Pakistan Journal of Psychological Research, 2019, Vol. 34, No. 4, 853-867

https://doi.org/10.33824/PJPR.2019.34.4.46

DC-MMS: Diagnostic Checklist of Major Depression, Mania and Schizophrenia

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The present study was designed to develop a Computer Software for computer based diagnosis of schizophrenia, mania, and patients having major depression on the basis of their nonverbal communicative patterns. The study was conducted into two phases. The first phase consisted of (a), recording videos of non verbal communicative patterns of patients in order to assign behavioural patterns to each on the basis of observations of recorded videos by a panel of three clinical psychologists named as Aware Group and (b), defining of those patterns (for each disorder) by practitioners called the Unaware Group as they were unknown to the behaviors posed by the patients recorded in the videos, in order to verify the assigned patterns by the Aware Group. The second phase comprised of developing the diagnostic software and its validation on the basis of obtained information. Results revealed that non-verbal behavioural patterns associated with each disorder are significant tools that can be used as differential diagnostic criteria by the clinicians. The findings concluded that nonverbal behavioural cues can reliably be used for diagnosing different mental disorders with an accuracy of 97%, 100%, and 97% for Schizophrenia, Major Depression, and Mania, respectively.

Keywords. Nonverbal behavioural cues, diagnosis, schizophrenia, mania, major depression, computer assisted diagnosis, software

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Nonverbal cues are the actions in communication for understanding and expressing the emotions and thoughts through means of behavioural patterns as physical appearance, postures, paralinguistic, facial expressions, gestures, and eye contact, etc. Being the immediate and unconscious modes of communication, these non-verbal channels define and reflect much information about a person's emotional states and perceptions (Ambady & Rosenthal, 1998; Sotiri & Lika, 2013). The nonverbal communication work partially on conscious level, but the major part of communication involves the unconscious use of these body signals, and thus, they regulate the attitudes and emotions. Timmins (2012) in his study confirmed the major role of non-verbal modes in communication by stating that 90% of the communication relies on these behavioral modes, while only 10% constitutes words. Having significant role in communication, these modes are thus used as diagnostic tool for various mental disorders (Ekman, 1985).

In mental disorders the behavioural domain is the most prominent one, which gets affected and through these behavioural sigs one can assess the individual's condition as normal or abnormal. Such as in Autistism Spectrum Disorder, the individual pose reduced non-verbal communication, and thus, Vitaskova and Palacky (2012) in their study used these behavioral signs as diagnostic tools. In another study, Jones, Carr, and Klin (2008) studied the frequency of eye-mouth fixation patterns in patients of Autistic Spectrum Disorder by recording and studying the video recordings of these patients. These fixation patterns were matched with the group of normal children and thus significant difference was observed in terms of eye-mouth movements and motor activities. Various researches emphasize the legitimacy of attained information via behavioral patterns in the process of communication (Malandro & Barker, 1983; Mehrabian, 1981; Knapp, 1972) with the focus on nonverbal constituents to comprehend effects of the speaker (Hakman & Johnson, 2000).

In clinical settings, before starting therapy, a baseline assessment is done for acquiring prime conditions and judgments about the clients. Grounded on vocal and non vocal constituents, the clinicians gather much relevant information about client's mental states, diagnosis, and even progression in symptoms as these are the reflection of unconscious mind of a person (Burgoon, Guerrero, & Floyd, 2009; Philipport, Feldman, & Coats, 2003). The reflection of unconscious mental states are the various indicators as facial expressions, gestures and eye contact etc. As therapeutic process progress, these cues deliver imperative information about client's conditions, diagnosis, and treatment (Egbochuku, 2008). For instance,

in a study on patients with schizophrenia. Condon and Ogston (1996) revealed impaired emotional expressions as affective flattening, grimacing, rigidity and self-laughing as the most prominent signs. Other researchers reported decreased motor movements, specifically the hand gestures (Grand, Freedman, Steingrat, & Buchwald, 1975), reduced facial movements while communicating (Ellgring, 1986), and eye gaze aversion as noticeable symptoms among patients with schizophrenia (Rutter, 1973, 1976). In psychiatry, professionals try to understand the deep-rooted causes of psychological problems by observing these non-verbal modes as these reveal much important information about client's condition. For instance, clinicians observed the relation of high pitch with strain, anxiety, and dependence; while, the low pitch was found as the indicator of strength and maturity. In major depression, the para-linguistics have been found slow, hesitant, and elaborated (Darby, 1984); while, in schizophrenia as flat and monotonous (Cancro & Lehmann, 2014). Individuals with psychopathologies usually sound low and gloomy as their affective states (Bernhardt, 2010).

