Chapter 9
Schizophrenia: Indian Research: I-Epidemiology, Clinical Features Neurobiology and Psychosocial Aspects

Parmanand Kulhara, Sandeep Grover and Natasha Kate

1 Introduction

Schizophrenia as a disorder has fascinated many researchers in India. It is possibly the most researched psychiatric disorder in the Indian context. During the last four or five decades, large numbers of studies have evaluated various aspects of schizophrenia. It is suggested that research on schizophrenia from India far exceeds that done in any developing country from Asia and Africa (Wig 2010). This chapter provides an overview of the research on schizophrenia emerging from India.

2 Epidemiology

In the 1960s and the 1970s, many studies from different parts of the country assessed the prevalence and incidence of schizophrenia (Dube 1979; Elanagar et al. 1971; Issac and Kapur 1980; Nandi et al. 1975; Sethi et al. 1967, 1972, 1974; Surya et al. 1964; Thacore and Gupta 1975; Verghese et al. 1973). These studies have evaluated 1,393–29,648 subjects from the community and reported prevalence rate of schizophrenia to vary from 1.1 to 4.3 per 1,000. Very few studies

P. Kulhara, Consultant Psychiatrist; S. Grover, Assistant Professor; N. Kate, Formerly Senior Resident

P. Kulhara (✉)
Fortis Healthcare, Chandigarh, India
e-mail: param_kulhara@yahoo.co.in

P. Kulhara · S. Grover · N. Kate
Department of Psychiatry, Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh, India

S. Malhotra and S. Chakrabarti (eds.), *Developments in Psychiatry in India*,
DOI 10.1007/978-81-322-1674-2_9

have assessed the incidence rate of schizophrenia. A study from the rural area reported the incidence rate to be 4.2/10,000 population (Sartorius et al. 1986).

A recent World Health Survey (WHS) also covered six states (Assam, Karnataka, Maharashtra, Rajasthan, Uttar Pradesh and West Bengal) in India and provided data about the epidemiology of psychosis in India. Health status was assessed from individual questionnaires administered to 9,994 adult population in ages of 18 and above. This study showed that 0.7–3.7 % of the population was diagnosed with psychosis, but of these, only 36.2–85.2 % received treatment. Higher proportions of patients who received treatment were from the urban areas and from higher income groups (World Health Survey 2003).

3 Clinical Features

Communication and linguistic skills: Some of the studies have focused on communication pattern, linguistic competence and thought disorder, reporting disturbances in communication in the form of inhibition of speech (Murthy 1965) and perseveration, circumstantiality and irrelevancy in speech (Singh 1971). Mazumdar et al. (1988) assessed thought, language and communication disorders and observed that positive and negative thought disorders occurred in equal proportion in patients with positive and negative schizophrenia. Varma et al. (1973) studied concretization of thinking and found that compared to normal controls and subjects with neurosis, patients with schizophrenia had low abstract ability. Abraham et al. (1979) used the repertory grid technique for the assessment of schizophrenic thinking and were able to discriminate patients with schizophrenia from those with neurosis and healthy controls based on this. Giridhar et al. (1992) found a higher linguistic competence in patients with positive schizophrenia, compared to the other groups, and also reported that high linguistic competence was an indicator of poor prognosis in positive schizophrenia and of a better prognosis in negative schizophrenia.

Hallucinations: Studies have also focused on understanding the phenomenology of hallucinations in schizophrenia. Ramanathan (1983) studied auditory hallucinations in patients with schizophrenia and reported that these were more real than unreal for the patients. Other studies have shown that neuroticism scores are positively related to the anxiety prior to the 'voices', anticipation of the voice and interference of activities of the patient by the voice (Ramanathan 1986). Chatterjee and Thakur (1976) found that the Muller-Lyer illusion could be used to distinguish patients with schizophrenia from healthy controls, but not from patients with neurosis. A study by Singh et al. (2003) from PGIMER, Chandigarh studied the phenomenology of hallucinations using factor analysis and identified two factors, i.e., 'reality of hallucinatory perception' and 'immersion in hallucinations'. Thomas et al. (2007) compared the prevalence and correlates of hallucinations in Indians with Americans and found differences in the prevalence of hallucinations in different modalities in the Indian and US samples, though the rank order of frequency was similar.

Delusions: Gupta (1979) reported that different types of delusions occurred in different types of families. A study from NIMHANS evaluated the content of delusions

in patients with schizophrenia and affective disorder. The authors reported that the content of delusions remained similar during different episodes in both the disorders. Kulhara et al. (1986a) studied the phenomenology of delusions in 112 patients with schizophrenia using the present state examination (PSE) and found that the delusions of persecution were more common in males and those above the age of 30 years. Educated patients had more delusions of reference, delusional misinterpretation and delusions of thoughts being read. Also, systematization was seen more in younger patients, while married patients had more delusions of reference. Another study which evaluated delusions reported that the delusional content is more consistent in Hindus, those who were married, and those from a rural background in the group with schizophrenia (Sinha and Chaturvedi 1990).

Descriptive studies on subtypes and distinction from other psychotic disorders: Some of the studies have described the clinical picture of different subtypes of schizophrenia. Varma et al. (1977) provided detailed clinical descriptions of 13 cases of 'pseudoneurotic schizophrenia'. Singh and Kulhara (1991) presented four cases of 'simple schizophrenia' and argued in favour of retention of this category. On the basis of clinical criteria, family history, treatment response and follow-up data, a study concluded that schizoaffective schizophrenia was closer to primary affective disorders rather than being considered as a subtype of schizophrenia (Singh and Sachdava 1982). As acute and transient psychosis became a distinct category in ICD-10, Janakiramaiah et al. (1992) successfully used logistic discriminant function analysis to classify patients with schizophrenia or acute psychosis.

Typology of schizophrenia: Many studies have tried to characterize the typology of positive and negative schizophrenia in the Indian context. Kulhara et al. (1986) examined the concept of positive and negative subtyping using principal components analysis and concluded that their data supported the positive and negative symptom complexes. Also, Kota and Kulhara (1988) used a cross-sectional phenomenological approach in 40 patients with schizophrenia and found that on variables such as age, duration of illness and premorbid adjustment, significant differences emerged between positive and negative subtypes. A longitudinal study (Kulhara and Chandiramani 1990) evaluated the stability of positive and negative subtypes of schizophrenia. It was seen that after a follow-up duration of 18–30 months, there was significant reduction in positive symptom scores and the number of patients in the positive subtype of schizophrenia. Further, the mixed subtype of schizophrenia increased in number and at follow-up, and there were significantly more patients with mixed subtypes who did not meet criteria for either the positive or negative subtype, i.e., who had little of either type of symptomatology. However, the number of patients categorized as having negative subtype, as well as negative symptom scores, did not change appreciably over the follow-up period. On the basis of their findings, the authors concluded that compared to positive symptoms, negative symptoms are more stable over a period of time. Borde et al. (1992) reported that negative symptoms and syndromes were more stable over time as compared to positive symptoms, and both positive and negative subtypes were stable. A study from Chennai (Eaton et al. 1995) evaluated the structure and temporal course of the symptoms of schizophrenia. Patients were assessed each month for 10 years following the first hospitalization. Factor analyses revealed positive and negative factors with a slight tendency to merge over time. The prevalence

of positive and negative symptoms declined in the year following first hospitalization and was stable thereafter. Positive and negative symptoms in 1 month were highly predictive of the same type of symptoms in the next month. On the basis of this, the authors concluded that positive and negative symptom clusters are independent, both cross-sectionally and longitudinally. Arora et al. (1997) grouped symptoms and signs of schizophrenia by evaluating the patients on the scale for the assessment of positive symptoms (SAPS), the scale for the assessment of negative symptoms (SANS) and the comprehensive psychopathological rating scale (CPRS). However, their analysis did not lead to replication of the positive–negative dichotomy. A study by Tirupati et al. (2006) evaluated psychopathology by using the positive and negative syndrome scale (PANSS), in patients with schizophrenia living in the community never treated with antipsychotic medications. The authors observed that positive symptoms were more frequent than negative symptoms. Factor analysis unfolded a five-factor structure, namely negative, positive, anxiety-depression, motor and excitement. The factor structure resembled that of treated patients reported in most studies except for the identification of a motor symptom cluster. One study compared the onset and course of previously untreated first-episode psychosis in Canada and India (Iyer et al. 2010). Patients with first-episode non-affective psychosis were evaluated for demographic variables, duration of untreated psychosis (DUP), baseline diagnosis, positive, negative and general psychopathology symptoms and overall functioning at baseline and 1 year. The authors reported significant improvement in symptoms and functioning over the 1-year course of treatment. Evaluation of time-by-site interactions showed significant difference between the centres in negative symptoms, with patients in India showing greater improvement over time than their Canadian counterparts. The time-by-site interactions were not significant for positive symptoms and general psychopathology. This relationship of negative symptoms and time-site interaction persisted even after controlling for demographic variables such as age, gender and marital status. On the basis of this, the authors concluded that there is a higher rate of improvement at 1 year in negative symptoms and functioning in patients from India, when compared those receiving similar treatment in Canada. A recent study carried out factor analysis of PANSS ratings done within 1 week of admission and extracted five factors, namely negative, autistic, activation, positive and depression. Negative factors explained the maximum percentage of variance (Kumar and Khess 2012).

Many studies have evaluated the usefulness of different diagnostic systems and rating scales. In a cross-sectional study, Kulhara et al. (1986) evaluated the usefulness, comprehensiveness and concordance between the CATEGO, research diagnostic criteria (RDC), DSM-III criteria, Feighner's criteria, Schneider's first-rank symptoms (FRS) and the ICD-9 diagnosis of schizophrenia. It was found that all the diagnostic systems had good agreement with the ICD-9 diagnosis of schizophrenia. However, the rate of concordance among the different systems varied. In another study, Kulhara et al. (1989a) examined the effect of different diagnostic systems and sociodemographic variables on the outcome of schizophrenia and reported that the DSM-III diagnosis of schizophrenia, duration of illness and the PSE syndrome of non-specific psychosis were important predictors of outcome. The CATEGO and the RDC diagnosis of schizophrenia and the Schneiderian FRS were found to be poor

predictors of outcome. Kulhara et al. (1987) also examined the usefulness of the brief psychiatric rating scale (BPRS) in positive and negative subtyping of schizophrenia. Significant differences emerged between the two subtypes on items such as emotional withdrawal, guilt feelings, tension, hallucinatory behaviour, motor retardation, blunted affect and excitement. Kota et al. (1986) evaluated the inter-rater reliability for the SANS in schizophrenia and found it to be significant for all items of the scale.

Movement disorders in schizophrenia: A series of studies from Chennai have evaluated extrapyramidal symptoms in patients with schizophrenia and their relatives. One study evaluated the prevalence of abnormal movements in never-medicated Indian patients with schizophrenia and reported that dyskinesia were seen in 15 % of normal subjects, 15 % of first-degree blood relatives of younger patients with schizophrenia, 38 % of the never-medicated patients and 41 % of medicated patients. The authors concluded that dyskinesia in elderly patients with schizophrenia was an integral part of the illness and was not associated with antipsychotic medications (McCreadie et al. 1996).

One study evaluated the prevalence of spontaneous dyskinesia and Parkinsonism in never-medicated, chronically ill patients with schizophrenia at baseline and at 18 months of follow-up. Twenty-four per cent of the patients had dyskinesia at both the assessments, 33 % had the same on one of the assessments and 43 % did not have dyskinesia at any time; 35 % had Parkinsonism on at least one occasion (McCreadie et al. 2002). Another study evaluated the prevalence of spontaneous dyskinesia in first-degree relatives of chronically ill never-treated people with schizophrenia and reported that 14 % of the relatives had dyskinetic movements in at least one body area, and 3 % had Parkinsonism (McCreadie et al. 2003).

Cenesthesias: According to one study, depersonalization, motor weakness, abnormal pain, numbness and stiffness were the most commonly endorsed cenesthesias. These correlated positively with disturbances of body concept and were present at onset in 40 % of subjects and changed form in 76 % of subjects (Rajender et al. 2009).

Relapse: Studies, which have evaluated the predictors of relapse in schizophrenia, report that regularity of follow-up, presence of affective symptoms, self-neglect and lack of social contacts are associated with relapses (Rajkumar and Thara 1989). Relapse was significantly associated with unemployment, number of psychotic episodes, side effects of medication and life events score (Chabungbam et al. 2007). In a study involving retrospective assessment of life events over a period of 1 year, Das et al. (1997) reported that those who experienced relapses of their illness had experienced a significantly greater number of life events and also had a significantly higher stress score than the ‘stable’ group. A study, which evaluated the relationship of life events, marriage and social support, concluded that marriage led to experiencing more stress, but there are other psychosocial variables mitigating the same and preventing relapse (Kulhara et al. 1998).

Distinction of depressive and negative symptoms: Studies have also tried to distinguish negative symptoms in schizophrenia from depression. A study revealed that the global ratings for affective flattening, alogia, avolition and inattention were significantly higher in patients with schizophrenia compared to depression, whereas anhedonia–asociality was equally prevalent in patients with schizophrenia and

depression (Chaturvedi et al. 1985). Another study compared subjects with schizophrenia and depression and reported that compared to patients with schizophrenia, frequency of suicide attempts was higher in depressed patients (Gupta et al. 1992).

