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Evaluating the Social Functioning Scale modified for use in individuals at clinical high-risk for psychosis

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Abstract

Background: Social functioning deficits occur prior to the onset of psychosis and predict conversion to psychosis in clinical high-risk (CHR) populations. The Social Functioning Scale (SFS), a self-report measure of social functioning, is widely used in adults with psychosis but has not been tailored to CHR individuals. CHR syndromes overlap with the adolescent/young-adult developmental period, a time with unique social demands and contexts. The current study evaluates a modified version of the SFS in CHR individuals.

Methods: Two independent samples of CHR participants (n = 84 and n = 45) and non-CHR participants (n = 312 and n = 42) completed the SFS and a psychosis-risk interview. Resulting factors were compared across diagnostic categories (CHR, Major Depressive Disorder, Generalized Anxiety Disorder) and community controls (CC) who were not excluded for any psychopathology except psychosis, depression, and anxiety. CHR participants completed scales of

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Credit authorship contribution statement

Franchesca S. Kuhney conceptualized the project, conducted analyses, and drafted the manuscript. Katherine S. F. Damme, Jason Schiffman, Lauren M. Ellman, and Vijay A. Mittal aided with regards to project conceptualization and interpretation, in addition to data analysis and drafting of the manuscript.

Declaration of competing interest

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

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.schres.2022.09.018.

negative symptoms, global social and role functioning, cognition, and finger tapping as measures of convergent and divergent validity.

Results: Exploratory factor analysis identified three SFS factors (*RMSEA* = 0.05) which demonstrated reliability in a confirmatory analysis in an independent sample: Recreation (α = 0.82), Nightlife (α = 0.85), and Interpersonal (α = 0.69). Factors and their composite score demonstrated increased social deficits in CHR compared to CC and depression groups and showed expected convergent (*r*'s = 0.30–0.54) and divergent (*r*'s = −0.004–0.26) validity with appropriate measures.

Conclusions: These findings suggest that there are reliable, valid, and developmentally relevant categories of social behavior within the SFS that differentiate between CHR and MDD or CC individuals. Recommendations for future work with CHR populations are included.

Keywords

Psychosis-risk; Social behavior; Scale validation

1. Introduction

Social functioning impairments are common (Brekke et al., 2005; Hooley, 2010; Abel et al., 2021) in individuals with psychosis, confer significant personal and financial burden, and decrease quality of life (Katschnig, 2000). Additionally, social impairments predate formal illness onset and predict the transition to psychosis in people at clinical high-risk for psychosis (CHR) (Cornblatt et al., 2007). Apart from positive symptoms, social decline is the largest predictor of psychosis conversion (Cannon et al., 2016) and predicts poorer functional outcomes among individuals who transition to psychosis (Rosengard et al., 2019). As such, early intervention and prevention research examines the nature, severity, and trajectory of social functioning prior to illness onset depending primarily on the Global Functioning Scale-Social (Cornblatt et al., 2007): a general social functioning interview designed specifically for CHR individuals. Though the Social Functioning Scale (SFS) (Birchwood et al., 1990) has been widely used in psychosis populations, it has not been optimized for CHR samples.

The SFS demonstrates strong reliability and validity in adult psychosis samples (Birchwood et al., 1990). This scale provides a total score of overall functioning and scores for seven domains of social behavior. The SFS has contributed to insight into the heterogeneity of social functioning (Grant et al., 2001), relationship between functioning and symptoms and cognition (Fischer et al., 2020), and targets for support in adults with psychosis (Vázquez Morejón et al., 2018). The SFS was optimized to identify social deficits in adults with chronic illness (e.g., unemployment, independence) rather than subtle difficulties observed in psychosis-risk populations (e.g., dating, after-school activities). Therefore, this measure requires tailoring for CHR individuals to capture impairment specific to this population (Birchwood et al., 1990; Hellvin et al., 2013; Kupferberg et al., 2016). The psychosis-risk period overlaps with the transition from childhood to adolescence and young adulthood, which is characterized by an increasingly complex social environment. This social environment represents an increase in the importance of peer friendships,

romantic relationships, social desirability, and social status (Nelson et al., 2016; Pfeifer and Allen, 2020; Roisman et al., 2004). The SFS captures domains of social functioning that currently receive little empirical attention as current social/role functioning CHR interviews (Cornblatt et al., 2007) result in a single score. This approach has shown great utility (Abel et al., 2021; Carrión et al., 2019; D'Angelo et al., 2019) for general social and role function, but provides limited specificity into the deficits (Granö et al., 2014; Newberry et al., 2018; Lee et al., 2020). Additionally, the available social functioning scales used in CHR research require a trained clinician thus limiting its accessibility; a valid questionnaire assessing social functioning in this population is needed. Although the SFS has scarcely been used in psychosis-risk studies, it is associated with conversion to psychosis, psychosocial treatment efficacy, and social anxiety (Addington et al., 2011; Addington et al., 2017; Kuhney et al., 2021). The SFS may also provide added insights into cognitive mechanisms of psychosis-risk as social functioning depends on language (Roche et al., 2016), abstract reasoning (Solomon et al., 2011), motor functioning (van Harten et al., 2017), role functioning (Cornblatt et al., 2007; Carrión et al., 2019).

