Schizophrenia Bulletin
doi:10.1093/schbul/sbab033

Cognitive Predictors of Social and Occupational Functioning in Early Psychosis: A Systematic Review and Meta-analysis of Cross-Sectional and Longitudinal Data

Megan Cowman[1], Laurena Holleran[1], Edgar Lonergan[2], Karen O'Connor[2], Max Birchwood[3], and Gary Donohoe*[,1]

[1]Centre for Neuroimaging, Cognition & Genomics (NICOG), School of Psychology, National University of Ireland Galway, Galway, Ireland; [2]First Episode Psychosis Service, South Lee Mental Health Service, Cork, Ireland; [3]Warwick Medical School, University of Warwick, Coventry, UK

*To whom correspondence should be addressed; Centre for Neuroimaging and Cognitive Genomics (NICOG), School of Psychology, National University of Ireland Galway University Road, Galway, Ireland; tel: +353-(0)91-495-122, e-mail: gary.donohoe@nuigalway.ie

Many individuals with early psychosis experience impairments in social and occupational function. Identification of modifiable predictors of function such as cognitive performance has the potential to inform effective treatments. Our aim was to estimate the strength of the relationship between psychosocial function in early psychosis and different domains of cognitive and social cognitive performance. We conducted a systematic review and meta-analysis of peer-reviewed, cross-sectional, and longitudinal studies examining cognitive predictors of psychosocial function. Literature searches were conducted in PsycINFO, PubMed, and reference lists of relevant articles to identify studies for inclusion. Of the 2565 identified, 46 studies comprising 3767 participants met inclusion criteria. Separate meta-analyses were conducted for 9 cognitive domains. Pearson correlation values between cognitive variables and function were extracted. All cognitive domains were related to psychosocial function both cross-sectionally and longitudinally. Importantly, these associations remained significant even after the effects of symptom severity, duration of untreated psychosis, and length of illness were accounted for. Overall, general cognitive ability and social cognition were most strongly associated with both concurrent and long-term function. Associations demonstrated medium effect sizes. These findings suggest that treatments targeting cognitive deficits, in particular those focusing on social cognition, are likely to be important for improving functional outcomes in early psychosis.

Key words: schizophrenia/early psychosis/cognition/social function/occupational function

Introduction

Psychosocial function describes social and occupational functioning related to mental health that can affect an individual's ability to participate fully in life.[1,2] According to the World Health Organisation (WHO),[3] psychosis is ranked as a top 5 leading cause of disability for 18- to 30-year-olds. The combination of early-onset and unemployment results in psychosis having a significant social and economic cost.[4–8] While antipsychotic treatment is effective for ameliorating clinical symptoms, it has little impact on psychosocial function.[9] As a consequence, successfully addressing functional recovery in psychosis has become a clinical and research focus.

Cognitive deficits are a potential predictor of psychosocial function.[10–12] These deficits are present well before the onset of psychosis, increase following a first episode of psychosis,[13–15] and remain impaired during the chronic stage of illness.[16,17] While the significance of cognitive deficits is now widely accepted in chronic stage schizophrenia, its role in early psychosis is uncertain. Early Intervention in Psychosis (EIP) services attempt to improve function in a number of ways, including by reducing duration of untreated illness and symptom severity, but usually without directly targeting cognition. Whether the importance of cognition in determining recovery is being underestimated as a result, or whether it has predictive validity once symptomatology and illness duration is accounted for, is unclear. Other questions about the role of cognitive function in predicting psychosocial function include whether some individual cognitive domains (eg, social cognition) are better predictors than more global measures.

The aim of this review was to systematically evaluate current evidence that cognitive performance predicts psychosocial function in early psychosis, based on cross-sectional and longitudinal data. Among the general and specific cognitive domains to be included, we specifically sought to quantify the association between social cognition and psychosocial function. Moreover, we aimed to further evaluate whether these domains continue to

explain variation in function once other aspects of clinical presentation are accounted for.

Methods

Study Selection

Cross-sectional and longitudinal studies examining cognitive predictors of psychosocial function were considered for inclusion. Domains of cognition included were as follows: attention, executive function, processing speed, social cognition, verbal fluency, verbal memory, visual memory, working memory, and general cognitive ability (composite scores and IQ scores). Cognitive domains were broadly based on the Measurement and Treatment Research to Improve Cognition in Schizophrenia (MATRICS) Committee domains,[18] and on those most commonly evaluated in the literature (of note, the term "executive function" was replaced by "reasoning and problem solving" in the MATRICS battery and so both terms were included in our search strategy below). Only early psychosis samples (<5 years illness duration, affective, and non-affective psychosis) were considered. The term "early psychosis" rather than "first episode psychosis" was used due to difficulty in determining whether studies included true first-episode samples. Studies were considered if well-established measures of cognitive function were used. Measures of psychosocial function included: (1) Standardized measures of global function (eg, Global Assessment of Function [GAF]); (2) Standardized measures of Quality of Life (eg, WHO Quality of Life [WHOQoL]); (3) Individual definitions of function covering areas such as occupational function, educational function, or relationships.

Search Strategy

An electronic search was conducted using PubMed and PsycINFO. The following relevant keywords were used as search terms: ("first episode psychosis" OR "first episode schizophrenia" OR "recent onset psychosis" OR "recent onset schizophrenia" OR "early psychosis" OR "early schizophrenia") AND ("cognition" OR "neurocog*" OR "neuropsych*" OR "cognitive function" OR "IQ" OR "memory" OR "attention" OR "executive function" OR "reasoning" OR "problem-solving" OR "learning" OR "verbal fluency" OR "processing speed" OR "social cog*" OR "emotion perception" OR "affect perception" OR "emotion recognition" OR "Theory of Mind" OR "ToM" OR "mentalising" OR "social knowledge" OR "social perception" OR "social judgment") AND ("social function*" OR "social outcome*" OR "global function*" OR "global outcome*" OR "community function*" OR "community outcome*" OR "occupational function*" OR "occupational outcome*" OR "work function*" OR "work outcome*" OR "vocational function*" OR "vocational outcome*" OR "recovery" OR "quality of life" OR "employment" OR "global assessment of function" OR "social and occupational functioning assessment scale" OR "functioning scale" OR "disability"). The keywords were searched in titles, abstracts, and indexed terms. Searches were limited to original articles written in English and published in peer-reviewed journals from January 2000 to March 2020. Additional articles were identified by hand-searching the references of retrieved articles and reviews.

Data Extraction

Data were extracted on all cognitive variables for each study. Relevant data extracted also included study and participant characteristics (follow-up length, age, percent male, diagnoses, medication use, illness duration), cognitive measures, and functional measures. Discrepancies were resolved by consensus (M.C., G.D., and L.H.).