Depression in schizophrenia: The Indian Council of Medical Research (ICMR) multicentre collaborative study on course and outcome of schizophrenia reported that depressive mood was not related to course and outcome of schizophrenia at 2 and 5 years of follow-up. At intake, depressed mood was noted in 22.3 % subjects, which dropped to 13 % at 2 years of follow-up (ICMR 1988). A prospective study from Bangalore reported that only 0.5 % of patients with schizophrenia develop post-psychotic depression (PPD) (Das and Kapur 1980). In another prospective study, newly diagnosed patients with schizophrenia were followed for 6–48 months. The findings of this study indicated that depression was either intrinsic to schizophrenia or could be due to neuroleptics. Moreover, this study showed that the proportion of patients with depression was high in those who responded to 8 weeks of neuroleptic treatment (Raju 1986). A study, which compared the PSE syndrome of depression in patients with first-episode Feighner's schizophrenia, noted that the PSE syndrome of depression was present in 45 % of patients who had a relapse, compared to 19 % of the patients who did not relapse (Rajkumar and Thara 1989). A study from Chandigarh, which primarily studied the relationship between depressive and negative symptoms, reported depressed mood in 32 % patients with schizophrenia (Kulhara et al. 1989). However, none of the above studies, rated depressive symptoms on scales used primarily for the assessment of depression. Studies, which have evaluated the role of gender in depression, have reported that at intake simple depression was more common in males, at follow-up depressive delusions or hallucinations were also more frequent in males and depressive features at intake and follow-up affected the outcome in males. However, at 10-year follow-up, no gender differences were noted, and depression was almost non-existent (Thara and Rajkumar 1992; Thara and Joseph 1995). Another prospective longitudinal study evaluated patients with a diagnosis of schizophrenia as per DSM-IIIR, with at least 5 years of hospitalization, at the baseline and after 9 months. This study found that positive and negative subtypes of schizophrenia were stable, whereas depression as assessed on the PANSS was not found to be stable (Borde et al. 1992). In a cross-sectional study from Chandigarh, 80 patients with stable chronic schizophrenia as per DSM-III R were rated on the SANS, the SAPS and the CPRS. Factor analysis segregated positive and negative symptoms into more than two dimensions. The CPRS led to a factor loading high on depressive/asthenic items. The authors concluded that depressive symptoms were a salient feature in course of schizophrenia (Arora et al. 1997). Some of the studies have used scales specifically to rate depression. A study from Chandigarh compared two groups of 30 subjects each of PPD and non-PPD in DSM-III-R schizophrenia in remission. Patients with PPD had a longer duration of psychosis, more frequent hospitalizations and more sadness and anxiety-somatisation during florid illness phase. Severity of depression assessed on the Hamilton depression rating scale (HDRS) correlated positively with age of onset, age of patient, number of stressful life events and negatively with social support (Chintalapudi et al. 1993).

A study from South India reported an increasing prevalence of depression, from 17 % at intake to 50 % at 1–10 months of follow-up, in 46 DSM-III-R subjects with schizophrenia who were off medications for 1 month. Severity of depression, assessed on the HDRS, was generally mild with maximum scores obtained on 'loss of work interest', which is not a core psychological symptom of depression. The authors hypothesized the occurrence of two different kinds of depression: reactive depression in unmedicated patients with greater insight into illness and akinetic depression in medicated patients with extrapyramidal symptoms, which is associated with higher doses of neuroleptics (Tharyan and Kuruvilla 1994). Another study showed that patients with schizophrenia with substance use tended to have more depressive symptoms (Chakraborty et al. 2008).

In a study investigating the nature of factor structure of DSM-IV schizophrenia, the authors reported that introduction of the HDRS scores to the factor equation along with the variables of the SAPS and the SANS resulted in extraction of four factors viz. reality distortion syndrome, disorganized syndrome and negative syndrome (split into diminished expression and schizoid syndrome). Depression scores loaded high on reality distortion and also had secondary, albeit low loading on the diminished expression syndrome. This supports the notion that the aetiopathogenesis of depressive symptoms is related more closely to positive symptoms and general psychopathology, than negative symptoms (Kulhara and Avasthi 2003). Another study investigated the relationship of depression and insight in patients with schizophrenia and reported that insight and depression had strong correlation with each other; better insight was associated with the presence of low mood (Ampalam et al. 2012).

Obsessive compulsive symptoms in schizophrenia: On studying obsessive–compulsive symptoms in schizophrenia, Jaydeokar et al. (1997) found that among patients with more than 5-year durations of illnesses, 27 % had obsessive–compulsive symptoms and that obsessive–compulsive symptoms were more prevalent among patients with paranoid schizophrenia. One study presented the clinical profile of patients with schizophrenia, with and without comorbid obsessive–compulsive disorder. This study suggested that schizo-obsessive patients were more likely to have paranoid symptoms and first-rank symptoms of schizophrenia. They had lower anergia, higher depression scores, more comorbid personality disorders and somewhat lesser disability. There was a significant correlation between severity of obsessive–compulsive symptoms and schizophrenia (Rajkumar et al. 2008). Another study which evaluated the prevalence of obsessive–compulsive symptoms in subjects with schizophrenia reported a 10 % prevalence (Hemrom et al. 2009). Raj and Raguram (2001) found that neurotic symptoms were highly prevalent (83 %) in the patient with schizophrenia, and there were significant associations between anxiety and certain symptoms of schizophrenia.

Affect: Felt affect in good and poor outcome patients of schizophrenia was compared by Sovani et al. (2005), and no differences were found. A study reported emotional recognition deficits in antipsychotic-naive schizophrenia subjects (Bharadwaj et al. 2008).

Insight: Aga et al. (1995) examined the relationship of insight with psychopathology in schizophrenia and found that insight had significant positive associations with

number of previous episodes and treatment taken in the past. Tharyan and Sarvanan (2000) studied the relation between insight and psychopathology and found that the severity of psychopathology correlated significantly with dimensional measures of awareness of the abnormal experiences, whereas another study reported no relation between insight and psychopathology and severity of illness (Armstrongh et al. 2002).

Duration of untreated psychosis: Tirupati et al. (2004) examined the outcome and factors related to the DUP after 1 year of treatment of patients with schizophrenia, who were ill for many years and had not been treated previously. Evaluations of outcome were carried at intake, and at the end of 1 year of treatment using standardized methods. Good clinical outcome was found in 29 % of cases at the end of 1 year. The proportion with good outcome in clinical, work and global measures fell steadily with increasing DUP. This difference was significant for clinical and global outcomes after a DUP of 5 years. The authors concluded that the relationship between DUP and response to treatment held well even in chronic stages of schizophrenia with longer DUP associated with poorer outcome.

Cross-cultural evaluations: A study compared the clinical phenotype of patients with schizophrenia in India, Australia and Malaysia and reported that more patients with schizophrenia were living alone in Australia than India or Malaysia, drug use was lower in India than Australia or Malaysia, DUP was longer in India than Australia or Malaysia, the rate of schizoaffective disorder was lower in India than Australia or Malaysia and age at onset of psychosis was greater in Malaysia, than in Australia and India (McLean et al. 2012).

4 Schizophrenia and Drug Abuse

A community-based study, which relied on a house-to-house interview-based survey of 16,725 persons in and around Agra, reported that 14 % of patients with schizophrenia abuse alcohol and other drugs defined as regular use for more than a year (Dube and Handa 1971). Clinic-based studies suggest that 7 and 6 % of patients with schizophrenia abuse alcohol and cannabis, respectively (Trivedi and Sethi 1978). Other studies have looked at the epidemiology of psychosis in patients with cannabis use and have reported prevalence rates of 6 % for psychosis (Goel and D'Netto 1975) and incidence rate of 50 % in regular cannabis users (Bagadia et al. 1976). Another study with a small sample compared the lifetime prevalence of schizophrenia in patients with alcohol and opioid dependence and reported that 8 % of the patients with alcohol dependence and 15 % of the patients with opioid dependence had schizophrenia; the difference between the two groups was statistically significant (Kisore et al. 1994). Other studies, which have assessed patients with alcohol dependence for psychiatric comorbidity, have reported the prevalence rate of psychosis to be 22 % (Vohra et al. 2003) and that of schizophrenia to be 2 % (Singh et al. 2005). Schizophrenia was noted in 25 % of patients with polysubstance dependence and 4.3 % of patients with alcohol dependence in a recently published study from Tamil Nadu (Venkatesan and Suresh 2008). A recent clinic-based study from Chandigarh evaluated patients

attending a drug de-addiction and treatment centre for 13 year period and found that only 1.4 % were diagnosed to have substance-independent psychotic illness, of which only half of the patients had the diagnosis of schizophrenia. The authors ascribed the lower rates to the fact that established cases of psychosis are much more likely to attend (or be referred to) the general psychiatry section rather than a specialized de-addiction centre (Aggarwal et al. 2012).

A study from PGIMER, Chandigarh, compared clinical picture of cannabis psychosis with schizophrenia and reported that compared to patients with schizophrenia, cannabis psychosis is short-lasting, presents with a predominantly polymorphic clinical picture, with more odd and bizarre behaviour, violence and panic but reactive and congruent affect, less evidence of formal thought disorder, and is associated with rapid and complete recovery (Basu et al. 1999). The demographic and clinical correlates of substance abuse in schizophrenia were assessed by Aich et al. (2004). People using substance were predominantly represented by the positive syndrome and non-abusers by the negative syndrome. The same group of authors (Aich et al. 2005) found that psychopathology remitted much faster in the group abusing substances, but after discharge, these patients tended to return back to the preadmission state.

Another study from PGIMER, Chandigarh examined the relationship of the course of substance abuse and schizophrenia symptomatology in patients with 'dual-diagnosis' of substance abuse and schizophrenia and reported that in five out of twenty-two patients, onset of schizophrenia preceded the onset of substance use. In seven out of twenty-two subjects, there was clear temporal relationship between exacerbation of schizophrenia and increase in substance abuse in the preceding 2–12 months. In none of the subjects, decrease in substance use led to a decrease or increase in schizophrenic symptoms (Goswami et al. 2003). A study from Ranchi compared patients with substance dependence with and without psychosis and showed that patients with substance dependence without psychosis attributed both maintenance and relapse to external factors such as nature of work, social milieu or peer pressure, while the 'dual-diagnosis' group attributed them to internal factors such as enhancement of positive mood and alleviation of withdrawal effects (Saddichha et al. 2010).

Srinivasan and Thara (2002) studied the relationship of nicotine use and schizophrenia in urban male patients and found 38 % were current smokers, which was significantly more than in other psychiatric patients studied (major affective disorders and non-psychotic disorders), but not medically ill controls, and was not higher than the rates for the general male population in India.

5 Neurobiology of Schizophrenia

Since the beginning, there have been efforts to study the neurobiology of schizophrenia. However, most of the data have come in last 10–15 years.

Neurochemistry: Various studies have reported biological markers and diagnostic tests in schizophrenia. Kondaiah et al. (1981) found that plasma creatine phosphokinase (CPK) levels were higher in patients with schizophrenia, suggesting diagnostic

value of CPK. Ghosh et al. (1981) found that patients with schizophrenia excreted greater amount of vanilmandelic acid (VMA) and lower amounts of steroid fractions as compared to controls. Significantly lower levels of Cerebrospinal fluid (CSF) 5-hydroxy indole acetic acid (5-HIAA) were found in patients as compared to controls by Pandey et al. (1987). Tiwari et al. (1984) found increased levels of serum and cerebrospinal fluid immunoglobulins; whereas Rao et al. (1985) observed no significant differences in immunoglobulin levels between patients with schizophrenia (paranoid and non-paranoid) and normal controls. Platelet monoamine oxidase activity was studied in patients with chronic schizophrenia, and no differences were documented between the patients and normal subjects (Gupta et al. 1985). Serum prolactin level was also studied in treatment-naive and medicated patients, and no differences were found between unmedicated patients and control subjects, refuting the hypothesis that there is a generalized hyper-dopaminergic state in schizophrenia (Kuruvilla et al. 1986). Chatterjee (1988) studied dopamine-related hormones–prolactin, growth hormone and luteinizing hormone in 84 patients with acute schizophrenia, but found that a simple theory of dopamine overactivity was not supported. Radioisotopic techniques were employed to measure platelet monoamine oxidase activity by Sharma et al. (1991), and no differences were found between subjects with schizophrenia, mania and normal subjects. However, the same group also found that the enzyme activity was significantly lower in paranoid schizophrenia, compared to the other groups. Also, significant negative correlations between enzyme activity and severity and duration of illness were found (Sharma et al. 1990). Pradhan et al. (1992) studied plasma homovanillic acid levels in patients with schizophreniform disorder, patients with schizophrenia on medications and patients with schizophrenia off medications. A bimodal distribution of plasma homovanillic acid was seen in schizophreniform disorder, indicating plasticity of the dopaminergic system to neuroleptics. Similarly, concentrations of homovanillic acid and gonadal hormones were studied by Gong et al. (1993). The results suggested that change of gonadal hormones may be related to the pathogenesis of schizophrenia. Kurup et al. (1999) studied serum digoxin levels in 25 patients to support the hypothesis that hypothalamic digoxin dysfunction occurs in schizophrenia. Anand et al. (2002) measured cerebrospinal fluid levels of dopamine, serotonin and their metabolites and attempted to elucidate their relation to various psychopathological dimensions. Serum prolactin levels, when measured in drug-naive patients, were raised, but did not show any relation to severity of psychopathology or prognosis (Shrivastava and Tamhane 2000).

Neuroimaging: In one of the earliest studies, Jayaswal et al. (1987) examined structural changes in brain using computed axial tomography scans (CAT scans) and found that the size of lateral ventricles expressed as the ventricular-brain ratio, and the width of the third ventricle and the sylvian fissure were significantly greater in patients with schizophrenia. Siddharatha et al. (1997) performed CAT scans in 50 patients with schizophrenia and found abnormalities compared to control subjects. Lal et al. (1998) studied neurological soft signs, cognitive dysfunction and ventricular-brain ratio in schizophrenia patients. Minimum of one neurological soft sign was present in all the patients. The positive group had higher memory and IQ scores and lower Bender-Gestalt Test (BGT) scores than the negative group. Negative

correlation was seen for memory and BGT scores with ventricular-brain ratio (VBR), and the. soft signs showed positive correlation in the positive subtype only. Raju et al. (2001) carried out magnetic resonance imaging in patients with schizophrenia to measure prefrontal lobe volumes in patients with and without frontal dysfunction, as measured by the Lubria-Nebraska Neuropsychological Battery. They reported that patients with frontal dysfunction had minor frontal structural deficits. Padmavati (2001) studied differences in cerebral morphology in three groups: untreated patients with schizophrenia with dyskinesia, without dyskinesia and normal subjects.

