Domains of Awareness in Schizophrenia

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Patients with schizophrenia are often characterized as lacking insight or awareness into their illness and symptoms, yet despite considerable research, we still lack a full understanding of the factors involved in causing poor awareness. Within schizophrenia, there has been shown to be a fractionation across dimensions of awareness into mental illness: of being ill, of symptoms, and of treatment compliance. Recently, attention has turned to evidence of a fractionation between awareness of illness and of cognitive impairments and functioning. The current study investigated the degree of fractionation across a broad range of domains of function in schizophrenia and how each domain may be associated with neuropsychological functioning, clinical, mood, and demographic variables. Thirty-one mostly chronic stable patients with schizophrenia completed a battery of neuropsychological tests and measures of psychopathology, including mood. Cognitive insight and awareness of illness, symptoms, memory, and behavioral functioning were also measured. Insight and awareness were assessed using a combination of semistructured interview, observer-rated, self-rated, and objective measures, and included measures of the discrepancy between carer and self-ratings of impairment. Results revealed that awareness of functioning in each domain was largely independent and that awareness in each domain was predicted by different factors. Insight into symptoms was relatively poor while insight into cognitive deficits was preserved. Relative to neuropsychological variables, cognitive insight, comprising self-certainty and self-reflexivity, was a greater predictor of awareness. In conclusion, awareness is multiply fractionated and multiply determined. Therapeutic interventions could, therefore, produce beneficial changes within specific domains of awareness.

Key words: schizophrenia/insight/awareness/cognition/mood/discrepancy

Introduction

Lack of awareness of illness and symptoms is a prevalent feature of patients with schizophrenia, with up to 80% of sufferers failing to acknowledge that they have a mental illness.1 With low awareness comes poor treatment compliance2,3,4 and poorer prognosis,5,6,7 thus elucidating that the nature of awareness in schizophrenia may lead to interventions that can improve adherence to treatment and hence patient outcome. The current literature provides a complex account of the key predictors of awareness in schizophrenia, speaking to cognitive, metacognitive, clinical, and mood factors.

Awareness and Cognition

The research literature presents a mixed account of the contributory factors to lack of awareness. Deficits in intelligence7–12 and set-shifting capacity (see Cooke et al13 for a review) have each been shown to be associated with impaired awareness across numerous studies. This latter association supposes that awareness deficits are attributable to an incapacity in conceptually “shifting-set” from a previously established cognitive “schema”—being well—to a more accurate and up-to-date schema—being ill. A meta-analysis of the relationship between Wisconsin Card Sorting Test, a “set-shifting” measure, and awareness showed that of 29 studies, 12 studies reported a correlation between “perseverative errors” and awareness11,13 (but see Cuesta et al,14 Freudenburg et al,15 and Goodman et al16). A systematic review of the literature concluded that there was evidence of a neuropsychological basis to insight, with impaired cognitive functioning being associated with low awareness17 although the effect size is modest.

Metacognition

More recently, attention has turned to metacognitive capacity as a potential predictor of awareness, where
metacognition refers to the capacity to reflect upon one’s (cognitive) functioning. Beck et al. 18 devised the Beck Cognitive Insight Scale (BCIS), which measures self-reflectivity (SR) and self-certainty (SC), together probing the capacity to reflect on the self and for schema about the self to be malleable in the face of contradictory evidence. SR positively and SC negatively, or SC alone, has been shown to be significant predictors of awareness in schizophrenia. Pedrelli et al. 21 reported that increased SR and BCIS total but not SC were modestly but significantly associated with increased insight but that these relationships were specific to the relabeling dimension of the Birchwood Insight Scale. 22

Reduction of positive symptoms following hospitalization has also been shown to be associated with both improved clinical insight and SR. 19 Lower BCIS total scores, lower SR, and greater SC have also variously been found to be associated with psychosis, 19,23 and the presence of stronger delusions 23–25 but see Pedrelli et al., Warman et al., and Warman and Martin, although these latter studies did not investigate awareness per se.

Meta-awareness can also be measured in the form of “online” awareness, which is the capacity to judge accurately one’s cognitive function, where such judgments can be sought before and after task completion. Metacognition into executive test performance has been shown to be more strongly associated with awareness than the actual executive test score and so may mediate between basic-level cognitive deficits and deficits in awareness. 27

However, complex cognitive operations such as self-reflection may depend on simple component processes. For example, working memory may be required to hold self-representations in mind while a comparison with others’ functioning, or semantic knowledge (of being well/ill), is performed. Determining the critical cognitive components is a challenge for research in this area, hence the need to apply a broad range of cognitive tasks to probe the underlying processes.

Psychopathology and Mood

Aside from cognition, psychopathology would appear to make a small but reliable contribution to degree of awareness, as measured by standard psychiatric symptom scales (see Mintz et al. 28 for a meta-analysis). Lower mood also reliably predicts better awareness 29–36 with low awareness of symptoms and illness commonly thought to reflect a form of denial in order to maintain the self-esteem, which is threatened by acknowledgment of having a mental illness.

Sociodemographic Factors

Lastly, awareness in schizophrenia appears to be largely unrelated to sociodemographic variables, such as gender and level of education, although there is mixed evidence for an association with age (see Markova 36 for a review and Wiffen et al. 37).

