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The Centrality of Motivation in Psychosocial Functioning: Network and Bifactor Analysis of the Quality of Life Scale in First-Episode Psychosis

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Psychosocial functioning impairment is prevalent in first-episode psychosis and chronic schizophrenia. The Quality of Life Scale (QLS) is a widely used tool to measure psychosocial functioning; however, given the overlap between negative symptoms and functioning, along with the QLS being conceptualized initially as a measure of the deficit syndrome, it is unclear whether summing QLS items into a total score is an appropriate measure of overall psychosocial functioning. This study aimed to examine the centrality of QLS items and the appropriateness of using a QLS total score. Participants with first-episode psychosis ($n = 404$) completed the QLS. Item centrality was assessed using a network analysis approach, while reliability and dimensionality of the QLS total score and subscales were measured using bifactor modeling and related psychometric indices. Network analysis results showed that an item relating to motivation was the most central item within the scale. Moreover, bifactor modeling results found that motivation and other items relating to negative symptoms may reflect the QLS total score more strongly than other functioning (i.e., Interpersonal, Instrumental) domains. Based on these findings, we urge researchers to use caution when using a QLS total score, as it may unequally confound functional domains and motivation. Moreover, our results continue to underscore the importance of negative symptoms, particularly motivational impairment, in psychosocial functioning. Future studies should aim to examine the centrality of other functioning measures in psychosis and schizophrenia, as our results suggest that psychosocial functioning may be greatly influenced by motivation.

Public Significance Statement
The Quality of Life Scale (QLS) is commonly used to understand how people with schizophrenia function and perform in various life roles (e.g., during work and socially). We observed that levels of general motivation may greatly influence these roles, which suggests that the QLS may not be an appropriate measure of overall functioning.

Keywords: functioning, motivation, psychosis, network analysis, bifactor

Supplemental materials: https://doi.org/10.1037/pas0001080.supp

Schizophrenia is a highly heterogeneous disorder, with varying presentations of positive, negative, and disorganized symptoms. These symptoms contribute to impairment in performing roles and participating in life. Impairment in psychosocial functioning is already prominent at the first episode of nonaffective psychosis and is relatively stable over time. A 25-year longitudinal study showed that low social and occupational functioning are characteristics found throughout the illness (Velthorst et al., 2017), suggesting that psychosocial impairment is a common, long-term characteristic of schizophrenia. While treatment may lessen impairment severity over time, psychosocial functioning deficits often persist despite treatment.

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All statistical code used for this study is available upon request. This study was not preregistered.

Samuel J. Abplanalp played lead role in formal analysis, methodology, software, visualization, writing of original draft and writing of review and editing and equal role in validation. Kim T. Mueser played lead role in conceptualization, data curation, funding acquisition, investigation, project administration and resources and supporting role in methodology, supervision, validation and writing of review and editing. Daniel Fulford played supporting role in formal analysis, methodology, supervision, validation, visualization and writing of review and editing.

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Generally, psychosocial functioning is assessed through objective indicators (e.g., competitive employment) or with structured assessments to quantify the degree to which people are engaged in daily activities. Given that individuals with schizophrenia and psychosis often struggle with meeting functional achievements, rating scales can also identify subthreshold milestones, such as readiness for work (Harvey, 2013). The Quality of Life Scale (QLS; Heinrichs et al., 1984) is one of the most well-known measures of psychosocial functioning in schizophrenia-spectrum disorders and has been used in numerous intervention studies designed to assess domains relating to interpersonal functioning, instrumental (occupational/role) functioning, and engagement in life activities (e.g., Addington & Addington, 2009; Kane et al., 2016). As the scale was originally developed to measure the deficit syndrome of schizophrenia (i.e., the presence of enduring, primary negative symptoms; Carpenter et al., 1988), the QLS also contains items that overlap conceptually with negative symptoms, such as motivation, anhedonia. Items in this subscale were originally termed "Intrapsychic foundations," which were thought to reflect "the building blocks from which interpersonal and instrumental role functioning are derived" (Heinrichs et al., 1984, p. 390).

Intrapsychic foundations items cover a range of constructs that may reflect different processes, such as empathy and motivation (Heinrichs et al., 1984). Although these items may be moderately correlated, the broad scope of their content suggests they may not form a unitary construct. Nonetheless, Heinrichs and colleagues included Intrapsychic foundations as one of the four subscales of the QLS, and it continues to be analyzed as a latent factor in many studies in schizophrenia. With this approach in question, Mueser et al. (2017) showed that the four-factor structure provided poor fit to the data and did not conform to the original conceptualization of QLS subscales. Instead, the authors showed that a three-factor solution, including Interpersonal functioning, Instrumental functioning, and Motivation (i.e., Intrapsychic foundations), provided adequate fit. Despite poor fit of the four-factor solution, its subscales and total score are still commonly used in schizophrenia and psychosis research. However, research on functioning and negative symptoms raises questions about whether the QLS total score represents an appropriate measure of psychosocial functioning.

Previous work suggests functional domains may be confounded with negative symptoms (Foussias et al., 2011; Green et al., 2012; Konstantakopoulos et al., 2011). Because of this, summing Interpersonal/Instrumental functioning items with items reflecting a core negative symptom (i.e., motivation) may lead to unclear interpretation and meaning of a QLS total score; a problem that may persist when using either the three- or four-factor solution. Additionally, a total score assumes that each item within a measure is given equal weight in explaining a given construct; however, evidence suggests that functional domains (i.e., social, occupational) show low-to-moderate associations (Bowie et al., 2008; Leifker et al., 2009), and therefore may not evenly contribute to a total functioning score. Intrapsychic foundations/Motivation items may compound this issue, as motivation may differentially influence, and be influenced by, functional domains over time (Fulford et al., 2018). Despite these concerns, no study has tested Heinrichs et al.'s (1984) original hypothesis that Intrapsychic foundations items are central to interpersonal and instrumental role functioning in schizophrenia. No study has also tested whether summing QLS items into a total score represents an appropriate measure of psychosocial functioning.

