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## Communication Abnormalities Predict Functional Outcomes in Chronic Schizophrenia: Differential Associations with Social and Adaptive Functions

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### Abstract

Communication abnormalities are hallmark features of schizophrenia. Despite the prevalence and persistence of these symptoms, little is known about their functional implications. In this study, we examined, in a sample of chronically institutionalized schizophrenia patients (N=317), whether two types of communication abnormalities (i.e., verbal underproductivity and disconnected speech) had differential relationships with social and adaptive outcomes. Baseline ratings of verbal underproductivity, disconnected speech, global cognitive performance, and clinical symptoms, were entered into stepwise regression analyses to examine their relationship with 2.5 year social and adaptive outcomes. At baseline, disconnected speech was significantly associated with socially impolite behavior, while verbal underproductivity was associated with social disengagement and impaired friendships. Both types of communication abnormalities were significantly associated with other types of social skills. Verbal underproductivity predicted follow-up social skills, social engagement, and friendships, accounting for more variance than cognition or symptoms. In contrast to social outcomes, adaptive outcomes were predicted by baseline neurocognition and clinical symptoms, but not communication abnormalities. These findings provide evidence for specific relationships of communication disorder subtypes with diverse impairments in social functions. In this chronically institutionalized sample, communication disorder was a stronger predictor of social, but not adaptive, outcomes than neurocognition or clinical symptoms.

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## 1.1 Introduction

Communication abnormalities (commonly referred to as formal thought disorder) have long been recognized as a core symptom of schizophrenia, dating back to the original conceptions of the illness (Bleuler, 1911; Kraepelin 1919). Several investigators have argued that the term “*thought disorder*” is misleading when one refers to the speech of schizophrenia patients, since this term assumes a direct link between the manifest behavior of speech with the less observable process of thought (Chaika, 1990; Harvey, 1983). The term “*thought disorder*”, in contrast to language disorder or communication disorder, may conceptually overlap with a variety of deficits in crucial neurocognitive abilities (e.g., information processing) as well as deficits in language performance. The contemporary distinction between thought and overt language may be even more important, given the increasingly sophisticated focus on finding discrete causes of specific real world functional impairments (Evans et al, 2003; Bowie et al, 2008; Williams et al, 2008). Of these causes, neurocognitive dysfunction typically emerges as the most robust and reliable predictor, with this robustness often contrasted to the more modest correlations of positive and negative symptoms with everyday functional outcomes (Green, 1996; Harvey et al, 1997a; Bowie et al, 2006). Yet, communication abnormalities are often omitted from these predictions. In other cases, they are amalgamated with positive, negative, or disorganized symptoms or assessed with questionably valid single-item ratings from interviews designed to rate clinical symptoms. The specific contributions of communication disturbances, compared to other symptoms and cognitive impairments, to real-world functional disability are unknown.

Communication disturbances take various forms, often defined as either “positive” or “negative” thought disorder (Andreasen, 1979a,b). Positive thought disorder is characterized by disconnected or disorganized speech, such as reduced connectedness between concepts expressed as words or phrases, inadequate (i.e., tangential) responses to questions or circumstantial and discursive speech patterns. Negative thought disorder manifests as a reduction of verbal output. These subtypes, referred to hereafter as disconnected speech and verbal underproductivity, are distinct from one another (Andreasen, 1979a; Harvey et al, 1992) and from positive and negative symptoms in young, neuroleptic-naïve (John et al, 2003) and chronically ill (White et al, 1997) samples. Several investigators have reported more substantial associations between communication disorder and elements of disorganized behavior and aspects of cognitive dysfunction. There is some evidence for somewhat specific correlations among various cognitive impairments and communication disorder subtypes (Subotnik et al; 2006; Kerns, 2007); however, these correlations are often modest, with some studies even finding small, non-significant relationships (Maeda et al, 2007). Further, communication abnormalities and cognitive dysfunction have differential responses to conventional antipsychotic treatment (Gold & Hurt, 1990). For many patients, communication disorder responds well to antipsychotic medications (Harvey & Pedley, 1989; Gold & Hurt, 1990; Clark et al, 1994), though a substantial proportion do not respond or experience residual deficiencies in communication (Marengo & Harrow, 1987). Taken together, these findings suggest that cognitive dysfunction and communication disorder are related but separable features of schizophrenia, much like the relationship between negative symptoms and cognitive deficits (Harvey et al., 2006).

