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Towards Dimensionality in Psychosis: A Conceptual Analysis  
of the Dimensions of Psychosis Symptom Severity

Jessica Abigail Carmona

A thesis submitted to the faculty of  
Brigham Young University  
in partial fulfillment of the requirements for the degree of  
Master of Science

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## ABSTRACT

### Towards Dimensionality in Psychosis: A Conceptual Analysis of the Dimensions of Psychosis Symptom Severity

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Given the heterogeneity of symptoms allowed in the diagnosis of psychotic disorders, as well as other challenges of categorical diagnosis (e.g., First et al., 2002; Krueger, 1999), the increased specificity brought by dimensional ratings of underlying features is often important. Models using the factorial structure of psychotic symptoms perform as good as or better than traditional categorical models (Allardyce, Suppes, & Van Os, 2007). DSM-5 has provided such a system of ratings to aid clinicians, the *Clinician Rated Dimensions of Psychosis Symptom Severity Scale* (PSS; APA, 2013). In this approach, the clinician rates symptom severity in eight domains which emphasize traditional psychotic symptomatology, cognition, and mood. Given its accessibility and the support of the DSM-5, it is possible that the measure could achieve wide use. However, little is known about the measure and the challenges of applying it in clinical settings. This study is a conceptual analysis of the conceptual foundation of the PSS, including its psychometric properties, applications, and demonstrated validity. It is also compared to the widely used Brief Psychiatric Rating Scale – Revised (BPRS-R).

The PSS is more concise than other measures, and five of the PSS domains parallel the DSM-5's "Key Features That Define the Psychotic Disorders" (p. 87-88) (although the brief instructions of the PSS differ at times from DSM-5 definitions, and little in the way of definition is offered in the PSS itself). In contrast, no rationale is given for adding the remaining three domains. The dimensional model of the PSS has similarities to the factor structure typically found for symptomatology in psychotic disorder, but a number of important differences are noted. The data required for making ratings is never defined, although the only mention of data that might be helpful for rating one of the domains depends upon extensive testing. Although anchors for the ratings might, at first glance, appear to be given in the PSS, in fact, they offer almost nothing beyond the adjectives of "equivocal," "mild," "moderate," and "severe." Finally, we found that very little research exists on the PSS, no field trial was done, psychometric properties are largely unknown, and normative data is unavailable.

The PSS is brief and provides a quick way to rate the severity of the five key features of psychosis required by DSM-5 diagnoses. Thus, it can work as a quick quantification of these features. Beyond this its utility is unknown, and it appears to lack the specificity of other rating scales, such as the BPRS-R.

Keywords: PSS, psychosis, inpatient, SMI, dimensionality, conceptual analysis

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Towards Dimensionality in Psychosis: A Conceptual Analysis  
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**Background**

The fifth publication of *The Diagnostic Statistical Manual* (American Psychiatric Association, 2013) like the ones before it, has introduced new elements to the mental health field. Perhaps, one of the most prominent changes and recurrent themes is the beginning of a cautious introduction of a dimensional approach to the conceptualization of psychopathology. The presence of dimensionality is not very marked, but it can be seen in the new arrangement of disorders and the introduction of measures especially designed to capture critical dimensions of psychopathology. The concept of dimensionality has a strong research base, but our short somewhat successful history with categorical diagnoses keeps us from fully embracing this new diagnostic system. Ambivalence is to be expected, but as researchers, as clinicians, we should be able to review available data before making informed decisions. This conceptual analysis focuses on assessing the adequateness of a dimensional model in the conceptualization and measurement of psychosis. It offers a concise review of the relevant literature, and it identifies areas of improvement in this developing area in psychology.

**Categorical and Continuous Models of Psychopathology**

**Medical roots.** With the decline of the asylum model (with its intent to provide a protected environment, but often deteriorating to warehousing and a means to remove the disordered from society), alternative ways to employ the emerging science of psychology were needed. Medicine stood at the ready. Historically, those most interested in mental disorders at that time were physicians. For example, Rush, the father of American psychiatry, promoted treatment within hospitals (Comer, 2010), and such treatment was naturally provided by



physicians. Similarly, most early 20<sup>th</sup> Century figures in the field were physicians, such as Breuer, Freud, Jung, Kraepelin, and Bleuler. Disorders became “mental illnesses,” a term readily and widely adopted as a de-stigmatizing label (Comner, 2010).

Not surprisingly, then, the model for organizing and describing the mental disorders was also borrowed from medicine. The medical model of diagnosis was itself borrowed from biology, which employed the notion of taxons—essentially, categories or discrete populations of organisms which share essential features. The assumption of taxonomy is that properly formed groups are discrete in nature, such that the essential features are shared by all in the population, but not by other taxons. Some features are broadly distributed and others narrowly distributed, creating hierarchical organizations of the taxa. Thus, mammals all have hair and give birth to live young; in contrast, reptiles have scales and are cold-blooded. This system evolved and remains sustainable because such distinctions are found in nature; that is, the taxonomy captures the qualities of nature, and only a few exceptions exist (e.g., the duck-billed platypus). Such categorical organization within medicine often worked. A bone was broken or it was not, an ulcer was present or it was not, and a serious contagion, such as smallpox, was present or not. Such definitive representation of biological condition seemed perfectly satisfactory for 19<sup>th</sup> Century medicine. Further, it parallels the way people seem to think about the world, in that it seems easier to place things into categories and give them a label rather than organizing in some other fashion.

This was further promoted at the beginning of the 20<sup>th</sup> Century by emerging understanding of genetics. Genes drove phenotypic expression, and as genes were discrete (an individual has one or two of a limited set of alleles), so was the phenotypic under Mendelian distributions of gene dominance. That biological structure paralleled one’s genes was an

exciting idea and promoted an expectation that the discrete nature of genes would be replicated in psychopathology. Only later did we recognize that nature did not always follow Mendelian patterns; that penetrance, multifactorial genetic contributions, regulator genes, and gene-environment interactions were commonplace and critical to phenotypic expression; and that the complexity of thought and behavior rarely yielded to simple genetic models as did the early, obvious examples of physical structure. As the science of psychology emerged, it became increasingly evident that new knowledge could not be easily incorporated into the categorical models that suited the theories of early 20<sup>th</sup> Century psychopathologists.

**Modern categorical models of psychopathology.** The dominant system of psychiatric diagnosis is the DSM system of the American Psychiatric Association. The *Diagnostic and Statistical Manual of Mental Disorders*, first published in 1952, is now in its fifth edition (APA, 2013). Others predated this, such as the categories noted in the U.S. census (1840 census with one category; 1880 census with seven). Kraepelin, often noted as the father of modern psychodiagnosis, believed that different kinds of mental illness were natural entities, and that scientific methods would sooner or later arrive at these entities. He, for example, distinguished what was previously lumped into a single category of psychosis, into what he called “manic depression” (now bipolar disorder and recurrent major depression) and “dementia praecox” (now included within schizophrenia).

Throughout its history, the DSM has employed categorical models, but researchers have long noted that measures of psychiatric conditions, as described by the DSM, are not usually bimodally distributed (Widiger, & Samuel, 2005). Thus, rules for creating a category are necessarily fuzzy and rely heavily upon accompanying generic features of help-seeking, distress, and lowered functioning. Diagnostic rules are designed to minimize both false positives and

false negatives, but otherwise appear somewhat arbitrary. For example, is an individual with the required five of nine symptoms under Major Depressive Disorder disordered, whereas a person with only four symptoms is not?

The discrete nature of psychiatric diagnosis is most present in two forms. First, there is a clear attempt to determine “which” diagnosis is the correct one. Although diagnoses are organized into broader categories because of shared features, there is no formal hierarchy to the DSM system. Typically, diagnoses represent a syndrome, consisting of a collection of symptoms which presumably covary to a greater degree within that category than within any other category or across categories. To account for the noise introduced by focus on less directly-observable and environmentally-influenced psychological features, the full set of features/symptoms with any given category is generally regarded as a prototype, and actual cases are included if they merely approximate the prototype. Given this fuzziness, methods have arisen to provide a diagnosis in cases where the person meets criteria for more than one condition based on the same symptoms, or meets no condition’s criteria but is seemingly disordered with features “of the type” represented by a disorder or collection of disorders (such as Not Otherwise Specified or Unspecified diagnoses); unfortunately, these “don’t fit diagnoses” are sometimes quite commonly used, as many cases seen in treatment centers do not fit the prototypes very well (Button, Benson, Nollett, & Palmer, 2005; Verheul, & Widiger, 2004).

Second, the discrete nature of DSM diagnosis is present in the system’s reliance upon the “presence” of symptoms. This places considerable burden upon the diagnostician to determine if a behavior, cognitive pattern, or emotional state matches what the DSM definition of a symptom. Consider, for example, the first symptom of Major Depressive Disorder, that of “depressed mood.” One could reasonably ask questions about type, such as, do my client’s thoughts

represent a depressed mood; or of quantity/severity, such as, how depressed does it need to be, or how often does such mood need to be present. DSM-5 tries to help the diagnostician with phrases such as “most of the day,” “nearly every day,” and “by subjective report,” but the mere fact that we need that help, and naturally wonder if a client’s mood state matches a prototype, is an admission that we are trying to convert a quantitative feature into a dichotomy.

**Lessons from personality theory and personality disorders.** The area in which dimensionality has perhaps been studied the most is in the conceptualization of personality, and its underlying attributes. As Axis II was created in the third edition of the DSM, with better specification of criteria and an expectation of a solid research base, researchers and clinicians became more interested in personality disorders. With this interest came dissatisfaction with the categorical diagnoses that were described in the DSM-III. As in other areas of psychopathology, there were concerns with high comorbidity rates among personality disorders, ambiguous boundaries with normal personality traits, unclear boundaries among mental disorders, and the utility of personality pathology categories in treatment planning and diagnosis (First et al., 2002). Axis II was intended to emphasize, as does the concept of personality, disorders that are pervasive and enduring. It soon became increasingly evident that considering some disorders “personality-like” and others not was itself an unsupportable dichotomy. Rather, as knows any clinician who relies upon psychometrically based instruments (e.g., MMPI) to aid in understanding psychopathology, symptoms, associated features, distress, coping, and the like are often best understood as matters of degree, intensity, or frequency, and typically obtain meaning by comparison to norms.

