Published in final edited form as:

J Psychiatr Res. 2014 August ; 55: 68–76. doi:10.1016/j.jpsychires.2014.03.022.

COGNITIVE TASK PERFORMANCE AND SYMPTOMS CONTRIBUTE TO PERSONALITY ABNORMALITIES IN FIRST HOSPITALIZED SCHIZOPHRENIA

Ronald J. Gurrera, MD^a, Robert W. McCarley, MD^a, and Dean Salisbury, PhD^{b,3}

^aVA Boston Healthcare System and Harvard Medical School Department of Psychiatry, Boston MA, USA

^bMcLean Hospital, Belmont MA and Harvard Medical School Department of Psychiatry, Boston MA, USA

Abstract

Chronic schizophrenia patients have personality abnormalities and cognitive deficits that are associated with poor clinical, social, and vocational outcomes. Very few studies have examined relationships between personality and cognitive function, and chronic illness effects may have confounded those studies. In this study personality traits in clinically stable first episode schizophrenia patients (21M, 9F) and psychiatrically healthy controls (38M, 24F) were measured with the NEO-FFI, a self-report measure of neuroticism, extraversion, openness, agreeableness, and conscientiousness. All subjects completed the Information, Digit Span, Vocabulary, and Digit Symbol subtests of the Wechsler Adult Intelligence Scale; and Trails A and B. Standard statistical techniques were used to quantify relationships between personality and symptom levels and/or task performance, and relative contributions of diagnosis and task performance to personality variance. Patients showed elevated mean neuroticism and openness, and reduced mean extraversion, agreeableness and conscientiousness. Task performance and negative symptoms contributed significantly and uniquely to most personality dimensions in patients. Task performance accounted for significant amounts of personality variance even after accounting for diagnosis, and it also contributed to personality variance in controls. These results suggest that cognitive deficits and negative symptoms contribute to consistently observed personality abnormalities in this disorder, and that the contribution of neuropsychological performance to personality variance may be independent of diagnostic classification. Personality abnormalities in schizophrenia may stem from the neurocognitive deficits associated with this disorder, and add to their adverse effects on social and vocational functioning.

Address correspondence to: Ronald J. Gurrera, MD, VA Boston Healthcare System, 940 Belmont Street (116A), Brockton, MA 02301, U.S.A., +1-774-826-2482, +1-508-586-0894 (fax), ronald.gurrera@va.gov, ronald_gurrera@hms.harvard.edu.

^cCurrent address: Western Psychiatric Institute and Clinic and University of Pittsburgh School of Medicine Department of Psychiatry, Pittsburgh, PA, USA

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

CONTRIBUTORS: Author RG designed the study, performed the statistical analyses and wrote the first draft of the manuscript. Author RM assisted with interpretation of results and preparation of the manuscript. Author DS managed data collection and assisted with statistical analyses and preparation of the manuscript. All authors contributed to and have approved the final manuscript.

Keywords

schizophrenia; personality; neurocognition; social cognition

OBJECTIVES OF THE STUDY AND BACKGROUND

Contemporary studies confirm early observations (Bleuler, 1911/1950; Kraepelin, 1919/1989) that personalities of individuals with schizophrenia differ from those without schizophrenia, even before psychotic symptoms appear. Patients report being more introverted and neurotic than psychiatrically healthy subjects (Berenbaum & Fujita, 1994), and individuals who later manifest schizophrenia are more introverted, socially withdrawn, and socially incompetent than those who do not. One large prospective study of Swedish army recruits found that behavioral indices of neuroticism and introversion were associated with subsequent psychosis (Malmberg et al, 1998). In another large study higher neuroticism and extraversion at age 16 years were associated with increased and decreased risk, respectively, for developing schizophrenia by age 43 years (van Os & Jones, 2001). A recent prospective study of Finnish conscripts found that high neuroticism predicted future schizophrenia onset, whereas high extraversion predicted future bipolar disorder (Lönngqvist et al, 2009). Personality disorders are 3 times more prevalent in individuals with psychosis (McMillan et al, 2009), schizophrenia patients are 8 times more likely than non-psychiatric subjects to screen positive for personality disorder (Moore et al, 2012), and first episode schizophrenia patients score higher than healthy controls for all personality disorders (Keshavan et al, 2005).

Comprehensive personality assessments measure the so-called “Big Five” dimensions, which describe the full range of normal personality variation (Digman, 1990; Wiggins, 1996; John & Srivastava, 1999; McCrae & Costa, 2003), including clinical personality disorders (Wiggins & Pincus, 1989; Costa & McCrae, 1990). The NEO Personality Inventory - Revised (NEO-PI-R; Costa & McCrae, 1992) is the most widely used instrument for measuring these dimensions: neuroticism, extraversion, openness, agreeableness, and conscientiousness. Outpatients with schizoaffective disorder (Kentros et al, 1997) or chronic schizophrenia (Kentros et al, 1997; Gurrera et al, 2000) have higher neuroticism and lower conscientiousness. Other studies found increased neuroticism and decreased extraversion, agreeableness, and conscientiousness in chronic schizophrenia (Bagby et al, 1997; Camisa et al, 2005). Studies using the Temperament and Character Inventory (Cloninger et al, 1993), which assesses behavioral domains corresponding to the five-factor model (De Fruyt et al, 2000), yield similar results (Guillem et al, 2002; Hori et al, 2008; Ohi et al, 2012). These studies demonstrate consistent and pervasive personality changes in chronic schizophrenia.

Whether personality deviations are independent risk factors (Meehl, 1989), or stem from the disease process in some way, remains an open question. Among twin pairs discordant for schizophrenia, affected twins are lower on social closeness and extraversion and higher on neuroticism than their non-affected co-twins and population norms, but these within-pair personality differences were absent in childhood and early adolescence (DiLalla & Gottesman, 1995). This suggests that the personality differences arose during or after adolescence, possibly in an early phase of illness. If personality deviations are

manifestations of abnormal brain function, this could account for the contradictory findings that personality deviations are statistically associated with schizophrenia, but many schizophrenia patients appear to have normal premorbid personality (Gross & Huber, 1993).