Quality Assessment

A quality evaluation scale was used to rate each study on the following: (1) Quality of sample description (diagnosis based on clinical diagnostic manuals), (2) Description of sample size calculations and/or power analysis, (3) Use of well-established measures of psychosocial function, (4) Provision of variability estimates (standard error, standard deviation, or confidence intervals), (5) Assessment of collinearity/multiple testing correction analysis, and (6) Modelling of possible confounding variables. Each item scored 1 point if the criterion was met, and the overall quality score was calculated by summing items.

Data Analysis

Pooled correlations (Pearson's r) were estimated with Comprehensive Meta- Analysis Software (CMA), Version 3.[19] Samples with a probable degree of overlap were excluded based on sample size: estimates from smaller sample sizes were excluded. Fisher's r-to-z conversion was used for variance stabilization and normalization.[20] Due to the considerable variability in adjustment for potential confounders across studies, unadjusted effect sizes were used. All effect sizes were transformed to r scale; where regression results were reported using beta coefficients, the transformation proposed by Peterson and Brown[21] was used to derive an estimate to r. Where the t statistic was reported, the transformation proposed by Borenstein et al.[20] was used. Odds ratios were converted to r in CMA for a small number of studies. Effect sizes were pooled using random-effects models.[20]

Meta-regression Analyses

Meta-regression analyses were conducted using positive and negative symptom severity scores, duration of

untreated psychosis (DUP) in weeks, and illness duration in months as covariates to identify potential influences of these variables on the effect sizes for the associations between cognition and psychosocial function. Where the Scale for the Assessment of Positive and Negative Symptoms (SAPS & SANS) were used, these were converted to Positive and Negative Syndrome Scale (PANSS) scores using an established method.[22] Meta-regressions were carried out on studies that provided these relevant covariate scores. Due to the limited number of studies available, we were unable to run separate meta-regressions for individual cognitive domains. Studies were also compared based on mixed samples of both affective and non-affective psychoses vs samples of or non-affective psychosis only.

Heterogeneity and Publication Bias

Heterogeneity was assessed via the Q statistic and the I^2 statistics. The Q statistic measures the dispersion of all effect sizes about the mean effect size, the I^2 statistic measures the ratio of true variance to total variance.[20] Where significant heterogeneity was detected, and where possible, separate analyses for different domains of functioning were performed to compare effect sizes based on type of outcome measure: (1) global function, (2) quality of life, (3) occupational function. Publication bias was examined with funnel plots and the trim-and-fill method.[23]

Results

Study Characteristics

The electronic search initially identified 2565 relevant publications. A further 11 studies were identified through a review of the reference lists. Of these, 46 studies involving 3767 patients were included in our analysis. A PRISMA flow diagram detailing the inclusion decisions is presented in figure 1. Characteristics of the included studies are presented in supplementary table 1. Over half of these studies (N = 32) included non-affective psychosis patients only. A wide variety of functioning measures were used across studies. Twenty-six studies included measures of global function, 9 studies included measures of disability, 5 studies included measures of quality of life, 5 studies included measures of individual function (employment, work, and interpersonal relations) and 1 study included a measure of functional capacity.

Fifteen studies examined cross-sectional associations or short-term longitudinal associations (<1-year follow-up),[24–38] 20 studies examined longitudinal associations (>1-year follow-up),[39–58] while a further 11 studies provided both cross-sectional and longitudinal data.[59–69] Follow-up periods ranged from 6 months to 15 years; 6 included follow-ups of less than 1 year, 15 included follow-ups of 1 year, 11 included follow-ups of 2–5 years, 2 included follow-ups of 5–10 years, and 3 included follow-ups of >10 years. Participants' mean age ranged from 18.7 to 30.5 years (mean = 24.67, SD = 4.60). Mean percentage of male participants across studies was 65.15%.

Methodological Quality

The quality of studies was assessed using a quality evaluation scale. The scores ranged from 2 to 5 points (out of 6) (supplementary table 2). Most studies confirmed diagnosis using clinical diagnostic manuals (Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)/ International Classification of Diseases (ICD-10)). Only 2 studies reported performing sample size calculations and/or power analysis and 7 studies used a sample size of less than 30 patients, thus limiting the generalisability of findings. Other methodological issues included not describing length of illness, not providing estimates of variability, and not providing assessment of collinearity. In addition, important potential confounding variables were often not included as covariates.

Cognitive Predictors of Function

Summary statistics were extracted for cross-sectional and longitudinal studies separately to avoid sample overlap and to allow for the inclusion of a greater number of studies in each analysis, as presented in table 1. All cognitive domains were found to be significantly positively associated with psychosocial function both cross-sectionally and longitudinally. Medium effect sizes were identified, ranging from 0.21 to 0.43. General cognitive ability and social cognition emerged as the strongest predictors of function. Overall, the associations between cognitive domains and psychosocial function were relatively consistent across time. Forest plots of the cross-sectional and longitudinal associations between cognitive domains and function are presented in figures 2–4. Accurate comparisons across different domains of functioning could not be performed due to the insufficient number of studies. In general, effect sizes were similar when compared across domains of functioning (global function vs quality of life vs occupational function) (supplementary figures 1–3).

General Cognitive Ability. Thirteen studies evaluated the *cross-sectional* association between general cognitive ability and function, of which 10 found a significant positive association. Associations were observed across measure of IQ and composite cognitive scores. Of 13 studies reviewed, pooled data was available for 12 of these. Results of meta-analysis indicated a significant positive association between general cognitive ability and function (r = .368, 95% CI [0.287–0.444], P < .001).

Twenty-one studies evaluated the *longitudinal* association between general cognitive ability and function. Of