Using two independent datasets, the current study explored the underlying structure of the Social Functioning Scale in individuals at CHR for psychosis. Further, the current study provides a validation of a modified form of the SFS using only items relevant to the psychosis-risk population. Using a multisite sample of CHR participants and general community controls (CC), the current study (1) explored the underlying factor structure of the SFS when used specifically in a population of adolescents and young adults at-risk for developing psychosis, (2) examined the discriminant validity of the modified SFS between individuals at CHR, the CC group, and individuals with other clinical diagnoses, and (3) explored the convergent and divergent validity of the modified SFS compared to other established clinical measures. Using a second, independent sample of participants, aims one through three were again examined, however, a confirmatory approach, rather than exploratory, was used to confirm the underlying factor structure of the modified SFS relevant for individuals at CHR for psychosis.

2. Methods

2.1. Exploratory sample

Participants included 432 adolescents and young adults (CHR = 84, CC = 348) who were recruited as part of the ongoing Multisite Assessment of Psychosis-Risk study (Ellman et al., 2020) (MAP; 2017–2020 for current analytic sample) study. The study contained two phases: (1) an online survey that included a battery of questionnaires, among which were two self-report psychosis-risk screening questionnaires, and (2) participants who scored above predetermined cutoffs on psychosis-risk self-report screening questionnaires or randomly selected participants below the cutoff were invited for in-person clinical interviews (Ellman et al., 2020). See Supplement Materials (SM) for additional information of study phases and procedures.

2.2. Validation sample

The dataset included 87 participants (CHR n = 45, CC n = 42) who were recruited as part of the Adolescent Development and Preventative Treatment (ADAPT) lab located in Evanston, Illinois. No participants in the validation sample were drawn from the exploratory sample (see SM).

2.3. Measures

2.3.1. Social Functioning Scale—All participants completed the Social Functioning Scale (SFS) (Birchwood et al., 1990). The SFS is a 79-item self-report measure designed to assess social functioning in schizophrenia. Items assess ability and performance related to social engagement, interpersonal contact, recreation, independence and competence in activities, and activities of daily living and employment. The MAP study modified it to reflect both developmentally relevant and social functioning specific impairments within the target CHR for psychosis group. Modifications excluded subscales assessing ability and performance of skills necessary for independent living (independence-competence and independence- performance subscales, see SM). Additionally, the occupation/employment subscale of the SFS was adjusted to fit the high school/college-age sample, and the scoring of this occupation/employment subscale was adapted to account for these changes in both exploratory and validation samples (see SM). A higher total SFS score indicates better social functioning. The independent validation sample completed the entire SFS, however, the independence-competence and independence-performance subscales were excluded from analysis to align with the MAP study.

2.3.2. Diagnostic measures—Participants underwent clinical interviews as part of their respective studies, including the Structured Interview for Psychosis-Risk Syndromes (SIPS) (Miller et al., 2003) and the Structured Clinical Interview for DSM-5, Research Version (SCID-5-RV) (First et al., 1995). Exploratory and validation samples in the current study were comprised of CHR individuals meeting SIPS criteria for attenuated positive symptoms syndrome (APSS), including those identified as APSS persistent (CHR persistent; symptom severity and frequency have remained stable over the past 12 months) or APSS progressive (CHR progressive; attenuated symptoms have begun or worsened in severity and frequency within the past year). The SIPS rates positive symptom severity on a 7-point Likert-type scale rated absent (0) to psychotic (6) (Ellman et al., 2020). As seen in SM Fig. 1, both exploratory and validation samples underwent both clinical interviews.

Participants in the MAP study who completed in-person interviews and did not meet the criteria for a CHR syndrome, but met criteria for Major Depressive Disorder (MDD; n = 25) and Generalized Anxiety Disorder (GAD; n = 41) were included as comparison groups. A separate comparison group (CC; n = 246) was derived from MAP study participants who did not meet the criteria for a CHR syndrome, MDD, or GAD. Notably, the CC category identifies those who do not have a DSM-5 diagnosis of MDD, GAD, or CHR syndrome though these individuals may still have another non-MDD or non-GAD diagnosis.

2.3.3. Convergent validity measures—Negative Symptom Inventory-Psychosis Risk (NSI-PR) (Pelletier-Baldelli et al., 2017) was administered in both exploratory and

validation samples, and the asociality subdomain was used as a convergent measure. Asociality was rated on a scale from 0 (absent; e.g., no asociality) to 6 (extremely severe; e.g., extreme asociality). For additional information regarding the NSI-PR, see SM.

The Global Functioning Scale: Social (GFS:S) (Cornblatt et al., 2007) is a widely-used interview of social functioning in CHR individuals. Trained clinicians administered semi-structured interviews to obtain one score which encompasses the participant's peer relationships, peer conflict, age-appropriate intimate relationships, and family involvement. The GFS:S scale generates three scores: (1) current level, (2) highest and (3) lowest level of functioning in the past year prior to the assessment.

