The patient’s age, sex, race, and ethnic background are also recorded.

- **Attitude**: The patient’s facial expressions and attitude towards the examiner are noted, and indicate whether the patient appeared interested or bored during the interview. The observer must also record whether the patient is hostile and defensive, or friendly and cooperative, or seems guarded and whether he or she seems relaxed or uncomfortable throughout the interview session.

- **Behavior**: Observe for any abnormalities of behavior, and also for abnormalities of activity that include observations of specific abnormal movements.

- **Mood and Affect**: Trzepacz and Baker [12] described mood as “a person’s predominant internal state at any one time”, and affect as “the external and dynamic manifestation of a person’s internal emotional state.” In other words, mood is regarded as a current subjective state as described by the patient (e.g. “happy”, “angry”, etc.), and affect as the examiner’s inferences of the quality of the patient’s emotional state based on the objective observation (e.g. How does the patient appear to the examiner?).

- **Speech**: This component is closely related to the appearance component above. It is more concerned with the production of speech rather than the content of speech. The observer will record and comment on paralinguistic features such as the loudness, rhythm, prosody, intonation, pitch, phonation, articulation, quantity, rate, spontaneity, and latency of speech. Normally, the patient is asked to name objects, repeat short sentences, or produce as many words as possible from a certain category within a given time frame.

- **Thought Process**: This describes the way in which the patient thinks. Here, the quantity, tempo (the rate of flow), and form (or logical coherent) of the patient’s thought is examined. Observe and record whether the patient’s comments are logical and presented in an organized manner, and see if the patient’s thought is appropriately linked or simply all over the map [13].

- **Thought Content**: This is a description of what the patient is thinking about. This would give indications of a patient’s delusions, overvalued ideas, obsessions, phobias, and preoccupations. Questions asked include: “Is the patient paranoid?”; “Is the patient hearing or seeing things that others do not?”

- **Perceptions**: A perception is any sensory experience. The three broad types of perceptual disturbance are hallucinations, pseudohallucinations, and illusions. This component checks for any presence of false perceptions such as hallucinations (i.e., auditory, visual, or other sensory experiences in the absence of external stimuli).

- **Cognition**: This component evaluates the patient’s level of alertness, orientation, attention, memory, visuospatial functioning, language functions, and executive function.

- **Insight**: Insight covers the person’s understanding of his or her mental illness, the treatment options, and also the ability to re-label unusual mental events such as delusions and hallucinations as pathological. It is related to a correct understanding of the presence, nature, cause, and significance of any mental or emotional problem.

- **Judgment**: This refers to the ability of a patient to make sound, reasonable, and responsible decisions concerning the appropriate thing to do in various situations. Questions asked may include “what the person would do if he she found a purse lying on the street.”
Other than the above components, there are other domains that a psychiatrist might want to look into such as cultural considerations and also whether or not the patients being evaluated are young children.

The MSE system incorporated all of the components in such a way that the examination of a patient’s mental status (state) is conducted in a comprehensive manner and will correctly determine the actual mental status or state of the evaluated person.

The mental status of the evaluated person/patient is used as an indicator to whether or not further diagnosis needs to be carried out on the patient mental health. If the mental status is Normal, then the individual is considered as mentally healthy; otherwise, the individual is considered to be having some kind of mental problems or disorders (refer to Table 1).

Once the mental status of a person is established, the next step is to diagnose that person’s mental health further in the case where a more detailed examination is required. If the patient’s Mental Status is NOT Normal (Very Mild, Mild, Moderate, Severe, or Very Severe), then a more detailed diagnosis is carried out by the proposed Mental Health Diagnostic System to see if the patient is suffering from any mental disorders [14]. Fig. 2 presents a framework for the Mental Health Diagnostic System.

![Diagram of Mental Health Diagnostic System](image)

**Figure 2.** A framework for the Mental Health Diagnostic System [14]
4. Results: MSE system and mental health diagnostic system

An online Mental Status Examination (MSE) system is developed and evaluated. This MSE system intends to assist new psychotherapists/psychiatrists in diagnosing the mental state or status of any individuals who seek their service. It is hoped that the system is able to simplify the process of evaluating a patient’s mental status correctly and efficiently. The score scales in Table 1 [14] are used in assigning the mental status (the result of performing the MSE on a patient) to each patient’s mental status evaluation.

The scales are based on the total points scored after the mental examination has been carried out; the higher the total points scored, the more serious the mental problem faced by the patient. For each question asked during the mental examination, a specific number of points (can be a zero if the patient does not have or does not show the indicated signs/symptoms) is assigned to the given answer, and at the end examination, the mental status for the evaluated patient is displayed [14].

<table>
<thead>
<tr>
<th>Score (Total Points)</th>
<th>Mental Status</th>
<th>Further diagnoses required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>Normal</td>
<td>No</td>
</tr>
<tr>
<td>11-20</td>
<td>Very Mild</td>
<td>Yes</td>
</tr>
<tr>
<td>21-30</td>
<td>Mild</td>
<td>Yes</td>
</tr>
<tr>
<td>31-40</td>
<td>Moderate</td>
<td>Yes</td>
</tr>
<tr>
<td>41-50</td>
<td>Severe</td>
<td>Yes</td>
</tr>
<tr>
<td>51-60</td>
<td>Very Severe</td>
<td>Yes</td>
</tr>
</tbody>
</table>

The first column in Table 1 indicates the ranges of the score. For example, if the Score (Total Points) is within 0 to 10 (inclusive), then the patient is considered as Normal (Mental Status = Normal). If the patient’s Mental Status is Normal, then no further diagnosis is required; otherwise, the patient must undergo further diagnosis (refer to column 3 of Table 1).