Several studies have examined cognitive performance to investigate the role of altered brain function in schizophrenia-related personality changes. Wisconsin Card Sort test (WCST) performance was associated with agreeableness and conscientiousness in individuals with schizophrenia spectrum traits (Tien et al, 1992); and with neuroticism (Lysaker et al, 1999), and neuroticism and conscientiousness (Gurrera et al, 2005), in schizophrenia outpatients. Openness was positively, and conscientiousness negatively, correlated with WAIS-III Vocabulary subtest performance in male outpatients with schizophrenia or schizoaffective disorder, and extraversion was negatively correlated with WCST performance (Lysaker & Davis, 2004). Memory and executive function performance were associated with abnormal personality traits in psychotic inpatients (Cuesta et al, 2001).

Personality alterations in schizophrenia are relevant to clinical outcomes. Extraversion and neuroticism are associated with premorbid function and prognosis (Berenbaum & Fujita, 1994), and with clinical presentation and treatment response (Smith et al, 1995). Neuroticism is associated with poorer social and vocational functioning, whereas extraversion, openness and agreeableness are associated with better social functioning (Kentros et al, 1997). In chronic schizophrenia outpatients, neuroticism and extraversion predict work performance (Lysaker et al, 1998) and neuroticism accounts for significant variance in disability scores (Herrán et al, 2006). Novelty seeking, which is related to extraversion (De Fruyt et al, 2000), is correlated with substance use, whereas symptom levels are not (van Ammers et al, 1997). More extreme personality deviations are associated with treatment refractoriness (Smith et al, 1996).

There is also a growing appreciation for the relevance of neurocognition to functional outcome in schizophrenia. A recent review of the literature (Green et al, 2000) concluded “[W]e can state with considerable confidence ... that certain aspects of neurocognition (e.g., secondary verbal memory, immediate memory, vigilance, and executive functioning/card sorting) are related to functional outcome in schizophrenia.” (p 133) Verbal learning – but not crystallized verbal ability, sustained visual vigilance, problem-solving, processing speed or symptom levels – predicted improvement in everyday life skills performance following a year of rehabilitation in a group of outpatients with schizophrenia or schizoaffective disorder (Kurtz et al, 2008). In outpatients with first episode schizophrenia working memory was the single strongest predictor of functional capacity at 10-month follow-up (Vesterager et al, 2012). The fact that these recurring patterns of personality abnormalities and neurocognitive deficits co-exist and are associated with the same functional outcomes in schizophrenia suggests that they may be linked in some way. Personality features may represent epiphenomena of neurocognitive impairments, and may contribute to a degradation in social functioning as a secondary effect.

The present study measured “big five” personality dimensions in first episode schizophrenia patients and psychiatrically healthy controls; subjects also completed basic neuropsychological testing. The purpose of this study was to investigate whether

neuropsychological performance also contributes to personality variance early in the clinical course of schizophrenia, as has been demonstrated in chronic illness. We hypothesized that patient and control groups would have distinct personality profiles, and that neuropsychological performance would account for a statistically significant amount of personality variance in each group.

MATERIALS AND METHODS

Subjects

Recruitment—“First episode” was defined as within one year of first hospitalization for psychosis (see Salisbury et al, 1998; 2007). Patients were recruited from inpatient units at McLean Hospital in Belmont, Massachusetts. Control subjects were recruited from the local community through newspaper or online advertisements. This study was approved by the McLean Hospital and Harvard Medical School Institutional Review Boards. All subjects gave written informed consent and were compensated for their time.

Selection Criteria—Subjects previously met screening criteria for functional brain imaging studies: 18–45 years old with estimated full scale IQ >75 and negative histories for seizures, traumatic brain injury or significant head trauma, neurologic disorder, alcohol or drug detoxification within 5 years, or current dependence. Clinically stable patients were diagnosed with the Structured Clinical Interview for DSM (SCID) – Patient Edition (Spitzer et al, 1990a) and medical records. Control subjects had no Axis I (SCID Non-Patient Edition; Spitzer et al, 199b) or II (SCID-II; Spitzer et al, 1990c) disorder; no history of an Axis I disorder or prior treatment with antipsychotic, antidepressant or mood stabilizing medications; and no history of an Axis I disorder in a first-degree relative.

Demographic Data—Age, years of education completed, and socioeconomic status (Hollingshead, 1965) of subjects (SES) and their parents (PSES) were recorded. Socioeconomic data were scaled such that lower scores indicate higher status. Groups were similar in age, PSES, and gender distribution (Table 1). Patients had lower personal SES and educational achievement, and racial distribution also differed.

Clinical Assessment

Symptom and Neuropsychological Task Measures—Symptom severity was measured with the PANSS (Kay et al, 1987), SANS (Andreasen, 1984a) and SAPS (Andreasen, 1984b). All subjects completed the Information, Digit Span, Vocabulary, and Digit Symbol subtests of the Wechsler Adult Intelligence Scale III (WAIS; Wechsler, 1997); and Trails A and B (Adjutant General’s Office, 1944). Scores for Digit Span forward and backward were combined. All cognitive tests were scaled to normative values such that higher scores indicate better performance.

Personality Measures—The NEO Five Factor Inventory (NEO-FFI), Form S (Costa & McCrae, 1992), is a self-administered questionnaire consisting of 60 items rated on a 5-point response scale (‘strongly disagree’ to ‘strongly agree’). It is a shorter version of the NEO-PI-R, which has been shown to provide reliable and valid measures of personality traits across

many cultures (McCrae et al, 2004). *T* scores were computed using gender-specific normative data (Costa & McCrae, 1992).

Statistical Analyses

One-way MANOVA was used to compare group personality scores, and one-way repeated measures MANOVA (subject group= between-subjects factor, personality measures= within-subjects factor) was used to compare group personality profiles. Principal components factor analysis with varimax rotation was applied separately to symptom measures and task data by group for the purpose of data reduction. The principal components method was used because of the exploratory nature of the present study (Sheskin, 2007). A series of hierarchical linear regressions quantified the contributions of symptom and task performance factor scores to personality variance. Relative contributions of diagnosis and cognitive function to personality variance were evaluated with a second series of hierarchical linear regressions. All significance levels are two-tailed exact.

RESULTS

Group Comparisons

Symptoms and Task Performance—Symptom and task performance data for each group are summarized in Table 2. Principal components analysis yielded 3 rotated symptom components with eigenvalues >1 that accounted for 85.5% of total variance: Component 1 (31.4%), with highest loadings for PANSS Negative subscale and SANS scores (negative symptom factor); component 2, (28.0%) with highest loadings for PANSS Positive subscale and SAPS scores (positive symptom factor); and component 3 (26.6%), with highest loadings for PANSS General and Supplemental subscales (general symptom factor).

