Autobiographical Memory Retrieval in Schizophrenia and its Association with Symptom Severity

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Abstract

Background

There is emerging evidence that people with schizophrenia spectrum disorders may recall personal experiences in an over-general manner. However, it remains unclear how autobiographical memory recall relates to schizophrenia symptoms and whether recall differs as a function of the valence of the words used to cue them.

Method

Adults with schizophrenia spectrum disorders (n= 45) were compared against age- and gender-matched healthy individuals (n= 45) on specificity and detailedness of autobiographical memories using the Autobiographical Memory Test. Patients were assessed on general intelligence, schizophrenia symptoms and depressive symptoms.

Results

People with schizophrenia spectrum disorders recalled less detailed memories than controls regardless of cue valence. There was no group difference in specificity of memories. Within patients, severity of negative symptoms was negatively correlated with specificity of positive memories.

Conclusions

While episodic detailedness differentiated patients from controls, specificity of autobiographical memories is more closely related to severity of schizophrenia symptoms.

Keywords:

Autobiographical memory test; psychosis; depression; specificity; over-general memory; detailedness

General Audience Summary:

Schizophrenia is a severe mental health problem with important consequences for sufferers and their loved ones. Understanding the psychological mechanisms that contribute to schizophrenia is important for helping us to improve treatments.

Autobiographical memories are our memories for past personally experienced events. People with a range of mental health problems – including depression and post-traumatic stress disorder – tend to recall autobiographical memories that, instead of referring to detail-rich (who, what, where) time-limited events from their past (*When I was hanging out with my friends last week*), refer to detail-poor events that occur over long periods of time (*When I was at university*) or which have repeated many times (*When I walk my dog*). We refer to this as *over-general* or *non-specific* autobiographical memory and this contributes to a worsening of their mental health over time. However, whether people with schizophrenia show a similar pattern of autobiographical memory, how this relates to their symptoms, and whether it might be better explained by the depression that is common within schizophrenia, are questions yet to be fully addressed.

This study compared 45 adults with schizophrenia and 45 adults without any mental health problems. Participants were asked to recall ten memories of events from their past and we measured whether these events referred to specific events, how much detail they included and whether they referred to positive or negative events. As we expected, people with schizophrenia reported less detail in their autobiographical memories than healthy people. The two groups did not differ in terms of how many specific memories they recalled, but more severe schizophrenia symptoms were associated with worse memory for specific positive events from the past. Training that helps people with schizophrenia to recall the detail of events from their past could be beneficial.

Autobiographical memory retrieval in schizophrenia and its association with symptom severity

Introduction

Autobiographical memory refers to recall of events that one has personally experienced in the past. The specificity (vs. generality) of an autobiographical memory is commonly assessed using the Autobiographical Memory Test (AMT; Williams & Broadbent, 1986), where participants are prompted to recall past personally experienced events in response to a series of positive and negative cue words. As reviewed by Barry et al. (2021), people with psychiatric diagnoses tend to recall fewer specific memories (i.e., memories for discrete events that occurred on a particular day, within 24 hours) and more general memories (i.e. memories for events that occur many times or over extended periods of time) than diagnoses-free individuals. This phenomenon of overgeneral (or less specific) autobiographical memory is most marked in major depressive disorder (reviews by Liu et al., 2013; van Vreeswijk & de Wilde, 2004; Weiss-Cowie et al, 2023) and post-traumatic stress disorder (Moore & Zoellner, 2007; Ono et al., 2016; Piltan et al., 2021), whereas evidence also exists for borderline personality disorder (Beran et al., 2019) and anxiety disorders (e.g. Moscovitch et al., 2018). In the depression and post-traumatic stress disorder studies, overgeneral autobiographical memory has also been associated with symptom severity (Liu et al, 2013; van Vreeswjik & de Wilde, 2004) and is predictive of future episodes (Hallford et al., 2022; Kleim & Ehlers, 2008; Sumner et al., 2010). Recent years have seen an increase in attention to understanding autobiographical memory within schizophrenia, and yet gaps remain in our understanding of the contribution of autobiographical memory to schizophrenia.

Schizophrenia is a mental health problem that is characterised by positive symptoms (such as hallucinations and delusions), negative symptoms (such as flat affect), and disorganised speech and behaviour. As one of several Schizophrenia Spectrum Disorders (‘SSD’, such as delusional disorder and schizophreniform disorder, etc.), schizophrenia affects approximately 1% of the population and constitutes one of the leading causes of disease burden globally. Understanding the psychological mechanisms that contribute to schizophrenia and other SSDs is important for identifying targets for intervention. Three reviews in this area have converged on the finding that people with schizophrenia recall fewer specific memories than diagnoses-free people (Berna et al., 2016; Ricarte et al., 2017; Zhang et al., 2019), with a large effect size of *d* = 0.97 (Berna et al., 2016).