2.3.4. Divergent validity measures—In the exploratory sample, the Wechsler Abbreviated Scale of Intelligence, second edition (WASI-II) (McCrimmon and Smith, 2013) Vocabulary and Matrix Reasoning subtests were used as measures of divergent validity. Participants in the validation sample completed the Global Functioning Scale: Role (GFS:R) (Cornblatt et al., 2007). Consistent with the GFS:S, a score (1–10) on the GFS:R represents the participant's current level of functioning. Participants in both the exploratory and validation sample completed the Penn Battery Computerized Finger Tapping Task (CTAP) (Gur et al., 2010). The Computerized Finger Tapping Test (CTAP) measures motor speed. See SM for additional information on divergent and convergent validity measure provided in each sample.

2.4. Analytic strategy

All analyses were completed using R 3.6.1. Group differences in demographic variables (age, sex assigned at birth, race, household income) were examined between exploratory and validation CHR samples and discriminant diagnostic categories within each sample. Exploratory factor analysis (EFA) was conducted to explore the underlying factor structure of the SFS relevant for individuals at CHR for psychosis. Within the validation dataset, a confirmatory factor analysis (CFA) was conducted with the EFA-derived subscales. The Root Mean Square Error of Approximation (RMSEA) was used as an estimation of model fit. Reliability as assessed by Cronbach's alpha and Guttman's Lambda was calculated for each EFA-derived factor and the composite scores. Factor analyses and item reliability estimates were evaluated using the Psych package (Ravelle, 2020).

Factors from the EFA and CFA, and their composite total, were then used in subsequent discriminant, convergent, and divergent validity analyses. Within the exploratory dataset, discriminant validity examined the degree to which the factors/subscales differed between the CHR group, other disorders (MDD and GAD), and a CC using one-way analysis of variance (ANOVA) per subscale/factor. Within the validation sample, logistic regression was used to evaluate the specificity of the modified SFS, given that social impairment is a transdiagnostic. This approach allowed for the evaluation of the modified SFS as a predictor of diagnostic group and to covary for any differences in demographic variables across clinical groups. To examine convergent and divergent validity, the SFS subscales and total score were compared to interviews assessing social functioning (i.e., NSI-PR, GFS:S, GFS: R), tests of intelligence (i.e., WASI-II: Vocabulary and Matrix Reasoning), and motor

speed (i.e., CTAP), using Pearson correlations. All participants with the data for that given analysis were included for each analysis, rather than reducing the study sample size to only those with a complete dataset (see SM).

3. Results

3.1. Participants

3.1.1. CHR samples across datasets—Across the exploratory (n = 84) and validation (n = 45) CHR samples, there were no significant differences in key demographic variables, including age, and income. There were significant differences between the exploratory and validation CHR samples regarding gender and race such that there were more female, Asian, and White participants in the exploratory dataset compared to the validation dataset, Table 1.

3.1.2. Exploratory sample participants—There were no significant differences in key demographic variables across diagnostic groups (CHR, GAD, MDD, CC) within the exploratory sample, including sex assigned at birth, $\chi^2(6) = 7.79.$, $p = 0.25$, age, $F(3,411) = 0.51$, $p = 0.67$, race, $\chi^2(15) = 19.68$, $p = 0.18$, or household income, $\chi^2(49.47) = 47.42$, $p = 0.75$.

3.1.3. Validation sample participants—Between CHR and CC groups, there were no significant differences in key demographic variables in the validation sample, including biological sex at birth, $\chi^2(2) = 2.52$, $p = 0.28$, age, $t(80.95) = 0.22$, $p = 0.82$, or household income, $\chi^2(7) = 5.49$, $p = 0.60$. There was a significant difference across groups in race, $\chi^2(7) = 15.44$, $p = 0.03$. Models comparing differences between CHR and CC groups included race as a covariate.

3.2. Factor analyses

3.2.1. Exploratory factor analyses and item reliability—An exploratory factor analysis using Cattell's scree approach suggested that, within a sample of CHR participants, the SFS had three factors. Parallel scree analyses compared to simulated data suggested the presence of three factors and three components (comprised of 24/79 items of the original SFS) under a Principal Component Analysis framework with excellent model fit: (1) Recreation, (2) Nightlife, (3) Interpersonal, *RMSEA* = 0.05, 90 % CI: 0.04–0.06, Fig. 1 and SMTable1. All three factors demonstrated high item-reliability, SMTable2. See SM for the modified questionnaire and SMTable3 for excluded items.

3.2.2. Confirmatory factor analyses and item reliability—Using the validation sample, a confirmatory factor analysis evaluated SFS subscales identified in the EFA in the current study (Recreation, Nightlife, Interpersonal) for psychosis. Overall, the model demonstrated a significant but modest fit, *RMSEA* = 0.12, 90 % CI: 0.10–0.15, $p < 0.001$. Subscale and composite scores demonstrated reliability of Cronbach's alpha between 0.51 and 0.76 and Guttman's lambda between 0.66 and 0.89, SMTable2. The three factors derived from the EFA were used in all subsequent analyses. Additionally, the three subscales derived from the EFA were summed to create a total/composite SFS score.