Principal components analysis of task performance scores yielded 2 very similar rotated components for each group. In patients component 1 (38.6% of variance) had the highest loadings for Information, Digit Span, Digit Symbol, and Vocabulary (memory factor); component 2 (30.2%) had the highest loadings for both Trails tasks (attention/planning factor). In controls component 1 (33.0%) had the highest loadings for both Trails tasks and Symbol Digit (attention/planning factor); component 2 (27.9%) had the highest loadings for Information, Digit Span and Vocabulary (memory factor).

Personality Traits—Groups differed significantly on all personality dimensions (multivariate $F_{[5,86]}=14.456$, $p=.000$) (Table 3). Personality dimensions also differed significantly within subjects ($F_{[3.5,313.9]}=14.790$, $p=.000$), and the personality*group interaction was significant ($F_{[3.5,313.9]}=25.595$, $p=.000$; Greenhouse-Geisser correction for non-sphericity applied) (Figure 1). Patients scored higher than population norms on neuroticism and lower on extraversion, agreeableness and conscientiousness. The control group evidenced a complimentary pattern, scoring lower than population norms on neuroticism and higher on extraversion, agreeableness and conscientiousness. Both groups were higher than norms on openness.

Correlation Analyses – Component Scores vs. Personality Scores—Greater attention/planning was correlated with higher extraversion and conscientiousness scores, and better memory was correlated with openness, in patients (Table 4). Negative symptoms were positively correlated with neuroticism and inversely correlated conscientiousness (Table 4).

In controls, initial computations indicated that attention/planning was negatively correlated with neuroticism ($r = -.387$, $p = .002$), and memory was associated with both openness ($r = .281$, $p = .027$) and conscientiousness ($r = -.356$, $p = .004$). Visual inspection of scatterplots suggested that the 2 controls with the lowest NEO-C scores might account for the significant correlation between this dimension and the memory factor: One of these extreme low C scorers had both the highest Digit Span score and highest Vocabulary score, and the other was tied for the second-highest Vocabulary score. When these 2 subjects were excluded, memory and conscientiousness were no longer correlated (Table 4). Subsequent analyses were conducted with these extreme subjects excluded.

Regression Analyses – Task Performance and Symptom Levels—To further evaluate relationships between symptom and neuropsychological factors and personality measures, a series of hierarchical regression analyses were performed by group. In each regression a personality dimension served as the dependent variable, and independent variables were symptom factors (entered stepwise, first block for patient group) and neuropsychological factors (entered stepwise, second block for patient group). These analyses (Table 5) confirmed the observed correlations (Table 4) and demonstrated that negative symptoms and neuropsychological performance contribute significantly and uniquely to most personality dimensions in patients, and that neuropsychological performance variance also contributes to personality variance in controls. Notably, attention/planning performance and negative symptoms accounted for half of conscientiousness variance in the patient group. Figure 2 shows scatterplots of the statistically significant regression analyses.

Relative Contributions of Diagnosis and Task Performance—To evaluate the relative contributions of diagnosis and task performance to group personality differences, groups were combined and a series of hierarchical linear regressions was performed with each personality dimension as the dependent variable, and diagnosis (first block) and task scores (second block, stepwise) serving as independent variables (Table 6). After accounting for variance related to diagnosis, Digit Symbol performance contributed significantly to neuroticism, and Trails A performance contributed significantly to extraversion and conscientiousness. Vocabulary performance, but not diagnosis, accounted for a significant portion of openness variance.

DISCUSSION

The principal findings are (1) all patient personality dimensions deviated from population norms, and differed more markedly from individuals carefully screened to exclude personal and family histories of psychiatric and neurological disorders; (2) symptom levels and neuropsychological performance accounted for substantial amounts of personality variance in patients, and these relationships were distinct across personality dimensions; and (3) in

healthy individuals with benign personal and family neuropsychiatric histories, neuropsychological performance accounted for a significant amount of variance in some personality dimensions.

The deviations from population personality norms observed in these first episode schizophrenia patients is similar to patterns seen in chronic schizophrenia (Bagby et al, 1997; Kentros et al, 1997; Gurrera et al, 2000; Camisa et al, 2005). This pattern was exaggerated in comparison with a control group, whose scores were higher than norms when patients were lower, and lower than norms when patients were higher. The exception to this pattern was openness: Controls were higher than patients, and both groups were higher than norms.

Patients performed worse on all neuropsychological tasks, consistent with research employing less rigorously screened control groups (Mesholam-Gately et al, 2009). Previous associations between neuropsychological task performance and personality traits in chronic schizophrenia (Lysaker et al, 1999, Lysaker & Davis, 2004; Gurrera et al, 2005), non-psychotic schizophrenia spectrum disorders (Tien et al, 1992), and heterogeneous psychosis (Cuesta et al, 2001) were typically smaller in number and magnitude than those observed here, but patterns were similar: Neuroticism was associated with worse performance whereas extraversion, openness, agreeableness and conscientiousness were associated with better performance.

A few studies have observed relationships between neuropsychological performance and personality variance in non-psychiatric samples. For example, better Trail B and WCS performance correlates negatively with neuroticism and positively with conscientiousness, and WCS errors correlated negatively with agreeableness (Gurrera et al, 2005). Similarly, in community-dwelling older adults executive function is correlated with neuroticism, openness and agreeableness (Williams et al, 2010), and higher conscientiousness is associated with reduced risk of subsequent Alzheimer disease and a slower rate of cognitive decline (Wilson et al, 2007). The control group in the present study demonstrated a negative relationship between attention/planning and neuroticism and a positive association between memory and openness.

Clinical symptoms were also associated with personality dimensions. Patients with more negative symptoms scored higher on neuroticism and lower on conscientiousness, but positive and general symptom factors were unrelated to personality. The effects of symptom level and neuropsychological performance on personality were most apparent with conscientiousness. This domain subsumes ‘order’ (neat, tidy, well-organized), ‘achievement’ (diligence, purposefulness, sense of direction in life), and ‘self-discipline’ (ability to begin and complete tasks despite boredom or other distractions, self-motivation) (Costa & McCrae, 1992). Attention/planning performance and negative symptoms factors each contributed substantial portions of conscientiousness variance in patients, which suggests an intuitively appealing explanation for lower scores on this dimension. The Trails tasks measure attention, sequencing, and mental flexibility – abilities needed for organization and task completion; impaired Trails performance may index reduced capacity for order and self-discipline, whereas negative symptoms may undermine achievement and

self-discipline. Thus, negative symptoms and impaired executive function may act synergistically to reduce conscientiousness.