Over the years, schizophrenia has been understood as a neurodevelopmental disorder. Most of the research on neuroimaging from India also suggests this. The National Institute of Mental Health and Neurosciences (NIMHANS) at Bangalore has emerged as the leader in this field. Investigations suggest that compared to healthy control subjects, subjects with schizophrenia have significantly smaller global grey matter, greater global cerebrospinal fluid volumes and smaller regional grey matter volume in superior frontal, inferior frontal, cingulate, post-central, superior temporal and parahippocampal gyri, inferior parietal lobule (IPL), insula, caudate nuclei, thalamus and cerebellum (Jayakumar et al. 2005). It was also seen that positive symptoms have significant negative correlation with left superior temporal gyrus volume. Negative symptoms score have inverse correlation with frontal, cingulate and cerebellar grey matter volumes (Venkatasubramanian et al. 2010). Another study reported negative correlation between negative symptoms score and cerebellar grey matter volumes (Arasappa et al. 2008). Venkatasubramanian et al. (2003) evaluated a new corpus callosum measurement method with a valid neuroanatomical and cytoarchitectural basis and showed a good intraclass correlation coefficient and inter-rater reliability. Studies from NIMHANS have reported significant volume deficits in bilateral lateral orbitofrontal and left medial orbitofrontal cortices as well as bilateral pars triangularis and significant thickness deficit in bilateral medial orbitofrontal cortices in subjects with schizophrenia (Venkatasubramanian et al. 2008; Behere et al. 2009). John et al. (2009) compared frontal pole (FP) grey matter volume in neuroleptic-naïve recent-onset schizophrenia subjects with a matched healthy control group and reported lack of difference in FP grey volumes between the healthy subjects and those with schizophrenia. In a study from Mumbai, Parkar et al. (2006) reported ventricular dilatation and prominent cerebral sulci and cerebellar folia. It has also been found that subjects with schizophrenia have lower phosphocreatine (PCr)/total adenosine tri-phosphate (ATP) ratio in bilateral basal ganglia, and this ratio was least in patients with developmental reflexes suggesting neurodevelopmental aetiology for schizophrenia (Gangadhar et al. 2006). A study from NIMHANS reported that subjects with schizophrenia have significantly smaller caudate volumes than healthy controls. PCr/total phosphorous and PCr/total ATP ratios of both caudate nuclei were significantly lower in patients than controls (Jayakumar et al. 2006). Another study reported that at 1-year follow-up, the difference between healthy controls and subjects with schizophrenia on PCr/total phosphorus ratio became non-significant, and there was significant positive correlation between the magnitude of improvement in PANSS total scores and the extent of change in the PCr/ATP ratio (Jayakumar et al. 2010). McCreadie et al. (2002) studied patients with dyskinesia using magnetic resonance imaging and proposed that there

may be a subgroup of schizophrenia associated with dyskinesia and striatal pathology (namely, an enlarged lenticular nucleus, especially on the left side).

Malhotra et al. (2006) studied cerebral perfusion using single photon emission computed tomography (SPECT) in subjects with childhood-onset schizophrenia. Compared to lack of perfusion abnormality in the healthy control group, 9 patients (64 %) showed perfusion anomaly on SPECT scans, specifically in the left temporal and frontal areas of the brain. A cross-sectional study examined the effect of antipsychotics on brain metabolism in individuals with schizophrenia who were in different phases of treatment. Patients underwent an 18F-deoxyglucose positron emission tomography scan in a resting state 12 h after the last dose of antipsychotic. Results showed an immediate increase in cortical uptake followed by a decrease in cortical uptake, while the basal ganglia uptake remained high, albeit with a decreasing trend. Typical antipsychotics were associated with lower frontal cortical and higher basal ganglia and cerebellar uptake as compared to atypical antipsychotics (Seethalakshmi et al. 2007). Another study showed that compared to healthy subjects, genu and body of the corpus callosum were significantly smaller in patients with schizophrenia (Venkatasubramanian et al. 2010). A study from NIMHANS which assessed antipsychotic-naïve schizophrenia patients showed that patients with FRS had significant deficits in the right IPL (specifically angular gyrus), in comparison with patients without FRS and healthy controls. However, there was no difference on the left side, which authors attributed to larger variance in healthy controls (Venkatasubramanian et al. 2011). Another study showed relationship between first-rank symptoms and corpus callosum morphometry with patients having significantly smaller corpus callosum, splenium and isthmus areas than control subjects (Rao et al. 2011).

Family and genetic studies: Sethi et al. (1980) in a family study reported higher incidence of psychiatric morbidity in parents. Ponnudurai (1989) by drawing pedigree charts concluded that the findings favoured a polygenic inheritance. Chaterjee and Basu (1980) by nuclear sexing and karyotyping in patients with schizophrenia showed higher prevalence of chromatin positive compared to controls. Ponnudurai and Jayakar (2010) evaluated 'parental imprinting' and the phenomenon of 'anticipation' and reported that age of onset in probands was lower in those with family history of psychosis, and the difference was more significant when the paternal side was affected. When the age of onset in the grandparents was compared with either of the parental sides of the probands, no difference emerged, indicating lack of support from this study for the theory of anticipation. Verma et al. (2005) investigated the relationship of MLC1 (putative cation-channel gene on 22q13) with schizophrenia and bipolar disorders and concluded that association of MLC1 with schizophrenia and bipolar disorders suggests involvement of a common pathway. Chowdari et al. (2002) evaluated the role of transcription of the regulator of G-protein signalling 4 (RGS4) in the pathogenesis of schizophrenia, by genetic association and linkage studies using samples ascertained independently in Pittsburgh and New Delhi and by the NIMH Collaborative Genetics Initiative, and reported significant transmission distortion in Pittsburgh and NIMH samples. Tiwari et al. (2005) investigated the significance of CYP3A4*1B and CYP2D6*4 polymorphisms in tardive dyskinesia susceptibility among patients with chronic schizophrenia, but failed to demonstrate significant

association of either of the two single nucleotide polymorphisms (SNPs) with tardive dyskinesia. Gangandhar et al. (2002) studied the relationship of reversed gender effect on age at onset (AAO) in schizophrenia in relation to infant mortality rate, but found no difference in age of onset in the samples from lower infant mortality rate. Verma et al. (2005) studied the SYNGR1 gene, located on 22q13.1 in subjects with schizophrenia and bipolar disorders, and found that 9 out of 14 dbSNPs were associated with schizophrenia and bipolar disorder. Mukherjee et al. (2006) reported positive linkage and association finding at 18p11.2 for psychosis (schizophrenia, bipolar disorder and psychosis NOS). Holliday et al. (2006) reported association of dystrobrevin binding protein 1 (dysbindin) gene (DTNBP1) with schizophrenia. Holliday et al. (2009) reported a significant linkage of schizophrenia to chromosome 1p31.1. Talkowski et al. (2006) studied associations between dopamine D3 receptor gene polymorphisms and schizophrenia in two independent samples, one from the US and another from India. In the US samples, significant associations were detected with eight Single nucleotide polymorphisms (SNPs), including rs6280; whereas, in the Indian sample, one SNP was associated (rs10934254, $p = 0.03$) with schizophrenia. Kukreti et al. (2006) investigated the association of synonymous polymorphisms (His313 and Pro319) in the dopamine D2 receptor gene with schizophrenia using a case–control approach and found that genotype distribution for the His313 polymorphism was significantly different between patients with schizophrenia and control subjects, while the Pro319 polymorphism did not show any association with the disease. Debnath et al. (2006) investigated the incidence of human leucocyte antigen (HLA) class I alleles in patients with delusional disorder and paranoid schizophrenia and found that HLA-A*03 gene was significantly associated with delusional disorder as well as with paranoid schizophrenia. Gupta et al. (2009) investigated the role OD16 polymorphisms from three genes, dopamine receptor D2 (DRD2), catechol-O-methyl transferase (COMT) and brain-derived neurotrophic factor (BDNF) in schizophrenia and found significant associations of two SNPs of DRD2 (rs11608185, genotype; rs6275, genotype) and one SNP in the COMT gene (rs4680, genotype). However, when corrections for multiple comparisons were made, a weak association of individual markers of DRD2 and COMT with schizophrenia was seen. Multifactor dimensionality reduction analysis suggested a two locus model (rs6275/DRD2 and rs4680/COMT) as the best model for gene–gene interaction with 90 % cross-validation consistency and 42 % prediction error in predicting disease risk among patients with schizophrenia. Srivastava et al. (2010) studied gene polymorphisms and genetic susceptibility in subjects with schizophrenia and reported a significant allelic association of catechol-O-methyltransferase rs362204 -/G ($p = 0.028$) marker; whereas, nominally significant genotypic associations were seen for tyrosine hydroxylase rs6356 A/G and dopamine beta-hydroxylase rs1108580 A/G with schizophrenia.

Ahmad et al. (2009) reported the role of GRIK3 for susceptibility to schizophrenia in Indian population. Vijayan et al. (2009) reported significant allelic and genotypic associations of rs2066713 (both allelic and genotypic), 5HTTLPR and STin2 polymorphisms with schizophrenia. A haplotype linking these three risk alleles, 5HTTLPR/S-rs2066713/C-STin2/12-repeat, was also significantly associated with schizophrenia. Thara et al. (2009) studied schizophrenia pedigrees and reported very low prevalence of affective psychoses such as schizoaffective disorder in most

affected individuals with schizophrenia. Srivastava et al. (2006) reported DRD4 and COMT genes as the most important candidate genes for development of tardive dyskinesia in North Indian subjects with schizophrenia. Thomas et al. (2011) evaluated the associations of selected SNPs with schizophrenia with selected indices of severity and symptom pattern but did not find any significant associations following corrections for multiple comparisons. A recent study showed association of schizophrenia and schizophrenia-related neurocognitive measures with two SNPs (rs35753505 and rs6994992) from the Neuregulin-1 gene promoter region in a North Indian cohort (Kukshal et al. 2013). Singh et al. (2008) showed that compared to age- and gender-matched healthy subjects from the same ethnic group as the patients, patients of schizophrenia have increased frequency of HLA-A*03 as well as decreased frequencies of HLA-A*31 and HLA B*51.

Soft neurological signs and minor physical anomalies: Some genetically determined somatic traits such as ear lobes, finger hair and hairy ear were studied in schizophrenia (Ponnudurai 1989). The proportion of patients with schizophrenia with ear lobes hanging free was much less than the controls. The presence of physical anomalies was investigated in schizophrenia, and the incidence was found to be significantly high (Lal and Sharma 1987). Soft neurological signs (SNS) and minor physical anomalies (MPA) were studied in 107 adult patients with schizophrenia by Nizamie et al. (1989) who found SNS more frequently in patients with chronic schizophrenia compared to normal subjects and also found higher mean MPA score as compared to reported score in normal populations. John et al. (2008) compared MPAs and neurologic soft signs (NSSs) as a composite endophenotype for schizophrenia subjects with a matched healthy control group and noted that subjects with schizophrenia had significantly higher frequencies of MPAs and NSSs than healthy controls. Biswas et al. (2007) compared NSSs in patients with childhood-onset schizophrenia (COS), adolescence onset (AdOS) and adulthood onset (AOS) and reported that NSSs were significantly more frequent in COS and AdOS compared with AOS patients.

Cognitive functions: Ananthnarayan et al. (1993) studied clinically remitted outpatients with schizophrenia on measures of visual information processing and found that they performed poorly when compared to patients with neurotic depression. Borde et al. (1996) used the happy–sad chimeric faces test to elicit left hemifacial bias (LHF bias) and found that patients with mania and schizophrenia did not show significant LHF bias. Another study compared cognitive functions of subjects with schizophrenia with those suffering from bipolar disorder and reported that compared to controls, both bipolar disorder and schizophrenia patients were significantly impaired on different tests of executive function, memory, IQ and perceptuomotor functions. Patients with schizophrenia consistently performed worse than patients with bipolar disorder, but none of the differences between schizophrenia and bipolar disorder were significant (Pradhan et al. 2008). Bhatia et al. (2009) examined cognitive functions of subjects with schizophrenia and schizoaffective disorder and compared them with their parents and a control group and found that subjects with schizophrenia and schizoaffective disorder took significantly more time than controls on Part B of the trail making test (TMT), and there was no significant difference between patients and parents on any of the

TMT parameters. A study, which evaluated the relationship between cognition and work functioning in patients with schizophrenia, found that cognitive deficits did not relate significantly with current employment status or the level of performance at work. Negative symptoms predicted employment status, and poor social functioning predicted poor work performance (Srinivasan and Tirupati 2005). A study evaluated the relationship between insight and executive functions and reported that poor insight was associated with poor executive functioning (Choudhury et al. 2009). Grover et al. (2011) compared the neurocognitive deficits in patients with paranoid schizophrenia and delusional disorder and reported that compared with patients with paranoid schizophrenia, patients with delusional disorder had more impairment on different tests of attention, visual learning and memory, verbal working memory and executive functions. John et al. (2011) examined the pattern of functional magnetic resonance imaging blood oxygen level dependent activations and deactivations during semantic word generation and showed that in addition to the brain regions activated during word generation in healthy individuals, patients with schizophrenia showed additional activations of temporo-parieto-occipital cortical regions as well as subcortical regions, despite significantly poorer behavioural performance than the healthy participants.

Social cognition: A study evaluated the facial emotion recognition deficits in antipsychotic-naïve schizophrenia patients and showed that the patients with schizophrenia made significantly greater number of errors in recognition of negative emotions of fear and disgust compared to normal controls (Behere et al. 2009). In another study, Behere et al. (2011) evaluated the facial emotional recognition deficits in patients with FRS and those without FRS and showed that patients with FRS made significantly greater errors in over-identification as compared to those without FRS.

Dermatoglyphics: Dasgupta et al. (1973) conducted research on dermatoglyphics in schizophrenia and found that the patients had higher indices as compared to normal controls. Eswaraiah (1978) in a study found that patients had higher frequency of single radial base crease than controls. Jhingan and Munjal (1990) studied dermatoglyphics in patients with catatonic schizophrenia; whereas, Jain et al. (1992) studied palmer flexion crease pattern in schizophrenia subjects, their relatives and normal controls. Studies in dermatoglyphics were also reported by Sengupta and Bhuyan (1995) and Ponnudurai et al. (1997) in familial and non-familial schizophrenia.

Neurotropins: Kale et al. (2009) studied the CSF and plasma nerve growth factor (NGF) in drug-naïve patients with psychosis and reported significantly lower levels of NGF in both CSF and plasma.

Oxidative Stress: A study evaluated the levels of malondialdehyde (MDA), superoxide dismutase (SOD), glutathione peroxidase (GSHPx) and reduced glutathione (GSH) in subjects of schizophrenia. Compared to healthy controls, significantly lower levels of SOD, GSHPx and GSH were found in subjects with schizophrenia, along with an increased oxidative stress as indicated by high blood MDA levels (Dadheech et al. 2008). Another study reported lower levels of antioxidants in haloperidol-treated subjects compared to those treated with olanzapine (Singh et al. 2008).

Immunological changes: Significant reduction in interleukin-2 (IL-2) and interleukin-6 (IL-6) was reported in subjects with schizophrenia, irrespective of the medication status, i.e. those on antipsychotics and those not on antipsychotics, suggesting immune dysregulation in pathophysiology of schizophrenia. Further, the medicated patients showed lower level of IL-2 and IL-6 than the psychotropic medication-free patients (Singh et al. 2009).

