Remote Cognitive Assessment in Severe Mental Illness: A Scoping Review

**Background:** A large majority of individuals diagnosed with a severe mental illness (e.g., schizophrenia) present cognitive deficits and biases in decision-making that negatively impact clinical trajectories and functioning. Within the context of the current pandemic, both clinicians and researchers must adapt traditional in-person assessment methods and psychological interventions for remote delivery, but there are a lack of guidelines and protocols for such an endeavor. To synthesize the current literature on the topic and facilitate the development of these guidelines, we are conducting a scoping review of remote cognitive assessment in severe mental illness.

**Objectives:** We are specifically interested in mapping current knowledge of remote cognitive assessment as it pertains to severe mental illness, identify potential barriers and facilitators of such assessments, and highlight current knowledge gaps in remote cognitive assessment for mental health.

**Eligibility criteria:** Articles were selected based on the following criteria: (a) peer-reviewed; (b) include individuals with a diagnosis involving severe mental illness (e.g., schizophrenia, bipolar disorder); and (c) report on remote or computerized assessment of cognitive capacity and/or cognitive biases.

**Sources of evidence:** Our literature search was conducting using the OVID (MEDLINE, PsycInfo, Health and Psychosocial Instruments, and EMBASE) and EBSCO (CINAHL) databases. Additionally, the grey literature was searched (e.g., PsycTESTS), experts in the field were contacted for unpublished findings, and reference lists of selected articles were examined for additional studies.

**Charting methods:** Data extraction is ongoing and is being performed according to predetermined variables, including study design, study population, remote measure parameters, and main findings. Extracted data will be synthesized and illustrated using the logic models methodology.

**Results:** Out of 24,515 retrieved articles, 53 were included in the scoping review. One unpublished article was retrieved from a collaborator and 3 more were identified through the reference list of selected articles. Thus, 57 articles were included in our scoping review. Inter-rater reliability between the independent reviewers was high at the start, midpoint, and end of article selection. We propose a draft logic model, categorizing cognitive measures into the 7 MATRICS consensus domains with the addition of a cognitive bias domain.

**Conclusions:** Our upcoming synthesis will include measure procedures (remote platform, materials, cost), measure reliability and validity, and facilitators/barriers of remote cognitive assessment. We will highlight avenues for future research on this topic and provide rapidly applicable recommendations for clinicians and researchers who wish to assess cognition remotely.
Introduction

Schizophrenia and related psychoses are arguably the most serious of all mental disorders, imposing an enormous burden on individuals, families, and communities.1,2 The course of these disorders commonly involves symptom recurrence and variable magnitudes of deterioration in social functioning3-6. With its onset typically occurring during adolescence or early adulthood, psychosis can seriously derail young people’s lives and interfere with important life transitions to higher education, employment, life-partnership, and parenthood. People with schizophrenia often present persistent positive symptoms (hallucinations, delusions), negative symptoms (flat affect, apathy), and affective symptoms (depression, anxiety). Moreover, a large majority of individuals also present cognitive impairments7 such as difficulties in verbal memory, executive functions and attention. Beyond this reduced cognitive capacity, psychosis also involves increased cognitive distortions, leading to biases, errors and misinterpretations in information processing8. These impairments affect the vast majority of people afflicted with schizophrenia9-12 and as such represent an important target of interventions. Both cognitive dimensions negatively impact clinical trajectories and functioning6,8. Hence, there is an important need to ameliorate overall cognitive health in schizophrenia as a means to improve outcome.

The last 25 years have witnessed significant, though often separate, advances in the development of psychological interventions targeting the inter-related dimensions of cognitive capacity (e.g., attention, memory, executive function) and cognitive biases (e.g., jumping to conclusions, evidence integration biases) in schizophrenia. Specifically, cognitive remediation therapy (CRT), has been shown across multiple trials to significantly improve cognitive capacity and functioning3,5,6,14. Meta-cognitive training (MCT), which selectively focuses on increasing insight into false beliefs by raising awareness of everyday thinking biases, has also been shown to significantly improve cognitive biases, in addition to psychotic symptoms, insight and self-esteem8,15. Both approaches aim to improve overall cognitive health, by cultivating cognitive capacity and framing distorted cognitions, respectively. Brain imaging evidence, including our own, suggests that such psychological interventions improve multiple measures of brain structure and function16,17,18,19. Despite substantial progress, there remains a significant research-to-practice gap limiting the implementation of interventions in real mental health settings.

