Highlights

- Meta-analysis of 166 studies (12,868 individuals) examining relationships between neurocognition and social cognition and functional outcomes.
- Domains of neurocognition and social cognition demonstrate small to medium relationships with functional outcomes.
- Neurocognition and social cognition did not demonstrate significantly different relationships with functional outcomes, however, social cognition domains explained more unique variance.
- Social cognition is a partial mediator between neurocognition and functional outcomes.

Abstract

The current meta-analysis explored relationships between functional outcomes in schizophrenia spectrum disorders and different domains of neurocognition and social cognition. Literature searches were conducted in PsycINFO, PubMed, and ProQuest to identify articles reporting correlations between cognition domains and functional outcomes. Of 1,361 articles identified, 166 met all inclusion criteria (12,868 participants; 518 correlations). Fifty-three random-effects meta-analyses yielded mean correlation estimates for relationships between neurocognition and social cognition and functional outcomes. Overall, associations between social cognition and neurocognition, and functional outcomes demonstrated significant small-to-medium effect sizes. Social cognition explained more unique variance in functioning than neurocognition (7.3% vs. 4.4%; 9.2% total average variance). Social cognition also mediated the relationship between neurocognition and functional outcomes. A significant proportion of the variance in the relationships between cognition and functional outcomes remained unexplained. These findings suggest that integrated interventions targeting both neurocognition and social cognition may optimally improve functional outcomes. Standardized measurement of cognition and functioning, longitudinal studies, and tests of additional moderators (e.g., first episode samples) in future research were identified as important future directions.

Pathways to Functional Outcomes in Schizophrenia Spectrum Disorders: Meta-Analysis of Social Cognitive and Neurocognitive Predictors

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1. Introduction

Decades of research have established a strong link between functional outcomes in schizophrenia and impairments in both social cognition (SC) and neurocognition (NC) (Couture, Penn, & Roberts, 2006; Fett et al., 2011; Ludwig, Pinkham, Harvey, Kelsven, & Penn, 2017; Green, Kern, & Braff, 2011). As a result, interventions targeting NC (McGurk et al., 2007; Prikken et al., 2018; Reeder et al., 2017) *or* SC (Grant et al., 2017; Kurtz et al., 2016; Kurtz and Richardson, 2012), are widely disseminated yielding improvements in specific NC and SC abilities but equivocal effects on functional outcomes (e.g., Grant, Lawrence, Preti, Wykes, & Cella, 2017; Prikken et al., 2018). More nuanced understanding of interrelationships between NC and SC and effects on functioning is needed to clarify how to best target NC and SC to improve treatment development, implementation, and outcomes (Horan & Green, 2017).

Although both NC and SC exhibit some overlap (i.e., strong relationships with one another), they are demonstrably separate constructs that differentially relate to functional outcomes (Allen, Strauss, Donohue, & van Kammen, 2007; Ludwig, Pinkham, Harvey, Kelsven, & Penn, 2017; Nuechterlein et al., 2004). Pinkham, Penn, Green, & Harvey (2016) demonstrated that SC has incremental validity in explaining the variance in functional outcomes beyond NC in both first-episode and chronic schizophrenia populations, possibly as a mediator between NC and functional outcomes. Several studies support the role of SC as a mediator, providing additional evidence of a related but distinct relationship between NC, SC, and functional outcomes (Brekke et al., 2005; Schmidt et al., 2011; Vauth et al., 2004).

Despite support for SC as a mediator between NC and functional outcomes, the majority of interventions target either NC *or* SC impairments (Paquin et al., 2014). Interventions targeting only one domain of cognition may be one explanation for small or null effects on functional outcomes in schizophrenia (Horan & Green, 2017). A better understanding of the relationships between NC, SC, and functioning is necessary to inform development and dissemination of optimally effective interventions in schizophrenia.

We therefore undertook a meta-analysis of the relationships between functional outcomes in schizophrenia and social cognition and neurocognition. Meta-analysis is needed because the only previous quantitative review is 10 years old (studies reviewed up to 2007) and examined just 55 studies (Fett et al., 2011). Fett et al. (2011) found small to large mean correlations between NC and SC and functional outcomes. Interpreting the strongest individual correlations, the data suggested that SC explains more variance in functional outcomes than NC, with the strongest individual correlations observed between theory of mind and community functioning ($\hat{u}_p$ = .48; 23% variance explained) and attention and vigilance and social skills ($\hat{u}_p$ = .39; 15% variance explained), respectively. A search of PsychINFO indicated that more than 2,000 papers with "neurocognition" or "social cognition" and "functioning" in the title have been published during the interim. It is also the case that new work has emerged on SC domains such as attributional style and for participants in the early stages of schizophrenia ("first-episode psychosis" or FEP). Understanding how SC and NC relate to outcomes for FEP samples is important given the (a) qualitative differences between first-episode and chronic schizophrenia (e.g., Braw, Bloch, & Mendelovich, 2008), (b) increased focus on FEP treatments (e.g., RAISE Early Treatment Program, Kane et al., 2015), and (c) need for intervention before impairments in social functioning stabilize (Velthorst et al., 2017).

The present meta-analysis will review all eligible studies published up to July 2017 to improve our current understanding of interrelationships between NC and SC with functional outcomes in schizophrenia by: 1) quantifying the relationships between functional outcomes and domains of NC and SC, 2) comparing the strength of relationships between NC and SC with functional outcomes, while accounting for important moderator variables; 3) analyzing the associations between specific NC and SC cognitive domains and functional outcomes in FEP samples; and 4) formally testing mediation of the NC-functional outcome relation by SC.

2. Method

The meta-analysis was registered through Prospero (CRD42018092456) and followed PRISMA guidelines, see Supplementary Table 1 for concordance with PRISMA Checklist for meta-analyses (Moher et al., 2009).

2.1. Search Strategy

Articles for potential inclusion were identified through searches completed in July 2017 in the databases PsychINFO and PubMed. To address the file-drawer effect (Rosenthal, 1979), unpublished findings were identified through dissertations published on ProQuest and pre-prints published on PsyArXiv (searches yielded no pre-prints). All studies from Fett et al. (2011) were also included. Searches spanned August 2009, the most recent time period included by Fett et al. (2011) to July 2017. Search terms were identified through consultation with an academic librarian and included: *schizophrenia spectrum and other psychotic disorders* (PubMed MeSH term) or (*schizophrenia, psychosis, psychotic, schizophrenia spectrum, prodrome*) combined with functional outcome search terms *(functional outcome, independent living skills, skills of daily living, community functioning, social functioning, work functioning, occupational functioning, vocational functioning, social skill, quality of life, community behavior, social behavior, life satisfaction, social adjustment, social dysfunction, employment*) and neurocognition search terms (*neuropsych*, neurocog**) or social cognition search terms *(emotional perception, affect perception, emotional recognition, attribution*, theory or mind, mentalizing, mentalising, social cognition, prosody, social knowledge, mind reading, social cue, social judgment*). Search terms were identical to Fett et al. (2011) with the addition of: *schizophrenia spectrum* and *prodrome* and the use of PubMed MeSH term (*schizophrenia spectrum and other psychotic disorders*).

2.2. Article Inclusion Criteria

Articles were inspected for the following inclusion criteria: a) the article was written in English b) the sample consisted of individuals with a diagnosis of non-affective psychosis according to well

established diagnostic criteria (e.g., *Diagnostic and Statistical Manual of Mental Disorder* and the *International Classification of Diseases)*, c) at least one cross-sectional correlation between a cognitive domain and functional outcome measure was reported, d) established and reproducible outcome measures were used that could be classified into domains of cognition and functioning. Correlations with study-specific factor scores and partial correlations were excluded as these indices could not meaningfully be combined across studies. Samples with special characteristics (e.g., geriatric and forensic) were excluded to minimize potential bias in effect size estimates; low statistical power precluded using special sample characteristics as moderators.

2.2.1. Neurocognition Domains

Domains of NC included: attention and vigilance, processing speed, reasoning and problem solving, verbal comprehension, verbal fluency, verbal learning and memory, visual learning and memory, working memory, and combined neurocognition – a composite score based on two or more NC domains (Supplementary Table 3). NC domains were based on NC factors identified by the Measurement and Treatment Research to Improve Cognition in Schizophrenia (MATRICS) Committee (Nuechterlein et al., 2004).

2.2.2. Social Cognition Domains

Five domains of SC were included: attribution bias, emotion perception and processing, social knowledge and perception, theory of mind, and combined social cognition – a composite score based on two or more SC domains (Supplementary Table 3). SC domains were based on SC factors identified by the MATRICS Committee (Green, Olivier, Crawley, Penn, & Silverstein, 2005). The present review included attribution bias and combined social cognition domains, previously omitted in Fett et al. (2011), because new studies reported relationships between these SC domains and functional outcomes.

2.2.3. Domains of Functional Outcome

Four domains of functional outcomes were included in line with Fett et al. (2011): community functioning (e.g., activities of daily life and relationships), social behavior in the milieu (e.g., observed behaviors in a specific context), social problem solving (e.g., abilities to address a social problem or generate solutions), and social skills (e.g., social interaction abilities like eye contact and conversation skills, Supplementary Table 4). Functional outcomes are typically based on observer ratings (e.g., Quality of Life Scale; Heinrichs, Hanlon, & Carpenter, 1984), performance on a task meant to simulate real-world scenarios and responsibilities (e.g., UCSD Performance Based Skills Assessment; Patterson, Goldman, McKibbin, Hughs, & Jeste, 2001), ratings of social interaction during role-play tasks (e.g., Role Play Test; Penn, Mueser, Doonan, & Nishith, 1995), or observations made in-vivo such as work performance or behavior in a treatment setting (e.g., Work Personality Profile; Bolton & Roessler, 1986). In general, domains of community functioning and social behavior in the milieu are based on ratings of perceived real-world performance while domains of social problem solving and social skill are considered measures of functional capacity measured by task-based performance (Bowie, Reichenberg, Patterson, Heaton, & Harvey, 2006). Hence, measures of functional capacity are not the same as measures of community functioning and we would not expect the same pattern of effects.

2.4. Effect Size Relationships

Potential articles were pooled from all sources and duplicates were removed resulting in 1,361 articles (see Figure 1 for the flow of information through phases of the present review). Article titles were inspected for inclusion, followed by abstracts, resulting in 533 articles reviewed at the full-text level. Reasons for exclusion at the full-text level included a) study did not report a cross-sectional correlation between a cognitive domain and functional outcome (n = 352); b) sample included affective diagnoses (n = 8); c) sample was a specialized population (n = 6); d) article was not an empirical study (n = 1). Penn, Mueser, Doonan, & Nishith (1995), previously included in Fett et al. (2011), was excluded during full-text review since the Conversation Role Play Test, previously categorized as a

measure of social cognition, is now considered a functional outcome and thus a correlation between a cognition domain and functional outcome was not present.

One hundred and sixty-six articles met inclusion criteria for the present review (see Supplementary Materials for full reference list and Supplementary Table 2 for sample characteristics). If studies reported multiple cognition-outcome correlations within the same domain (e.g., working memory and community functioning), correlations were pooled. Studies were allowed to contribute multiple cognition-outcome correlations across unique domains (e.g., working memory and community functioning *and* working memory and social skills) resulting in a total of 518 effect sizes.

2.5. Coding Procedure

Article coding categories were defined prior to article review and were based on categories included by and recommendations by PRISMA (Moher et al., 2009). Articles were coded for: year of publication, country of publication, inpatient percentage, schizophrenia spectrum diagnoses, illness duration, chlorpromazine (CPZ) equivalent dosage, percent of sample taking medication, age, percent male, percent white, years of education, cognitive measure and classification, functional measure and classification, and risk of bias. Risk of bias was evaluated by adapting items for correlational studies from Downs and Black (1998) and generating a summary score of 1 (low risk of bias) to 3 (high risk of bias). Socioeconomic status, reliability of measures, and diagnostic standard were included in the coding procedure but not discussed here due to infrequent reporting. Supplementary Table 2 provides coding categories and corresponding study values.

All articles were double-coded by TFH and CCM or MOP (doctoral students in clinical psychology). Discrepancies in objective categories (e.g., sample size) were reconciled by consulting original articles; discrepancies in subjective categories (e.g., risk of bias) were reconciled through a consensus meeting. Intraclass correlation coefficients (ICCs) prior to collation were excellent for objective coding categories (ICC = .99 for correlation effect sizes; M_{ICC} = .97 (range .84 - .99) for study

characteristic categories). The reliability for coding of article quality was satisfactory, M_{PABAK} = .78 (Koo and Li, 2016).

2.6. Overlapping Samples

Overlapping samples were identified through 1) cross-referencing all authors and research groups, 2) cross-referencing grant numbers, and 3) cross-referencing committee members for unpublished dissertations. Samples with potential overlap underwent a second-round of full-text inspection. Samples with a probable degree of overlap were dealt with in the following ways: estimates from smaller sample sizes were deleted in the case of overlapping samples presenting identical cognition-outcome relationships (13 studies); overlapping studies were included if they presented unique cognition-outcome relationships (37 studies); identical overlapping samples presenting the same cognition-outcome pairs were averaged (7 studies; see Supplementary Table 2).

2.7. Statistical Methods

Correlation coefficients between SC, NC, and functional outcomes formed the indices of effect size. Correlation coefficients were converted using Fisher's *r*-to-*z* transformation to stabilize variance and estimate confidence intervals prior to all analyses (Fisher, 1922). All analyses were conducted in R using the 'metafor' package (Viechtbauer, 2010).

Random effects meta-analyses were conducted for each domain of cognition and functional outcome pair (e.g., processing speed and community functioning, theory of mind and social problem-solving) whenever there were three or more relevant observations. Random effects meta-analyses account for heterogeneity introduced by different methods or samples and allow for multiple effect estimates from a single sample (Hasselblad and Hedges, 1995; Hedges and Vevea, 1998; Viechtbauer, 2010). Relationships between functional outcomes and overall NC domains (i.e., estimation of effect size across all neurocognitive domains) and overall SC domains were also conducted to provide overall effect estimates in addition to specific cognition-outcome pair estimates. Sample-weighted average

effect sizes ($\hat{u}_p$), and heterogeneity statistics (I^2, Q) were calculated for each meta-analysis. Additionally, moderators (e.g., age, illness duration) were examined utilizing a mixed-effects model.

Funnel plots and regression tests for funnel plot asymmetry were generated for each meta-analysis to examine publication bias (Egger et al., 1997). For the subset of studies that reported relationships between all three domains (i.e., NC, SC, and functional outcomes), a random effects mediation analysis was conducted utilizing the 'metaSEM' package (Cheung, 2015) to examine SC as a potential mediator of the relationship between NC and functional outcome.

3. Results

3.1. Sample Characteristics

The sample of studies in the present review included 12,868 participants with non-affective psychosis with a mean age of 39.84 (*SD* = 6.85); 69.3% of the sample was male, 48.2% white, and had completed an average of 12.18 years of education (*SD* = 1.10). Participants had a diagnosis of schizophrenia (87.9%), schizoaffective disorder (8.0%), psychosis NOS (0.2%), or other diagnoses within the non-affective psychosis spectrum (3.9%). Twenty-four studies reported aggregate schizophrenia spectrum sample sizes but did not report frequency of specific diagnoses (see Supplementary Table 2).

The majority of samples (78.9%) were outpatients, and average illness duration was 16 years (range: 0.44 – 34.45 years; *SD* = 7.64). Most patients were taking psychotropic medication (95.8%) and the average CPZ equivalence was 549.2 mg (*SD* = 231.9). Samples with an average illness duration less than or equal to five years (*n* = 11) were classified as a FEP sample (Breitborde et al., 2009).

Seventeen studies included in the review were unpublished (10%). A meta-regression indicated publication status did not significantly predict effect sizes (β = -.01, *SE* = .04, *p* = .78). Likewise, coder ratings of bias risk were not associated with relationship estimates (β = -.01, *SE* = .03, *p* = .67). Meta-regression indicated effects were not characterized by small sample bias (β = -.04, *SE* = .03, *p* = .09),

where small sample bias was defined as possessing sufficient power to detect a medium-sized effect (i.e., $N \geq 48$) or not ($N < 48$).

Fifty-three random effects meta-analyses were conducted to quantify the relationship between the four functional outcomes (behavior in the milieu, community functioning, social problem-solving, and social skills) and each SC and NC domain, as well as overall SC (e.g., multilevel model providing weighted average for all individual domains of SC combined) and NC (i.e., see Figure 2 for estimated effects organized by functional outcome). An additional 15 relationships had fewer than 3 studies contributing effects so meta-analyses could not be conducted (see Supplementary Table 7 and relationships presented without effect sizes in Figure 2). Moderator analyses were conducted for overall SC and NC only, to ensure adequate power to detect moderation.

The majority of samples reported information for at least one moderator variable: mean age (99.2%), sex (100%), race or ethnicity (46%), mean years of education (75.8%), specific diagnosis (86.3%), duration of illness (75.8%), inpatient status (94.4%), and mean CPZ dosage (35.5%). Few studies included information for all moderators of interest, so moderators were applied to all overall models individually with Bonferroni correction for multiple comparisons rather than incrementally to maximize observations included in each analysis.

3.2. Publication Bias

Publication bias was examined through funnel plot inspection (See Supplementary Figure 1) and Egger's regression. Out of 41 tests for funnel plot asymmetry, only two regression equations for associations between cognition and functional outcomes were significant: the association between reasoning and problem solving and social skills ($z = 2.42$, $p = .02$), and between theory of mind and community functioning ($z = 2.84$, $p < .01$). The associations between reasoning and problem solving and social skills included only 4 observations, therefore any interpretation about funnel plot asymmetry should be made cautiously. A significant Egger's test with regards to the association between theory of

mind and community functioning was due to a single observation (-0.4). Removal of this observation from the model results in a non-significant Egger's test. Taken together, these findings suggest that publication bias is not a concern in the current analysis.

3.3. Neurocognition

3.3.1. Overall Neurocognition-Functional Outcome Associations

A random-effects meta-analysis yielded a medium-sized average correlation between overall NC (i.e., across all NC domains) and functional outcomes and ($\hat{u}_p$ = 0.21, 95% CI [0.18, 0.24], p < .01) based on 399 effect sizes; 60.88% of the variation in effect sizes was due to heterogeneity between studies (Q = 1556.36, p <.001; I^2 = 60.88). Random-effects meta-analyses examining relationships between summary NC and specific functional outcome domains also yielded medium correlations ($\hat{u}_p$s = .14 - .26) based on 32-264 relationships. Significant variation (31% - 73%) due to heterogeneity between studies (Qs 108.9-988.9, ps <.001) was present for functional outcomes of community functioning, social behavior in the milieu and social skills but not for social problem solving (Q = 31.3, p = .45; see Supplementary Table 5).

3.3.2. Associations between Specific Neurocognition Domains and Functional Outcomes

Mean correlation estimates across specific NC functional outcome relationships were small to medium in size ($\hat{u}_p$ = .06 to .33). The smallest effect was observed between verbal comprehension and social behavior in the milieu ($\hat{u}_p$ = .06, p = .60). The largest effect was observed between overall neurocognition and social skills ($\hat{u}_p$ = .33, p <.001). All relationships between specific NC domains and respective functional outcomes are presented in Supplementary Table 6, as well as in Figure 2.

3.3.3. Moderators of the Neurocognition-Functional Outcomes Association

Random-effects meta-regression analyses were conducted to examine potential influence of moderator variables on NC – functional outcome relationships (See Supplementary Table 5). Most moderators did not significantly influence relationships between NC and functional outcomes, with

some exceptions: samples with more males showed weaker relationships between NC and summary functional outcomes (ß = -.0038, *SE* = .001, *p* <.001) and more racially diverse samples showed weaker relationships between NC and summary functional outcomes (ß = -.0030, *SE* =.001, *p* = <.001). Moderators should be interpreted with caution given the small observed associations and modest variance explained by moderators (all pseudo R^2s for significant moderators <1%).