One way to test the relative contribution of Intrapsychic foundations items to psychosocial functioning is through a network analysis approach. Network analysis involves a graphical representation of associations among components (e.g., personality traits, items of a self-report scale). Network analysis differs from traditional latent factor approaches due to partial correlations between individual items (Fried, 2020). For example, a network analysis of a depression measure would highlight correlations between items (e.g., items related to sleep, appetite) after controlling for other correlations within the network. In contrast, latent factor models reduce a large pool of individual items into a smaller number of latent variables. Network theory suggests constructs stem from interactions between items, as opposed to the idea that changes in latent variables cause variation in individual items (Epskamp et al., 2012). One critical component of network analysis is its ability to examine centrality, which provides information regarding the relative strength and influence specific nodes have on other nodes and, in turn, the network.

Though network analysis quantifies the centrality of individual items, it does not provide information on the reliability and dimensionality of a scale's total score. Ideally, a total score should reflect a reliable construct that captures unique variance after accounting for any subscales that may be present within a scale. Given the heterogeneity of items within the QLS, it is unclear whether a QLS total score represents an appropriate measure of overall psychosocial functioning. One approach well suited to answer this question is bifactor modeling. Bifactor modeling is a type of factor analysis in which each item loads on a general factor, with a primary aim to summarize or explain a construct's underlying structure using latent variables instead of interrelationships among specific items (Markon, 2019). In bifactor modeling, the general factor reflects the commonality among all the items and represents the individual differences in the target dimension. Specific factors reflect the remaining variance not explained by the general factor. While most prior work using bifactor modeling in psychological research has focused on intelligence (i.e., the *g*-factor; Cucina & Byle, 2017) and psychopathology (i.e., the *p*-factor; Caspi et al., 2014), bifactor modeling can also be used to test the reliability and dimensionality of clinical measures and self-reports (Bornovalova et al., 2020). As traditional fit statistics can be biased toward overfitting bifactor models (Greene et al., 2019), additional indices can be examined that identify a construct's reliability and dimensionality.

Network analysis and bifactor modeling may be used as complementary approaches (Watters et al., 2016). Combining these methods may be particularly beneficial when defining latent variables as summary statistics of interrelationships among variables instead of common-cause entities that lead to changes and fluctuations in individual items or variables (Cramer et al., 2012; Fried, 2020; Watters et al., 2016). For example, a general factor of psychosocial functioning may be more accurately conceptualized as a formative construct (i.e., items forming and describing a latent variable), such as socioeconomic status, rather than a reflective construct (i.e., a latent variable being the root cause of the items; Fried, 2020; Watts et al., 2020). Psychosocial functioning, in turn, would not be conceptualized as a latent variable causing variability and change in social and occupational domains, but instead, activity in those domains defines variability in functioning.

The present study had two primary aims. First, we sought to formally test Heinrichs et al.'s (1984) hypothesis that Intrapsychic foundations items are the building blocks of functional domains by mapping the network structure of the QLS and examining centrality metrics, including strength, betweenness, and closeness. Based on previous literature suggesting that motivation is a robust predictor of psychosocial functioning in schizophrenia, we hypothesized that the item "Degree of Motivation" would be the most central item in the network. To test this hypothesis, we first focused on the four-factor structure originally conceptualized by Heinrichs et al. (1984). We chose the original scale for our network model given that network analysis is highly influenced by individual nodes; as such, QLS items that may not have fit into a factor analytic subscale may be influential in a network model without the need for any unobserved latent variables (Bornovalova et al., 2020). As a sensitivity analysis, we then also tested the same hypothesis on the revised three-factor scale.

Second, based on the formative structure of psychosocial functioning, we tested confirmatory bifactor models of both the three- and four-factor scales. Due to poor fit of the four-factor scale in prior studies, we mainly focused on the three-factor scale for the bifactor model. We hypothesized that a general factor would show low reliability (i.e., explain minimal error-free variance in a total score), lack evidence of unidimensionality (i.e., subscales would explain unique variance in a total score), and show factor loadings consistent with hypothesis one (i.e., high factor loading for "Degree of Motivation," lower loadings for functional items). Confirmation of both hypotheses would suggest that the QLS total score may lack specificity as a measure of overall psychosocial functioning.

Method

Participants

Participants were part of the longitudinal multisite National Institute of Mental Health's (NIMH) Recovery After an Initial Schizophrenia Episode-Early Treatment Program (RAISE-ETP) study (Kane et al., 2015). Four hundred and four participants were recruited across 34 community mental health treatment centers in 21 states and were followed up for a minimum of 2 years; for this study, we only examine baseline data. The study was approved by the Institutional Review Boards of the coordinating center and the participating sites. The NIMH Data and Safety Monitoring Board provided study oversight. Inclusion criteria were: (a) between 15 and 40 years of age; (b) ability to participate in research assessments in English; (c) ability to provide fully informed consent; and (d) the presence of definite psychotic symptoms and evidence that one of the following is included in the differential diagnosis: schizophrenia; schizoaffective disorder; schizophreniform disorder, psychotic disorder not otherwise specified, or brief psychotic disorder (according to DSM-IV). Exclusion criteria were: (a) experience of more than one discrete psychotic episode; (b) substance-induced psychotic disorder; and (c) current neurological disorder or psychiatric disorder due to a general medical condition. All participants provided written informed consent. Access to study materials is publicly available through: https://grants.nih.gov/grants/guide/notice-files/NOT-MH-16-006.html. All statistical code used for this study is available upon request. This study was not preregistered.

QLS

The QLS (Heinrichs et al., 1984) is a semistructured interview containing 21 items rated on a 0–6 scale, with higher scores indicating better functioning. The QLS assesses domains related to Interpersonal functioning (e.g., quality of friendships), Instrumental functioning (e.g., performance at work or school), Intrapsychic foundations (e.g., motivation, empathy), and Commonplace objects and activities (e.g., checking the news) and takes approximately 45 min to administer. Interviews were conducted using two-way video conferencing completed by remote, centralized personnel.

Other Measures

The Positive and Negative Syndrome Scale (PANSS; Kay et al., 1987) assessed psychotic (positive and negative) symptoms, with items ranging from 1 (*absent*) to 7 (*extreme*). For this study, scores for the positive and negative subscales were summed. The Calgary Depression Scale for Schizophrenia (CDSS; Addington et al., 1993) measured symptoms of depression, reflecting the mean average of 9 items on a 0 (*absent*) to 3 (*severe*) scale. The Brief Assessment of Cognition for Schizophrenia (BACS; Keefe et al., 2004) assessed cognition. The BACS includes tests of verbal memory, digit sequencing, token motor, verbal fluency, symbol coding, and tower of London.