Domains of Awareness

Studies in this area often use one measure of awareness as a dependent variable and evaluate the contributory value of various predictor variables. Yet, awareness of illness has been shown to fractionate by domain with some independence between each. For example, David 38 delineated 3 dimensions of awareness: awareness of illness, ability to relabel symptoms as pathological (a form of attribution), and treatment compliance, to which there is some statistical 39 and neuroimaging support. 40,41 Another commonly used scale, the Scale to assess Unawareness of Mental Disorder (SUMD) 42 has a similar multidimensional structure. Thus, a patient may, eg, be aware of his/her illness but not symptoms or not aware of his/her illness but comply with treatment. Independence of dimensions within a multidimensional conceptualization of awareness suggests that different factors may underpin each domain.

Further domains that may be legitimate “objects” of awareness include cognitive function and social behavior. Awareness of cognitive function in schizophrenia patients has recently been the focus of interest. Medalia and Thysen 43 devised a scale for this purpose based on the SUMD and found that awareness of cognitive impairments (measured by objective tests) was poor and did not correlate with awareness of psychopathology. It was however associated with low mood. Similarly, Lecarier et al. 44 found no correlation between the Positive and Negative Syndrome Scale for schizophrenia insight item and subjective cognitive complaints, again suggesting independence, although it is not clear how strongly such complaints are related to measurable deficits (see Bayard et al. 45). This notion of multiple “awarenesses” is also in line with current thinking in neuropsychology regarding anosognosia for different sensory, motor, and higher functions (see Markova, McGlynn and Schacter, 46 and Berti et al. 47,48).

Aims

There are several aims to the study. First, to establish whether people with schizophrenia lack awareness in domains other than the traditional “psychiatric” ones focused on psychotic symptoms and behavior, such as social functioning, “executive” capacity, and mnemonic deficits. Second, to establish to what extent awareness correlates across domains. If the correlations are low, this would indicate that lacking awareness in one domain does not necessarily entail low awareness in another domain, thus speaking to a differential mechanism. Finally, we sought to explore the extent to which single or clusters of factors account for awareness per se, such as specific cognitive processes (eg, executive functions such as working memory and set shifting) or metacognitive processes.
Alternatively, it may be that awareness across domains is underpinned by common factors or processes.

**Hypotheses**

The main hypotheses of the study are that (1) awareness will fractionate across domains; in other words, awareness will correlate more strongly within domain than between domains. (2) Certain factors will correlate with specific awareness measures by virtue of them being in the same domain (ie, awareness of memory functioning will correlate with memory; awareness of executive functioning will correlate with measures of executive ability; and psychopathology will correlate with awareness of illness). (3) There will be a set of variables that account for significant proportions of the awareness scores across domains, specifically mood, self-reflectiveness, and SC.

**Methods**

The design of the study was to gather awareness measures across several domains using semistructured interview to produce research-rated awareness scores and also using test score and informant ratings of functioning to formulate awareness discrepancy scores of functioning. Correlation and regression analyses were conducted to establish fractionation and predictors of domains of awareness. Data were analyzed using SPSS 13.0. Pearson correlations were utilized, except when data were not normally distributed in which case Spearman correlations were used. Statistical significance was set at the 5% level. Regression analyses were conducted using predictors found to be significantly associated with outcome measures, which was set at the 1% level.

**Participants**

The patient group consisted of 31 patients with a diagnosis of schizophrenia according to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, criteria, of which 16 (51.6%) were male. Table 1 shows the statistics for the clinical, demographic, and awareness measures. They were a mixture of inpatients (N = 18) and outpatients (N = 13). Mean age at first onset of illness was 24.0 years (SD = 5.13); mean length of illness was 13.71 years (SD = 10.82); and mean number of hospitalizations was 2.94 (SD = 5.13); mean length of illness was 13.71 years (SD = 10.82); and mean number of hospitalizations was 2.94 (SD = 5.13). All patients provided consent to take part in the study, and the study received full ethical approval by South London and Maudsley NHS Trust Ethical Committee (Reference: 115/04) to be conducted.

**Informants**

Informants were asked to rate behavioral functioning (Patient Competency Rating Scale [PCRS] and the Dysexecutive Questionnaire [DEX]) that were compared with patients’ self-ratings (on the same measure).