An alternative to the conceptualization of personality disorders as discrete categories is to see personality disorders as maladaptive variations of normal personality traits. This is not a

new idea; in fact, dimensional changes were considered in the DSM- IV and its revision (American Psychiatric Association, 2000). However, these changes were not implemented due to a lack of a widely-accepted, integrative, dimensional approach to measuring personality pathology and a general reluctance to create a radical change in the way that personality disorders are conceptualized. As research moved forward, different research laboratories provided support for a dimensional approach to personality. Models such as the Five Factor Model (Widiger & Costa, 1994) and the Schedule for Nonadaptive and Adaptive Personality (SNAP) (Clark, 1993) were created. Although different models were created, these tended to overlap, relying upon a structure of pathology with about four to five broad trait domains of personality. Under one model, these include: emotional dysregulation/negative affect, introversion, antagonism, irresponsibility and peculiar/odd behavior and thinking (Krueger, Eaton, South, Clark, & Simms, 2011). These five dimensions tend to add incremental validity to personality disorders and, perhaps beginning with Harkness and McNulty's (1994) Personality Psychopathology Five, or PSY-5, can be conceptualized as the negative ends of the five factor model continua (Widiger & Costa, 1994). These parallel non-pathological traits normally used to describe personality in nonpathological populations: neuroticism, extroversion, agreeableness, conscientiousness, and openness to experience.

### **Advantages of Dimensional Models**

Upon first impression, dimensional models in psychopathology might appear needlessly complicated and convoluted. It is a valid concern, given that as a discipline we are accustomed to the false ease that comes with categorical diagnosis. However, given the extensive research published in the last two decades, it is time to move towards the implementation of dimensional models in the conceptualization of psychopathology. Discussed below are some benefits that

could come about from the use of dimensional models, as presented by Widiger and Samuel (2005).

**Improvements in disorder definitions.** Currently, comorbidity between disorders is the rule rather than the exception (Krueger, 1999). Dimensional models explain these communalities between disorders. For example, mood disorders tend to be comorbid with anxiety disorders. Under the current categorical model it is assumed that the individual has two different disorders with different etiological causes. Research in internalizing disorders has shown that the comorbidity between mood and anxiety disorders can be explained by a shared dimension, high levels of neuroticism (Griffith, Zinbarg, Craske, Mineka, Rose Waters, & Sutton, 2010). The presence of this dimension in both disorders indicates that there is a common etiological, genetic, or environmental factor that accounts for the shared variance between disorders. Dimensions also help to reduce the ambiguity that comes from overlap in disorder boundaries. This is a common problem in clinical settings where the most often assigned diagnosis is NOS. In a dimensional model the individual needs only be rated along the continua of predefined dimensions. Clinicians need not make an arbitrary decision on whether a criterion is present or not; they just need to rate the quantity or severity. Widiger and Samuel (2005) propose that using dimensional methods could reduce the time spent collecting data in clinical settings because clinicians no longer need to spend time collecting data to rule out disorders.

Dimensional models can help in the creation of appropriate clinical definitions of psychiatric disorders. With time these could be improved and aid in the research of biological, genetic and other physiological factors that contribute to the development of disorders. Also, clinicians would be provided with useful, idiographic, descriptive diagnosis of their clients.

**Real-world diagnosis.** Clinicians often collect data in order to make a clinical diagnosis, including dimensional data. Diagnosis, however, dichotomizes this data (criteria is met or not), encouraging disregard of the more complete dimensional data. Dimensional models provide an alternative in which clinicians are able to keep relevant information about their clients in the diagnosis. The conceptualization of clients using dimensions also allows for individualized profiles of clients, which is not possible with categorical models. The use of categorical diagnosis allows clinicians to know that a client is depressed, but it does not specify the symptoms that led to the diagnosis. In fact, in the case of Obsessive–Compulsive Personality Disorder it is theoretically possible to have two clients with the same diagnosis that do not share a single diagnostic feature (Krueger, Watson, & Barlow, 2005). This often leads to problems in treatment planning, where it is necessary to target the specific symptoms that are causing impairment or distress. Once a dimensional model is defined, specific dimensions can be targeted for the development of treatment programs.

### **Dimensional Elements of DSM-5**

**New disorder clusters.** The fifth edition of the DSM represents the beginning of a shift towards dimensionality in the way that clinicians and researchers conceptualize psychopathology. With this in mind, there was a regrouping of mental disorders in such a way that newly formed clusters represent commonalities between disorders, thus creating something of a hierarchy that reflects result from dimensional research. This system separates most psychiatric disorders into two broad clusters, externalizing and internalizing disorders. Internalizing disorders are characterized by depressive, anxiety, and somatic presentations. Externalizing disorders are driven by impulsiveness, disruptive behavior, and substance abuse.

Beyond that, DSM-5 organization is meant to reflect commonality of symptoms and the role they might play in the search of etiology factors.

**Severity specifiers.** Also, severity specifiers have been included for some DSM-5 disorders to capture the intensity, frequency and duration of symptoms within that categorical diagnosis. Thus, attempts were made to provide, within diagnosis, more differentiating information along a severity dimension. This is not surprising, given the converging evidence that more severe symptomatology commonly co-occurs with earlier emergence, more frequent and longer-lasting episodes, and greater comorbidity (McKetin, McLaren, Lubman, & Hides, 2006; Portugal, Martinez, Gonzalez, Amo, Haro & Cervilla, 2011). In some cases, these severity indicators are suggestive of other important distinctions, such as functional impairment, disorder subtype, and treatment response (Ganjekar, Desai, Chandra, 2013; Rabinowitz, Smedt, Harvey, & Davidson, 2002; Smith et al., 2011). It is expected that the study of current disorder clusters could lead to the development of dimensional models that could explain the overlap between disorders and, hopefully, the etiology behind them.

**The DSM-5 alternative model for personality disorders.** The DSM-5 alternative model for personality disorders provides a helpful illustration of how dimensionality can be introduced into traditional psychodiagnosis. The inclusion of a dimensional model for personality disorders in the DSM-5 generated considerable debate. Ultimately, due to uncertainties as to inertia among the community of practitioners and how the new model would be perceived, and in spite of the recommendation of the DSM-5 Personality Disorders Subcommittee, it was decided to keep categorical diagnoses. The dimensional model developed and recommended by the Subcommittee was included as an alternative model under Section III, Emerging Measures and Models, of the DSM-5 (APA, 2013). Under this model, personality



disorders are viewed as maladaptive patterns of behaviors that are derived from normal personality traits (and hence, towards the end of a continuum of normal personality variability). Individuals must show impaired personality functioning, Criterion A being that impairment must be evident in two or more of four personality areas: identity, self-direction, empathy and, intimacy. In keeping with a dimensional model, these domains of functioning are assessed on a continuum. This alternative model retains use of well-validated clusters of symptomology for diagnosis that have been reasonably well-validated (such as Borderline Personality Disorder), but also adds a method for rating clients in terms of pathological traits, including those who might not present with a known syndrome of these traits.

To aid in the identification of pathological personality traits, the Subcommittee also introduced the Personality Inventory for DSM-5 (PID-5), which is a scale measuring five personality psychopathological domains and 25 underlying facets, following a measurement model very similar to Costa and McCrae's (1992) NEO Personality Inventory. Initial results have reported good internal consistencies for the 25 facets ( $\alpha > .70$ ) and the five domain's ( $\alpha > .90$ ) (Fossati, Krueger, Markon, Borroni, & Maffei, 2013). The original five-factor structure has also been replicated, which provides support for the five-factor model of psychopathology and the PID-5's ability to measure these five domains and its facets.

**Conclusion.** The inclusion of new disorder clusters based on underlying dimensional modalities, severity specifiers and the introduction of new dimensional measures to the DSM-5 are important inclusions that will likely lead to improvements in the way that psychopathology is diagnosed and treated. These small additions represent a small step towards dimensionality that is likely to open the field to broader adoptions of dimensionality and to more complex dimensional methods in the future.

## Psychosis

As in personality disorders and other disorders of general psychopathology, questions have been raised regarding the utility of categorical diagnosis in treatment planning and conceptualization of psychosis. This argument is of particular importance because progress and new discoveries in the understanding of psychosis have become stagnant. According to Heckers and colleagues (2013), this lack of progress could be, in part, attributed to limitations in our current definitions of psychopathology (Allardyce, Suppes & van Os, 2007). The current categorical system has allowed clinicians and researchers to communicate effectively and has led to identifying risk factors for psychotic conditions. However, the fact that a specific etiology for disorders such as schizophrenia and other psychotic disorders has yet to be identified may indicate that there are deficits in our current conceptualization of psychosis.

Even though it has long been identified, and is commonly viewed as relatively distinct from other forms of mental disorder, psychosis itself is rarely clearly defined. Attempts to define it start with a description of general loss of contact with reality followed by a listing of symptoms that are indicative of psychosis, i.e., somewhat commonly found in persons with psychosis but not otherwise common. Symptoms that are commonly cited include disorganization and both “positive” and “negative symptoms” (Comer, 2010). For example, diagnosis of schizophrenia, according to DSM-5, requires symptoms within at least two of five broad symptom clusters, allowing for the common finding that two people, both with a diagnosis of schizophrenia, may not share a single symptom in common. In addition, although not always recognized as differential indicators of psychosis mood and cognitive deficits are often present in psychotic disorders and tend to be important in prognosis and treatment outcomes even though

they are not distinctive of psychosis (Bowie, Reichenberg, Patterson, Heaton, & Harvey, 2006; Green, Kern, Braff, Mintz, 2000).

