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Diagnostic accuracy and feasibility of a net-based application for diagnosing common psychiatric disorders

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ABSTRACT

A net-based application, which enables users to diagnose and manage common psychiatric disorders independently, was developed. Diagnostic accuracy and reliability of the application were compared with the Mini International Neuropsychiatric Interview among 274 adult outpatients. The screening sub-module of the application had high sensitivity, specificity and negative predictive values for most disorders, but low positive predictive values for several disorders. The criteria-based diagnostic sub-module demonstrated moderate to substantial agreement (kappa > 0.50) for all 4 broad categories and 10 of the 18 individual disorders included. Diagnostic agreement was, however, low (kappa < 0.4) for most of the disorders comprising the broad category of 'neurotic and stress-related disorders'. Low sensitivity was also observed among these disorders, though specificity, and positive and negative predictive values were high for most disorders. Inter-rater reliability of the application's diagnoses was high. Symptom-severity and functional status scores correlated significantly with those on standard scales. Average time taken was 5 min for screening and 20 min for detailed diagnostic assessment. A majority of the patients, their relatives and interviewers were satisfied with the assessment. The results suggest that with further refinement the application could be suitable for use as a net-based diagnostic tool for psychiatric disorders.

1. Introduction

Though mental disorders are highly prevalent and equally disabling in low- and middle-income countries like India, there are large gaps in provision of mental-health care in these countries because of scarcity of mental-health resources, which is often compounded by a grossly unequal distribution of the available resources between urban and rural areas, and between primary and secondary care (Reddy and Chandrasekar, 1998; Ganguli,2000; World Health Organization, 2011; Thirunavukarasu, 2011). The traditional solution to bridge this 'mental-health gap', advocated as a part of the National Mental Health Programme of India (Government of India, 1982) has been to strengthen existing resources, develop new ones and enhance manpower (Patel, 2010; Thirunavukarasu, 2011). However, these measures are highly resource-intensive and their implementation has been slow. Thus, alternative methods of service delivery have been proposed. Telepsychiatry, the use of information and communication technologies to provide or support clinical psychiatric care from a distance, is one such alternative (American Psychiatric Association, 1998). Established telepsychiatric services usually follow different models of care such as direct patient management though video-conferencing, consultation models, collaborative-care, or asynchronous models of care (Hilty et al., 2013; Malhotra et al., 2013). However, a somewhat different model of service delivery, which enables a team of non-specialist personnel (typically a team consisting of general physicians and para-professionals) at remote sites to diagnose and treat mental illnesses on their own, with minimal consultation, supervision, or direct care from a nodal-care centre may be more suited to resource-constrained environments of low-income countries like India (Malhotra et al., 2013, 2014).

Driven by this newer model of mental health-care delivery for remote areas, a pilot project was undertaken at the Department of Psychiatry of the Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh, India. The Department was the nodal centre of this project and linked to three peripheral sites located in the adjoining hill states of north-India. An online application was developed to enable the non-specialist users to diagnose as well as manage common psychiatric disorders independently.

While developing the diagnostic part of the application, several well-validated interviews such as the Structured Clinical Interview

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for DSM-IV Axis I disorders (SCID-CV; First et al., 1996), the Composite International Diagnostic Interview (CIDI; Wittchen,1994) and the Mini International Neuropsychiatric Interview (MINI; Sheehan et al., 1998) were reviewed for their suitability. The SCID and the CIDI were felt to be unsuitable because of the long time (1–2 h) and the extensive training required for diagnostic assessments. In terms of brevity of administration, the MINI which takes about 15–20 min for a complete diagnostic assessment was more appropriate. Moreover, a number of studies from around the world have found high inter-rater and test–retest reliabilities, as well as moderate convergent validity of the MINI relative to the CIDI and the SCID (Lecrubier et al., 1997; Sheehan et al., 1997, 1998; Rossi et al., 2004; Otsubo et al., 2005; Mordal et al., 2010). The MINI has also been translated extensively and a local language (Hindi) version was available. However, the developers only allow limited use of the MINI as a research-instrument and did not permit its incorporation in the application. Other problems with the MINI were that it did not include several common disorders such as organic, adjustment, somatoform and dissociative disorders. Though meant for both research and clinical use, the MINI has been mainly used as a research instrument. For this particular online application, a diagnostic tool which replicated diagnostic interviews in ordinary clinical settings was essential. Since the diagnostic part of the application was linked to further management, it also had meet the dual objectives of a comprehensive psychiatric clinical interview, albeit with a more focused and systematic evaluation. A balance between an objective criteria-based diagnostic exercise and conducting the interview in a conversational style was considered crucial, with the aim of replicating the routine clinical interview situation, where there is a greater need (as opposed to research settings) to establish a therapeutic relationship with the patient right from the onset. For these reasons an entirely new diagnostic tool had to be developed.