<table>
<thead>
<tr>
<th>Measure</th>
<th>Mean (SD)</th>
<th>Participant Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>38.3 (10.41)</td>
<td>21–62</td>
</tr>
<tr>
<td>Years of education (after age 10)</td>
<td>7.73 (1.97)</td>
<td>5–11</td>
</tr>
<tr>
<td>Premorbid IQ</td>
<td>102 (12.77)</td>
<td>79–127</td>
</tr>
<tr>
<td>BPRS score</td>
<td>49.7 (10.39)</td>
<td>31–72.5</td>
</tr>
<tr>
<td>SUMD-MD</td>
<td>3.37 (1.56)</td>
<td>1–5</td>
</tr>
<tr>
<td>SAI-E total</td>
<td>11.2 (7.15)</td>
<td>1.3–23.5</td>
</tr>
<tr>
<td>Illness</td>
<td>4.56 (3.48)</td>
<td>0–10</td>
</tr>
<tr>
<td>Relabeling</td>
<td>3.20 (2.78)</td>
<td>0–8.5</td>
</tr>
<tr>
<td>Compliance</td>
<td>3.60 (2.12)</td>
<td>0–9</td>
</tr>
<tr>
<td>Treatment compliance</td>
<td>5.14 (1.67)</td>
<td>2–7</td>
</tr>
<tr>
<td>RBMT</td>
<td>30.65 (9.51)</td>
<td>12–44</td>
</tr>
<tr>
<td>MARS prediction-performance</td>
<td>–0.71 (10.78)</td>
<td>–21 to 19</td>
</tr>
<tr>
<td>MARS performance-postdiction</td>
<td>0.50 (7.75)</td>
<td>–14 to 20</td>
</tr>
<tr>
<td>PCRS Self</td>
<td>98.31 (23.15)</td>
<td>59–148</td>
</tr>
<tr>
<td>Informant</td>
<td>99.48 (18.69)</td>
<td>61–137</td>
</tr>
<tr>
<td>Discrepancy</td>
<td>1.17 (SD)</td>
<td>–64 to 42</td>
</tr>
<tr>
<td>DEX Self</td>
<td>28.06 (14.81)</td>
<td>3–60</td>
</tr>
<tr>
<td>Informant</td>
<td>26.17 (13.80)</td>
<td>2–57</td>
</tr>
<tr>
<td>Discrepancy</td>
<td>2.48 (SD)</td>
<td>–33 to 31</td>
</tr>
<tr>
<td>Beck Cognitive Insight Scale Self-reflectiveness</td>
<td>10.8 (5.39)</td>
<td>3–21</td>
</tr>
<tr>
<td>Self-certainty</td>
<td>8.52 (4.53)</td>
<td>1–17</td>
</tr>
<tr>
<td>Beck Depression Inventory</td>
<td>14.6 (9.70)</td>
<td>0–34</td>
</tr>
</tbody>
</table>

**Note:** BPRS, Brief Psychiatric Rating Scale; SUMD-MD, item 1 from the Scale to assess Unawareness of Mental Disorder; SAI-E, Schedule for the Assessment of Insight-Extended version; RBMT, Rivermead Behavioral Memory Test; MARS, Memory Awareness Rating Scale; PCRS, Patient Competency Rating Scale; DEX, Dysexecutive Questionnaire.

Informants were chosen based on who was available, who had the most contact with the respective patient’s functioning, and therefore who could provide the most accurate knowledge and, in turn, ratings of their functioning. By the very nature of this approach, informants had a variety of relationships with the patients. Informants for 21 (67.7%) of the patients were clinicians, 8 (25.8%) were friends or relatives, and the remaining 2 (6.5%) were spouses. As well as contributing ratings for determining discrepancy scores, informants also rated treatment compliance.
Tests and Measures

Psychopathology. This was rated using the expanded Brief Psychiatric Rating Scale (BPRS\(^{51}\)) by a researcher trained in its use (possible test range = 24–168). Subjects had mean BPRS scores indicative of moderate psychopathology (table 1).

Awareness of Illness. Awareness of illness was measured by the multidimensional Schedule for the Assessment of Insight-Extended version (SAI-E) semistructured.\(^{52}\) Item 1 from the Scale to assess Unawareness of Mental Disorder (SUMD-MD\(^{55}\)) was also used as a single item measuring awareness of having a mental disorder and is a 5-point Likert scale ranging from 1 (aware) to 5 (unaware).

Awareness of Memory Deficits. The Memory Awareness Rating Scale (MARS\(^{53}\)) was used. The MARS, in part, is constituted by the Rivermead Behavioral Memory Test (RBMT\(^{54}\)), which is a 12-item memory battery comprising of tasks analogous to everyday situations. The MARS itself is a series of questions that directly relate to each of these 12 items in which participants are asked to judge their ability to perform the task before they attempt it (prediction) and then asked to judge their performance after they have done it (postdiction). The MARS items are rated on the same scales (5-point Likert scale—0 to 4) as the RBMT and are therefore considered to be isomorphic and thus directly comparable. Discrepancy scores of patient Prediction-Performance (Pre-Perf) and Performance-Postdiction (Perf-Post) can then be calculated and used as proxy measures of awareness. The former measures how patients expect to perform compared with how they actually perform while the latter measures how they think they performed compared with how they actually performed, a measure of “online” awareness.

Awareness of Functioning. Awareness of functioning was measured by the amended PCRS,\(^{55}\) which is the original scale with 7 added items relating to “theory of mind” reasoning, and DEX questionnaire from the Behavioral Assessment of the Dysexecutive Syndrome (BADS\(^{50}\)). Both scales were originally designed for use with brain injury populations; however, questions concerning functioning apply equally well to other patient groups. The PCRS is a 37-item, 5-point Likert scale self-report questionnaire that addresses day-to-day behavioral, cognitive, and emotional problems. The DEX is a 20-item 5-point Likert scale measure of functioning that addresses more abstract “executive” problems such as impulsivity and inhibition control. Patients and informants rated both scales, and the difference in scores provides a discrepancy score, such that the greater and more negative the discrepancy between the scores, the greater the unawareness of the patient. PCRS discrepancy scores can range from −148 to +148. DEX discrepancy scores can range from −80 to +80. A score of zero indicates perfect awareness in that the patient agrees with the level of impairment scored by their respective informant.