3.3. Discriminant validity among clinical samples

3.3.1. Exploratory sample—One-way ANOVAs were conducted to compare social functioning total and subscale scores across diagnostic groups (CHR, GAD, MDD, and CC). There was a significant effect of diagnostic group on total social functioning score, $F(3,385) = 6.68$, $p < 0.001$, $\eta_g^2 = 0.05$. Follow-up contrasts showed that there was a significant difference between CHR and both MDD, $t(385) = 5.15$, $p = 0.006$, $d = -0.60$, and CC groups, $t(385) = 4.28$, $p < 0.001$, $d = -0.51$, but not between CHR and GAD groups.

There was a significant effect of diagnostic group on the Recreation subscale, $F(3,385) = 6.06$, $p < 0.001$, $\eta_g^2 = 0.04$. Follow-up testing showed that there was a significant difference between the CHR and MDD group, $t(385) = 2.54$, $p = 0.03$, $d = -0.52$, and the CC group, $t(385) = 2.73$, $p < 0.0001$, $d = -0.50$, such that CHR participants endorsed engagement in fewer leisure activities compared the MDD and CC groups, but did not differ from the GAD group.

A significant effect of diagnostic group was found on the Interpersonal subscale, $F(3,385) = 5.66$, $p < 0.001$, $\eta_g^2 = 0.04$. There was a significant difference between CHR and MDD, $t(385) = 1.55$, $p = 0.01$, $d = -0.61$, as well as CHR and CC groups, $t(385) = 1.10$, $p = 0.001$, $d = -0.39$. This suggests that individuals at CHR for psychosis evidenced greater difficulty engaging with family, peers, and strangers compared to individuals in the MDD and CC groups, but did not differ from the GAD group, Fig. 2.

There was no significant effect of diagnostic group on the Nightlife subscale, $F(3,385) = 2.49$, $p = 0.06$, $\eta_g^2 = 0.02$, Table 2 and Fig. 1.

3.2.3. Validation sample—Logistic regressions predicting the odds of diagnostic group with SFS subscales found that total, $b = 0.06$, $p = 0.03$, $d = 0.54$, $OR = 2.67$, and Interpersonal scores, $b = 0.41$, $p < 0.001$, $d = 0.77$, $OR = 4.04$, significantly predicted group membership. Specifically, the odds of being in the CHR group increased by a factor of 2.67 and 4.04 for each one-unit increase in the SFS total and Interpersonal score, respectively. Unique to the validation sample, scores on the Nightlife subscale, $b = 0.27$, $p = 0.004$, $d = 0.55$, $OR = 2.71$, significantly predicted the odds of group membership such that the odds of being in the CHR group increased by a factor of 2.71 for each one-unit increase in the Nightlife score. Additionally, the Recreation subscale, $b = 0.05$, $p = 0.20$, did not significantly predict the odds of group membership, Table 2.

3.4. Convergent and divergent validity

3.4.1. Exploratory sample

Convergent Validity.: The NSI-PR: asocial behavior subscale demonstrated a significant negative relationship with the total score, $r(76) = -0.30$, $p = 0.008$, Nightlife, $r(81) = -0.23$, $p = 0.03$, and Interpersonal subscale scores, $r(77) = -0.32$, $p = 0.004$. Increased asocial behavior assessed by the NSI-PR was related to decreased overall social functioning, engagement in nighttime social activities, and engagement with others. The Recreation

subscale score was not significantly related to NSI-PR: asocial behavior score, $r(80) = -0.18$, $p = 0.10$, Table 3 and SM Fig. 2.

Divergent Validity.: WASI Vocabulary scores demonstrated small, non-significant correlations with total social functioning, $r(76) = 0.02$, $p = 0.88$, Nightlife, $r(81) = -0.03$, $p = 0.80$, Interpersonal, $r(77) = 0.14$, $p = 0.20$, or Recreation, $r(80) = 0.06$, $p = 0.61$. WASI Matrix Reasoning scores demonstrated correlations ranging from small, yet significant, to non-significant with total social functioning, $r(75) = -0.23$, $p = 0.05$, Nightlife, $r(80) = -0.26$, $p = 0.02$, Interpersonal, $r(76) = -0.06$, $p = -0.58$, or Recreation, $r(79) = -0.18$, $p = 0.11$. The CTAP demonstrated no significant correlations with any social functioning subscale or total, p's > 0.64, Table 3 and SM Fig. 2.

3.4.2. Validation sample

Convergent Validity.: The GFS:S demonstrated significant positive correlations with the total, $r(28) = 0.48$, $p = 0.008$, Recreation, $r(28) = 0.39$, $p = 0.03$, and Interpersonal $r(28) = 0.54$, $p = 0.002$, subscales. The Nightlife subscale demonstrated a trend-level positive relationship with the GFS:S, $r(28) = 0.36$, $p = 0.05$. Consistent with the exploratory sample, the NSI-PR: asocial behavior subscale demonstrated a significant negative relationship with the social functioning total score, $r(35) = -0.53$, $p < 0.001$, Nightlife, $r(43) = -0.36$, $p = 0.01$, Recreation, $r(35) = -0.49$, $p = 0.01$, and Interpersonal subscale scores, $r(43) = -0.44$, $p = 0.003$, such that increased asocial behavior assessed by the NSI-PR was related to decreased overall social functioning, engagement in nighttime social activities, recreation, and engagement with others, Table 3 and SMFigure2.