Both disconnected speech and verbal underproductivity appear to be stable traits through much of the course of schizophrenia (Harvey et al, 1984; Marengo & Harrow, 1997; Harvey et al, 1990), though in late-life, patients who have a chronic, continuous course of illness show both more severe impairments than younger patients (Harvey et al., 1997b) and a pattern of longitudinal worsening in verbal underproductivity (Bowie et al, 2005). Despite the chronicity of communication disorder and a large literature base dedicated to its etiology, little is known about its functional implications, in contrast to recent sophisticated work on prediction of, for instance, vocational disturbances where persistent psychotic symptoms and cognitive abnormalities are shown to have incremental potential to predict poor vocational outcomes (McGurk et al., 2003).

Within the small existing literature base dedicated to the functional implications of communication disorder, Harrow and colleagues (Harrow et al, 1983; Marengo & Harrow, 1987; Racenstein et al, 1999) found more severe and persistent formal thought disorder (i.e., disconnected speech) was associated with poorer premorbid work adjustment, rehospitalization, and global deficits in adaptive functions such as work, with disconnected speech predicting 12% of the variance in work functioning at 7.5y follow-up. Ulas et al, (2008) found small non-significant associations of both verbal underproductivity and disconnected speech with self-reported quality of well being, but self-reported quality of well being in schizophrenia has previously been found to be unreliable and uncorrelated with performance on objective measures of disability (McKibbin et al., 2004). Finally, in a large-scale study, Keefe et al. (1987) found that total scores on a measure of formal thought disorder were one of the major discriminators between patients with schizophrenia who were completely and persistently disabled for 5 or more years and those who were not.

Thus, the few previous studies of the relationships among communication disorder and outcome variables are limited by 1) a reliance on self-reported assessment of outcomes, which can be inaccurate in schizophrenia (McKibbin et al, 2004; Bowie et al, 2007); 2) use of global measures of outcomes that combine social and everyday living behaviors, which vary in course (Harvey et al, 1997a) and have different predictors (Bowie et al, 2008), and 3) use of global measures of communication disorder and a failure to distinguish between disconnected speech and verbal underproductivity (which are typically not significantly correlated).

## 1.2 Purpose

In this study, we examined deficits in social and adaptive behavior as a function of the severity of different clinically rated aspects of communication disorder in an older sample of chronically ill patients with schizophrenia who were living in institutional settings. We selected a subsample of patients from a previous study of the course of communication disorder (Bowie et al, 2005) who were also rated with a reliable and valid measure of social and adaptive deficits, and who were examined with a neurocognitive assessment. We examined the cross-sectional correlation of the two communication disorder subtypes with social and adaptive functions and then examined, along with symptoms and neurocognitive deficits, their predictive value for identification of longitudinal changes in social and adaptive outcomes. In the absence of a strong literature base, we hypothesized that

disconnected speech would be negatively associated with social skills and friendships because this form of communication disorder is, at least superficially, more socially disruptive. We hypothesized that verbal underproductivity would be associated with impairments in communication, conversation, social skills, and social engagement. Thirdly, we hypothesized that these differential relationships would add to the predictive value of social functions, but not everyday adaptive living skills, after accounting for the influence of neurocognitive dysfunction on these outcomes.

## 2.1 Methods

### 2.1.1 Subjects

Subjects in this study were part of a longitudinal study of chronic schizophrenia described in detail elsewhere (Davidson, 1995; Bowie et al., 2005). All subjects were residing in a state psychiatric inpatient facility or in a restricted nursing home setting. For these analyses, we selected schizophrenia patients who had been rated for communication disorder and were available for follow-up analyses of their functional status. We selected subjects who had at least 6 years of education to exclude those who may have experienced significant developmental delays and a Mini-Mental Status Examination (Folstein et al, 1975) of 10 or greater since we have previously found this cutoff to distinguish our ability to assess patients with the cognitive battery employed in this study (Bowie et al, 2002). All subjects met DSM-IV criteria for schizophrenia or schizoaffective disorder and diagnoses were confirmed at consensus meetings with the second author.