The “distinctiveness” of psychosis is suggestive of a discrete category, and this is emphasized by common definitions, such as *loss* of contact with reality or *presence* of delusions or thought disorder. Symptoms of full-blown psychosis do tend to co-occur and are relatively rare, at least when described in their extreme form, in persons not thought to be psychotic. Thus, a general notion prevails that psychosis is not only distinctive, but also distinct. In practice, however, it is not uncommon to encounter cases which fall on the borders, and we frequently note that persons who carry life-long diagnoses of psychosis, such as schizophrenia, may not be “actively psychotic” much of the time. So, how much distortion of reality is required before contact is considered lost? At what point does magical thinking become delusional? When are pleasure, interest, and motivation low enough to be regarded as indicative of negative symptomatology? The answers are always addressed with dimensional data, particularly as we examine individual elements which are (often vaguely) implied by the label of psychosis.

### **Taxa versus Dimensions**

For more than 100 years the field has relied on a Kraepelinian categorization of psychotic disorders, wherein every disorder is assumed to be a single unit or disease (Heckers, 2008). However, recent research finds that psychotic disorders may be better conceptualized dimensionally (Allardyce et al., 2007; Demjaha et al., 2009; Dikeos et al., 2006; Heckers et al., 2013). Support for a dimensional approach to psychotic disorders has come from research that has reported the existence of subclinical levels (not just undiagnosed) of psychotic symptoms in the general population (Van Os, Hanssen, Bijl, & Volleberg, 2001). Subthreshold symptoms of mania and depression (dysthymia) have also been found in non-clinical samples (Allardyce et al.,

2007). This evidence indicates that the presence of psychotic symptoms is not likely to be dichotomous, where a clinician must make a decision only on whether a symptom is present or not. Rather psychosis itself can be seen as a dimension where it can be present in normal populations, even if the distribution is highly skewed, but is only indicative of psychopathology at high levels and not at the lower levels that can be found in the general population.

### **The Structure of Psychotic Symptoms**

A number of studies have explored the dimensionality of psychotic disorders using factor analytic methods (Demjaha et al., 2009; Dikeos et al., 2006). In these studies researchers collect data on relevant criteria and correlates known to be associated with the presence of psychosis. Examples of data that may be collected include: age of onset, length of hospital stay, neurological correlates, symptoms and other psychiatric history descriptors. Although the strength of the factor analytic loadings fluctuates depending on the sample and the variables included, it is common to find a five-factor model (Demjaha et al., 2009; Dikeos et al., 2006; Hecker et al., 2013). The factors that are commonly found are: positive symptoms, negative symptoms, disorganization, depression and mania. Even with such convergence, the factors together typically account for only about 50% of the variability of items analyzed, suggesting, as is commonly found in other lines of research, that additional and more specific information may be lost by only considering factor data; further, it was common in these studies to exclude items which applied to a small proportion of subjects, but which may have important implications for them (such as catatonia). Further research has shown that some of these factors or dimensions tend to vary depending on the disorder that is being studied. For example, schizophrenia tends to exhibit a three-factor model in which positive symptoms, negative symptoms and disorganization are present (Allardyce et al., 2007).

Studies that compared categorical and dimensional approaches to psychosis used these previously discussed five factors to study dimensionality in psychotic disorders (Demjaha et al., 2009; Dikeos et al., 2006; Hecker et al., 2013). A consistent finding has been that dimensions are as good or better predictors of outcomes in psychotic populations than categorical representations of disorders. The difference is statistically significant, although the actual magnitude of the increase in predictability by using dimensional methods does not appear to translate into large clinical effects (Allardyce et al., 2007; Hecker et al., 2013).

### **The Dimensions of Psychosis Symptom Severity (PSS) Measure**

#### **The Rationale**

In order to bring these research findings to the field and to provide clinicians and researchers with tools to include dimensionality in traditional categorical diagnosis, the DSM-5 task force developed a number of measures which quantify and organize features of disorders. To encourage broad application of dimensionality which the measures provide, they elected to use new, essentially untested measures which clinicians could freely copy. That, and the stamp of approval by the DSM, makes it very likely these measures will be widely used. For psychosis, the proposed dimensional measure is the Clinician Rated Dimensions of Psychosis Symptom Severity (PSS; American Psychiatric Association, 2013). Although the PSS may be thought of as a scale, technically it is not. There is no indication that the ratings are to be combined in any way, such as to give an overall score for psychosis, severity, or the like. Also, no theory that ties the ratings together is referenced; rather, the measure's elements seem to exist merely to represent symptom coverage. The measure is a series of ratings made by a clinician to note the severity of psychotic symptoms in eight domains emphasizing traditional psychotic symptomatology, cognition, and mood. The dimensions are hallucinations, delusions,

disorganized speech, abnormal psychomotor behavior, negative symptoms, impaired cognition, depression and mania. Barch and colleagues (2013) explain the rationale for the inclusion of some of the eight dimensions that make up this measure.

**Hallucination and delusion dimensions.** In the case of delusions and hallucinations, it could be argued that those should belong to one dimension, since both are related to loss of contact with reality. However, the DSM-5 task force decided to leave them as two separate dimensions because some disorders present delusions, but not hallucinations. Also, the treatment of these two psychotic symptoms tends to be approached somewhat differently.

**Negative symptoms dimension.** The item for the rating of negative symptoms encompasses two domains: restricted emotional expression and avolition. According to the literature reviewed by Barch and colleagues (2013), these two domains are likely to be somewhat distinct from each other. However, they are highly correlated, and there is no knowledge of efficacious treatments for these domains. Therefore, in order to keep the PSS short the DSM-5 Task Force decided to combine both domains into one dimension.

**Depression and mania dimensions.** Lastly, depression and mania were added because of the presence of mood dimensions in psychotic symptoms. The presence of mood pathology in psychotic disorders tends to provide relevant information about treatment, outcome, and prognosis (Green et al., 2000).

According to the APA (2013), the implementation and use of this measure is likely to help in treatment planning, prognostic decision-making, and research on pathological mechanisms. However, this new measure has little research and did not go through clinical trials; thus, the amount of information about its psychometric and clinical utility is limited. The only research article published to date showed support for acceptable reliability, internal

consistency and convergent and diagnostic ability with a severely and persistently mentally ill (SPMI) sample (Ristner, Mar, Arbitman, & Grinshpoon, 2013). Although this provides support for the use of the PSS, there are other considerations that need to be taken into account before deciding if this new measure should be implemented in research or clinical settings.

### **A Measure for the Severely and Persistently Mentally Ill (SPMI)**

The PSS measures the severity of psychotic symptoms. Therefore, it will be used with SPMI populations. There are variations in the way that SPMI status is assigned, but it tends to include three characteristics: diagnosis of non-organic psychosis, treatment duration of two years, and significant levels of functioning impairment (Ruggeri, Leese, Thornicroft, Bisoffi, & Tansella, 2000). Work with this population is difficult because of the severity of the impairment, and improvement in this population is often minimal. According to Burlingame and colleagues (2005), measures to be used as outcome measures for SPMI populations should be normed and sensitive to change in this population, have strong psychometric properties, and show clinical utility. Clinical utility is of particular importance in clinical settings where procedures have to be time and cost efficient. Although there are challenges in the development of reliable and valid measures for SPMI populations there are measures that are being used.

### **Current Methods to Measure Psychosis**

Perhaps one of the most common types of scales used in SPMI populations are those that are clinician rated. The Brief Psychotic Rating Scale (BPRS) is a 16-item measure that was initially constructed to assess outcome in SPMI populations (Overall, & Gorham, 1962). Throughout the years the measure has gone through changes in an effort to improve its predictive ability, psychometric properties, and clinical utility. The most recent version, the Brief Psychiatric Rating Scale- Expanded (BPRS-E), is one of the most widely used outcome measures

in SPMI populations (Burlingame, Dunn, Chen, Lehtnan, Axman, Earnshaw, & Rees, 2005; Ventura, Green, & Shaner, 1993). This clinician rated scale was standardized by Ventura and colleagues (1993) and has shown good psychometric properties. A meta-analysis of exploratory factor analysis of the BPRS has shown four to five consistent factors: positive symptoms, negative symptoms, affect, resistance, and activation (Shafer, 2005). Parallel factor structures have been found when using the improved BPRS-E instead of the original BPRS (Day, 2003; Velligan et al., 2005). Given this information, the BPRS-E might a reasonable candidate to add dimensionality to diagnostic categories. Also, the BPRS-E factors and all but 2 items of the BPRS-E have been found to be sensitive to change (Burlingame et al., 2006).

The use of self-report measures in SPMI populations is not as common as the use of clinician rated scales (Burlingame et al., 2005). However, there are measures that have been specifically designed to meet the needs of measurement in SPMI patients. One of these measures is the Severity Outcome Questionnaire (S-OQ). This scale was created by combining the 30 items of the Life Status Questionnaire (LSQ) and 15 items that were specifically created to assess levels of distress relevant to SPMI individuals. The 30 items of the LSQ come from the original 45 items of the Outcome Questionnaire, which measures levels of distress in clinical populations (OQ-45; Lambert, Burlingame, Umphress, Hansen, Vermeersh, Clouse, & Yanchar, 1996). These items were chosen for their sensitivity to change. The LSQ measures subjective discomfort, interpersonal relationships and social role performance; by adding 15 additional items targeting discomfort in SPMI individuals, S-OQ measures all the original domains plus severity of functional impairment (Lambert et al., 1996).



### **Goals of the Current Study**

The APA introduced the PSS in an attempt to promote the inclusion of dimensionality in categorical conceptualization of psychotic disorders. However, this measure is new and not enough support and information has been provided regarding its development and the advantages that the use of this measure might bring. This issue is of particular importance because current measures with good reliability and validity such as, the BPRS-E and S-OQ, are already in use. The burden of proof, then falls on the newly developed PSS. Since there may not yet be enough research on the PSS, it is important to clarify the strengths and weaknesses of this newly developed measure and to compare its utility to well established measures in the field. The purpose of this study will be to gain a conceptual understanding of the PSS by conducting a conceptual analysis of the measure, including foundation, psychometric properties, applications and demonstrated validity, and by comparing it to a measure that does an appropriate job at structuring and quantifying symptoms of psychosis found in severe mental illness.