Another study was conducted with patients with mania and patients with major depression by Angst, et al. (2011) in relation to their behavioral patterns. The findings revealed appropriate physical appearance than maniacs which were found hyper, overactive, impulsive, vigilant and extreme loquacious. Moreover they had inappropriate clothing i.e. too bright and vibrant. Further research findings suggested strained, down-casted tedious activities as decreased body movements, affects and social communication (Buck, 1984; Fridlund, Ekman, & Oster, 1987;Waxer, 1976; Ellgring, 1986; Ekman & Friesen, 1974;) poor eye contact (Rutter, 1973a., Hinchiffe, Lancashire, & Roberts, 1970), with diminished facial signs as behavioral domains in major depressives (Jaeger, Borod, & Peselow, 1986).

Much research data emphasize the significance of Non-verbal signs in clinical practice in order to understand the psychopathological causes with various backgrounds (Hakman & Johson, 2000; Meharrbian, 1981; Knapp, 1972; Malandoro & Barker, 1983; Sotiri & Lika, 2013). Later findings determined these signs as differential diagnostic tools for different disorders (Vitaskova, & Palacky, 2012; Jones et al., 2008). The field of psychiatry depends primarily on the diagnosis on the basis of which other subsequent works depends as classification, severity of the disorder, differences and similarities among disorders, etc. In order to formulate an effective treatment plan, a comprehensive diagnosis is a pre-requisite. By considering the significant and vital role of diagnosis, professionals are striving to

make this process more objective day by day. Consequently, many attempts are being made to introduce computer based assessment (Honigfeld, Gillus, & Klett, 1966; Overall & Gorhan, 1962; Young, Brien, Gutterman, & Cohen, 1987).

Current era is the computer age and with the advancing technology, more sophisticated, less time consuming, and cost effective products are being launched with every single day. Because of the changing world and ease of computers in professional settings, clinicians are also preferring to adopt and incorporate modern technology in their work in terms of diagnosis, treatment, data entry and client's records etc. Therefore, various attempts have been made and introduces computerized programs for report writing procedures, billing, patient-interactive screens and word processing methods in interview taking; so that the therapeutic process can be made more objective and easy. These programs are facilitating the clinical settings by making the trainees and professionals well equipped with advanced technology for the process of objective decision making (Chris, 1989).

Rationale of the Study

In clinical settings, especially in Pakistan and more specifically in Khyber Pakhtunkhwa, the common method to diagnose the patient, is the clinician's experience in diagnosing any disorder. Based on brief clinical interviews comprising of few questions related to the suspected disorder (as per ICD 11 or DSM 5 Criteria), the practitioners confirms the diagnosis and prescribe the treatment. The practicing methodology does not denote the incompetence of the practitioner, rather, the said practice is performed due to high influx of patients in Out Patient Department (OPDs). On daily basis a single psychiatrist in his OPD has to see more than hundred patients without using any psychiatric tool even Mini Mental State Examination Scale (MMSE) in detail. Few psychiatrists do administer some of its items to confirm their assumed diagnosis for the patient. The detailed examination is only practiced for admitted or Inpatients on whom psychologists and the team do work on daily basis in terms of in depth screening with the help of screening tools as MMSE, Bender Depression Anxiety Scale (BDI), Projective Tests as Human Figure Drawing Test (HFD), Thematic Apperception Tests (TAT), and others. The reason for using these tools on only admitted patients is that all these are paper pencil and time consuming tests in terms of both administration and interpretation. By observing the practice in mental health Institutes in terms of diagnosis, the researcher felt the

need of developing such a diagnostic tool that could bring ease to the practitioner, be less time consuming both in terms of administration as well as interpretation along with owing the objectivity and reliability in its findings which was assumed to be achieve by using a computer-based program rather than using a paper pencil test.

Moreover in Pakistan, the literacy rate is low and most of the population even find difficult to handle pen to write. In terms of understanding the items, the uneducated respondents/patients do face difficulty in responding. Therefore, the researcher in the current study focused more on the behavioral domains of the patients for observations by the clinicians. The clinical expertise of the practitioners in terms of schizophrenia, major depression and mania along with use of this developed software could provide a perfect combo for an objective and error free diagnosis for the said disorders only.