### 2.2.1 Measures

In this project, research subjects are followed longitudinally and scheduled to be reevaluated every two years, depending on availability. All measures are performed at each time point by a master's level psychometrician. Training on all measures was conducted over one week by the first and/or second author. Integrity of ratings was maintained by quarterly retraining sessions as well as quality assurance checks of all data. Inter-rater reliability statistics are provided for specific measures below.

Communication disorder was rated with the Scale for Assessment of Thought, Language, and Communication (TLC; Andreasen et al, 1979a,b). The TLC ratings were based on five to ten minute unscripted conversations conducted prior to other assessment procedures as well as observation of communication during other aspects of the clinical assessments. The TLC provides definitions and criteria for 18 subtypes of abnormal language expression. Two subtypes of communication abnormalities previously identified with confirmatory factor analysis (Harvey et al, 1992), disconnected speech and verbal underproductivity, were examined. Disconnected speech is defined as the mean of the following TLC items: Derailment, Tangentiality, Loss of Goal, Circumstantially and Incoherence (Harvey et al, 1992). Verbal underproductivity is the score on the Poverty of Speech item from the TLC. The aspects of speech performance reported on here were found in a previous study to have suitable inter-rater reliability (all ICCs > .56, range .56-.91; Harvey et al, 1997b) in older patients with schizophrenia with our raters, who performed these assessments well prior to the formulation of these hypotheses. Many of the other elements of communication disorder

defined by the TLC were simply not common enough to have sufficient reliability to be included in the analyses (see Harvey et al., 1997b for a reliability analysis of these communication disorder subtypes)

A Neurocognitive Composite Score (NCS) was created by averaging standard scores from performance on neurocognitive tests included in the Consortium to Establish a Registry for Alzheimer's Disease (CERAD; Morris et al, 1993) battery, for which all patients provided data. The CERAD battery is comprised of a 10-item, 3-trial word list learning, delayed recall, and recognition task, a modified (15-item) version of the Boston Naming Test, Semantic (i.e., animal naming) Fluency, and an assessment of Constructional Praxis. To create the NCS, the mean of standard scores based on healthy control data adjusted for age (Morris et al, 1993) was calculated for each participant.

Severity of clinical symptoms was examined with the Positive and Negative Syndrome Scale (PANSS; Kay, 1991). After a chart review and structured interview with the patient and clinician informant, seven positive symptoms, seven negative symptoms, and sixteen general aspects of psychopathology are rated on a seven-point Likert scale. Inter-rater reliability for the PANSS for our raters ranges from 0.86 to 1.00 ( $p < .01$ ). For the present analyses, we used the total score by summing all items with the exception of conceptual disorganization, lack of spontaneity and flow of conversation, and social withdrawal, since these items have definitional and methodological overlap with the TLC or Social Outcomes measure.

Functional disability was rated with the Social Adaptive Functioning Evaluation (SAFE; Harvey et al., 1997c). The SAFE is a 17-item scale designed for use in inpatient settings. It measures social-interpersonal, instrumental self-care, and impulse-control features of daily living outcomes, with each item ranging from 0 (no impairment) to 4 (extreme impairment), with behavioral anchors provided for each item. The scale is rated after observation of the subject, as well as an interview with a clinician who observes behavior on a daily basis in these inpatient settings. As opposed to the TLC, which is rated by the research examiner based on speech expressed during a delineated conversation, the SAFE is rated on the basis of observations by clinical staff in the patient's environment over the week prior to the assessment, reducing the chance of associations between these variables being an artifact of shared method variance. The SAFE has suitable reliability, with inter-rater reliabilities of the items all exceeding .88 (ICC,  $n=60$ ). In this study, we were interested in the differential prediction of impairment of specific behaviors from the social-interpersonal domain, as opposed to instrumental adaptive functions, to examine whether disconnected speech and verbal underproductivity had differential relationships with these behaviors. The social-interpersonal domain comprises six social behaviors: Communication, Conversation, Social Skills, Social Politeness, Social Engagement, and Friendships. Communication assesses success in using the telephone or writing letters. Note that this item is only rated if the patient has the opportunity to perform these activities, resulting in a smaller sample size than the other variables. Conversation is rated from the engaging in and sustaining dialogue and considers verbal as well as non-verbal behavior. Instrumental social skills consider the patient's ability to satisfactorily ask for assistance or direction. Social Politeness is based on the regard the patient has for others during social contact and considers insults, disruptive