Lipid metabolites and insulin-like growth factor: A study of antipsychotic-naïve patients with schizophrenia showed significantly lower levels of leptins compared to healthy controls. However, with antipsychotic treatment, leptins levels increased in patients with schizophrenia (Venkatasubramanian et al. 2010). Another study showed significant inverse correlation between total negative syndrome score and serum HDL levels (Venkatasubramanian et al. 2010). A study involving antipsychotic-naïve schizophrenia demonstrated significantly lower levels of insulin-like growth factor (IGF-1) and higher levels of cortisol in patients with schizophrenia, compared to healthy controls. With treatment, IGF-1 levels increased significantly along with significant reduction in cortisol levels (Venkatasubramanian et al. 2010).

6 Psychosocial Issues

Causal or explanatory models: Few studies have evaluated the explanatory models as understood by the patients with schizophrenia themselves and their caregivers (Kulhara et al. 2000; Srinivasan and Thara 2001). It was documented that beliefs in supernatural factors were quite prevalent in caregivers of mentally ill patients and that many patients and their caregivers sought the help of faith healers quite often (Saravanan et al. 2008). It has also been shown that indigenous healing methods are considered complementary to the medical management of mental illness by patients and caregivers (Saravanan et al. 2008). Studies, which have evaluated the patients, suggest that although some patients do subscribe to biomedical models, about two-thirds of the patients have non-biomedical causal models of schizophrenia (Saravanan et al. 2007; Kate et al. 2012). Charles et al. (2007) reported that majority of the patients and their relatives held multiple and contradictory models of illness and its treatment simultaneously. However, in contrast to studies from the South India, a study from the north India suggested that in addition to belief in supernatural causes, many patients also had biological causal models (Kate et al. 2012). Data also suggest that patients who held biomedical concepts of disease had significantly higher scores on the insight scale compared to those who held non-medical beliefs (Saravanan et al. 2007). Multivariate analyses identified three factors associated with spiritual/mystical models (female sex, low education and visits to traditional healers) and a single factor (high level of insight) for the endorsement of biological model. Preserved insight was associated with anxiety, help-seeking and perception of change. Insight was strongly associated with willingness to attribute symptoms to disease in others and in one's self, but not to supernatural forces (Saravanan et al. 2007).

Marriage and related issues: Impact of schizophrenia on marriage had been studied by some researchers. Thara and Srinivasan (1997) followed a cohort of patients with first-episode psychosis for 10 years after the onset of illnesses and reported that 70 % patients with schizophrenia got married, and in 85 % of cases, marriages were intact at follow-up. Compared to females, more men remained single; whereas, more women faced broken marriages. Low marriage rates were associated with a continuous and relapsing course. Thara et al. (2003a, b) evaluated female patients with schizophrenia who had broken marriages and observed that many patients had not separated legally and were not receiving any maintenance from their husbands. It was also observed that even after several years of separation, patients expected to be reunited with their spouse. With regards to the caregivers, most of the families expressed intense distress and concern about the long-term future and security of these women. Further, the families perceived care of children of these women to be an additional problem, due to lack of any financial support from the separated husbands. A recent study evaluated the QOL and marital adjustment in patients with various mental disorders including schizophrenia during the phase of remission in a rural setting and reported that compared to patients with bipolar disorder and recurrent depressive disorder, patients with schizophrenia reported significantly poorer QOL. Patients of schizophrenia also reported greatest marital dissatisfaction. With regards to marital adjustment, patients perceived the same to be poor, but spouses did not endorse the same (Vibha et al. 2013). Bhatia et al. (2004) compared the indices of fertility and fecundity among male and female patients with schizophrenia or schizoaffective disorder from New Delhi with patients from north-eastern United States. In the US sample, male patients were significantly more likely to be single and childless compared with female patients. They also had fewer children. In contrast, there were no significant gender differences among Indian male and female patients with regard to the reproductive indices. Multivariate analyses revealed that the indices of reproduction were associated with different variables in the US and Indian samples.

Stigma: In one of the largest studies from India, Murthy (2005) evaluated stigma in 1,000 patients in four cities, as a part of the Indian initiative of the World Psychiatric Association Programme to reduce the stigma and discrimination because of schizophrenia. He reported that urban respondents in large centres try to hide their illness hoping to remain unnoticed; whereas, rural respondents in smaller regions experience greater ridicule, shame and discrimination, as anonymity is more difficult. Other studies suggest that in women, stigma was related to marriage, pregnancy and childbirth. Both men and women revealed certain cultural myths about their illnesses and how they affected their lives in a negative way (Loganathan and Murthy 2008). Mishra et al. (2009) concluded that those with better insight perceived higher stigma, compared to those with poor insight. With respect to perceived causes of stigma, a strikingly large number of participants (97 %) believed that stigma was caused by a lack of awareness about schizophrenia and the nature of the illness itself. Behavioural symptoms associated with schizophrenia were also thought to be a cause of stigma; whereas, medication-related complications were seen as playing a less causal role in stigma

(Shrivastava et al. 2011). It has also been suggested that stigma in patients is associated with external non-stigmatizing beliefs about illness (karma and evil spirits), the disease model of illness, the total number of causal models, the total number of non-medical causal beliefs, visiting temples or other places of worship for cure, total family stigma score and the relatives' perception of stigma on the patient subscale (Charles et al. 2007). The most common forms, in which stigma was experienced, were through lowered self-esteem. Also prevalent (in approximately half of the patients) were reports of being avoided due to their illness, discrimination suffered in the family, overhearing offensive comments about mental illness, discrimination at the work place, problems coping with their marriage and not receiving proposals for marriage due to their illness (Mishra et al. 2009) and strains in marital relationship (Raguram et al. 2004). Studies of stigma in caregivers suggest that caregivers most frequently have concerns about the social impact of the illness on the affected person in the form of difficulties for the person to marry, problems in an existing marriage, social devaluation and avoidance by others. Other social issues included family concerns about disclosure, feelings of shame and embarrassment about their relative's condition and difficulties for a relative of the patient to marry (Raguram et al. 2004). Raguram et al. (2001) reported that caregivers believe that employability is lower for persons with previous history of schizophrenia and caregivers were likely to hide the history of schizophrenia among patients. Thara and Srinivasan (2000) found that Hindus experience higher level of stigma than Muslims and Christians, and higher level of stigma in caregivers is associated with patient being female and young, and caregiver being younger.

Costs of care: Occasional studies have comprehensively evaluated the cost of care of schizophrenia. Grover et al. (2005) showed that cost of care of schizophrenia is similar to the total cost of care of diabetes mellitus; however, the indirect cost of schizophrenia is significantly more than diabetes mellitus (indirect cost schizophrenia: 63 %, diabetes mellitus 29 %); whereas, direct cost was significantly more in diabetes mellitus compared to schizophrenia (direct cost diabetes mellitus: 71 %, schizophrenia: 37 %). Total cost of schizophrenia was significantly higher in those who were unemployed had higher number of hospital visits and higher psychopathology and higher level of disability (Grover et al. 2005). Another study reported direct cost of treatment of schizophrenia and estimated the drug cost to be about 11 % of the total cost. In this study, development of side effects with treatment was associated with higher treatment cost (Pahuja et al. 2011).

A few studies have compared the cost of care of schizophrenia with cost of care of bipolar disorder (Somaiya et al. 2014a; Deshpande 2005; Thakral et al. 2011). In a comprehensive study, which evaluated multiple aspects of cost of care, Somaiya et al. (2014a) reported that cost of care of schizophrenia is similar to that of bipolar disorder, and the proportion of indirect cost was the main driver of the total cost for both the disorders; it also highlighted the fact that higher total cost of care is associated with total duration of illness and lower level of functioning. Deshpande (2005) compared the cost of care of schizophrenia with bipolar disorder and reported that patients with bipolar disorder spent more on the cost of consultation with faith healers, on travel to reach non-psychiatric services and

medications than those with schizophrenia. Thakral et al. (2011) evaluated the direct cost of treatment for patients with schizophrenia, bipolar and major depressive disorder and reported that direct cost of patients with bipolar disorder was more than that that of schizophrenia and major depression, with direct cost for schizophrenia being intermediate between the affective disorders. Thara (2005) assessed the direct cost of treatment with clozapine and reported that after shifting the patients to clozapine from other antipsychotics, despite the costs of blood tests, the total cost of treatment with clozapine had come down by nearly twenty-five per cent. A recent study evaluated the changes in the trends of cost of care of schizophrenia over a decade. It compared the cost of care of schizophrenia as estimated in 2000–2001 and in 2010–2011. Findings suggested that overall cost of care of schizophrenia has doubled. This study also suggested that the indirect cost is the main determinant of total cost of care of schizophrenia. Total direct cost of the treatment had not changed much in last decade, but total indirect cost has increased more than two times. The contribution of the providers' cost (i.e., treating agency) was been minimal, and this proportion has not changed much over the last decade. Cost of care of schizophrenia was more for those with lower levels of functioning, and those who had to visit the hospital more often (Somaiya et al 2014b).

Needs: Some of the studies have attempted to examine health care needs of patients with schizophrenia and their caregivers (Nagaswami et al. 1985; Shankar and Kamath 1991; Elangovan et al. 1997; Nagarajaiah et al. 1997; Shrivastava et al. 2001; Srinivasan 2000; Jagannathan et al. 2008; Gandotra et al. 2004; Kulhara et al. 2010; Neogi 2010; Gopinath et al. 1987; Chadda et al. 2000). Evaluating rehabilitation needs of the patients with schizophrenia, Nagaswami et al. (1985) reported that the most important felt needs for both patients and families were finding a job for the patient and being gainfully employed. In chronically ill patients, Shankar and Kamath (1991) reported that families express needs for information about medication, management of unpredictable or disturbed behaviour and lack of interest in daily activities, assistance with job placement and day care. In patients with chronic schizophrenia, Elangovan et al. (1997) reported that the primary needs expressed were those for patient to participate in meaningful daytime activities. In a rural community, it was reported that there were pressing needs in the form of basic education, money, treatment and benefits; whereas, the need for information was given less importance (Nagarajaiah et al. 1997). Need for information, rehabilitation services, jobs and skills training and financial assistance as the important areas of need were reported by Shrivastava et al. (2001). Others have pointed out that needs in the form of training of patient in daily living skills and vocational activities and facilities for day care are important (Srinivasan 2000). A study from NIMHANS, Bangalore used focused group discussions to understand the needs of the caregivers.

The main needs that emerged were needs regarding managing behaviour of patients (29 %), managing social-vocational problems of patients (21 %), health issues of caregivers (18 %), education about schizophrenia (15 %) and rehabilitation (13 %) and managing sexual and marital problems of patients (5 %). All family caregivers who attended the focus group discussions emphatically stated that they required help in managing all their needs and expressed their willingness

to participate in any training that addressed their needs (Jagannathan et al. 2008). A study from Ranchi compared the rehabilitation needs of the inpatients and outpatients and reported significant differences in the needs for help from a voluntary agency, employment, accommodation, leisure activities and help for family. Negative symptoms significantly correlated with rehabilitation needs among both groups of patients (Gandotra et al. 2004).

Kulhara et al. (2010) evaluated the needs of schizophrenia subjects using Camberwell Assessment for Needs instrument and reported 8.12 and 7.13 needs of patients as perceived by patients and caregivers, respectively, of which more than two-third were unmet. The most commonly reported needs by both patients and their caregivers were need for welfare benefits. Government or Non-governmental organizations provided negligible help in the areas of needs. Another study from PGIMER, Chandigarh by using Camberwell Assessment for Needs instrument and a self-designed instrument, assessed the needs of patients with schizophrenia and bipolar disorders and needs of patients as perceived by their caregivers reported that the total number of needs expressed by patients with schizophrenia were significantly more than that reported by patients with bipolar disorder; however, there was no significant difference in the total number of met and unmet needs as perceived by the patients. There was no significant difference in the total number of needs and total number of met and total number of unmet needs of patients as perceived by the caregivers. The most common domain of need as per the patients was that of welfare benefits, which was perceived as not being met at all (Neogi 2010).

Religion: Researchers have looked at the role of religion in psychopathology and help-seeking and in understanding the explanatory models, coping with the illness and influence on QOL. A study from Chennai attempted to understand the reasons why mentally ill patients and their families choose to seek help from a religious site and reported that the main reason for the same was cultural explanation for the illness (Padmavati et al. 2005). One study evaluated the use of religious coping and its relation to psychological well-being among caregivers of patients with schizophrenia and reported that the strength of religious belief was a significant predictor of well-being of the caregivers (Rammohan et al. 2002). In a cross-sectional study, the relationship between coping skills and the WHOQOL-Spirituality, Religiousness and Personal Belief (WHOQOL-SRPB) scale was evaluated, and it was found that positive reappraisal as a coping strategy had significant positive correlation with all the facets of WHOQOL-SRPB and SRPB total domain scores leading to conclusion that a sound spiritual, religious or personal belief system is associated with active and adaptive coping skills in subjects with residual schizophrenia (Shah et al. 2011). A recent study from PGIMER, Chandigarh evaluated the caregivers of patients with schizophrenia and studied QOL, including the spirituality, religiousness and personal beliefs (SRPB) facets and reported significant positive correlation between WHOQOL-BREF and various facets of WHOQOL-SRPB, indicating that SRPB forms an integral component of the concept of QOL (Kate et al. 2013).

