Investigating Cognitive and Clinical Predictors of Real-Life Functioning, Functional Capacity, and Quality of Life in Individuals at Ultra-High Risk for Psychosis

Louise Birkedal Glenthøj*,1,2, Tina Dam Kristensen1,2, Christina Wenneberg1,2, Carsten Hjorthøj1,3, and Merete Nordentoft1,2

1Copenhagen Research Centre for Mental Health (CORE), Copenhagen University Hospital, Hellerup, Denmark; 2Centre for Clinical Intervention and Neuropsychiatric Schizophrenia Research, CINS, Hellerup, Denmark; 3Department of Public Health, Section of Epidemiology, University of Copenhagen, Hellerup, Denmark

*To whom correspondence should be addressed; Copenhagen Research Centre for Mental Health (CORE), Gentofo Hospitalslvej 15, 4, DK-2900 Hellerup, Denmark; tel: +45-2254-0222, fax: +45-3864-7504, e-mail: louise.birkedal.glenthoej@regionh.dk

A substantial proportion of individuals at ultra-high risk (UHR) for psychosis show long-term functional impairments, which may have profound consequences for the individual and society. Finding predictors of these functional impairments is critical to inform on the individual’s functional prognosis and potentially develop targeted interventions. This study used data from 91 UHR individuals participating in a randomized, clinical trial, that were followed up at 12 months, to elucidate on clinical, neuro- and social-cognitive predictors of UHR individuals’ functional outcome in the domains of social- and role functioning, quality of life, and functional capacity. The proportion of UHR individuals showing a poor social- and role outcome at 12-month follow-up was 50% and 63%, respectively. Worse social outcome was predicted by higher levels of negative symptoms, reduced processing speed, and impaired baseline social functioning explaining 52% of the variance. Worse role outcome was predicted by impaired role functioning at baseline, explaining 25% of the variance. Quality of life impairments were predicted by better theory of mind explaining 4% of the variance, and functional capacity social skills deficits were predicted by impaired baseline social skills explaining 20% of the variance. Our findings indicate that processing speed and negative symptoms may contribute to social- and role-functioning deficits, and while aspects of social cognition may also relate to social- and role functioning, baseline-functional impairments seem to be a strong contributor to persistent impairments in functioning and quality of life. If replicated, our findings suggest the need for future studies investigating the effect of pro-functional interventions targeting baseline functioning and targeted cognitive domains in UHR.

Key words: clinical high risk/prodromal psychosis/at-risk mental state-functional outcome/functional recovery

Introduction

During the last decades, research has spurred into identifying and treating individuals in a putative prodromal or ultra-high risk (UHR) state of psychosis. Instituting treatment at this early illness stage has the appealing potential of improving the functional and clinical prognosis of UHR individuals. Predicting and preventing psychosis has traditionally been the key outcome of interest in UHR research, but the declining transition rates has prompted interest into other equally important unfavorable outcomes, such as persistence of real-life functional impairments. A growing body of evidence reveals significant and persistent decrements in functioning (global-, social- and role functioning and quality of life) in a substantial proportion of the UHR individuals, including cases who remit from their UHR state. Functioning is a multifaceted concept encompassing multiple aspects such as real-life social and role functioning; ie, functional achievements, and functional capacity tapping the individual’s capacity for real-life functioning. Functional capacity can be regarded as intermediate between basic cognitive function and intricate real-life behaviors and achievements and functional capacity, therefore, reflects the skills needed to carry out real-life functioning. While functional achievements may be influenced by numerous external factors, functional capacity may be more proximal to biological and genetic causation. Additionally, quality of life is an important

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aspect of functioning as it encompasses the individual’s subjective evaluation of wellbeing and life satisfaction, and it has received increasing attention as a central treatment target in psychosis spectrum disorders.12