Beck Cognitive Insight Scale. The 15-item BCIS\(^{18}\) provides a measure of patient’s self-reflectiveness and over-confidence in their interpretation of their experiences and consists of a self-reflectiveness (SR) subscale (9 items) and an SC subscale (6 items—scored negatively).

Mood. All patients were administered the self-report Beck Depression Inventory (BDI\(^{56}\)).

Neuropsychological Functioning. Current intellectual functioning was assessed using the 2-test version of the Wechsler Abbreviated Scale of Intelligence\(^{57}\). Premorbid intelligence was determined by the National Adult Reading Test-Revised (NART-R\(^{58}\)). Executive function was measured using the verbal fluency test (letters “F,” “A,” and “S”\(^{59}\)) that measures cognitive flexibility; Letter-Number Span (LNS) from the Wechsler Adult Intelligence Scale-III that provides a measure of working memory; the Key Search, Modified Six Elements (MSE), and Action Program tests from the BADS test battery\(^{50}\) that provide measures of strategy, set shifting, planning, and self-monitoring; and the Trail Making Test\(^{60}\) that measures set shifting, speed of attention, sequencing, mental flexibility, visual search, and motor function. The ratio of tests B:A durations is taken as a measure of flexibility and set shifting. Lastly, the Bells Test\(^{61}\) assesses attention, as well as speed of processing and symbol discrimination.

Results

The results below are divided into 3 sections. First are the analyses examining awareness across the domains of illness, behavioral functioning, and memory functioning. This is followed by analyses showing the variables that are associated with awareness. Lastly, the results of regression analyses within each domain of awareness are presented.

Awareness

Awareness of Illness. As a group, mean SAI-E total scores reflected low to moderate levels of awareness. Awareness specifically of having a mental disorder as rated by the SUMD-MD (SUMD item 1: awareness of mental disorder) revealed much variation across the group, yet the majority were unaware of being mentally ill. Twelve (39%) patients were completely unaware of being mentally ill; 5 (16%) patients were completely aware; and the remaining patients fell fairly evenly between and were thus to various degrees “partially” aware of being
mentally ill. Objective treatment compliance (SAI-TC), which was informant rated, indicated that the mean patient attitude to medication was of “passive acceptance.”

Behavioral Functioning. Awareness of impairments of day-to-day functioning across the group was excellent (mean PCRS discrepancy = 1.17 [SD 28.55]), as was awareness of “executive functioning” (mean DEX discrepancy = 2.48 [SD 17.39]). The PCRS discrepancy equates to a 1-point difference on one of thirty-seven 5-point questions. Similarly, the DEX discrepancy equates to a 2-point difference on a scale of twenty 5-point scale questions. Hence, mean concordance between the patients and informants was high, although there was again much variation in discrepancy scores (see table 1). Some patients even demonstrated overawareness of behavioral impairments and were thus overly critical of their behavioral functioning with respect to the informant’s ratings. Importantly, subjects did have impairments of which to lack awareness, as both informants and subjects themselves report significant impairments (PCRS: mean scores of 98.31 [subjects] and 99.48 [informants] where 148 reflects no impairments; DEX: mean scores of 28.0 [subjects] and 26.17 [informants] where 0 reflects no impairments). This is supported by the objective impairments on neuropsychological test battery scores.

Memory Functioning. Mean RBMT memory scores were in the “moderately impaired” range, (less than 32/48), yet mean awareness of memory performance across the group was very good, being close to zero (ie, no overestimation), and across the group actually reflected slight underestimations of their memory capacity, albeit with much variation in awareness of memory discrepancy scores. As with behavioral problems, some subjects gave worse ratings of their memory than their respective informants.

Awareness Across Domains. Correlational analyses of all awareness scores revealed high within-domain correlations of awareness (see table 2), with all correlation coefficients greater than .7 (SUMD-MD with SAI-total [r = -.83]; DEX with PCRS [r = .77]; and MARS Pre-Perf and Perf-Post [r = .72]) but much lower between-domain correlations (all below r = .5). High within-domain correlations also lend weighting to each scale’s validity of assessing awareness in their respective domains. We will restrict further analysis of the behavioral functioning discrepancy scales to the DEX because the profile of findings is very similar to that of the PCRS. (PCRS data are presented in Gilleen et al.62)

Associations With Awareness

Demographic Factors. There were few associations between any awareness measures and demographic variables, except a weak association between higher age and higher informant-rated treatment compliance (SAI-TC). Years of education and premorbid IQ were not associated with levels of awareness, except between NART and both MARS Pre-Perf (r = .54) and Perf-Post (r = .66) discrepancy scores.

Psychopathology. BPRS total score was moderately associated with awareness as measured by the SUMD total score (r = .46) and DEX (r = .55) but not MARS scores (r = -.3). Only symptom relabeling within the SAI was significantly associated with BPRS total scores (r = -.58). In terms of BPRS factors and specific symptoms, BPRS positive symptoms and in particular the Unusual Thought Content item showed by far the strongest association with SUMD and SAI awareness scores (all subscales r = .40 to .75). DEX scores were only associated with BPRS total and positive symptom scores (r = .41 to .55), yet MARS scores were not associated with any BPRS total or subfactor scores.