Disability: It is well known that schizophrenia, as a disorder is associated with significant disability. As early as in 1970s, the 'PGI Disability Scale' was developed to measure psychiatric disability mainly for use in schizophrenia patients in

the community (Murthy et al. 1975; Wig et al. 1979). Later, Thara et al. (1988) developed the Schedule for Assessment of Psychiatric Disability (SAPD) as a modification and Indian adaptation of the WHO-Disability Assessment Schedule II. The SAPD assesses disability in three areas, namely, personal, social and occupational and has a rating for overall disability. The SAPD was found to be reasonably reliable and valid for measuring disability in psychiatric outpatients (Thara et al. 1988). It has been used for studying the course and outcome of schizophrenia, (Thara and Rajkumar 1993) treatment effectiveness, (Singh et al. 2010) relationship of disability with duration of hospitalization in patients with schizophrenia, (Gupta and Chadda 2008) and the association between disability and costs in patients with schizophrenia (Grover et al. 2005). In 2001, the task force of Rehabilitation Committee of the Indian Psychiatric Society developed the Indian Disability Evaluation and Assessment Scale (IDEAS) for measuring and quantifying disability in patients with mental disorders (The Rehabilitation Committee of the Indian Psychiatric Society 2002). The scale was field tested at eight centres across the country and was found to have good internal consistency, face, content and criterion validities (Thara 2005). The scale was later approved by Government of India for the assessment and certification of disability associated with mental illnesses (Ministry of Social Justice and Empowerment, Government of India 2002). In the last decade, about a dozen studies have employed the IDEAS and have focused on prevalence and pattern of psychiatric disabilities in hospital- and community-based samples (Chaudhury et al. 2006; Mohan et al. 2005; Solanki et al. 2010; Kumar et al. 2008; Thirthalli et al. 2009, 2010; Kumar et al. 2006; Balhara et al. 2011; Kashyap et al. 2012; Krishnadas et al. 2007). These studies indicate that schizophrenia is among the most disabling psychiatric disorders (Chaudhury et al. 2006; Mohan et al. 2005; Solanki et al. 2010). Disability in patients with schizophrenia correlates with severity of psychopathology (Chaudhury et al. 2006) and reduces with treatment, (Thirthalli et al. 2010, 2009), and most of the requests for disability certification are for schizophrenia (Kumar et al. 2006; Balhara et al. 2011; Kashyap et al. 2012). However, disability does not correlate with cognitive dysfunction (Krishnadas et al. 2007). One recent study evaluated the internal consistency and validity of IDEAS in patients with schizophrenia and reported that the scale has good internal consistency and construct validity (Grover et al. 2014)

Quality of life: A study compared the QOL of patients with schizophrenia and dysthymia and showed that the QOL of patients with schizophrenia was significantly poorer compared to those with dysthymia, but the duration of illness of schizophrenia did not have significant impact on QOL (Gupta et al. 1998). One study evaluated the convergent validity of quality of life interview—brief version (QOLI) by using it with quality of life scale (QLS) and WHOQOL-BREF in patients of schizophrenia and concluded that QOLI has convergent validity with both a disease-specific (QLS) and a generic (WHOQOL-BREF) scales and also reported that subjective and objective measures of QOL have good correlation (Lobana et al. 2001, 2002). On comparing patients with ICD-10 schizophrenia with and without depression on quality of life (QOL), it emerged that the

depressed group had more disability compared to the non-depressed group, but depressive symptoms had no significant correlation with subjective or objective domain of QOL (Dan et al. 2011). Chugh et al. (2013) evaluated the relationship between psychopathology and QOL in patients with first-episode schizophrenia and found that the physical well-being domain of the WHOQOL-BREF to be related significantly to the positive, negative and general psychopathology symptoms of schizophrenia as assessed on PANSS. In remitted patients, significantly better QOL in males compared to females was observed (Kujur et al. 2010).

Studies comparing QOL of patients with schizophrenia with physical illness, like systemic lupus erythematous, suggest that the two disorders differ significantly only the social domain (Radhakrishnan et al. 2012). Studies, which have compared QOL between patients with schizophrenia and obsessive–compulsive disorder, report no statistically significant difference between the two groups (Solanki et al. 2010).

A study, which longitudinally evaluated QOL of patients with schizophrenia on maintenance treatment, reported that patients had lowest QOL scores in social relationships domain and poor QOL in this domain is associated with employment status (Solanki et al. 2008).

7 Conclusions

Over the years there has been significant progress in research on schizophrenia from India. Studies in the early years mainly focused on the epidemiology, clinical features and course and outcome. In recent times, several studies have focused on neurobiology and genetics. Studies evaluating various aspects of caregiving have been carried out, and show that family remains an important support for the patients of schizophrenia. However, except for the early studies, most of the studies have been done at single centres, and on small sample sizes. It is expected that in future multi-centric studies, involving more number of patients and their caregivers, will strengthen the research evidence.

References

Abraham, A., Kuruvilla, K., & Verghese, A. (1979). The use of repertory grid technique in the assessment of schizophrenic thinking disorder. *Indian Journal of Psychiatry, 21*, 51–53.

Aga, V. M., Agarwal, A. K., & Gupta, S. C. (1995). The relationship of insight to psychopathology in schizophrenia: A cross-sectional study. *Indian Journal of Psychiatry, 37*, 129–135.

Ahmad, Y., Bhatia, M. S., Mediratta, P. K., Sharma, K. K., Negi, H., Chosdol, K., et al. (2009). Association between the ionotropic glutamate receptor kainate3 (GRIK3) Ser310Ala polymorphism and schizophrenia in the Indian population. *World Journal of Biological Psychiatry, 10*, 330–333.

Aich, T. K., Sinha, V. K., Khess, C. R., & Singh, S. (2004). Demographic and clinical correlates of substance abuse comorbidity in schizophrenia. *Indian Journal of Psychiatry, 46*, 135–140.

Aich, T. K., Sinha, V. K., Christoday, R., Khess, J., & Singh, S. (2005). Substance abuse comorbidity in schizophrenia: An inpatient study of course and outcome. *Indian Journal of Psychiatry, 47*, 33–39.

Ampalam, P., Deepthi, R., & Vadaparty, P. (2012). Schizophrenia—insight, depression: A correlation study. *Indian Journal of Psychological Medicine, 34*, 44–48.

Anand, L., Sunitha, T. A., & Khanna, S. (2002). CSF amines and their metabolites in first episode drug naive schizophrenic patients and their correlations with dimensions of schizophrenia. *Indian Journal of Psychiatry, 44*, 212–219.

Aggarwal M, Banerjee A., Singh SM., Mattoo SK., Basu D. (2012). Substance-induced psychotic disorders: 13-Year data from a de-addiction centre and their clinical implications. *Asian Journal of Psychiatry, 5*, 220–224.

Ananthanarayanan, C. V., Janakiramaiah, N., Vittals, B. N., Andade, C., & Kumaraiah, V. (1993). Visual information processing deficits in clinically remitted outpatient schizophrenics. *Indian Journal of Psychiatry, 35*, 27–31.

Arasappa, R., Rao, N. P., Venkatasubramanian, G., Jayakumar, P. N., & Gangadhar, B. N. (2008). Structural cerebellar abnormalities in antipsychotic-naive schizophrenia: Evidence for cognitive dysmetria. *Indian Journal of Psychological Medicine, 30*, 83–89.

Armstrongh, K. P., Chandrasekaran, R., & Perme, B. (2002). Insight, psychopathology and schizophrenia. *Indian Journal of Psychiatry, 44*, 332–337.

Arora, A., Avasthi, A., & Kulhara, P. (1997). Subsyndromes of chronic schizophrenia: a phenomeno-logical study. *Acta Psychiatrica Scandinavica, 96*, 225–229.

Bagadia, V. N., Copalani, J., & Shah, L. P. (1976). Habitual use of Cannabis indica in psychiatric patients. *Indian Journal of Psychiatry, 18*, 141–146.

Balhara, Y. P. S., Gauba, D., & Deshpande, S. N. (2011). Profile difference between male and female psychiatric patients seeking certificate of disability. *Oman Medical Journal, 26*, 410–415.

Basu, D., Malhotra, A., Bhagat, A., & Varma, V. K. (1999). Cannabis psychosis and acute schizophrenia: A case-control study from India. *European Addiction Research, 5*, 71–73.

Behere, R. V., Kalmady, S. V., Venkatasubramanian, G., & Gangadhar, B. N. (2009a). Orbitofrontal lobe volume deficits in antipsychotic-naive schizophrenia: A 3-Tesla MRI study. *Indian Journal of Psychological Medicine, 31*, 77–81.

Behere, R. V., Venkatasubramanian, G., Arasappa, R., Reddy, N., & Gangadhar, B. N. (2009b). Effect of risperidone on emotion recognition deficits in antipsychotic-naïve schizophrenia: A short-term follow-up study. *Schizophrenia Research, 113*, 72–76.

Behere, R. V., Venkatasubramanian, G., Arasappa, R., Reddy, N. N., & Gangadhar, B. N. (2011). First rank symptoms & facial emotion recognition deficits in antipsychotic naïve schizophrenia: Implications for social threat perception model. *Progress in Neuropsychopharmacology and Biological Psychiatry, 35*, 1653–1658.

Bharadwaj, B., Arasappa, R., Behere, R. V., Venkatasubramanian, G., Jayakumar, P. N., & Gangadhar, B. N. (2008). Emotion recognition deficits in antipsychotic-naive schizophrenia. *Indian Journal of Psychological medicine, 30*, 90–97.

Bhatia, T., Franzos, M. A., Wood, J. A., Nimgaonkar, V. L., & Deshpande, S. N. (2004). Gender and procreation among patients with schizophrenia. *Schizophrenia Research, 68*, 387–394.

Bhatia, T., Garg, K., Pogue-Geile, M., Nimgaonkar, V. L., & Deshpande, S. N. (2009). Executive functions and cognitive deficits in schizophrenia: Comparisons between probands, parents and controls in India. *Journal of Postgraduate Medicine, 55*, 3–7.

Biswas, P., Malhotra, S., Malhotra, A., & Gupta, N. (2007). Comparative study of neurological soft signs in schizophrenia with onset in childhood, adolescence and adulthood. *Acta Psychiatrica Scandinavica, 115*, 295–303.

Borde, M., Davis, E. J. B., & Sharma, L. N. (1992). The stability of symptoms and syndromes in chronic schizophrenic patients. *Indian Journal of Psychiatry, 34*, 133–139.

Borde, M., Roy, A., Davis, E. J., & Davis, R. (1996). Right hemispheric function in normals, affective disorder and schizophrenia. *Indian Journal of Psychiatry, 38*, 225–230.

Chabungbam, G., Avasthi, A., & Sharan, P. (2007). Sociodemographic and clinical factors associated with relapse in schizophrenia. *Psychiatry and Clinical Neurosciences, 61*, 587–593.

Chadda, R. K., Pradhan, S. C., Bapna, J. S., Singhal, R., & Singh, T. B. (2000). Chronic psychiatric patients: An assessment of treatment and rehabilitation-related needs. *International Journal of Rehabilitation Research, 23*, 55–58.

Chakraborty, R., Chatterjee, A., Chaudhury, S., & Khess, C. R. (2008). Impact of substance abuse on presentation and short term course of schizophrenia. *Indian Journal of Psychiatry, 50*, 4.

Charles, H., Manoranjitham, S. D., & Jacob, K. S. (2007). Stigma and explanatory models among people with schizophrenia and their relatives in Vellore, South India. *International Journal of Social Psychiatry, 53*, 325–332.

Chatterjee, S. B. (1988). Dopamine related hormone levels in acute schizophrenia. *Indian Journal of Psychiatry, 30*, 7–13.

Chatterjee, S. B., & Basu, S. K. (1980). Sex chromosome aberrations in schizophrenia. *Indian Journal of Psychiatry, 22*, 142–153.

Chatterjee, S. B., & Thakur, M. S. (1976). A Comparative study of Muller-Lyer illusion among normal's, neurotics and schizophrenics. *Indian Journal of Psychiatry, 18*, 6–14.

Chaturvedi, S. K., Rao, G. P., Mathai, J. P., Sarmukaddam, S., & Gopinath, P. S. (1985). Negative symptoms in schizophrenia and depression. *Indian Journal of Psychiatry, 27*, 237–242.

Chaudhury, P. K., Deka, K., & Chetia, D. (2006). Disability associated with mental disorders. *Indian Journal of Psychiatry, 48*, 95–101.

Chintalapudi, M., Kulhara, P., & Avasthi, A. (1993). Post-psychotic depression in schizophrenia. *European Archives of Psychiatry and Clinical Neuroscience, 243*, 103–108.

Choudhury, S., Khess, C. R. J., Bhattacharyya, R., & Sanyal, D. (2009). Insight in schizophrenia and its association with executive functions. *Indian Journal of Psychological Medicine, 31*, 71–76.

Chowdari, K. V., Mirnics, K., Semwal, P., Wood, J., Lawrence, E., Bhatia, T., et al. (2002). Association and linkage analyses of RGS4 polymorphisms in schizophrenia. *Human Molecular Genetics, 11*, 1373–1380.

Chugh, P. K., Rehan, H. S., Unni, K. E., & Sah, R. K. (2013). Predictive value of symptoms for quality of life in first-episode schizophrenia. *Nordic Journal of Psychiatry, 67*, 153–158.

Dadheech, G., Mishra, S., Gautam, S., & Sharma, P. (2008). Evaluation of antioxidant deficit in schizophrenia. *Indian Journal of Psychiatry, 50*, 16–20.

Dan, A., Kumar, S., Avasthi, A., & Grover, S. (2011). A comparative study on quality of life of patients of schizophrenia with and without depression. *Psychiatry Research, 189*, 185–189.

Das, P., & Kapur, R. L. (1980). Post psychotic depression in schizophrenics: A prospective study. *Indian Journal of Psychiatry, 22*, 277–282.

Das, M. K., Kulhara, P. L., & Verma, S. K. (1997). Life events preceding relapse of schizophrenia. *International Journal of Social Psychiatry, 43*, 56–63.

Dasgupta, J., Dasgupta, D., & Balasubrahmanyan, M. (1973). Dermatoglyphics in the diagnosis of schizophrenia. *Indian Journal of Psychiatry, 15*, 104–122.

Debnath, M., Das, S. K., Bera, N. K., Nayak, C. R., & Chaudhuri, T. K. (2006). Genetic associations between delusional disorder and paranoid schizophrenia: A novel etiologic approach. *Canadian Journal of Psychiatry, 51*, 342–349.

Deshpande, S. (2005). Cost of illness in schizophrenia—perspective from a GHPU. *Indian Journal Psychiatry, 47*, 205–217.

Dube, K. C. (1979). A study of prevalence and biological variables in mental illness in rural urban community in Uttar Pradesh. *India Acta Psychiatr Scand, 46*, 327–342.

Dube, K. C., & Handa, S. K. (1971). Drug use in health and mental illness in an Indian population. *British Journal of Psychiatry, 118*, 345–346.

Eaton, W. W., Thara, R., Federman, B., Melton, B., & Liang, K. Y. (1995). Structure and course of positive and negative symptoms in schizophrenia. *Archives of General Psychiatry, 52*, 127–134.

Elanagar, M. N., Maitra, P., & Rao, M. N. (1971). Mental health in an Indian rural community. *British Journal of Psychiatry, 118*, 499.

Elangovan, S., Verghese, M., & Murali, T. (1997). Assessment of needs and disability in chronic schizophrenia and bipolar affective disorder. *NIMHANS Journal, 15*, 199–200.

Eswaraiah, G. (1978). Palm prints and schizophrenia. *Indian Journal of Psychiatry, 20*, 349–353.

Gandotra, S., Paul, S. E., Daniel, M., Kumar, K., Raj, H. A., & Sujeetha, B. (2004). A preliminary study of rehabilitation needs of in-patients and out-patients with schizophrenia. *Indian Journal of Psychiatry, 46*, 244–255.