The existing literature primarily consists of cross-sectional study designs, with few prospective follow-up studies investigating correlates to functioning: 4 longitudinal studies have described symptom correlates to functioning, 6 studies have described neurocognitive correlates, and, to the best of our knowledge, no longitudinal studies have elucidated on social cognitive correlates to functioning in UHR. Regarding symptom correlates to UHR individuals functional decrements, studies primarily link negative and depressive symptoms to a poor functioning,13–20 while attenuated psychotic symptoms generally show modest association with learning and memory, 22,27–29 spatial working memory, 31 to poor functioning in UHR. Associations between cognition and functioning have been found within global neurocognition13,26 and the specific neurocognitive domains of processing speed, 27–30 attention, 27 verbal learning and memory, 22,27–29 spatial working memory, 31 and executive function. 24 While considerably less studied, social cognitive correlates to UHR individuals functioning have been described cross-sectionally within the areas of theory of mind, 23,32,33 emotion recognition, 34,35 and attributional bias. 32 Due to the importance of understanding factor leading to functional deficits in UHR states, there is a clear need to improve the evidence base on predictors of UHR individuals functional prognosis in longitudinal studies. Additionally, the current literature shows a paucity of evidence on the prediction of multiple areas of UHR individuals’ functional deficits tapping on both their functional achievements and functional capacity, along with their perceived decrements in quality of life. Improving the knowledge on predictors of functional impairments in UHR will inform on which individuals are at highest risk of a functional decline and potentially limit future disability by allowing for tailoring interventions accordingly.

Method

This study aimed to extend the current knowledge on predictors of UHR individuals’ functional prognosis by exploring different aspects of clinical symptoms, cognition and sociodemographic variables as potential predictors of several aspects of UHR individual’s functional outcome; ie, real-life social- and role functioning, quality of life, and functional capacity.

Participants

The sample consisted of help-seeking individuals aged 18 to 40 years meeting 1 or more UHR criteria according to the Comprehensive Assessment of At-Risk Mental States (CAARMS)36: attenuated psychotic symptom group; brief limited intermittent psychotic symptoms group; and/or trait and vulnerability group along with a significant drop in functioning or sustained low functioning for the past year. Patients were excluded if they: had a history of a psychotic episode of ≥1-week duration; experienced psychiatric symptoms explained by a physical illness with psychotropic effect (eg, delirium) or acute intoxication (eg, cannabis use); had a diagnosis of a serious developmental disorder (eg, Asperger’s syndrome or mental retardation, ie, IQ < 70); or currently received methylphenidate.

Assessments

Clinical Assessments. Axis I and axis II diagnoses were assessed using the Structured Clinical Interview for DSM-IV (SCID)37 with all SCID assessors being certified in SCID diagnostic interviewing. Level of attenuated psychotic symptoms was assessed with the CAARMS positive symptoms scale (ie, item 1.1–1.4); negative symptoms with the Scale for the Assessment of Negative Symptoms (SANS)38; depressive symptoms with the Montgomery-Åsberg Depression Rating Scale (MADRS)39, and finally cognitive basic symptoms were assessed using the COGDIS criteria from the Schizophrenia Prediction Proneness Instrument – Adult Version (SPI-A).40

Functional Assessment. Four measures were included covering the functional aspects of social- and role functioning, self-reported quality of life, and functional capacity social skills performance. The Global Functioning (GF): Social and Role Scales41 were used to assess social and role functioning. The GF-Social and GF-Role scales have been developed specifically to assess functioning in the putative prodromal state of psychosis and include age-appropriate anchors for assessing...
functioning in UHR. The GF-Social and GF-Role were interview-based ratings based on patients’ reports of their level of functioning and the assessor’s evaluation. Subjective quality of life was reported with the Assessment of Quality of Life (AQoL-8D), which assesses quality of life in the overarching dimensions of physical (tapping dimensions such as independent living and pain) and psycho-social (tapping dimensions such as happiness, relationships, and coping). A composite quality of life score was used in the analyses. Finally, the performance-based, functional capacity social skills measure the High Risk Social Challenge Task (HiSoC) was included. HiSoC is a standardized videotaped task in which the participants are instructed to do a 45-second audition in a mock competition, with a grand money prize, on being the most interesting person in the country. A standardized test instruction is read aloud to the participant that is subsequently given 10 seconds to prepare what he/she will say on the video. In scoring of the task, social skills are assessed in terms of the display of affect, odd behavior and language, social-interpersonal anxiety, and interest in the task. The 16 items in the task are rated on a 5-point Likert scale (with higher scores indicating better social skills). The task was originally developed for use in adolescents at genetic high risk for psychosis where it has proven to have excellent inter-rater reliability and construct validity. We have previously demonstrated the HiSoC to show excellent inter-rater reliability and construct validity in a sample of UHR sample.44