Fig. 3 presents a screen capture of the first page of an execution example of the MSE system. The components or domains shown (out of the 11 components) here are the patient’s “Appearance” and “Behavior.” Each button clicked by the examiner or user corresponds to a score (using points system) [14]. If the answer to the question is “Yes”, then the point given is a 1; otherwise the point given is a zero. Other questions asked might have more than two options, and for each option, the number of points assigned will differ.

Figure 3. A screen capture of the MSE system’s execution
Fig. 4 shows another screen capture of the MSE system after the user has answered all 27 questions in the MSE’s questionnaire, and after the *Submit* button has been clicked. The MSE system will give an error message if any of the questions is left unanswered (incomplete). This is to ensure that the mental status examination is performed thoroughly. Another screenshot of the results of the examination is depicted in Fig. 5. Here, it can be concluded that the patient is experiencing some kind of mental health problem (*Very Severe* condition).

**Figure 4.** A screen capture of the MSE system’s execution with results

**Figure 5.** A screen capture of the MSE system’s results

If the mental health status of the examined individual is not normal, then the Mental Health Diagnostic System will diagnose a patient for any mental disorders’ symptoms related to mood, anxiety, eating, psychotic, and neurological disorders. The diagnostic system performs a thorough examination on the patient for each category of mental disorders, and at the end of the diagnosis process, a complete report of the patient’s mental health and disorder is presented [14].
Fig. 6, Fig. 7, and Fig. 8 show examples of screen captures of executing the integrated (improved) system. The system, which is named Mental Health Diagnostic System or MeHDS, is used for assessing a person’s mental health condition in more detail. A rule base (a knowledge base on symptoms for each mental disorder) holds a set of production rules that is used to diagnose the patient’s mental health. As mentioned earlier, only those patients with some kind of mental disorders (Mental Status: Very Mild, Mild, Normal, Moderate, Severe, Very Severe) are required to go through further diagnosis as given in the screen captures below. The diagnosis will give details about any possible mental disorders (can be more than 1 mental disorder) that are related to the selected symptoms displayed in Fig. 6.

![Figure 6](image1.png)

**Figure 6.** A screen capture of the MeHDS’s execution that displays the symptoms to be selected

![Figure 7](image2.png)

**Figure 7.** A screen capture of the system’s execution for a person who has eating disorders
5. Discussions

Based on our evaluation, the proposed integrated Mental Health Diagnostic System that maintains a rule base (a knowledge base on mental disorders) has proven to be very useful in giving fast and effective diagnosis for a given set of symptoms presented to the system by a user, who in this case is either a psychotherapist or a psychiatrist. In addition, it can be used as a learning tool for new psychotherapists/psychiatrists in assisting them to perform correct diagnoses in determining the actual conditions of patients with mental health problems. This comprehensive diagnostic system is also useful in cutting down the amount of time required for diagnosing an individual for mental disorders. Consequently, one of the direct results would be a more reasonable and affordable cost for diagnosing and treating mental patients.

6. Significance and benefit of the research

It is believed that the proposed Mental Health Diagnostic System will benefit a lot of people, especially the ordinary people. Even psychiatrists/psychotherapists will find that their tasks of identifying individuals with mental disorders are going to be simplified. It has been known for a long time that, in spite of being common, mental disorders/illnesses are still being under diagnosed by human experts. Doctors identify less than 50% of those who meet the diagnostic criteria for psychological/mental disorders [3]. In other words, the majority of those with some kind of mental disorders are not diagnosed as having mental illnesses, and this may lead to other more serious social problems.

7. Future work and conclusion

The development of the integrated Mental Health Diagnostic System, which incorporated the Mental Status Examination (MSE) system, has been completed. It implements a knowledge base or rule base that holds a set of rules for diagnosing five selected categories of mental disorders, which are mood disorders, anxiety disorders, eating disorders, psychotic disorders, and neurological disorders. This research study has been carried out successfully with the assistance of a psychotherapist who is actively involved with the examination and treatment of people with mental problems. The entire
diagnostic system has been verified and validated by the psychotherapist and the results are very encouraging. The psychotherapist was quite satisfied with the results. The only improvement that needs to be done is to enhance the process of upgrading the contents of the rule base, which requires some kind of machine learning ability. The existing system only allows the administrator to add new rules to the rule base. It is hoped that in the future, the rule-based reasoning and case-based reasoning techniques can be implemented within the system in coming up with more accurate mental health and disorders diagnosis.

Hopefully, the outcomes of this research study can assist those new and inexperienced psychotherapists and psychiatrists to assess and diagnose more patients correctly, and efficiently. In addition, it is hoped that the costs of assessing and treating mental health and disorders can be reduced by using the online integrated Mental Status Examination and Mental Health Diagnostic System.

8. References