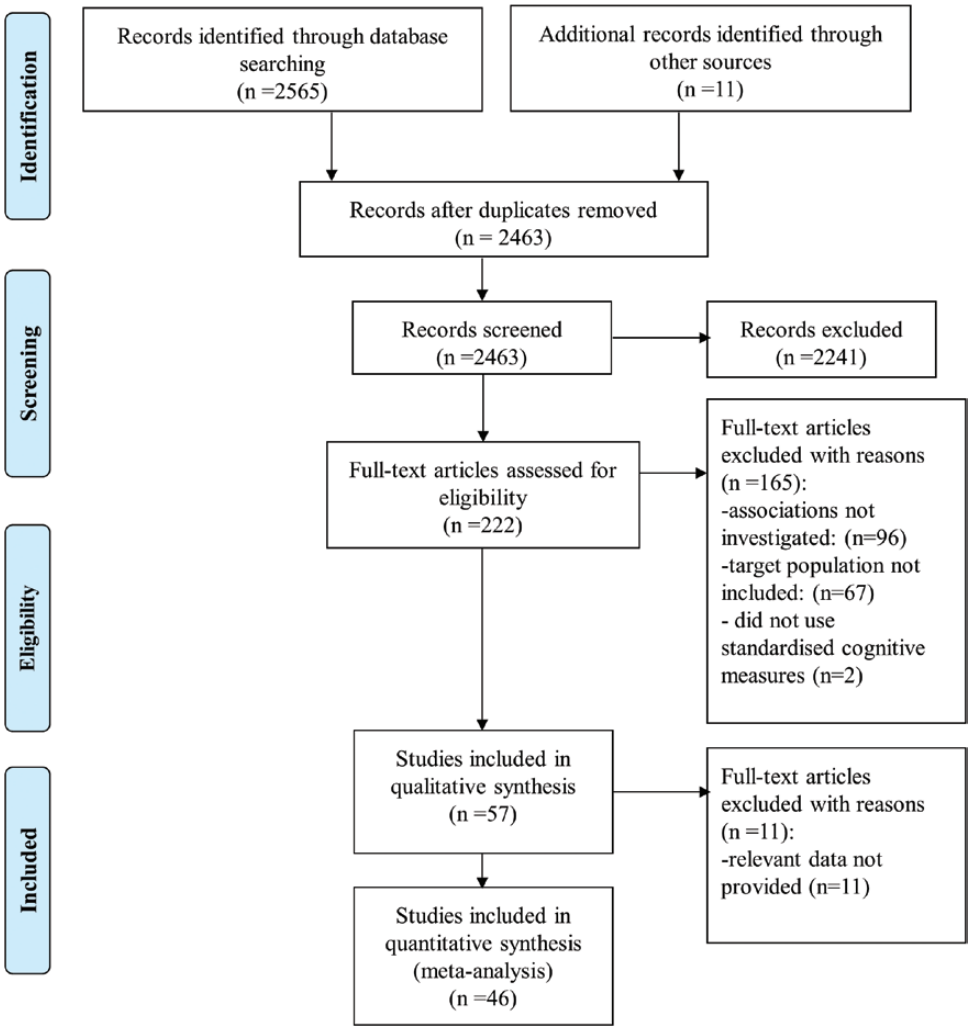

Fig. 1. Prisma flow diagram of studies included in meta-analysis.

Table 1. Summary of Overall Results of Meta-Analyses for Each Cognitive Domain

	Cross-sectional		Longitudinal	
Cognitive Domain	*r*	*P* value	*r*	*P* value
General cognitive ability	.368	<.001	.340	<.001
Social cognition	.362	<.001	.430	<.001
Processing speed	.307	<.001	.300	<.001
Verbal memory	.239	.002	.263	<.001
Visual memory	.346	<.001	.222	<.001
Working memory	.329	<.001	.258	.003
Attention	.260	.015	.283	<.001
Executive function	.248	<.001	.254	<.001
Verbal fluency	.219	.001	.205	<.001

these, 10 found a significant positive association. Data was pooled from 13 studies, based on which a significant positive association was found between general cognitive ability and function (r = .340, 95% CI [0.253–0.422], P < .001).

Social Cognition. Twelve studies evaluated the *cross-sectional* association between social cognition and function. Of these 12 studies, 10 found a significant positive association. Associations were observed across multiple measures including emotion recognition, Theory of Mind, social perception, and emotional intelligence. Measures of social cognition used included the Hinting task, Faux Pas Test, False Belief Task, Emotion Recognition Task, Facial Emotion Identification Test, Social Cue Recognition Task, Mayer-Salovey-Caruso Emotional Intelligence Test, and TASIT Part III: Social Inference—Enriched. Data

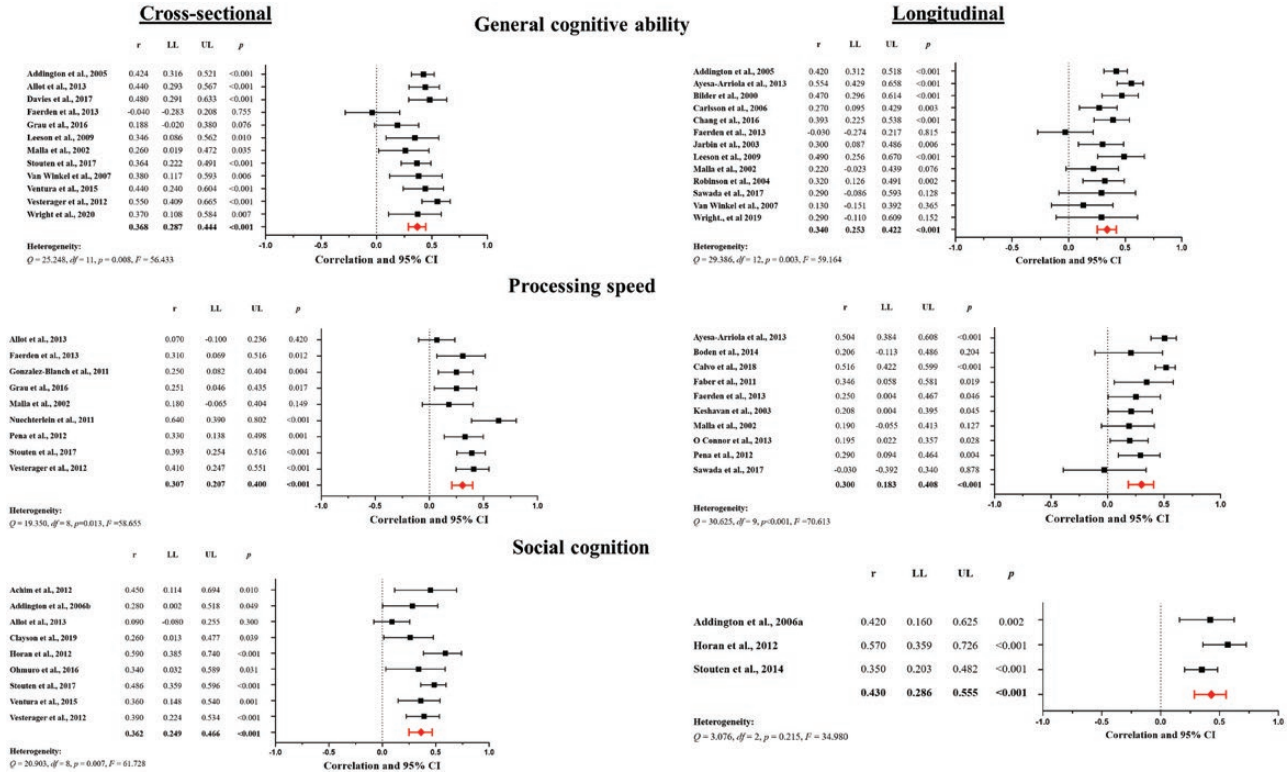

Fig. 2. Forest plots of summary correlations for general cognitive ability, processing speed and social cognition.