3.4. Social Cognition

3.4.1. Overall Social Cognition-Functional Outcome Associations

A random-effects meta-analysis yielded an overall medium correlation between all domains of social cognition and functional outcomes, ($\hat{u}_p$ = 0.24, 95% CI [0.19, 0.28], *p* <.01) based on 119 relationships with 62.29% of the variation in effect sizes due to heterogeneity between studies *(Q* = 300.10, *p* <.001; I^2 = 62.29)**.** Random-effects meta-analyses examining relationships between summary SC and specific functional outcome domains also yielded medium correlations ($\hat{u}_p$s = .21 - .46, *p*s <.01) based on 3 – 82 relationships. Significant variation (2% - 67%) due to heterogeneity between studies (*Q*s 39.2-227.9, *p*s <.01) was present for functional outcomes of community functioning and social skills but not social problem solving and social skills (*Q*s = 2.6-13.2, *p* >.05; see Supplementary Table 5). Caution is warranted with interpretation of the overall relationship between SC and social problem solving ($\hat{u}_p$s = .46). This estimate is based on only three relationships (two from emotion perception and processing and one from social perception and knowledge) and is presented only for comparison with overall NC relationships.

3.4.2. Associations between Specific Social Cognition Domains and Functional Outcomes

Mean correlation estimates across specific SC-functional outcome relationships were small to medium in size ($\hat{u}_p$ = .08 to .38). The smallest effect was observed between attribution bias and community functioning ($\hat{u}_p$ = .08, *p* = .16). The largest effect was observed between theory of mind and

social skills ($\hat{u}_p$ = .38, p <.001). Relationships between specific SC domains and respective functional outcomes are presented in Supplementary Table 6 and Figure 2.

No significant differences emerged when directly comparing effect estimates between domains of NC and SC with functional outcomes. Eighty percent of the observed relationships (8 out of 10) between SC and functional outcomes were significant, compared with 68% (21 out of 31) of the observed relationships between NC and functional outcomes (proportion not significantly different between NC and SC ($X^2(1) = 0.52$, $p = 0.48$)).

3.4.3. Moderators of the Social Cognition-Functional Outcomes Association

Random-effects meta-regression meta-analyses were conducted to examine potential influence of moderator variables on SC – functional outcome relationships (See Supplementary Table 5). Most moderators did not significantly influence relationships between SC and functional outcomes, with one exception: samples with more inpatients were associated with weaker relationships between SC and community functioning (ß = -.0024, *SE* = .001, p <.001). However, caution in interpretation is warranted since inpatient status explained less than 1% of the variance in this relationship (pseudo R^2 <1%).

3.5. Hierarchical Regression of Functional Outcomes on Social Cognition and Neurocognition

To better understand incremental variance explained by NC and SC, respectively, hierarchical regressions utilizing the subset of studies that reported relationships between NC, SC, *and* functional outcomes were conducted (n = 32; 153 correlation matrices). NC and SC both has significant beta coefficients in respective equations and together explained 9.2% of variance in functional outcomes. However, NC explained an additional 1.9% of variance (4.4% total variance) in functional outcomes after accounting for SC, F (1, 2417) = 50.401, p < .01, whereas SC explained an additional 4.8% of variance (7.3% total variance) in functional outcomes after accounting for NC, F (1, 2417) = 127.05, p < .01.

3.6. Mediation analyses.

A random effects mediation analysis explored the potential role of SC as a mediator between NC and functional outcomes in the same subset of studies. Correlations between NC and SC allowed for modeling of dependency between these two domains. Results suggest SC is a partial mediator between NC and functional outcomes (Figure 3). Prior to mediation, NC was significantly correlated with SC ($\hat{u}_p$ = .29, p <.01), SC was significantly correlated with functional outcomes ($\hat{u}_p$ = .23, p <.01), and NC was significantly correlated with functional outcomes ($\hat{u}_p$ = .23, p <.01). When SC was included as a mediator in the model, the relationship between NC and functional outcome decreased but was still significant ($\hat{u}_p$ = .14, p <.01).

4. Discussion

4.1. Current Findings

With respect to a priori aims, 1) domains of NC and SC demonstrated small to medium relationships with functional outcomes. Specific domains of cognition exhibited a range of effect estimates based on functional outcome. This range likely reflects differences in the type of functional outcome (e.g., community functioning and social behavior in the milieu measure real-world functional performance while social problem solving and social skills measure task-based functional capacity). Specific NC domains of verbal learning and memory (community functioning), working memory (social behavior in the milieu and social skills) and reasoning and problem solving (social problem solving) demonstrated the strongest relationships with specific functional outcomes (2 - 10% variance explained). For SC, the strongest associations were present for social knowledge and perception (community functioning) and theory of mind (social behavior in the milieu and social skills) explaining 7-14% of variance in functioning; 2) Relationships between overall NC and SC with functional outcomes were not significantly different in bivariate analyses. However, SC did explain more *unique* variance in functioning (4.8%) than NC (1.9%) in a subset of studies examining both domains, suggesting distinct relationships for respective domains of cognition with functional outcomes; 3) Relationships were not

moderated by FEP sample status, suggesting similar associations between NC and SC with functional outcomes are already present in the early stages of illness; 4) Consistent with previous theoretical and empirical work, the role of SC as a partial mediator between NC and functional outcomes was substantiated (Addington, Girard, Christensen, & Addington, 2010; Green & Nuechterlein, 1999; Schmidt et al., 2011; Vaskinn et al., 2008).

In line with previous findings of Fett et al. (2011), specific domains of NC and SC generally demonstrated small to medium relationships with functional outcomes irrespective of sample characteristics. Results of the present review substantiate the previous finding that SC explains more unique variance in functional outcomes than NC with the inclusion of 18 previously unreported cognition-functional outcome relationships (see Supplementary Table 7). Whereas theory of mind exhibited the strongest SC association with community functioning, the current results show that social knowledge and perception exhibits the strongest relationship with community functioning. Verbal learning had the strongest NC association with community functioning, which replicates Fett et al.'s (2011) results.

Of note, relationships between NC, SC, and functional outcomes were generally weaker (i.e., smaller effect estimates) than relationships presented in Fett et al. (2011) . The present review includes three times the number of studies with a sample size almost five times bigger, spanning an additional ten years of published and unpublished results. The phenomenon of observing decreasing, but more robust, effect sizes over time with the expansion of areas of research (i.e., the "in silico effect"; Monsarrat & Vergnes, 2018) may be one explanation for the present results. Many of the smaller effect sizes observed also exhibited smaller confidence intervals in line with the in silico effect. Another potential explanation for smaller effect estimates may be the novel inclusion of unpublished findings to address the file-drawer effect (Rosenthal, 1979). Although publication status did not significantly predict effect size, effect estimates from unpublished work were slightly smaller than published estimates and likely

contributed to overall smaller effect estimates. Finally, whereas Fett et al. (2011) only presented individual effect estimates (e.g., verbal learning and community functioning), the present review utilized random effects approaches to model summary estimates between NC, SC, and functional domains for the first time (e.g., all domains of NC with community functioning). When combining these individual effect estimates to produce summary effect estimates across domains of functional outcomes, the average variance explained by NC (2-7%) and SC (4-10%) is smaller than individual relationship estimates. However, the largest individual effect estimates do replicate Fett et al. (2011) in terms of variance explained.

This meta-analysis is the first to investigate the relationships between specific NC and SC domains with functional outcomes in a large sample of 166 studies in conjunction with a mediation analysis that is vital for the comprehensive understanding of cognition-outcome relationships. Mediation results demonstrated SC is a mediator in the relationship between NC and functional outcomes. According to the proximal-distal approach (e.g., Brenner, Curbow, & Legro, 1995; Green, Horan, & Lee, 2019; Ryan, 2009), the proximity of SC to functional outcomes offers support for SC as a primary treatment target for optimal improvement in functioning. However, correlation analyses based on the entire sample of studies demonstrated medium effect sizes from both NC and SC domains and seem to support the increasing focus on integrated interventions targeting both domains of NC and SC in schizophrenia populations (Fisher et al., 2017; Horan & Green, 2017, 2019; Peña et al., 2016).

Additionally, results recommend consideration of the desired type of functional outcome improvement when planning interventions. Perhaps unsurprisingly, SC was particularly more strongly associated with measures of outcome that are social skill and behavior-related (e.g., social behavior in the milieu and social skills) while NC and SC seemed to be equally associated with community functioning which is more related to activities of daily living. SC may be particularly important with respect to social behavior, which in turn may improve community outcomes through better helping

networks, while NC may be particularly important for independent living which makes these networks possible. Overall, results suggest integrated approaches to interventions targeting both NC and SC may engender optimal improvements in functioning.

4.2. Limitations

The effect size estimates are correlations between functional outcomes and NC and SC which means that caution is warranted in drawing causal conclusions. Longitudinal research examining cognitive domains and functional outcomes will be important to delineate directional relationships between these domains. Second, a surprisingly small proportion of studies (n = 11) included FEP populations; thus, the effect estimates for this population need to be considered with caution. The lack of significant moderators observed in the relationship between cognitive domains and functional outcomes also leaves a significant amount of heterogeneity in the observed relationships between NC, SC, and functional outcomes unexplained. Routine reporting of clinical factors such as symptoms (Ventura et al., 2009), as well as motivation and social competence (Schmidt et al., 2011) would allow for investigation of these as moderators and may explain more heterogeneity between cognition and outcomes.

4.3. Future Directions

Notwithstanding these limitations, results from this meta-analysis point to important areas for future development and research. Although measures were grouped into categories of respective NC, SC, and functional outcomes, a wide range of methods and measures were used to quantify these different domains. Categorization of cognitive domains and functional outcomes allows for taxonomic organization of relationships in a meaningful way, but these classifications were defined in different ways across studies. The sheer number of different measures precludes the inclusion of moderators specific to each instrument, but future research should continue the work of the MATRICS and SCOPE studies to examine psychometric properties (e.g., reliability, internal and external validity) of cognition

measures within schizophrenia populations (Nuechterlein et al., 2008; Pinkham et al., 2014). The large number of studies included in the present meta-analysis suggests we *are* measuring SC, NC, and functional outcomes in schizophrenia populations but more research into *how* we measure these domains is an important future direction. Focusing not just on capturing these domains, but doing so in a way that is accurate, reliable, and standardized may reduce heterogeneity related to measurement methods and allow for meaningful discoveries regarding why relationships between cognitive domains vary across studies and individuals. Investigation of the relationships between domains of functional outcomes (e.g., social behavior in the milieu and social skills) and real-world functioning is also needed to better understand which relationships are essential treatment targets for genuine improvements in functioning. Finally, the relationships between NC, SC, and functional outcomes leaves much of the variance in functional outcomes unexplained. One implication of this finding may be to shift focus away from NC and SC to identify factors that are more closely linked with functioning (e.g., motivation; Green, Horan, & Lee, 2019). Alternatively, examining NC and SC in isolation may be overly simplistic and may underestimate the role of cognition. More complex models examining relationships between NC, SC, and functioning with intervening variables (e.g., motivation, metacognition) may provide a more comprehensive understanding of this relationship via identification of indirect effects of NC and SC on functional outcomes (Galderisi et al., 2014; Grant & Beck 2009; Green, Horan, & Lee, 2019; Lysaker et al., 2010).

4.4. Conclusions

NC and SC exhibit reliable relationships with different functional outcomes within schizophrenia spectrum populations with SC accounting for greater unique variance. Importantly, findings demonstrate SC mediates the relationship between NC and functional outcomes. Future research is needed to explain significant heterogeneity observed within these relationships and more research on additional moderators such as clinical factors and measurement methods may provide a promising next step.

Findings suggest observed cognition-outcome relationships are already established in FEP, highlighting the importance of early intervention, but more research with FEP populations is needed. Additionally, longitudinal studies and experimental studies that improve NC and SC and assess change in functioning will provide more comprehensive understanding of the direction and strength of the relationships among NC, SC, and functional outcomes.

References

1. Addington, J., Girard, T.A., Christensen, B.K., Addington, D., 2010. Social cognition mediates illness-related and cognitive influences on social function in patients with schizophrenia-spectrum disorders. J. Psychiatry Neurosci. 35, 49–54. https://doi.org/10.1503/jpn.080039
2. Allen, D.N., Strauss, G.P., Donohue, B., van Kammen, D.P., 2007. Factor analytic support for social cognition as a separable cognitive domain in schizophrenia. Schizophr. Res. 93, 325–333. https://doi.org/10.1016/j.schres.2007.02.008
3. Bolton, B., Roessler, R., 1986. The Work Personality Profile: Factor scales, reliability, validity, and norms. Vocat. Eval. Work Adjust. Bull.
4. Bowie, C.R., Reichenberg, A., Patterson, T.L., Heaton, R.K., Harvey, P.D. 2006. Determinants of real-world functional performance in schizophrenia subjects: Correlations with cognition, functional capacity, and symptoms. Am J Psychiatry. 163, 418-425. https://doi.org/10.1176/appi.ajp.163.3.418
5. Breitborde, N.J.K., Srihari, V.H., Woods, S.W., 2009. Review of the operational definition for first-episode psychosis. Early Interv. Psychiatry 3, 259–265. https://doi.org/10.1111/j.1751-7893.2009.00148.x
6. Brekke, J., Kay, D.D., Lee, K.S., Green, M.F., 2005. Biosocial pathways to functional outcome in schizophrenia. Schizophr. Res. 80, 213–225. https://doi.org/10.1016/j.schres.2005.07.008
7. Brenner, M. H., Curbow, B., & Legro, M. W., 1995. The proximal-distal continuum of multiple health outcome measures: the case of cataract surgery. Med. Care. 33, AS236-44.

8. Cheung, M.W.-L., 2015. metaSEM: an R package for meta-analysis using structural equation modeling. Frontiers in Psychology. 5. https://doi.org/10.3389/fpsyg.2014.01521
9. Couture, S.M., Penn, D.L., Roberts, D.L., 2006. The functional significance of social cognition in schizophrenia: A review. Schizophr. Bull. 32. https://doi.org/10.1093/schbul/sbl029
10. Downs, S.H., & Black, N., 1998. The feasibility of creating a checklist for the assessment of the methodologi ... J. Epidemiol. Community Health 377–384.
11. Egger, M., Davey Smith, G., Schneider, M., Minder, C., 1997. Bias in meta-analysis detected by a simple, graphical. Bmj 315, 629–634. https://doi.org/10.1136/bmj.316.7129.469
12. Fett, A.K.J., Viechtbauer, W., Dominguez, M. de G., Penn, D.L., van Os, J., Krabbendam, L., 2011. The relationship between neurocognition and social cognition with functional outcomes in schizophrenia: A meta-analysis. Neurosci. Biobehav. Rev. 35, 573–588. https://doi.org/10.1016/j.neubiorev.2010.07.001
13. Fisher, M., Nahum, M., Howard, E., Rowlands, A., Brandrett, B., Kermott, A., Woolley, J., Vinogradov, S., 2017. Supplementing intensive targeted computerized cognitive training with social cognitive exercises for people with schizophrenia: An interim report. Psychiatr. Rehabil. J. 40, 21–32. https://doi.org/10.1037/prj0000244
14. Fisher, R., 1922. On the mathematical foundations of theoretical statistics. Philos. Trans. R. Soc. London. Ser. A, Contain. Pap. a Math. or Phys. Character 222, 309 LP-368.
15. Galderisi, S., Rossi, A., Rocca, P., Bertolino, A., Mucci, A., Bucci, P., … Italian Network for Research on Psychosis, 2014. The influence of illness-related variables, personal resources and context-related factors on real-life functioning of people with schizophrenia. World Psychiatry. 13, 275-287. https://doi.org/10.1002/wps.20167

16. Grant, P. M., & Beck, A.T., 2009. Defeatist beliefs as a mediator of cognitive impairment, negative symptoms, and functioning in schizophrenia. Schizophr. Bull. 35, 798-806. https://doi.org/10.1093/schbul/sbn008

17. Grant, N., Lawrence, M., Preti, A., Wykes, T., Cella, M., 2017. Social cognition interventions for people with schizophrenia: a systematic review focussing on methodological quality and intervention modality. Clin. Psychol. Rev. 56, 55–64. https://doi.org/10.1016/j.cpr.2017.06.001

18. Green, M.F., Horan, W.P., Lee, J.L., 2019. Nonsocial and social cognition in schizophrenia: current evidence and future directions. World Psychiatry. 18, 146-161. https://doi.org/10.1002/wps.20624

19. Green, M.F., Kern, R.S., Braff, D.L., Mintz, J., 2011. Neurocognitive deficits and functional outcome in schizophrenia are we measuring the “right stuff”? Schizophr. Bull. 119–136. https://doi.org/10.1002/9780470978672

20. Green, M.F., Nuechterlein, K.H., 1999. Conceptual frameworks: Should schizophrenia be treated as a neurocognitive disorder? Schizophr. Bull. 25, 309–319. https://doi.org/10.1093/oxfordjournals.schbul.a033380

21. Green, M.F., Olivier, B., Crawley, J.N., Penn, D.L., Silverstein, S., 2005. Social cognition in schizophrenia: Recommendations from the Measurement and Treatment Research to Improve Cognition in Schizophrenia New Approaches Conference. Schizophr. Bull. 31, 882–887. https://doi.org/10.1093/schbul/sbi049

22. Hasselblad, V., Hedges, L. V, 1995. Meta-analysis of screening and diagnostic tests. Psychol. Bull. 117, 167–178. https://doi.org/10.1037/0033-2909.117.1.167

23. Hedges, L. V, Vevea, J.L., 1998. Fixed- and random-effects models in meta-analysis.

Psychol. Methods 3, 486–504. https://doi.org/10.1037/1082-989X.3.4.486

24. Heinrichs, D.W., Hanlon, T.E., Carpenter, W.T.J., 1984. The Quality of Life Scale: an instrument for rating the schizophrenic deficit syndrome. Schizophr. Bull. 10, 388–398.
25. Horan, W.P., Green, M.F., 2017. Treatment of social cognition in schizophrenia: Current status and future directions. Schizophr. Res. 203, 3–11. https://doi.org/10.1016/j.schres.2017.07.013
26. Kane, J.M., Schooler, N.R., Marcy, P., Correll, C.U., Estroff, S.E., Robinson, J., Penn, D.L., Robinson, D.G., 2015. The RAISE Early Treatment Program for First-Episode Psychosis: Background, rationale, and study design. J. Clin. Psychiatry 76, 240–246. https://doi.org/10.4088/JCP.14m09289
27. Koo, T.K., Li, M.Y., 2016. A guideline of selecting and reporting intraclass correlation coefficients for reliability research. J. Chiropr. Med. 15, 155–163. https://doi.org/10.1016/j.jcm.2016.02.012
28. Kurtz, M.M., Gagen, E., Rocha, N.B.F., Machado, S., Penn, D.L., 2016. Comprehensive treatments for social cognitive deficits in schizophrenia: A critical review and effect-size analysis of controlled studies. Clin. Psychol. Rev. 43, 80–89. https://doi.org/10.1016/j.cpr.2015.09.003
29. Kurtz, M.M., Richardson, C.L., 2012. Social cognitive training for schizophrenia: A meta-analytic investigation of controlled research. Schizophr. Bull. 38, 1092–1104. https://doi.org/10.1093/schbul/sbr036
30. Levkovitz, Y., Braw, Y., Bloch, Y., Tripto, A., Harari, H., Gal, G., Ratzoni, G., Mendelovich, S., 2007. Cognition in young schizophrenia outpatients: Comparison of first-episode with multiepisode patients. Schizophr. Bull. 34, 544–554.