Metacognition. The measure of metacognition, BCIS, correlated strongly with SAI-E total and modestly with SUMD and MARS prediction-functioning discrepancy scores. Greater BCIS “cognitive insight” total, self-reflectivity (SR), and to a lesser extent lower SC scores were associated with greater awareness across the SUMD and SAI-E measures. SR, but not SC scores, correlated significantly with SUMD-MD (r = -.42) and total scores (r = -.60). Within the SAI-E, awareness of illness (SAI-III) and relabeling (SAI-Rel) both correlated strongly (r > .5) with SR and moderately with SC (r = -.37 and -.39, respectively), and as shown, the total BCIS correlated highly significantly with the SAI-E total scores (r = .82). Higher scores on SAI Compliance were associated with lower SC (r = -.46). BCIS scores were not associated with DEX discrepancy scores. MARS Pre-Perf discrepancy scores only showed a trend level of correlation with SR (r = .35, P = .07) and BCIS total score (r = .37, P = .06).

Mood. Anxiety and depression measured with the psychiatric interview (BPRS) held no associations with any awareness of illness measures. In contrast, there were modest associations between self-rated BDI scores and clinician-rated SUMD awareness of mental disorder (r = .38). However, these associations were in the opposite direction to that anticipated: greater self-rated depression was associated with lower awareness. A post hoc analysis demonstrated that greater depression was associated with greater symptomatology (r = .67), particularly positive symptoms (r = .51) that, in part, might account for the association. Intriguingly, the association between unawareness of behavioral function (DEX discrepancy scores) and depression was in the anticipated direction, with greater depression being associated with greater awareness. Interestingly, high levels of depression
Neuropsychological Performance. Broadly speaking, patients broadly showed impaired functioning across the range of measures (see table 3). In order to investigate the role of “executive” impairment in determining the level of awareness, correlation analyses between neuropsychological test scores and awareness measures were performed (table 4).

First, DEX discrepancy scores and SAI-E awareness measures pertaining to medication were all not related to any neuropsychological measure (all \( r \) < .05). As shown in table 4, the SUMD-MD, however, was significantly associated with the Trails B:A ratio uniquely, while SAI-Rel scores correlated moderately with a variety of test scores. Lastly, SAI-III was moderately and significantly associated with the majority of the neuropsychological test scores, except Bells Test omissions.

MARS (Pre-Perf) was strongly related to all neuropsychological measures except Action Program, Trails Test B:A ratio, and Bells Test Omissions (\( P > .05 \)) (data not shown). Most associations were strong (\( r > .54 \)) and highly significant (\( r < .0025 \)) although to a lesser extent with the LNS (\( r = .43, P < .05 \)) and Bells Test completion time (\( r = .40, P < .05 \)). Post hoc analyses were conducted to investigate separately the strength of association between memory and each of the 2 constituents of the discrepancy scores (self-ratings and actual score). This revealed that it was the actual memory test score that accounted for the associations with the neuropsychological variables (all Pearson coefficients > .41; all \( P \) values < .05) and not the prediction self-ratings (all Pearson coefficients < .24; all \( P \) values > .20). Aside from the associations with the MARS measure, which as suggested may be attributable to memory performance, verbal fluency, NART, and Bells Test scores were not associated with any other awareness measure. The Action Program was not significantly associated with any awareness measure or subfactor (data not shown).

**Predictive Regression Models of Awareness**

Regression analyses were conducted to determine: (1) the best model of predicting awareness in each domain and how much variance the variables could account for and (2) which variable is the best predictor of each dimension of awareness. In this analysis, any factor, not just neuropsychological test scores, that correlated at \( r > .3 \) with the dependent awareness variable was included in a backward linear regression. In such a regression, all variables are entered and those with the smallest partial correlations were associated with any awareness measure or subfactor (data not shown).

### Table 3. Neuropsychological Test Scores (Mean, SD)

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>WASI IQ</td>
<td>94.41</td>
<td>19.02</td>
</tr>
<tr>
<td>Verbal</td>
<td>52.19</td>
<td>15.16</td>
</tr>
<tr>
<td>Matrix</td>
<td>19.32</td>
<td>8.21</td>
</tr>
<tr>
<td>NART</td>
<td>102.30</td>
<td>12.78</td>
</tr>
<tr>
<td>RBMT</td>
<td>30.65</td>
<td>9.51</td>
</tr>
<tr>
<td>BADS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Action</td>
<td>4.23</td>
<td>0.85</td>
</tr>
<tr>
<td>Key</td>
<td>9.45</td>
<td>4.33</td>
</tr>
<tr>
<td>MSE</td>
<td>13.29</td>
<td>2.61</td>
</tr>
<tr>
<td>Letter-Number Span</td>
<td>4.07</td>
<td>1.49</td>
</tr>
<tr>
<td>Trails Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part A (s)</td>
<td>72.2</td>
<td>62.32</td>
</tr>
<tr>
<td>Part B (s)</td>
<td>185.3</td>
<td>127.15</td>
</tr>
<tr>
<td>Trails B/A time</td>
<td>2.72</td>
<td>1.26</td>
</tr>
<tr>
<td>Verbal fluency</td>
<td>10.48</td>
<td>4.39</td>
</tr>
<tr>
<td>Bells Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time (s)</td>
<td>183.6</td>
<td>94.6</td>
</tr>
<tr>
<td>Omissions</td>
<td>3.8</td>
<td>3.53</td>
</tr>
</tbody>
</table>