Conscientiousness and, to a lesser extent, extraversion are the principal personality predictors of workplace performance (Barrick & Mount, 1991), and conscientiousness and neuroticism are salient job performance traits (Le et al, 2011). In schizophrenia the relationship between conscientiousness and job performance is mediated by social skills (Witt & Ferris, 2003), and higher neuroticism predicts poorer workplace success (Lysaker et al, 1998). Social interaction frequency is associated with fewer negative symptoms and lower neuroticism, higher agreeableness and better verbal memory (Lysaker & Davis, 2004). In the same study, capacity for intimacy was related to fewer negative symptoms and higher openness, agreeableness and conscientiousness. Social cognition, neurocognition and negative symptoms are closely related constructs in schizophrenia, with social cognition and neurocognition more closely related to one another than to negative symptoms (Sergi et al, 2007).

Extraversion was positively associated with attention/planning in patients, which parallels a previously reported correlation between extraversion and Trails performance in male first-degree relatives of schizophrenia patients (Eysenck & Eysenck, 1985). Extraversion is correlated with N170 amplitude during emotional face processing in schizophrenia (Kirihaara et al, 2012), suggesting that deficits in the earliest stages of social cognition may contribute to low extraversion, and decreased extraversion predicts future schizophrenia risk (van Os & Jones, 2001), which indicates that illness-related social functioning impairment may be present before the illness is overt. This proposition is supported by the finding that global neurocognition, and processing speed in particular, predicts current social and role functioning in adolescents at risk for psychosis (Carriòn et al, 2011). There is evidence that “core” neuropsychological deficits in schizophrenia are relatively independent of one another (Kravariti et al, 2009), arise earlier in more severe forms of schizophrenia (Rajji et al, 2009), and are present before the emergence of psychotic symptoms (Green, 2006). Thus, the relative independence of cognitive deficit domains, and their variable age of onset, could account for some personality variance in schizophrenia, including premorbid abnormalities.

Attention/planning was also negatively associated with neuroticism in controls. One major model of personality views extraversion and neuroticism as representing the broad traits of positive and negative emotionality, respectively (Clark & Watson, 1999). In healthy individuals right inferior frontal cortical thickness is negatively correlated with extraversion and left anterior orbitofrontal cortical thickness is negatively correlated with neuroticism (Wright et al, 2006), suggesting a possible neuroanatomical basis for observed relationships between frontal lobe functions and these personality traits.

Other research illustrates one mechanism by which reduced neurocognitive ability may be expressed as low extraversion and/or elevated neuroticism. Social interactions, e.g., informal conversations, make many demands on the participants, including comprehension, turn-taking, response generation, remembering one's thoughts while awaiting one's turn, and response production (Lieberman & Rosenthal, 2001). In a series of experiments, introverted individuals were shown to have deficits in the central executive component, but not the

storage components, of working memory that are only evident under multitasking conditions (Lieberman & Rosenthal, 2001). According to those authors, introverts are relatively disadvantaged in most social situations because they must engage simultaneously in conversation maintenance and the generation of reflected appraisals, which are effortful controlled processes that rely on working memory. They propose that this vulnerability “might lead to a developmental sequence in which introverts have predominantly successful interactions but are only self-reflectively aware of sub-par interactions, ultimately contributing to the lower self-esteem and reduced happiness associated with introversion (p 307).” (Lieberman & Rosenthal, 2001). It is not difficult to imagine other ways in which inefficient neurocognition might impede or distort the mental processes that support personality functions, producing long-term alterations in social behaviors and self-assessments.

Studies consistently demonstrate that relationships between neuropsychological performance and personality deviations are more pervasive in schizophrenia patients than in healthy individuals. This pattern of observations may reflect a threshold phenomenon, such that neurocognitive deficits must be sufficiently severe in number or magnitude before personality function is noticeably compromised. A contingent relationship between neurocognitive capacity and personality function could also account for some of the inconsistent findings regarding the emergence of abnormal personality features in the lifetime course of schizophrenia.

The present findings extend previous work by demonstrating that personality abnormalities observed in chronic schizophrenia are present at first episode, and are related to illness-associated neurocognitive deficits and enduring symptoms. A large (N=2204) meta-analysis found that neurocognitive impairments present at first episode are similar to those evident in well established illness, but greater than those demonstrated in the premorbid period (Mesholam-Gately et al, 2009). Those authors believe these results represent deterioration between premorbid and first episode illness phases followed by deficit stability at the group level, but note substantial heterogeneity of effect sizes indicating variability in illness manifestation and likely moderator variable contributions. The personality abnormalities and neurocognitive deficits found in these first episode patients are very similar to those reported in chronic patients, and the contribution of neuropsychological performance to personality variance in patients appears to represent a broader relationship between these variable domains that is not limited to schizophrenia. There were no differences between groups with respect to gender distribution, and gender-specific population norms for personality measures were used, so these results are not likely accounted for by gender factors. Similarly, PSES was similar for both groups, so it is unlikely that differences in the socioeconomic status of families of origin played a role.

There are limitations to this study. Sample size, though comparable to many studies of first episode schizophrenia, may be considered small by personality research standards, limiting statistical power. Although the ratio of subjects to variables met the suggested minimum requirement for principal components analysis (Sheskin, 2007), the total number of subjects in each group was small, so the results may not generalize to other samples. Many individual

task correlations with a medium effect size (Sheskin, 2007) did not reach statistical significance.

Most patients were diagnosed with paranoid schizophrenia, and the control group was carefully screened for disorders that might be associated with impaired brain function, so the extent to which these findings will generalize to more heterogeneous populations is not known. The cross-sectional design does not provide a basis for determining when personality changes first emerged, or demonstrating causal relationships between symptom, cognition, and personality domains. Thus, the design of the present study does not permit any conclusions regarding causal relationships between neurocognitive deficits and personality abnormalities.