Data Analysis

Network Analysis

For our network analyses, the width of edges indicates the strength (i.e., wider edges equating to stronger associations) and their color indicates the direction of correlations between nodes (i.e., positive associations between QLS items in blue and negative associations between QLS items in red). Polychoric correlations were used to calculate associations between edges in the current networks. We estimated networks using the Graphical Gaussian Model (GGM; Lauritzen, 1996), in which edges represent conditional independence among the nodes. Edges in a GGM network are partial correlations that signify the association between two nodes when controlling for all other network correlations. Due to the high number of parameters and the possibility of false-positive edges, we regularized the networks using the adaptive least absolute shrinkage and selection operator (LASSO; Friedman et al., 2008). LASSO shrinks all edges in the network and sets small edges to zero, eliminating spurious correlations for the most parsimonious model. We estimated the GGMs using the R package qgraph (Epskamp et al., 2012), which also applies Bayesian Information Criterion (EBIC) model selection. In sum, EBIC estimates 100 different network models with different sparsity degrees and selects the model with the lowest EBIC based on the hyperparameter γ. This value controls the trade-off between including false-positive edges and removing true edges. For the present study, the value of γ was set to 0.50, per recommendations by Foygel and Drton (2010). Node placement was determined by the Fruchterman–Reingold algorithm, which arranges nodes with stronger associations near the center of the graph and nodes with weaker average associations closer to the sides of the graph (Fruchterman & Reingold, 1991).

Centrality

To assess centrality, or a given node's connectedness with all other nodes in the network, we measured strength, closeness, and betweenness (Costantini et al., 2015). Strength is defined as the overall relation of a node to others in the model and is the absolute sum of partial correlations involving a node. Higher scores reflect greater strength of connectivity within the model. Closeness is the average distance of one node to all other nodes and is calculated as the inverse of partial correlations between nodes. Betweenness refers to the shortest path length connecting any two nodes. A variable with high betweenness lies along the shortest path connecting one node to another. While all three centrality measures were examined and reported, closeness and betweenness tend to have poor stability (Epskamp et al., 2018), and therefore in our analyses we focused mainly on strength. Information regarding model stability is in the Supplemental Materials.

Network Stability

We used a bootstrapping approach from the bootnet package in R (Epskamp et al., 2012) with 95% confidence intervals to examine edge strength stability (Epskamp et al., 2018). To measure stability, we repeatedly correlated centrality values calculated from the complete data set with those calculated from a subsample with a percentage of participants missing. The correlation stability (CS) coefficient indicates the proportion of participants that can be dropped from the original sample while maintaining a correlation of 0.70 or above for centrality measures. A CS value of at least 0.25 is recommended to interpret centrality measures as stable (Epskamp et al., 2012).

Bifactor Analysis

Bifactor modeling was then performed using the same sample. Bifactor analysis is a confirmatory approach in which a general latent factor is modeled with specific factors. The general factor decomposes covariance shared between specific factors. Specific factors then model unique variance after accounting for the general factor and represent factors not attributable to a common factor. This approach was used in the present study to identify if the QLS total score reflects a general factor after accounting for specific factors. All factors were orthogonal, and goodness of fit was measured by chi-square, root mean square error of approximation (RMSEA), comparative fit index (CFI), and Tucker–Lewis index (TLI).

Reliability

Omega hierarchical (ω*H*; McDonald, 1999; Reise et al., 2013) was used to test the proportion of reliable variance (i.e., error-free variance) in total scores attributable to the general factor. ω*H* is computed by dividing the factor loadings' squared sum on the general factor by the variance of total scores and reflecting the percentage of systematic variance in unit-weighted total scores that can be attributed to the individual differences on the general factor. Higher values reflect a greater amount of systematic variance explained by the general factor and less variance explained by specific factors. Omega hierarchical subscale (ω*HS*) was used to determine the reliable variance in specific factors. ω*HS* reflects the proportion of systematic variance of a subscale score after partitioning out variability attributed to the general factor and thus identifies whether subscales capture meaningful amounts of unique variance not explained by a scale total score.

Explained Common Variance

Given the QLS was created to measure a broad spectrum of behaviors, it is crucial to understand whether the QLS total score stands alone as a unidimensional construct due to its assessment of items relating to both instrumental and interpersonal functioning and items reflecting reduced motivation/intrapsychic foundations. To assess this, we examined explained common variance (*ECV*; Reise et al., 2010, 2013) of the general factor. *ECV* indexes variance specific to a general factor by taking the variance explained by a general factor and dividing it by the variance explained by the general and specific factors. *ECV* values indicate a general factor's strength, which may guide the decision to fit a unidimensional model to multidimensional data and subsequently interpret if a total score represents a unidimensional construct. *ECV* was also tested for specific factors (*ECV_S*), representing the percent of variance for only those indicators loading on a specific factor. A critical distinction between ω*H* and *EVC* is that ω*H* reflects systematic, reliable variance in unit-weighted total scores from a single source, whereas *EVC* reflects the general factor's relative strength and *where* the variance is extracted. In other words, a high ω*H* value does not automatically indicate unidimensionality, as the variance measured by ω*H* stems from individual differences on the general factor, which may not be unidimensional.

Results

Demographic characteristics are provided in Table 1. The sample's average age was 23.14 years, and 72.5% of the sample were male. Approximately half (53%) of the sample were diagnosed with schizophrenia and 86% were unemployed at the time of the study. Table 2 shows all QLS items and example interviewer prompts.

Network Analysis

Figure 1 represents the network model for the original scale structure (Heinrichs et al., 1984). Forty-seven percent of the network edges were set to zero. Among all items, the strongest edges were between "Extent of occupational role functioning" and "Degree of underemployment," and between "Social initiatives" and "Social withdrawal." Among Intrapsychic foundations items, the strongest edge was between the items "Sense of Purpose" and "Degree of Motivation." In line with the scale's original conceptualization, numerous edges bridged Intrapsychic foundations items to Interpersonal/Instrumental functioning items. In contrast, only one edge bridged Interpersonal functioning items to Instrumental functioning items ("Active acquaintances" and "Level of accomplishment"); however, the confidence interval of this edge contained zero.