### **Conceptual Analysis**

The focus of this conceptual analysis will be to study the adequacy of the theoretical model proposed by the PSS, by reviewing the relevant literature that was used in its development. The clarity of the constructs used, overlap between constructs and the clarity of the instructions provided by the scale will be assessed. The psychometric properties of the scale and its ability to capture meaningful aspects of psychosis will be assessed, as compared to the BPRS-E.

### **Clarity of Constructs Underlying Dimensions**

The first five items of the PSS were designed to go along with Criterion A of schizophrenia (Barch et al., 2013). These five dimensions are postulated as the core

symptomatology of psychosis (APA, 2013). Given this assumption, none of the schizophrenia related disorders can be diagnosed without the presence of at least one of the five core criteria. Thus, given the parallelness of the PSS with the DSM, it can serve as a method for determining if Criterion A is met. The DSM-5 provides definitions of the constructs that make up all five domains, but it does not clarify the origin of the constructs, nor does it provide users with a rationale as to why these domains were chosen to represent the core of psychosis. Also, because the DSM definitions appear to be narrower than those commonly attached to the core criteria labels, confusion may be introduced.

The introduction of this model without a rationale introduces a measure of confusion as to what behaviors and symptoms are relevant for treatment and diagnosis of psychotic disorders. With these five critical domains, the conceptualization moves away from the more traditional dichotomy of negative and positive symptoms. This dichotomy, first introduced by Sir John Reynolds, is often used to describe psychosis in terms of loss of functioning or abilities and the excess or alteration of normal behaviors (Berrios, 1985; Chapman & Chapman, 1973). Although widely used, this dichotomy is not always able to fully encompass all the symptoms that make up psychosis, and at times it is difficult to differentiate between positive and negative attributes (Kay, 1990). For example, Chapman and Chapman (1973) explain how thought disorder can be explained as the loss of the ability to understand proverbs or as a replacement of a thought process. Depending on the definition, thought disorder could be categorized as a positive or negative symptom. If a construct is created to delineate disordered thinking, then this dilemma ends and the specificity of the construct increases.

Problems arise when these five domains are transferred to the PSS along with three other domains, Impaired Cognition, Depression and Mania, which were introduced with no more than

a passing explanation as to why these domains were relevant. These three new constructs are mentioned in the DSM-5, but no definition is offered in the text. An article by Barch and colleagues (2013) reports the inclusion of mood as relevant due to its effects on prognosis and outcome. Given that mood disturbances are common in psychotic disorders and the relative clarity of the mood constructs, there are no pressing concerns about the rationale or its inclusion in the PSS. Unfortunately, this is not the case for the Impaired Cognition domain.

There is no doubt that cognitive impairment is a good predictor of functionality in psychotic disorders, but its inclusion with the core symptoms of psychosis rises concerns about overlap among dimensions (August, Kiwanuka, McMahon & Gold, 2012; Green et al., 2000). Depending on the definition used, Impaired Cognition could overlap with Delusions, Hallucinations, Disorganized Thought (Speech) or Negative Symptoms. Delusions and hallucinations are often accepted as independent transient positive symptoms in psychosis, but separating disorganized thoughts and negative symptoms from cognitive impairments is more difficult because there is no one clear widely accepted consensus of their distinctions.

#### **Disorganized Thinking versus Cognitive Impairment and Negative Symptoms.**

When there is no clear consensus in the literature, it is of the utmost importance to provide clear definitions of constructs. Disorganized thinking (i.e. formal thought disorder) could be interpreted as the loss of the ability to think linearly. Since this is a loss/deficit, disorganized thinking could be interpreted as a negative symptom. However, if you take into consideration the literature associating disorganized speech with attention and executive deficits, both cognitive impairments, then the disorganized thinking construct's independence becomes questionable (Kerns, 2007; Kerns, & Berembaum, 2002). Unless an appropriate definition is provided for the construct, disorganized thinking could be independent, a negative symptom, or

an indication of cognitive impairments. Fortunately, the DSM-5 provides a clear definition of the disorganized thinking (speech) construct, but the definition is compromised once this construct is included in the PSS. Further, the PSS only mentions “disorganized speech,” and makes no mention of “disorganized thought” or “formal thought disorder.” Although disorganized thinking (i.e. formal thought disorder) is often measured by the presence of disorganized speech, the removal of “formal thought disorder” from the definition narrows the construct and is likely to change the perception of the item and to affect construct validity. If a clear comprehensive definition for the disorganized thinking construct is provided, systematic ratings for this dimension are possible.

**Negative Symptoms versus Cognitive Impairment.** The overlap between the Cognitive Impairments and Negative Symptoms construct is more complicated. Although, some consensuses have been achieved in defining these constructs, confusion continues in the literature where laboratories apply their own definitions of the constructs. The cause is not helped by the natural overlap between these dimensions (Harvey Koren, Reichenberg, & Bowie, 2006).

Negative symptoms have traditionally been defined as pathological deficits that represent the loss of a function (Harvey et al., 2006). Although negative symptoms have for a long time been widely recognized as part of the diagnosis of psychotic disorders such as schizophrenia, there is no clear standard of what should be included under the label of negative symptoms (Berrios, 1985). In fact, it is common to include cognitive deficits as negative symptoms, even when these might represent different dimensions of psychotic disorders (Kirkpatrick, Fenton, Carpenter & Marder, 2006). For example, if negative symptoms are conceptualized as the loss of a function, then the deficits in attention and concentration that individuals with psychotic

disorders commonly present could be categorized as negative symptoms, but these are often recognized as cognitive deficits (Nuechterlein et al., 2008; Reichenberg et al., 2009). The challenge comes from a notion of negative symptoms that is based upon a bifurcation of total symptomatology, wherein most symptoms fall into either positive (add-on, like delusions) or negative (subtracted, like loss of pleasure) symptom clusters. Thus, overlaying this onto a method with greater divisions is bound to create overlap. The relationship between cognitive and negative symptoms of schizophrenia is not very clear, but it is likely that these represent two different dimensions with some shared communalities (Harvey et al., 2006). After reviewing the existent research for these two clusters of symptoms, the DSM-5 task force decided that it would be important to maintain two separate dimensions, one for negative symptoms and one for impaired cognition in the PSS. The subcommittee in charge of the psychotic disorders provided a clear detailed definition of what constitutes negative symptoms but did not provide a definition for the cognitive impairment dimension.

**Negative Symptoms dimension.** Although a complete separation between negative symptoms and cognitive symptoms has not been achieved, findings in negative symptom research continuously finds a two-factor model in the distribution of negative symptoms in psychotic populations (Barch et al., 2013; Harvey et al., 2011; Messinger et al. 2011). In 2005, the National Institute of Mental Health (NIMH) and a group of experts, as part of the Measurement and Treatment Research to Improve Cognition in Schizophrenia (MATRICS) conference, presented a consensus statement on a definition of what constitutes negative symptoms in schizophrenia. The consensus of the conference included five symptoms divided into two factors. The first factor included blunted affect and alogia. The second factor included asociality, anhedonia, and avolition (Kirkpatrick et al., 2006). These two factors have been

labeled as restrictive emotional expression (REE) and avolition, respectively, and were derived from factor analytic approaches designed to identify factors that explain significant amounts of shared variance between symptoms. The symptoms that are commonly used are those measured by the Scale for the Assessment of Negative Symptoms, but other measures such as the Schedule for the Deficit Syndrome and the Motor-Affective-Social Scale have shown similar two-factor structures (Messinger et al., 2011). The REE and avolition factors have been replicated across different samples which increases the certainty that these represent important underlying factors likely to aid in the identification of treatment and etiologies.

**Impaired Cognition dimension.** The ability of cognitive deficits to predict functional outcomes in people with schizophrenia and other psychotic disorders has been often replicated (August, Kiwanuka, McMahon, & Gold, 2012; Green et al., 2000). It appears that cognitive deficits are more severe and persistent in individual with schizophrenia, but overall affective and nonaffective psychotic disorders show similar patterns of cognitive deficits (Reichenberg et al., 2009). Unfortunately, given that most studies tend to use their own measures of cognition, there is no formal definition as to what constitutes cognitive deficits. In an effort to create a standardized battery and, as a result, a definition of cognitive deficits in schizophrenia, the MATRICS conference was formed. In this conference experts reviewed existing literature and gave their opinion on the dimensions that should be considered when working with individuals with psychosis. After reviewing 18 factor analytic studies looking at the factor structure of cognitive deficits, Nuechterlein and colleagues (2004) proposed to include the following six categories as relevant cognitive deficits in schizophrenia: Speed and Processing, Attention/Vigilance, Working Memory, Verbal Learning and Memory; Visual Learning and Memory; and Reasoning and Problem Solving. They debated on adding a seventh category,

social cognition; this cognitive deficit appears to be important in social functioning, but due to its emerging status, it lacked sufficient research support. However, they reasoned that in order to learn more about this type of cognitive deficit it would be beneficial to measure it when possible. The battery was initially created to measure cognitive deficits in schizophrenia, but it has been used effectively with other disorders such as bipolar disorder and schizoaffective disorder (August et al., 2012; Burdick et al., 2011). Based on the literature reviewed by Barch and colleagues (2013), these are the cognitive impairments that could define the construct of cognitive impairment.