Neuropsychological assessment was limited by the measures employed in this study. Memory and attention were measured, but other cognitive domains relevant to schizophrenia (i.e., processing speed, visual learning and memory, reasoning/problem solving, and verbal comprehension; Nuechterlein et al, 2004) were not. Therefore, it is likely that these results understate the number of actual relationships between cognitive performance and personality, and that the measured strengths of association between specific neuropsychological and personality variables might have been different if a more comprehensive cognitive assessment battery had been used. However, while measurements of association may vary somewhat between studies, these results add to an emerging pattern of relationships between neurocognitive function and personality features that is not limited to schizophrenia, and may help to explain the basis of pervasive personality abnormalities in this disorder. Consistently observed associations between clinically relevant neurocognitive variables and personality features in both first episode and chronic patient populations, and numerous reports of similar associations in psychiatrically healthy individuals, are consistent with a hypothesis that personality abnormalities in schizophrenia stem from impaired neurocognition. Neurocognitive deficits and secondary personality abnormalities may work in tandem to undermine successful social adaptation.

Acknowledgments

The authors thank Toni Mahowald and Elizabeth Ronan for their assistance with data collection and data management for this study.

FUNDING SOURCES: This work was supported by the Department of Veterans Affairs (Merit Award, Schizophrenia Center Award, Middleton Award to RWM); the National Institute of Health (R01 MH 40799, R01 MH 052807, and P50MH080272 to RWM; R01 MH58704 to DFS); the Mind Foundation of British Columbia (RWM); and National Alliance for Research on Schizophrenia and Depression (NARSAD; DFS). This work was also supported with resources and the use of facilities at the VA Boston Healthcare System.

REFERENCES

- Adjutant General's Office. Army individual test battery. Washington, DC: War Department; 1944.
- Andreasen, NC. Scale for the assessment of negative symptoms (SANS). Iowa City: University of Iowa; 1984a.
- Andreasen, NC. Scale for the assessment of positive symptoms (SAPS). Iowa City: University of Iowa; 1984b.

- Bagby RM, Bindseil KD, Schuller DR, Rector NA, Young LT, Cooke RG, Seeman MV, McCay EA, Joffe RT. Relationship between the five-factor model of personality and unipolar, bipolar and schizophrenic patients. *Psychiatry Research*. 1997; 70:83–94. [PubMed: 9194202]
- Barrick MR, Mount MK. The Big Five personality dimensions and job performance: A meta-analysis. *Personnel Psychology*. 1991; 44:1–26.
- Berenbaum H, Fujita F. Schizophrenia and personality: exploring the boundaries and connections between vulnerability and outcome. *Journal of Abnormal Psychology*. 1994; 103:148–158. [PubMed: 8040476]
- Bleuler, E. *Dementia Praecox or the Group of Schizophrenias*. Zinkin, J., translator. New York: International Universities Press, Inc; 1911/1950.
- Camisa KM, Bockbrader MA, Lysaker P, Rae LL, Brenner CA, O'Donnell BF. Personality traits in schizophrenia and related personality disorders. *Psychiatry Research*. 2005; 133:23–33. [PubMed: 15698674]
- Carrión RE, Goldberg TE, McLaughlin D, Auther AM, Correll CU, Cornblatt BA. Impact of neurocognition on social and role functioning in individuals at clinic high risk for psychosis. *American Journal of Psychiatry*. 2011; 168:806–813. [PubMed: 21536691]
- Clark, LA.; Watson, D. Temperament: A new paradigm for trait psychology. In: Pervin, LA.; John, OP., editors. *Handbook of personality: Theory and research*. 2nd edition. Vol. chapter 16. New York, NY: The Guilford Press; 1999. 1999. p. 399–423.
- Cloninger CR, Svrakic DM, Przybeck TR. A psychobiological model of temperament and character. *Archives of General Psychiatry*. 1993; 50:975–990. [PubMed: 8250684]
- Costa PT Jr, McCrae RR. Personality disorders and the five-factor model of personality. *Journal of Personality Disorders*. 1990; 4:362–371.
- Costa, PT., Jr; McCrae, RR. *NEO PI-R: Professional Manual (Revised NEO Personality Inventory (NEO-PI-R) and NEO Five-Factor Inventory (NEO-FFI)*. Odessa, FL: Psychological Assessment Resources, Inc; 1992.
- Cuesta MJ, Peralta V, Zarzuela A. Are personality traits associated with cognitive disturbance in psychosis? *Schizophrenia Research*. 2001; 51:109–117. [PubMed: 11518631]
- De Fruyt F, Van De Wiele L, Van Heeringen C. Cloninger's psychobiological model of temperament and character and the five-factor model of personality. *Personality and Individual Differences*. 2000; 29:441–452.
- Digman JM. Personality structure: emergence of the five-factor model. *Annual Review of Psychology*. 1990; 41:417–440.
- DiLalla DL, Gottesman II. Normal personality characteristics in identical twins discordant for schizophrenia. *Journal of Abnormal Psychology*. 1995; 104:490–499. [PubMed: 7673572]
- Eysenck, HJ.; Eysenck, MW. *Personality and individual differences: A natural science approach*. New York: Plenum Press; 1985. p. 64138
- Green MF. Cognitive impairment and functional outcome in schizophrenia and bipolar disorder. *Journal of Clinical Psychiatry*. 2006; 67(S9):3–8. [PubMed: 16965182]
- Green MF, Kern RS, Braff DL, Mintz J. Neurocognitive deficits and functional outcome in schizophrenia: Are we measuring the “right stuff”? *Schizophrenia Bulletin*. 2000; 26:119–136. [PubMed: 10755673]
- Gross G, Huber G. Premorbid personality in schizophrenia: The contribution of European long-term studies. *Neurology Psychiatry and Brain Research*. 1993; 2:14–20.
- Guillem F, Bicu M, Semkovska M, Debruille B. The dimensional symptom structure of schizophrenia and its association with temperament and character. *Schizophrenia Research*. 2002; 56:137–147. [PubMed: 12084428]
- Gurrera RJ, Nestor PG, O'Donnell BF. Personality traits in schizophrenia: comparison with a community sample. *Journal of Nervous and Mental Disease*. 2000; 188:31–35. [PubMed: 10665458]
- Gurrera RJ, Nestor PG, O'Donnell BF, Rosenberg V, McCarley RW. Personality differences in schizophrenia are related to performance on neuropsychological tasks. *Journal of Nervous and Mental Disease*. 2005; 193:714–721. [PubMed: 16260924]