Considering the mentioned significance of computer-based assessment in the today's world, the current research endeavored to develop a diagnostic software on the basis of behavioral patterns so that the diagnostic process for schizophrenia, major depression, and mania could be made easy, precise, reliable, less time consuming, cost-effective, and objective.

Objectives of the Study

Following objectives were kept in mind to achieve goal of the study.

1. To formulate a checklist for the diagnosis of Schizophrenia, Mania, and Major Depression.
2. Based on obtained information to devise a computer software for computer-based diagnosis.
3. To determine validity of the developed software.

Method

Sample

For Study 1 of Phase-I, total 101 patients of schizophrenia (n = 32), major depression (n = 35), and mania (n = 34) were approached for video-recording procedure through purposive sampling technique belonging form age range of 16 to 60 years. The

sample of Study 2 comprised 25 clinical professionals including psychiatrists and clinical psychologists from different mental health institutes who participated for validation of the checklist obtained in Study 1.

The Phase-2 incorporated 209 patients of schizophrenia (n = 75), major depression (n = 61), and mania (n = 73) through convenient sampling method belonging to age range of 16-60 years, who were diagnosed with the developed diagnostic soft ware for determining the validity of the devised software. Only diagnosed patients of schizophrenia, mania and major depression were approached for the research. Any somatic infirmity in the patients such as visual or limbs impairment were debarred from the sample as these deficiencies could produce behavioral changes.

Procedure

Developing a diagnostic tool requires verification and validations of the test items and for this purpose current study was divided into two phases. The data was collected with the ethical approval and written consent of the Mental Health Institutes. As the patients were suffering from Major Depression, Mania and Schizophrenia so it was not possible to take permission from them. In this regard for the purpose of data collection their immediate attendant (mother, father, sibling and any immediate care taker) were requested to fill a written consent form after which the data was collected. Initially the nonverbal behaviors of the diagnosed patients of schizophrenia, Major Depression and mania (as per ICD-11 and DSM-5 Criteria), were recorded in the form of videotapes, which were later analyzed by a panel comprising three expert clinical psychologists.

The panel was named as the Aware Group as they witnessed the patient's videos and assigned nonverbal behavioral patterns to Schizophrenia, Mania and Major Depression. The panel identified 91 behavioral characteristics under six non-verbal domains among which 11 were for Physical Appearance, 14 for Postures of Upper limbs, 8 for Postures of Lower Limbs, 04 for Postures of Torso, 09 for Facial Expressions, 27 for Gestures, 03 for Patterns of Fixation, 03 for Pupil dilation, 03 for Meter/rate, 03 for Volume and 03 for Pitch while length of gaze, Frequency of glances and blink rate were measured in one minute time/60 seconds thus were in numeric value.

As the research process cannot rely on observations, therefore, the assignment of these behavioral cues to different disorders was needed to be made more scientific and objective for which Cross Tab Formula (CTF) was used through SPSS. Cross tab formula (CTF) is a

statistical technique, used in the study, as it helps the researcher to compare mutually exclusive data sets of the two variables. The results are produced in the form of contingency table and provides a calculated value of the comparison by the formula ad/bc.

The analysis was done in a way that three files were made namely, Fila-A, File-B, and File-C. Each file comprised the data sets, as of schizophrenia (SCZ) - mania (MA); mania (MA) - major depression (MD) and major depression (MD)-schizophrenia (SCZ) respectively. Such procedure of data analysis was adopted so that to measure the presence of each variable for each category of the disorder twice in a group. Through the application of formula that is, ad/bc a six dimensional checklist was obtained comprising physical appearance, postures, facial expressions, gestures, eye contact and para-linguistics.

The next step in the research was the determination of validity of the differential checklist for which Study 2 of the Phase-I was conducted. The study comprised a sample of 25 practicing clinical psychiatrists and psychologists, to whom a checklist of the indicators was provided. In the checklist the indicators of nonverbal behaviors were randomly numbered for each disorder and the professionals were requested to define these behaviors as per their professional expertise. The group of the professionals was called as the Unaware group as they did not witnessed the video-recordings. After the data collection, the indicators defined by the unaware group was matched with the checklist obtained through the Study 1 by calculating frequencies and percentages. On the basis of obtained matched frequencies and percentages, the final diagnostic checklist was formed.

