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Evidence that communication impairment in schizophrenia is associated with generalized poor task performance

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ABSTRACT

People with schizophrenia exhibit wide-ranging cognitive deficits, including slower processing speed and decreased cognitive control. Disorganized speech symptoms, such as communication impairment, have been associated with poor cognitive control task performance (e.g., goal maintenance and working memory). Whether communication impairment is associated with poorer performance on a broader range of non-cognitive control measures is unclear. In the current study, people with schizophrenia (n =51) and non-psychiatric controls (n =26) completed speech interviews allowing for reliable quantitative assessment of communication impairment. Participants also completed multiple goal maintenance and working memory tasks. In addition, we also examined (a) simple measures of processing speed involving highly automatic prepotent responses and (b) a non-cognitive control measure of general task performance. Schizophrenia communication impairment was significantly associated with poor performance in all cognitive domains, with the largest association found with processing speed (r_s =−0.52). Further, communication impairment was also associated with the non-cognitive control measure of poor general task performance (r_s =−0.43). In contrast, alogia, a negative speech symptom, and positive symptoms were less if at all related to cognitive task performance. Overall, this study suggests that communication impairment in schizophrenia may be associated with relatively generalized poor cognitive task performance.

1. Introduction

People with schizophrenia exhibit wide ranging deficits in most cognitive domains, such as goal maintenance, working memory, and processing speed (e.g., Nuechterlein et al., 2004). One focus of schizophrenia research has been whether cognitive deficits are related to specific symptoms of schizophrenia (Dominguez et al., 2009). A schizophrenia symptom consistently associated with poor cognitive task performance is disorganized speech (e.g., Kerns and Berenbaum, 2002; Dominguez et al., 2009; Tandon et al., 2009). In particular, disorganized speech symptoms, such as communication impairment (i.e., communication impairment is defined as communication failures in speech, that is, a phrase or passage of speech in which the meaning is sufficiently unclear to impair the overall meaning of the speech passage; Docherty, 2005), have been consistently associated with poor performance on cognitive control tasks (e.g., Docherty et al., 1996b; Kerns and Berenbaum, 2002), which are tasks that require goal directed behavior in the face of conflict (Rougier et al., 2005). However, whether disorganized speech is associated with poorer performance on a broader range of tasks that do not require cognitive control (i.e., non-cognitive control tasks, such as processing speed on an automatic task) is unclear. The current research examined whether communication impairment in schizophrenia was specifically associated with poor cognitive control task performance or associated with a pattern of general poor task performance[1] that was not restricted to cognitive control tasks.

Disorganized speech refers to speech that is difficult to understand or poorly organized (e.g., frequent jumping to unrelated ideas;

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[1] "General poor task performance," alternatively referred to as "the generalized deficit," is the tendency for those with schizophrenia to perform poorly across a broad range of cognitive tasks, regardless of the specific cognitive abilities required by the task (for more on the generalized deficit, see Dickinson et al. (2008)).

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Andreasen, 1979; McGrath, 1991). One conceptualization of disorganized speech is communication impairment, which refers to frequent instances of significant speech unclarity (Docherty, 2005) and is typically measured by the Communication Disturbances Index (CDI; Docherty et al., 1996a). The CDI rates speech based on the occurrence of language that fails to communicate the intended message through unclear references or grammatical disturbances.[2] Communication impairment is related to more traditional constructs of disorganized speech, such as formal thought disorder (Docherty and Gordinier, 1999) and measures such as the Thought, Language, and Communication (TLC) scale (Docherty et al., 1996a). However, in measuring disorganized speech, communication impairment focuses on the communication failures in speech, rather than the underlying thought disorder (Docherty, 2005). Communication impairment can be assessed very sensitively (Kerns and Berenbaum, 2003) and reliably (Docherty et al., 1996a) and has been found to be elevated in first-degree relatives of people with schizophrenia (Docherty et al., 2004).

Furthermore, as previously mentioned, communication impairment and other disorganized speech measures have been consistently associated with poor cognitive control task performance, including measures of goal maintenance and working memory (e.g., Docherty et al., 1996b; Cohen et al., 1999). Goal maintenance is the ability to maintain important task critical information, such as rules, goals, or instructions (Rougier et al., 2005). In a meta-analytic review, cognitive control (executive functioning) task performance was strongly associated with disorganized speech symptoms (Kerns and Berenbaum, 2002). More recently, communication impairment has consistently been associated with both poor goal maintenance and poor working memory task performance (e.g., Kerns and Berenbaum, 2003; Docherty, 2005; Becker et al., 2012; Docherty, 2012). However, despite the strong evidence for a relationship between disorganized speech and cognitive control, previous research has not examined cognitive control using the AX-CPT, which is arguably the most well-validated measure of cognitive control (Cohen et al., 1999). Therefore, one goal of the present study is to further examine the relationship between communication impairment and cognitive control by using the AX-CPT as the measure of cognitive control.