- Herrán A, Sierra-Biddle D, Cuesta MJ, Sandoya M, Vázquez-Barquero JL. Can personality traits help us explain disability in chronic schizophrenia? *Psychiatry and Clinical Neurosciences*. 2006; 60:538–545. [PubMed: 16958935]
- Hollingshead, A. Two factor index of social position. New Haven, CT: Yale University Press; 1965.
- Hori H, Noguchi H, Hasimoto R, Nakabayashi T, Saitoh O, Murray RM, Okabe S, Kunugi H. Personality in schizophrenia assessed with the Temperament and Character Inventory (TCI). *Psychiatry Research*. 2008; 160:175–183. [PubMed: 18602163]
- John, OP.; Srivastava, S. The Big Five trait taxonomy: History, measurement, and theoretical perspectives. In: Pervin, LA.; John, OP., editors. *Handbook of personality: Theory and research*. 2nd edition. Vol. chapter 4. New York, NY: The Guilford Press; 1999. p. 102-138.
- Kay SR, Fiszbein A, Opler LA. The positive and negative syndrome scale (PANSS) for schizophrenia. *Schizophrenia Bulletin*. 1987; 13:261–276. [PubMed: 3616518]
- Kay, SR.; Opler, LA.; Fiszbein, A. Positive and negative syndrome scale (PANSS) Manual. New York: Multi-Health Systems, Inc; 1986.
- Kentros M, Smith TE, Hull J, McKee M, Terkelsen K, Capalbo C. Stability of personality traits in schizophrenia and schizoaffective disorder: a pilot project. *Journal of Nervous and Mental Disease*. 1997; 185:549–555. [PubMed: 9307616]
- Keshavan MS, Duggal HS, Veeragandham G, McLaughlin NM, Montrose DM, Haas GL, Schooler NR. Personality dimensions in first-episode psychoses. *American Journal of Psychiatry*. 2005; 162:102–109. [PubMed: 15625207]
- Kirihara K, Kasai K, Tada M, Nagai T, Kawakubo Y, Yamasaki S, Onitsuka T, Araki T. Neurophysiological impairment in emotional face processing is associated with low extraversion in schizophrenia. *Progress in Neuropsychopharmacology and Biological Psychiatry*. 2012; 37:270–275.
- Kraepelin, E. *Dementia praecox and paraphrenia*. Barclay, RM., translator. Birmingham, Alabama: The Classics of Psychiatry & Behavioral Sciences Library, Division of Gryphon Editions, Inc; 1919/1989.
- Kravariti E, Morgan K, Fearon P, Zanelli JW, Lappin JM, Dazzan P, Morgan C, Doody GA, Harrison G, Jones PB, Murray RM, Reichenberg A. Neuropsychological functioning in first-episode schizophrenia. *British Journal of Psychiatry*. 2009; 195:336–345. [PubMed: 19794203]
- Kurtz MM, Wexler BE, Fujimoto M, Shagan DS, Seltzer JC. Symptoms versus neurocognition as predictors of change in life skills in schizophrenia after outpatient rehabilitation. *Schizophrenia Research*. 2008; 102:303–311. [PubMed: 18495433]
- Le H, Oh I-S, Robbins SB, Ilies R, Holland E, Westrick P. Too much of a good thing: Curvilinear relationships between personality traits and job performance. *Journal of Applied Psychology*. 2011; 96:113–133. [PubMed: 20939656]
- Lieberman MD, Rosenthal R. Why introverts can't always tell who likes them: Multitasking and nonverbal decoding. *Journal of Personality and Social Psychology*. 2001; 80:294–310. [PubMed: 11220447]
- Lönngqvist J-E, Verkasalo M, Haukka J, Nyman K, Tiihonen J, Laaksonen I, Leskinen J, Lönngqvist J, Henriksson M. Premorbid personality factors in schizophrenia and bipolar disorder: Results from a large cohort study of male conscripts. *Journal of Abnormal Psychology*. 2009; 118:418–423. [PubMed: 19413416]
- Lysaker PH, Bell MD, Kaplan E, Bryson GJ. Personality and psychosocial dysfunction in schizophrenia: the association of extraversion and neuroticism with deficits in work performance. *Psychiatry Research*. 1998; 80:61–68. [PubMed: 9727964]
- Lysaker PH, Bell MD, Kaplan E, Greig TC, Bryson GJ. Personality and psychopathology in schizophrenia: the association between personality traits and symptoms. *Psychiatry*. 1999; 62:36–48. [PubMed: 10224622]
- Lysaker PH, Davis LW. Social function in schizophrenia and schizoaffective disorder: Associations with personality, symptoms and neurocognition. *Health and Quality of Life Outcomes*. 2004; 2:15–20. [PubMed: 15025789]
- Malmberg A, Lewis G, David A, Allebeck P. Premorbid adjustment and personality in people with schizophrenia. *British Journal of Psychiatry*. 1998; 172:308–313. [PubMed: 9715332]