The formulation of final diagnostic checklist lead the study into Phase-2 which comprised the shaping of formulated six dimensional checklist in the form of a diagnostic software. The procedure was done with the assistance of professional computer software personnel. The software passed through multi-revisions till its final version. The computer programmer along with the researcher tested-retested the efficiency and correctedness of the devised tool. Total 5 revisions were made in the programing unless the software became error-free, accurate and objective for the diagnosis of schizophrenia, mania and major depression which was named as Diagnostic Checklist of Major Depression, Mania, and Schizophrenia (DC-MMS). The developed diagnostic software was again has to be checked and validated in the clinical settings. Therefore, the procedure adopted was to diagnose the referred patients by the psychiatrists through developed software and then matched the findings with the diagnosis already given by the

professional (on the basis of ICD-11 and DSM-5 criteria) and thus the validity of the diagnostic software was determined.

Results

The developed diagnostic software was to be checked and validated in the clinical settings. Therefore, the procedure adopted was to diagnose the referred patients by the psychiatrists through developed software and then matched the findings with the diagnosis already given by the professional (on the basis of ICD-11 and DSM-5 criterions), and thus, the validity of the diagnostic software was determined. The Tables 1 and 2 are revealing the accuracy findings of developed software in terms of diagnosing Schizophrenia, mania, and major depression along with Cronbach's alpha reliability of each behavioral pattern in association to each disorder, respectively.

Table 1

Frequencies and Percentages (Accuracy) of Nonverbal Cues Diagnosed by Clinicians and Through Devised Software in Three Groups

S.No.	Category	Patients Diagnosed by Clinicians (*f*)	Patients Diagnosed through Software (*f*)	Accuracy %
1	SCZ	75	73	97%
2	MD	61	61	100%
3	MA	73	71	97%
	Total	209	207	98%

Note. SCZ=Schizophrenia, MA=Mania, MD=Major Depression, D= Diagnosis

Findings of Table 1 are showing the validity of the developed diagnostic software. The results reveal that the overall diagnostic accuracy of the developed software is 98% while the software diagnose schizophrenia, mania and major depression with an accuracy percentage of 97, 97, and 100 respectively.

Table 2

Descriptive statistics and Reliability Coefficient of Developed Checklist

Cronbach Alpha	*n*	*α*	*M*	*SD*	Range
Schizophrenia	41	.82	.11	.01	0.43
Mania	34	.74	.19	.04	0.88
Major Depression	21	.71	.31	.06	0.78

Table 2 is showing the Cronbach Alpha reliability of the scale for the three disorder. Thus, the scale has high reliability for the diagnosis of Schizophrenia, Mania, and Major Depression.

Discussion

For devising an effective treatment plan, the process of classification, identification, and diagnosis are the imperative steps in relation to any mental or physical illness. Affective pathways are the most reliable information source of understanding psychopathology and even diagnosis can be made on the observations of these behavioural signs. Different researches confirmed the role of nonverbal behavioural patterns in order to detect the unconscious minds of the clients as a valid and reliable source of information in the process of psychotherapy (Hakman & Johson, 2000; Malandoro & Barker, 1983; Meharrbian, 1981; Knapp, 1972;). Further, research studies revealed these nonverbal signs as differential diagnostic tool (Vitaskova & Palacky, 2012; Jone, et al., 2008).

In terms of computer-based assessment, Lukin, Dowd, Plake, and Kraft (1985) conducted a survey and found that 85% of the population favoured computerized procedures. In another study, Young et al., (1987) introduced computer-based structural clinical interviews for the assessment for various mental disorders and found it more cost effective, less time consuming and rich information source in terms of clients. Another significance of computerized programs in clinical settings is generation and regulation of data bases which can help in quality assurance, research as authentic source of information and third party dealings, etc. (Adams& Heaton, 1987).