### **Clarity of PSS Instructions**

The instructions that accompany the PSS are limited. These do not even mention that the first five dimensions correspond with DSM Psychosis Criterion A. This lack of transparency could lead clinicians who are not familiar with the literature used in the development of the PSS to assume that they should only rate what is specifically included in the printed version of the PSS. This is problematic because the definitions provided in the PSS are very limited and not always clear. There is no guidance to the rater as to how to consider key elements such as frequency, duration, severity, type, or how impactful the symptom is on functioning. In fact, beyond the instruction to rate severity (on a continuum of absent—equivocal—mild—moderate—severe), there is no instruction. Rather, for each rating a guiding phrase is offered; but it is not clear if this phrase is merely an example of how broader issues of severity might be applied, or if it is specifically what is to be rated. For example, the first item of the PSS is intended to measure the presence of hallucinations. The phrase for the rating of “mild” indicates that the patient should be rated on how he or she relates to auditory hallucinations (“little pressure to act upon voices”), thus leaving it unclear if the rating is based solely on evidence of

*acting upon* the content of auditory hallucinations that are voices with clear content, without consideration of how frequent and enduring hallucinations are or how inclined the patient is to attend to the hallucinations. It makes no mention of other types of sensory hallucination that, although less likely, could still be present in the individual.

Given that there is a general consensus on what constitutes hallucinations, and most clinicians will probably ignore the limiting features of the phrases and apply their own notions of what constitutes mild, moderate, or severe hallucinations, it is perhaps not likely that clinicians or researchers will forget to rate all types of hallucinations and consider all elements of severity. However, definitions are more controversial and consensus is less clear with some other PSS items; items such as Disorganized Speech, Abnormal Psychomotor Behavior, and Negative Symptoms are perhaps most likely to be affected by the PSS's limited definitions.

**Rating Negative Symptoms.** Consistent with research findings in negative symptoms research, the PSS includes REE and avolition under the item of negative symptoms. Given the strong support for a two factor structure in negative symptoms it could be argued that the PSS needed to include two dimensions or items measuring the different facets of negative symptoms. However, this was not the case. According to Brach and colleagues (2013), this decision was made because currently there is no support for different therapeutic implications for either factor. One of the goals of the PSS is to be a simple, concise measure. Therefore, in an attempt to keep the measure short, both factors were collapsed into one item. Although this is a logical and practical decision, the lack of specificity that results from the consolidation is likely to affect future research using this scale. This concern may already be apparent. Ritsner and colleagues (2013), the only study reporting on the psychometric properties of the PSS, divided the negative symptoms into two items. Their participants rated individuals with psychotic disorders in both



REE and avolition, providing two separate ratings for the negative symptoms dimension. These ratings were not combined in any way to form a total score for the dimension, and were used instead as independent ratings for their statistical analysis.

The items on negative symptoms ask raters to rate the individual on REE *or* avolition, and provide “decrease in facial expressivity, prosody, gestures, or self-initiated behavior” as the behaviors that should be rated. The first three behaviors measure blunted affect which is one of the facets of the REE factor. The definition in the DSM-5 (p. 88) also includes alogia, which is part of the REE factor and measures poverty of speech; but it is not mentioned in the PSS. The remaining directions, “self-initiated behavior,” refer to avolition, but this factor should also include anhedonia and asociality. These two facets are meant to capture the decrease in the ability to experience pleasure and lack of interest in social interactions that some people with psychotic disorders experience. If these behaviors are not included in the definitions that accompany the PSS, raters could miss these signs and render the negative symptoms dimension less encompassing than what it was originally meant to be. It should also be remembered that REE and avolition are simply names of two factors, as well as names for specific symptoms which are part of those factors. A rater well familiar with this literature may recognize the breadth of the two factors, but others should see a list of the separate symptoms meant to be represented by the factors so that they rate the whole scope of negative symptomology intended.

Currently, clinicians are instructed to rate either REE *or* avolition under the Negative Symptoms dimension, when in fact both behaviors could be present in the same individual. Although, there might not be research supporting different treatment approaches or etiologies it is likely that differentiating between the two facets can improve current research on these areas. Since raters will be rating negative symptoms as a dimension they will be looking at all the

different behaviors that are considered negative symptom as per the DSM-5 definition, what are they to do when an individual presents prosody and asociality? Are they to choose the one that is the most severe, the most persistent, or the most debilitating? Given the current instructions it is unclear how raters should decide which factor to measure when both are present. This forced dichotomy decreases the ability of the PSS to measure dimensionality at a relevant level of specificity.

Since there are two factors within the negative symptoms dimension, and there is no way to report which one is present, is likely to complicate the sharing of information across multiple sites, because an individual could present any of the five behaviors defined in the DSM-5. Therefore, even if the creation of a simple measure requires a limited number of items, a method should be delineated to ensure that the information that is rated is sufficiently specific and useful in the conceptualization of psychosis.

**Rating Impaired Cognition.** Of the three dimensions added to the core five, Impaired Cognition is particularly problematic. The PSS instructions only tell raters when cognitive functioning should be declared to be impaired (i.e., outside of normal range on unspecified measures of cognitive ability), but it gives no indication of what behaviors or abilities should be rated. Also, unlike the first five items of the PSS, a definition of Impaired Cognition cannot be found in the DSM-5. Therefore, unless the clinician is familiar with the literature on psychosis and cognitive impairments, it is unlikely that they will be able to fully consider all the relevant deficits that makeup this dimension.

In an article explaining the rationale behind the PSS, Barch and colleges (2013) suggest that neuropsychological testing should be used when possible to rate this item, but if formal neuropsychological testing is not available or feasible, raters are asked to use any relevant

information available to make their judgments on the level of impairment of the patient. This makes the rating of this item not only difficult because there is no definition for the construct to be rated, but because the PSS measures cognitive impairment using standard deviations (with severe being above 2SD from the mean). If test scores with norms are not available for review, how can a clinician reliably rate a patient using standard deviations? Also, research has found that clinician ratings on cognitive deficits are not good predictors of cognitive deficits as measured by neuropsychological testing. Harvey and his team (2001) found that cognitive deficits, as measured by clinicians using the PANS, were slightly less correlated to neuropsychological tests ( $r = .56$ ) than negative symptoms ( $r = .60$ ). Therefore, if this dimension is rated only by observation, the validity and reliability are likely to be compromised.

Unfortunately, up to date there are no short neuropsychological batteries that can measure cognitive impairment dimensionally in individuals with psychotic disorders that is both time and cost effective (Barch et al., 2013; Hurford, Marder, Keefe, Reise, & Bilder, 2011).

### **Factor Structure**

A study conducted by Ritsner and his team (2013) reported a two-factor structure for the PSS in a mixed sample of inpatients and outpatients with psychotic disorders. The two factors identified were named Psychotic Syndrome and Deficit Syndrome. The first factor was made up of delusions, disorganization, abnormal psychomotor behavior, and mania. The second factor was included REE, avolition, and impaired cognition. Neither depression nor hallucinations meet their  $> 0.4$  minimum loading criteria. Thus, the nine PSS items (treating REE and avolition as separate items) only formed two factors, which is different from the usual four to five factor structure that is found when factory analytic studies are conducted using lists of symptom or scales such as the BPRS-E or PANSS (Day, 2003; Demjaha et al., 2009; Dikeos et al, 2006;

Lacon, Auquier, Nayt, & Reine, 2000; Shafer, 2005; Velligan et al., 2005;). Figure 1 sets the factor analysis of Ritsner et al. (2013) next to several other factor analyses of psychotic symptomatology for comparison. The two most consistent factors from these other studies, a variation of negative symptoms and positive symptoms, were apparent in the PSS. The difference in factorial solution for these two factors might be due to the reduction of items and the rating of the dimensions. Loadings appear to be consistent with past research. Although both negative symptoms and cognitive impairment loaded under the same factor, this is not unexpected, given that these two symptoms tend to be correlated (Harvey et al, 2006). Also, there were higher loadings, -.87 and -.64, for REE and avolition respectively than for cognitive impairments (-.53). Even within the psychotic syndrome, disorganization and abnormal psychomotor behaviors had higher loadings than the delusions and mania items. The first two items tend to load in the disorganization factor in other studies looking at the full array of symptoms rather than the condensed dimensions that are presented in the PSS (Day, 2003).

The striking differences highlighted in Figure 1 are not so much the mostly minor differences among the Dikeos, Demjaha, Shafer, and Day studies, as between the Ritsner study of the PSS and all the other factor analytic studies. Most notable, many fewer elements are distinctively assessed in the PSS (the elements in these other approaches are more narrowly defined, so that elements may covary with others, but are more clearly different in form), and their consequently appears to be less breadth of coverage, in part revealed in fewer distinct factors and less richness within factors that might guide ratings.

### **Conceptual Mapping**

Using the definitions provided in the DSM5, for the PSS and by Ventura and colleagues (1993)