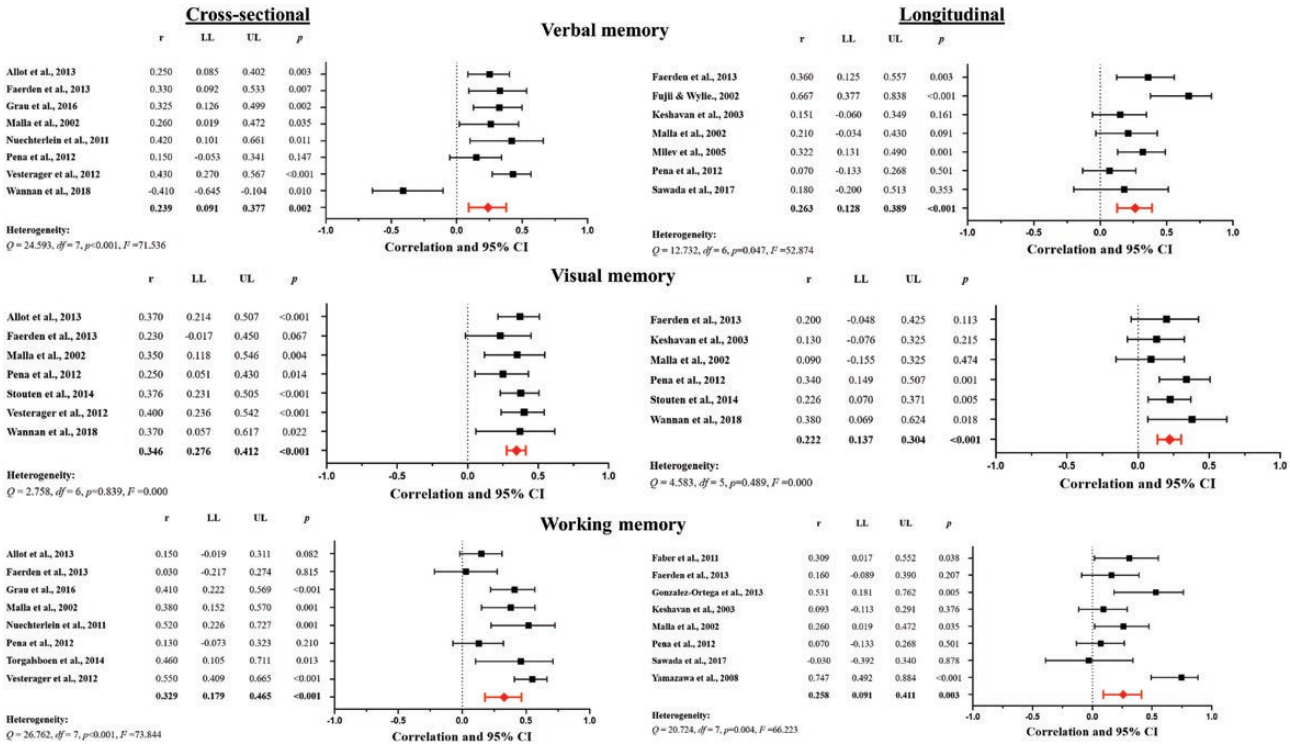

Fig. 3. Forest plots of summary correlations for verbal, visual, and working memory.

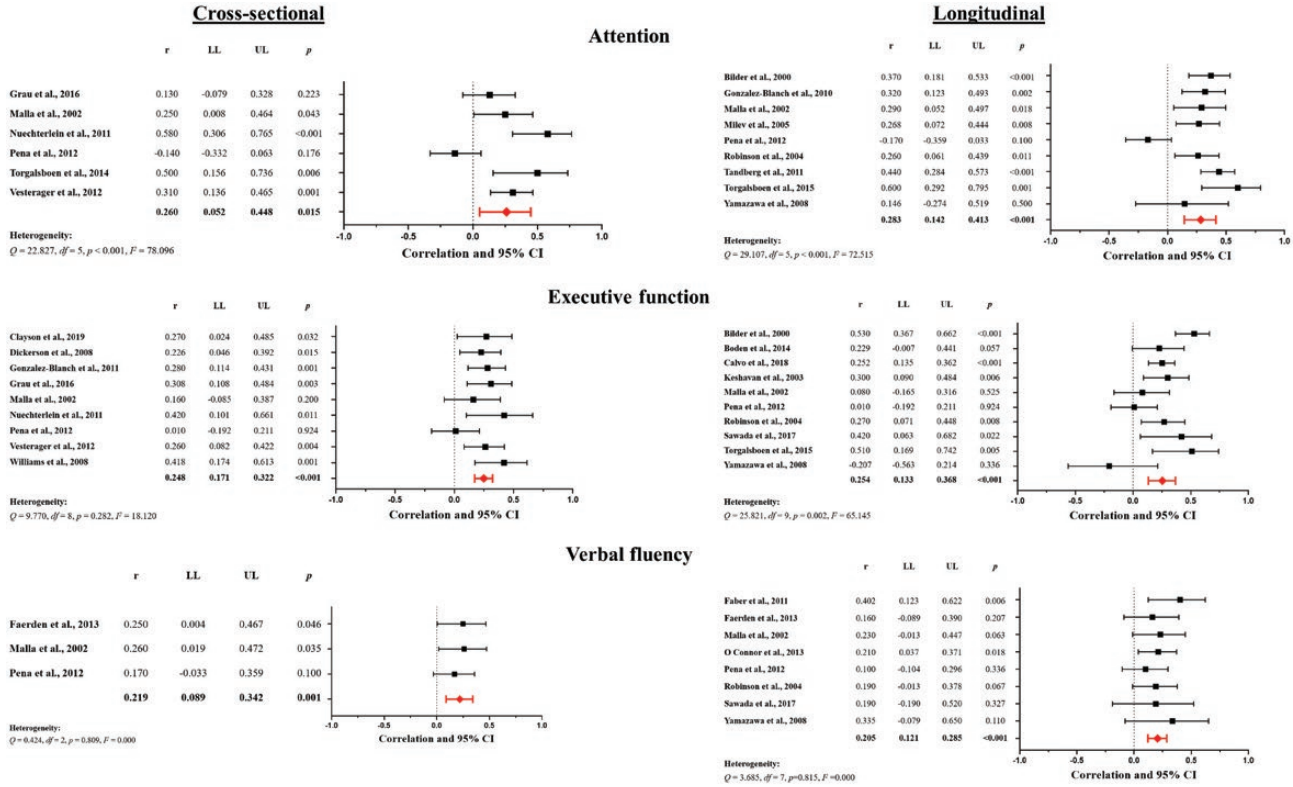

Fig. 4. Forest Plots of summary correlations for attention, executive function, and verbal fluency.

was pooled from 9 of these studies, based on which a significant positive association was observed between social cognition and level of function (r = .362, 95% CI [0.249–0.466], P < .001).