Extending beyond cognitive control, it is not clear whether disorganized speech measures are also associated with broader non-cognitive control task performance. For instance, processing speed is a well-established deficit in schizophrenia (Dickinson et al., 2007) and there is some previous evidence that communication impairment is also associated with deficits in processing speed (Docherty, 2005; Docherty et al., 2006). Hence, the current research examined whether communication impairment in schizophrenia was associated only with complex cognitive control measures such as working memory and goal maintenance tasks or whether communication impairment would also be associated with simpler non-cognitive control measures, such as slower processing speed and general poor task performance. In contrast to the complex cognitive control measures, we examined whether communication disturbances would be related to processing speed for responses that required minimal attention and cognitive processing due to previous associations between stimulus and response (i.e., prepotent responses). Similarly, general poor task performance was measured with a non-cognitive control condition of the AX-CPT task (i.e., BY errors). Following Docherty (2012), we also examined whether cognitive control measures (i.e., "more complex cognitive measures" in Docherty) were still statistically associated with communication impairment after accounting for non-cognitive control measures (i.e., "less complex cognitive measures" in Docherty).

[2] One such example is confused references, which, according to Docherty et al. (1996a), "are unclear because they could refer to one of at least two clear-cut alternative referents, and the correct choice is not obvious" (p. 359). For example, "He stabbed the dude and I kicked him. I thought he punched him. I thought he was on the ground just acting like he was hurt" (p. 359, Docherty et al., 1996a).

Finally, although disorganization is the symptom most associated with cognition, negative speech symptoms such as alogia, or decreased amount of speech, have also been associated with cognitive deficits (e.g., Becker et al., 2012). Therefore, we also examined the relationships between cognitive performance and both negative and positive symptoms.

2. Method

2.1. Participants

Fifty-one people with schizophrenia and 26 healthy controls participated in this study. The schizophrenia group was comprised of non-acute inpatients recruited from a long-term state psychiatric hospital with a largely forensic population, and with participants residing on units in which the average length of stay was approximately 8 years. Given that prolonged hospitalization in this sample was often not contingent on current symptomatology or functional disability, there was a wide range of functioning within the group of people with schizophrenia. For instance, for hallucinatory behavior on the BPRS, 34% had scores of 4 or above and for unusual thought content 51% had scores of 5 or above. As far as general cognitive functioning, on the Mini-Mental State Examination (MMSE; Folstein et al., 1975), patients scored between 19 and 30 (i.e., the max score), with 3 people having scores less than 21% and 80% having MMSE scores above 24. This wide variation and lack of truncated range for both symptoms and cognitive functioning is arguably ideal for assessing the relationships between symptoms and cognitive performance (e.g., difficult to assess relationships in a relatively low symptom and/or minimal cognitive deficit group; there is limited generalizability of understanding relationship between cognition and symptoms in schizophrenia if only assessing people with low levels of both cognitive deficits and symptoms). All eligible participants met Diagnostic and Statistical Manual of Mental Disorders (4th ed.; DSM-IV; American Psychiatric Association, 1994) criteria for schizophrenia (n =33) or schizoaffective disorder (n =18) based on the Structured Clinical Interview for the DSM-IV (SCID; First et al., 1998). All but three participants in the schizophrenia group were taking antipsychotic medication at the time of participation: 9% taking typical antipsychotics, 53% atypical, and 38% combination of typical and atypical. We collected specific antipsychotic dosage information from 35 of the patients with schizophrenia and converted dose to chlorpromazine equivalents (due to limited access to medical records, specific dosage information was not available for the other 16 patients). For those 35 patients with known medication dose, there was no relationship between chlorpromazine equivalents and CDI scores or other symptoms (all $p > 0.32$). Given the absence of associations with symptoms makes it, if anything, arguably less likely that antipsychotic effects can account for any of the associations between task performance and symptoms (for limitations of this approach, see Blanchard and Neale (1992)). Control participants were recruited through community advertisements in central Missouri. Exclusion criteria for controls were no history of psychosis and no current Axis I disorder based on the SCID. General exclusionary criteria for both groups included diagnosis of a substance disorder within the past 6 months, diagnosis of intellectual disability, a history of any neurological event or disease (e.g., loss of consciousness for more than 10 min) or being a non-native English speaker. As can be seen in Table 1, the groups did not differ in age, gender, or parental education, all $p > 0.20$. The groups did differ in ethnicity, $\chi^2 = 6.30$, $p = 0.01$, but there was no evidence that differences in ethnicity accounted for any group differences presented in the results (i.e., when sample was restricted to one ethnicity or when ethnicity was included as a covariate, all results remained the same). This study was approved by the Institutional Review Board of the University of Missouri, the state of Missouri Department of Mental Health, and Fulton State Hospital.