Divergent Validity.: Pearson correlations were conducted between the social functioning total and subscale scores with the GFS:R and the CTAP. The GFS:R demonstrated no significant correlations with total social functioning and subscale scores, p's > 0.32. Consistent with the exploratory sample, the CTAP demonstrated no significant correlations with any social functioning subscale or total, p's > 0.29, Table 3 and SMFigure2. See SM for results of divergent validity correlations between positive symptom total and SFS total and subscales.

4. Discussion

Overall, the SFS demonstrated three reliable factors/subscales (Nightlife, Recreation, Interpersonal). The total (subscale composite) score calculated using these three factors demonstrated high reliability and reflected a valid, comprehensive measure of social functioning in CHR individuals. These three factors comprised 24/79 items of the original measure, indicating that an abridged version of the SFS may be appropriate for CHR individuals. Further, these subscales discriminated between clinical diagnoses, demonstrated moderate convergent and strong divergent validity. Taken together, results of the current study support an abbreviated but robust self-report SFS measure for assessment of relevant social behavioral domains in CHR for psychosis individuals.

Exploratory factor analysis derived subscales distinct from the original SFS. The original SFS subscales measured were prosocial activities, interpersonal engagement, recreation,

employment, and independence (Birchwood et al., 1990). The current study, however, identified only two categories previously identified by the original SFS (Interpersonal, Recreation). Although these subscales were similar to the original, items relevant to the CHR population differed. Items that predict functional deficits in adults (e.g., items related to frequency of engagement in religious activities, evening classes, employment), were not relevant to CHR groups. This inconsistency may reflect differences in the relevance of behaviors within these social domains to developmental groups and underscore the importance of identifying social behaviors that may reflect impairment. Indeed, items that were relevant in adults (e.g., spending time alone in their bedroom, unemployment) did not load strongly onto any factor and may not be as relevant for adolescents/young adults at high-risk for psychosis, whose social values and contexts likely lead to different signs of functional impairment (e.g., not attending parties, having few friends).

Further, the original SFS does not explicitly assess a subcategory of nighttime activities, however, the current study derived four items that comprise a Nightlife category. This Nightlife category is consistent with social developmental literature (Nelson et al., 2016) that suggests social reorientation towards peers (e.g., parties). Therefore, the current study extends previous work by identifying a subscale that assesses a unique category of functioning during a developmental period that temporally coincides with the psychosis prodrome. Of note, a correlation between age and the Nightlife subscale, $r = 0.24$, $p < 0.001$, suggests that this factor may become more relevant in older adolescents/young adults. Recreational activities and social withdrawal are assessed in separate domains within the original SFS, but this can be derived using fewer items in a younger psychosis-risk population. In sum, the subscales of the SFS derived from the current study tap into three social domains that may reflect markers of abnormal functioning, specifically for adolescents and young adults at CHR for psychosis.

Social functioning subscales differed between diagnostic groups, which reflects sensitivity of the measure to psychopathology. Though all clinical groups (CHR, MDD, GAD) showed social impairment, the most consistent differences were between individuals at CHR for psychosis, individuals with a primary diagnosis of MDD, and CC peers. As expected, individuals at CHR for psychosis showed decreased social functioning compared to their CC peers. Additionally, the scale was sensitive to differences between CHR and MDD individuals, consistent with previous literature (Yasuyama et al., 2017) demonstrating that individuals with schizophrenia have poorer social functioning than individuals with MDD. The total and subscale scores did not demonstrate differences between GAD and CHR groups. This may be attributable to the rate of comorbid GAD within the CHR group (26 %) in the current study, which is reflective of prevalence of anxiety in high-risk individuals broadly (McAusland et al., 2017). Additionally, the functional similarities between CHR and GAD groups are consistent with previous literature (De Jong et al., 1984; Cupo et al., 2021) suggesting that psychotic syndromes emerge from a continuum of nonpsychotic syndromes. However, the total (composite) and subscales showed utility for detecting social functioning deficits in individuals with GAD. Though social impairment is transdiagnostic (Birchwood et al., 1990; Hellvin et al., 2013; Kupferberg et al., 2016), findings from the current study support the use of the SFS as a measure of dysfunction for individuals at CHR for psychosis.