Eight studies evaluated the *longitudinal* association between social cognition and psychosocial function, of which 5 found a significant positive association. Data was pooled from just 3 studies due to limited availability of effect sizes, based on which a significant positive association between social cognition and function was observed (r = .430, 95% CI [0.286–0.555], P < .001).

Processing Speed. Thirteen studies examined the *cross-sectional* association between processing speed and function, of which 9 found a significant positive association. Associations were observed across multiple measures including Digit Symbol Coding, Trail Making Test-A (TMT-A), and STROOP task. Data was pooled for 9 studies, based on which a significant positive association was observed between processing speed and function (r = .307, 95% CI [0.207–0.400], P < .001).

Twenty-one studies examined the *longitudinal* association between processing speed and function, of which 11 found a significant positive association. Data was pooled for 10 studies, based on which a significant positive association was observed between processing speed and function (r = .300, 95% CI [0.183–0.408], P < .001).

Verbal Memory. Fourteen studies examined the *cross-sectional* association between verbal memory and function, of which 5 found a significant positive association. Associations were observed across multiple measures including California Verbal Learning Test, Rey Auditory Verbal Memory Test, Logical Memory (Wechsler Memory Scale; WMS), and Hopkin's Verbal Learning Test. Data was pooled for 8 studies, based on which a significant positive association was observed between verbal memory and function (r = .239, 95% CI [0.091–0.377], P = .002).

Twenty-three studies examined the *longitudinal* association between verbal memory and function, of which 6 found a significant positive association. Data was pooled for 7 studies, based on which a significant positive association was observed between verbal memory and function (r = .263, 95% CI [0.128–0.389], P < .001).

Visual Memory

Ten studies examined the *cross-sectional* association between visual memory and function, of which 6 found a significant positive association. Associations were observed across multiple measures including the Rey–Osterrieth Complex Figure Test, Design Reproduction (WMS), Brief Visuospatial Memory Task, and Paired Associates Learning (Cambridge Neuropsychological Test Automated Battery; CANTAB). Data was pooled

for 7 studies, based on which a significant positive association was observed between visual memory and function (r = .346, 95% CI [0.276–0.412], P < .001).

Seventeen studies examined the *longitudinal* association between visual memory and function, of which 7 found a significant positive association. Data was pooled for 6 studies, based on which a significant positive association was observed between visual memory and function (r = .222, 95% CI [0.137–0.304], P < .001).

Working Memory. Eleven studies examined the *cross-sectional* association between working memory and function, of which 6 found a significant positive association. Association were observed across multiple measures including Digit Span, Spatial Span, and Letter Number Sequencing. Data was pooled for 8 studies, based on which a significant positive association was observed between working memory and function (r = .329, 95% CI [0.179–0.465], P < .001).

Nineteen studies examined the *longitudinal* association between working memory and function, of which 7 found a significant positive association. Data was pooled for 8 studies, based on which a significant positive association was observed between working memory and function (r = .258, 95% CI [0.091–0.411], P = .003).

Attention. Eleven studies evaluated the *cross-sectional* association between attention and function, of which 4 found a significant positive association. Associations were observed across multiple measures including the Continuous Performance Task, Brief Test of Attention, and Cancellation Task. Data was pooled for 6 studies, based on which a significant positive association was observed between attention and function (r = .260, 95% CI [0.052–0.448], P < .001).

Nineteen studies examined the *longitudinal* association between attention and function, of which 9 found a significant positive association. Data was pooled for 9 studies, based on which a significant positive association was observed between attention and function (r = .283, 95% CI [0.142–0.413], P < .001).

Executive Function. Fourteen studies examined the *cross-sectional* association between executive function and psychosocial function, of which 7 found a significant positive association. Associations were found across a range of measures including the Wisconsin Card Sorting Test, TMT– B, Neuropsychological Assessment Battery (NAB) Mazes, NAB Reason and Problem Solving, and Tower of London Test. Data was pooled for 9 studies, based on which a significant positive association was observed between executive function and psychosocial function (r = .248, 95% CI [0.171–0.322], P < .001).

Twenty-four studies examined the *longitudinal* association between executive function and psychosocial function, of which 7 found a significant positive association. Data was pooled for 10 studies, based on which a significant positive association was observed between executive function and psychosocial function (r = .254, 95% CI [0.133–0.368], P < .001).

Verbal Fluency. Four studies examined the *cross-sectional* association between verbal fluency and function, of which only 1 found a significant association. Data was pooled from just 3 studies due to limited availability of effect sizes, there was a significant positive association between verbal fluency and function (r = .219, 95% CI [0.089–0.342], P = .001).

15 studies evaluated the *longitudinal* association between verbal fluency and function, of which 4 found a significant association. Data was pooled for 8 studies, based on which a significant positive association was observed between verbal fluency and function (r = .205, 95% CI [0.121–0.285], P < .001).

Meta-Regression Analyses

No significant effect was observed for positive (coefficient = 0.0088, 95% CI [−0.0027 – 0.0203], P = .1339, r^2 = .12) or negative (coefficient = 0.0058, 95% CI [−0.0168 – 0.0283], P = .6157, r^2 = −.07) symptom scores when included as covariates. Similarly, no significant effects were observed for DUP (coefficient = 0.0007, 95% CI [−0.0046 – 0.0061], P = .7933, r^2 = −0.09) or duration of illness (coefficient = −0.0007, 95% CI [−0.0055 – 0.0042], P = .7883, r^2 = −.09). When studies were grouped based on duration of illness, no notable differences in effect sizes were observed between studies that included samples with short-term (≤ 1 year) (r = .357, 95% CI [0.288 – 0.423], P < .001), medium-term (1 – 4 years) (r = .387, 95% CI [0.254 – 0.505], P < .001), and long-term duration of illness (>4 years) (r = .376, 95% CI [0.128 – 0.580], P = .004).

When studies were compared based on diagnosis (non-affective vs mixed affective/non-affective samples), studies with non-affective psychosis only showed a larger effect size (r = .406, 95% CI [0.363 – 0.448], P < .001) than combined affective/non-affective studies (r = .299, 95% CI [0.224 – 0.370], P < .001). This was true for both general cognition (non-affective psychosis only: r =.393, 95% CI [0.310–0.471], P < .001; affective/non-affective psychosis: r = .208, 95% CI [0.049 – 0.357], P = .011;) and social cognition (non-affective psychosis only: r = .414, 95% CI [0.329–0.492], P < .001]; affective/non-affective psychosis: r = .183, 95% CI [−0.063 – 0.408], P = .143).