The computerized decision support system for diagnosis and management of common psychiatric disorders eventually developed for this project is a fully automated, internet-based application consisting of interlinked modules for diagnosis, pharmacological and psychosocial treatment, and follow-up care. Separate versions for adults and children/adolescents in English and Hindi have been developed. The diagnostic part of the application has a screening sub-module, and more detailed diagnostic sub-modules, which generate a final diagnosis mainly based on ICD-10 criteria.

In an earlier study, the diagnoses made by a pre-computerized version of the application were compared with clinical diagnoses based on detailed semi-structured clinical assessments supervised by consultant psychiatrists (Malhotra et al., 2014). The results indicated that despite some limitations the diagnostic part of the application was reasonably comprehensive, brief and feasible with an acceptable level of diagnostic accuracy. The application was subsequently upgraded and run online. This paper focuses on the accuracy and reliability of diagnoses generated by the online version of the application, compared to those obtained by using the MINI (Sheehan et al., 1998) among adult patients attending the psychiatric outpatient services of the nodal-centre. Symptom-severity, functional status, inter-rater reliability of diagnoses generated by the online-application, and the feasibility of its use as a diagnostic tool, were also examined in these patients.

2. Methods

2.1. Description of the diagnostic module of the online application for adults

The development, basic structure and content of the diagnostic module of the application for adults have been described in greater detail earlier (Malhotra et al., 2014). Briefly, the application assesses for 18 common psychiatric disorders in adults. The 'core' of the diagnostic module consists of an initial screening sub-module incorporating 18 questions for all disorders, followed by a detailed assessment for specific disorders by separate diagnostic sub-modules. Diagnoses are based primarily on ICD-10 criteria, both from the Clinical Diagnostic Guidelines (World Health Organization, 1992) and the Diagnostic Criteria for Research (World Health Organization, 1993). In certain parts (e.g. for delirium or dementia), DSM-IV (American Psychiatric Association, 1994) criteria have been used. To avoid multiple diagnoses, a diagnostic hierarchy giving precedence to diagnostic categories appearing earlier in the ICD-10 is incorporated. The diagnostic exercise follows a stepwise approach. After identification details, socio-demographic profile, presenting complaints and precipitating events are recorded, the screening sub-module, which acts as the first gateway is administered. Depending upon the positive responses on screening, the detailed diagnostic sub-modules open in an order based on the inbuilt hierarchy. In each diagnostic sub-module, there is a second-level enquiry about the primary or typical symptoms of that disorder, which proceeds to a third-level enquiry employing other criteria, only if the specified threshold is met at the second level. Alternatively, it skips the remaining part of that sub-module and moves to the next sub-module derived from screening. At the end of diagnostic work-up, assessments of symptom-severity (on a five-point scale) and socio-occupational functioning (on a visual analogue scale) are carried out. The 'core' diagnostic assessment can be supplemented by 'additional' sections on past, family, personal, developmental, medical and treatment history, and physical and mental status examinations, whenever required. The diagnostic algorithm for the screening and diagnostic sub-modules consists of three main components, namely the question-item, the 'rater's rule' for the rater to apply; and the 'decision rule' for computer automation. Each question-item is based on the official classificatory systems, but is more descriptive, uses culturally relevant idioms and examples, and is simple to comprehend. 'Rater's rules' specify how the interviewer should rate an item as present or absent, based on the intent of the question, the duration and persistence of symptoms, and the distress or dysfunction caused by the symptoms. 'Decision rules' are automated rules, which govern the flow of the diagnostic algorithm; they define how a response influences the diagnostic decision tree. 'Decision rules' have been built based on the diagnostic thresholds set by standardized classification systems, as well as socio-cultural norms, duration of symptoms, possibility of self-limiting symptoms, and dysfunction caused by symptoms.

2.2. Study procedure

The study was approved by the Institute Ethics Committee. Written informed consent was obtained from all patients and their relatives, and other ethical safeguards were maintained during the conduct of the study. The diagnostic accuracy of the application's diagnostic module was compared with diagnoses generated by the MINI (Sheehan et al., 1998) among adult outpatients with psychiatric disorders at the nodal centre. To allow proper comparisons for certain diagnostic categories, which were a part of the application but were not included in the MINI, additional interview questions were asked at the end of the MINI assessment. These additional set of questions were derived from the MINI-Plus (Sheehan et al., 1998) for the diagnostic categories of dysthymia, somatization disorder, hypochondriasis, body dysmorphic disorder, pain disorder and adjustment disorder; for delirium and dementia from the DSM-IV (American Psychiatric Association, 1994), and from ICD-10 Diagnostic criteria for Research (World Health Organization, 1993) for dissociative disorder, neurasthenia,