**Note:** WASI IQ, Wechsler Abbreviated Scale of Intelligence; NART, National Adult Reading Test; RBMT, Rivermead Behavioral Memory Test; BADS, Behavioral Assessment of the Dysexecutive Syndrome; Action, Action Program; Key, Key Search; MSE, Modified Six Elements Test; Trails B/A, Trails Test Part B to Part A completion time ratio.
Table 4. Correlations Between Awareness of Illness Measures and Neuropsychological Test Scores

<table>
<thead>
<tr>
<th>Awareness Measure</th>
<th>Significant Predictor Variables</th>
<th>F test, P value, $R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUMD-MD</td>
<td>BCIS</td>
<td>7.12, .01, .23</td>
</tr>
<tr>
<td>SAI-Rel</td>
<td>BPRS total, self-reflectiveness, and Key Search Test</td>
<td>12.45, &lt;.001, .80</td>
</tr>
<tr>
<td>DEX</td>
<td>BPRS positive symptoms, depression-anxiety</td>
<td>6.97, &lt;.01, .38</td>
</tr>
<tr>
<td>MARS Pre-Perf</td>
<td>RBMT</td>
<td>44.58, &lt;.001, .62</td>
</tr>
<tr>
<td>SAI Compliance</td>
<td>Self-certainty</td>
<td>7.29, &lt;.05, .23</td>
</tr>
</tbody>
</table>

Note: Key, Key Search; MSE, Modified Six Elements Test; LNS, Letter-Number Span; Trails B:A, Trails Test Part B to Part A completion time ratio; RBMT, Rivermead Behavioral Memory Test; WASI IQ, Wechsler Abbreviated Scale of Intelligence; BCIS, Beck Cognitive Insight Scale; SUMD-MD, item 1 from the Scale to assess Unawareness of Mental Disorder; SAI-Rel, Schedule for the Assessment of Insight-Relabeling; SAI-III, Schedule for the Assessment of Insight-Illness. Significant correlations are shown in bold.

are sequentially removed, until no more variables satisfy the removal criteria. The remaining variables represent the best explanatory model. Measures from each domain of awareness, SUMD-MD, SAI-Rel, SAI Compliance, DEX, and MARS mean scores, were analyzed. Table 5 provides the summary of the regression models. The alpha level was set at .05 to identify all potential predictor variables within the correlation analyses; however, to address multiple testing, the alpha value within the regression analyses was set at .01.

Awareness of Mental Disorder (SUMD-MD). A model consisting of only the BCIS remained significantly predictive of the SUMD-MD score, accounting for 23% of the variance, while the BDI accounted for an additional 6.5% of the variance, but this was not a significant contribution.

Table 5. Summary of Regression Models for Each Domain of Awareness

<table>
<thead>
<tr>
<th>Awareness Measure</th>
<th>Significant Predictor Variables</th>
<th>F test, P value, $R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUMD-MD</td>
<td>BCIS</td>
<td>7.12, .01, .23</td>
</tr>
<tr>
<td>SAI-Rel</td>
<td>BPRS total, self-reflectiveness, and Key Search Test</td>
<td>12.45, &lt;.001, .80</td>
</tr>
<tr>
<td>DEX</td>
<td>BPRS positive symptoms, depression-anxiety</td>
<td>6.97, &lt;.01, .38</td>
</tr>
<tr>
<td>MARS Pre-Perf</td>
<td>RBMT</td>
<td>44.58, &lt;.001, .62</td>
</tr>
<tr>
<td>SAI Compliance</td>
<td>Self-certainty</td>
<td>7.29, &lt;.05, .23</td>
</tr>
</tbody>
</table>

Note: SUMD-MD, item 1 from the Scale to assess Unawareness of Mental Disorder; BCIS, Beck Cognitive Insight Scale; SAI-Rel, Schedule for the Assessment of Insight-Relabeling; BPRS, Brief Psychiatric Rating Scale; DEX, Dysexecutive Questionnaire; MARS Pre-Perf, Memory Awareness Rating Scale Prediction-Performance discrepancy; RBMT, Rivermead Behavioral Memory Test; SAI Compliance, Schedule for the Assessment of Insight-Compliance.

Relabeling of Symptoms (SAI-Rel). All significant variables, namely BPRS total, BCIS, Trails B:A ratio, RBMT, LNS, and the Key Search Test, were entered into the regression analysis. A model constituted of BPRS total, Self-reflection, and Key Search Test scores accounted for 79.5% of the variance in relabeling (SAI-Rel). SC was the next largest nonsignificant contributor to the variance in SAI-Rel scores.

Awareness of the Need for Treatment and Treatment Compliance (SAI Compliance). Only SC was found to be significantly correlated with awareness of medication. A regression analysis showed that SC scores could account for 23% of the variance in SAI Compliance scores ($F_{1,27} = 7.29, P < .05$).

Awareness of Behavioral Dysfunction (DEX). Awareness of behavioral and executive problems surprisingly bore no association to any individual neuropsychological test score. However, a regression analysis in which BPRS positive symptoms and depression-anxiety factors were entered as predictor variables revealed that a model consisting of both factors accounted for 37.7% of the variance in unawareness of behavioral functioning ($F_{2,25} = 6.97, P < .01; R^2 = .377$).