Similar results emerged (Figure 2) for the network analysis conducted on the revised QLS (Mueser et al., 2017). Indeed, the strongest edges were again between "Extent of occupational role functioning" and "Degree of underemployment," and between "Social initiatives" and "Social withdrawal." Also like the original scale, numerous Motivation items (i.e., Intrapsychic foundations)

Table 1
Sample Demographic Characteristics (n = 404)

Sample characteristics	*M* (*SD*) or %
Age	23.14 (5.07)
Gender: male	72.5%
Race	
American Indian or Alaskan Native	5.2%
Asian	3.0%
Black or African American	37.6%
Native Hawaiian or other Pacific Islander	0.2%
White	54.0%
Ethnicity: Hispanic or Latino	18.1%
Education	
Some high school or less	36.0%
Completed high school	33.0%
Some college or higher	31.0%
Employment	
Currently working	14.4%
Not currently working	85.6%
Residence	
Independent living	17.8%
Lives with family	71.0%
Supported or structured housing	3.5%
Homeless, shelter, other	7.7%
Months of untreated psychosis (n = 355)	6.36 (8.62)
Age of first psychiatric illness (n = 398)	19.15 (6.15)
Number of psychiatric hospitalizations (n = 314)	1.94 (1.98)
Diagnosis	
Schizophrenia	53.0%
Schizoaffective bipolar	5.9%
Schizoaffective depressive	14.1%
Schizophreniform provisional or definite	16.6%
Brief psychotic disorder	0.5%
Psychotic disorder NOS	9.9%
Medication status	
Using antipsychotics	83.4%
Not using antipsychotics	16.6%
PANSS positive symptoms	18.77 (5.22)
PANSS negative symptoms	20.19 (5.31)
CDSS	4.65 (4.28)
BACS	36.76 (7.33)

Note. PANSS = Positive and Negative Syndrome Scale; CDSS = Calgary Depression Scale for Schizophrenia; BACS = brief assessment of cognition in schizophrenia.

bridged to Interpersonal/Instrumental functioning items, and the sole bridge between Interpersonal and Instrumental functioning items was between "Active acquaintances" and "Level of accomplishment." As the two network models showed similar patterns, our results mainly focus upon the original scale structure for two primary reasons. First, the original scale is still widely used in schizophrenia and psychosis research. Second and perhaps most critically, the original scale contains more items than the revised scale, thus providing a more accurate and robust assessment of Heinrichs et al.'s (1984) theory of Intrapsychic foundations as the building blocks of functioning. More detailed network analysis results of the revised scale, including centrality metrics, are in the Supplemental Materials.

Centrality

Centrality measures are shown in Figure 3. On average, items reflecting the subscales Interpersonal functioning, Instrumental functioning, Intrapsychic foundations, and Common objects and activities items had strength values of 0.86, 0.97, 0.83, and 0.83. "Degree of motivation" had the highest strength value in the network but did not significantly differ from "Level of social activity," "Social initiatives," and "Level of accomplishment" (see Figure 4). However, strength values for these latter items appear to be primarily driven by fewer edges compared to "Degree of motivation." This is particularly evident for "Level of accomplishment," as this item's high strength value only stems from its association with the other two Instrumental functioning items. "Degree of Motivation" and "Time Utilization" had the highest betweenness values. "Degree of Motivation" also had the highest closeness value, along with "Social initiatives."

Network Stability

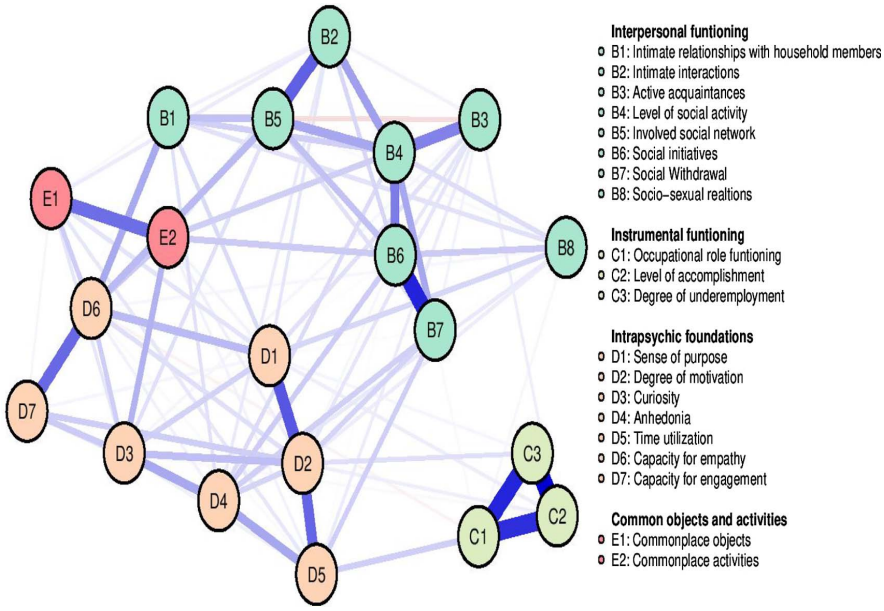
For network edges, bootstrapped 95% confidence intervals revealed high network stability, suggesting the network can be reliably interpreted. The CS coefficient also suggested highly stable strength centrality (CS = 0.67; Figure 5).

Table 2
QLS Items

Item wording
1[a]. *Intimate relationships with household members* (e.g., Are you especially close with any of the people you currently live with or your immediate family?)
2. *Intimate interactions* (e.g., Do you have friends with whom you are especially close other than your immediate family or the people you live with?)
3. *Active acquaintances* (e.g., Apart from close personal friends, are there people you know with whom you have enjoyed doing things?)
4. *Level of social activity* (e.g., How often have you done things for enjoyment that involved other people?)
5. *Involved social network* (e.g., Are there people who have been concerned about your happiness and well-being?)
6. *Social initiatives* (e.g., Have you often asked people to do something with you, or have you usually waited for them to ask you?)
7. *Social withdrawal* (e.g., Have you turned down offers to do things with other people?)
8[a]. *Sociosexual relations* (e.g., Have you dated?)
9. *Extent of occupational role functioning* (e.g., Have you had a job?)
10. *Level of accomplishment* (e.g., The challenge and responsibility of the employment, praise or reprimands from employer)
11. *Degree of underemployment* (e.g., Have you had the opportunity to look for employment?)
12[b]. *Satisfaction with occupational role functioning* (e.g., Do you like your work or schooling?)
13. *Sense of purpose* (e.g., What makes life worth living for you?)
14. *Degree of motivation* (e.g., How have you been going about accomplishing your goals?)
15. *Curiosity* (e.g., How often have you seen or heard about something that you wanted to know more about or understand better?)
16[a]. *Anhedonia* (e.g., Have you been able to enjoy yourself?)
17. *Time utilization* (e.g., Did you spend much time doing nothing—just sitting around or in bed?)
18[a]. *Commonplace objects* (e.g., Are you wearing or carrying a wallet or purse?)
19. *Commonplace activities* (e.g., Have you shopped for food in the past month?)
20. *Capacity for empathy* (e.g., Are you usually sensitive to the feelings of others?)
21. *Capacity for engagement* (i.e., The extent to which the participant actively engages with the interviewer—based on entire interview)

Note. QLS = Quality of Life Scale.
[a] Excluded from bifactor analyses. [b] Excluded from all analyses.