Much of work has been done in this domain and the use of computerized programs in clinical settings is common now-a-days. Some of the most frequently used programs are the Present State Examination (Wing, Cooper, & Sartorius, 1974), Brief Psychiatric

Scale (Overall & Gorhan, 1962) and the Nurse's Observation Scale for Inpatient Evaluation (Honigfeld et al., 1966). All these programs are widely serving as diagnostic tools. Similarly, there are many online diagnostic software such as SoftPsych (2009) which is being widely used for the diagnosis of anxiety, depression and hypertension. WinSite (2012) is another diagnostic program of schizophrenia and anxiety. Another online diagnostic program has been introduced by Benet (2012) named as Assessment Psychology Online for anxiety, bipolar, schizophrenia, and borderline personality disorders. Blouin (1985) developed Data Information System (DIS) for clinical and administrative procedures. The program was based on the diagnostic procedures of DSM-III and used for diagnosis and determination of duration and onset of symptoms, and thus, generate a report in printed form. It is still in use by clinicians in clinical settings.

Diagnostic Analysis of Nonverbal Accuracy for Postures is a diagnostic system developed by Pitterman and Nowiciki (2004) in order to establish an association between emotional states and postures and ease the process of understanding the client's conditions as anger, fear, happiness, etc. Another computer-based diagnostic procedure called Facial Expression Coding System was introduced with a purpose of identification and differentiations of emotional conditions in patients (Ekman, 2016).

A Three Dimensional (3D) computer based program was introduced by Skuse et al. (2004) named as The Developmental Dimensional and Diagnostic Interview for attainment of objective diagnosis of Autistic Spectrum Disorder. Management Information System is another attempt in computerized clinical work for making the client's record from the very first session till the end of the therapy (Elias, Dalton, Cobb, Lavoie, & Zlotolow, 1979). Wilkinss and McKenzie (1989) examined reliability and validity of widely used computer assisted programs. The Kauffman Assessment Battery for Children, Rorschach Interpretation Assistance Program, the Kaufman Method of WISC-R Hypothesis Generation and the Devereux Elementary School Behaviour Rating Scale, were selected. The findings revealed close link between the computer assisted analysis and the American Psychological Association Guidelines. Based on the findings of above mentioned studies, in present study, the authors developed computer software for diagnosis of three mental disorders i.e. schizophrenia, major depression and mania to simplify the process of diagnosis and successfully completed their task. The developed software was named as Diagnostic Checklist of Major Depression, Mania and Major Depression (DC-MMS).

Step 1: The display screen of the software shows login options with user name and password. The display page also shows the software name and specifications in terms of its function.

Step 2: After logging-in, the system displays multiple options on the screen. One side (left) of visible blocks on the screen shows total number of patients (overall cases) seen and on other side (right) patients dealt on the same day (Today's Cases). Other visible categories include Registration Form, Patient List, All Report, Single Report and New User Form. Each option has its own function and modality.

Step 3: The Registration Form has a function of registering new patients/clients for diagnosis. A single click on icon opens a new window to view Profile/Demographics sheet of the patients. The window consists most of the options related to the client's demographics. After completing the demographic variables, the clinician can save data by clicking on the save sign/key () which save data. Apart from doing this he can move backward and forward to see/examine cases dealt using their respective key/sign.

Step 4: After completing the registration form clinician will be able to start the process of diagnosis by moving to different domains of nonverbal behaviors. The first domain of nonverbal patterns is Physical Appearance, a single click on physical appearance automatically displays the variables and the clinicians can check the behaviors as per client's visible condition. After checking the observable findings the clinician can save the data by clicking on the option to save record.

Step 5: Click on the desired domain display the variables in a new window. The same process of checking of the variables follows for each domain and after selection the clinician can click on to save the record.

Step 6: After checking and entering all visible characteristics in the client for each domain, the professional has to click on the "Make Result" and the resultant diagnosis would produce automatically on the screen as per entered/checked observations by the professional.

Implications

The present study has important implications in field of psychiatry.

1. In clinical setting it will ease the diagnostic process.
2. It is simple and easy to use, and thus, requires less training and skill to operate by the clinicians.

3. The client's report can be easily made and established.
4. Through the software, the most accurate, precise and objective diagnosis of schizophrenia, mania, and major depression would be possible.
5. It will facilitate the process of developing data base including client's basic information, behavioral manifestations, and diagnosis.

Limitations and Suggestions

Following limitations were observed in the present study and thus there are certain suggestions for these as well.

1. The sample was more of male patients than the females in video-recording procedure due to cultural barriers and restrictions. For future researches, the equal ratio of the male and female patients will facilitate the generalization of the findings.
2. The software does not cater the intensity and chronicity of the disorders thus future researches could be done in this domain.

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Received 15th January, 2019

Revision received 4th September, 2019