https://doi.org/10.1093/schbul/sbm115

31. Ludwig, K.A., Pinkham, A.E., Harvey, P.D., Kelsven, S., Penn, D.L., 2017. Social cognition psychometric evaluation (SCOPE) in people with early psychosis: A preliminary study. Schizophr. Res. 190, 136–143. https://doi.org/10.1016/j.schres.2017.03.001
32. Lysaker, P. H., Shea, A. M., Buck, K. D., Dimaggio, G., Nicolò, G., Procacci, M., ... & Rand, K. L., 2010. Metacognition as a mediator of the effects of impairments in neurocognition on social function in schizophrenia spectrum disorders. Acta Psychiatrica Scandinavica 122, 405-413. 10.1111/j.1600-0447.2010.01554.x
33. McGurk, S.R., Twamley, E.W., Sitzer, D.I., McHugo, G.J., Mueser, K.T., 2007. A meta-analysis of cognitive remediation in schizophrenia. Am. J. Psychiatry 164, 1791–1802. https://doi.org/10.1176/appi.ajp.2007.07060906.A
34. Moher, D., Liberati, A., Tetzlaff, J., Altman, D.G., 2009. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. J. Clin. Epidemiol. 62, 1006–1012. https://doi.org/10.1016/j.jclinepi.2009.06.005
35. Monsarrat, P., & Vergnes, J. N., 2018. The intriguing evolution of effect sizes in biomedical research over time: smaller but more often statistically significant. GigaScience. 7, 1–10. doi:10.1093/gigascience/gix121
36. Nuechterlein, K.H., Barch, D.M., Gold, J.M., Goldberg, T.E., Green, M.F., Heaton, R.K., 2004. Identification of separable cognitive factors in schizophrenia. Schizophr. Res. 72, 29–39. https://doi.org/10.1016/j.schres.2004.09.007
37. Nuechterlein, K.H., Green, M.F., Kern, R.S., Baade, L.E., Barch, D.M., Cohen, J.D., Essock, S., Fenton, W.S., Frese, F.J. 3rd, Gold, J.M., Goldberg, T., Heaton, R.K., Keefe, R.S.E., Kraemer, H., Mesholam-Gately, R., Seidman, L.J., Stover, E., Weinberger, D.R., Young,

A.S., Zalcman, S., Marder, S.R., 2008. The MATRICS Consensus Cognitive Battery, part 1: Test selection, reliability, and validity. Am. J. Psychiatry 165, 203–213. https://doi.org/10.1176/appi.ajp.2007.07010042

38. Paquin, K., Wilson, A.L., Cellard, C., Lecomte, T., Potvin, S., 2014. A systematic review on improving cognition in schizophrenia: Which is the more commonly used type of training, practice or strategy learning? BMC Psychiatry 14. https://doi.org/10.1186/1471-244X-14-139
39. Patterson, T.L., Goldman, S., McKibbin, C.L., Hughs, T., Jeste, D. V, 2001. USCD performance-based skills assessment: Development of a new measure of everyday functioning for severely mentally ill adults. Schizophr. Bull. https://doi.org/10.1093/oxfordjournals.schbul.a006870
40. Peña, J., Ibarretxe-Bilbao, N., Sánchez, P., Iriarte, M.B., Elizagarate, E., Garay, M.A., Gutiérrez, M., Iribarren, A., Ojeda, N., 2016. Combining social cognitive treatment, cognitive remediation, and functional skills training in schizophrenia: a randomized controlled trial. npj Schizophr. 2, 16037. https://doi.org/10.1038/npjschz.2016.37
41. Penn, D.L., Mueser, K.T., Doonan, R., Nishith, P., 1995. Relations between social skills and ward behavior in chronic schizophrenia. Schizophr. Res. 16, 225–232.
42. Pinkham, A.E., Penn, D.L., Green, M.F., Buck, B., Healey, K., Harvey, P.D., 2014. The social cognition psychometric evaluation study: Results of the expert survey and RAND Panel. Schizophr. Bull. 40, 813–823. https://doi.org/10.1093/schbul/sbt081
43. Pinkham, A.E., Penn, D.L., Green, M.F., Harvey, P.D., 2016. Social cognition psychometric evaluation: Results of the initial psychometric study. Schizophr. Bull. 42, 494–504. https://doi.org/10.1093/schbul/sbv056
44. Prikken, M., Konings, M.J., Lei, W.U., Begemann, M.J.H., Sommer, I.E.C., 2018. The

efficacy of computerized cognitive drill and practice training for patients with a schizophrenia-spectrum disorder: A meta-analysis. Schizophr. Res. https://doi.org/10.1016/j.schres.2018.07.034

45. Reeder, C., Huddy, V., Cella, M., Taylor, R., Greenwood, K., Landau, S., Wykes, T., 2017. A new generation computerised metacognitive cognitive remediation programme for schizophrenia (CIRCuiTS): A randomised controlled trial. Psychol. Med. 47, 2720–2730. https://doi.org/10.1017/S0033291717001234
46. Rosenthal, R., 1979. The file drawer problem and tolerance for null results. Psychol. Bull. 86, 638–641. https://doi.org/10.1037/0033-2909.86.3.638
47. Ryan, P., 2009. Integrated theory of health behavior change: background and intervention development. Clinical nurse specialist CNS, 23, 161. 10.1097/NUR.0b013e3181a42373
48. Schmidt, S.J., Mueller, D.R., Roder, V., 2011. Social cognition as a mediator variable between neurocognition and functional outcome in schizophrenia: Empirical review and new results by structural equation modeling. Schizophr. Bull. 37. https://doi.org/10.1093/schbul/sbr079
49. Vaskinn, A., Sundet, K., Friis, S., Simonsen, C., Birkenaes, A.B., Jónsdóttir, H., Ringen, P.A., Andreassen, O.A., 2008. Emotion perception and learning potential: mediators between neurocognition and social problem-solving in schizophrenia? J. Int. Neuropsychol. Soc. 14, 279–88. https://doi.org/10.1017/S1355617708080314
50. Vauth, R., Rüsch, N., Wirtz, M., Corrigan, P.W., 2004. Does social cognition influence the relation between neurocognitive deficits and vocational functioning in schizophrenia? Psychiatry Res. 128, 155–165. https://doi.org/10.1016/j.psychres.2004.05.018
51. Velthorst, E., Fett, A.K.J., Reichenberg, A., Perlman, G., Van Os, J., Bromet, E.J., Kotov, R.,

2017. The 20-year longitudinal trajectories of social functioning in individuals with psychotic disorders. Am. J. Psychiatry 174, 1075–1085. https://doi.org/10.1176/appi.ajp.2016.15111419

52. Ventura, J., Hellemann, G.S., Thames, A.D., Koellner, V., Nuechterlein, K.H., 2009. Symptoms as mediators of the relationship between neurocognition and functional outcome in schizophrenia: a meta-analysis. Schizophr. Res. 113, 189–199. https://doi.org/10.1016/j.schres.2009.03.035
53. Viechtbauer, W., 2010. Conducting Meta-Analyses in R with the metafor Package. J. Stat. Softw. 36, 1–48. https://doi.org/10.1103/PhysRevB.91.121108

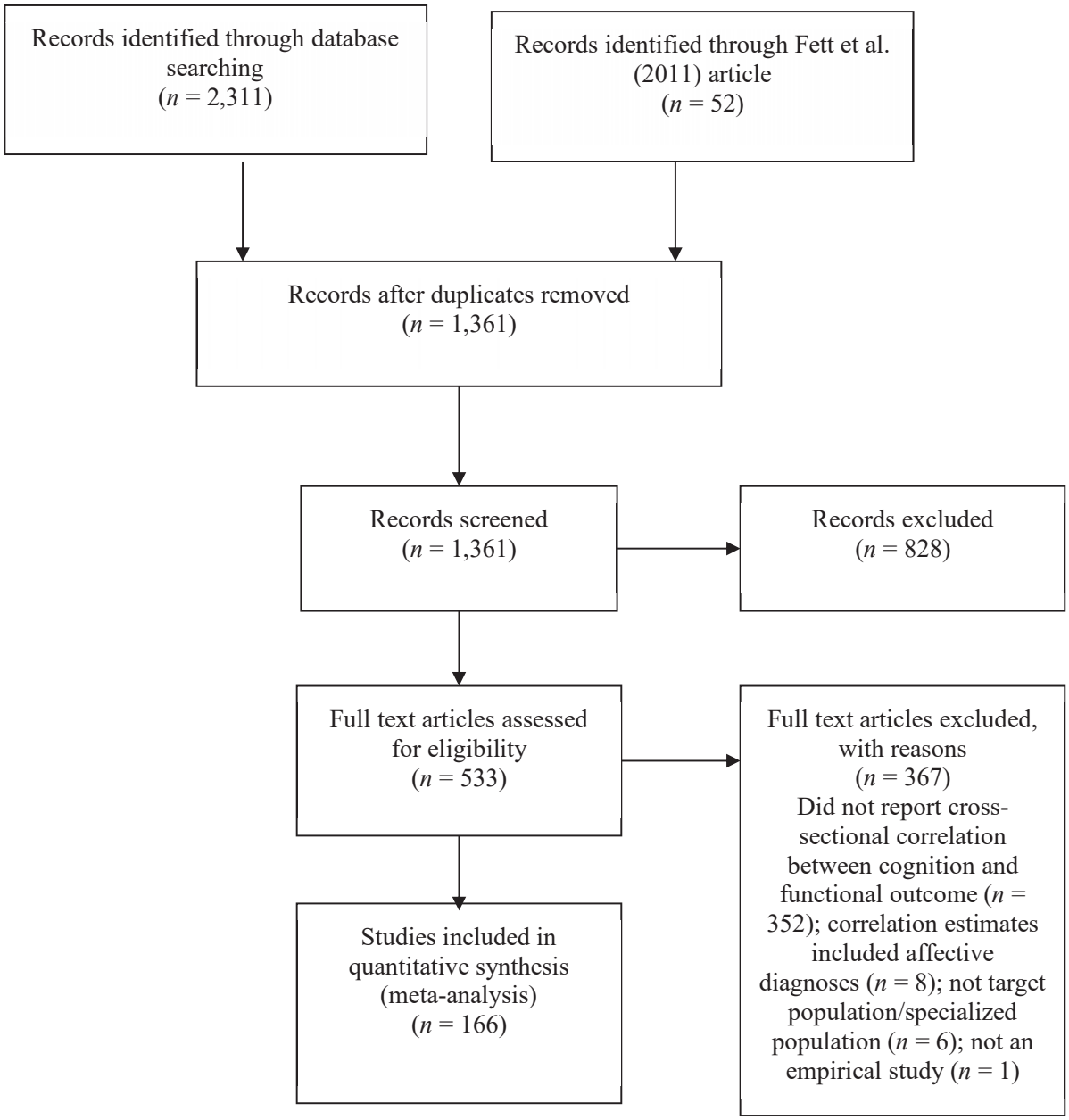

Figure 1. Consort diagram for article inclusion.

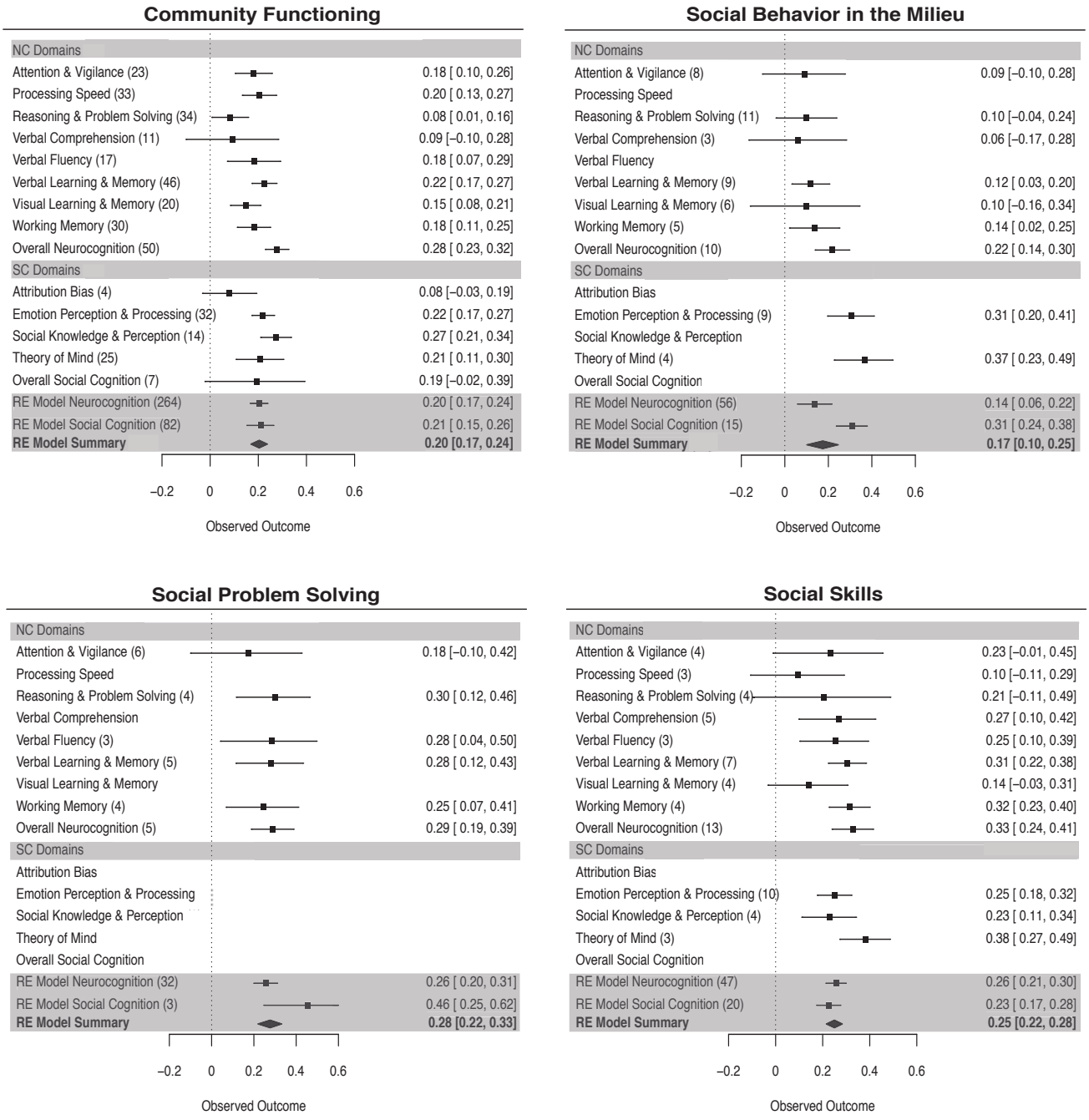

Figure 2. Forest plots displaying correlation coefficients [95% CI] by functional outcome. Diamond polygons represent summary correlation coefficient estimates among all cognition domains. *Note*: (*n*) = number of studies (*K*) included in estimates, RE = random effects, relationships with $K \leq 3$ not presented. RE Model Social Cognition based on effect estimates from emotion perception & processing ($K = 2$) and social perception and knowledge ($K = 1$), specific SC domains not presented since $K \leq 3$, RE model effect estimate presented for comparison with NC but should be interpreted with caution.

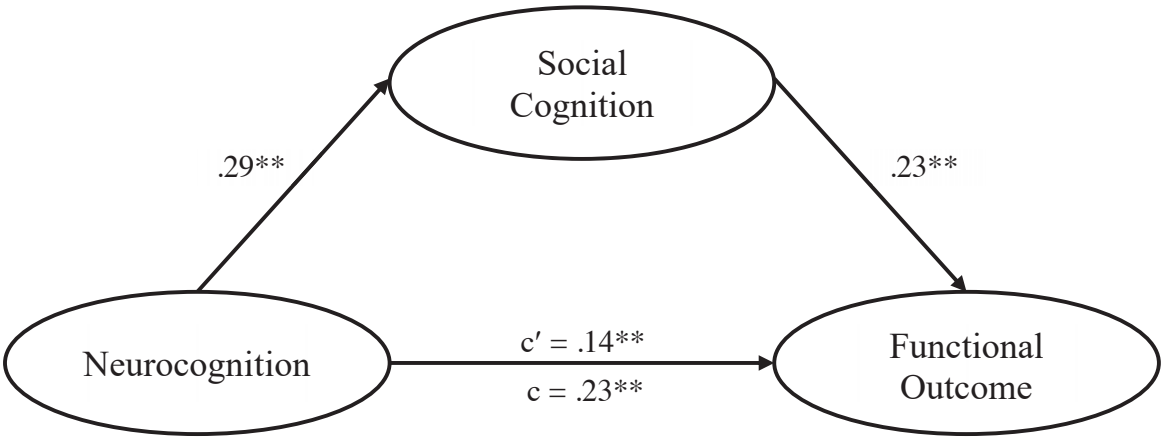

Figure 3. Mediation analysis examining NC, SC, and functional outcome relationships. *Note*: c = direct effect, c′ = mediated (i.e., partial) effect. ***p* <.01

Pathways to Functional Outcomes in Schizophrenia Spectrum Disorders: Meta-Analysis of Social Cognitive and Neurocognitive Predictors

Supplementary Materials

Table S1. PRISMA Checklist.