behavior, and greeting others. The rating for Social Engagement is based on the initiation and responsiveness, quantity and quality of the patient's interactions with his or her peers. Clinicians' ratings of the Friendship item consider the quantity, closeness, stability, and frequency of contacts. We also examined an adaptive functioning score derived from the SAFE to distinguish instrumental adaptive functioning (e.g., dressing, eating, recreational pursuits) from social behavior, since there is reason to believe that there are different predictors of social versus adaptive behavior in schizophrenia (Bowie et al, 2008).

### 2.3.1 Data Analysis

Partial correlations were calculated to examine the magnitude and direction of the associations of disconnected speech and verbal underproductivity with the six social behaviors and with adaptive behavior while adjusting for age at baseline. Age was used in the partial correlations due to the wide age range of the present sample and previous work that revealed a significant relationship of age with the two types of communication abnormalities (Bowie et al, 2005). Using the Bonferroni procedure, the alpha-level was adjusted to .003 (.05/14) to correct for multiple comparisons. The test for significance of the differences between correlation coefficients was used to examine whether associations with social behavior were stronger for a specific communication disorder subtype. Disconnected speech, verbal underproductivity, age at baseline assessment, clinical symptoms, and neurocognition were entered in stepwise regression analyses to predict each of the social behaviors and adaptive functioning at the follow-up assessment.

### 3.1.1 Results

#### 3.1.2 Demographics

Of the 317 chronically ill schizophrenia patients who met our selection criteria, 198 (62.5%) were male; the group had a mean age of 67.7 (SD=11.5; range 51–93) at baseline, a mean of 11.5 (SD=2.3) years of education, and a mean age at first hospitalization of 26.5 (SD=10.1). All subjects but one was taking at least one antipsychotic medication. The mean follow-up interval was 753 days (SD=446; range 249–2125). 80% of patients were Caucasian, 16% were African-American, 3% were Hispanic, and less than 1% were Asian. All were English speaking (for 95% English was the first language) without sensory deficits, and cooperative with the assessment procedures. The mean item rating for the total PANSS score was 3.0 (SD=0.81) at baseline and 3.1 (SD=0.90) at follow-up. Subjects were mild to moderately cognitively impaired, with a mean composite z-score of –1.2 relative to normative standards (SD=1.7) at baseline and –1.3 (SD=0.9) at follow-up. Mean rating on the disconnection score was 4.8 (SD=1.1; possible range 0–17) at baseline and 3.9 (SD=2.9) at follow-up. Mean rating on the poverty of speech item was 0.96 (SD=1.0; possible range 0–4) at baseline and 1.3 (SD=1.3) at follow-up.

#### 3.1.3 Baseline Correlational Analyses

The two types of communication disorder had a modest inverse relationship ( $r=-.25$ ,  $p<.001$ ). As seen in table 1, verbal underproductivity and disconnected speech had differential relationships with specific social behaviors. Tests of significance of the differences between correlation coefficients revealed a significantly higher association for more severe

disconnected speech and social impoliteness ( $p=.001$ ) and higher associations for increased verbal underproductivity and social disengagement ( $p<.001$ ) and impairments in friendships ( $p<.001$ ). Both communication disorder subtypes had statistically significant, modest correlations with communication, conversation, and social skills.