Figure 1
Network Analysis of the Quality of Life Scale (QLS)



Note. See the online article for the color version of this figure.

Bifactor Analysis

Factor loadings for the three-factor bifactor model are presented in Table 3. In contrast to the network analysis, we omitted Items 1, 8, 16, and 18, consistent with prior factor analytic findings. The model adequately fit the data (CFI = 0.953; TLI = 0.936; RMSEA = 0.065, $\chi^2(88, N = 404) = 237.84$, $p < .001$). All items loaded on the general factor at >0.40. "Degree of motivation" (0.85) and "Time utilization" (0.71) showed the highest factor loadings, while "Capacity for engagement" (0.41) and "Intimate interactions" (0.41) showed the lowest factor loadings. Examining specific factors, loadings for Interpersonal functioning ranged from 0.34 (*Active acquaintances*) to 0.67 (*Level of social activity*). Instrumental functioning had the highest specific factor loadings, with all items loading ≥0.80. There was a wide range of variability in the Motivation factor loadings. "Time utilization" and "Degree of motivation"—the two highest loadings on the general factor—had the smallest loadings on the Motivation-specific factor (−0.10 and 0.03, respectively). "Capacity for engagement" (0.47) and "Capacity for empathy" (0.57) loaded most strongly on the Motivation-specific factor. The four-factor model, while showing similar fit to the three-factor model, was deemed uninterpretable due to numerous anomalous item loadings on the general factor. These results are consistent with Mueser et al. (2017) suggesting poor fit of the four-factor solution and work showing bifactor models may satisfactory fit data yet produce unreliable and uninterpretable results (Bonifay et al., 2017; Greene et al., 2019). Full results of the four-factor bifactor model are included in the Supplemental Materials.

Reliability

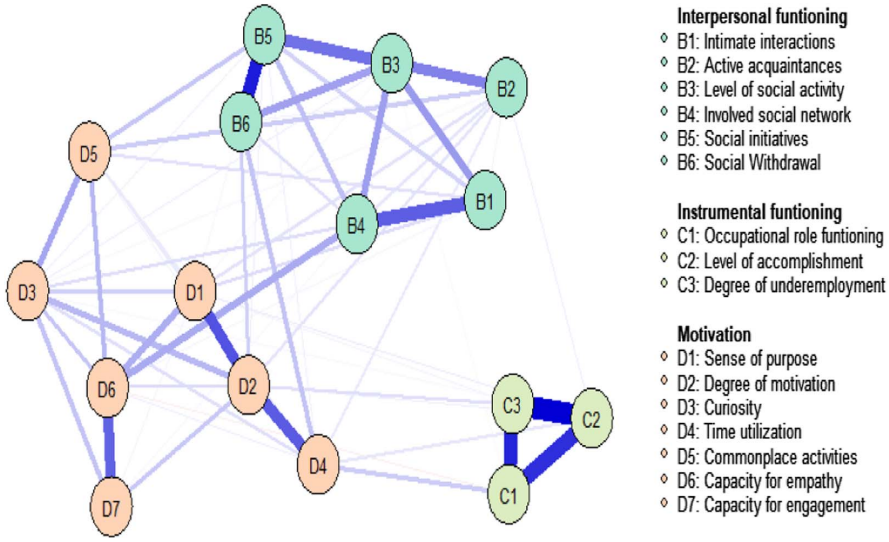
ω*H* for the general factor (ω*H* = 0.75) was just below the ideal limit of 0.80, suggesting that approximately 25% of the variance in the QLS total score is not attributable to the general factor. ω*HS* for specific factors were all below the recommended 0.75 cutoff. Instrumental functioning showed the highest reliability (ω*HS* = 0.72), while Motivation had the lowest reliability (ω*HS* = 0.10). Interpersonal functioning showed moderately low reliability (ω*HS* = 0.46). These results show that a general factor captured 72% of the systematic variance in the QLS total score, as specific factors also explain systematic variance in the total score. Once the general factor was partitioned out, the Instrumental functioning factor explained the high amount of variance, followed by Interpersonal functioning, with Motivation explaining the least variance. Thus, the Motivation factor is most strongly reflected by the QLS total score, and the Instrumental functioning factor is most weakly reflected.

ECV

The explained common variance of the general factor (*ECV*) was 0.53, which fell below recommended cutoffs of 0.70–0.80 (Rodriguez et al., 2016), suggesting the QLS total score does not show evidence of high unidimensionality. In combination with ω*H*, these results suggest the QLS total score predominately reflects a single source, but its items are not unidimensional, as subscales still reflect variance that the general factor does not capture. Instrumental functioning (*EVC_S* = 0.77) captured the most multidimensional variance in the QLS total score. Interpersonal functioning (*EVC_S* = 0.53) captured the second-most total score variance, while Motivation (*EVC_S* = 0.20) did not capture substantial total score variance. These findings are in line with ω*H* results, such that Motivation—and to a lesser extent, Interpersonal functioning—may be the key drivers of the QLS total score, with Instrumental minimally represented.

Figure 2

Network Analysis of the Revised Quality of Life Scale (QLS)



Note. See the online article for the color version of this figure.

Discussion

In the present study, we tested the conceptualization initially put forth by Heinrichs et al. (1984) that QLS Intrapsychic foundations serve as the building blocks of psychosocial functioning. We also sought to determine whether a QLS total score is an appropriate measure of overall psychosocial functioning. We used network analysis and bifactor modeling—two complementary approaches used to identify the centrality of the QLS and the appropriateness of using a total score. Our first hypothesis, that the item "Degree of Motivation" would be the most central item in a network model using strength, closeness, and betweenness, was supported, providing evidence for Heinrichs et al.'s (1984) scale conceptualization.