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	Title Page
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	Abstract Page
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	2
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	2-3
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	3
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	3-6
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	3-7
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	3
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	3-6
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	6-8
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	6-7
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	6
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	7
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	6-8

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	9-10

Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	7-8
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	3-4; Figure 1
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Supplementary Table 2
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	Supplementary Table 2
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	Figure 2; Supplementary Tables 5 and 6
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	Figure 2; Supplementary Tables 5 and 6
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	8
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	10-13
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	13-15
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	16
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	16-18
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	Funding Support Page

Table S2. Study Characteristics

Authors (year)	*N*	Age (yrs)	Male (%)	White (%)	Education (yrs)	Illness Duration (yrs)	Inpatient (%)	CPZ (mg)	Schizophrenia (%)	Schizoaff (%)	Psychosis NOS (%)	Other (%)	Risk of Bias	Cognitive Domain	Functional Domain
Abram et al. (2014)[d]	59	36	63	44	-	15		363	100				1	ON, EPP	CF, SS
Achim et al. (2012)	31	25	84	-	12	2	10	-	74	6	6	13	1	SPK, ToM	CF
Addington et al. (2006a)[d]	103	30	66	86	-	-		535	82	1	3	14	1	ON, SPK	CF, SPS
Addington et al. (2006b)[d]	103	30	66	86	-	-		-	82	1	3	14	1	ON, EPP	CF
Aksaray et al. (2002)	57	39	67	-	11	15		387	100				2	RPS	CF
Alessandrini et al. (2016)[d]	271	36	71	-	-	13		847	100				1	AV, PS, VF, VeLM	CF
Allen et al. (2007)	114	36	100	-	12	13	100	-	100				1	RPS, VC, WM, OSC	CF
Bambini et al. (2016)[c]	47	40	62	-	12	15		439	100				1	ON, ToM	CF
Bechi et al. (2013)	30	38	46	-	11	12		382	100				2	ToM	CF
Bechi et al. (2017)	79	41	62	-	-	17		-	100				1	ON, EPP, ToM	CF
Bellack & Sayers (1994)	27	30	56	52	12	8	100	-	100				2	VeLM, WM, ON	SPS, SS
Bora et al. (2006)	50	31	66	-	11	9		494	100				1	PS, VC, ViLM, WM, ToM	CF
Bougioukas (2009)[b, d]	50	58	48	40	11	36	100	-	48	52			2	ON	CF, SS
Bowen et al. (1994)	30	36	80	-	13	-	100	-	100				2	AV, WM	SPS
Bowie et al. (2011)	90	-	76	54	-	-		-	-	-	-	-	2	ON	CF, SS
Bowie et al. (2007)[d]	67	57	76	61	13	35		-	76	24		-	2	ON	CF
Boyer et al. (2012)[d]	113	39	70	-	-	14		568	96	4			2	AV, PS, VF, VeLM	CF
Bozikas et al. (2006)	40	36	63	-	11	12		-	100				1	PS, RPS, VeLM, ViLM, WM, ON	CF
Brekke et al. (2005)[d]	139	38	69	42	12	14		-	-	-	-	-	2	ON, EPP	CF
Brekke et al. (2001)	40	33	63	48	13	12		400	58	43			2	RPS	CF
Brissos et al. (2012)	104	38	69	-	9	13	27	-	100	-	-	-	3	PS, VeLM, WM	CF
Brittain et al. (2010)	64	42	53	-	14	18		462	100				2	SPK	CF
Brown et al. (2014)[d]	45	36	51	-	11	12		489	100				2	AB, EPP, ToM	CF
Brüne (2005)[d]	23	39	78	-	-	12	-	-	100				2	RPS, ON, EPP, ToM	SBiM
Brüne et al. (2007)[c]	38	36	42	-	-	9	100	770	100				2	RPS, ON, ToM	SBiM

Authors (year)	*N*	Age (yrs)	Male (%)	White (%)	Education (yrs)	Illness Duration (yrs)	Inpatient (%)	CPZ (mg)	Schizophrenia (%)	Schizoaff (%)	Psychosis NOS (%)	Other (%)	Risk of Bias	Cognitive Domain	Functional Domain
Brüne et al. (2009)	50	39	44	-	-	10	100	668	76	18	6		2	RPS, ON, ToM	SBiM
Brüne et al. (2011) [d]	69	36	65	-	-	11	-	-	88	12			2	RPS, ON, ToM	SBiM
Buck et al. (2014) [d]	45	39	67	64	12	15		-	-	-			2	EPP	CF, SS
Bulzacka et al. (2016)	100	31	81	-	-	8		-	75	25			2	RPS	CF
Caqueo-Urízar et al. (2015)[e]	253	36	66	-	-	15		-	100				2	ON	CF
Caqueo-Urízar et al. (2016) [e]	253	36	66	-	-	15		-	100				2	ON	CF
Chang et al. (2017)	321	38	44	-	11	2		-	44	1	6	50	2	PS, RPS, VF, VeLM, WM	CF
Cohen et al. (2006)	28	33	86	43	12	-	100	-	100				2	AV, RPS, VC, VeLM, ViLM, ON, EPP	SBiM, SS
Corrigan & Toomey (1995)	26	34	7	69	12	14	100	1218	-	-			2	AV, RPS, VeLM, WM, SPK	SPS
Couture (2006) [b]	44	28	89	71	13	6		-	-	-			2	PS, VF, ViLM, ON, EPP, ToM, OSC	CF
Eack & Keshavan (2008) [d]	58	26	69	69	-	3		-	66	34			2	ON	CF
Eack et al. (2010) [d]	64	26	70	67	-	3		-	58	36		6	2	EPP	CF, SBiM
Farreny et al. (2013)	62	41	68	-	-	18		-	87	11			2	ON	CF
Fervaha et al. (2014) [c]	1312	41	74	61	12	14		-	100				2	ON	CF
Fervaha et al. (2015) [c]	166	26	83	66	12	3		-	100				2	ON	CF
Fiszdon et al. (2008)	151	43	78	61	13	20		685	70	30			1	PS, RPS, VeLM, WM	CF
Fiszdon et al. (2010)	48	49	81	56	12	26		-	83	17			1	ON, EPP	CF, SS
Fox et al. (2017) [d]	28	33	64	43	-	15		330	100				2	SPK	SS
Fujimaki et al. (2012)	217	55	59	-	11	34	100	798	100				2	VF, ON	CF
Gard et al. (2010) [d]	91	40	75	-	13	20		-	100				2	ON, OSC	CF
Gavron (2016)[b, d]	47	44	66	43	13	-		-	-	-	-	-	1	EPP	CF
Gelder et al. (2015)	19	50	68	-	-	-		-	63	37			1	AV, VC, VF, VeLM, ON	CF
Giusti et al. (2014)	76	46	58	-	11	21	100	-	100				1	ON	CF
Gold et al. (2012)	138	40	62	54	13	-		-	90				2	VC, WM, ON	CF

Authors (year)	*N*	Age (yrs)	Male (%)	White (%)	Education (yrs)	Illness Duration (yrs)	Inpatient (%)	CPZ (mg)	Schizophrenia (%)	Schizoaff (%)	Psychosis NOS (%)	Other (%)	Risk of Bias	Cognitive Domain	Functional Domain
González-Blanch et al. (2011)	131	27	65	-	10	2	100	-	59	3	5	33	2	PS	CF
Grant & Beck (2009) [c]	55	37	65	-	-	14		-	91	9			2	ON	CF
Grant & Beck (2010)	123	39	66	-	-	-		-	82	18			1	ON, EPP	CF
Green et al. (2012)	191	47	68	-	13	24		-	91	9			1	AV, EPP, SPK	CF
Harvey et al. (2013)	195	44	69	55	13	-		-	100				2	ON	CF
Hasson-Ohayon et al. (2015)	39	39	59	-	12	-		-	100				2	EPP, ToM	CF
Hatashita-Wong et al. (2002) [d]	44	36	51	80	-	18		-	64	39			2	AV, PS, RPS, VC, VF, VeLM, WM, ON	SPS
Healey et al. (2015) [d]	62	40	66	65	12	17		-	44	56			1	OSC	CF, SS
Hegeman (2002)[b, d]	55	47	86	87	14	23		417	82	18			2	AV, VF, VeLM, ON	CF, SBiM
Herrera (2017)[b, e]	93	38	81	-	-	15	-	897	81	19			2	AV, PS, RPS, ViLM, EPP	CF
Hooker & Park (2002)	20	39	75	75	13	19	100	1043	100				1	ViLM, EPP	SBiM
Hooker et al. (2011)	21	44	81	-	13	24		-	57	43			1	PS, RPS, VeLM, ViLM, ON, ToM	CF
Horan et al. (2012)	55	22	76	18	13	1		-	100				2	EPP, SPK, OSC	CF
Horton & Silverstein (2007)	65	46	66	46	-	26		-	77	23			2	AV, VeLM	CF
Ihnen et al. (1998)	26	33	58	35	12	-		698	100				1	EPP, SPK	SS
Jung et al. (2014)	56	33	55	-	15	11		-	73	16		14	1	ToM	CF
Kalin et al. (2015) [e]	179	42	65	42	13	-		-	54	46			2	AB, EPP, SPK, ToM	CF, SS
Kalwa et al. (2012)	34	57	38	-	13	31	24	-	71				2	PS, VF	CF
Kanie et al. (2014)	52	38	54		14	13	60	707	100				2	VeLM, AB, SPK, ToM, OSC	CF
Keats (2015)[b]	38	43	63	40	12	-	100	100	55	45			2	ToM	SS
Kee et al. (2009) [d]	50	34	62	62	14	10		-	100				1	EPP	CF
Keefe et al. 2006)	56	35	84	-	12	-	98	-	100				2	PS, RPS, VF, VeLM, WM, ON	CF
Kennedy (2002)[b]	110	39	75	67	14	16		633	88	12			2	RPS, ON	CF
Kern et al. (2009) [d]	50	35	63	84	14	-		-	-	-			2	SPK	CF

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Kimhy et al. (2012) [c]	44	30	64	54	-	-	-	240	80	7	7	7	2	EPP	CF
Kimhy et al. (2015)	77	33	58	60	-	-	-	-	77	14	8	1	2	EPP	CF
Krishnadas et al. (2007)	25	40	64	-	9	11		-	100				2	PS, RPS, VeLM, ViLM, WM, ON	CF
Kurtz & Tolman (2011) [d]	71	31	75	-	12	10	4	-	-	-			2	PS, RPS, VC, VF, VeLM, WM	CF
Laes & Sponheim (2006) [d]	39	44	74	-	14	-		-	100				2	AV, RPS, VF, VeLM, ON	SBiM
Lalchandani (2009) [b, d]	102	40	76	66	13	20		-	100				2	PS, RPS, VeLM	CF
Lancaster (2004) [b, d]	63	48	100	-	12	23		720	52	48			2	AV, RPS, VeLM, WM, EPP	SBiM
Langdon et al. (2014)	23	21	96	-	11	20		-	91	4	4		2	ON, ToM	CF
Li et al. (2012)	64	25	52	-	12	3	64	-	100				2	AV, PS, RPS	CF
Li et al. (2017)	40	27	53	-	14	5		-	73	8	10	10	2	VeLM	CF
Lin et al. (2013)	302	38	61		11	14	100	496	100				2	AV, PS, RPS, VeLM, ViLM, WM, EPP	CF
Lindenmayer et al. (2017)	63	41	81	-	12	-	90	-	-	-	-	-	2	AV, PS, RPS, VeLM, ViLM, WM, ON	CF
Lo & Siu (2015)	30	42	53	-	9	17		-	100				2	RPS, AB, EPP, ToM	SBiM
Ludwig et al. (2017)	38	23	87	76	14	-		-	66	16	18		2	ON, AB, EPP, SPK, ToM	CF, SS
Lynch (2006) [b]	22	44	64	68	13	16		643	-	-	-		2	AV, VC, VeLM, ViLM, ON, EPP	CF, SBiM
Lysaker & Davis (2004) [d]	65	48	100	55	12	23		860	63	37			1	RPS, VC, VeLM	CF
Lysaker et al. (2010)	102	47	85	40	13	19		-	67	33			1	ON	CF
Lystad et al. (2016) [d]	131	33	70	-	12	7		-	89	8	2	2	2	AV, PS, RPS, VeLM, ViLM, WM, ON	SBiM
Lystad et al. (2014) [d]	131	33	70	-	12	7		-	89	8	2	2	2	AV, PS, RPS, VeLM, ViLM, WM, ON	CF
Macaulay & Cohen (2014)	26	42	69	59	12	-		-	100				2	ON	CF

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Mancuso et al. (2011)	85	49	89	31	13	26		-	68	22	9		2	ON	CF, SPS, SS
Mann-Wrobel (2009)[b]	20	46	65	15	12	24		-	70	30			2	RPS, VeLM	CF
Martínez-Domínguez et al. (2015)	21	39	71	-	16	13	-	249	100				2	AV, PS, VeLM, ViLM, WM, ON, EPP, ToM, OSC	CF
Mathews et al. (2011)	40	37	65	48	13	18		-	75	25			2	EPP, SPK	CF
Mazza et al. (2012)	227	33	69	-	12	9	100	186	100				2	ToM	CF
McClure et al. (2007)	181	58	71	68	13	-		-	-	-			2	PS, RPS, VF, VeLM, WM	CF, SS
Meyer et al. (2009)[d]	53	35	72	74	13	12		659	-	-			2	AV, RPS, VC, VeLM, EPP	SS
Michaels et al. (2014)[c]	52	35	69	46	-	15		373	100				2	ON	CF, SS
Mohamed et al. (2008)	1386	41	75	60	-	17		-	100				2	ON	CF
Moore et al. (2013)	72	51	51	43	12	26		-	85	15			2	ON	CF, SS
Moriarty (2002)[b, d]	28	58	96	-	11	38	100	-	100				2	AV, PS, VC, VF, VeLM, ViLM, WM, EPP, SPK	CF
Mueser et al. (1991)[d]	45	33	56	47	11	-	100	-	60	40			2	VC, ViLM, WM, ON	SS
Mueser et al. (1995)	38	38	53	74	12	15	100	601	74	26			2	AV, VC, VF, VeLM, ViLM, ON	SS
Mueser et al. (1996)	28	45	46	93	11	24	100	650	71	29			1	ViLM, EPP	SBiM, SS
Nakagami et al. (2008)[d]	120	38	69	43	12	14		-	-	-			2	AV, RPS, VF, VeLM, WM	CF
Narvaez et al. (2008)[c]	88	47	67	66	13	22		318	42	58			2	ON	CF
Nemoto et al. (2007)	40	30	75	-	14	6		593	100				2	PS, RPS, VF, VeLM, WM	CF
Nienow (2004)[b]	56	42	75	34	12	19	100	-	-	-			2	AV, EPP	SPS
Oh et al. (2010)	42	36	55		12	8		500	100				2	AV, PS, VeLM, EPP, SPK, ToM	CF
Ohmuro et al. (2016)	40	23	28		13	-		372	60		20	15	2	ToM	CF
Olbert et al. (2013)	173	43	72	51	13	21		-	100				1	ON, EPP	CF, SS
Pan et al. (2009)	40	31	50	-	14	6		449	100				2	AV, PS, WM, ON, EPP	CF

Authors (year)	*N*	Age (yrs)	Male (%)	White (%)	Education (yrs)	Illness Duration (yrs)	Inpatient (%)	CPZ (mg)	Schizophrenia (%)	Schizoaff (%)	Psychosis NOS (%)	Other (%)	Risk of Bias	Cognitive Domain	Functional Domain
Park et al. (2008)	20	39	65	-	14	-		297	100				2	EPP	CF
Peña et al. (2012)	58	28	84	-	11	0	-	390	57	7		36	2	AV, PS, RPS, VF, ViLM, WM	CF
Penadés et al. (2010)	40	35	58	-	10	14		361	100				2	PS, RPS, VeLM, ViLM, WM	CF
Penn et al. (1996) [d]	38	36	55	-	-	-	100	1081	87	13			2	AV, RPS	SS
Perivoliotis (2006) [b]	77	53	75	78	12	28		-	-				2	ON	CF
Perlick et al. (2008)	309	47	96	41	12	25		-	-	-			2	PS, RPS, VeLM	CF
Pijnenborg et al. (2009) [d]	46	27	74	100	-	7	7	-	100				2	PS, VeLM, ON, EPP, ToM	CF
Pinkham et al. (2006)	49	33	57	80	14	10		353	71	24	4		1	PS, VC, VeLM, EPP, SPK, ToM	SS
Pinkham et al. (2016) [e]	179	42	65	42	13	-		-	54	46			2	PS, VF, VeLM, WM, AB, EPP, SPK, ToM	CF, SS
Poole et al. (1999) [c]	26	40	54	58	14	15			100				2	ON	CF
Poole et al. (2000) [c]	40	41	78	63	13	-		300	90	10			2	EPP	CF
Puig et al. (2008)	29	35	55	-	-	13		-	100				1	VeLM	CF
Quinlan (2014) [b]	165	47	64	61	12	22		-	-	-	-	-	2	ON	CF, SS
Revheim & Medalia (2004)	162	37	62	20	11	15	54	-	67	33			2	VC, VeLM	CF
Revheim et al. (2006) [e]	38	39	74	34	12	19	63	1151	76	24			2	AV, PS, RPS, VF, VeLM, ViLM, WM	CF
Reynolds (2015) [b, d]	52	53	73	63	12	-	50	-	60	40			2	ON	CF, SBiM
Riccardi et al. (2016)	30	38	70	-	10	14		-	100				2	RPS, ON, EPP, ToM	CF
Robertson et al. (2013)	216	41	74	-	-	17	-	562	-	-			2	ON, ToM	CF
Sabbag et al. (2013)	195	44	-	54	13	-		-	-	-			2	ON	CF
Sánchez et al. (2009)	95	36	82	-	10	14	100	-	100				2	PS, RPS, VeLM, WM	CF
Savilla et al. (2008)	57	36	75	-	-	-		-	100				2	AV, RPS, VF, VeLM, WM, ON	CF
Schroeder et al. (2013)	45	30	80	-	11	-	100	-	80	11	9		2	AV, PS, RPS, VC, VeLM, WM, ON	CF

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Sergi et al. (2006) [c]	75	47	92	-	13	21		-	100				2	AV, SPK	CF
Smith et al. (1999) [d]	46	39	63	94	-	21		-	57	43			2	AV, RPS, VeLM, ViLM, WM	CF, SBiM
Smith et al. (2002) [e]	46	37	59	81	-	18		-	61	39			2	VeLM, WM	SBiM
Smith et al. (2012) [d]	46	35	65	39	-	15		347	100				2	VeLM, ON	CF
Stewart et al. (2009)	18	36	94	-	12	9		-	83	11	6	-	2	ToM	CF
Stratta et al. (2009) [c]	20	35	85	-	11	-		-	100				2	RPS	CF
Tas et al. (2013) [d]	28	34	46	-	11	11	100	512	100				2	AV, PS, RPS, VeLM, ViLM, ON, AB, EPP, ToM	CF
Thomas et al. (2017)	1415	46	69	44	13	24		-	-	-			2	VeLM, ViLM, WM	CF
Tso et al. (2010)	33	39	67	-	14	18		505	-	-			2	RPS, VC, VeLM, ON, EPP, ToM	CF, SBiM
Tyson et al. (2008)	36	38	86	-	-	13	14	-	100				2	AV, ON	CF
Urbach et al. (2013)	206	41	72	-	-	-	100	-	100				3	ToM	CF
Vaskinn et al. (2018)	26	32	65	-	13	7		390	100				1	AV, PS, RPS, VC, VF, VeLM, ON, EPP	SPS
Vauth et al. (2004)	133	29	65	-	-	7	100	-	100				2	AV, PS, RPS, VeLM, WM, SPK	SBiM
Velligan et al. (2004) [d]	339	41	64	32	11	-		-	-	-			2	ON	CF
Velligan et al. (2007) [d]	264	40	61	35	12	-		-	-	-			2	VF	CF
van Beilen et al. (2003) [d]	52	28	75	-	-	4	46	-	-	-	-	-	2	AV, RPS, VeLM	CF
Ventura et al. (2008) [c]	35	39	66	29	14	-		-	82	3		14	2	ON	CF
Ventura et al. (2015)	77	21	78	48	12	1		-	65	9		26	2	ToM	CF
Ventura et al. (2010)	176	44	76	59	12	-	-	-	86	14			2	ON	CF
Villalta-Gil et al. (2006)	113	42	68	-	-	19		-	100				2	VeLM, ON	CF
Walther et al. (2016)	28	38	71	-	14	14		295	89			11	2	SPK	CF
Wölwer & Frommann (2011)	38	37	68	-	-	-	100	-	82	18			2	SPK	CF
Woon et al. (2010)	83	31	64		12	6		240	100				2	VeLM, WM	CF
Woonings et al. (2003)	44	31	86	-	-	9		-	100				2	AV, RPS, VeLM, WM	SBiM

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Xiang et al. (2010)	110	32	65	-	10	1	100	483	100				2	RPS, VeLM	CF
Xiao (2013)[b]	103	38	70	42	12	13		-	-	-			2	ON, EPP	CF
Zanello et al. (2006)	20	33	50	-	-	8		168	80	20			2	AV, RPS, VF, VeLM, ViLM	SPS
Zhu et al. (2007)	40	30	45	-	11	9	100	171	100				2	ToM	CF
Zuo et al. (2012)	40	46	100	-	11	23	100	422	100				2	VeLM, WM	CF

Note: [a]included in Fett et al. (2011) meta-analysis; [b]unpublished dissertation; [c]overlapping sample, effect sizes removed from analysis because larger samples contribute identical relationship; [d]overlapping sample, unique effect sizes included; [e]overlapping sample, effect sizes averaged because identical samples presenting identical relationships; - indicates data not reported by study, blank cells indicate a value of 0; AB = attribution bias, AV = attention and vigilance, EPP = emotion perception and processing, ON = overall neurocognition, OSC = overall social cognition, PS = processing speed, RPS = reasoning and problem-solving, SKP = social knowledge and perception, ToM = theory of mind, VC = verbal comprehension, VeLM = verbal learning and memory, VF = verbal fluency, ViLM = visual learning and memory, WM = working memory; SBiM = social behavior in the milieu, CF = community functioning, SPS = social problem-solving, SS = social skills.