Table 1  
*Comparison of Various Factor Structures*

	Psychosis			BPRS	BPRS-E
	PSS	Dikeos et al. (2006)	Demjaha et al. (2009)	Shafer (2005)	Day (2003)
Psychotic Delusions, Disorganization, Abnormal psychomotor behavior, Mania	Reality distortion Auditory hallucinations, Running commentary, Abuse/accusatory voices, Other hallucination, Thought broadcasting, Thought echo, Thought insertion, Delusions of passivity, Thought withdrawal	Reality distortion Auditory hallucinations, Running commentary, Abuse/accusatory voices, Other hallucination, Thought broadcasting, Thought echo, Thought insertion, Delusions of passivity, Thought withdrawal	Reality distortion Non-affective auditory hallucination, Non-specific auditory hallucinations, Disorder form of thoughts, Delusions of reference, Bizarre delusions and interpretations, Delusions of persecutions	Positive symptoms Unusual thought content, Hallucinatory behavior, Conceptual disorganization, Grandiosity	Positive symptoms Grandiosity, Suspiciousness, Hallucinations, Unusual Thought Content, Bizarre Behavior
Deficit Restricted emotional expression, Avolition, Impaired cognition	<u>Negative symptomatology</u> Blunted affect, Negative formal thought disorder, Restricted affect, Slowed activity	<u>Negative symptomatology</u> Blunted affect, Negative formal thought disorder, Restricted affect, Slowed activity	<u>Negative</u> Non-verbal communication, Poverty of speech, Flat and incongruous affect, Motor retardation	<u>Negative symptoms</u> Blunted affect, Emotional withdrawal, Motor retardation, Disorientation	<u>Negative symptoms</u> Self-neglect, Blunted Affect, Disorientation, Emotion Withdrawal, Motor Retardation, Mannerisms and Posturing
	<u>Mania</u> Pressured speech, Excessive activity, Thoughts racing, Elevated mood, Increased sociability, Reduced need for sleep, Distractibility, Reckless activity, Irritable mood, Increased self-esteem, Grandiose delusions	<u>Mania</u> Pressured speech, Excessive activity, Thoughts racing, Elevated mood, Increased sociability, Reduced need for sleep, Distractibility, Reckless activity, Irritable mood, Increased self-esteem, Grandiose delusions	<u>Manic</u> Heightened subjective functioning, Expansive mood, Rapid subjective tempo, Expansive delusions and hallucinations, Overactivity, Socially embarrassing behavior	<u>Activation</u> Excitement, Mannerisms-posturing, Tension	<u>Depression</u> Somatic Concern, Anxiety, Depression, Suicidality, Guilt
	<u>Depression</u> Loss of pleasure, Dysphoria, Excessive self-reproach, Poor concentration, Sleep problems, Appetite/weight problems, Suicidal ideation, Delusions of guilt	<u>Depression</u> Loss of pleasure, Dysphoria, Excessive self-reproach, Poor concentration, Sleep problems, Appetite/weight problems, Suicidal ideation, Delusions of guilt	<u>Depressive</u> Special features of depressed mood, Depressed mood, Depressive delusions and hallucinations	<u>Affective</u> Depressive mood, Anxiety, Guilt feelings, Somatic concern	<u>Manic/Excitement</u> Elevated Mood, Tension, Excitement, Distractibility, Motor Hyperactivity
	<u>Disorganization</u> Positive formal thought disorder, Speech difficult to understand, Incoherence, Bizarre behavior, Inappropriate affect, No insight, Widespread delusions, Well-organized delusions, Bizarre delusions, Catatonia	<u>Disorganization</u> Positive formal thought disorder, Speech difficult to understand, Incoherence, Bizarre behavior, Inappropriate affect, No insight, Widespread delusions, Well-organized delusions, Bizarre delusions, Catatonia	<u>Disorganization</u> Incoherent speech, Emotional turmoil	<u>Resistance</u> Hostility, Uncooperativeness, Suspiciousness	<u>Disorganization</u> Hostility, Uncooperativeness

*Note:* Factors are reordered to maximize comparability across studies. The Dikeos study used data from 51 items of the Operational Criteria Checklist for Psychotic and Affective Illness, and the Demjaha study used data from the Schedules for Clinical Assessment in Neuropsychiatry. Factor solutions accounted for 98% (likely incorrect), 50%, 48%, 87%, and 44% of total variance.

for the BPRS-E, a conceptual mapping of the PSS onto the BPRS-E was created. The final mapping can be observed in Figure 2. This mapping was used to observe the overlap between the recently create PSS and a veteran measure, the BPRS-E, that is often used as an outcome measure in SMI populations (Burlingame et al, 2006). This allowed us to see the symptoms that were retained with the dimensional measure and to calculate the loss of information that might occur as a result from moving away from a symptomatic scale to a dimensional scale. Most of the 19 BPRS-E items could be fit onto the dimensional model represented by the PSS. The items that could not be fit onto the eight dimensions of the PSS were mainly related to suicidality, hostility, and anxiety.

The prevalence of suicide in psychotic disorders is of 5-6% (APA, 2013). Given these rates it is important to have information regarding the suicidality that patients present. However, give that suicidality is a major concern, clinicians should not need to have an item in the PSS to measure suicidality, not when suicidality should be standard care and assessed regularly. In past factor analytic studies using the items of the BPRS-E suicidality has not loaded or loaded under the Depression dimension. Although it would be useful to have an item on the scale to track suicidality, it does not appear to be necessary, but further research would be needed to see if adding suicidality to the dimension could add dimensional coverage.

According to a recent review conducted by Hartley, Barrowclough, and Haddock (2013) the rates of anxiety in individuals with psychosis is about 50% in clinical samples. Regardless of the high prevalence of anxiety in psychosis, the research on psychosis and anxiety is limited, although studies have associated anxiety with the severity of delusion and auditory hallucinations (Hartley et al., 2013). Commonly, the anxiety symptoms included in factor analytic studies using BPRS-E items place the anxiety items under the depression dimension (Day, 2003;

Shaffer, 2005), suggesting that the depression factor may be tapping into the more general factor of neuroticism. Once again the omission of these items could restrict the coverage of the depression dimension that was included in the PSS, but further research is need studying the ability of individual items to measure the stretch of the dimension.

Table 2

*Conceptual Mapping of the BPRS-E onto the Dimensions of the PSS*

Psychosis Symptom Severity scale (PSS)	Brief Psychiatric Rating Scaled- Expanded (BPRSE)
Hallucinations	10. Hallucinations
Delusions	8. Grandiosity 9. Suspiciousness 11. Unusual Thought Content
Disorganized Speech	15. Conceptual Disorganization
Abnormal Psychomotor Behavior	18. Motor Retardation 13. Self-neglect 24. Mannerisms and Posturing
Negative Symptoms (restricted emotional expression or avolition)	16. Blunted Affect (REE) 17. Emotional Withdrawal (REE)
Impaired Cognition	14. Disorientation 22. Distractibility
Depression	3. Depression 5. Guilt
Mania	7. Elevated Mood 21. Excitement 23. Motor Hyperactivity
Not Included	1. Somatic Concerns 2. Anxiety 6. Hostility 12. Bizarre Behavior 4. Suicidality 19. Tension

## Other Psychometric Characteristics

Ritsner and colleagues (2013) reported acceptable convergent validity for the PSS when compared with the PANSS and Bech-Rafaelsen Mania Scale (BRMAS). The PSS psychotic scale correlated with the PANSS positive ( $r = 0.86, p < 0.001$ ) scale and BRMAS scores ( $r = 0.87, p < 0.001$ ). The deficit scale was highly correlated with the negative symptom PANSS subscale ( $r = 0.85, p < 0.001$ ). In average, individuals with psychotic disorders scored higher than mood disorder individuals in all but the mania and depression dimensions. Using the dimensions of the PSS to predict diagnosis 77.9 % of the patients with psychotic disorders were diagnosed correctly (the PANSS was able to correctly diagnose 82.0%). Sensitivity was reported to be 95% and specificity 34% (Ritsner et al., 2013). Unfortunately, this study did not report the training procedures used to train the clinicians that completed the PSS, but interclass correlations (ICC) were reported to be between 0.80-0.95 for all eight dimensions. Currently data on test-retest reliability, sensitivity to change, and items' ability to measure dimensionality is unavailable.

## Clinical Utility

**Practicality.** The PSS is a very short measure that includes only eight items. Ristner and colleagues (2013) reported ICC ranging from 0.79 to 0.97 for the PSS items, which is comparable with the ICCs that they reported for the PANSS (0.89). They also reported that clinicians found the PSS to be easy to understand, less burdensome (than the PANSS, BRMAS and CGI-S) and acceptable to be used in clinical practice. The average total administration time for the PSS was of 10 ( $\pm 7.5$ ) minutes. Overall it seems like clinicians were satisfied with the short, succinct PSS. However, Ristner and his team (2013) do not provide detailed information



as to how clinicians were trained to complete the scale or if further directions were provided other than those provided by the PSS scale sheet.

**Standardization.** The PSS is a short measure that summarizes relevant information that could potentially help clinician and researcher to work with individual with schizophrenia. It provides individuals with a simple dimensional rating of symptomatology. As good as it might be, this measure would benefit from standardization. As it has been mentioned before, it could use cleared definitions and anchor points. It also needs directions that address issues such as the two facets within the negative symptoms and the behaviors to be used to measure cognitive impairment when neuropsychological testing is not available. Another important issue to address is rater drift. One of the possible uses that the PSS could have is as an outcome measure. If ratings will be conducted periodically then raters will be susceptible to raters drift. Ventura and his team at the University of California Los Angeles created a set of DVDs that helps calibrate BPRS-E raters every three months (Ventura et al. 1993). The PSS could benefit from methods such as this to ensure not only high ICCS, but to maintain reliability, validity and fidelity. If the chances of raters drift are minimized then rates can be confident that changes in PSS scores are due to treatment gains and not to other external factor. Similarly, interpretation of ratings could benefit from normative data for typical populations (e.g., inpatient, schizophrenic, and affective psychosis).

**Research.** As it is, the PSS looks like a measure that can be used to summarize much the data collected on individual patients. In the future, if these dimensions are indeed important for the discovery of etiologies and treatment approaches, these dimensions will be a fast and easy way to detect areas of treatment. Its utility as a clinician tool depends on how well clinicians are able to rate the eight dimension in a consistent and valid manner. The first five items of the PSS

reflect the DSM's Criterion A for psychosis, so clinicians, regardless of the time, must collect that information. Having a place where they can organize that information can help clinicians to decide if Criterion A is met and if a diagnosis should be considered. However, the extensive data collection that is needed to obtain valid ratings on the cognitive impairment item might be too burdensome for clinical settings that already have limited resources to serve their clinic populations. Unfortunately, there are no short, valid, and effective batteries that could assess cognitive impairment that has been validated with individuals with schizophrenia.

### **Discussion**

It has been more than thirty years since the publication of the DSM-III. Its publication marked the beginning of a new era of research and diagnosis. Diagnostic descriptions were no longer based on psychodynamic or theoretical explanations. The new system focused on symptomatology, identifying specific clusters of pathology, and establishing thresholds with the ability to distinguish between pathological and normal behavior. These changes improved communication between researchers and clinicians and allowed for the systematic study of clusters of symptoms across research teams, which led to the development of research-based treatments. Ultimately, a lot of knowledge was made possible due to the implementation of this new system, but as a discipline we have reached a point where categorical diagnosis are no longer sufficient.