Discussion

Summary of Findings

The evidence that cognitive performance was associated with concurrent and longitudinal psychosocial function was unequivocal. The amount of variance explained by individual cognitive variables, although modest, remained significant even after accounting for

the effects of positive and negative symptoms, DUP and duration of illness. Comparing studies of non-affective psychosis only to studies of mixed affective and non-affective psychoses, the association between cognition and psychosocial function was stronger in the non-affective group. Finally, cognitive performance was an equally important predictor of psychosocial function whether a person was diagnosed with psychosis for 1 month, 1 year or 5 years. Collectively, these data highlight the importance of cognitive performance for predicting psychosocial function in early psychosis, even after clinical variables were accounted for. Of those aspects of cognition assessed, the strongest association was observed on measures of social cognition, with evidence from longitudinal studies that this aspect of cognition explained ~19% of variation in psychosocial function. This novel finding suggests that social cognition may represent a potential treatment target for those experiencing psychosocial function impairments in early psychosis.

Limitations

Significant heterogeneity was noted for most cognitive domains, likely reflecting variability in study characteristics, including sample size, duration of follow-up, diagnosis, and measures used. We were unable to distinguish between variance explained in social vs occupational functioning because these were not typically distinguished in the studies reviewed. Significant variation in definitions of FEP was observed, with some studies reporting a duration of illness of up to 60 months. This meant we were unable to assess first-episode psychosis specifically, vs early psychosis more broadly. In terms of cognitive measurement, inconsistencies were also noted in relation to the measurement and conceptualization of some cognitive domains such as executive function and attention. Finally, although the limited number of studies in each meta-analysis prevented us from properly testing publication bias, significant reporting bias was evident in the literature. Many studies did not provide non-significant data, suggesting caution when interpreting the generalisability of these results.

Future Directions

Notwithstanding these limitations, our findings highlight important questions for future research. Given the medium effect sizes observed, it would be useful to model the combined variance explained by interaction between demographic, clinical and cognitive variables, and to identify potential moderators or mediators in these associations. Further understanding the dynamic relationship between cognition and other predictor variables over time will also be key in determining long-term function. To this end, comparison of predictors across different stages of illness (prodromal phase vs FEP vs chronic schizophrenia) and over longer periods of time could provide novel insight.

Conclusions

This study provides narrative and meta-analytic evidence that cognitive variables are likely to represent predictors of function in early psychosis, with important clinical implications. EIP services have sought to improve psychosocial function in a number of ways, including by reducing DUP and symptom severity, but usually without a specific focus on cognition. While the reasons for this are often practical – involving challenges in assessment and treatment - our results indicate that an important determinant of recovery is consequently being neglected. These data suggests that comprehensive assessment at an early stage of illness can help to identify individuals who are at increased risk of long-term psychosocial disability associated with cognitive deficits. These findings also suggest the need to target cognitive aspects of disability, in addition to reducing clinical symptom severity. They further suggest that such cognitively focused interventions (eg, Cognitive Remediation Therapy; CRT) should specifically target social cognition as an important predictor of function. In addition to predicting function, recent evidence suggests that social cognition also predicts response to therapy.[70] Given the increased awareness of the importance of social and occupational rehabilitation for recovery, CRT has already begun to form one part of the multicomponent response aimed at improving level of function in some services. At the same time, CRT continues to be criticized as a labor intensive and hence expensive intervention, notwithstanding development of cost-effective online interventions (eg, Donohoe et al[71]). However, this study highlights the importance of providing such interventions as part of a multicomponent response where it might serve to potentiate the improvements associated with other recovery-oriented treatment components.

Supplementary Material

Supplementary material is available at *Schizophrenia Bulletin* online.

Funding

This Study was generously funded by a Research Leader's Award to GD from the Irish Health Research Board (RL-2020-007).

Acknowledgment

The authors have declared that there are no conflicts of interest in relation to the subject of this study.