Table S3. Cognition Domains and Measures

Cognition Domain	**Measure**
Attention and Vigilance	Audio Recorded Cognitive Screen - Attention (ARCS; Schofield et al., 2010)
	Brief Assessment of Cognition in Schizophrenia - Attention and Information Processing (BACS; Keefe, 1999)
	Brief Test of Attention – Letters and Numbers (BTA; Schretlen, 1996)
	Continuous Performance Task (CPT; Nuechterlein & Dawson, 1984)
	D2 Attention Task (Brickenkamp, 1978)
	Degraded Stimulus-CPT (DS-CPT; Nuechterlein & Asarnow, 1992)
	Early Visual Processing Masking Procedure (Green et al., 2003)
	Color-Word Interference Test (Delis et al., 2001)
	MATRICS Consensus Cognitive Battery – Attention and Vigilance (MCCB; Nuechterlein et al., 2008)
	Penn CPT (PCPT; Kurtz et al., 2001)
	Span of Apprehension (Asarnow et al., 1991)
	Speech Sounds Perception Test (SSPT; Boll, 1991)
	Test of Everyday Attention (TEA; Robertson et al., 1994)
	Wechsler Memory Scale - Attention and Concentration (WMS; Wechsler, 1987)
Processing Speed	Digit Symbol Substitution Test (Wechsler, 1955)
	Letter Cancellation (Brickenkamp, 1978; Diller et al., 1974)
	MCCB - Speed of Processing (Nuechterlein et al., 2008)
	Stroop Color-Word Test (SCWT; Stroop, 1935; Lezak et al., 2004)
	Trail Making Test A and B (Reitan, 1958)
	Wechsler Adult Intelligence Scale Processing Speed (WAIS; Wechsler, 1997)
	WMS Mental Tracking (Wechsler, 1987)
Reasoning and Problem Solving	Block Design (Wechsler, 1981)
	Wisconsin Card Sorting Test (Heaton, 1981)
	Hamburg-Wechsler-Intelligence Test-Revised, Picture Completion Task (HAWIE-R; Tewes, 1991)
	Idea Fluency Test (IFT; Takano, 1989)
	Key Search Test (KST; Wilson et al., 1996)
	MCCB – Problem Solving (Nuechterlein et al., 2008)
	Multiple Errands Test (MET; Shallice & Burgess, 1991)

	Penn Conditional Exclusion Test (PCET; Kurtz et al., 2004) Social Cognition Screening Questionnaire – Jumping to Conclusions (SCSQ-JTC; Roberts et al., 2010) WAIS Similarities (Wechsler, 1997) Standard Progressive Matrices (Raven, 1958) Tower of London/Hanoi (ToL; Shallice, 1982) WAIS Perceptual Organization (Wechsler, 1997) WAIS Picture Completion (Wechsler, 1997) WMS Logical Reasoning (Wechsler, 1987) Zoo Map Test (ZMT; Wilson et al., 1996)
Verbal Comprehension	ARCS Language (Schofield et al., 2010) MCCB Language (Nuechterlein et al., 2008) National Adult Reading Test (NART; McGurn et al., 2004) WAIS Verbal Comprehension (Wechsler, 1997) Wide Range Achievement Test – Reading Scale (WRAT; Wilkinson, 1993) Modified Boston Naming Test (Morris et al., 1989)
Verbal Fluency	ARCS Verbal Fluency (Schofield et al., 2010) BACS Verbal Fluency (Keefe, 1999) Category/Semantic/Letter Fluency Tasks Controlled Oral Word Association Test (COWAT; Benton 1967) Delis-Kaplan Executive Function System - Semantic Fluency (DKEFS; Delis et al., 2003)
Verbal Learning and Memory	Word List Learning Test (WLT; Saan & Deelman, 1986) ARCS Memory (Schofield et al., 2010) BACS Verbal Memory (Keefe, 1999) California Verbal Learning Test (CVLT; Delis et al., 1987) Hong Kong List Learning Test (HKLT; Chan, 2006) Hopkins Verbal Learning Test (HVLT; Brandt, 1991) MCCB Verbal Learning and Memory (Nuechterlein et al., 2008) Penn Word Memory Test (PWMT; Gur et al., 1993) Rey Auditory Verbal Learning Test (RAVLT; Rey, 1964) SCSQ Verbal Memory (Roberts et al., 2010) Spain Verbal Learning Test – Complutense (TAVEC; Benedet & Alejandre, 1998) WMS Logical Memory Scale (Wechsler, 1987)

Visual Learning and Memory	ARCS Visuospatial Functioning (Schofield et al., 2010) Benton Facial Recognition Test (BFRT; Benton, 1992) Benton Lines Test (Benton, Hamsher, Varney, & Spreen, 1983) Brief Visual Memory Test (Benedict & Groninger, 1995) Line Orientation Test (Benton et al., 1983) MCCB Visual Learning and Memory (Nuechterlein et al., 2008) MCCB Visuospatial Functioning (Nuechterlein et al., 2008) Penn Face Memory Test (Gur et al., 1993) Penn Visual Object (Gur et al., 2010) Rey Complex Figure Test (Rey, 1941) WMS-R Visual Memory (Wechsler, 1987) Design Fluency Task (DFT; Jones-Gotman et al., 1977)
Working Memory	Auditory Consonant Trigrams (Anil et al., 2003) BACS Working Memory (Keefe, 1999) Digit Span (Wechsler, 1955) Digit Span Distractibility Test (DSDT; Olthmanns & Neale, 1975) Dot Probe expectancy Task (DPX; MacDonald et al., 2005) Letter Number Sequencing (Wechsler, 1997) MCCB Working Memory (Nuechterlein et al., 2008) N-Back (Gur et al., 2001) Varied Mapping Task (Schneider & Shiffrin, 1977) WAIS Working Memory (Wechsler, 1997)
Overall Neurocognition	ARCS Composite (Schofield et al., 2010) BACS Composite (Keefe, 1999) Brief Assessment of Dysexecutive Syndrome Composite (BADS; Wilson et al., 1996) Cognitive Assessment Interview (CAI; Ventura et al., 2010) Clinical Global Impression of Cognition in Schizophrenia (CGI-CogS; Ventura et al., 2008) Frontal Assessment Battery (FAB; Dubois et al., 2000) GEOPTE Scale of Social Cognition for Psychosis – Neurocognition Items (SanJuan et al., 2003) MCCB Composite (Nuechterlein et al., 2008) Multiple Choice Verbal Comprehension Test (MWT; Lehrl, 1976) Positive and Negative Syndrome Scale – Cognitive (PANSS; Kay et al., 1987)

	Hasegawa Dementia Scale (HDS; Hasegawa, 1990)
	Schizophrenia Cognition Rating Scale (SCoRS; Keefe et al., 2006)
	Delis–Kaplan Executive Function System Composite (D–KEFS; Delis et al., 2003)
	WAIS Intelligence Quotient (IQ; Wechsler, 1997)
	Two or more neurocognition measures combined
Attribution Bias	Ambiguous Intentions and Hostility Questionnaire (AIHQ; Combs et al., 2007)
	Internal Personal and Situational Attributions Questionnaire (IPSAQ)
	SCSQ Attribution Bias (Roberts et al., 2010)
Emotion Perception and Processing	Bell-Lysaker Emotion Recognition Test (BLERT; Bell et al., 1997)
	Diagnostic Analysis of Non-Verbal Accuracy – Facial Expression (DANVA-2; Tseng, 2003)
	Emotional Differentiation Task (Kohler et al., 2000)
	Emotion in Biological Motion (Heberlein et al., 2004)
	Facial Affect Perception (FAP; Derntl et al., 2009)
	Facial Affect Recognition (Biehl et al., 1997; Ekman & Friesen, 1976)
	Facial Emotion Discrimination Test (FEDT; Kerr et al., 1993)
	Facial Emotion Identification Test (FEIT; Kerr & Neale, 1993)
	Facial Expression of Emotion (Young et al., 2000)
	Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT; Mayer et al., 2002)
	Movie Stills Task (Majewska et al., 2001)
	Narrative of Emotions Task (NET; Buck et al., 2014)
	Penn Emotion Acuity Test (PEAT; Erwin et al., 1992)
	Penn Emotion Recognition Task (ER-40; Kohler et al., 2003)
	Pictures of Facial Affect (POFA; Ekman & Friesen, 1976)
	Point-Light Motion Displays (Heberlein et al., 2001)
	Prosody Task (Pijnenborg et al., 2007)
	Vocal Affect Recognition (Bowers et al., 1991; Nowicki & Duke, 1994)
	Toronto Alexithymia Scale (TAS-20; Bagby et al., 1994)
Social Perception and Knowledge	Half Profile of Nonverbal Sensitivity (Ambady et al., 1995)
	Relationships Across Domains (RAD; Sergi et al., 2009
	Schema Component Sequencing Task (SCST; Corrigan & Addis, 1995)
	Situational Features Recognition Test (SFRT; Corrigan & Green 1993)
	Social Behavior Sequencing Task (SBST; Kwon et al., 2003)
	SCSQ Schematic Inference (Roberts et al., 2010)

	Social Cue Recognition Task (SCRT; Corrigan & Green 1993)
	Social Knowledge Task (Achim et al., 2012)
	Social Stimuli Sequencing Task (Corrigan et al., 1992)
	The Awareness of Social Inference Test (TASIT; Mcdonald, 2002)
Theory of Mind	False Belief Task (Langdon et al., 1997)
	Advanced Theory of Mind Task (Happe, 1994)
	Animated Theory of Mind Task (Abell et al., 2000)
	Faux Pas Task (Stone et al., 1998)
	Hinting Task (Concoran et al., 1995)
	Theory of Mind Jokes (Marjoram et al., 2005)
	Picture Stories (Brune, 2003)
	Conversation Task (Blackshaw et al., 2001; Platt & Spivack, 1975)
	Reading the Mind in the Eyes Test (Eyes/RMET; Baron-Cohen et al., 2001)
	Scale for the Evaluation of Communication Disorders (SCD; Olivier et al., 1997)
	SCSQ Theory of Mind (Roberts et al., 2010)
	Theory of Mind Movie Task (Mehl et al., 2010)
	Unexpected Outcomes Test (UOT; Dyck et al., 2001)
	Versailles-Situational Intention Reading (V-SIR; Bazin et al., 2009)
Overall Social Cognition	Observable Social Cognition: A Rating Scale (OSCARS; Healey et al., 2015)
	SCSQ Composite (Roberts et al., 2010)
	WAIS Social Cognition (Wechsler, 1997)
	Two or more social cognition measures combined

Table S4. Functional Outcome Domains and Measures

Functional Outcome Domain	**Measure**
Community Functioning	Activities of Daily Living (ADL; Nouri & Lincoln, 1987)
	Brief Psychiatric Rating Scale - Social Competence (BPRS; Overall & Gorham, 1962)
	Clinical Global Impression (CGI; Guy, 1970)
	Clinical Global Impression of Cognition in Schizophrenia (Bilder et al., 2003)
	Community Adjustment Form (Test et al., 1991)
	Comprehensive Occupational Therapy Evaluation Scale (Brayman et al., 1976)
	Disability Assessment Scale (DAS; WHO, 1998)
	Functional Needs Assessment (FNA; Dombrowski et al., 1990)
	Functional Remission of General Schizophrenia (FROGS; Llorca et al., 2009)
	Global Assessment of Functioning (GAF; APA, 1994)
	General Self-Efficacy Scale (Schwarzer & Jerusalem, 1995)
	Global Assessment Scale (Endicott et al., 1976)
	Global Social and Role Functioning Scale (GSRFS; Auther et al., 2006, Niendam et al., 2006)
	Groningen Social Disability Scale (GSDS; Wiersma et al., 1988)
	Independent Living Skills (Menditto et al., 1999)
	Indian Disability Evaluation Scale (IPA, 2002)
	Lehman Work and Productivity Scale (Lehman, 1997)
	Life Assessment Scale for the Mentally Ill (LASMI; Iwasaki et al., 1994)
	Life Skills Profile (LSP; Rosen et al., 1987)
	Multinomah Community Ability Scale (MCAS; Barker et al., 1994)
	Performance Potential Inventory (Hogarty et al., 2008)
	Personal and Social Performance Scale (PSP; Morosini et al., 2000)
	Physical, Cognitive, Affective, Social, Economic, Ego functions (PCASEE; Bech, 1993)
	Provision of Social Relations Scale (PSRS; Turner et al., 1983)
	Quality of Life Interview (QOLI; Lehmann, 1989)
	Quality of Life Scale (QLS; Heinrichs et al., 1984)
	Quality of Life Self Assessment Inventory (Skantze & Malm, 1994)
	Real World Functioning (Perivoliotis, 2006)
	Role Functioning Scale (RFS; Goodman et al., 1993)
	Subjective Quality of Life (Stein & Test, 1980)
	Schizophrenia Quality of Life Scale (Boyer et al., 2010)

	Sheehan Disability Scale (Sheehan, 1983) Social and Adaptive Functioning Scale (SAFE; Harvey et al., 1997) Social and Occupational Assessment of Functioning Scale (SOFAS; APA, 1994) Social Autonomy Scale (Leguay et al., 1998) Social Functioning Scale (SFS; Birchwood et al., 1990) Specific Levels of Function Scale (SLOF; Schneider & Struening, 1983) Subjective Well-Being Under Neuroleptic Treatment (SWN; Naber, 1995; Naber, 2001) UCSD Performance Based Skills Assessment (UPSA; Patterson et al., 2001) World Health Organization Quality of Life (WHOQOL Group, 1998) Wisconsin Quality of Life Index for Mental Health (Becker et al., 1993) Zigler Social Competence Scale (Zigler & Levine, 1981) Test of Adaptive Behaviors in Schizophrenia (TABS; Velligan et al., 2007)
Social Behavior in the Milieu	Rehabilitation Evaluation Hall and Baker (REHAB; Baker & Hall, 1988) Social Adjustment Scale (SAS; Schooler & Weissman, 1979) Social Behavior Schedule (SBS; Wykes & Sturt, 1986) Social Dysfunction Index (SDI; Munroe-Blum et al., 1996) Vocational Cognitive Rating Scale (VCRS; Greig et al., 2004) Work Behavior Inventory (WBI; Bryson et al., 1997) Work Personality Profile (Bolton & Roessler, 1986)
Social Problem Solving	Assessment of Interpersonal Problem Solving Skills (AIPSS; Donahoe et al., 1990) Response Evaluation Test (Mueser et al., 1993) Response Generation Test (Sayers et al., 1993) Social Problem Solving Assessment (SPSA; Sayers et al., 1995)
Social Skills	Conversation Probe Role Play Test (Penn et al., 1995) Maryland Assessment of Social Competence (MASC; Bellack et al., 1994) Role Play Test (Penn et al., 1995) Social Skills Performance Assessment (SSPA; Patterson et al., 2001)

Table S5. Meta-regression of effect sizes on cognition domains, functional outcomes, and sample characteristics.

		Functional Outcome				
	Cognition Domain	Summary Outcome	Community Functioning	Social Behavior in the Milieu	Social Problem Solving	Social Skills
Correlation Coefficient $\hat{u}_p$ [CI 95%]	NC	**.21** [.18, .24]	**.20** [.17, .24]	**.14** [.06, .22]	**.26** [.20, .31]	**.26** [.21, .30]
	K	*399*	*264*	*55*	*32*	*47*
	SC	**.24** [.19, .28]	**.21** [.15, .26]	**.31** [.24, .38]	**.46** [.25, .62]	**.23** [.17, .28]
	K	*119*	*82*	*15*	*3*	*20*
Moderator				ß (*SE*)		
Age (*M*, years)	NC	-.0010 *(.002)*	-.0014 *(.003)*	-.0037 *(.006)*	-.0003 *(.001)*	-.0023 *(.003)*
	SC	.0005 *(.004)*	-.0001 *(.004)*	.0029 *(.006)*	-.0335 *(.024)*	-.0001 *(.005)*
Male (%)	NC	**-.0038 *(.001)***	-.0028 *(.002)*	-.0007 *(.003)*	.0010 *(.002)*	-.0016 *(.002)*
	SC	-.0028 *(.002)*	-.0013 *(.002)*	-.0017 *(.003)*	-.0053 *(.004)*	-.0004 *(.003)*
White (%)	NC	**-.0030 *(.001)***	-.0019 *(.001)*	-.0043 *(.004)*	-.0004 *(.003)*	-.0044 *(.002)*
	SC	.0005 *(.001)*	.0003 *(.001)*	-.0011 *(.006)*	-	.0010 *(.002)*
Education (*M*, years)	NC	.0084 *(.015)*	.0162 *(.019)*	-.0174 *(.029)*	.0011 *(.084)*	-.0460 *(.042)*
	SC	.0334 *(.024)*	.0480 *(.028)*	.0400 *(.033)*	.1235 *(.379)*	-.0509 *(.054)*
Illness Duration (*M*, years)	NC	.0021 *(.002)*	.0021 *(.003)*	-.0109 *(.007)*	-.0013 *(.007)*	.0140 *(.006)*
	SC	.0005 *(.004)*	.0007 *(.005)*	.0032 *(.006)*	-.0175 *(.027)*	-.0014 *(.011)*
First Episode (yes/no)	NC	-.0882 *(.060)*	-.0940 *(.066)*	-	-	-
	SC	-.0193 *(.102)*	.0155 *(.113)*	-.1619 *(.135)*	-	-
Inpatient (%)	NC	.0005 *(.001)*	-.0002 *(.001)*	.0014 *(.001)*	.0004 *(.001)*	.0007 *(.001)*
	SC	-.0008 *(.001)*	**-.0024 *(.001)***	.0002 *(.001)*	-.0006 *(.004)*	.0018 *(.001)*
Schizophrenia Dx (%)	NC	.0021 *(.001)*	.0025 *(.002)*	-.0037 *(.002)*	-.0021 *(.002)*	.0026 *(.003)*
	SC	.0008 *(.002)*	-.0001 *(.003)*	-.0016 *(.003)*	-	-.0004 *(.001)*
CPZ (*M*, mg)	NC	.0001 *(.001)*	.0001 *(.001)*	-.0001 *(.001)*	.0001 *(.001)*	.0001 *(.001)*
	SC	.0001 *(.001)*	.0001 *(.001)*	-.0003 *(.001)*	-	-.0005 *(.001)*

Note: Bold values indicate significant, $p < .05$, Bonferroni adjusted for multiple comparisons. Less than three first episode samples available for moderator investigation of social skills, social problem solving, and social behavior in the milieu (NC only) functional outcomes. Less than three samples reported specific schizophrenia diagnosis and average CPZ dosage for social problem solving (SC only) functional outcome.

Table S6. Estimated mean correlation coefficients and heterogeneity characteristics from individual cognition domains and functional outcomes.