Categorical diagnoses are not able to encompass the full range of psychopathology, and the overlap between categories is so nebulous that we often have to resort to NOS diagnosis or creating new diagnoses (e.g. schizoaffective disorder and Depressive Personality Disorder) to account for the uncertainty that is inherent between categories. Fortunately, new statistical techniques have propelled new discoveries that have directed the conceptualization of

psychopathology towards a dimensional model. It appears that much psychopathology can be organized within hierarchical models in which most of the variance across symptoms can be explained by one underlying factor or dimension (Griffith et al., 2010; Witkiewitz et al., 2013). It is often the case that this overarching factor can be further divided into meaningful facets that could potentially improve our understanding of psychiatric disorders at a fundamental level.

Numerous studies have been published supporting the dimensionality of psychopathology (Allardyce et al., 2007; Demjaha et al., 2009; Dikeos et al., 2006). However, as it is often the case there is a lag between research findings and field implementations. The DSM-5, with its prestige, respectability, and authority, has the responsibility to bridge the gap between the laboratories and the field. It also plays a major role in the allocation of research and clinical resources. Therefore, the initial attempts of the DSM-5 to include dimensionality in its categorical diagnoses may represent a small step that is likely to lead to larger implications in the future conceptualization of psychopathology.

Research on personality and personality theory has taught us that the development of dimensional models is possible and is a desired direction. It also allowed us to see how effective and encompassing dimensional models can be in explaining overlaps between diagnostic categories. Personality research has arrived to a point where they are ready to use dimensional models to conceptualize personality pathology, but other areas, such as psychosis are still in its developmental stages. This does not mean that we should wait for 30 years to happen in order to develop a reliable method to assess psychosis dimensionally. In fact, we can start testing a model of dimensionality in psychosis now. With the creation of the PSS the psychotic disorders subcommittee has opened the door to further dimensional research in psychosis.

The model with eight dimensions that is postulated by the PSS appears to overlap with previously reported factor analytic solutions of psychotic disorders, but with somewhat less coverage, for which implications are not yet known. It encompasses a wide variety of symptoms that are often found in widely used measures in SPMI populations, such as the BPRS-E, but is less likely than other approaches to capture specificity of these symptoms (which allows its likely key strength over other approaches—brevity). These attributes might indicate that the PSS has the potential to become a good measure of dimensionality in psychosis. However, there are some areas that need to be further improved before the PSS can be reliably used.

First, there needs to be more information as to how individual dimensions were elected to be part of the PSS. It is particularly important to indicate if the PSS follows a model of psychopathology, or if it is just an initial prototype marking any dimension that could be relevant for further study. This is important because it can make a difference in how the scale is approached. There needs to be more clarification as to how the categories were included in the PSS. The need for clarifications and rationales is especially important for dimensions that have high rates of overlap, such as impaired cognition and negative symptoms.

This leads to the second point of improvement. The PSS needs to offer better instructions on how to and what to rate when assessing PSS dimensions. As it is, the clarity of each dimension is not good. In its effort to make the PSS a one page instrument the construct definitions were sacrificed. Disorganized thinking becomes disorganized speech, the range of negative symptoms was reduced from five to three, and cognitive impairment is not even defined in non-standardized terms. Clear well-defined items are essential for the vitality of a measure. In order for the PSS to meet its expectations, and to become a valid, reliable measure each item should be clearly defined in such a way that raters reading the items at different times should

interpret similar meanings. A way to address this issue is to standardize the PSS. This could be done by offering clear detailed definitions of each PSS dimension. Every dimension would then include detailed anchor points, where behaviors are described to denote the severity required for each point. A system could also be put into place to continuously check for raters drift, ensuring that PSS scores are the product of observed psychopathology and not fluctuations in raters' perceptions.

As it is, the PSS is a short scale only taking about 10 minutes to complete, but if the deficits identified in this study were to be improved, it is likely that detail would be added and the completion time would increase. It is at that point that one has to wonder if the scale is worth the time and resources (i.e., does knowing these things matter—in clinical settings for treatment and patient management—and in research for better understanding the pathology). This is especially relevant when discussing the Impaired Cognition item, which requires extensive psychological testing to be reliably assessed. It might be that until a short, valid, and reliable neuropsychological battery is developed to rate this item, this dimension will be more relevant to researcher's than to clinicians. If this is the case, then a separate definition should be created to be used when neuropsychological testing is not available; this would ensure that raters across settings are rating the same construct. The Negative Symptoms item should be amended to include all five facets of negative symptoms, and even if this item is not split into two items (consistent with the two factor structure found in negative symptoms research), a systematic method should be built in to make decisions of which factor to rate when both are present and based on what criteria (e.g. severity, persistence). Keeping with construct validity, the first five dimensions that are derived from Criteria A should be kept consistent with DSM-5 definitions.

The PSS has a future, but it needs to be further developed. In its initial stages it might be more appropriate for research settings, where the measure can be improved, but it could also be used to summarize clinical information in clinical settings. However, the lack of standardization, unclear definitions and instructions are likely to prove toxic to the validity of the measure. Further investigation should be made looking at clinician's understanding of the scale and its instructions. Also, studies should be conducted to test the conclusions of this paper, focusing on how the PSS performs as a predictor of clinical outcomes, such as length of stay, as compared with the BPRS-E or other SMI scales. Because this is a dimensional scale, each item should be tested for its ability to capture psychosis using IRT methods, which will help to clarify how much dimensionality is captured by each item.

## References

- American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text rev.). Arlington, VA: American Psychiatric Publishing.
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.
- Allardyce, J., Suppes, T., & van Os, J. (2007). Dimensions and psychosis phenotype. *International Journal of Methods in Psychiatric Research, 16*(SI), S34-S40.
- August, S. M., Kiwanuka, J. N., McMahon, R. P., & Gold, J. M. (2012). The MATRICS Consensus Cognitive Battery (MCCB): Clinical and cognitive correlates. *Schizophrenia Research, 134*, 76-82.
- Barch, D. M., Bustillo, J., Gaebel, W., Gur, R., Heckers, S., Malaspina, ... Carpenter, W. (2013). Logic and justification for dimensional assessment of symptoms and related phenomena in psychosis: Relevance to DSM-5. *Schizophrenia Research, 150*, 15-20.
- Berrios, G. E. (1985). Positive and negative symptoms and Jackson: A conceptual history. *Archives of General Psychiatry, 42*, 95-97.
- Bowie, C. R., Reichenberg, A., Patterson, T. L., Heaton R. K., & Harvey, P. D. (2006). Determinants or real-world functional performance in schizophrenia subjects: Correlations with cognition, functional capacity, and symptoms. *American Journal of Psychiatry, 163* (3), 418-425.
- Burlingame, G. M., Dunn, T. W., Chen, S., Lehman, A., Axman, R., Earnshaw, D., & Rees, F. M. (2005). Selection of outcome assessment instruments for inpatients with severe and persistent mental illness. *Psychiatric Services, 56*, 444-451.

- Burlingame, G. M., Seaman, S., Johnson, J. E., Whipple, J., Richardson, E., Rees, ... O'Neil, B. (2006). Sensitivity to change of the Brief Psychiatric Rating Scale-Expanded (BPRS-E): An item and subscale analysis. *Psychological Services, 3*(2), 77-87.
- Burdick, K. E., Goldberg, T. E., Cornblatt, B. A., Keefe, R. S., Gopin, C. B., DeRosse, P., Braga, R. J., & Malhotra, A. K. (2011). The MATRICS consensus battery in patients with bipolar I disorder. *Neuropsychopharmacology, 36*, 1587-1592.
- Button, E. J., Benson, E., Nollett, C., & Palmer, R. L. (2005). Don't forget EDNOS (eating disorder not otherwise specified): Patterns of service use in an eating disorders service. *Psychiatric Bulletin, 29*, 134-136.
- Burdick, K. E., Goldberg, T. E., Cornblatt, B. A., Keefe, R. S., Gopin, C. B., DeRosse, P., Braga, R. J., & Malhotra, A. K. (2011). The MATRICS Consensus Cognitive Battery in patients with Bipolar I Disorder. *Neuropsychopharmacology, 36*, 1587-1592.
- Carey, J. A., (2000). *The Severe Outcome Questionnaire: A preliminary study of reliability and validity*. (unpublished doctoral dissertation). Brigham Young University, Provo, Utah.
- Chapman, L. J., & Chapman, J. P. (1973). *Disordered thought in schizophrenia*. New York: Appleton-Century-Crofts.
- Clark, L. A. (1993). SNAP (Schedule for Nonadaptive and Adaptive Personality); *Manual for administration, scoring and interpretation*. Minneapolis: University of Minnesota Press.
- Comer, R. J. (2010). *Abnormal Psychology*. New York, NY: Worth Publishers.
- Day, G. L. (2003). *Confirmatory factor analysis of the Brief Psychiatric Rating Scale- Expanded version*. (unpublished doctoral dissertation). Brigham Young University, Provo, Utah.