Cognitive Assessment. Neurocognitive tests included the 6 core neurocognitive domains, as stated in the National Institute of Mental Health (NIMH) Measurement and Treatment Research to Improve Cognition in Schizophrenia (MATRICS) battery. List learning and symbol coding, from the Brief Assessment of Cognition in Schizophrenia (BACS) battery indexed verbal learning and memory and speed of processing, respectively. Tests from the Cambridge Neuropsychological Test Automated Battery (CANTAB) included: Paired Associate Learning (PAL) indexing visual learning and memory, Spatial Working Memory (SWM) indexing working memory, Stockings of Cambridge (SOC) indexing executive function/planning, and Rapid Visual Information Processing (RVP) indexing sustained attention. Four social cognitive measures were included covering 3 of the 4 hypothesized social cognitive domains, excluding the domain of social perception. Theory of mind with The Awareness of Social Inference Test (TASIT); attributional bias with the Social Cognition Screening Questionnaire (SCSQ); and facial emotion recognition accuracy and latency with the Emotion Recognition Task (ERT) of the CANTAB Test battery. Current IQ was estimated using the 4 subtests from the Third version of the Danish Weschler Adult

| Table 1. Clinical Characteristics of Ultra-High Risk Participants at Baseline (n = 91) |
| --- | --- |
| Variable | Baseline |
| N (%) | |
| Female | 54 (59.3) |
| CAARMS status |  |
| APS | 70 (76.9) |
| BLIPS | - |
| Trait/state | 1 (1.1) |
| APS + trait/state | 18 (19.8) |
| APS + BLIPS | 2 (2.2) |
| Medication |  |
| Antipsychotics | 23 (25.3) |
| - Antidepressant | 27 (29.7) |
| - Mood stabilizers | 3 (3.3) |
| - Benzodiazepines | 6 (6.6) |
| - No medication | 46 (50.5) |
| DSM-IV diagnoses |  |
| Affective disorder | 56 (61.5) |
| Anxiety disorder | 46 (50.5) |
| Substance use disorder | 13 (14.3) |
| Somatoform disorder | 2 (2.2) |
| Eating disorder | 4 (4.4) |
| Adjustment disorder | 0 |
| Personality disorder | 32 (35.2) |
| None | 13 (14.3) |
| Mean (SD) |  |
| Age | 24.51 (4.65) |
| Years of education | 15.00 (2.80) |
| Estimated IQ (WAIS III) | 104.75 (11.88) |
| Symptoms |  |
| CAARMS | 49.95 (15.14) |
| SANS | 1.47 (0.79) |
| MADRS | 14.85 (7.27) |
| SPI-A | 9.11 (7.15) |
| Cognition |  |
| BACS list learning | 51.68 (8.35) |
| BACS symbol coding | 58.75 (11.58) |
| CANTAB PAL | 5.69 (7.94) |
| CANTAB SWM | 10.84 (11.21) |
| CANTAN SOC | 9.93 (1.82) |
| CANTAB RVP A’ | 0.90 (0.05) |
| TASIT | 52.96 (3.94) |
| CANTAB ERT accuracy | 69.88 (6.59) |
| CANTAB ERT latency (ms) | 1699 (602) |
| SCSQ | 0.54 (4.47) |

Note: CAARMS, Comprehensive assessment of at-risk mental states; APS, Attenuated Psychotic Symptom; BLIPS, Brief Limited Intermittent Psychotic Symptom; SANS, Scale for the Assessment of Negative Symptoms; MADRS, Montgomery-Åsberg Depression Rating Scale; SPI-A, The Schizophrenia Prediction Instrument, Adult Version BACS, Brief Assessment of Cognition in Schizophrenia, CANTAB, Cambridge Neuropsychological Test Automated Battery; PAL, Paired Associate Learning; SWM, Spatial Working Memory; SOC, Stockings of Cambridge; RVP, Rapid Visual Memory; TASIT, The Awareness of Social Inference Test; ERT, Emotion Recognition Task; SCSQ, Social Cognition Screening Questionnaire; GF-Social, Global Functioning Social scale; GF-Role, Global Functioning Role scale; AQoL-8D, Assessment of Quality of Life; HiSoC, High-Risk Social Challenge Task.