Implementation of these interventions is made more difficult in the current context. Indeed, there are great concerns with regard to the effects of the COVID-19 pandemic on people with mental health disorders in Canada. The current situation with its numerous restricting measures (e.g. no non-essential visits to hospitals and care centres and limited travel) has caused a significant barrier (which adds to many others) in accessing psychological and social services. This in turn, increases the risk for relapse, ER visits, and hospitalizations for individuals diagnosed with mental health disorders. Several groups, including our own, are currently working on remote delivery of such interventions to combat these barriers during the COVID-19 pandemic and beyond. Effective remote assessment of cognition is crucial to these endeavours and as such, we are conducting a scoping review of the current literature on remote cognitive assessment in order to determine best practices in this field. Findings will benefit the larger community in Canada who are moving rapidly towards remote interventions for cognitive health with various populations.

Rationale

There is an urgent need for service delivery models that are effective while also being accessible, sustainable, and engaging. One promising approach is to leverage technology to improve access to psychological and social therapies. Several studies have demonstrated that individuals with psychosis are interested in and willing to use digital mental health services20. Moreover, our own preliminary results in this area indicate that these services are indeed feasible to implement21. A necessary condition to deliver such interventions is having a validated protocol for the remote assessment of these cognitive dimensions.
Although there have been several studies examining remote cognitive assessments with psychiatric, geriatric and neurological populations, there are many questions for which only a scoping review could provide satisfactory answers. We are specifically interested in mapping knowledge on remote cognitive assessment as it pertains to severe mental illness, identifying potential barriers and facilitators of such assessments, and highlighting current knowledge gaps in remote cognitive assessment for mental health. A scoping review is well indicated for such objectives.

Objectives

We are conducting a scoping review on remote cognitive assessment in severe mental illness following the recently published PRISMA extension for scoping reviews (PRISMA ScR). Our objectives are to:

1. Map current knowledge concerning remote cognitive assessment in severe mental illness including measures of both cognitive capacity and cognitive biases;
2. Identify barriers and facilitators of such remote assessments;
3. Explore current state of knowledge regarding remote cognitive assessments in neurological and geriatric populations and determine whether this literature can add to our scoping review;
4. Develop rapidly applicable recommendations for remote cognitive assessment in severe mental illness.

Methods

The protocol was registered on the Open Science Framework: https://osf.io/cbzq8 (Registration DOI: 10.17605/OSF.IO/CBZQ8). A comprehensive literature search was conducted using OVID (MEDLINE, PsycInfo, Health and Psychosocial Instruments, and EMBASE) and EBSCO (CINAHL) databases. The following keywords were used: (schizophreni* OR psychosis OR psychoses OR psychotic* OR severe mental illness) AND (cogniti* OR neuropsych* OR bias* OR reason*) AND (remote* OR online* OR mobile* OR digital*) AND (assessment OR evaluat* OR test* OR measure*). The search was limited to articles written in English or French. Additionally, the grey literature was searched (e.g., PsycTESTS), experts in the field were contacted for unpublished findings, and reference lists of selected articles were examined for additional studies.

Articles retrieved from the OVID and EBSCO databases were combined in Endnote software and a first pass of duplicates was excluded automatically by comparing Author, Year, Title, and Journal fields. Duplicates based on smaller combinations of these fields were produced and checked manually. The remaining articles were exported to Excel and randomized for screening.

Titles and abstracts of the retrieved articles were screened by five independent reviewers based on the following eligibility criteria (a) peer-reviewed articles; (b) include individuals with a diagnosis involving severe mental illness (e.g., schizophrenia, bipolar disorder); and (c) report on remote assessment of cognitive capacity and/or cognitive biases. Due to the urgent nature of this knowledge synthesis, we assigned five reviewers to screen approximately one-fifth of the total number of articles following duplicate removal. To establish inter-rater reliability (IRR), a sample of 100 articles was screened by all reviewers at three timepoints (start, midpoint, end) during article selection. Following each IRR timepoint, raters met virtually to produce a consensus for inconsistent ratings. Intra-rater reliability was assessed to examine within-rater differences in rating agreement to consensus across IRR timepoints. At mid- and endpoint, questionable articles were included or excluded by consensus decision. Full texts of the selected articles were then retrieved and reviewed.
Data Charting Process

The findings compiled in the scoping review described above will be synthesized and illustrated using the logic models methodology. Several authors have used the logic models methodology to synthesize their systematic review findings (e.g., 32, 33). This method is flexible and allows one to explicitly illustrate the links and mechanisms of action between categories of findings 34, 35. Further, our team will follow the good research practice guidelines for logic models, developed by the W.K. Kellogg Foundation Team 36.