The NCS had a small, non-significant correlations with disconnected speech ( $r=-.03$ ;  $p=.57$ ) and modest negative relationships with verbal underproductivity ( $r=-.24$ ;  $p<.001$ ) and PANSS total score ( $r=-.28$ ,  $p<.001$ ). PANSS total score had modest relationships with disconnected speech ( $r=.23$ ,  $p<.001$ ) and verbal underproductivity ( $r=.21$ ,  $p<.001$ ). Thus, although statistically significant correlations exist among the potential predictors of functional outcome, the relationships are small enough that the multicollinearity is not an issue.

### 3.1.4 Longitudinal Regression Analyses

The regression analyses revealed differential relationships with specific social outcomes, as seen in table 2. Neurocognitive performance at baseline was the strongest predictor of communication skills at follow-up, with both types of communication disorder and age at baseline contributing small, statistically significant variance. Clinical symptoms were the strongest predictor of conversation and social politeness, with disconnected speech adding additional variance to both of these social outcomes. Verbal underproductivity was the most robust predictor of social skills, which was also predicted by disconnected speech. Verbal underproductivity also entered first in the prediction of social engagement and friendships, which were also predicted by clinical symptoms and age at baseline. As opposed to social behavior, adaptive behavior was largely predicted by cognitive functioning, with clinical symptoms and age at baseline, but not communication abnormalities, also contributing to follow-up performance in this domain.

#### 4.1.1 Discussion

This study found evidence for differential relationships of communication disorder subtypes with diverse aspects of social functioning in an older, chronically hospitalized sample of patients with schizophrenia. Disconnected speech (i.e., formal thought disorder) was associated with more socially disruptive behavior, while verbal underproductivity (i.e., negative thought disorder) was associated with withdrawal from social contact and fewer friendships. In contrast to social behavior, neither type of communication disorder predicted adaptive functioning when neurocognitive, clinical symptoms, and age at baseline were considered.

Interestingly, disconnected speech was associated with socially disruptive behavior, but not the number or quality of friendships. It is possible that within the milieu of inpatient settings, disorganized speech and impoliteness do not impinge on engagement with peers. The rating of social politeness does not specify the target of the behavior. Since this item is rated by a clinician, it is possible that impolite behavior toward a clinician is more likely to be rated on this scale. Not yet known is whether impolite behavior toward peers would be associated with fewer friendships or the extent to which these findings from an inpatient setting would translate to a community setting.

Predictions of social behavior at the 2.5 year follow-up assessment revealed similar distinctions between communication disorder subtypes. Interestingly, when a cognitive composite score was included with the communication disorder subtypes, it entered first only when predicting communication and adaptive behavior. The skills necessary for the communication item could be argued to be more representative of instrumental adaptive behavior (e.g., communicating through writing or using the telephone), while the other social items represent interpersonal behavior. Even when neurocognitive functions and clinical symptoms entered the predictive equations first, communication disorder still contributed to the variance in social outcomes, but not adaptive life skills at follow-up. Verbal underproductivity accounted for more variance than neurocognition or clinical symptoms in several social domains. The lower predictive power of neurocognition for social outcomes, relative to functional outcomes, is consistent with the results of a study of younger community dwelling patients with schizophrenia (McClure et al., 2007). In that study elements of a structured neuropsychological assessment were found to consistently correlate more highly with measures of the ability to perform functional skills measures in a laboratory setting than with performance on a direct measure of social competence.

The relative strength of the communication disorder subtypes in predicting outcomes is noteworthy, since there has been strong support for viewing neurocognitive dysfunction as a treatment target (Green et al., 2008; Nuechterlein et al., 2008; Kern et al., 2008) following its acceptance as a potent predictor of functional outcomes (Green, 1996). In this sample of institutionalized schizophrenia patients with severe cognitive impairments and persistent symptoms, communication disorder was a stronger predictor of social outcomes, while neurocognition predicted more variance in adaptive functional outcomes. These findings suggest that communication disorder and neurocognition, viewed as separable indicators of disordered thought processes (i.e., manifest speech versus ability to process information), are differentially related to diverse outcome domains.