Figure 3

Network Centrality Measures

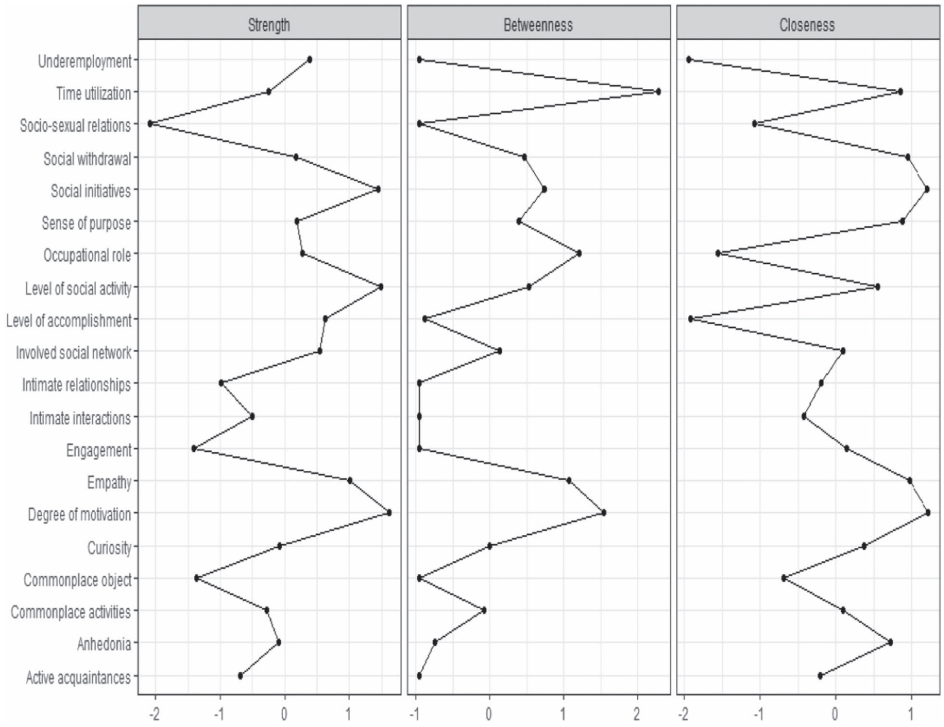
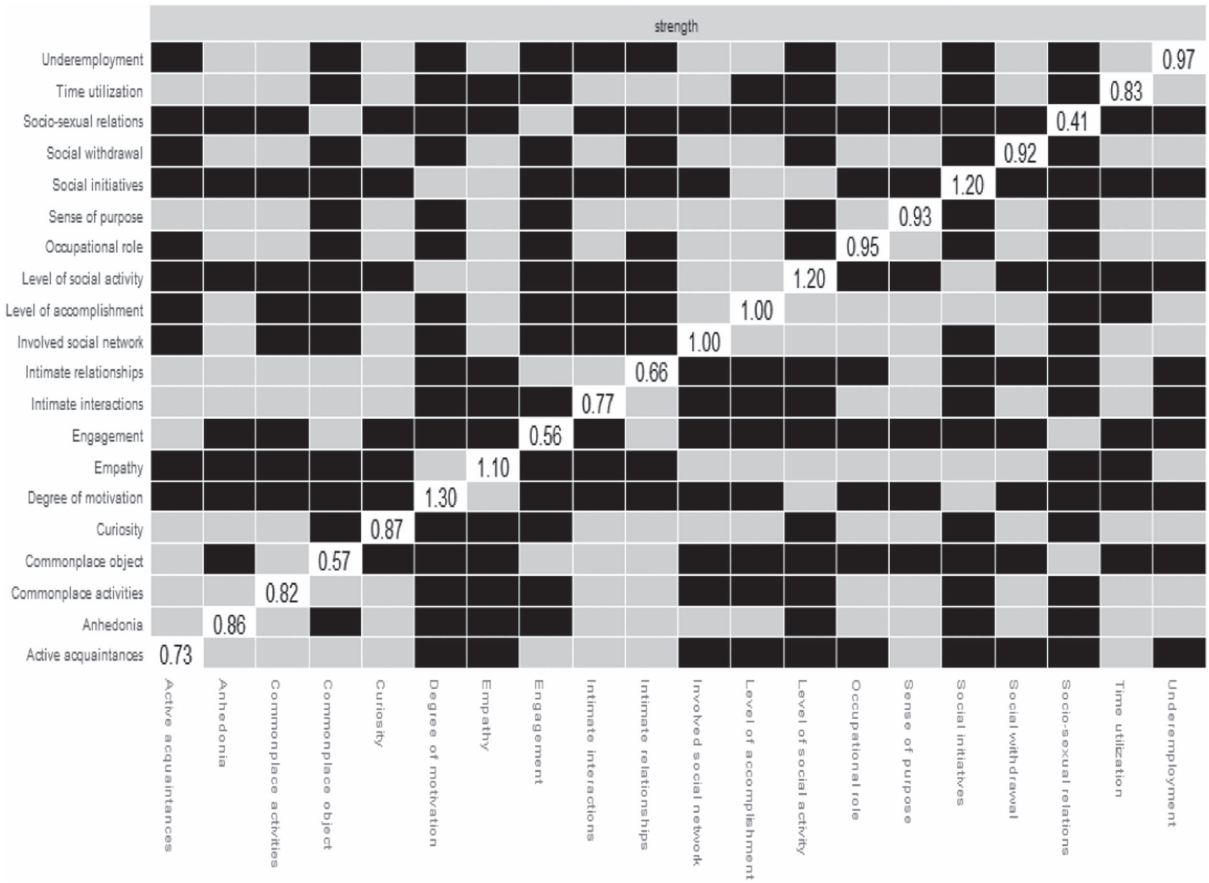