The subscales and composite scores found in the current study demonstrated convergent validity with a measure of asociality, such that higher scores on SFS subscales (i.e., higher social functioning) were associated with decreased asociality. The NSI-PR: asocial behavior scale rates social behavior stemming from apathy (Pelletier-Baldelli et al., 2017), convergence of the subscales provides support that SFS is a measure of impaired social interactions and relationships. The subscales derived from the current study also significantly related to the Global Functioning Scale: Social (Cornblatt et al., 2007; Carrión et al., 2019). The moderate positive relationships between the GFS:S and the SFS composite and subscales derived from the current study suggest that they are assessing similar areas of functioning, however, they may also be capturing unique information about social impairment. Future work may find it beneficial to use the SFS alongside other global measures of functioning to capture broad and specific impairment in social domains.

The complexity of social domains represents a particular problem when attempting to measure convergent and divergent validity of social functioning measures. Indeed, levels of sociality and complex skills (e.g., abstract reasoning) would be more related to social functioning compared to simpler behaviors (e.g., motor behaviors). As a result, we compared the modified SFS to a range of proximal (for convergent validity) and distal (for divergent validity) behaviors. As expected, most subscales of the SFS did not relate to measures established to assess non-social related functioning (e.g., GFS:R, CTAP, WASI-II: Vocabulary). This suggests that subscales of the SFS assessing subdomains and overall social functioning are assessing non-overlapping domains of functioning. Notably, the WASI-II: Matrix Reasoning scores had a small but significant correlation with the Nightlife subscale, which may reflect pervasive cognitive deficits with downstream impacts on social functioning (Sharma and Antonova, 2003; Green et al., 2020). As such, findings from the current study may suggest an overlap of broad deficits across domains encompassing social functioning.

Despite the study's strengths, there are some limitations. The exploratory and validation samples primarily consisted of participants whose attenuated positive symptoms had progressed (APSS progression) or remained consistent (APSS persistence) in the past year. Future work should evaluate the generalizability of the modified SFS to those whose attenuated positive symptoms are remitting (APSS partial and full remission) and other high-risk populations (i.e., those with brief, intermittent psychosis and genetic high-risk with functional deterioration). The validation dataset used a small sample size, although comparable to previous studies using the SFS (Hellvin et al., 2013; Addington et al., 2011), which may have contributed to the variation of internal consistency across samples. Despite the size of the validation sample, the SFS subscales still demonstrated convergence in a confirmatory factor model, suggesting robust effects. Additionally, the validation sample had a low frequency of non-CHR participants with a current diagnosis of MDD or GAD only. As such, the discriminant validity analyses grouped all non-CHR participants into a CC category regardless of DSM-5 diagnosis. A strength of the current study is the incorporation of a comparison group of general community peers, rather than overly "healthy" individuals that may not necessarily be reflective of the general population. Given this approach, the current study was unable to compare scores on the modified SFS between CHR individuals and a non-psychiatric sample.

Social dysfunction is associated with psychotic illness development (Rajkumar and Thara, 1989), poor adaptation to community environments (Johnstone et al., 2005), and cost of mental health service utilization (McCrone et al., 1998; Raudino et al., 2014). Given the importance of early identification of social impairment prior to the onset of psychosis, it is critical to have valid and reliable measures of social functioning for individuals with sub-threshold psychotic symptoms. The current study provides supporting evidence for a measure previously established for psychosis, the SFS, to assess developmentally relevant social impairment in young adults and adolescents at CHR for psychosis. Moreover, the self-report nature of the abridged SFS provides a short, feasible alternative assessment of specific social impairment to traditional clinician-rated, interview-based assessments.

5. Recommendations

Based on this validation study, we put forward the following recommendations.

