Schizophrenia Research 125 (2011) 152–160

Contents lists available at ScienceDirect

Schizophrenia Research

journal homepage: www.elsevier.com/locate/schres

A path model investigation of neurocognition, theory of mind, social competence, negative symptoms and real-world functioning in schizophrenia

Shannon M. Couture [a,*], Eric L. Granholm [b,c], Scott C. Fish [b]

[a] University of Maryland College Park, 1123M Biology-Psychology Building, College Park, MD 20742, USA
[b] University of California San Diego, USA
[c] Veterans Affairs San Diego Health Care System, 3350 La Jolla Village Drive, San Diego, CA 92161, USA

ARTICLE INFO

Article history:
Received 15 June 2010
Received in revised form 20 September 2010
Accepted 23 September 2010
Available online 20 October 2010

Keywords:
Schizophrenia
Real-world functioning
Functional capacity
Social cognition
Neuropsychological functioning
Negative symptoms

ABSTRACT

Problems in real-world functioning are pervasive in schizophrenia and much recent effort has been devoted to uncovering factors which contribute to poor functioning. The goal of this study was to examine the role of four such factors: social cognition (theory of mind), neurocognition, negative symptoms, and functional capacity (social competence). 178 individuals with schizophrenia or schizoaffective disorder completed measures of theory of mind, neurocognition, negative symptoms, social competence, and self-reported functioning. Path models sought to determine the relationships among these variables. Theory of mind as indexed by the Hinting Task partially mediated the relationship between neurocognition and social competence, and negative symptoms and social competence demonstrated significant direct paths with self-reported functioning. Study results suggest theory of mind serves as an important mediator in addition to previously investigated social cognitive domains of emotional and social perception. The current study also highlights the need to determine variables which mediate the relationship between functional capacity and real-world functioning.

1. Introduction

Deficits in such diverse areas of functioning as communicating with others, obtaining and maintaining employment, and general community functioning have been widely documented and are apparent throughout the schizophrenia spectrum (Addington et al., 2003; Walker, 1994; Wiersma et al., 2000). Interventions targeting functional impairment should be guided by research on the factors that contribute to problems in functioning. Several factors have been theoretically and empirically linked with functioning. First, functional attainment, or one's demonstrated ability to live independently in the real-world, is reliant on the skills necessary to achieve this independence, or functional capacity (Patterson and Mausbach, 2010). In addition, neurocognition, social cognition, and negative symptoms are also significantly associated with functioning in prior research. The empirical support for each of these constructs is outlined in the following paragraphs.

Neurocognition, a constellation of cognitive abilities including processing speed, working memory, visual and verbal learning and memory, and executive functioning, has been reliably associated with functional impairment both concurrently and prospectively (e.g., Green et al., 2000). Research has shown that neurocognitive impairment is a well-established feature of schizophrenia (reviewed in Heinrichs and Zakzanis, 1998; Hoff and Kremen, 2002), with some proposing neurocognitive impairment plays a role in most of the disturbances observed in schizophrenia (Cornblatt et al., 2009). Although neurocognitive impairment

* Corresponding author. Tel.: +1 301 405 7190; fax: +1 301 314 9566.
E-mail addresses: scouture@psyc.umd.edu (S.M. Couture), egranholm@ucsd.edu (E.L. Granholm), scott.c.fish@gmail.com (S.C. Fish).

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doi:10.1016/j.schres.2010.09.020

may account for 20–60% of the variance in real-world outcomes (Green et al., 2000), 40–80% of the variance in functional outcome is unaccounted for by traditional neurocognitive measures. Clearly other relevant factors contribute to functional impairment in schizophrenia.

In line with this notion, independent research groups have suggested that attention must focus on identifying factors that mediate the relationship between neurocognition and functioning behaviors in order to enhance predictive value and identify further treatment targets (Green et al., 2000). Social cognition, "a domain of cognition that involves the perception, interpretation, and processing of social information" (Ostrom, 1984, p.176), clearly requires neurocognitive skills (e.g., reasoning, attention, basic perception) and has obvious links with social behavior. Thus, it is not surprising social cognition has been proposed as likely candidate for mediation. Specifically, it has been demonstrated that social cognition is distinct from neurocognition (e.g., Sergi et al., 2007), and that it is significantly associated with functional outcome (reviewed in Couture et al., 2006). In addition, several studies have investigated the hypothesis that social cognition serves as a mediator between neurocognition and functional outcome. For instance, Addington et al. (2006) found that social perception and social knowledge fully mediated the relationship between neurocognition and social problem solving, and partially mediated the relationship with social functioning in an early psychosis sample. Similarly, a second study also found support for the role of social perception as a mediator between early visual processing and functional outcome (Sergi et al., 2006), and social perception was also identified as a mediator in the relationship between neurocogniton and work skills in a third study (Vauth et al., 2004). In contrast, Nienow et al. (2006) found evidence that affect recognition performed as a moderator, rather than a mediator, in the relationship between attention/vigilance and social problem solving. Accordingly, it seems clear that social cognition, as measured by emotion or social perception, appears to play a crucial role in the relationship between neurocognition and domains of functional outcome.