Figure 4

Strength Measures of Quality of Life Scale (QLS) Items



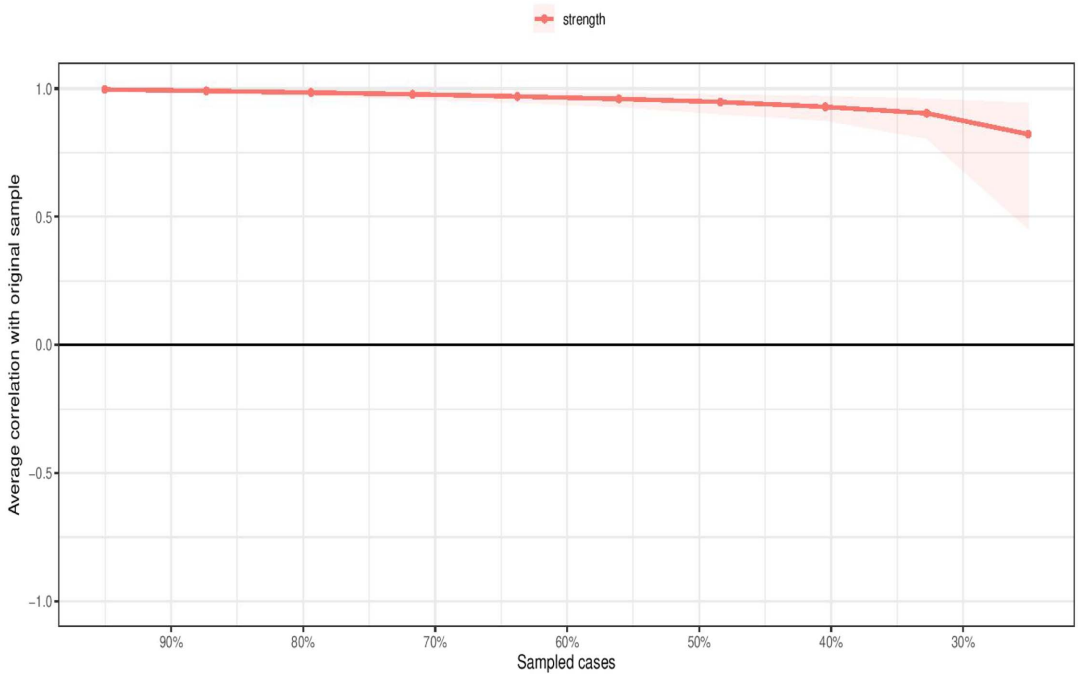
Note. Black boxes indicate significantly different values from other items. Gray boxes indicate nonsignificant differences.

Our second hypothesis, that the QLS total score would show evidence as an inappropriate measure of overall psychosocial functioning, was partially supported. Together, results from the network and bifactor analyses suggest that (a) motivation is the most central construct within the QLS and may be highly reflected in a total score and (b) a QLS total score, while possibly providing a broad overview of overall psychosocial functioning, may lack specificity and confound various functional domains. We further discuss our findings below and provide recommendations relating to appropriate use of the QLS in future research.

"Degree of Motivation" had the highest strength value in the network but did not differ significantly from "Level of social activity," "Social initiatives," and "Level of accomplishment." The high strength centrality of these nodes stems primarily from two strong edges. In the case of "Level of social activity" and "Social initiatives," there is a strong edge connecting them and to "Social withdrawal." "Level of accomplishment" was only connected to the other two nodes reflecting Instrumental functioning. "Degree of motivation" connected other Intrapsychic foundations nodes and bridged nodes from both Interpersonal functioning and Instrumental functioning—albeit to a lesser extent for Instrumental functioning. Network strength findings are in line with the QLS's original conceptualization and more recent work highlighting the importance and influence of negative symptoms, and more specifically motivation, on functional domains. In contrast, sociosexual relations had the lowest strength value in the network. While romantic relationships may improve symptoms of psychosis (Ajnakina et al., 2021), their effect on functional domains, including interpersonal and instrumental functioning, has yet to be thoroughly explored. Future work should aim to directly examine the potential effects romantic relationships have on various functional domains before drawing any conclusions.

Because strength values may be biased in that they may only reflect one strong edge, as was the case with "Level of accomplishment," we also examined closeness and betweenness. Although closeness and betweenness often yield unreliable metrics (Epskamp et al., 2018), they may still provide descriptive information regarding the overall centrality of the network. "Degree of motivation" had one of the highest betweenness and closeness values in the network, suggesting motivation may serve to connect nodes—a finding again consistent with the QLS's original conceptualization relating to Intrapsychic foundations as the building blocks of functioning. In other words, motivation may indirectly influence bridges between nodes. For example, when examining the network structure, "Degree of Motivation" may influence bridges between "Degree of accomplishment"

Figure 5
Network Strength Correlation Stability



Note. See the online article for the color version of this figure.

and "Degree of underemployment" and "Social initiative" and "Social withdrawal." Despite direct bridges between these items, motivation may still influence their association, such that higher levels of motivation may increase or decrease bridge (i.e., correlation) magnitude. Associations between motivation and functional domains were more prevalent for Interpersonal functioning compared to Instrumental functioning. This is consistent with prior studies showing cross-sectional associations between motivation and social functioning; however, prior longitudinal work suggests that motivation may play a larger role in occupational functioning compared to social functioning (e.g., Fulford et al., 2018). Therefore, motivation and items relating to interpersonal functioning may be confounded if measured cross-sectionally, but third variables, such as social skills, may play a larger role in interpersonal functioning over time than motivation. It should be noted that these interpretations of the QLS network model would be applicable to both the original and revised scale versions. Indeed,

Table 3
Standardized Factor Loadings of the Bifactor Model With Three Specific Factors of the QLS

QLS items	QLS total (general)	Interpersonal functioning (S1)	Instrumental functioning (S2)	Motivation (S3)
2. Intimate interactions	0.41	0.52		
3. Active acquaintances	0.48	0.34		
4. Level of social activity	0.51	0.67		
5. Involved social network	0.48	0.54		
6. Social initiatives	0.58	0.61		
7. Social withdrawal	0.59	0.52		
9. Extent of occupational role functioning	0.42		0.80	
10. Level of accomplishment	0.47		0.80	
11. Degree of underemployment	0.44		0.82	
13. Sense of purpose	0.67			0.17
14. Degree of motivation	0.85			0.03
15. Curiosity	0.60			0.25
17. Time utilization	0.71			−0.10
19. Commonplace activities	0.49			0.21
20. Capacity for empathy	0.53			0.57
21. Capacity for engagement	0.41			0.46

Note. QLS = Quality of Life Scale.

as "Degree of Motivation" was the most central item in both networks, motivation may influence either scale structure in similar patterns.