- McCrae RR, Costa PT Jr, Martin TA, Oryol VE, Rukavishnikov AA, Senin IG, H ebí ková M, Urbánek T. Consensual validation of personality traits across cultures. *Journal of Research in Personality*. 2004; 38:179–201.
- McCrae, RR.; Costa, PT, Jr. *Personality in adulthood: A five-factor theory perspective*. New York: The Guilford Press, a division of Guilford Publications, Inc; 2003.
- McMillan KA, Enns MW, Cox BJ, Sareen J. Comorbidity of axis I and II mental disorders with schizophrenia and psychotic disorders: Findings from the national epidemiological survey on alcohol and related conditions. *Canadian Journal of Psychiatry*. 2009; 54:477–486.
- Meehl PE. Schizotaxia revisited. *Archives of General Psychiatry*. 1989; 46:935–944. [PubMed: 2552952]
- Mesholam-Gately RI, Giuliano AJ, Goff KP, Faraone SV, Seidman LJ. Neurocognition in first-episode schizophrenia: A meta-analytic review. *Neuropsychology*. 2009; 23:315–336. [PubMed: 19413446]
- Moore EA, Green MJ, Carr VJ. Comorbid personality traits in schizophrenia: Prevalence and clinical characteristics. *Journal of Psychiatry Research*. 2012; 46:353–359.
- Nuechterlein KH, Barch DM, Gold JM, Goldberg TE, Green MF, Heaton RK. Identification of separable cognitive factors in schizophrenia. *Schizophrenia Research*. 2004; 72:29–39. [PubMed: 15531405]
- Ohi K, Hashimoto R, Yasuda Y, Fukumoto M, Yamamori H, Iwase M, Kazui H, Takeda M. *Psychiatry Research*. 2012 Mar 5. e-pub ahead of print.
- Rajji TK, Ismail Z, Mulsant BH. Age at onset and cognition in schizophrenia: Meta-analysis. *British Journal of Psychiatry*. 2009; 195:286–293. [PubMed: 19794194]
- Salisbury DF, Kuroki N, Kasai K, Shenton ME, McCarley RW. Progressive and interrelated functional and structural evidence of post-onset brain reduction in schizophrenia. *Archives of General Psychiatry*. 2007; 64:521–529. [PubMed: 17485604]
- Salisbury DF, Shenton ME, Sherwood AR, Fischer IA, Yurgelun-Todd DA, Tohen M, McCarley RW. First-episode schizophrenic psychosis differs from first-episode affective psychosis and controls in P300 amplitude over left temporal lobe. *Archives of General Psychiatry*. 1998; 55:173–180. [PubMed: 9477932]
- Sergi MJ, Rassovsky Y, Widmark C, Reist C, Erhart S, Braff DL, Marder SR, Green MF. Social cognition in schizophrenia: Relationships with neurocognition and negative symptoms. *Schizophrenia Research*. 2007; 90:316–324. [PubMed: 17141477]
- Sheskin, DJ. *Handbook of parametric and nonparametric statistical procedures*. 4th edition. Boca Raton, FL: Chapman & Hall/CRC; 2007. p. 1310
- Smith TE, Grabstein E, Kentros M, Kulchicky S, Borgaro S. Axis II diagnoses and treatment refractoriness in schizophrenia. *Psychiatric Quarterly*. 1996; 67:51–64. [PubMed: 8623039]
- Smith TE, Shea MT, Schooler NR, Levin H, Deutsch A, Grabstein E. Studies of schizophrenia: personality traits in schizophrenia. *Psychiatry*. 1995; 58:99–112. [PubMed: 7568541]
- Spitzer, RL.; Williams, JBW.; Gibbson, M.; First, M. *The structured clinical interview for DSM-III-R (SCID)*. Washington, DC: American Psychiatric Association; 1990a.
- Spitzer, RL.; Williams, JBW.; Gibbson, M.; First, M. *The structured clinical interview for DSM-III-R-non-patient edition (SCID-NP)*. Washington, DC: American Psychiatric Association; 1990b.
- Spitzer, RL.; Williams, JBW.; Gibbson, M.; First, M. *The structured clinical interview for DSM-III-R-personality disorder (SCID-II)*. Washington, DC: American Psychiatric Association; 1990c.
- Tien AY, Costa PT, Eatonl WW. Covariance of personality, neurocognition, and schizophrenia spectrum traits in the community. *Schizophrenia Research*. 1992; 7:149–158. [PubMed: 1515376]
- van Ammers EC, Sellman JD, Mulder RT. Temperament and substance abuse in schizophrenia: is there a relationship? *Journal of Nervous and Mental Disease*. 1997; 185:283–288. [PubMed: 9171804]
- van OS J, Jones PB. Neuroticism as a risk factor for schizophrenia. *Psychological Medicine*. 2001; 31:1129–1134. [PubMed: 11513380]
- Vesterager L, Christensen TØ, Olsen BB, Krarup G, Melau M, Forchhammer HB, Nordentoft M. Cognitive and clinical predictors of functional capacity in patients with first episode schizophrenia. *Schizophrenia Research*. 2012; 141:251–256. [PubMed: 23017825]

- Wechsler, DA. Wechsler adult intelligence scale - III manual. New York: Psychological Corporation; 1997.
- Wiggins J, Pincus A. Conceptions of personality disorders and dimensions of personality. *Psychological Assessment*. 1989; 1:305–316.
- Wiggins, JS. The five-factor model of personality. New York: Guilford Press; 1996.
- Williams PG, Suchy Y, Kraybill ML. Five-factor model personality traits and executive functioning among older adults. *Journal of Research in Personality*. 2010; 44:485–491.
- Wilson RS, Schneider JA, Arnold SE, Bienias JL, Bennett DA. Conscientiousness and the incidence of Alzheimer disease and mild cognitive impairment. *Archives of General Psychiatry*. 2007; 64:1204–1212. [PubMed: 17909133]
- Witt LA, Ferris GR. Social skill as moderator of the conscientiousness-performance relationship: Convergent results across four studies. *Journal of Applied Psychology*. 2003; 88:809–820. [PubMed: 14516246]
- Wright C, Williams D, Feczko E, Barrett LF, Dickerson BC, Schwartz CE, Wedig MM. Neuroanatomical correlates of extraversion and neuroticism. *Cerebral Cortex*. 2006; 16:1809–1819. [PubMed: 16421327]

Figure 1.

Mean personality T scores by subject group: neuroticism (N), extraversion (E), openness (O), agreeableness (A), and conscientiousness (C). Vertical bars represent standard deviations; * $p < .05$, ** $p < .01$, *** $p < .0001$, **** $p < .00001$ (see Table 3).

Figure 2.

Scatterplots of personality dimension scores against symptom and neuropsychological factor scores, by group, with corresponding simple linear regression lines (Table 5). Control data are presented in first column, patient data in second and third columns. In controls the attention/planning component had the highest loadings for both Trails tasks and Symbol Digit, and the memory component had the highest loadings for Information, Digit Span and Vocabulary. In patients the memory component had the highest loadings for Information, Digit Span, Digit Symbol, and Vocabulary, whereas the attention/planning component had the highest loadings for both Trails tasks.

TABLE 1

Demographic Data by Group

Variable	Schizophrenia (N=30)				Controls (N=62)			
	Mean	S.D.	Mean	S.D.	t	df ^a	p	
Age (years)	25.2	6.9	24.8	1.6	.295	30.50	.770	
PSES	1.53	.86	1.47	.80	.359	90	.721	
SES	3.20	1.27	2.13	1.11	4.140	90	.000	
Education (years)	14.0	2.1	16.4	1.25	-5.723	39.38	.000	
Sex (M/F)	21/9 (70%/30%)		38/24 (61.3%/38.7%)		.667	1	.491	
Race					χ^2	df	p	
White	76.7%		82.3%		8.947	4	.030	
Black	20.0%		6.5%					
Asian	0.0%		9.7%					
Native Hawaiian or Pacific Islander	3.3%		0.0%					
American Indian or Alaskan Native	0.0%		1.6%					

^a Degrees of freedom <90 when group variances unequal.