Data Items

Data extraction is ongoing and is being performed according to predetermined variables as follows: study aim(s), country, design type, setting, sample size, age, sex and gender ratio, study population, psychiatric diagnosis, remote platform used, remote/traditional measure(s) used, measure version/developer/publisher/language, measure duration, alternate forms available, material required by participant, inclusion of norms or clinical cut-offs, main findings, group means, validity, reliability, sensitivity/specificity, facilitators/barriers described, future directions listed.

Sex/Gender Considerations

Sex is a well-established risk factor for schizophrenia and a predictor of outcome. Our recent work has identified important sex differences on cognitive capacity in psychosis. This includes a recent large study (n=336) on insight (Penney et al., in press) and another (n=435) on verbal memory and functioning (Buck et al., In press). This review will examine whether sex differences are also observed in remote assessment of cognitive capacity and cognitive biases as well as whether the use of technology for remote assessment presents sex differences. We will also examine whether gender defined as a socio-cultural factor influences cognitive assessment, but we anticipate less data on this in this specialized literature. If that is the case, we will raise awareness on the need for researchers to examine this question more carefully.

Results

Article Selection

The flowchart for article selection is displayed in Figure 1. Overall, 24,515 references were identified through our database search and one additional record was identified through other sources (unpublished data). After removal of 1,760 duplicate records, titles and abstracts of 22,756 articles were randomly divided to be screened by five reviewers. Of these, 58 articles were flagged as relevant for data extraction, which is currently ongoing. To date, 7 articles were excluded at the full-text stage due to not meeting the peer-review criterion. Three additional articles have so far been identified through searching the reference lists of included articles. Thus, 54 articles are currently eligible for our scoping review.
Inter-Rater Reliability

Given that five independent raters were involved in article selection, inter-rater reliability (IRR) was assessed with a random sample of 100 articles at the start, mid-point, and end of this process as recommended by recent research\(^31\). In order to avoid biased statistics in cases where ratings are unevenly distributed (i.e., the kappa paradoxes), we opted to use Gwet’s AC\(_1\) statistic\(^37\) via the R AgreeStat package.

Inter-rater reliability was high at all three timepoints and increased over time (Table 1, Figure 2). The percentage of conflicting ratings between two or more raters was also low and decreased over time (IRR\(_1\) = 10%, IRR\(_2\) = 6%, IRR\(_3\) = 4%). Table 2 also displays the distribution of disagreements (initial rating compared to final consensus) per rater over the three IRRs, showing that the majority of disagreements were between few raters and that disagreements decreased or remained stable over time.
Table 1. Inter-rater reliability (IRR) at three timepoints during article selection.

<table>
<thead>
<tr>
<th>IRR</th>
<th>Gwet’s AC1</th>
<th>SE</th>
<th>95% CI</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRR1</td>
<td>0.95</td>
<td>0.02</td>
<td>[0.92 – 0.98]</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>IRR2</td>
<td>0.97</td>
<td>0.01</td>
<td>[0.94 – 1.00]</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>IRR3</td>
<td>0.98</td>
<td>0.01</td>
<td>[0.96 – 1.00]</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Note. SE = standard error; CI = confidence interval.

Table 2. Conflicting articles between initial rating and consensus by rater at each reliability timepoint.

<table>
<thead>
<tr>
<th></th>
<th>IRR1 (n = 10)</th>
<th>IRR2 (n = 6)</th>
<th>IRR3 (n = 4)</th>
</tr>
</thead>
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<tr>
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</tr>
<tr>
<td>Rater B</td>
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<td>1.0</td>
</tr>
<tr>
<td>Rater C</td>
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<td>4.0</td>
</tr>
<tr>
<td>Rater D</td>
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<td>1.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Rater E</td>
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<td>3.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Draft Logic Model

Based on our preliminary overview of the articles selected and the data extraction process, we designed a draft logic model (Figure 3). The centre of our model highlights the currently available remote cognitive assessment measures in severe mental illness and current procedures of assessment (platform, materials, etc). Measures will be categorized by the MATRICS consensus domains with the addition of a cognitive bias domain. Measures will be classified on whether they were tested in lab, remotely, or both. Measure quality will be assessed as depicted in the upper circles (reliability, sensitivity/specificity, concurrent/predictive validity). The lower circles will depict general categories of facilitators and barriers to remote cognitive assessment. We will also report on proposed improvements and avenues for future research as well as provide clear, easily implemented recommendations for remote cognitive assessment in severe mental illness.
Figure 3. Draft logic model.
References