Theory of Mind (ToM) is another aspect of social cognition that has not yet been evaluated as a mediator. ToM involves the ability to ascertain the mental states of others, and accordingly is likely to affect functioning behaviors to a great extent (Bora et al., 2006). Indeed, there is preliminary evidence to support a link between ToM and functional outcome (Couture et al., 2006), and several studies have found associations between ToM and neurocognition (e.g., Greig et al., 2004). Although ToM and emotion perception are both under the umbrella of social cognition, ToM and emotion perception are distinct constructs. For example, in individuals with traumatic brain injury, ToM and emotion perception performance could be dissociated (Henry et al., 2006; McDonald and Flanagan, 2004), and in studies of individuals with schizophrenia, ToM and emotion recognition have demonstrated no, or very little, association with one another (Bell et al., 2009; Brune, 2005). Therefore, the present study is an important extension of previous research by examining whether ToM also mediates the relationship between neurocognitive impairment and functional outcome.

A third factor found to mediate the relationship between neurocognition and functioning behaviors is functional capacity. There may be a discrepancy between which behaviors are performed in the real-world, versus which behaviors the individual is capable of performing (Harvey et al., 2007). This distinction between performance and capacity has given rise to investigation of several new performance-based measures assessing functional capacity. Social competence is one aspect of functional capacity which has been reliably measured with role play tasks such as the Maryland Assessment of Social Competence (MASC; Bellack et al., 2006). The MASC is able to differentiate between good and poor work outcomes within schizophrenia, and between patients with schizophrenia and healthy controls or those with bipolar disorder (Bellack et al., 2006). Similar to findings from real-world functioning measures, the MASC has also demonstrated relationships with neurocognition (Green et al., 2008). Other role-play tasks, such as the conversation probe (e.g., Penn et al., 1994), have evidenced significant relationships with the social cognitive domains of affect recognition, social perception, and ToM (Pinkham and Penn, 2006). Thus, there is evidence to suggest that the ability to understand the intentions of others (ToM) is associated with social competence, and ultimately, real-world functioning.

Finally, functioning behaviors have also been associated with negative symptoms, Clearly, features such as appropriate levels of motivation, the ability to experience rewards in the environment, and the expression of one's emotional state in an appropriate manner are necessary to navigate life challenges effectively. In support of this idea, negative symptoms have been significantly associated with functional outcome (e.g., Guaiana et al., 2007), neurocognition (e.g., Harvey et al., 2006), and ToM (e.g., Corcoran et al., 1995), which provides evidence of its suitability for inclusion in modern models of real-world functioning. In addition, a recent study (Leifker et al., 2009) found that negative symptoms served as a mediator between functional capacity and real-world functioning behaviors. These findings suggest that if individuals with schizophrenia possess the necessary skills to function well in the community, negative symptoms may be predictive of whether they actually engage in these behaviors in the real-world. Deficient skill level (i.e., functional capacity) may be impaired prior to illness onset and may thus affect the development of negative symptoms via lack of successful experiences and through the formation of dysfunctional beliefs and low self-efficacy (e.g., Beck et al., 2009). In contrast, one recent study found that negative symptoms are associated with neurocognitive ability and each independently predict functioning behaviors (Bowie et al., 2006), and another found that social competence mediates the relationship between negative symptoms and interpersonal functioning (Bowie et al., 2008). Thus, these findings are in line with conceptualizations of negative symptoms as illness factors which are more closely tied to the neurocognitive and biological markers of schizophrenia. Taken together, previous work clearly indicates negative symptoms are important in predicting real-world functioning, although it is unclear whether negative symptoms are best thought of as a proximal cause to functioning behaviors (i.e., reflecting poor drive and motivation to perform the behaviors they are capable of) or a more distal cause affecting the ability to correctly ascertain appropriate social