Patients fulfilling 1 or more of the DSM-IV diagnoses.
Table 2. Logistic Regression Analyses of Cognition and Symptom Variables Predicting Social Functioning (GF-Social) at 12-Month Follow-up

| Predictors                              | Univariable | Multivariable |
|-----------------------------------------|-------------|---------------|
|                                         | β [95% CI]  | t   | P          | β [95% CI]  | t   | P          |
| Symptoms                                |             |     |            |             |     |            |
| CAARMS                                  | 0.004 [-0.12 to 0.19] | -467 | 0.641      | -0.417 [-0.677 to -0.158] | -3.197 | 0.002 |
| SANS                                    | -0.827 [-1.066 to -0.589] | -6.897 | <0.001     | -0.417 [-0.677 to -0.158] | -3.197 | 0.002 |
| MADRS                                   | -0.029 [-0.061 to -0.003] | -1.816 | 0.073      | -0.417 [-0.677 to -0.158] | -3.197 | 0.002 |
| SPI-A                                   | -0.022 [-0.056 to -0.012] | -1.306 | 0.195      | -0.417 [-0.677 to -0.158] | -3.197 | 0.002 |
| Neurocognition                          |             |     |            |             |     |            |
| BACS List learning                      | 0.028 [0.01 to 0.056] | -2.050 | 0.043      | 0.016 [0.001 to 0.032] | -2.095 | 0.039 |
| BACS Symbol coding                      | 0.039 [0.020 to 0.057] | -4.135 | <0.001     | -0.417 [-0.677 to -0.158] | -3.197 | 0.002 |
| CANTAB PAL                              | -0.028 [-0.057 to 0.000] | -1.958 | 0.053      | -0.417 [-0.677 to -0.158] | -3.197 | 0.002 |
| CANTAB SWM                              | -0.016 [-0.037 to 0.005] | -1.518 | 0.133      | -0.417 [-0.677 to -0.158] | -3.197 | 0.002 |
| CANTAB SOC                              | -0.061 [-0.190 to 0.067] | -0.945 | 0.347      | -0.417 [-0.677 to -0.158] | -3.197 | 0.002 |
| CANTAB RVP A'                           | 0.384 [-4.341 to 5.110] | 1.62 | 0.872      | -0.417 [-0.677 to -0.158] | -3.197 | 0.002 |
| Social cognition                        |             |     |            |             |     |            |
| TASIT                                   | 0.033 [-0.027 to 0.092] | 1.099 | 0.275      | -0.417 [-0.677 to -0.158] | -3.197 | 0.002 |
| CANTAB ERT accuracy                     | -0.005 [-0.041 to 0.031] | -0.281 | 0.779      | -0.417 [-0.677 to -0.158] | -3.197 | 0.002 |
| CANTAB ERT latency                      | -0.001 [-0.001 to 0.000] | -2.981 | 0.004      | -0.417 [-0.677 to -0.158] | -3.197 | 0.002 |
| SCSQ                                    | 0.092 [-0.017 to 0.202] | 1.68 | 0.097      | -0.417 [-0.677 to -0.158] | -3.197 | 0.002 |
| Other                                   |             |     |            |             |     |            |
| GF-Social                               | .768 [.586 to .950] | 8.376 | <0.001     | .483 [.257 to .709] | 4.252 | <0.001 |
| Antipsychotic medication                | .247 [.288 to .782] | .916 | .362       | -0.417 [-0.677 to -0.158] | -3.197 | 0.002 |
| Gender                                  | .439 [-.029 to .906] | 1.865 | .066       | -0.417 [-0.677 to -0.158] | -3.197 | 0.002 |
| Estimated IQ                            | -.001 [-0.021 to 0.018] | -0.146 | 0.884      | -0.417 [-0.677 to -0.158] | -3.197 | 0.002 |
| Intervention group                      | .040 [-.430 to .509] | 1.68 | 0.867      | -0.417 [-0.677 to -0.158] | -3.197 | 0.002 |

Note: CAARMS, Comprehensive Assessment of At-Risk Mental States; SANS, Scale for the Assessment of Negative Symptoms; MADRS, Montgomery-Åsberg Depression Rating Scale; GF-Social, Global Functioning Social scale; GF:Role, Global Functioning Role scale; AQoL-8D, Assessment of Quality of Life; SRS-A, Social Responsiveness Scale Adult Version; BACS, Brief Assessment of Cognition in Schizophrenia, CANTAB, Cambridge Neuropsychological Test Automated Battery; PAL, Paired Associate Learning; SWM, Spatial Working Memory, SOC, Stockings of Cambridge; RVP, Rapid Visual Memory; TASIT, The Awareness of Social Inference Task; ERT, Emotion Recognition Task; SCSQ, Social Cognition Screening Questionnaire. Predictors that are significant at the P ≤ .05 level are given in bold.