		Functional Outcome			
NC Domains		Community Functioning	Social Behavior in the Milieu	Social Problem Solving	Social Skills
Attention & Vigilance	$\hat{u}_p$ [CI 95%]	**.18** [.10, .26]	.09 [-.10, .28]	.18 [-.10, .42]	.23 [-.01, .45]
	N (K)	1849 (23)	522 (8)	202 (6)	157 (4)
	Q	46.78**	28.67**	15.90**	6.99
	I^2	57.9%	76.6%	71.2%	56.7%
Processing Speed		**.20** [.13, .27]			.10 [-.10, .32]
		3171 (33)			409 (3)
		125.71	-	-	9.27**
		72.5%			77.0%
Reasoning & Problem Solving		**.08** [.01, .16]	.10 [-.04, .24]	**.30** [.12, .46]	.21 [-.11, .49]
		3033 (34)	666 (11)	116 (4)	300 (4)
		149.67**	27.19**	0.48	24.14**
		73.63%	66.2%	0%	82.5%
Verbal Comprehension		.09 [-.10, .28]	.06 [-.17, .28]		**.27** [.10, .42]
		747 (11)	83 (3)		213 (5)
		88.76**	0.80	-	6.27
		84.1%	0%		36.4%
Verbal Fluency		**.18** [.07, .29]		**.28** [.04, .50]	**.25** [.1, .39]
		1998 (17)		90 (3)	398 (3)
		81.56**	-	2.32	4.05
		82.0%		21.5%	51.7%
Verbal Learning & Memory		**.22** [.17, .27]	**.12** [.03, .20]	**.28** [.12, .43]	**.31** [.22, .38]
		5348 (46)	555 (9)	143 (5)	555 (7)
		130.06**	9.83	0.88	7.73
		64.8%	2.7%	0%	4.0%
Visual Learning & Memory		**.15** [.08, .21]	.10 [-.16, .34]		.14 [-.03, .31]
		2690 (20)	275 (6)		139 (4)
		31.92*	17.58**	-	1.61
		34.0%	2.7%		0%
Working Memory		**.18** [.11, .25]	**.14** [.02, .25]	**.25** [.07, .41]	**.32** [.23, .40]
		4092 (30)	417 (5)	127 (4)	432 (4)
		87.92**	5.48	0.30	1.68
		73.7%	25.5%	0%	0%
Overall Neurocognition		**.28** [.23, .32]	**.22** [.14, .30]	**.29** [.19, .39]	**.33** [.24, .41]
		5755 (50)	600 (10)	338 (5)	918 (13)
		122.8**	4.78	2.20	22.29*
		66.8%	0%	0%	48.7%
SC Domains					
Attribution Bias		.08 [-.03, .19]			
		314 (4)			
		1.58	-	-	-
		0%			

Emotion Perception & Processing	**.22** [.17, .27] 2418 (32) 38.50 21.2%	**.31** [.20, .41] 311 (9) 7.93 1.6%	-	**.25** [.18, .32] 677 (10) 9.66 0%
Social Perception & Knowledge	**.27** [.21, .34] 939 (14) 19.26 4.6%	-	-	**.23** [.11, .34] 271 (4) 1.98 0%
Theory of Mind	**.21** [.11, .30] 1683 (25) 114.72** 73.3%	**.37** [.23, .49] 182 (4) 3.14 5.6%	-	**.38** [.27, .49] 255 (3) 1.89 0%
Overall Social Cognition	.19 [-.02, .39] 439 (7) 29.69** 79.0%	-	-	-

Note: $\hat{u}_p$ estimates in bold reflect $p < .05$. $\hat{u}_p$ = estimated average correlation coefficient, N = individuals, K = number of samples, Q = Q-test for heterogeneity, I^2 = percentage of total variability in observed effect size due to heterogeneity between samples, - denotes $K \leq 3$.

Table S7. Cognition-functional outcome unreported and novel relationships.

Unreported[a] Relationships

Cognition Domains	Functional Outcome			
	Community Functioning	Social Behavior in the Milieu	Social Problem Solving	Social Skills
NC Domains	-	Processing Speed Verbal Fluency	Processing Speed Verbal Comprehension Visual Learning and Memory	-
Social Cognition Domains	-	Attribution Bias Social Knowledge and Perception Combined SC	Attribution Bias Emotion Perception and Processing Social Knowledge and Perception Theory of Mind Combined SC	Attribution Bias Theory of Mind Combined SC

Novel[b] Relationships

NC Domains	Verbal Comprehension	Working Memory Verbal Comprehension Combined NC	Verbal Fluency Combined NC	Processing Speed Working Memory Verbal Fluency Combined NC
Social Cognition Domains	Attribution Bias Combined SC	Attribution Bias Theory of Mind	Attribution Bias	Attribution Bias Theory of Mind Emotion Perception and Processing

Note: [a]Unreported refers to relationships with less than 3 observations; [b]Novel refers to relationships presented in the present analyses but not presented in Fett et al. (2011).

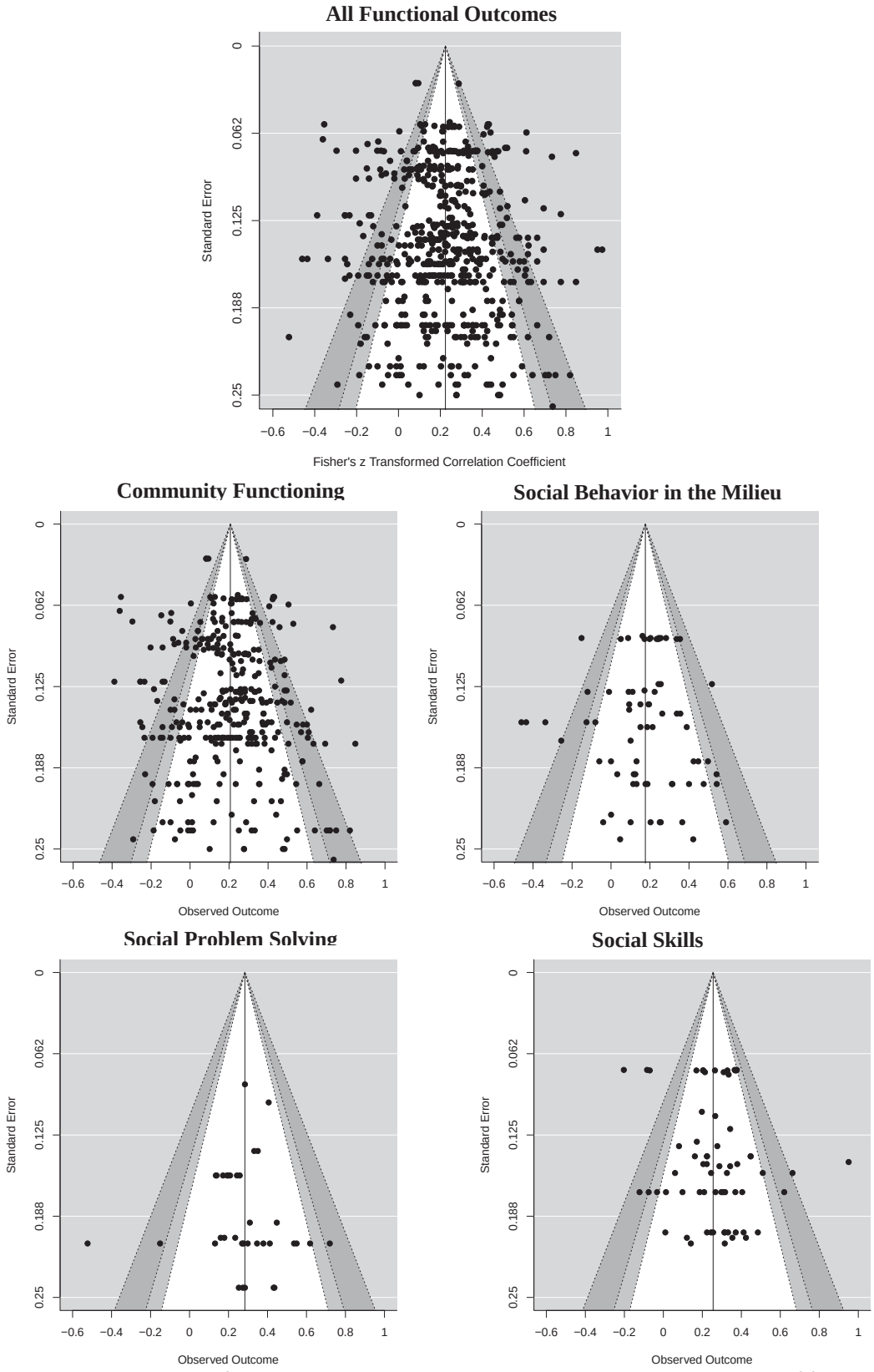

Figure S1. Funnel plot asymmetry for associations between all cognitive domains and each domain of functioning

References*
*studies listed contributed effect sizes

Abram, S. V., Karpouzian, T. M., Reilly, J. L., Derntl, B., Habel, U., & Smith, M. J. (2014). Accurate perception of negative emotions predicts functional capacity in schizophrenia. *Psychiatry Research*, *216*(1), 6–11. https://doi.org/10.1016/j.psychres.2014.01.032

Achim, A. M., Ouellet, R., Roy, M. A., & Jackson, P. L. (2012). Mentalizing in first-episode psychosis. *Psychiatry Research*, *196*(2–3), 207–213. https://doi.org/10.1016/j.psychres.2011.10.011

Addington, J., Saeedi, H., & Addington, D. (2006a). Influence of social perception and social knowledge on cognitive and social functioning in early psychosis. *The British Journal of Psychiatry : The Journal of Mental Science*, *189*, 373–378. https://doi.org/10.1192/bjp.bp.105.021022

Addington, J., Saeedi, H., & Addington, D. (2006b). Facial affect recognition: A mediator between cognitive and social functioning in psychosis? *Schizophrenia Research*, *85*(1–3), 142–150. https://doi.org/10.1016/j.schres.2006.03.028

Aksaray, G., Oflu, S., Kaptano□lu, C., & Bal, C. (2002). Neurocognitive deficits and quality of life in outpatients with schizophrenia. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, *26*(6), 1217–1219. https://doi.org/10.1016/S0278-5846(02)00217-8

Alessandrini, M., Lançon, C., Fond, G., Faget-Agius, C., Richieri, R., Faugere, M., … Boyer, L. (2016). A structural equation modelling approach to explore the determinants of quality of life in schizophrenia. *Schizophrenia Research*, *171*(1–3), 27–34. https://doi.org/10.1016/j.schres.2016.01.012

Allen, D. N., Strauss, G. P., Donohue, B., & van Kammen, D. P. (2007). Factor analytic support for social cognition as a separable cognitive domain in schizophrenia. *Schizophrenia Research*, *93*(1–3), 325–333. https://doi.org/10.1016/j.schres.2007.02.008

Bambini, V., Arcara, G., Bechi, M., Buonocore, M., Cavallaro, R., & Bosia, M. (2016). The communicative impairment as a core feature of schizophrenia: Frequency of pragmatic deficit, cognitive substrates, and relation with quality of life. *Comprehensive Psychiatry*, *71*, 106–120. https://doi.org/10.1016/j.comppsych.2016.08.012

Bechi, M., Bosia, M., Spangaro, M., Buonocore, M., Cavedoni, S., Agostoni, G., … Cavallaro, R. (2017). Exploring functioning in schizophrenia: Predictors of functional capacity and real-world behaviour. *Psychiatry Research*, *251*(October 2016), 118–124. https://doi.org/10.1016/j.psychres.2017.02.019

Bechi, M., Spangaro, M., Bosia, M., Zanoletti, A., Fresi, F., Buonocore, M., … Cavallaro, R. (2013). Theory of mind intervention for outpatients with schizophrenia. *Neuropsychological Rehabilitation*, *23*(3), 383–400. https://doi.org/10.1080/09602011.2012.762751

Bellack, A., & Sayers, M. (1994). Evaluation of social problem solving in schizophrenia. *Journal of Abnormal Psychology 103*(2), 371–8. Retrieved from http://psycnet.apa.org/psycinfo/1994-33655-001

Bora, E., Eryavuz, A., Kayahan, B., Sungu, G., & Veznedaroglu, B. (2006). Social functioning, theory of mind and neurocognition in outpatients with schizophrenia; mental state decoding may be a better predictor of social functioning than mental state reasoning. *Psychiatry Research*, *145*(2–3), 95–103. https://doi.org/10.1016/j.psychres.2005.11.003

Bougioukas, M. (2009). *Cognitive and adaptive functioning deficits in non -geriatric schizophrenic nursing home patients at acute hospitalization*. *ProQuest Dissertations and Theses*. Hofstra University, Ann Arbor. Retrieved from http://libproxy.lib.unc.edu/login?url=https://search.proquest.com/docview/304894988?accountid=14244

Bowen, L., Wallace, C. J., Glynn, S. M., Nuechterlein, K. H., Lutzker, J. R., & Kuehnel, T. G. (1994). Schizophrenic individuals' cognitive functioning and performance in interpersonal interactions and skills training procedures. *Journal of Psychiatric Research*, *28*(3), 289–301. https://doi.org/10.1016/0022-3956(94)90012-4

Bowie, C. R., Gupta, M., & Holshausen, K. (2011). Disconnected and underproductive speech in schizophrenia: Unique relationships across multiple indicators of social functioning. *Schizophrenia Research*, *131*(1–3), 152–156. https://doi.org/10.1016/j.schres.2011.04.014

Bowie, C. R., Twamley, E. W., Anderson, H., Halpern, B., Patterson, T. L., & Harvey, P. D. (2007). Self-assessment of functional status in schizophrenia. *Journal of Psychiatric Research*, *41*(12), 1012–1018. https://doi.org/10.1016/j.jpsychires.2006.08.003

Boyer, L., Aghababian, V., Richieri, R., Loundou, A., Padovani, R., Simeoni, M. C., … Lançon, C. (2012). Insight into illness, neurocognition and quality of life in schizophrenia. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, *36*(2), 271–276. https://doi.org/10.1016/j.pnpbp.2011.10.008

Bozikas, V. P., Kosmidis, M. H., Kafantari, A., Gamvrula, K., Vasiliadou, E., Petrikis, P., … Karavatos, A. (2006). Community dysfunction in schizophrenia: Rate-limiting factors. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, *30*(3), 463–470. https://doi.org/10.1016/j.pnpbp.2005.11.017

Brekke, J., Kay, D. D., Lee, K. S., & Green, M. F. (2005). Biosocial pathways to functional outcome in schizophrenia. *Schizophrenia Research*, *80*(2–3), 213–225. https://doi.org/10.1016/j.schres.2005.07.008

Brekke, J., Kohrt, B., & Green, M. F. (2001). Neuropsychological functioning as a moderator of the relationship between psychosocial functioning and the subjective experience of self and life in schizophrenia. *Schizophrenia Bulletin*, *27*(4), 697–708.

Brissos, S., Palhava, F., Marques, J. G., Mexia, S., Carmo, A. L., Carvalho, M., … Figueira, M. L. (2012). The Portuguese version of the Personal and Social Performance Scale (PSP): Reliability, validity, and relationship with cognitive measures in hospitalized and community schizophrenia patients. *Social Psychiatry and Psychiatric Epidemiology*, *47*(7), 1077–1086. https://doi.org/10.1007/s00127-011-0412-6

Brittain, P., ffytche, D. H., McKendrick, A., & Surguladze, S. (2010). Visual processing, social cognition and functional outcome in schizophrenia. *Psychiatry Research*, *178*(2), 270–275. https://doi.org/10.1016/j.psychres.2009.09.013

Brown, E. C., Tas, C., Can, H., Esen-Danaci, A., & Brüne, M. (2014). A closer look at the relationship between the subdomains of social functioning, social cognition and symptomatology in clinically stable patients with schizophrenia. *Comprehensive Psychiatry*, *55*(1), 25–32. https://doi.org/10.1016/j.comppsych.2013.10.001

Brüne, M. (2005). Emotion recognition, "theory of mind," and social behavior in schizophrenia. *Psychiatry Research*, *133*(2–3), 135–147. https://doi.org/10.1016/j.psychres.2004.10.007

Brüne, M., Abdel-Hamid, M., Lehmkämper, C., & Sonntag, C. (2007). Mental state attribution, neurocognitive functioning, and psychopathology: What predicts poor social competence in schizophrenia best? *Schizophrenia Research*, *92*(1–3), 151–159. https://doi.org/10.1016/j.schres.2007.01.006

Brüne, M., Abdel-Hamid, M., Sonntag, C., Lehmkämper, C., & Langdon, R. (2009). Linking social cognition with social interaction: Non-verbal expressivity, social competence and "mentalising" in patients with schizophrenia spectrum disorders. *Behavioral and Brain Functions*, *5*, 1–10. https://doi.org/10.1186/1744-9081-5-6

Brüne, M., Schaub, D., Juckel, G., & Langdon, R. (2011). Social skills and behavioral problems in schizophrenia: The role of mental state attribution, neurocognition and clinical symptomatology. *Psychiatry Research*, *190*(1), 9–17. https://doi.org/10.1016/j.psychres.2010.03.015

Buck, B., Ludwig, K., Meyer, P. S., & Penn, D. L. (2014). The use of narrative sampling in the assessment of social cognition: The Narrative of Emotions Task (NET). *Psychiatry Research*, *217*(3), 233–239. https://doi.org/10.1016/j.psychres.2014.03.014

Bulzacka, E., Delourme, G., Hutin, V., Burban, N., Méary, A., Lajnef, M., … Schürhoff, F. (2016). Clinical utility of the Multiple Errands Test in schizophrenia: A preliminary assessment. *Psychiatry Research*, *240*, 390–397. https://doi.org/10.1016/j.psychres.2016.04.056

Caqueo-Urízar, A., Urzúa, A., & Boyer, L. (2016). Caregivers' perception of patients' cognitive deficit in schizophrenia and its influence on their quality of life . *Psicothema*, *28*(2), 150–155. https://doi.org/10.7334/psicothema2015.120

Caqueo-Urízar, A., Boyer, L., Baumstarck, K., & Gilman, S. E. (2015). Subjective perceptions of cognitive deficits and their influences on quality of life among patients with schizophrenia. *Quality of Life Research*, *24*(11), 2753–2760. https://doi.org/10.1007/s11136-015-1019-2

Chang, W. C., Kwong, V. W. Y., Hui, C. L. M., Chan, S. K. W., Lee, E. H. M., & Chen, E. Y. H. (2017). Relationship of amotivation to neurocognition, self-efficacy and functioning in first-episode psychosis: A structural equation modeling approach. *Psychological Medicine*, *47*(4), 755–765. https://doi.org/10.1017/S0033291716003044

Cohen, A. S., Forbes, C. B., Mann, M. C., & Blanchard, J. J. (2006). Specific cognitive deficits and differential domains of social functioning impairment in schizophrenia. *Schizophrenia Research*, *81*(2–3), 227–238. https://doi.org/10.1016/j.schres.2005.09.007

Corrigan, P.W., & Toomey, R. (1995). Interpersonal problem solving and information processing in schizophrenia. *Schizophrenia Bulletin*, *21*(3), 395–403. Retrieved from http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L25252580%5Cnhttp://sfx.library.uu.nl/utrecht?sid=EMBASE&issn=05867614&id=doi:&atitle=Interpersonal+problem+solving+and+information+processing+in+schizophrenia&stitle=SCHIZOPHR.+BULL.&

Couture, S. M. (2006). *Neurocognition, social cognition, and functional outcome in schizophrenia and high-functioning autism*. *ProQuest Dissertations and Theses*. The University of North Carolina at Chapel Hill, Ann Arbor. Retrieved from http://libproxy.lib.unc.edu/login?url=https://search.proquest.com/docview/305280546?accountid=14244

Eack, S. M., & Keshavan, M. S. (2008). Foresight in schizophrenia: a potentially unique and relevant factor to functional disability. *Psychiatric Services (Washington, D.C.)*, *59*(3), 256–260. https://doi.org/10.1176/ps.2008.59.3.256

Eack, S. M., Greeno, C. G., Pogue-Geile, M. F., Newhill, C. E., Hogarty, G. E., & Keshavan, M. S. (2010). Assessing social-cognitive deficits in schizophrenia with the mayer-salovey-caruso emotional intelligence test. *Schizophrenia Bulletin*, *36*(2), 370–380. https://doi.org/10.1093/schbul/sbn091

Farreny, A., Aguado, J., Ochoa, S., Haro, J. M., & Usall, J. (2013). The role of negative symptoms in the context of cognitive remediation for schizophrenia. *Schizophrenia Research*, *150*(1), 58–63. https://doi.org/10.1016/j.schres.2013.08.008

Fervaha, G., Foussias, G., Agid, O., & Remington, G. (2015). Motivational deficits in early schizophrenia: Prevalent, persistent, and key determinants of functional outcome. *Schizophrenia Research*, *166*(1–3), 9–16. https://doi.org/10.1016/j.schres.2015.04.040

Fervaha, G., Foussias, G., Siddiqui, I., Agid, O., & Remington, G. (2014). Abbreviated quality of life scales for schizophrenia: Comparison and utility of two brief community functioning

measures. *Schizophrenia Research*, *154*(1–3), 89–92. https://doi.org/10.1016/j.schres.2014.02.013

Fiszdon, J. M., Choi, J., Goulet, J., & Bell, M. D. (2008). Temporal relationship between change in cognition and change in functioning in schizophrenia. *Schizophrenia Research*, *105*(1–3), 105–113. https://doi.org/10.1016/j.schres.2008.06.010

Fiszdon, J. M., & Johannesen, J. K. (2010). Functional significance of preserved affect recognition in schizophrenia. *Psychiatry Research*, *176*(2-3), 120–125. https://doi.org/10.1016/j.psychres.2009.08.006.