#### 4.1.2 Limitations

While the sample size, thorough clinical assessment, and longitudinal research design are strengths of the study, we acknowledge several important issues that may limit the generalizability of these findings. First, we used a brief neurocognitive battery that was selected for its applicability to older, chronically ill patients who were likely to manifest severe cognitive dysfunction. This battery does not include some domains often include in research with schizophrenia patients, such as executive functioning or verbal working memory. Poor performance in executive functions is a strong predictor of both positive thought disorder (Barrera et al, 2005; Stirling et al, 2006) and functional outcomes (Green et al, 2000) in younger samples. Further, the social behavior of these older and chronically ill patients is rated from observations within the inpatient setting, which are markedly different from the social demands and opportunities in the community and among younger individuals. Thus, the present findings that associate communication disorder with social deficits will need to be replicated in younger and ambulatory samples with variable assessment procedures before they can be generalized throughout the course of schizophrenia.



### 4.1.3 Implications

For many chronically ill patients, disconnected speech or verbal underproductivity are persistent and functionally disabling. In the institutional setting, treatments aimed at reducing social dysfunction may have different targets than those aimed at adaptive functions. Acquisition of social skills may require efforts to address communication disorder, above and beyond attempts to alleviate clinical symptoms or remediate neurocognitive dysfunction. Several interventions have been piloted in this regard and they would seem to be a very reasonable strategy to reduce social disability in chronic schizophrenia.

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**Table 1**

Partial Correlation Coefficients (p-value) for Communication Disorder Subtypes with Social and Adaptive Behavior at Baseline Adjusting for Age at Baseline.

	<b>Verbal Underproductivity</b>	<b>Disconnected Speech</b>
Communication	.31 (<.001)	.19 (.001)
Conversation	.36 (<.001)	.33 (<.001)
Social Skills	.25 (.001)	.17 (.001)
Social Politeness *	.09 (.17)	.31 (<.001)
Social Engagement *	.43 (<.001)	.04 (.23)
Friendship *	.42 (<.001)	.03 (.62)
Adaptive Behavior	.25 (<.001)	.18 (.001)

Note: alpha adjusted to (.003) with Bonferroni procedure

\* Correlations between verbal underproductivity and disconnected speech were significantly different in magnitude with the test for significance of the differences between correlation coefficients

**Table 2**

## Stepwise Regressions Predicting Follow-up Functional Outcomes

Outcome Variable	Significant Predictors	R <sup>2</sup>	R <sup>2</sup>	F Change (df)	p-value
Communication	NCS	.15		50.0 (1,291)	<.001
	Verbal Underproductivity		.04	17.0 (1,290)	<.001
	Age		.03	14.1 (1,289)	<.001
	Disconnected Speech		.04	14.9 (1,288)	<.001
Conversation	PANSS	.14		49.3(1,308)	<.001
	Disconnected Speech		.08	32.1(1,307)	<.001
	Verbal Underproductivity		.06	23.3(1,306)	<.001
	NCS		.02	10.3(1,305)	.001
Social Skills	Verbal Underproductivity	.08		26.8(1,308)	<.001
	Disconnected Speech		.04	13.4(1,307)	<.001
Social Politeness	PANSS	.20		75.7(1,308)	<.001
	Disconnected Speech		.03	11.3 (1,307)	.006
Social Engagement	Verbal Underproductivity	.10		35.5(1,308)	<.001
	PANSS		.04	13.2(1,307)	<.001
	Age		.02	8.9 (1,306)	.003
Friendships	Verbal Underproductivity	.13		44.9(1,308)	<.001
	PANSS		.07	24.7(1,307)	<.001
	Age		.03	10.2 (1,306)	.002
Adaptive Functions	NCS	.14		48.3 (1,308)	<.001
	PANSS		.04	14.7(1,307)	<.001
	Age		.05	19.1 (1,306)	<.001

Note: PANSS= Positive and Negative Syndrome Scale total score without conceptual disorganization, lack of spontaneity and flow of conversation, and passive/apathetic social withdrawal. NCS=Neurocognitive Composite Score. Age=Age at baseline assessment.