References

1. United Nations Convention on the Rights of Persons with Disabilities. http://www.un.org/disabilities/documents/convention/convention_accessible_pdf.pdf. Accessed July 13, 2020.
2. Griffiths SL, Wood SJ, Birchwood M. Vulnerability to psychosocial disability in psychosis. *Epidemiol Psychiatr Sci.* 2019;28(2):140–145.
3. World Health Organization. *Depression and other common mental disorders: Global Health Estimates*. Geneva: World Health Organization; 2017.
4. Behan C, Kennelly B, O'Callaghan E. The economic cost of schizophrenia in Ireland: a cost of illness study. *Ir J Psychol Med.* 2008;25(3):80–87.
5. Organisation for Economic Co-operation and Development. *Health at a Glance: Europe 2018: State of Health in the EU Cycle*. Brussels, Belgium: OECD Publishing; 2018
6. Evensen S, Wisløff T, Lystad JU, Bull H, Ueland T, Falkum E. Prevalence, employment rate, and cost of schizophrenia in a high-income welfare society: a population-based study using comprehensive health and welfare registers. *Schizophr Bull.* 2016;42(2):476–483.
7. Phanthunane P, Vos T, Whiteford H, Bertram M. Improving mental health policy in the case of schizophrenia in Thailand: evidence-based information for efficient solutions. *BMC Public Health* 2012;12:1–1.
8. Ekman M, Granstrom O, Omerov S, Jacob J, Landen M. The societal cost of schizophrenia in Sweden. *J Ment Health Policy Econ.* 2013;16(1):13–25.
9. McGorry PD, Killackey E, Yung A. Early intervention in psychosis: concepts, evidence and future directions. *World Psychiatry.* 2008;7(3):148–156.
10. Santesteban-Echarri O, Paino M, Rice S, et al. Predictors of functional recovery in first-episode psychosis: a systematic review and meta-analysis of longitudinal studies. *Clin Psychol Rev.* 2017;58:59–75.
11. Allott K, Liu P, Proffitt TM, Killackey E. Cognition at illness onset as a predictor of later functional outcome in early psychosis: systematic review and methodological critique. *Schizophr Res.* 2011;125(2-3):221–235.
12. Fett AK, Viechtbauer W, Dominguez MD, Penn DL, van Os J, Krabbendam L. The relationship between neurocognition and social cognition with functional outcomes in schizophrenia: a meta-analysis. *Neurosci Biobehav Rev.* 2011;35(3):573–588.
13. Aas M, Dazzan P, Mondelli V, Melle I, Murray RM, Pariante CM. A systematic review of cognitive function in first-episode psychosis, including a discussion on childhood trauma, stress, and inflammation. *Front Psychiatry.* 2014;4:182.
14. Green MF, Horan WP, Lee J. Nonsocial and social cognition in schizophrenia: current evidence and future directions. *World Psychiatry.* 2019;18(2):146–161.
15. Halverson TF, Orleans-Pobee M, Merritt C, Sheeran P, Fett AK, Penn DL. Pathways to functional outcomes in schizophrenia spectrum disorders: Meta-analysis of social cognitive and neurocognitive predictors. *Neurosci Biobehav Rev.* 2019;105:212–219.
16. Bora E, Murray RM. Meta-analysis of cognitive deficits in ultra-high risk to psychosis and first-episode psychosis: do the cognitive deficits progress over, or after, the onset of psychosis? *Schizophr Bull.* 2014;40(4):744–755.
17. Lepage M, Bodnar M, Bowie CR. Neurocognition: clinical and functional outcomes in schizophrenia. *Can J Psychiatry.* 2014;59(1):5–12.
18. Nuechterlein KH, Barch DM, Gold JM, Goldberg TE, Green MF, Heaton RK. Identification of separable cognitive factors in schizophrenia. *Schizophr Res.* 2004;72(1):29–39.
19. Borenstein M, Hedges L, Higgins J, Rothstein H. *Comprehensive Meta-Analysis Version 3*. Englewood, NJ: Biostat; 2013
20. Borenstein M, Hedges LV, Higgins JP, Rothstein HR. *Introduction to meta-analysis*. Hoboken, NJ: John Wiley & Sons; 2011.
21. Peterson RA, Brown SP. On the use of beta coefficients in meta-analysis. *J Appl Psychol.* 2005;90(1):175–181.
22. van Erp TG, Preda A, Nguyen D, et al. Converting positive and negative symptom scores between PANSS and SAPS/SANS. *Schizophr Res.* 2014;152(1):289–294.
23. Duval S, Tweedie R. Trim and fill: a simple funnel-plot-based method of testing and adjusting for publication bias in meta-analysis. *Biometrics.* 2000;56(2):455–463.
24. Achim AM, Ouellet R, Roy MA, Jackson PL. Mentalizing in first-episode psychosis. *Psychiatry Res.* 2012;196(2-3):207–213.
25. Allott KA, Cotton SM, Chinnery GL, et al. The relative contribution of neurocognition and social cognition to 6-month vocational outcomes following Individual Placement and Support in first-episode psychosis. *Schizophr Res.* 2013;150(1):136–143.
26. Clayson PE, Kern RS, Nuechterlein KH, et al. Social vs. non-social measures of learning potential for predicting community functioning across phase of illness in schizophrenia. *Schizophr Res.* 2019;204:104–110.
27. Davies G, Fowler D, Greenwood K. Metacognition as a Mediating Variable Between Neurocognition and Functional Outcome in First Episode Psychosis. *Schizophr Bull.* 2017;43(4):824–832.
28. Dickerson FB, Stallings C, Origoni A, Boronow JJ, Sullens A, Yolken R. Predictors of occupational status six months after hospitalization in persons with a recent onset of psychosis. *Psychiatry Res.* 2008;160(3):278–284.
29. González-Blanch C, Pérez-Iglesias R, Rodríguez-Sánchez JM, et al. A digit symbol coding task as a screening instrument for cognitive impairment in first-episode psychosis. *Arch Clin Neuropsychol.* 2011;26:48–58.
30. Grau N, Rubio-Abadal E, Usall J, et al.; GENIPE Group. Influence of cognition, premorbid adjustment and psychotic symptoms on psycho-social functioning in first-episode psychosis. *Psychiatry Res.* 2016;242:157–162.
31. Nuechterlein KH, Subotnik KL, Green MF, et al. Neurocognitive predictors of work outcome in recent-onset schizophrenia. *Schizophr Bull.* 2011;37 Suppl 2:S33–S40.
32. Ohmuro N, Katsura M, Obara C, et al. Deficits of cognitive theory of mind and its relationship with functioning in individuals with an at-risk mental state and first-episode psychosis. *Psychiatry Res.* 2016;243:318–325.
33. Stouten LH, Veling W, Laan W, van der Helm M, van der Gaag M. Psychosocial functioning in first-episode psychosis and associations with neurocognition, social cognition, psychotic and affective symptoms. *Early Interv Psychiatry.* 2017;11(1):23–36.
34. Torgalsbøen AK, Mohn C, Rishovd Rund B. Neurocognitive predictors of remission of symptoms and social and role functioning in the early course of first-episode schizophrenia. *Psychiatry Res.* 2014;216(1):1–5.