Fox, J. M., Abram, S. V, Reilly, J. L., Eack, S., Goldman, M. B., Csernansky, J. G., … Smith, M. J. (2017). Default mode functional connectivity is associated with social functioning in schizophrenia. *Journal of Abnormal Psychology*, *126*(4), 392-405. https://doi.org/10.1037/abn0000295

Fujimaki, K., Morinobu, S., Yamashita, H., Takahashi, T., & Yamawaki, S. (2012). Predictors of quality of life in inpatients with schizophrenia. *Psychiatry Research*, *197*(3), 199–205. https://doi.org/10.1016/j.psychres.2011.10.023

Gard, D. E., Fisher, M., Garrett, C., & Genevsky, A., & Vinogradov, S. (2009). Motivation and its relationship to neurocognition, social cognition, and functional outcome in schizophrenia, *Schizophrenia Research, 115*(1), 74–81. https://doi.org/10.1016/j.schres.2009.08.015.

Gavron, L. A. (2016). *An examination of the relationships between respiratory sinus arrhythmia and social functioning in patients with schizophrenia*. *ProQuest Dissertations and Theses*. Alliant International University, Ann Arbor. Retrieved from http://libproxy.lib.unc.edu/login?url=https://search.proquest.com/docview/1728323248?accountid=14244

Gelder, B. M., Loughland, C. M., Carr, V. J., & Schofield, P. W. (2015). Application of the audio recorded cognitive screen and its relation to functioning in schizophrenia. *Acta Neuropsychiatrica*, *27*(5), 279–290. https://doi.org/10.1017/neu.2015.19

Giusti, L., Ussorio, D., Tosone, A., Di Venanzio, C., Bianchini, V., Necozione, S., … Roncone, R. (2014). Is personal recovery in schizophrenia predicted by low cognitive insight? *Community Mental Health Journal*, *51*(1), 30–37. https://doi.org/10.1007/s10597-014-9767-y

Gold, J. M., Barch, D. M., Carter, C. S., Dakin, S., Luck, S. J., MacDonald, A. W., … Strauss, M. (2012). Clinical, functional, and intertask correlations of measures developed by the cognitive neuroscience test reliability and clinical applications for schizophrenia consortium. *Schizophrenia Bulletin*, *38*(1), 144–152. https://doi.org/10.1093/schbul/sbr142

González-Blanch, C., Pérez-Iglesias, R., Rodríguez-Sánchez, J. M., Pardo-García, G., Martínez-García, O., Vázquez-Barquero, J. L., & Crespo-Facorro, B. (2011). A digit symbol coding task as a screening instrument for cognitive impairment in first-episode psychosis. *Archives of Clinical Neuropsychology*, *26*(1), 48–58. https://doi.org/10.1093/arclin/acq086

Grant, P. M., & Beck, A. T. (2009). Defeatist beliefs as a mediator of cognitive impairment, negative symptoms, and functioning in schizophrenia. *Schizophrenia Bulletin*, *35*(4), 798–806. https://doi.org/10.1093/schbul/sbn008

Grant, P. M., & Beck, A. T. (2010). Asocial beliefs as predictors of asocial behavior in schizophrenia. *Psychiatry Research*, *177*(1–2), 65–70. https://doi.org/10.1016/j.psychres.2010.01.005

Green, M. F., Hellemann, G., Horan, W. P., Lee, J., & Wynn, J. K. (2012). From perception to functional outcome in schizophrenia: Modeling the role of ability and motivation. *Archives of General Psychiatry*, *69*(12), 1216–1224. https://doi.org/10.1001/archgenpsychiatry.2012.652

Harvey, P.D., Stone, L., Lowenstein, D., Csaja, S.J., Heaton, R.K., & Patterson, T.L. (201s). The convergence between self-reports and observer ratings of financial skills and direct assessment of financial capabilities in patients with schizophrenia: More detail is not always better, *Schizophrenia Research, 147*(1), 86–90. https://doi.org/10.1016/j.schres.2013.02.018.

Hasson-Ohayon, I., Avidan-Msika, M., Mashiach-Eizenberg, M., Kravetz, S., Rozencwaig, S., Shalev, H., & Lysaker, P. H. (2015). Metacognitive and social cognition approaches to understanding the impact of schizophrenia on social quality of life. *Schizophrenia Research*, *161*(2–3), 386–391. https://doi.org/10.1016/j.schres.2014.11.008

Hatashita-Wong, M., Smith, T. E., Silverstein, S. M., Hull, J. W., & Willson, D. F. (2002). Cognitive functioning and social problem-solving skills in schizophrenia. *Cognitive Neuropsychiatry*, *7*(2), 81–95. https://doi.org/10.1080/13546800143000168

Hegeman, B. M. (2002). *Functioning in schizophrenia and schizoaffective disorder: Quality of life, symptom presentation, language production, and neurocognitive abilities*. *ProQuest Dissertations and Theses*. University of Montana, Ann Arbor. Retrieved from http://libproxy.lib.unc.edu/login?url=https://search.proquest.com/docview/305493532?accountid=14244

Herrera, S. N. (2017). *Contrast Processing Deficits in Schizophrenia and Schizoaffective Disorder: Contributions to Neurocognition, Facial Emotion Recognition, and Functional Outcome*. *ProQuest Dissertations and Theses*. Yeshiva University, Ann Arbor. Retrieved from http://libproxy.lib.unc.edu/login?url=https://search.proquest.com/docview/1970008668?accountid=14244

Hooker, C. I., Bruce, L., Lincoln, S. H., Fisher, M., & Vinogradov, S. (2011). Theory of mind skills are related to gray matter volume in the ventromedial prefrontal cortex in schizophrenia. *Biological Psychiatry*, *70*(12), 1169–1178. https://doi.org/10.1016/j.biopsych.2011.07.027

Hooker, C., & Park, S. (2002). Emotion processing and its relationship to social functioning in schizophrenia patients. *Psychiatry Research*, *112*(1), 41–50. https://doi.org/10.1016/S0165-1781(02)00177-4

Horan, W. P., Green, M. F., Degroot, M., Fiske, A., Hellemann, G., Kee, K., … Nuechterlein, K. H. (2012). Social cognition in schizophrenia, part 2: 12-month stability and prediction of functional outcome in first-episode patients. *Schizophrenia Bulletin*, *38*(4), 865–872. https://doi.org/10.1093/schbul/sbr001

Horton, H. K., & Silverstein, S. M. (2007). Cognition and functional outcome among deaf and hearing people with schizophrenia. *Schizophrenia Research*, *94*(1–3), 187–196. https://doi.org/10.1016/j.schres.2007.04.008

Ihnen, G. H., Penn, D. L., Corrigan, P. W., & Martin, J. (1998). Social perception and social skill in schizophrenia. *Psychiatry Research*, *80*(3), 275–286. https://doi.org/10.1016/S0165-1781(98)00079-1

Jung, E., Wiesjahn, M., & Lincoln, T. M. (2014). Negative, not positive symptoms predict the early therapeutic alliance in cognitive behavioral therapy for psychosis. *Psychotherapy Research*, *24*(2), 171–183. https://doi.org/10.1080/10503307.2013.851425

Kalin, M., Kaplan, S., Gould, F., Pinkham, A. E., Penn, D. L., & Harvey, P. D. (2015). Social cognition, social competence, negative symptoms and social outcomes: Inter-relationships in people with schizophrenia. *Journal of Psychiatric Research*, *68*, 254–260. https://doi.org/10.1016/j.jpsychires.2015.07.008

Kalwa, A., Rzequska, M., & Borkowska, A. (2012). Cognitive dysfunction progression in schizophrenia - Relation to functional and clinical outcome. *Archives of Psychiatry and Psychotherapy*, *1*, 5–13. Retrieved from http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L365893058%5Cnhttp://sfx.library.uu.nl/utrecht?sid=EMBASE&issn=15092046&id=doi:&atitle=Cognitive+dysfunction+progression+in+schizophrenia+-+Relation+to+functional+and+clinical+outcome&s

Kanie, A., Hagiya, K., Ashida, S., Pu, S., Kaneko, K., Mogami, T., … Nakagome, K. (2014). New instrument for measuring multiple domains of social cognition: Construct validity of the Social Cognition Screening Questionnaire (Japanese version). *Psychiatry and Clinical Neurosciences*, *68*(9), 701–711. https://doi.org/10.1111/pcn.12181

Keats, L. B. (2015). *The Relationship between Theory of Mind (ToM), Neurocognition, and Clinical Symptomatology among Inpatients with Schizophrenia-Spectrum Disorders*.

ProQuest Dissertations and Theses. The Chicago School of Professional Psychology, Ann Arbor. Retrieved from http://libproxy.lib.unc.edu/login?url=https://search.proquest.com/docview/1774020097?accountid=14244

Kee, K. S., Horan, W. P., Salovey, P., Kern, R. S., Sergi, M. J., Fiske, A. P., … Green, M. F. (2009). Emotional intelligence in schizophrenia. *Schizophrenia Research*, *107*(1), 61–68. https://doi.org/10.1016/j.schres.2008.08.016

Keefe, R. S. E., Poe, M., Walker, T. M., & Harvey, P. D. (2006). The relationship of the Brief Assessment of Cognition in Schizophrenia (BACS) to functional capacity and real-world functional outcome. *Journal of Clinical and Experimental Neuropsychology*, *28*(2), 260–269. https://doi.org/10.1080/13803390500360539

Kennedy, A. (2002). *Frontal lobe functioning, psychiatric symptoms and quality of life in outpatients with schizophrenia*. *ProQuest Dissertations and Theses*. The Wright Institute, Ann Arbor. Retrieved from http://libproxy.lib.unc.edu/login?url=https://search.proquest.com/docview/305499163?accountid=14244

Kern, R. S., Green, M. F., Fiske, A. P., Kee, K. S., Lee, J., Sergi, M. J., … Nuechterlein, K. H. (2009). Theory of mind deficits for processing counterfactual information in persons with chronic schizophrenia. *Psychological Medicine*, *39*(4), 645–654. https://doi.org/10.1017/S0033291708003966

Kimhy, D., Vakhrusheva, J., Jobson-Ahmed, L., Tarrier, N., Malaspina, D., & Gross, J. J. (2012). Emotion awareness and regulation in individuals with schizophrenia: Implications for social functioning. *Psychiatry Research*, *200*(2–3), 193–201. https://doi.org/10.1016/j.psychres.2012.05.029

Kimhy, D., Vakhrusheva, J., Khan, S., Chang, R.W., Hansen, M.C., Ballon, J.S., … Gross, J.J. (2015). Emotional Granularity and Social Functioning in Individuals with Schizophrenia: An Experience Sampling Study. *Journal of Psychiatric Research*, 141–148. https://doi.org/10.1016/j.jpsychires.2014.01.020.Emotional

Krishnadas, R., Moore, B. P., Nayak, A., & Patel, R. R. (2007). Relationship of cognitive function in patients with schizophrenia in remission to disability: A cross-sectional study in an Indian sample. *Annals of General Psychiatry*, *6*, 1–8. https://doi.org/10.1186/1744-859X-6-19

Kurtz, M., & Tolman, A. (2011). Neurocognition, insight into illness and subjective quality-of-life in schizophrenia: What is their relationship? *Schizophrenia Research*, *127*(1–3), 157–162. https://doi.org/10.1016/j.schres.2010.12.004.

Laes, J. R., & Sponheim, S. R. (2006). Does cognition predict community function only in schizophrenia?: A study of schizophrenia patients, bipolar affective disorder patients, and

community control subjects. *Schizophrenia Research*, *84*(1), 121–131. https://doi.org/10.1016/j.schres.2005.11.023

Lalchandani, R. (2009). *Levels of processing speed and the relationship to problem solving, symptoms and quality of life in schizophrenia*. *ProQuest Dissertations and Theses*. Alliant International University, Ann Arbor. Retrieved from http://libproxy.lib.unc.edu/login?url=https://search.proquest.com/docview/1032550101?accountid=14244

Lancaster, R. S. (2004). *Predicting work performance in schizophrenia: The role of clinical symptoms, neurocognition, emotion perception, and coping*. *ProQuest Dissertations and Theses*. Purdue University, Ann Arbor. Retrieved from http://libproxy.lib.unc.edu/login?url=https://search.proquest.com/docview/305154377?accountid=14244

Langdon, R., Connors, M. H., Still, M., Ward, P. B., & Catts, S. (2014). Theory of mind and neurocognition in early psychosis: A quasi-experimental study. *BMC Psychiatry*, *14*(1), 1–7. https://doi.org/10.1186/s12888-014-0316-6

Li, A. W. Y., Viñas-Guasch, N., Hui, C. L. M., Chang, W. C., Chan, S. K. W., Lee, E. H. M., & Chen, E. Y. H. (2018). Verbal working memory in schizophrenia: The role of syntax in facilitating serial recall. *Schizophrenia Research*, *192*, 294–299. https://doi.org/10.1016/j.schres.2017.04.008

Li, N., Chen, Y., & Deng, H. (2012). Cross-sectional assessment of the factors associated with occupational functioning in patients with schizophrenia. *Shanghai Archives of Psychiatry*, *24*(4), 222–229. https://doi.org/10.3969/j.issn.1002-0829.2012.04.003

Lin, C. H., Huang, C. L., Chang, Y. C., Chen, P. W., Lin, C. Y., Tsai, G. E., & Lane, H. Y. (2013). Clinical symptoms, mainly negative symptoms, mediate the influence of neurocognition and social cognition on functional outcome of schizophrenia. *Schizophrenia Research*, *146*(1–3), 231–237. https://doi.org/10.1016/j.schres.2013.02.009

Lindenmayer, J. P., Fregenti, S., Kang, G., Ozog, V., Ljuri, I., Khan, A., … McGurk, S. R. (2017). The relationship of cognitive improvement after cognitive remediation with social functioning in patients with schizophrenia and severe cognitive deficits. *Schizophrenia Research*, *185*, 154–160. https://doi.org/10.1016/j.schres.2017.01.007

Lo, P., & Siu, A. M. H. (2015). Social cognition and work performance of persons with schizophrenia in a Chinese population. *Work*, *50*(4), 629–636. https://doi.org/10.3233/WOR-141828

Ludwig, K. A., Pinkham, A. E., Harvey, P. D., Kelsven, S., & Penn, D. L. (2017). Social cognition psychometric evaluation (SCOPE) in people with early psychosis: A preliminary study. *Schizophrenia Research*, *190*, 136–143. https://doi.org/10.1016/j.schres.2017.03.001

Lynch, B. C. (2006). *The correlates of executive functions in adults with schizophrenia as a predictor of social and vocational success*. *ProQuest Dissertations and Theses*. The University of Tulsa, Ann Arbor. Retrieved from http://libproxy.lib.unc.edu/login?url=https://search.proquest.com/docview/304984475?accountid=14244

Lysaker, P. H., & Davis, L. W. (2004). Social function in schizophrenia and schizoaffective disorder: associations with personality, symptoms and neurocognition. *Health and Quality of Life Outcomes*, *2*, 15. https://doi.org/10.1186/1477-7525-2-15

Lysaker, P. H., Shea, A. M., Buck, K. D., Dimaggio, G., Nicolò, G., Procacci, M., … Rand, K. L. (2010). Metacognition as a mediator of the effects of impairments in neurocognition on social function in schizophrenia spectrum disorders. *Acta Psychiatrica Scandinavica*, *122*(5), 405–413. https://doi.org/10.1111/j.1600-0447.2010.01554.x

Lystad, J. U., Falkum, E., Haaland, V. Ø., Bull, H., Evensen, S., Bell, M. D., & Ueland, T. (2016). Neurocognition and occupational functioning in schizophrenia spectrum disorders: The MATRICS Consensus Cognitive Battery (MCCB) and workplace assessments. *Schizophrenia Research*, *170*(1), 143–149. https://doi.org/10.1016/j.schres.2015.12.002

Lystad, J. U., Falkum, E., Mohn, C., Haaland, V. Ø., Bull, H., Evensen, S., … Ueland, T. (2014). The MATRICS Consensus Cognitive Battery (MCCB): Performance and functional correlates. *Psychiatry Research*, *220*(3), 1094–1101. https://doi.org/10.1016/j.psychres.2014.08.060

Macaulay, R., & Cohen, A. (2014). Self-conscious emotions role in functional outcomes within clinical populations. *Psychiatry Research*, *216*(1), 17–23. https://doi.org/10.1016/j.psychres.2014.01.022

Mancuso, F., Horan, W. P., Kern, R. S., & Green, M. F. (2011). Social cognition in psychosis: multidimensional structure, clinical correlates, and relationship with functional outcome. *Schizophrenia Research*, *125*(2–3), 143–151. https://doi.org/10.1016/j.schres.2010.11.007

Mann-Wrobel, M. C. (2009). *Error observation in schizophrenia*. *ProQuest Dissertations and Theses*. University of Maryland, College Park, Ann Arbor. Retrieved from http://libproxy.lib.unc.edu/login?url=https://search.proquest.com/docview/304924134?accountid=14244

Martínez-Domínguez, S., Penadés, R., Segura, B., González-Rodríguez, A., & Catalán, R. (2015). Influence of social cognition on daily functioning in schizophrenia: Study of incremental validity and mediational effects. *Psychiatry Research*, *225*(3), 374–380. https://doi.org/10.1016/j.psychres.2014.12.011

Mathews, J. R., Barch, D. M. (2010). Emotion responsivity, social cognition, and functional outcome in schizophrenia. *Journal of Abnormal Psychology, 119*(1), 50–59. doi: 10.1037/a0017861.