The confirmatory bifactor model results indicated adequate model fit; however, bifactor models tend to overfit data (Greene et al., 2019). Because of this, we also tested psychometric indices designed to test the reliability, dimensionality, and overall appropriateness of using a QLS total score. Results indicated that a QLS general factor may not reflect a latent variable representative of overall psychosocial functioning. While the general factor showed low unidimensionality, indicating that functional domains and items related to Intrapsychic foundations/Motivation may carry unique weight in a total score, it did show some evidence of reliability ($\omega H = 0.75$). This finding possibly suggests that a QLS total score, while lacking specificity, may reliably measure certain functional domains/items. ωHS for the specific factors indicated that Instrumental functioning explained a high amount of variance after accounting for the general factor, as 72% of the variance in that subscale was uniquely explained by those three items and not by the general factor. In contrast, only 10% of the variance in Motivation (i.e., Intrapsychic foundations) was explained by its specific factor and not the general factor. These results were further confirmed by *EVC_S* values, which showed that Instrumental functioning demonstrated unidimensionality as a subscale, while Motivation did not capture significant unique variance as a standalone subscale.

Together, results of our network and bifactor analyses suggest that the underlying data-generating mechanism of the QLS may best be described by a network model. Our bifactor modeling results, in turn, are useful summary statistics describing the variance components of the data. Hence, the network model may *explain* the data's variance/covariance structure, and the bifactor model may *describe* the structure (Kan et al., 2020). Therefore, because the general factor did not explain a high amount of variance in a total score after accounting for other subscales, along with "Degree of Motivation" being the most central item of the scale, a QLS total score may not equally reflect functional domains and confound functioning and motivation, leading to a questionable measure of overall psychosocial functioning. Despite this, a total QLS score may still have utility as a broad measure of functioning. Psychometric indices used in this study (e.g., omega indices), while helpful in describing aspects of a measure, reflect arbitrary cutoffs that may not speak to the overall utility of a measure. Indeed, a QLS total score, while failing to meet cutoffs of reliability and unidimensionality, does show convergence with other functional measures and is sensitive to change during intervention studies (e.g., Kane et al., 2016). As such, a QLS total score may be appropriate when researchers are simply attempting to gauge general levels of functioning and are not concerned with specific domains and the potential influence of other variables. If taking this approach, however, it is critical to understand that a QLS total score may lack specificity and potentially be misleading, as different functional domains may not be given equal weight, resulting in murky interpretation, and confounding with motivation. For example, a total score may represent different things for different people, with some scores being more a reflection of motivation/interpersonal functioning, while others may provide more information about instrumental functioning. As mentioned, this lack of specificity may be appropriate in certain contexts (e.g., for screening purposes), but we urge researchers to use caution, provide sufficient rationale, and be transparent regarding the use and potential limitations of a QLS total score.

Like our recommendations relating to a QLS total score, researchers should use caution when using subscales and individual items of the QLS. On the one hand, given the centrality of motivation within the network, functional subscales—mainly Interpersonal functioning— and items may be reflective of motivation and other Intrapsychic foundations items. On the other hand, Intrapsychic foundations items, such as "Degree of motivation," may not be a pure measure of motivation and instead provide indirect information concerning functional domains. This is critical given studies commonly use a single, or a reduced number, of items from the QLS as a predictor or outcome variable. For example, studies have begun using three Intrapsychic foundations/Motivation items ("Curiosity," "Degree of motivation," "Sense of purpose") as a measure of general motivation (Choi et al., 2014; Foussias et al., 2015; Luther et al., 2020). While capturing aspects of motivation, these items may also be capturing shared variance related to Interpersonal functioning and to a lesser degree Instrumental functioning. Caution and transparency are again needed if researchers choose to use specific items of the QLS.

Interestingly, Instrumental functioning items were highly correlated with each other but not with items from the Interpersonal functioning and Intrapsychic foundations subscales; including them in a QLS total score may have lowered its reliability and overall interpretability. Given high correlations between the items, relatively little variance may be lost if only one item is used to reflect Instrumental functioning. Future work should investigate the reliability and dimensionality of a model which omits one or two Instrumental functioning items. Such a model may prove to increase the QLS total score's psychometric properties and provide an appropriate, alternative total score.

This study's strengths are using complementary statistical methods, which elucidate both the underlying data-generating mechanism of the QLS and inform the scale's reliability and dimensionality. One limitation of the study is that the sample was comprised of individuals with first-episode psychosis, making it unclear how these results may translate to those not only with multiepisode schizophrenia, but also to those with different presentations of psychosis (e.g., those with affective psychosis). Despite this limitation, speculations can be made as to the generalizability of our findings to other psychosis populations. Functional impairment is common and persistent in schizophrenia spectrum disorders; however, the relationship between motivation and functioning may differ between first- and multiepisode populations. While our network model showed associations between motivation and both Interpersonal and Instrumental functioning, prior longitudinal work has shown that impaired motivation is associated with lower occupational functioning (Fervaha et al., 2015; Fulford et al., 2018; Mueser et al., 2001) but not social functioning (Fulford et al., 2018; Nakagami et al., 2010) over time. Future work is needed to compare prospective network models of the QLS to examine the extent to which results vary as a function of psychosis duration. Results may also differ based on illness course and symptom severity (Schlosser et al., 2014). Furthermore, the relationship between motivation and psychosocial functioning may differ between those with affective and nonaffective psychosis. For instance, impairment may stem from mood-related symptoms among people with a history of depression (Bowie et al., 2010). In such

cases, motivation may not be as central in a network model of the QLS compared to individuals with nonaffective psychosis.

Results of this study ultimately raise questions regarding the most appropriate and reliable way to assess functional domains in psychosis while accounting for motivation. As functional domains and motivation are highly confounded, researchers should control for motivation levels when assessing functioning, and creation of alternative functioning measures should be an urgent focus for future research. When using current functional measures, however, we encourage researchers to assess motivational negative symptoms and account for them in statistical analyses. One such scale that we recommend is the Clinical Assessment Interview for Negative Symptoms (Kring et al., 2013), as it provides an assessment of both expressive and experiential (i.e., motivational) negative symptoms. Although these results show that motivation is confounded with psychosocial functioning within the QLS, similar psychometric work is needed using other forms of functional assessments. Given the recent rise in popularity of methods such as behavioral tasks (e.g., Hanewald et al., 2017) and ecological momentary assessment (e.g., Granholm et al., 2020) to measure functional domains, it will be crucial for future research to appropriately account for the potential confounding role of motivation when using such methods.

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