35. Ventura J, Ered A, Gretchen-Doorly D, et al. Theory of mind in the early course of schizophrenia: stability, symptom and neurocognitive correlates, and relationship with functioning. *Psychol Med.* 2015;45(10):2031–2043.
36. Vesterager L, Christensen TØ, Olsen BB, et al. Cognitive and clinical predictors of functional capacity in patients with first episode schizophrenia. *Schizophr Res.* 2012;141(2-3):251–256.
37. Williams LM, Whitford TJ, Flynn G, et al. General and social cognition in first episode schizophrenia: identification of separable factors and prediction of functional outcome using the IntegNeuro test battery. *Schizophr Res.* 2008;99(1-3):182–191.
38. Wright AC, Mueser KT, McGurk SR, Fowler D, Greenwood KE. Cognitive and metacognitive factors predict engagement in employment in individuals with first episode psychosis. *Schizophr Res Cogn.* 2020;19:100141.
39. Ayesa-Arriola R, Rodríguez-Sánchez JM, Pérez-Iglesias R, et al. The relevance of cognitive, clinical and premorbid variables in predicting functional outcome for individuals with first-episode psychosis: a 3 year longitudinal study. *Psychiatry Res.* 2013;209(3):302–308.
40. Bilder RM, Goldman RS, Robinson D, et al. Neuropsychology of first-episode schizophrenia: initial characterization and clinical correlates. *Am J Psychiatry.* 2000;157(4):549–559.
41. Bodén R, Abrahamsson T, Holm G, Borg J. Psychomotor and cognitive deficits as predictors of 5-year outcome in first-episode schizophrenia. *Nord J Psychiatry.* 2014;68(4):282–288.
42. Treen Calvo D, Giménez-Donoso S, Setién-Suero E, Toll Privat A, Crespo-Facorro B, Ayesa Arriola R. Targeting recovery in first episode psychosis: The importance of neurocognition and premorbid adjustment in a 3-year longitudinal study. *Schizophr Res.* 2018;195:320–326.
43. Carlsson R, Nyman H, Ganse G, Cullberg J. Neuropsychological functions predict 1- and 3-year outcome in first-episode psychosis. *Acta Psychiatr Scand.* 2006;113(2):102–111.
44. Chang WC, Hui CL, Chan SK, Lee EH, Chen EY. Impact of avolition and cognitive impairment on functional outcome in first-episode schizophrenia-spectrum disorder: a prospective one-year follow-up study. *Schizophr Res.* 2016;170(2-3):318–321.
45. Faber G, Smid HG, Van Gool AR, Wunderink L, Wiersma D, van den Bosch RJ. Neurocognition and recovery in first episode psychosis. *Psychiatry Res.* 2011;188(1):1–6.
46. Fujii DE, Wylie AM. Neurocognition and community outcome in schizophrenia: long-term predictive validity. *Schizophr Res.* 2003;59(2-3):219–223.
47. González-Blanch C, Perez-Iglesias R, Pardo-García G, et al. Prognostic value of cognitive functioning for global functional recovery in first-episode schizophrenia. *Psychol Med.* 2010;40(6):935–944.
48. González-Ortega I, de Los Mozos V, Echeburúa E, et al. Working memory as a predictor of negative symptoms and functional outcome in first episode psychosis. *Psychiatry Res.* 2013;206(1):8–16.
49. Jarbin H, Ott Y, Von Knorring AL. Adult outcome of social function in adolescent-onset schizophrenia and affective psychosis. *J Am Acad Child Adolesc Psychiatry.* 2003;42(2):176–183.
50. Keshavan MS, Haas G, Miewald J, et al. Prolonged untreated illness duration from prodromal onset predicts outcome in first episode psychoses. *Schizophr Bull.* 2003;29(4):757–769.
51. Milev P, Ho BC, Arndt S, Andreasen NC. Predictive values of neurocognition and negative symptoms on functional outcome in schizophrenia: a longitudinal first-episode study with 7-year follow-up. *Am J Psychiatry.* 2005;162(3):495–506.
52. O'Connor JA, Wiffen B, Diforti M, et al. Neuropsychological, clinical and cognitive insight predictors of outcome in a first episode psychosis study. *Schizophr Res.* 2013;149(1-3):70–76.
53. Robinson DG, Woerner MG, McMeniman M, Mendelowitz A, Bilder RM. Symptomatic and functional recovery from a first episode of schizophrenia or schizoaffective disorder. *Am J Psychiatry.* 2004;161(3):473–479.
54. Sawada K, Kanehara A, Sakakibara E, et al. Identifying neurocognitive markers for outcome prediction of global functioning in individuals with first-episode and ultra-high-risk for psychosis. *Psychiatry Clin Neurosci.* 2017;71(5):318–327.
55. Tandberg M, Ueland T, Sundet K, et al. Neurocognition and occupational functioning in patients with first-episode psychosis: a 2-year follow-up study. *Psychiatry Res.* 2011;188(3):334–342.
56. Torgalsbøen AK, Mohn C, Czajkowski N, Rund BR. Relationship between neurocognition and functional recovery in first-episode schizophrenia: Results from the second year of the Oslo multi-follow-up study. *Psychiatry Res.* 2015;227(2-3):185–191.
57. Wright AC, Davies G, Fowler D, Greenwood K. Three-year follow-up study exploring metacognition and function in individuals with first episode psychosis. *Front Psychiatry.* 2019;10:182.
58. Yamazawa R, Nemoto T, Kobayashi H, Chino B, Kashima H, Mizuno M. Association between duration of untreated psychosis, premorbid functioning, and cognitive performance and the outcome of first-episode schizophrenia in Japanese patients: prospective study. *Aust N Z J Psychiatry.* 2008;42(2):159–165.
59. Addington J, Saeedi H, Addington D. The course of cognitive functioning in first episode psychosis: changes over time and impact on outcome. *Schizophr Res.* 2005;78(1):35–43.
60. Addington J, Saeedi H, Addington D. Facial affect recognition: a mediator between cognitive and social functioning in psychosis? *Schizophr Res.* 2006;85(1-3):142–150.
61. Addington J, Saeedi H, Addington D. Influence of social perception and social knowledge on cognitive and social functioning in early psychosis. *Br J Psychiatry.* 2006;189:373–378.
62. Faerden A, Barrett EA, Nesvåg R, et al. Apathy, poor verbal memory and male gender predict lower psychosocial functioning one year after the first treatment of psychosis. *Psychiatry Res.* 2013;210(1):55–61.
63. Horan WP, Green MF, DeGroot M, et al. Social cognition in schizophrenia, Part 2: 12-month stability and prediction of functional outcome in first-episode patients. *Schizophr Bull.* 2012;38(4):865–872.
64. Leeson VC, Barnes TR, Hutton SB, Ron MA, Joyce EM. IQ as a predictor of functional outcome in schizophrenia: a longitudinal, four-year study of first-episode psychosis. *Schizophr Res.* 2009;107(1):55–60.
65. Malla AK, Norman RM, Manchanda R, Townsend L. Symptoms, cognition, treatment adherence and functional outcome in first-episode psychosis. *Psychol Med.* 2002;32(6):1109–1119.
66. Peña J, Segarra R, Ojeda N, García J, Eguiluz JI, Gutiérrez M. Do the same factors predict outcome in schizophrenia and non-schizophrenia syndromes after first-episode psychosis? A two-year follow-up study. *J Psychiatr Res.* 2012;46(6):774–781.

67. Stouten LH, Veling W, Laan W, van der Helm M, van der Gaag M. Psychotic symptoms, cognition and affect as predictors of psychosocial problems and functional change in first-episode psychosis. *Schizophr Res.* 2014;158(1-3):113–119.
68. Wannan CMJ, Bartholomeusz CF, Cropley VL, et al. Deterioration of visuospatial associative memory following a first psychotic episode: a long-term follow-up study. *Psychol Med.* 2018;48(1):132–141.
69. van Winkel R, Myin-Germeys I, De Hert M, Delespaul P, Peuskens J, van Os J. The association between cognition and functional outcome in first-episode patients with schizophrenia: mystery resolved? *Acta Psychiatr Scand.* 2007;116(2):119–124.
70. Griffiths SL, Wood SJ, Fowler D, et al. Improved social functioning following social recovery therapy in first episode psychosis: Do social cognition and neurocognition change following therapy, and do they predict treatment response? *Schizophr Res.* 2021;228:249–255.
71. Donohoe G, Dillon R, Hargreaves A, et al. Effectiveness of a low support, remotely accessible, cognitive remediation training programme for chronic psychosis: cognitive, functional and cortical outcomes from a single blind randomised controlled trial. *Psychol Med.* 2018;48(5):751–764.