Kumar, S. G., Das, A., Bhandary, P. V., Soans, S. J., Harsha Kumar, H. N., & Kotian, M. S. (2008). Prevalence and pattern of mental disability using Indian disability evaluation assessment scale in a rural community of Karnataka. *Indian Journal of Psychiatry, 50*, 21–23.

Gangadhar, B. N., Panner Selvan, C., Subbakrishna, D. K., & Janakiramaiah, N. (2002). Age-at-onset and schizophrenia: Reversed gender effect. *Acta Psychiatrica Scandinavica, 105*, 317–319.

Gangadhar, B. N., Jayakumar, P. N., Venkatasubramanian, G., Janakiramaiah, N., & Keshavan, S. (2006). Developmental reflexes and 31P magnetic resonance spectroscopy of basal ganglia in antipsychotic-naive schizophrenia. *Progress in Neuropsychopharmacology and Biological Psychiatry, 30*, 910–913.

Ghosh, A., Varma, V. K., & Amma, M. K. P. (1981). Correlation between psychopathology and urinary steroid and biogenic amine metabolites in male schizophrenics. *Indian Journal of Psychiatry, 23*, 298–303.

Giridhar, C., Kulhara, P., & Varma, V. K. (1992). Linguistic compentence in positive and negative subtypes of schizophrenia. *Indian Journal of Psychiatry., 34*, 311–320.

Goel, D. S., & D'Netto, T. B. (1975). Cannabis: The habit and psychosis. *Indian Journal of Psychiatry, 17*, 238–243.

Gong, S. L., Wei, J., Ramchand, C. N., Ramchand, R., & Hemmings, G. P. (1993). Concentrations of homovanillic acid and gonadal hormones in the serum of male schizophrenic patients. *Indian Journal of Psychiatry, 35*, 181–184.

Gopinath, P. S., Sharma, P. S. V. N., & Reddy, M. V. (1987). Patients who discontinue day hospitalization—An analysis. *Indian Journal of Psychiatry, 29*, 197–201.

Goswami, S., Singh, G., Mattoo, S. K., & Basu, D. (2003). Courses of substance use and schizophrenia in dual diagnosis patients. *Indian Journal of Medical Sciences, 57*, 338–346.

Grover, S., Avasthi, A., Chakrabarti, S., Bhansali, A., & Kulhara, P. (2005). Cost of care of schizophrenia: A study of Indian outpatient attenders. *Acta Psychiatrica Scandinavica, 112*, 54–63.

Grover, S., Nehra, R., Bhateja, G., Kulhara, P., & Kumar, S. (2011). A comparative study of cognitive deficits in patients with delusional disorder and paranoid schizophrenia. *Industrial Psychiatry Journal, 20*, 107–114.

Grover S., Shah R., Kulhara P., Malhotra R. (2014). Internal consistency and validity of Indian Disability Evaluation and Assessment Scale (IDEAS) in patients with schizophrenia. *Indian Journal of Medical Research* (in press).

Gupta, S. (1979). Socio clinical aspects of delusions in schizophrenia. *Indian Journal of Psychiatry, 21*, 169–175.

Gupta, A., & Chadda, R. K. (2008). Disability in schizophrenia: Do short hospitalizations have a role? *International Journal of Psychosoc Rehabilitation, 13*, 91–96.

Gupta, A. K., Sethi, B. B., & Trivedi, J. K. (1985). Platelet MAO activity in chronic schizophrenia. *Indian Journal of Psychiatry, 27*, 279–287.

Gupta, S. C., Singh, H., & Trivedi, J. K. (1992). Evaluation of suicidal risk in depressives and schizophrenics: A 2-year follow-up study. *Indian Journal of Psychiatry, 34*, 298–310.

Gupta, S., Kulhara, P., & Verma, S. K. (1998). Quality of life in schizophrenia and dysthymia. *Acta Psychiatrica Scandinavica, 97*, 290–296.

Gupta, M., Chauhan, C., Bhatnagar, P., Gupta, S., Grover, S., Singh, P. K., et al. (2009). Genetic susceptibility to schizophrenia: Role of dopaminergic pathway gene polymorphisms. *Pharmacogenomics, 10*, 277–291.

Hemrom, S., Pushpa, D. P., Jahan, M., Jahan, A. R., & Kenswar, D. K. (2009). Prevalence of obsessive compulsive symptoms in patients with schizophrenia. *Industrial Psychiatry Journal, 18*, 77–80.

Holliday, E. G., Handoko, H. Y., James, M. R., McGrath, J. J., Nertney, D. A., Tirupati, S., et al. (2006). Association study of the dystrobrevin-binding gene with schizophrenia in Australian and Indian samples. *Twin Research and Human Genetics, 9*, 531–539.

Holliday, E. G., Nyholt, D. R., Tirupati, S., John, S., Ramachandran, P., Ramamurti, M., et al. (2009). Strong evidence for a novel schizophrenia risk locus on chromosome 1p31.1 in homogeneous pedigrees from Tamil Nadu, India. *American Journal of Psychiatry, 166*, 206–215.

Indian Council of Medical Research-ICMR. (1988). *Factors associated with the course and outcome of schizophrenia: ICMR-multicentred collaborative study*. New Delhi: ICMR.

Issac, M. K., & Kapur, R. L. (1980). A cost effectiveness analysis of three different methods of psychiatric case finding in the general population. *British Journal of Psychiatry, 137*, 540–546.

Iyer, S. N., Mangala, R., Thara, R., & Malla, A. K. (2010). Preliminary findings from a study of first-episode psychosis in Montreal, Canada and Chennai, India: Comparison of outcomes. *Schizophrenia Research, 121*, 227–233.

Jagannathan, A., Hamza, A., Thirthahalli, J., Nagendra, H. R., Hapipraqsad, V. R., & Gangadhar, B. N. (2008). Need of family caregivers of inpatients with schizophrenia in India. In Poster Presentation at the Third International Conference on Schizophrenia (p. 48). October 17–19, 2008, Chennai.

Jain, R., Jain, R. K., & Gurunani, K. C. (1992). Palmar flexion crease in male schizophrenics and their first degree relatives. *Indian Journal of Psychiatry, 34*, 148–154.

Janakiramaiah, N., Gururaj, G., Subbakrishna, D. K., Gangadhar, B. N., Rao, S., & Joseph, M. (1992). Acute psychosis diagnosed as schizophrenia in ICD 9: A discriminant validity study. *Indian Journal of Psychiatry, 34*, 344–346.

Jangid, R. K., & Verma, S. M. (1989). Schizophrenia and season of birth. *Indian Journal of Psychiatry, 31*, 238–241.

Jayakumar, P. N., Venkatasubramanian, G., Gangadhar, B. N., Janakiramaiah, N., & Keshavan, M. S. (2005). Optimized voxel-based morphometry of gray matter volume in first-episode, antipsychotic-naive schizophrenia. *Progress in Neuropsychopharmacology and Biological Psychiatry, 29*, 587–591.

Jayakumar, P. N., Venkatasubramanian, G., Keshavan, M. S., Srinivas, J. S., & Gangadhar, B. N. (2006). MRI volumetric and 31P MRS metabolic correlates of caudate nucleus in antipsychotic-naïve schizophrenia. *Acta Psychiatrica Scandinavica, 114*, 346–351.

Jayakumar, P. N., Gangadhar, B. N., Venkatasubramanian, G., Desai, S., Velayudhan, L., Subbakrishna, D., et al. (2010). High energy phosphate abnormalities normalize after antipsychotic treatment in schizophrenia: a longitudinal 31P MRS study of basal ganglia. *Psychiatry Research, 181*, 237–240.

Jayaswal, S. K., Chawla, H. M., Goulatia, R. K., & Rao, G. S. (1987). Structural changes in the brain in schizophrenia a computed tomographic study. *Indian Journal of Psychiatry, 29*, 229–234.

Jaydeokar, S., Gore, Y., Diwan, P., Deshpande, P., & Desai, N. (1997). Obsessive-compulsive symptoms in chronic schizophrenia: A new idea or an old belief? *Indian Journal of Psychiatry, 39*, 324–328.

Jhingan, H. P., & Munjal, G. C. (1990). Dermatoglyphics in male catatonic schizophrenics. *Indian Journal of Psychiatry, 32*, 198–201.

John, J. P., Shakeel, M. K., & Jain, S. (2008). Corpus callosal area differences and gender dimorphism in neuroleptic-naïve, recent-onset schizophrenia and healthy control subjects. *Schizophrenia Research, 103*, 11–21.

John, J. P., Burgess, P. W., Yashavantha, B. S., Shakeel, M. K., Halahalli, H. N., & Jain, S. (2009). Differential relationship of frontal pole and whole brain volumetric measures with age in neuroleptic-naïve schizophrenia and healthy subjects. *Schizophrenia Research, 109*, 148–158.

John, J. P., Halahalli, H. N., Vasudev, M. K., Jayakumar, P. N., & Jain, S. (2011). Regional brain activation/deactivation during word generation in schizophrenia: fMRI study. *British Journal of Psychiatry, 198*, 213–222.

Kale, A., Joshi, S., Pillai, A., Naphade, N., Raju, M., Nasrallah, H., et al. (2009). Reduced cerebrospinal fluid and plasma nerve growth factor in drug-naïve psychotic patients. *Schizophrenia Research, 115*, 209–214.

Kashyap, K., Thunga, R., Rao, A. K., & Balamurali, N. P. (2012). Trends of utilization of government disability benefits among chronic mentally ill. *Indian Journal of Psychiatry, 54*, 54–58.

Kate, N., Grover, S., Kulhara, P., & Nehra, R. (2012). Supernatural beliefs, aetiological models and help seeking behaviour in patients with schizophrenia. *Industrial Journal of Psychiatry, 21*, 49–54.

Kate, N., Grover, S., Kulhara, P., Nehra, R. (2013) Relationship of quality of life with coping and burden in primary caregivers of patients with schizophrenia. International Journal of Social Psychiatry. January 3, 2013 (Epub ahead of print).

Kisore, P., Lal, N., Trivedi, J. K., Dalal, P. K., & Aga, V. M. (1994). A study of comorbidity in psychoactive substance dependence patients. *Indian Journal of Psychiatry, 36*, 133–137.

Kondaiah, P., Murthy, K. K., & Reddy, O. S. (1981). Plasma creatine Phosphokinase in schizophrenia. *Indian Journal of Psychiatry, 23*, 351–352.

Kota, S. K., & Kulhara, P. (1988). A clinical study of positive and negative subtypes of schizophrenia. *Indian Journal of Psychiatry, 30*, 355–361.

Kota, S. K., Kulhara, P., Joseph, S., & Nagpal, R. S. (1986). Inter-rater reliability of the scale for assessment of negative symptoms in schizophrenia. *Indian Journal of Psychiatry, 28*, 349–350.

Krishnadas, R., Moore, B. P., Nayak, A., & Patel, R. R. (2007). Relationship of cognitive function in patients with schizophrenia in remission to disability: A cross-sectional study in an Indian sample. *Annals of General Psychiatry, 30*, 6–19.

Kujur, N. S., Kumar, R., & Verma, A. N. (2010). Differences in levels of disability and quality of life between genders in schizophrenia remission. *Indian Psychiatry Journal, 19*, 50–54.

Kukreti, R., Tripathi, S., Bhatnagar, P., Gupta, S., Chauhan, C., Kubendran, S., et al. (2006). Association of DRD2 gene variant with schizophrenia. *Neuroscience Letters, 392*, 68–71.

Kukshal, P., Bhatia, T., Bhagwat, A. M., Gur, R. E., Gur, R. C., Deshpande, S. N., et al. (2013). Association study of neuregulin-1 gene polymorphisms in a north Indian schizophrenia sample. *Schizophrenia Research, 144*, 24–30.

Kulhara, P., & Avasthi, A. (2003). Influence of depressive symptoms and premorbid adjustment on factor structure of phenomenology of schizophrenia: A study from India. *European Psychiatry, 18*, 226–232.

Kulhara, P., & Chandiramani, K. (1990). Positive and negative subtypes of schizophrenia. A follow-up study from India. *Schizophrenia Research, 3*, 107–116.

Kulhara, P., Chandiramani, K., Mattoo, S. K., & Awasthi, A. (1986a). A phenomenological study of delusions in schizophrenia. *Indian Journal of Psychiatry, 28*, 281–286.

Kulhara, P., Kota, S. K., & Joseph, S. (1986b). Positive and negative subtypes of schizophrenia. A study from India. *Acta Psychiatrica Scandinavica, 74*, 353–359.

Kulhara, P., Mattoo, S. K., Chandiramani, K., Bhave, S., & Avasthi, A. (1986c). Diagnostic systems for schizophrenia. A cross-sectional study of concordance from India. *Acta Psychiatrica Scandinavica, 74*, 55–61.

Kulhara, P., Mattoo, S. K., Awasthi, A., & Chandiramani, K. (1987). Psychiatric manifestations of Catego class + schizophrenia. *Indian Journal of Psychiatry, 29*, 307–313.

Kulhara, P., Avasthi, A., & Chandiramani, K. (1989a). Prognostic variables in schizophrenia. *Indian Journal of Psychiatry, 31*, 51–62.

Kulhara, P., Avasthi, A., Chadda, R., Chandiramani, K., Mattoo, S. K., Kota, S. K., et al. (1989b). Negative and depressive symptoms in schizophrenia. *British Journal of Psychiatry, 154*, 207–211.

Kulhara, P., Avasthi, A., Gupta, N., Das, M. K., Nehra, R., Rao, S. A., et al. (1998). Life events and social support in married schizophrenics. *Indian Journal of Psychiatry, 40*, 376–382.

Kulhara, P., Avasthi, A., & Sharma, A. (2000). Magico-religious beliefs in schizophrenia: A study from north India. *Psychopathology, 33*, 62–68.

Kulhara, P., Avasthi, A., Grover, S., Sharan, P., Sharma, P., Malhotra, S., et al. (2010). Needs of schizophrenia patients. *Social Psychiatry and Psychiatric Epidemiology, 45*, 809–818.

Kumar, A., & Khess, C. R. (2012). Factor analysis of positive and negative syndrome scale in schizophrenia: An exploratory study. *Indian Journal of Psychiatry, 54*, 233–238.

Kumar, S., Kulhara, P., Grover, S., & Malhotra, R. (2006). Preliminary experiences with use of disability assessment scales at mental disability clinic, PGIMER, Chandigarh. *Journal of Mental Health and Human Behavior, 11*, 39–43.