Mazza, M., Pollice, R., Pacitti, F., Pino, M. C., Mariano, M., Tripaldi, S., … Roncone, R. (2012). New evidence in theory of mind deficits in subjects with chronic schizophrenia and first episode: Correlation with symptoms, neurocognition and social function. *Rivista Di Psichiatria*, *47*(4), 327–336. https://doi.org/10.1708/1139.12561

McClure, M. M., Bowie, C. R., Patterson, T. L., Heaton, R. K., Weaver, C., Anderson, H., & Harvey, P. D. (2007). Correlations of functional capacity and neuropsychological performance in older patients with schizophrenia: Evidence for specificity of relationships? *Schizophrenia Research*, *89*(1–3), 330–338. https://doi.org/10.1016/j.schres.2006.07.024

Meyer, M. B., & Kurtz, M. M. (2009). Elementary neurocognitive function, facial affect recognition and social-skills in schizophrenia. *Schizophrenia Research*, *110*(1–3), 173–179. https://doi.org/10.1016/j.schres.2009.03.015

Michaels, T. M., Horan, W. P., Ginger, E. J., Martinovich, Z., Pinkham, A. E., & Smith, M. J. (2014). Cognitive empathy contributes to poor social functioning in schizophrenia: Evidence from a new self-report measure of cognitive and affective empathy. *Psychiatry Research*, *220*(3), 803–810. https://doi.org/10.1016/j.psychres.2014.08.054

Mohamed, S., Rosenheck, R., Swartz, M., Stroup, S., Lieberman, J. A., & Keefe, R. S. E. (2008). Relationship of cognition and psychopathology to functional impairment in schizophrenia. *American Journal of Psychiatry*, *165*(8), 978–987. https://doi.org/10.1176/appi.ajp.2008.07111713

Moore, R. C., Viglione, D. J., Rosenfarb, I. S., Patterson, T. L., & Mausbach, B. T. (2013). Rorschach measures of cognition relate to everyday and social functioning in schizophrenia. *Psychological Assessment*, *25*(1), 253–263. https://doi.org/10.1037/a0030546

Moriarty, P. J. (2002). *Social cognitive and non-social cognitive abilities: An examination of impact on global social functioning*. *ProQuest Dissertations and Theses*. Hofstra University, Ann Arbor. Retrieved from http://libproxy.lib.unc.edu/login?url=https://search.proquest.com/docview/305581099?accountid=14244

Mueser, K. T., Blanchard, J. J., & Bellack, A. S. (1995). Memory and social skill in schizophrenia: the role of gender. *Psychiatry Research*, *57*(2), 141–53. https://doi.org/10.1016/0165-1781(95)02661-f

Mueser, K. T., Bellack, A. S., Douglas, M. S., & Wade, J. H. (1991). Prediction of social skill acquisition in schizophrenic and major affective disorder patients from memory and symptomatology. *Psychiatry Research*, *37*(3), 281–296. https://doi.org/10.1016/0165-1781(91)90064-V

Mueser, K., Doonan, R., Penn, D., Blanchard, J., Bellack, A., Nishith, P., & DeLeon, J. (1996). Emotion Recognition and Social Competence in Chronic Schizophrenia. *J Abnorm Psychol*, *105*(2), 271–275. https://doi.org/http://dx.doi.org/10.1037/0021-843X.105.2.271

Nakagami, E., Xie, B., Hoe, M., & Brekke, J. S. (2008). Intrinsic motivation, neurocognition and psychosocial functioning in schizophrenia: Testing mediator and moderator effects. *Schizophrenia Research*, *105*(1–3), 95–104. https://doi.org/10.1016/j.schres.2008.06.015

Narvaez, J. M., Twamley, E. W., McKibbin, C. L., Heaton, R. K., & Patterson, T. L. (2008). Subjective and objective quality of life in schizophrenia. *Schizophrenia Research*, *98*(1–3), 201–208. https://doi.org/10.1016/j.schres.2007.09.001

Nemoto, T., Kashima, H., & Mizuno, M. (2007). Contribution of divergent thinking to community functioning in schizophrenia. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, *31*(2), 517–524. https://doi.org/10.1016/j.pnpbp.2006.12.001

Nienow, T. M. (2004). *The role of neurocognition and affect recognition in social competence in schizophrenia*. *ProQuest Dissertations and Theses*. Kent State University, Ann Arbor. Retrieved from http://libproxy.lib.unc.edu/login?url=https://search.proquest.com/docview/305174494?accountid=14244

Oh, S.-H., Lee, S.-H., Park, Y.-M., & Bae, S.-M. (2010). The multiple faces of social cognition in schizophrenia: Its relationship with neurocognition and functional outcomes. *Clinical Psychopharmacology and Neuroscience*, *8*(2), 90–96.

Ohmuro, N., Katsura, M., Obara, C., Kikuchi, T., Sakuma, A., Iizuka, K., … Matsumoto, K. (2016). Deficits of cognitive theory of mind and its relationship with functioning in individuals with an at-risk mental state and first-episode psychosis. *Psychiatry Research*, *243*, 318–325. https://doi.org/10.1016/j.psychres.2016.06.051

Olbert, C. M., Penn, D. L., Kern, R. S., Lee, J., Horan, W. P., Reise, S. P., … Green, M. F. (2013). Adapting social neuroscience measures for schizophrenia clinical trials, part 3: Fathoming external validity. *Schizophrenia Bulletin*, *39*(6), 1211–1218. https://doi.org/10.1093/schbul/sbt130

Pan, Y. J., Chen, S. H., Chen, W. J., & Liu, S. K. (2009). Affect recognition as an independent social function determinant in schizophrenia. *Comprehensive Psychiatry*, *50*(5), 443–452. https://doi.org/10.1016/j.comppsych.2008.11.003

Park, S., Matthews, N., & Gibson, C. (2008). Imitation, simulation, and schizophrenia. *Schizophrenia Bulletin*, *34*(4), 698–707. https://doi.org/10.1093/schbul/sbn048

Peña, J., Segarra, R., Ojeda, N., García, J., Eguiluz, J. I., & Gutiérrez, M. (2012). Do the same factors predict outcome in schizophrenia and non-schizophrenia syndromes after first-episode psychosis? A two-year follow-up study. *Journal of Psychiatric Research*, *46*(6), 774–781. https://doi.org/10.1016/j.jpsychires.2012.03.014

Penadés, R., Catalán, R., Puig, O., Masana, G., Pujol, N., Navarro, V., … Gastó, C. (2010). Executive function needs to be targeted to improve social functioning with Cognitive

Remediation Therapy (CRT) in schizophrenia. *Psychiatry Research*, *177*(1–2), 41–45. https://doi.org/10.1016/j.psychres.2009.01.032

Penn, D., Mueser, K., & Spaulding, W. (1996). Information processing, social skill, and gender in schizophrenia. *Psychiatry Research*, *59*, 213–220. Retrieved from http://www.sciencedirect.com/science/article/pii/0165178195027688

Perivoliotis, D. G. (2006). *Self-reported and performance -based functioning in middle -aged and older outpatients with schizophrenia*. *ProQuest Dissertations and Theses*. University of California, San Diego and San Diego State University, Ann Arbor. Retrieved from http://libproxy.lib.unc.edu/login?url=https://search.proquest.com/docview/304955370?accountid=14244

Perlick, D. A., Rosenheck, R. A., Kaczynski, R., Bingham, S., & Collins, J. (2008). Association of symptomatology and cognitive deficits to functional capacity in schizophrenia. *Schizophrenia Research*, *99*(1–3), 192–199. https://doi.org/10.1016/j.schres.2007.08.009

Pijnenborg, G. H. M., Withaar, F. K., Evans, J. J., Van Den Bosch, R. J., Timmerman, M. E., & Brouwer, W. H. (2009). The predictive value of measures of social cognition for community functioning in schizophrenia: Implications for neuropsychological assessment. *Journal of the International Neuropsychological Society*, *15*(02), 239. https://doi.org/10.1017/S1355617709090341

Pinkham, A. E., & Penn, D. L. (2006). Neurocognitive and social cognitive predictors of interpersonal skill in schizophrenia. *Psychiatry Research*, *143*(2–3), 167–178. https://doi.org/10.1016/j.psychres.2005.09.005

Pinkham, A. E., Penn, D. L., Green, M. F., & Harvey, P. D. (2016). Social cognition psychometric evaluation: Results of the initial psychometric study. *Schizophrenia Bulletin*, *42*(2), 494–504. https://doi.org/10.1093/schbul/sbv056

Poole, J. H., Ober, B. A., Shenaut, G. K., & Vinogradov, S. (1999). Independent frontal-system deficits in schizophrenia: cognitive, clinical, and adaptive implications. *Psychiatry Research*, *85*(2), 161–176.

Poole, J. H., Tobias, F. C., & Vinogradov, S. (2000). The functional relevance of affect recognition errors in schizophrenia. *Journal of the International Neuropsychological Society : JINS*, *6*(6), 649–658.

Puig, O., Penadés, R., Gastó, C., Catalán, R., Torres, A., & Salamero, M. (2008). Verbal memory, negative symptomatology and prediction of psychosocial functioning in schizophrenia. *Psychiatry Research*, *158*(1), 11–17. https://doi.org/10.1016/j.psychres.2007.04.017

Quinlan, T. (2014). *Mechanisms of Change in Cognitive Behavioral Social Skills Training for Schizophrenia*. *ProQuest Dissertations and Theses*. San Diego State University, Ann Arbor.

Retrieved from http://libproxy.lib.unc.edu/login?url=https://search.proquest.com/docview/1569506036?accountid=14244

Revheim, N., & Medalia, A. (2004). Verbal memory, problem-solving skills and community status in schizophrenia. *Schizophrenia Research*, *68*(2–3), 149–158. https://doi.org/10.1016/j.schres.2003.07.004

Revheim, N., Schechter, I., Kim, D., Silipo, G., Allingham, B., Butler, P., & Javitt, D. C. (2006). Neurocognitive and symptom correlates of daily problem-solving skills in schizophrenia. *Schizophrenia Research*, *83*(2–3), 237–245. https://doi.org/10.1016/j.schres.2005.12.849

Reynolds, G. (2015). *Predictive Modeling in Schizophrenia Spectrum Disorders: Relationship among Symptoms, Competence, Neurocognition, and Self-Efficacy*. *ProQuest Dissertations and Theses*. Hofstra University, Ann Arbor. Retrieved from http://libproxy.lib.unc.edu/login?url=https://search.proquest.com/docview/1726932294?accountid=14244

Riccardi, I., Carcione, A., Arcangelo, M. D., Rossi, R., Dimaggio, G., Lysaker, P. H., & Stratta, P. (2016). Empathic and cognitive processing in people with schizophrenia: a study on an Italian sample. *Journal of Psychopathology*, (October), 127–134.

Robertson, D. A., Hargreaves, A., Kelleher, E. B., Morris, D., Gill, M., Corvin, A., & Donohoe, G. (2013). Social dysfunction in schizophrenia: An investigation of the GAF scale's sensitivity to deficits in social cognition. *Schizophrenia Research*, *146*(1–3), 363–365. https://doi.org/10.1016/j.schres.2013.01.016

Sabbag, S., Twamley, E. W., Vella, L., Heaton, R. K., Patterson, T. L., & Harvey, P. D. (2013). Predictors of the accuracy of self assessment of everyday functioning in people with schizophrenia, *Schizophrenia Research, 137*, 190–195. https://doi.org/10.1016/j.schres.2012.02.002.Predictors

Sánchez, P., Ojeda, N., Peña, J., Elizagárate, E., Yoller, A. B., Gutiérrez, M., & Ezcurra, J. (2009). Predictors of longitudinal changes in schizophrenia: The role of processing speed. *Journal of Clinical Psychiatry*, *70*(6), 888–896. https://doi.org/10.4088/JCP.08m04294

Savilla, K., Kettler, L., & Galletly, C. (2008). Symptoms and quality of life in schizophrenia. *Australian and New Zealand Journal of Psychiatry*, *42*, 496–504. https://doi.org/10.1080/00048670802050512.Relationships

Schroeder, K., Huber, C. G., Jelinek, L., & Moritz, S. (2013). Subjective well-being, but not subjective mental functioning shows positive associations with neuropsychological performance in schizophrenia-spectrum disorders. *Comprehensive Psychiatry*, *54*(7), 824–830. https://doi.org/10.1016/j.comppsych.2013.02.008

Sergi, M. J., Rassovsky, Y., Nuechterlein, K. H., & Green, M. F. (2006). Social perception as a mediator of the influence of early visual processing on functional status in schizophrenia. *The American Journal of Psychiatry*, *163*(3), 448–54. https://doi.org/10.1176/appi.ajp.163.3.448

Smith, T. E., Hull, J. W., Goodman, M., Hedayat-Harris, A., Willson, D. F., Israel, L. M., & Munich, R. L. (1999). The relative influences of symptoms, insight, and neurocognition on social adjustment in schizophrenia and schizoaffective disorder. *The Journal of Nervous and Mental Disease*, *187*(2), 102–108.

Smith, T. E., Hull, J. W., Huppert, J. D., & Silverstein, S. M. (2002). Recovery from psychosis in schizophrenia and schizoaffective disorder: symptoms and neurocognitive rate-limiters for the development of social behaviour skills. *Schizophrenia Research*, *55*(3), 229–237. https://doi.org/10.1016/S0920-9964(01)00231-6

Smith, M. J., Horan, W. P., Karpouzian, T. M., Abram, S. V., Cobia, D. J., & Csernansky, J. G. (2012). Self-reported empathy deficits are uniquely associated with poor functioning in schizophrenia. *Schizophrenia Research*, *137*(1–3), 196–202. https://doi.org/10.1016/j.schres.2012.01.012

Tas, C., Brown, E., Cubukcuoglu, Z., Aydemir, O., Danaci, A. E., & Brüne, M. (2013). Towards an integrative approach to understanding quality of life in schizophrenia: The role of neurocognition, social cognition, and psychopathology. *Comprehensive Psychiatry*, *54*(3), 262–268. https://doi.org/10.1016/j.comppsych.2012.08.001

Thomas, M. L., Green, M. F., Hellemann, G., Sugar, C. A., Tarasenko, M., Calkins, M. E., … Light, G. A. (2017). Modeling deficits from early auditory information processing to psychosocial functioning in schizophrenia. *JAMA Psychiatry*, *74*(1), 37–46. https://doi.org/10.1001/jamapsychiatry.2016.2980

Tso, I. F., Grove, T. B., & Taylor, S. F. (2010). Emotional experience predicts social adjustment independent of neurocognition and social cognition in schizophrenia. *Schizophrenia Research*, *122*(1–3), 156–163. https://doi.org/10.1016/j.schres.2009.12.007

Tyson, P. J., Laws, K. R., Flowers, K. A., Mortimer, A. M., & Schulz, J. (2008). Attention and executive function in people with schizophrenia: Relationship with social skills and quality of life. *International Journal of Psychiatry in Clinical Practice*, *12*(2), 112–119. https://doi.org/10.1080/13651500701687133

Urbach, M., Brunet-Gouet, E., Bazin, N., Hardy-Baylé, M. C., & Passerieux, C. (2013). Correlations of theory of mind deficits with clinical patterns and quality of life in schizophrenia. *Frontiers in Psychiatry*, *4*(MAY), 1–8. https://doi.org/10.3389/fpsyt.2013.00030

van Beilen, M., Kiers, H. A. L., Bou, A., van Zomeren, E. H., Withaar, F. K., Arends, J., & van den Bosch, R. J. (2003). Cognitive deficits and social functioning in schizophrenia: a

clinical perspective. *The Clinical Neuropsychologist*, *17*(4), 507–514. https://doi.org/10.1076/clin.17.4.507.27935

Vaskinn, A., Sundet, K., Friis, S., Simonsen, C., Birkenaes, A. B., Jónsdóttir, H., … Andreassen, O. A. (2008). Emotion perception and learning potential: mediators between neurocognition and social problem-solving in schizophrenia? *Journal of the International Neuropsychological Society : JINS*, *14*(2), 279–88. https://doi.org/10.1017/S1355617708080314

Vauth, R., Rüsch, N., Wirtz, M., & Corrigan, P. W. (2004). Does social cognition influence the relation between neurocognitive deficits and vocational functioning in schizophrenia? *Psychiatry Research*, *128*(2), 155–165. https://doi.org/10.1016/j.psychres.2004.05.018

Velligan, D. I., Diamond, P., Glahn, D. C., Ritch, J., Maples, N., Castillo, D., & Miller, A. L. (2007). The reliability and validity of the Test of Adaptive Behavior in Schizophrenia (TABS). *Psychiatry Research*, *151*(1–2), 55–66. https://doi.org/10.1016/j.psychres.2006.10.007

Velligan, D. I., DiCocco, M., Bow-Thomas, C. C., Cadle, C., Glahn, D. C., Miller, A. L., … Crismon, M. L. (2004). A brief cognitive assessment for use with schizophrenia patients in community clinics. *Schizophrenia Research*, *71*(2–3), 273–283. https://doi.org/10.1016/j.schres.2004.02.027

Ventura, J., Ered, A., Gretchen-Doorly, D., Subotnik, K. L., Horan, W. P., Hellemann, G. S., & Nuechterlein, K. H. (2015). Theory of mind in the early course of schizophrenia: Stability, symptom and neurocognitive correlates, and relationship with functioning. *Psychological Medicine*, *45*(10), 2031–2043. https://doi.org/10.1017/S0033291714003171

Ventura, J., Cienfuegos, A., Boxer, O., & Bilder, R. (2008). Clinical global impression of cognition in schizophrenia (CGI-CogS): Reliability and validity of a co-primary measure of cognition. *Schizophrenia Research*, *106*(1), 59–69. https://doi.org/10.1016/j.schres.2007.07.025

Ventura, J., Reise, S. P., Keefe, R. S. E., Baade, L. E., Gold, J. M., Green, M. F., … Bilder, R. M. (2010). The Cognitive Assessment Interview (CAI): development and validation of an empirically derived, brief interview-based measure of cognition. *Schizophrenia Research*, *121*(1–3), 24–31. https://doi.org/10.1016/j.schres.2010.04.016

Villalta-Gil, V., Vilaplana, M., Ochoa, S., Haro, J. M., Dolz, M., Usall, J., & Cervilla, J. (2006). Neurocognitive performance and negative symptoms: Are they equal in explaining disability in schizophrenia outpatients? *Schizophrenia Research*, *87*(1–3), 246–253. https://doi.org/10.1016/j.schres.2006.06.013

Walther, S., Eisenhardt, S., Bohlhalter, S., Vanbellingen, T., Müri, R., Strik, W., & Stegmayer, K. (2016). Gesture Performance in Schizophrenia Predicts Functional Outcome after 6 Months. *Schizophrenia Bulletin*, *42*(6), 1326–1333. https://doi.org/10.1093/schbul/sbw124

Wölwer, W., & Frommann, N. (2011). Social-cognitive remediation in schizophrenia: Generalization of effects of the training of affect recognition (TAR). *Schizophrenia Bulletin*, *37*(SUPPL. 2), 63–70. https://doi.org/10.1093/schbul/sbr071

Woon, P. S., Chia, M. Y., Chan, W. Y., & Sim, K. (2010). Neurocognitive, clinical and functional correlates of subjective quality of life in Asian outpatients with schizophrenia. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, *34*(3), 463–468. https://doi.org/10.1016/j.pnpbp.2010.01.014

Woonings, F. M. J., Appelo, M. T., Kluiter, H., Slooff, C. J., & van den Bosch, R. J. (2003). Learning (potential) and social functioning in schizophrenia. *Schizophrenia Research*, *59*(2–3), 287–296.

Xiang, Y.-T., Shum, D., Chiu, H. F. K., Tang, W.-K., & Ungvari, G. S. (2010). Association of demographic characteristics, symptomatology, retrospective and prospective memory, executive functioning and intelligence with social functioning in schizophrenia. *Australian & New Zealand Journal of Psychiatry*, *44*(12), 1112–1117. https://doi.org/10.3109/00048674.2010.514854

Xiao, R. (2013). *Testing biopsychosocial models integrating electrodermal activity, neurocognition, and social cognition to predict the functional outcomes among people with schizophrenia at three time points over 12 months*. *ProQuest Dissertations and Theses*. University of Southern California, Ann Arbor. Retrieved from http://libproxy.lib.unc.edu/login?url=https://search.proquest.com/docview/1459239158?accountid=14244

Zanello, A., Perrig, L., & Huguelet, P. (2006). Cognitive functions related to interpersonal problem-solving skills in schizophrenic patients compared with healthy subjects. *Psychiatry Research*, *142*(1), 67–78. https://doi.org/10.1016/j.psychres.2003.07.009

Zhu, C.Y., Lee, T. M. C., Li, X.-S., Jing, S.-C., Wang, Y.-G., & Wang, K. (2007). Impairments of social cues recognition and social functioning in Chinese people with schizophrenia. *Psychiatry and Clinical Neurosciences*, *61*(2), 149–158. https://doi.org/10.1111/j.1440-1819.2007.01630.x

Zuo, S., Byrne, L. K., Peng, D., Mellor, D., McCabe, M., Zhang, J., … Xu, Y. (2012). Symptom severity is more closely associated with social functioning status in inpatients with schizophrenia than cognitive deficits. *Shanghai Archives of Psychiatry*, *24*(2), 83–90. https://doi.org/10.3969/j.issn.1002-0829.2012.02.003