Intelligence Scale (WAIS-III); Vocabulary, Similarities, Block Design, and Matrix reasoning.51

Trial assessors underwent extensive training in using the assessment instruments by senior researchers and Prof. Merete Nordentoft and, additionally, conducted several inter-rater reliability ratings. Professor Alison Yung, who developed the CAARMS instrument, trained the assessors in conducting the CAARMS interview. Furthermore, a significant proportion of the CAARMS ratings were based on consensus ratings by 2 clinicians to secure similar ratings among the assessors. Cognitive tests were conducted by psychologist’s students that were comprehensively trained in conducting the cognitive tests and received regular supervision by senior psychologists.

Interrater-reliability ratings on secondary outcome measures in the RCT were conducted throughout the trial period at a 3-month interval. Of relevance for this study is inter-rater reliability rating on the SANS and MADRS. The intraclass correlation coefficient (ICC) ratings were based on the total number of inter-rater reliability ratings.

Statistical Analysis

All analyses were performed using SPSS version 25.0. Descriptive statistics were reported as means and standard deviations. Chi-square tests and ANOVAs were used to compare the group attending 12-month follow-up assessment with those not attending 12-month assessment. Univariate logistic regression analyses were performed to predict functional outcome based on the baseline cognitive and clinical variables and demographic characteristics. The functional outcome scales were used as continuous variables. The analyses were performed for each of the 4 outcome measures. As independent variables, we used the baseline variables: clinical symptoms (CAARMS, SANS, MADRS, SPI-A) neurocognitive variables (list learning, symbol coding, PAL, SWM, SOC, RVP A’), social cognitive variables (TASIT, ERT latency, and accuracy, SCSQ) and the demographic characteristics (sex, antipsychotic medication, estimated IQ, and intervention allocation) and the baseline value for the respective outcome measure. The significant predictor variables identified in the univariate models were entered in multivariate
regression models using forward selection. Significance levels were set to $P < .05$.

**Results**

The total baseline sample of 146 UHR participants, 91 (62%) attended the 12-month follow-up assessments. Attrition analyses found that those participants attending the 12-month assessment differed from those not attending follow-up by being older, having higher estimated IQ, and higher scores on the functioning and cognitive measures of GF-R, BACS symbol-numbers, RVP A', and TASIT. The follow-up sample had a mean age of 24 (SD = 4.65), and 59% were females. Most of the participants (76%) fulfilled the CAARMS criteria of attenuated psychotic symptoms (APS) (table 1 displays sample demographics and clinical characteristics). The baseline sample on the HiSoC task comprised 102 UHR participants. The missing data was due to the HiSoC task being introduced after completion of baseline visit ($N = 5$), the participants declining to perform the task, or technical issues ($N = 39$). Of the 91 attending follow-up assessments, 49 (54%) completed the HiSoC task.

Using previous definitions of a good functional outcome defines as a score of ≥7 on the GF-Social and GF-Role (indicating mild impairments to superior functioning), we found 45 (49.5%) of our UHR sample showed a good social outcome, and 34 (37.4%) showed a good role outcome.

Interrater-reliability analyses revealed the assessors to have high levels of interrater-reliability on the SANS and MADRS; ICC = .98 and .96, respectively.

**Clinical and Cognitive Predictors of UHR Individuals’ 12-Month Functional Outcome**

**GF-Social.** Table 2 displays the univariate and multivariate regression models. In the univariate model, baseline negative symptoms, processing speed, emotion recognition latency, and social functioning were significant predictors of social functioning. The final logistic regression model revealed baseline negative symptoms, processing speed, and