TABLE 2

Mean (S.D.) Clinical Data by Group

Variable	Schizophrenia (N=30)	Controls (N=62)	Statistic	
SANS	9.60 (6.49)			
SAPS	9.90 (5.19)			
PANSS ^a				
Positive	20.80 (3.95)			
Negative	17.57 (7.18)			
General	35.20 (7.85)			
Depression	9.53 (4.31)			
Information	12.17 (2.84)	14.47 (2.05)	<i>t</i>	<i>p</i>
Digit span	9.37 (1.87)	12.68 (2.64)	-3.966	44.06 .000
Symbol Digit	7.40 (2.39)	12.31 (3.08)	-6.925	77.75 .000
Trails A	43.80 (10.17)	51.40 (5.77)	-7.671	90 .000
Trails B	39.67 (20.85)	56.47 (11.22)	-3.810	38.30 .000
Vocabulary	12.90 (2.52)	15.06 (1.96)	-4.134	37.35 .000
			-4.134	46.47 .000

^a All PANSS scales were computed according to the PANSS manual (Kay et al, 1986).^b Degrees of freedom <90 when group variances unequal.

TABLE 3

Mean (S.D.) Personality Measures by Group

Variable ^a	Schizophrenia (N=30)	Controls (N=62)	F	df	p
Neuroticism	58.92 (10.29)	42.02 (8.18)	72.701	1,90	.000
Extraversion	44.57 (14.96)	56.82 (9.84)	21.995	1,90	.000
Openness	55.95 (10.35)	60.41 (8.84)	4.600	1,90	.035
Agreeableness	46.87 (12.97)	54.31 (10.37)	8.821	1,90	.004
Conscientiousness	39.76 (15.45)	51.19 (9.51)	19.076	1,90	.000

^aT scores were computed using gender-specific population norms. T scores are defined as having population mean = 50 and S.D. = 10.

TABLE 4
Correlations of Symptom and Neuropsychological Factors with Personality Traits by Group

NEO Scales ^a	N		E		O		A		C	
	r	p	r	p	r	p	r	p	r	p
Schizophrenia Group										
Negative symptoms factor (1)	.471	.009	-.291	.119	-.166	.379	-.172	.364	-.464	.010
Positive symptoms factor (2)	.085	.655	.064	.735	.001	.998	-.153	.420	-.179	.344
General symptoms factor (3)	.247	.188	-.276	.139	-.159	.401	-.235	.211	-.280	.134
Memory factor (1)	-.081	.669	-.103	.590	.540	.002	-.169	.372	.203	.282
Attention/planning factor (2)	-.260	.166	.491	.006	-.008	.965	.230	.222	.619	.000
Control Group^{a,b}										
Attention/planning factor (1)	-.446	.000	-.098	.457	.131	.319	.070	.596	.056	.671
Memory factor (2)	-.127	.334	-.019	.883	.335	.009	.050	.702	-.207	.113

^aN= Neuroticism, E= Extraversion, O= Openness, A= Agreeableness, C= Conscientiousness

^bCorrelations computed after excluding 2 subjects with extreme values on conscientiousness and verbal memory.

Table 5
Linear Regression on Personality Traits with Symptom and Task Performance Factors as Independent Variables

Symptom and Task Performance Factors in Schizophrenia Patients										
Model	Sum of Squares	df	Mean Square	F	p	R	R²	Adj. R²	R²	FACTOR
NEUROTICISM										
1 Regression	680.87	1	680.87	7.985	.009	.471	.222	.194	.222	Negative symptoms
Residual	2387.41	28	85.26							
EXTRAVERSION										
1 Regression	1563.87	1	1563.87	8.892	.006	.491	.241	.214	.241	Attention/planning
Residual	4924.55	28	175.88							
OPENNESS										
1 Regression	907.40	1	907.40	11.540	.002	.540	.292	.267	.292	Memory
Residual	2201.71	28	78.63							
CONSCIENTIOUSNESS										
1 Regression	1489.68	1	1489.68	7.673	.010	.464	.215	.187	.215	Negative symptoms
Residual	5436.04	28	194.14							
2 Regression	3724.38	2	1862.19	15.706	.000	.733	.538	.504	.323	Negative symptoms
Residual	3201.34	27	118.57							Attention/planning
Task Performance Factors in Controls										
NEUROTICISM										
1 Regression	757.44	1	757.44	14.422	.000	.446	.199	.185	.199	Attention/planning
Residual	3046.22	58	52.52							
OPENNESS										
1 Regression	525.90	1	525.90	7.351	.009	.335	.112	.097	.112	Memory
Residual	4149.64	58	71.54							

Table 6
Linear Regression on Personality Traits with Diagnosis and Task Scores as Independent Variables

Model	Sum of Squares	df	Mean Square	F	p	R	R ²	Adj. R ²	R ²	VARIABLE	beta	p
NEUROTICISM												
1 Regression	5731.65	1	5731.65	73.40	.000	.674	.455	.449	.449	Diagnosis	.674	.000
Residual	6871.95	88	78.09									
2 Regression	6676.60	2	3338.30	49.002	.000	.728	.530	.519	.070	Diagnosis	.451	.000
Residual	5926.99	87	68.13							Digit Symbol	-.353	.000
EXTRAVERSION												
1 Regression	3129.14	1	3129.14	23.068	.000	.456	.208	.199	.208	Diagnosis	-.456	.000
Residual	11937.34	88	135.65									
2 Regression	3816.16	2	1908.08	14.755	.000	.503	.253	.236	.037	Diagnosis	-.352	.001
Residual	11250.32	87	129.31							Trails A	.237	.024
OPENNESS												
1 Regression	399.21	1	399.21	4.513	.036	.221	.049	.038	.049	Diagnosis	-.221	.036
Residual	7784.64	88	88.46									
2 Regression	1759.11	2	879.55	11.910	.000	.464	.215	.197	.159	Diagnosis	-.032	.757
Residual	6424.75	87	73.85							Vocabulary	.449	.000
AGREEABLENESS												
1 Regression	1023.13	1	1023.13	7.983	.006	.288	.083	.073	.083	Diagnosis	-.288	.006
Residual	11278.90	88	128.17									
CONSCIENTIOUSNESS												
1 Regression	3012.54	1	3012.54	23.882	.000	.462	.213	.205	.213	Diagnosis	-.462	.000
Residual	11100.38	88	126.14									
2 Regression	4556.54	2	2278.27	20.741	.000	.568	.323	.307	.102	Diagnosis	-.301	.003
Residual	9556.39	87	109.84							Trails A	.368	.000