Kurup, R. A., Augustine, J., & Kurup, P. A. (1999). Hypothalamic digoxin and schizophrenia—a model for conscious and subliminal perception and its dysfunction in schizophrenia. *Indian Journal of Psychiatry, 41*, 197–203.

Kuruvilla, K., Kuruvilla, A., & Kanagasabapathy, A. S. (1986). Serum prolactin levels in schizophrenia effects of neuroleptic medication—a preliminary study. *Indian Journal of Psychiatry, 28*, 237–243.

Lal, R., & Sharma, S. (1987). Minor physical anomalies in schizophrenia. *Indian Journal of Psychiatry, 29*, 119–123.

Lal, N., Tiwari, S. C., Srivastava, S., Khalid, A., & Siddharatha, K. N. (1998). Neurological soft signs, cognitive dysfunction and ventricular brain ratio in schizophrenics. *Indian Journal of Psychiatry, 40*, 180–185.

Lobana, A., Mattoo, S. K., Basu, D., & Gupta, N. (2001). Quality of life in schizophrenia in India: comparison of three approaches. *Acta Psychiatrica Scandinavica, 104*, 51–55.

Lobana, A., Mattoo, S. K., Basu, D., & Gupta, N. (2002). Convergent validity of quality of life interview (qoli) in an Indian setting: preliminary findings. *Indian Journal of Psychiatry, 44*, 118–124.

Loganathan, S., & Murthy, S. R. (2008). Experiences of stigma and discrimination endured by people suffering from schizophrenia. *Indian Journal of Psychiatry, 50*, 39–46.

Malhotra, S., Gupta, N., Bhattacharya, A., & Kapoor, M. (2006). Study of childhood onset schizophrenia (COS) using SPECT and neuropsychological assessment. *Indian Journal of Psychiatry, 48*, 215–223.

Mazumdar, P. K., Chaturvedi, S. K., & Gopinath, P. S. (1988). A study of thought, language and communication (T.L.C) disorders in schizophrnia. *Indian Journal of Psychiatry, 30*, 263–275.

McCreadie, R. G., Thara, R., Kamath, S., Padmavathy, R., Latha, S., Mathrubootham, N., et al. (1996). Abnormal movements in never-medicated Indian patients with schizophrenia. *British Journal of Psychiatry, 168*, 221–226.

McCreadie, R. G., Padmavati, R., Thara, R., & Srinivasan, T. N. (2002). Spontaneous dyskinesia and parkinsonism in never-medicated, chronically ill patients with schizophrenia: 18-month follow-up. *British Journal of Psychiatry, 181*, 135–137.

McCreadie, R. G., Thara, R., Srinivasan, T. N., & Padmavathi, R. (2003). Spontaneous dyskinesia in first-degree relatives of chronically ill, never-treated people with schizophrenia. *British Journal of Psychiatry, 183*, 45–49.

McLean, D., John, S., Barrett, R., McGrath, J., Loa, P., Thara, R., et al. (2012). Refining clinical phenotypes by contrasting ethnically different populations with schizophrenia from Australia, India and Sarawak. *Psychiatry Research, 196*, 194–200.

Ministry of Social Justice and Empowerment, Government of India. (2002). Guidelines for evaluation and assessment of mental illness and procedure for certification. (No. 16-18/97-NI). Available at: http://www.ccdisabilities.nic.in/page.php?s=reg&p=guidemental&t=pb#maincont.

Mishra, D. K., Alreja, S., Sengar, K. S., et al. (2009). Insight and its relationship with stigma in psychiatric patients. *Indian Psychiatry Journal, 18*, 39–42.

Mohan, I., Tandon, R., Kalra, H., & Trivedi, J. K. (2005). Disability assessment in mental illnesses using Indian disability evaluation assessment scale (IDEAS). *Indian Journal of Medical Research, 121*, 759–763.

Mukherjee, O., Meera, P., Ghosh, S., Kubendran, S., Kiran, K., Manjunath, K. R., et al. (2006). Evidence of linkage and association on 18p11.2 for psychosis. *American Journal of Medical Genetics B Neuropsychiatr Genetics, 141*, 868–873.

Murthy, N. (1965). Disturbances in communication in the schizophrenic. *Indian Journal of Psychiatry, 7*, 167–171.

Murthy, S. R. (2005). *Perspectives on the stigma of mental illness. Stigma of mental illness in the third world*. Geneva: World Psychiatric Association.

Murthy, R. S., Anuradha, D., Pershad, D., & Wig, N. N. (1975). Psychiatric disability Scale. Preliminary report. *Indian Journal of Clinical Psychology, 2*, 183.

Nagarajaiah, P., Murthy, R. S., Sekar, K., Puttamma, M., Moily, S., & Kishore Kumar, K. V. (1997). Needs of persons with schizophrenia in a rural community. *Indian Journal of Psychiatry, 39*(Suppl), 23.

Nagaswami, V., Valecha, V., Thara, R., Rajkumar, S., & Menon, M. S. (1985). Rehabilitation needs of schizophrenic patients: A preliminary report. *Indian Journal of Psychiatry, 27*, 213–220.

Nandi, D. N., Ajmany, S., Ganguly, H., et al. (1975). Psychiatric disorder in a rural community in West Bengal—an epidemiological study. *Indian Journal Psychiatry, 17*, 87–90.

Neogi, R. (2010). Health care needs of patients with bipolar disorder. MD Thesis submitted to PGIMER.

Nizamie, S. H., Nizamie, A., Sangma, M. W., & Sharma, P. L. (1989). Soft neurological signs and minor physical anomalies in schizophrenia. *Indian Journal of Psychiatry, 31*, 230–238.

Padmavati, R. (2001). Structural (MRI) brain differences between never treated schizophrenia patients with and without dyskinesia and normal control subjects. *Indian Journal of Psychiatry, 43*, 1.

Padmavati, R., Thara, R., & Corin, E. (2005). A qualitative study of religious practices by chronic mentally ill and their caregivers in South India. *International Journal of Social Psychiatry, 51*, 139–149.

Pahuja, S., Aboobacker, S., & Shini, V. K. (2011). Schizophrenia—cost of illness. *International Journal of Pharmaceutical Sciences Review and Research, 6*, 55–59.

Pandey, R. S., Rao, B. S. S., Subash, M. N., Krishna, D. K., & Srinivas, K. N. (1987). Central dopamine and serotonin turnover in schizophrenia. *Indian Journal of Psychiatry, 29*, 203–213.

Parkar, S. R., Seethalakshmi, R., & Shah, H. (2006). Structural brain lesions in schizophrenia—magnetic resonance imaging on a mid field magnet. *Indian Journal of Radiology Imaging, 16*(3), 299–301.

Ponnudurai, R. (1989). Schizophrenia—a genetic study. *Indian Journal of Psychiatry, 31*, 219–221.

Ponnudurai, R., & Jayakar, J. (2010). Mode of transmission of schizophrenia. *Asian Journal of Psychiatry, 3*, 67–72.

Ponnudurai, R., Menon, S., & Muthu, M. (1997). Dermatoglyphic fluctuating asymmetry and symmetry in familial and non familial schizophrenia. *Indian Journal of Psychiatry, 39*, 205–211.

Pradhan, N., Harihar, C., Das, P., & Andrade, C. (1992). Heterogeneity in plasma homovanillic acid levels in schizophreniform disorder. *Indian Journal of Psychiatry, 34*, 128–132.

Pradhan, B. K., Chakrabarti, S., Nehra, R., & Mankotia, A. (2008). Cognitive functions in bipolar affective disorder and schizophrenia: comparison. *Psychiatry and Clinical Neurosciences, 62*, 515–525.

Radhakrishnan, R., Menon, J., Kanigere, M., Ashok, M., Shobha, V., & Galgali, R. B. (2012). Domains and determinants of quality of life in schizophrenia and systemic lupus erythematosus. *Indian Journal of Psychological Medicine, 34*, 49–55.

Raguram, R., Weiss, M. G., Keval, H., et al. (2001). Cultural dimensions of clinical depression in Bangalore, India. *Anthropology and Medicine, 8*, 31.

Raguram, R., Raghu, T. M., Vounatsou, P., et al. (2004). Schizophrenia and the cultural epidemiology of stigma in Bangalore, India. *Journal of Nervous and Mental Disease, 192*, 734–744.

Raj, S. M., & Raguram, R. (2001). Neurotic symptoms in schizophrenia. *Indian Journal of Psychiatry, 43*, 4.

Rajender, G., Kanwal, K., Rathore, D. M., & Chaudhary, D. (2009). Study of cenesthesias and body image aberration in schizophrenia. *Indian Journal of Psychiatry, 51*, 195–199.

Rajkumar, S., & Thara, R. (1989). Factors affecting relapse in schizophrenia. *Schizophrenia Research, 2*, 403–409.

Rajkumar, R. P., Reddy, Y. C., & Kandavel, T. (2008). Clinical profile of "schizo-obsessive" disorder: A comparative study. *Comprehensive Psychiatry, 49*, 262–268.

Raju, S. S. (1986). Depressive disorders in schizophrenia. *Indian Journal of Psychiatry, 28*, 109–118.

Ramanathan, A. (1983). A study of experienced reality of auditory hallucinations in schizopherenics. *Indian Journal of Psychiatry, 25*, 148–154.

Ramanathan, A. (1986). An exploratory study on the relation between neuroticism and certain aspects of auditory hallucinations in schizophrenics. *Indian Journal of Psychiatry, 28*, 69–73.

Rammohan, A., Rao, K., & Subbakrishna, D. K. (2002). Religious coping and psychological well-being in carers of relatives with schizophrenia. *Acta Psychiatrica Scandinavica, 105*, 356–362.

Rao, N., Gopinath, P. S., Jayasimha, N., Rao, B. S. S., & Subbakrishna, D. K. (1985). Serum immunoglobulins and schizophrenia. *Indian Journal of Psychiatry, 27*, 325–329.

Rao, N. P., Venkatasubramanian, G., Arasappa, R., & Gangadhar, B. N. (2011). Relationship between corpus callosum abnormalities and schneiderian first-rank symptoms in antipsychotic-naive schizophrenia patients. *Journal of Neuropsychiatry and Clinical Neurosciences, 23*, 155–162.

Saddichha, S., Sur, S., Sinha, B. N., & Khess, C. R. (2010). How is substance use linked to psychosis? A study of the course and patterns of substance dependence in psychosis. *Substance Abuse, 31*, 58–67.

Saravanan, B., Jacob, K. S., Johnson, S., Prince, M., Bhugra, D., & David, A. S. (2007). Belief models in first episode schizophrenia in South India. *Social Psychiatry and Psychiatric Epidemiology, 42*, 446–451.

Saravanan, B., Jacob, K. S., Deepak, M. G., Prince, M., David, A. S., & Bhugra, D. (2008). Perceptions about psychosis and psychiatric services: A qualitative study from Vellore, India. *Social Psychiatry and Psychiatric Epidemiology, 43*, 231–238.

Sartorius, N., Jablensky, A., Korten, A., et al. (1986). Early manifestations and first contact incidence of schizophrenia in different cultures. *Psychological Medicine, 16*, 909–928.

Seethalakshmi, R., Parkar, S. R., Nair, N., Batra, S. A., Pandit, A. G., Adarkar, S. A., et al. (2007). Regional brain metabolism in schizophrenia: The influence of antipsychotics. *Journal of Postgraduate Medicine, 53*, 241–246.

Sengupta, S., & Bhuyan, S. D. (1995). Palmar dermatoglyphics in schizophrenia. *Indian Journal of Psychiatry, 37*, 86–90.

Sethi, B. B., Gupta, S. C., & Kumar, R. (1967). A psychiatric study of 300 urban families. *Indian Journal of Psychiatry, 9*, 280–302.

Sethi, B. B., Gupta, S. C., & Kumar, R. (1972). A psychiatric survey of 500 rural families. *Indian Journal of Psychiatry, 14*, 183–186.

Sethi, B. B., Gupta, S. C., Mahendru, R. K., et al. (1974). Mental health and urban life. A study of 850 families. *British Journal of Psychiatry, 124*, 293.

Sethi, B. B., Gupta, S. C., & Trivedi, J. K. (1980). Psychiatric morbidity among parents of schizophrenic patients. *Indian Journal of Psychiatry, 22*, 217–224.

Shah, R., Kulhara, P., Grover, S., Kumar, S., Malhotra, R., & Tyagi, S. (2011). Relationship between spirituality/religiousness and coping in patients with residual schizophrenia. *Quality of Life Research, 20*, 1053–1060.

Shankar, R., Kamath, S. (1991). Needs based interventions with families of the chronic mentally ill. Presented at the Congress of the World Association of Psychosocial Rehabilitation, Montreal. October 14–18, 1991.

Sharma, I., Kumar, A., & Chansouria, J. P. (1990). Platelet MAO activity in subgroups of schizophrenia. *Indian Journal of Psychiatry, 32*, 324–330.

Sharma, I., Kumar, A., Chansouria, J. N., & Varma, S. L. (1991). Clinical variables and platelet MAO in schizophrenia. *Indian Journal of Psychiatry, 33*, 271–280.

Shrivastava, A., & Tamhane, M. (2000). Serum prolactin level and severity of psychopathology in patients of schizophrenia. *Indian Journal of Psychiatry, 42*, 49–51.

Shrivastava, A., Sarkel, G., & Iyer, S. (2001). Experience of working with relatives of schizophrenia: evolving caregivers program for advocacy and intervention. *Indian Journal of Psychiatry, 43*(Suppl), 105.

Shrivastava, A., Johnston, M. E., Thakar, M., et al. (2011). Origin and impact of stigma and discrimination in schizophrenia—patients' perception: Mumbai study. *Stigma Research and Action, 1*, 67–72.

Siddharatha, N. L., Tewari, S. C., Dalal, P. K., Kohli, N., & Srivastava, S. (1997). A computed tomographic study of schizophrenia. *Indian Journal of Psychiatry, 39*, 115–121.

Singh, M. V. (1971). A psychometric approach to schizophrenic thought disorders. *Indian Journal of Psychiatry, 13*, 113–118.

Singh, S. P., & Kulhara, P. (1991). Simple schizophrenia: Patients in search of a diagnosis. *Indian Journal of Psychiatry, 33*, 266–270.

Singh, G., & Sachdava, J. S. (1982). Schizo affective psychoses—are they schizophrenic? *Indian Journal of Psychiatry, 24*, 42–49.

Singh, G., Sharan, P., & Kulhara, P. (2003). Phenomenology of hallucinations: A factor analytic approach. *Psychiatry and Clinical Neurosciences, 57*, 333–336.