| Predictors | Univariable | Multivariable |
|------------|-------------|---------------|
|            | $\beta$ [95% CI] | $t$ | $P$ | $\beta$ [95% CI] | $t$ | $P$ |
| Symptoms   |             |               |     |                 |     |     |
| CAARMS     | .006 [-.010 to .023] | .728 | .469 | -.468 [-.787 to -.188] | -3.235 | .002 |
| SANS       | -.025 [-.095 to .009] | -1.447 | .152 |
| MADRS      | -.029 [-.065 to .007] | -1.607 | .112 |
| Neurocognition |         |               |     |                 |     |     |
| BACS List learning | .003 [-.027 to .033] | .175 | .862 |
| BACS Symbol coding | .018 [-.003 to .040] | 1.699 | .093 |
| CANTAB PAL | -.014 [-.045 to .018] | -.855 | .395 |
| CANTAB SWM | .002 [-.021 to .025] | .167 | .868 |
| CANTAB SOC | -.053 [-.191 to .085] | -.758 | .450 |
| CANTAB RVP A' | -1.539 [-6.589 to 3.512] | -.605 | .546 |
| Social cognition |         |               |     |                 |     |     |
| TASIT      | -.003 [-.067 to .061] | -.099 | .922 |
| CANTAB ERT accuracy | -.014 [-.052 to .024] | -.730 | .467 |
| CANTAB ERT latency | -.001 [-.001 to .000] | -2.631 | .010 |
| SCSQ       | .113 [-.004 to .229] | 1.923 | .058 |
| Other      |             |               |     |                 |     |     |
| GF-Role    | .478 [.298 to .658] | 5.277 | .001 |
| Antipsychotic medication | .023 [-.552 to .599] | .081 | .936 |
| Gender     | .110 [-.400 to .620] | .429 | .669 |
| Estimated IQ | -.018 [-.039 to .003] | -1.735 | .086 |
| Intervention group | -.107 [-.609 to .395] | -.423 | .673 |

**Note:** CAARMS, Comprehensive Assessment of At-Risk Mental States; SANS, Scale for the Assessment of Negative Symptoms; MADRS, Montgomery-Asberg Depression Rating Scale; GF:Social, Global Functioning Social scale; GF:Role, Global Functioning Role scale; AQL-QOL, Assessment of Quality of Life; SRS-A, Social Responsiveness Scale Adult Version; BACS, Brief Assessment of Cognition in Schizophrenia; CANTAB, Cambridge Neuropsychological Test Automated Battery; PAL, Paired Associate Learning; SWM, Spatial Working Memory; SOC, Stockings of Cambridge; RVP, Rapid Visual Memory; TASIT, The Awareness of Social Inference Task; ERT, Emotion Recognition Task; SCSQ, Social Cognition Screening Questionnaire. Predictors that are significant at the $P \leq .05$ level are given in bold.
social functioning to predict the social functioning outcome at 12-month follow-up with an adjusted $R^2$ of .524.

**GF-Role.** Table 3 displays the results of the regression analyses. In the univariate model, baseline negative symptoms, emotion recognition latency, and role functioning were significant predictors of role functioning. The final logistic regression model revealed baseline role functioning to predict the role functioning outcome at 12-month follow-up with an adjusted $R^2$ of .252.

**AQoL-8D.** Table 4 displays the results of the regression analyses. In the regression model, theory of mind the only was a significant predictor of the quality of life measure at 12-month follow-up with an adjusted $R^2$ of .374.

**HiSoC.** Table 5 displays the results of the regression analyses. In the univariate model, baseline emotion recognition latency and functional capacity social skills were significant predictors of role functioning. The final logistic regression model revealed baseline social skills to predict the functional outcome measure at 12-month follow-up with an adjusted $R^2$ of .198.