Awareness of Memory Impairment (MARS Pre-Perf). Lastly, a regression analysis was conducted to determine the best predictive model of awareness of memory functioning. Memory and BCIS were entered into the regression analysis, yet a model consisting only of the RBMT proved significant and accounted for 79% of the variance in MARS Pre-Perf scores ($F_{1,28} = 44.58, P < .001$, adjusted $R^2 = .62$).

Discussion
The aim of the current study was to investigate the extent to which awareness in schizophrenia fractionates between domains of functioning and moreover to investigate whether distinct or similar factors contribute to awareness within domain. Results showed that
awareness fractionates (high within, modest between-domain correlations), thus lack of awareness in one domain does not necessarily entail lack of awareness in another domain. This, in turn, suggests that awareness is not singular within schizophrenia and suggests that /INS> “each awareness” is at least partly underpinned by a different mechanism. However, given that the correlations are at the very least modest between domains of awareness, there may be some common foundation to each. This is important in terms of identifying key factors in awareness per se and potential therapeutic targets.

The patient group was characterized by a diagnosis of schizophrenia, with moderately high psychopathology, and impairments in both behavioral and mnemonic functioning. Awareness of these sequelae was low in the psychiatric domain, but as a group, awareness was good for memory and behavioral deficits. With respect to behavioral functioning, some patients even displayed over-awareness of deficits. This overcriticality of impairment was specific to behavioral functioning (DEX self-ratings) and was associated with lower mood—greater depression (both self-rated and researcher rated) resulted in lower ratings of functioning. Low mood appeared to result in lower self-ratings of functioning, hence greater/“over”-awareness when compared with informant ratings of functioning, and may reflect negative self-schema (eg, “depressive realism”63). Generally speaking, middle-ranging scores on BDI and BPRS:Depression/Anxiety were associated with the least discrepancy because good mood produced overestimation of functioning (relative to informant).

The overall good levels of awareness of cognitive functioning shown in the present study contrasts with data reported recently by Medalia and Thysen43 who instead concluded that awareness of cognitive functioning in their patient group was both low and indeed lower than awareness of illness and symptoms. However, their study utilized a scale devised to be analogous to the SUMD scale—where patients’ capacity to attribute cognitive deficits to mental illness is judged to be correct or not. This in turn contributes to the awareness score. However, in contrast to psychiatric symptoms (as with the SUMD), it is less satisfactory to objectively deem cognitive deficits as attributable to mental illness, hence the question does not seem equivalent. For example, the neurodevelopmental conceptualization of schizophrenia holds that cognitive deficits exist before onset of other schizophrenia-related symptoms and may be considered “normal” by the patient. Alternatively, cognitive deficits may be attributable to the effects of medication rather than mental disorder. Thus, the 2 forms of awareness are not directly comparable.

Set shifting was the strongest neuropsychological predictor of awareness (see table 4) and was specifically associated with awareness of illness measures (SAI-E and SUMD not MARS and DEX). Thus, the categorical “shifting of set” is specific to awareness of illness, which is intuitive when one considers the categorical dichotomy between “being well” and “being ill.” Comparatively, problems with memory and functioning are continuous in nature and so reflect a degree of impairment, thus it may be expected that a set-shifting measure would not be so strongly associated with awareness in these domains.

The regression analyses, however, revealed that when combined with psychological and psychiatric factors, namely cognitive insight and symptomatology (including mood), the contribution of set-shifting deficits and other neuropsychological factors were comparably weak, with only the key search task providing added variance to the capacity to relabel over and above cognitive insight and symptomatology. In comparison, however, self-reflectiveness (lower) and to a lesser extent SC (higher) were stronger predictive variables of awareness. SC and BCIS total scores (but not SR) have recently been shown to be associated with verbal learning and memory functioning, perhaps reflecting the ability to retrieve past memories (Lepage et al66).

No neuropsychological measure correlated significantly with any measure assessing awareness of need for treatment or medication compliance. Instead, “cognitive insight” and psychiatric symptomatology were the strongest predictors of this aspect of awareness. Regression analyses showed that greater compliance was associated with lower SC. Of interest is that cognitive insight itself correlated significantly with Trails B:A ratio indicating that shifting set may be involved with the process of self-reflectiveness in the first instance. “Shifting” from noncompliance to compliance may very much be the direct result of a cognitive shifting of set, coupled with reduced SC. That BCIS scores correlate with both neuropsychological variables and awareness raises the possibility that self-reflectiveness and SC are intermediate factors between cognition and awareness. Interestingly, SR was more strongly associated with awareness of illness (and showed a trend with the MARS) than SC, while SC showed a stronger relationship to compliance to medication that held no relationship with SR.

Relabeling psychotic symptoms as pathological on the other hand showed very similar patterns of association to scores across tests in the battery and correlated moderately with several cognitive variables: set shifting, memory (RBMT and LNS), and the Key Search task that is a measure of self-monitoring but also of planning and strategy formation, suggesting that it is these aspects of cognition that aid relabeling.

Awareness of illness (SAI-III), interestingly, demonstrated significant correlations with each of the same measures as the relabeling but additionally with IQ and the most complex “executive” task, the MSE.
Accordingly, it may be speculated that awareness of “being ill” follows attribution of symptoms—in that perhaps one can only be aware of illness after being able to attribute symptoms correctly and that this relies on intelligence and better executive functioning. It should also be noted that the MSE is reliant on prospective self-motivated set shifting (from one task to another) (cf, Mysore et al). Together, this permits speculation that these are the mental capacities required for awareness: a capacity to shift-set onto new schema (of being ill), perhaps achieved following greater self-reflection, with intelligence perhaps facilitating greater expression of problems experienced, or indeed, via direct facilitation of the self-reflectiveness process.