Singh, N. H., Sharma, S. G., & Pasweth, A. M. (2005). Psychiatric co-morbidity among alcohol dependents. *Indian Journal of Psychiatry, 47*, 222–224.

Singh, B., Banerjee, S., Bera, N. K., Nayak, C. R., & Chaudhuri, T. K. (2008a). Analysis of the role of human leukocyte antigen class-I genes to understand the etiopathology of schizophrenia. *Indian Journal of Psychiatry, 50*, 166–171.

Singh, O. P., Chakraborty, I., Dasgupta, A., & Datta, S. (2008b). A comparative study of oxidative stress and interrelationship of important antioxidants in haloperidol and olanzapine treated patients suffering from schizophrenia. *Indian Journal of Psychiatry., 50*, 171–176.

Singh, B., Bera, N. K., Nayak, C. R., & Chaudhuri, T. K. (2009). Decreased serum levels of interleukin-2 and interleukin-6 in Indian Bengalee schizophrenic patients. *Cytokine, 47*, 1–5.

Singh, T. B., Kaloiya, G. S., Kumar, S., & Chadda, R. K. (2010). Rehabilitation need assessment of severely mentally ill and effect of intervention. *Delhi Psychiatry Journal, 13*, 109–116.

Sinha, V. K., & Chaturvedi, S. K. (1990). Consistency of delusions in schizophrenia and affective disorder. *Schizophrenia Research, 3*, 347–350.

Solanki, R. K., Singh, P., Midha, A., & Chugh, K. (2008). Schizophrenia: Impact on quality of life. *Indian Journal of Psychiatry, 50*, 181–186.

Solanki, R. K., Singh, P., Midha, A., Chugh, K., & Swami, M. K. (2010a). Disability and quality of life in schizophrenia and obsessive compulsive disorder: A cross-sectional comparative study. *East Asian Archives of Psychiatry, 20*, 7–13.

Solanki, R. K., Singh, P., Midha, A., Chugh, K., & Swami, M. K. (2010b). Disability and quality of life in schizophrenia and obsessive compulsive disorder: A cross-sectional comparative study. *East Asian Archives Psychiatry, 20*, 7–13.

Somaiya, M., Grover, S., Avasthi, A., & Chakrabarti, S. (2014a). Comparative study of cost of care of Bipolar disorder and schizophrenia: A study from India. *Asian J Psychiatr*. 2014 Aug 19. pii: S1876-2018(14)00191-9. doi: 10.1016/j.ajp.2014.08.003. [Epub ahead of print]

Somaiya, M., Grover, S., Avasthi, A., & Chakrabarti, S. (2014b). Changes in the cost of treating schizophrenia in India: A comparison of two studies done a decade apart. Psychiatry Research, *215*, 547–553

Sovani, A., Thatte, S., & Deshpande, C. G. (2005). Felt affect in good- and poor-outcome schizophrenia. *Indian Journal of Psychiatry, 47*, 27–30.

Srinivasan, N. (2000). Families as partners in care. Perspectives from AMEND. *Indian Journal of Social Work, 61*, 352–365.

Srinivasan, T. N., & Thara, R. (2001). Beliefs about causation of schizophrenia: Do Indian families believe in supernatural causes? *Social Psychiatry and Psychiatric Epidemiology, 36*, 134–140.

Srinivasan, T. N., & Thara, R. (2002). Smoking in schizophrenia—all is not biological. *Schizophrenia Research, 56*, 67–74.

Srinivasan, L., & Tirupati, S. (2005). Relationship between cognition and work functioning among patients with schizophrenia in an urban area of India. *Psychiatric Services, 56*, 1423–1428.

Srivastava, V., Varma, P. G., Prasad, S., Semwal, P., Nimgaonkar, V. L., Lerer, B., et al. (2006). Genetic susceptibility to tardive dyskinesia among schizophrenia subjects: IV. Role of dopaminergic pathway gene polymorphisms. *Pharmacogenetics and Genomics, 16*, 111–117.

Srivastava, V., Deshpande, S. N., & Thelma, B. K. (2010). Dopaminergic pathway gene polymorphisms and genetic susceptibility to schizophrenia among north Indians. *Neuropsychobiology, 61*, 64–70.

Surya, N. C., Datta, S. P., Gopalakrishna, R., et al. (1964). *Mental morbidity in Pondicherry* (pp. 50–61). Transaction of All India Institute of Mental Health: Bangalore.

Talkowski, M. E., Mansour, H., Chowdari, K. V., Wood, J., Butler, A., Varma, P. G., et al. (2006). Novel, replicated associations between dopamine D3 receptor gene polymorphisms and schizophrenia in two independent samples. *Biological Psychiatry, 60*, 570–577.

Thacore, V. R., & Gupta, S. (1975). Psychiatric morbidity in a North Indian Community. *British Journal of Psychiatry, 126*, 364.

Thakral, S., Mishra, N., & Bhatia, T. (2011). Cost of major mental disorders in Delhi India. *Asian Journal of Psychiatry, 4*, 155–156.

Thara, R. (2005a). Perspective from an NGO. *Indian Journal of Psychiatry, 47*, 212–214.

Thara, R. (2005b). Measurement of psychiatric disability. *Indian Journal of Medical Research, 121*, 723–724.

Thara, R., & Joseph, A. A. (1995). Gender differences in symptoms and course of schizophrenia of schizophrenia. *Indian Journal of Psychiatry, 37*, 124–128.

Thara, R., & Rajkumar, S. (1992). Gender differences in schizophrenia. Results of a follow-up study from India. *Schizophrenia Research, 7*, 65–70.

Thara, R., & Rajkumar, S. (1993). Nature and course of disability in schizophrenia. *Indian Journal of Psychiatry, 35*, 33–35.

Thara, R., & Srinivasan, T. N. (1997). Marriage and gender in schizophrenia. *Indian Journal of Psychiatry, 39*, 64–69.

Thara, R., & Srinivasan, T. N. (2000). How stigmatizing is schizophrenia in India? *International Journal of Social Psychiatry, 46*, 135–141.

Thara, R., Rajkumar, S., & Valecha, V. (1988). The schedule for assessment of psychiatric disability—a modification of the DAS-II. *Indian Journal of Psychiatry, 30*, 47–55.

Thara, R., Kamath, S., & Kumar, S. (2003a). Women with schizophrenia and broken marriages-doubly disadvantaged? Part I: Patient perspective. *International Journal of Social Psychiatry, 49*, 225–232.

Thara, R., Kamath, S., & Kumar, S. (2003b). Women with schizophrenia and broken marriages –doubly disadvantaged? Part I: Family perspective. *International Journal of Social Psychiatry, 49*, 233–240.

Thara, R., Srinivasan, T., John, S., Nancarrow, D., Chant, D., Holliday, E., et al. (2009). Design and clinical characteristics of a homogeneous schizophrenia pedigree sample from Tamil Nadu. *Indian, Australian, New Zealand Journal of Psychiatry, 43*, 561–570.

Tharyan, P., & Kuruvilla, K. (1994). The correlates of the syndrome of depression in schizophrenia. *Indian Journal of Psychiatry, 36*, 74–78.

Tharyan, A., & Saravanan, B. (2000). Insight and psychopathology in schizophrenia. *Indian Journal of Psychiatry, 42*, 421–426.

The Rehabilitation Committee of the Indian Psychiatric Society. (2002). *IDEAS (Indian disability evaluation and assessment scale)—A scale for measuring and quantifying disability in mental disorders*. India: Indian Psychiatric Society.

Thirthalli, J., Venkatesh, B. K., Kishorekumar, K. V., Arunachala, U., Venkatasubramanian, G., Subbakrishna, D. K., et al. (2009). Prospective comparison of course of disability in antipsychotic-treated and untreated schizophrenia patients. *Acta Psychiatrica Scandinavica, 119*, 209–217.

Thirthalli, J., Venkatesh, B. K., Naveen, M. N., Venkatasubramanian, G., Arunachala, U., Kishore Kumar, K. V., et al. (2010). Do antipsychotics limit disability in schizophrenia? A naturalistic comparative study in the community. *Indian Journal of Psychiatry, 52*, 37–41.

Thomas, P., Mathur, P., Gottesman, I. I., Nagpal, R., Nimgaonkar, V. L., & Deshpande, S. N. (2007). Correlates of hallucinations in schizophrenia: A cross-cultural evaluation. *Schizophrenia Research, 92*, 41–49.

Thomas, P., Chandra, A., Bhatia, T., Mishra, N. N., Sharma, V. R., Gauba, D., et al. (2011). Clinical and genetic correlates of severity in schizophrenia in India: an ordinal logistic regression approach. *Psychiatry Research, 189*, 321–323.

Tirupati, N. S., Rangaswamy, T., & Raman, P. (2004). Duration of untreated psychosis and treatment outcome in schizophrenia patients untreated for many years. *Australian and New Zealand Journal of Psychiatry, 38*, 339–343.

Tirupati, S. N., Padmavati, R., Thara, R., & McCreadie, R. G. (2006). Psychopathology in never-treated schizophrenia. *Comprehensive Psychiatry, 47*, 1–6.

Tiwari, S. G., Lal, N., Trivedi, J. K., Sayeed, J., & Bahauguna, L. M. (1984). Immunoglobulin patterns in schizophrenic patients. *Indian Journal of Psychiatry, 26*, 223–229.

Tiwari, A. K., Deshpande, S. N., Rao, A. R., Bhatia, T., Mukit, S. R., Shriharsh, V., et al. (2005). Genetic susceptibility to tardive dyskinesia in chronic schizophrenia subjects: I. Association of CYP1A2 gene polymorphism. *Pharmacogenomics J, 5*, 60–69.

Trivedi, J. K., & Sethi, B. B. (1978). Drug abuse in psychiatric patients. *Indian Journal of Psychiatry, 21*, 345–348.

Varma, V. K., Suri, A. K., & Kaushal, P. (1973). Abstract thinking in schizophrenia. *Indian Journal of Psychiatry, 15*, 123–131.

Varma, V. K., Ghosh, A., & Murthy, R. S. (1977). Pseudo-neurotic schizophrenia: Incidence and phenomenology in India. *Indian Journal of Psychiatry, 19*, 24–30.

Venkatasubramanian, G., Jayakumar, P. N., Gangadhar, B. N., Janakiramaiah, N., Subbakrishna, D. K., & Keshavan, M. S. (2003). Measuring the corpus callosum in schizophrenia: A technique with neuroanatomical and cytoarchtectural basis. *Neurol India, 51*, 189–192.

Venkatasubramanian, G., Jayakumar, P. N., Gangadhar, B. N., & Keshavan, M. S. (2008). Automated MRI parcellation study of regional volume and thickness of prefrontal cortex (PFC) in antipsychotic-naïve schizophrenia. *Acta Psychiatrica Scandinavica, 117*, 420–431.

Venkatasubramanian, G., Jayakumar, P. N., Reddy, V. V., Reddy, U. S., Gangadhar, B. N., & Keshavan, M. S. (2010a). Corpus callosum deficits in antipsychotic-naïve schizophrenia: Evidence for neurodevelopmental pathogenesis. *Psychiatry Research, 182*, 141–145.

Venkatasubramanian, G., Chittiprol, S., Neelakantachar, N., Shetty, T. K., & Gangadhar, B. N. (2010b). A longitudinal study on the impact of antipsychotic treatment on serum leptin in schizophrenia. *Clinical Neuropharmacology, 33*, 288–292.

Venkatasubramanian, G., Arasappa, R., Rao, N. P., Behere, R. V., Kalmady, S., & Gangadhar, B. N. (2010c). Inverse relationship between serum high density lipoprotein and negative syndrome in antipsychotic-naive schizophrenia. *Clinical Chemistry and Laboratory Medicine, 48*, 95–98.

Venkatasubramanian, G., Chittiprol, S., Neelakantachar, N., Shetty, T., & Gangadhar, B. N. (2010d). Effect of antipsychotic treatment on insulin-like growth factor-1 and cortisol in schizophrenia: A longitudinal study. *Schizophrenia Research, 119*, 131–137.

Venkatasubramanian, G., Jayakumar, P. N., Keshavan, M. S., & Gangadhar, B. N. (2011). Schneiderian first rank symptoms and inferior parietal lobule cortical thickness in antipsychotic-naïve schizophrenia. *Progress in Neuropsychopharmacology and Biological Psychiatry, 35*, 40–46.

Venkatesan, J., & Suresh, S. S. D. (2008). Substance dependence: decades apart in a teaching hospital. *Indian Journal of Psychiatry, 50*, 100–105.

Verghese, A., Beig, A., Senseman, L. A., et al. (1973). A social psychiatric study of a representative group of families in Vellore town. *Indian Journal of Medical Research, 61*, 608–620.

Verma, R., Mukerji, M., Grover, D., B-Rao, C., Das, S. K., Kubendran, S., et al. (2005a). MLC1 gene is associated with schizophrenia and bipolar disorder in Southern India. *Biological Psychiatry, 58*, 16–22.

Verma, R., Kubendran, S., Das, S. K., Jain, S., & Brahmachari, S. K. (2005b). SYNGR1 is associated with schizophrenia and bipolar disorder in southern India. *Journal of Human Genetics, 50*(635–40), 37.

Vibha, P., Saddichha, S., Khan, N., & Akhtar, S. (2013). Quality of life and marital adjustment in remitted psychiatric illness: An exploratory study in a rural setting. *Journal of Nervous Mental Disease, 201*, 334–338.

Vijayan, N. N., Iwayama, Y., Koshy, L. V., Natarajan, C., Nair, C., Allencherry, P. M., et al. (2009). Evidence of association of serotonin transporter gene polymorphisms with schizophrenia in a South Indian population. *Journal of Human Genetics, 54*, 538–542.

Vohra, A. K., Yadav, B. S., & Khurana, H. (2003). A study of psychiatric morbidity in alcohol dependence. *Indian Journal of Psychiatry, 45*, 247–250.

Wig, N. N. (2010). Schizophrenia: The Indian scene keynote address. In P. Kulhara, A. A. Vasthi, & S. Grover (Eds.), *Schizophrenia Indian scene* (2nd ed.). Chandigarh: PSYPROM, PGIMER.

Wig, N. N., Murthy, R. S., & Pershad, D. (1979). Relationship of disability with psychiatric diagnosis and treatment acceptance patterns. *Indian Journal of Psychiatry, 21*, 355–358.

World Health Survey, India. (2003). Health system Performance Assessment, International Institute for Population Sciences (IIPS), Mumbai, World Health Organisation, Geneva, World Health Organisation-India-WR Office, New Delhi. July 2006.