**Discussion**

Supporting the existing literature on the persistence of substantial functional deficits in UHR individuals, we found that half or more of our UHR sample displayed poor social- and role functioning at 12-month follow-up (50% and 63%, respectively). While around one-third of the identified UHR individuals are at risk for psychosis at medium-term follow-up, a larger proportion are at-risk for functional disability. This underscores the importance of considering UHR individuals’ functional prognosis as an equally important outcome to psychosis development in UHR studies and for interventions to be tailored accordingly. Regarding social functioning, we found this outcome to be predicted by worse negative symptoms, reduced processing speed, and impaired baseline social functioning with these variables explaining a significant proportion of the variance (52%). This replicates the 3- to 5-year follow-up findings of Carrion et al of processing speed and social functioning, along with disorganization symptoms, being significant predictors of a poor functional outcome. Taken together, this adds to a
growing body of literature relating the cognitive domain of processing speed to a poor functional trajectory in the UHR population.\textsuperscript{27,28,30} We found baseline negative symptoms to be the only symptom variable influencing functional outcome. A key role of negative symptoms in predicting functioning in UHR\textsuperscript{13,14,32} and psychotic disorders\textsuperscript{53,54} has previously been suggested, with additional evidence of the subdomain of experiential negative symptoms, opposed to expressive negative symptoms, being particularly influential on UHR individuals real-life functioning.\textsuperscript{16} We found a worse role outcome to be predicted by impaired role functioning at baseline, which mirrors a prior study finding.\textsuperscript{29} The lack of association between neurocognition and functioning does, however, contrast with previous findings of neurocognition influencing role functioning in UHR at both a global level\textsuperscript{13,26} and regarding the subdomains of verbal memory and motor disturbances.\textsuperscript{29} Furthermore, in the univariate analyses, we found the social cognitive variable of emotion recognition latency deficits to predict social- and role functioning, which is in line with our previous findings suggesting emotion recognition processing speed, rather than accuracy being related to functioning.\textsuperscript{35} This also mirrors previous findings from psychosis research of a significant relationship between social cognitive response time and functional outcome.\textsuperscript{55,56} With respect to quality of life impairments, we found it to be predicted by better theory of mind. This finding is difficult to explain and may relate to the well-known problems in patients self-evaluation,\textsuperscript{35} albeit acknowledging that correlations have been reported between UHR individuals quality of life and depressive symptoms,\textsuperscript{58,59} anxiety symptoms,\textsuperscript{60} attenuated psychotic symptoms,\textsuperscript{58,61} and basic symptoms\textsuperscript{61} along with an informant- and self-report measure of cognitive deficits.\textsuperscript{60} Additionally, theory of mind explained a very small proportion (4\%) of the variance on the quality of life measure in our model, suggesting a need to elucidate on other potential predictors outside the medical model. Lastly, we found our functional capacity social skills measure to be predicted by impaired baseline social skills, but not by any of the cognitive or clinical symptom measures. Generally, the literature on functional capacity in UHR is scarce\textsuperscript{11,62} and, while we in a previous study reported baseline associations between functional capacity

### Table 5. Logistic Regression Analyses of Cognition and Symptom Variables Predicting Functional Capacity Social Skills (HiSoC) at 12-Month Follow-up

| Predictors | Univariable | Multivariable |
|------------|-------------|---------------|
|            | β [95% CI]  | t  | P      | β [95% CI]  | t  | P      |
| Symptoms   |             |    |        |             |    |        |
| CAARMS     | -.003 [-.080 to .073] | -.089 | .930 |
| SANS       | -1.319 [-3.042 to .405] | -1.539 | .131 |
| MADRS      | -.046 [-.249 to .157] | -.456 | .651 |
| SPI-A      | -.147 [-.342 to .048] | -1.519 | .136 |
| Neurocognition |             |    |        |             |    |        |
| BACS List learning | -.013 [-.174 to .149] | -.159 | .875 |
| BACS Symbol coding | .055 [-.049 to .159] | 1.058 | .296 |
| CANTAB PAL | .061 [-.069 to .191] | .944 | .350 |
| CANTAB SWM | .035 [-.089 to .160] | .570 | .572 |
| CANTAB SOC | -.583 [-1.324 to .158] | -1.584 | .120 |
| CANTAB RVP A' | -.5.873 [-35.425 to 23.680] | -.400 | .691 |
| Social cognition |             |    |        |             |    |        |
| TASIT      | .216 [-.129 to .560] | 1.261 | .214 |
| CANTAB ERT accuracy | -.040 [-.231 to .151] | -.426 | .672 |
| CANTAB ERT latency | -.002 [-.004 to .000] | -2.098 | .041 |
| SCSQ       | -.085 [-.811 to .641] | -.236 | .815 |
| Other      |             |    |        |             |    |        |
| HiSoC      | .273 [.117 to .429] | 3.518 | .001 |
| Antipsychotic medication | .415 [-2.273 to 3.104] | .311 | .757 |
| Gender     | 1.551 [-.984 to 4.085] | 1.231 | .225 |
| Estimated IQ | -.067 [-.185 to .051] | -1.138 | .261 |
| Intervention group | -.977 [-3.523 to 1.570] | -.772 | .444 |