- Costa, P. T. Jr., & McCrae, R. R. (1992). *Revised NEO Personality Inventory (NEO-PI-R) and NEO Five-Factor Inventory (NEO-FFI) professional manual*. Odessa, Florida: Psychological Assessment Resources, Inc.
- Demjaha, A., Morgan, K., Morgan, C., Dean, S. L., Reichenberg, A., Sham, P., ... & Dazzan, P. (2009). Combining dimensional and categorical representation of psychosis: The way forward for DSM-V and ICD-11? *Psychological Medicine*, *39*, 1943-1955.
- Dikeos, D. G., Wickham, H., McDonald, C., Walshe, M., Signundsson, T., Bramon, ... Sham, P. C. (2006). Distribution of symptom dimensions across Kraepelinian divisions. *British Journal of Psychiatry*, *189*, 346-353.
- First, M. B., Bell, C. C., Cuthbert, B., Krystal, J. M., Malison, R., Offord, ... Wisner, K. L. (2002). Personality disorders and relational disorders. In D. J. Kupfer, M. B. First, & D. A. Regier (1<sup>st</sup> Edition), *A research agenda for DSM-V* (123-199). Washington, DC: American Psychiatric Association.
- Fossati, A., Krueger, R. F., Markon, K. W., Borroni, S., & Maffei, C. (2013). Reliability and validity of the Personality Inventory for DSM-5 (PID-5): Predicting DSM-IV personality disorders and psychopathy in community-dwelling Italian adults. *Assessment*, *20*(6), 689-708.
- Ganekar, S., Desai, G., & Chandra, P. S. (2013). A comparative study of psychopathology, symptom severity, and short-term outcome of postpartum and nonpostpartum mania. *Bipolar Disorder*, *15*, 713-718.
- Green, M. F., Kern, R. S., Braff, D. L., & Mintz, J. (2000). Neurocognitive deficits and functional outcome in schizophrenia: Are we measuring the "right stuff?" *Schizophrenia Bulletin*, *26*, 118-136.

- Griffith, J. W., Zinbarg, R. E., Craske, M. G., Mineka, S., Rose, R. D., Waters, A. M., & Sutton, J. M. (2010). Neuroticism as a common dimension in the internalizing disorders. *Psychological Medicine, 40*, 1125-1136.
- Harkness, A. R., & McNulty, J. (1994). The Personality Psychopathology Five (PSY-5): Issue from the pages of a diagnostic manual instead of a dictionary. In S. Strack & M. Lott (Eds.), *Differentiating normal and abnormal personality* (pp. 291-315). New York: Springer.
- Hartley, S., Barrowclough, C., & Haddock, G. (2013). Anxiety and depression in psychosis: A systematic review of associations with positive psychotic symptoms. *Acta Psychiatrica Scandinavica, 128*, 327-346.
- Harvey, P. D., Koren, D., Reichenberg, A., & Bowie, C. R. (2006). Negative symptoms and cognitive deficits: What is the nature of their relationship? *Schizophrenia Bulletin, 32*(2), 250-258.
- Harvey, P. D., Serper, M. R., White, L., Parrella, M. J., McGurk, S. R., Moriarty, ... Davis, K. L. (2001). The convergence of neuropsychological testing and clinical ratings of cognitive impairment in patients with schizophrenia. *Comprehensive Psychiatry, 42*, 306-313.
- Heckers, S. (2008). Making progress in schizophrenia research. *Schizophrenia Bulletin, 34*, 591-594.
- Heckers, S., Barch, D. M., Bustillo, J., Gaebel, W., Gur, R., Malaspina, D., ... Carpenter, W. (2013). Structure of the psychotic disorders classification in the DSM-5. *Schizophrenia Research, 150*, 11-14.

- Hurford, I. M., Marder, S. R., Keefe, R. S. E., Reise, S. P., & Bilder, R. M. (2011). A brief cognitive assessment tool for schizophrenia: A construction of a tool for clinicians. *Schizophrenia Bulletin*, *37*, 538-545.
- Kay, S. R. (1990). Significance of the positive-negative distinction in schizophrenia. *Schizophrenia Bulletin*, *16*, 635-652.
- Kay, S. R., Fiszbein, A. & Opler, L. A. (1987). The positive and negative syndrome scale (PANSS) for schizophrenia. *Schizophrenia Bulletin*, *13*(2), 262-276.
- Kerns, J. G. (2007). Verbal communication impairment and cognitive control components in people with schizophrenia. *Journal of Abnormal Psychology*, *116*, 279-289.
- Kerns, J. G., & Berenbaum, H. (2002). Cognitive impairments associated with formal thought disorder in people with schizophrenia. *Journal of Abnormal Psychology*, *111*, 211-274.
- Kirkpatrick, B., Fenton, W. S., Carpenter, W. T., Marder, S. R. (2006). The NIMH-MATRICES consensus statement on negative symptoms. *Schizophrenia Bulletin*, *32*, 214-219.
- Krueger, R. F. (1999). The structure of common mental disorders. *Archives of General Psychiatry*, *59*, 921-926.
- Krueger, R. F., Eaton, N. R., South, S. C., Clark, L. A., & Simms, L. J. (2011). Empirically derived personality disorder prototypes: Bridging dimensions and categories in DSM-5. In D. A. Regier, W. E. Narrow, E. A. Kuhl, & Kupfer (1<sup>st</sup> Ed.), *The conceptual evolution of DSM-5* (97-118). Washington, DC: American Psychiatric Publishing.
- Krueger, R. F., Watson, D., Barlow, D. H. (2005). Introduction to the special section: Dimensionally based taxonomy of psychopathology. *Journal of Abnormal Psychology*, *114*(4), 491-493.

- Lacon, C., Auquier, P., Nayt, G., & Reine, G. (2000). Stability of the five-factor structure of the Positive and Negative Syndrome Scale (PANSS). *Schizophrenia Research, 42*, 231-239.
- Lambert, M. J., Burlingame, G. M., Umphress, V., Hansen, N. B., Vermeersch, D. A., Clouse, G. G., & Yanchar, S. C. (1996). The reliability and validity of the Outcome Questionnaire. *Clinical Psychology and Psychotherapy, 3*(4), 249-258.
- McKetin, R., McLaren, J., Lubman, D. I., & Hides, L. (2006). The prevalence of psychotic symptoms among methamphetamine users. *Addiction, 100*, 1473-1478.
- Messinger, J. W., Tremeau, F., Antonius, D., Mendelsohn, E., Prudent, V., Standford, A. D., & Malaspina, D. (2011). Avolition and expressive deficits capture negative symptom phenomenology implications for DSM-5 and schizophrenia research. *Clinical Psychology Review, 31*, 161-168.
- Nuechterlein, K. H., Barch, D. M., Gold, J. M., Goldberg, T. E., Gree, M. F., & Heaton, R. K. (2004). Identification of separable cognitive factors in schizophrenia. *Schizophrenia Research, 72*, 29-39.
- Nuechterlein, K. H., Green, M. F., Kern, R. S., Baade, L. E., Barch, D. M., Cohen, ... Marder, S. R. (2008). The MATRICS consensus cognitive battery part 1: Test selection, reliability, and validity. *American Journal of Psychiatry, 165*, 203-213.
- Overall, J. E., & Gorham, D. R. (1962). The Brief Psychiatric Rating Scale. *Psychological Reports, 10*, 799-812.
- Portugal, E., Martinez, C., Gonzalez, N., Amo, V., Haro, J. M., & Cervilla, J. A. (2011). Clinical and cognitive correlates of psychiatric comorbidity in delusional disorder outpatients. *Australian and New Zealand Journal of Psychiatry, 45*, 416-425.

- Rabinowitz, J., Smedth, G., Harvey, P. D., & Davidson, M. (2002). Relationship between premorbid functioning and symptom severity as assessed at first episode of psychosis. *The American Journal of Psychiatry*, *159*(12), 2021-2026.
- Reichenberg, A., Harvey, P.D., Bowie, C. R., Mojtabai, R., Rabinowitz, J., Heaton, R. K., & Bromet, E. (2009). Neuropsychological function and dysfunction in schizophrenia and psychotic affective disorders. *Schizophrenia Bulletin*, *35*, 1022-1029.
- Ristner, M. S., Mar, M., Arbitman, M., Grinshpoon, A. (2013). Symptom severity scale of the DSM5 for schizophrenia, and other psychotic disorders: Diagnostic validity and clinical feasibility. *Psychiatry Research*, *208*, 1-8.
- Ruggeri, M., Leese, M., Thornicroft, G., Bisoffi, G., & Tansella, M. (2000). Definition and prevalence of severe and persistent mental illness. *The British Journal of Psychiatry*, *177*, 149-155.
- Shafer, A. (2005). Meta-analysis for the Brief Psychiatric Rating Scale factor structure. *Psychological Assessment*, *17*(3), 324-335.
- Smith, G. N., Ehmann, T. S., Flynn, S. W., MacEwan, G. W. Tee, Kopala, ... Honer (2011). The assessment of symptom severity and functional impairment with DSM-5 axis V. *Psychiatric Services*, *62*(4), 411-417.
- Thomas, A., Donell, A. J., & Young, T. R. (2004). Factor structure and differential validity of the Expanded Brief Psychiatric Rating Scale. *Assessment*, *11*, 177-187.
- Velligan, D., Prihoda, T., Dennehy, E., Biggs, M., Shores-Wilson, K., Crimson, ... Shon, S. (2005). Brief Psychiatric Rating Scale Expanded Version: How do new items affect factor structure? *Psychiatry Research*, *135*, 217-228.

- Van Os, J., Hanssen, M., Bijl, R. V., & Volleberg, W. (2001). Prevalence of psychotic disorder and community level of psychotic symptoms. *Archives of General Psychiatry*, *58*, 663-668.
- Ventura, J., Green, M. F., & Shanner, A. (1993). Training and quality assurance with the Brief Psychiatric Rating Scale: "The drift busters." *International Journal of Methods in Psychiatric Research*, *3*(4), 221-144.
- Verheul, R., & Widiger, T. A. (2004). A meta-analysis of the prevalence and usage of the personality disorder not otherwise specified (PDNOS) diagnosis. *Journal of Personality Disorders*, *18*(4), 309-319.
- Widiger, T. A., & Costa, P. T. (1994). Personality and personality disorders. *Journal of Abnormal Psychology*, *103*(1), 78-91.
- Widiger, T.A., & Samuel, D. B. (2005). Diagnostic categories or dimensions? A question for the diagnostic and statistical manual of mental disorders—fifth edition. *Journal of Abnormal Psychology*, *114*(4), 494-504.
- Witkiewitz, K., King, K., McMahon, R. J., Wu, J., Luk, J., Bierman, ... Pinderhughes, E. E. (2013). Evidence for a multi-dimensional latent of externalizing disorders. *Journal of Abnormal Child Psychology*, *41*, 223-237.