1. The Social Functioning Scale abbreviated 24 item version may be more appropriate to use with CHR individuals than the original scale, and has the added benefit of efficient, rapid screening of social functioning, Table 2. See SM for the Social Functioning Scale - Modified for Psychosis Risk (SFS-PR).
2. Three subscales, rather than 7, can be used to evaluate developmentally relevant social behavior and their associated deficits in individuals at CHR for psychosis: Interpersonal, Nightlife, Recreation. Given the somewhat mixed discriminant validity of Nightlife and Recreation, researchers should exercise caution.
3. The composite score may be used as a comprehensive, global measure of social functioning in CHR individuals.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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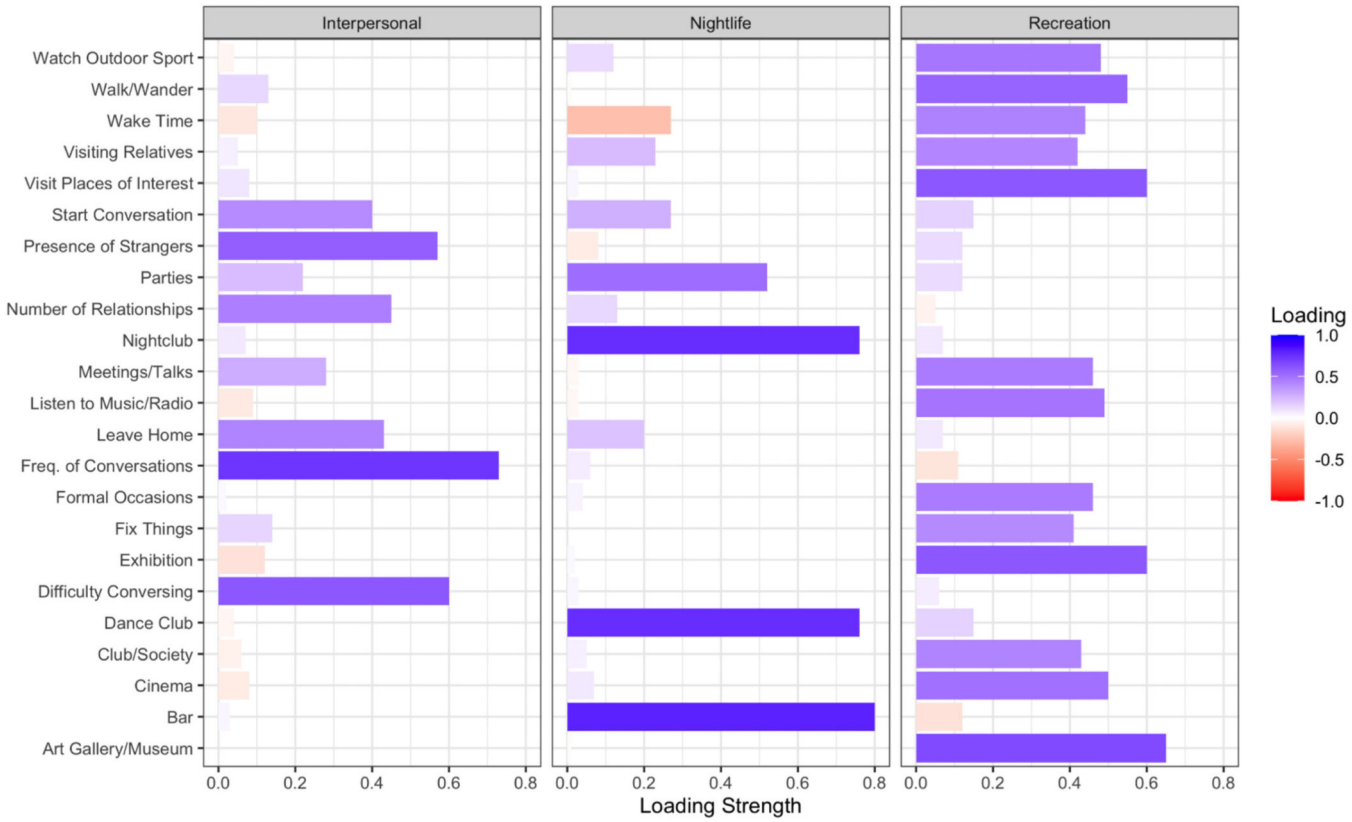

Fig. 1.

SFS item factor loadings using the exploratory sample. Each item is represented across all three factors with darker colors reflecting stronger factor loadings.