Note: CAARMS, Comprehensive Assessment of At-Risk Mental States; SANS, Scale for the Assessment of Negative Symptoms; MADRS, Montgomery-Asberg Depression Rating Scale; GF:Social, Global Functioning Social scale; GF:Role, Global Functioning Role scale; AQoL-8D, Assessment of Quality of Life; SRS-A, Social Responsiveness Scale Adult Version; BACS, Brief Assessment of Cognition in Schizophrenia; CANTAB, Cambridge Neuropsychological Test Automated Battery; PAL, Paired Associate Learning; SWM, Spatial Working Memory; SOC, Stockings of Cambridge; RVP, Rapid Visual Memory; TASIT, The Awareness of Social Inference Task; ERT, Emotion Recognition Task; SCSQ, Social Cognition Screening Questionnaire. Predictors that are significant at the $P \leq .05$ level are given in bold.
and negative symptoms and theory of mind, no previous study has, to the best of our knowledge, assessed which factors that may predict functional capacity in UHR. This indicates a need for future studies on the topic. Additionally, the substantial number of missing data on our functional capacity measure may have obscured finding correlations between this outcome and cognition and clinical symptoms. Overall, our study found, rather surprisingly, limited impact of neuro- and social cognition on functional outcome in UHR. While cross-sectional reports of links between social cognitive deficits and functioning in UHR have been described, our findings are in line with a report of the modest influence of social cognition on UHR individuals' clinical outcome (ie, symptom progression, including psychosis development, or risk remission). The findings of limited impact of social cognition on outcomes may partly reflect the substantial problems with the psychometric properties of the available social cognitive measures established in psychotic disorders, which supposedly may be even more pronounced in the heterogenous UHR population.

Methodological Considerations

The study findings should be evaluated, considering the study’s strengths and limitations. Strengths of this study comprise longitudinally assessments of different aspects of functioning, including functional capacity, which is rarely assessed in UHR. Additionally, the study included different clinical and cognitive measures with especially the investigation of social cognitive predictors of UHR individual's functional prognosis extending previous predominantly cross-sectional studies. A general limitation to the study is the fact that the analyses were secondary to an RCT meaning that the study was not designed, and neither may be adequately powered, for the current research question. Additionally, it cannot be automatically concluded that participants in the RCT resemble the full UHR population. Furthermore, the study is limited by a relatively short follow-up period (ie, 12 months) and further studies on clinical and cognitive correlates to functioning is therefore needed with longer follow-up (ie, ≥24 months) to shed light on the long-term functional prognosis of the UHR individuals. Furthermore, we enrolled an adult UHR sample aged 18–40 years, which is in line with other large-scale UHR studies (eg, ref.24). We do, however, acknowledge that this may be an older age range than other UHR studies (eg, refs.25,26), which may impact generalizability of the study findings.

Finally, our functional capacity measure (HiSoC) may be regarded as suboptimal due to issues with task tolerability and acceptability, resulting in a substantial proportion of missing data. Hence, it could be stated that this limits the conclusions to be drawn on predicting functional capacity in the UHR population.

Conclusion

In conclusion, our study suggests that those UHR individuals with better functioning at ascertainment may present with a better functional trajectory in terms of functional achievements, functional capacity, and quality of life, while those with impaired functioning at ascertainment may be at-risk for continued functional deficits. Our findings suggest that those with low functioning at baseline are in need of pro-functional interventions at ascertainment to prevent functional stagnation or decline. Thus, subgrouping UHR individuals and tailoring interventions accordingly may be a viable approach to consider when delivering functional enhancing interventions to the UHR population. Deficits in the neurocognitive aspect of processing speed may be of particular relevance to an unfavorable social outcome, and deficits in the social-cognitive domain of emotion recognition latency may relate to social- and role functioning impairments. These cognitive domains may, therefore, constitute important, separate treatment targets. This point to a potential need for targeted cognitive remediation interventions to improve functioning in UHR. Finally, alleviating negative symptoms may also be key when aiming at improving functioning in UHR owing to the direct influence of negative symptom on functioning, but also in order to make patients benefit from other pro-functional interventions (ie, due to negative symptoms comprising low motivation, asociality etc.). At current, there are no available treatments that have shown replicated and robust effect on functioning in UHR states or psychotic disorder. Development of effective pro-functional treatments, therefore, constitute a critical future research area when aiming to prevent UHR individual's functional disability.

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