Of considerable interest was that no neuropsychological variable correlated with awareness of functioning, as measured by the DEX discrepancy scores. This indicates that awareness of problems of executive functioning, activities of daily living, and social behavior is not, as was anticipated, a function of capacity in those areas but, instead, of severity of positive symptoms and low mood. In contrast, memory functioning was the single strongest predictor of awareness of memory deficits, with worse memory being associated with overestimation of function. This suggests that awareness of memory is a metamemory function, and this is consistent with findings in neurology such that cortical systems underpinning awareness of motor deficits are related and anatomically close to those underpinning motor control.

Symptomatology, as measured by the BPRS, was strongly related to variables across all domains of awareness except awareness of memory. Correct awareness, and relabeling of symptoms, is underpinned by these factors but also executive functioning, specifically set shifting, self-monitoring/strategy (Key Search), memory and working memory capacity (LNS), as well as Modified Six Elements performance that demands a high level of set shifting, strategy, and planning. Thus, it would seem that attribution, over and above awareness of illness, is a function of executive performance.

**Limitations**

It must be acknowledged that correlations cannot provide evidence of causality. Further, in this study, we have emphasized the pattern of correlations rather than their individual significance; hence, although we performed a relatively high number of statistical tests, we decided not to control for multiple comparisons. However, this may have lead us to draw inferences on weak or chance findings. The present study was also limited by the relatively small sample size that may have lead us to miss important associations (while raising the likelihood of chance findings), perhaps exacerbated by the large number of tests performed; however, there was sufficient variability in clinical parameters to explore associations with awareness. The various methodologies used to assess insight and awareness may be considered as strength of the current study, but future research may seek to find measures that, like the MARS, provide analogous and isomorphic ratings/performance scores by which discrepancy scores within the “executive function” and other cognitive domains may be better represented.

Lastly, choosing informants with different types of relationship with the patient was done in order to choose informants with the most contact and hence most accurate knowledge of the patients’ functioning. However, this is also a potential limitation in as far as informants with differing types of relationship to the patient may rate behavior differently. It would be ideal but was not possible to consult informants with the same relationship to the patient because there was either no overlap in the relationship type across subjects or where there was, contact with the patient was in many instances either minimal or nonexistent.

**Future Studies**

Future studies should look specifically for variation in awareness across groups, and the presence of both over-awareness and underawareness, rather than looking just at correlations that mask the valence and magnitude of variable scores. Studies must also consider the role of mood, depressive realism, and self-criticality in determining awareness scores and how the effects of each on awareness may be separated from each other. That self-rated but not researcher-rated mood was also associated with awareness raises the issue that there are real clinical differences between these 2 methods of assessment and, moreover, that clinician ratings of mood may be less sensitive than patients’ self-ratings. We have also highlighted the fact that future studies should examine the relationship between predictor variables and the constituents of any discrepancy-based awareness scores for, as here, it may be that observation of a relationship between a predictor variable and the discrepancy score is more parsimoniously attributable to a constituent score.

**Conclusions**

We conclude that this study shows that, in people with schizophrenia, poor insight or lack of awareness is not uniform for all symptoms and impairments. Awareness is most impaired with respect to the principle and defining symptoms of the syndrome of which patients are diagnosed and moreover of the diagnosis itself (of having a mental illness). Impairments in other domains, eg, memory and executive function, are more resistant to reduction to other component processes, as seen by low between-domain awareness correlations. There are several possible reasons for this. The experience
and awareness of mental, particularly psychotic, phenomena such as delusions could be affected by the same mechanisms. Historically, delusions were regarded as irreducible and “protected” from normal reasoning processes (see Markova36). This would not apply to behavioral disorders or cognitive deficits. However, if this “protection” is breached by insight, the burden shifts toward information-processing systems to “relabel” the symptoms as abnormal. It should be noted that others (eg, Medalia and Thysen43) find fairly marked deficits in the awareness of cognitive problems in schizophrenia patients contrasting with our findings, although the principle of differential awareness across domains of functioning is a common finding.

Finally, “cognitive insight” was a greater predictor of awareness of illness measures than neuropsychological or mood measures; memory was a greater predictor of awareness of memory problems; and psychopathology including depression-anxiety (not cognitive factors) was greater predictor of awareness of more behavioral and interpersonal deficits as indexed by the DEX. This pattern of results provides evidence against an overarching account of awareness and an all-encompassing core “awareness module” in schizophrenia. This, in turn, suggests that there may be specific targets for improving awareness in specific domains. This study suggests that improvement in psychiatric symptomatology (already sought via medication), improving cognitive insight, by specifically promoting self-reflection (or developing this skill if it absent) and reducing SC, and improving capacity to “shift set” would appear to prime targets for improving awareness of illness, symptoms, need for medication, and also awareness of problems with behavioral functioning. In sum, it is remediation of executive functioning and self-reflection, in tandem with engagement with treatment interventions, which should be a prime focus for the remediation of lack of awareness in schizophrenia.

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Domains of awareness in schizophrenia