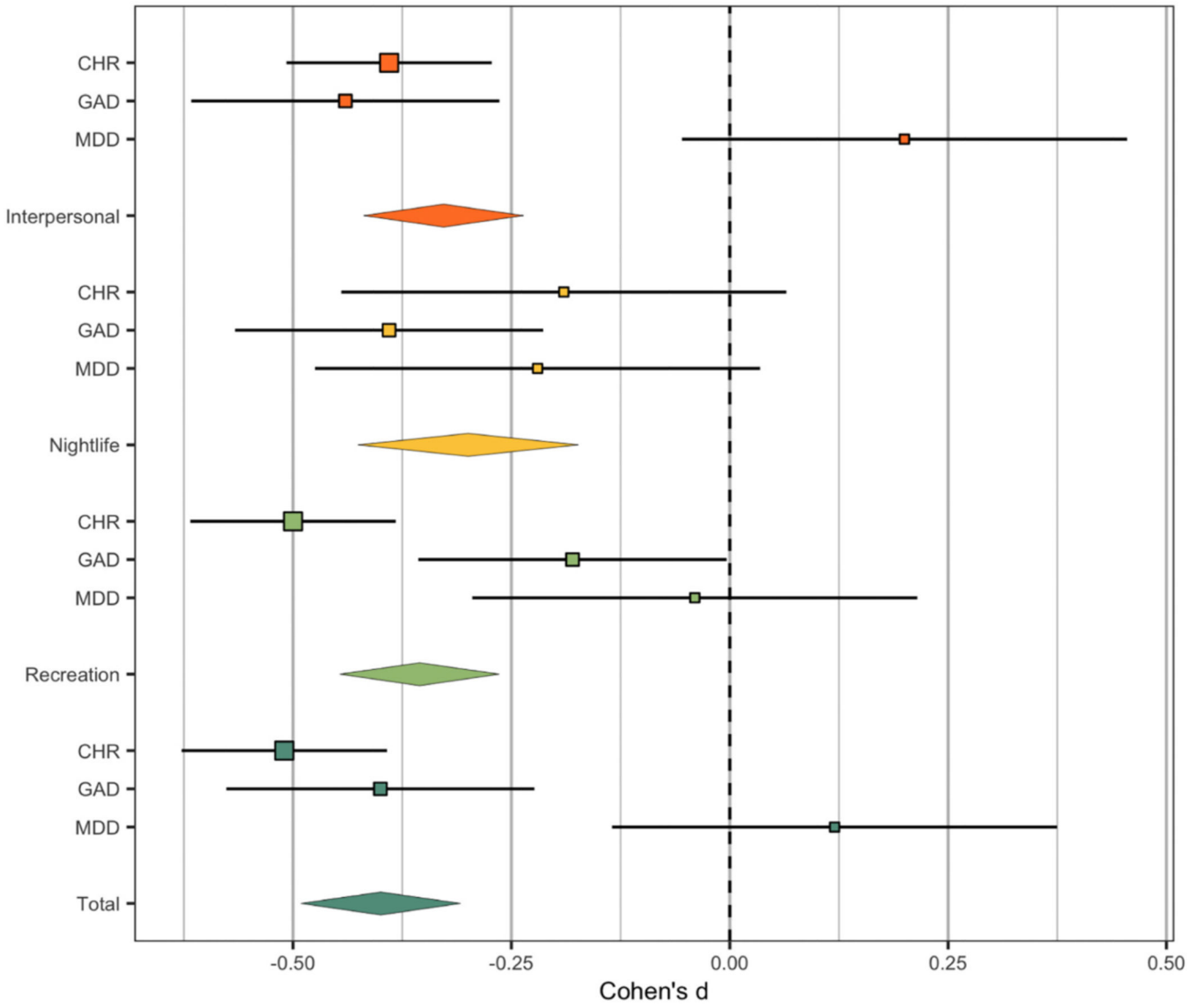

Fig. 2.

The Cohen's d reflects the difference between individuals with clinical groups to the community control sample. As a result, the 0 point reflects the score of the community control sample. If the error bar overlaps with the 0 point, this indicates that the clinical group did not significantly differ from the community controls.

Table 1

CHR participant demographic metrics: a comparison between samples. Asterisk indicates significance.

	Exploratory sample	Validation sample	Sample comparison statistics
	n = 84	n = 45	
Age	20.27	20.93	$t(65) = 1.40$, p = 0.17
Sex (% female)	73.26 %	46.67 %	$t(72.5) = -2.63$, p = 0.01*
Race			$\chi^2(5) = 20.64$, p < 0.001*
Central/South American	7.45 %	8.89 %	
Asian	20.23 %	6.67 %	
Black/African	15.48 %	31.11 %	
White	48.81 %	40.00 %	
Multiracial	5.95 %	4.44 %	
Unknown	1.19 %	8.89 %	
Household income			$\chi^2(7) = 5.49$, $p = 0.60$
<$10,000	11.90 %	6.67 %	
10,000–19,999	3.57 %	15.56 %	
20,000–39,999	7.14 %	11.11 %	
40,000–59,999	16.67 %	15.56 %	
60,000–99,999	22.62 %	15.56 %	
100,000 and over	23.81 %	17.78 %	
Unknown	14.29 %	17.78 %	

Table 2

Means (SEM) of SFS categories across exploratory and validation datasets.

SFS category	CHR	CC	MDD	GAD
Exploratory sample				
Total	32.25 (1.05)	36.53 (0.52) ***	37.4 (1.18) **	33.50 (1.14)
Recreation	16.26 (0.67)	18.99 (0.32) ***	18.80 (0.72) *	18.10 (0.73)
Interpersonal	13.21 (0.35)	14.30 (0.16) **	14.76 (0.39) *	13.15 (0.43)
Nightlife	2.73 (0.32)	3.26 (0.17)	3.84 (0.50)	2.24 (0.39)
Validation sample				
Total	31.84 (1.55)	37.29 (1.78) *	-	-
Recreation	18.1 (0.92)	20.1 (1.24)	-	-
Interpersonal	10.60 (0.39)	12.76 (0.42) ***	-	-
Nightlife	3.04 (0.4)	5.03 (0.45) **	-	-

As terisks reflect significance

*** = $p < 0.001$

** = $p < 0.01$

* = $p < 0.05$) of the diagnostic group compared to the CHR group.

Table 3

Convergent and divergent validity of SFS categories across exploratory and validation samples. Asterisks reflect significance

SFS category	Convergent measures		Divergent measures			
	NSI-PR: Asociality Behavior	GFS: Social	GFS: Role	WASI-II: Vocabulary	WASI-II: Matrix Reasoning	Computerized Finger Tapping (CTAP)
Exploratory sample						
Total	−0.30**	-	-	0.02	−0.23	−0.04
Recreation	−0.18	-	-	0.06	−0.18	0.02
Interpersonal	−0.32**	-	-	0.14	−0.06	−0.06
Nightlife	−0.23*	-	-	−0.03	−0.26*	−0.03
Validation sample						
Total	−0.53***	0.48**	0.01	-	-	0.003
Recreation	−0.49*	0.39*	−0.004	-	-	0.01
Interpersonal	−0.44**	0.54**	0.17	-	-	−0.22
Nightlife	−0.36*	0.36	−0.08	-	-	−0.03

*** = $p < 0.001$

** = $p < 0.01$

* = $p < 0.05$).