Our understanding of the problems with autobiographical memory that exist within schizophrenia remains incomplete, however. Firstly, the association between autobiographical memory retrieval and specific schizophrenia symptoms remains unclear. While there is emerging evidence that episodic memory and autobiographical memory may be uniquely associated with the negative symptoms of schizophrenia (Harrison & Fowler, 2004; Herold et al., 2022; Pillny et al., 2022), associations with positive symptoms have yielded contradictory evidence (Berna et al., 2016; Blairy et al., 2008; D’Argembeau et al., 2008; Neumann et al., 2007; Vorontsova et al., 2013), and, to our knowledge, associations with disorganised symptoms have not yet been tested. In view of symptom heterogeneity within schizophrenia, the specific association between autobiographical memory and various schizophrenia symptoms needs to be clarified.

Secondly, meta-analyses have established that people with depression have difficulty recalling specific autobiographical memories in response to both positive and negative emotional cues (Barry et al., 2021) despite some evidence that there may be valence-related impairments in depression (Young et al., 2014) and in schizophrenia (Barry et al., 2019a). Given high rates of comorbidity between depression and schizophrenia (Etchecopar-Etchart et al., 2021), it is important to establish that any association between autobiographical memory and schizophrenia is independent of depressive symptoms. There is mixed evidence in this respect (Barry et al., 2019a; Iqbal et al., 2004). One reason for this may be the use of the Beck Depression Inventory in previous studies, which may not adequately capture depressive symptoms within psychosis (Kim et al., 2006). In addition, although Barry et al. (2019a) reported that patients with chronic schizophrenia had particular difficulty recalling specific autobiographical memories in response to negative cue words, Herold et al. (2022) did not replicate this valence effect. There is therefore a need for further examinations into the roles of depression and of memory valence within autobiographical memory in schizophrenia.

Thirdly, there have been recent calls for a move beyond measurement of specificity alone to a broader consideration of episodic detailedness (Barry et al., 2023). More specific and detailed autobiographical memory recall has been associated with less severe depressive symptoms (Hallford et al., 2020a), and specificity and detailedness are positively correlated and yet independent (Hallford et al., 2020a; Kyung et al., 2016; Lam et al., 2022; Roberts et al., 2021). Therefore, it is important to report both specificity and detailedness so as to delineate whether certain effects are attributable to specificity, detail, or both. Moscovitch et al. (2018) reported that individuals with social anxiety disorder had less specific but more detailed autobiographical memories than healthy controls when those memories concerned aversive events. Findings of episodic detailedness in schizophrenia are scarce and inconsistent. Berna et al. (2016) synthesised the findings from nine studies, reporting a large effect size of *d* = 1.40 for reduced detailedness in patients with schizophrenia compared with diagnosis-free people. On the contrary, newer studies such as Herold et al. (2022) reported no group difference in episodic detailedness. Investigation of the association between episodic detailedness and schizophrenia symptoms is needed.

This study aimed to address each of these limitations and inconsistencies. In particular, we examine: (i) How do the specificity and detailed of autobiographical memories compare between people with SSD and healthy individuals without SSD? (ii) How does retrieval of autobiographical memories relate to the severity of schizophrenia symptoms among patients? (iii) Are there valence-specific impairments in autobiographical memory among people with schizophrenia?; and, (iv) whether any observed effects within the people with SSD persist even after accounting for depression symptoms. We expect that, compared to diagnoses-free individuals, patients with SSD will recall fewer specific memories and have lower episodic detailedness. Also, within the SSD group, there will be fewer specific memories in response to negative cue words than positive cue words. Finally, within the SSD group, we expect that the number of specific memories and the detailedness of memory will be negatively correlated with the severity of schizophrenia symptoms (especially negative symptoms) even when accounting for individual differences in depression symptom severity.

Methods

This study’s design has been pre-registered along with an analysis plan for the research as follows: <https://osf.io/tf7cs>. The study was approved by the Institutional Research Boards (IRB) of the first author’s university (reference numbers: CREC 2020.008, SBRE-23-0037). The study was conducted in compliance with the IRB, the Declaration of Helsinki, the ICH-GCP guidelines, and the APA ethical standards in the treatment of our sample. Written informed consent was obtained from all participants. The R script for data analysis has been made public at https://osf.io/dygh5/?view\_only=c30f77d944c84c17a0c1322383471d0f.

Participants

The sample consisted of two groups of adults (age 18-65) with Cantonese Chinese as their first language. The clinical group consisted of individuals who had a diagnosis of any schizophrenia spectrum disorder (SSD). In order to minimize complications by cognitive decline typically seen in chronic patients, only patients with early-stage SSD (i.e. with onset within the last 10 years) were recruited. Exclusion criteria were a primary diagnosis of substance dependence or intellectual disability. The control group consisted of healthy individuals who declared an absence of any past or present psychiatric disorders, which was further confirmed by the Chinese version of the Structured Clinical Interview for the DSM-IV (CB-SCID-I/P; So et al, 2003). Patients were recruited via their care teams from outpatient psychiatric services and day hospitals within the Hong Kong West Cluster and New Territories East Cluster of the Hong Kong Hospital Authority. Healthy controls (HC) were recruited from the general community via university mass emails, poster advertisements, and snowballing referrals.

Previous meta-analyses have estimated the between-group effect size between individuals with psychosis and healthy controls to be medium to large (*g* = -0.982 for specific memory, Barry et al. (2021); *d* = 1.40 for detailedness, Berna et al. (2016)). Using a conservative estimate of 0.60 (corresponding to f = 0.30), G\*Power suggests a sample size of 90 for alpha of 0.05 and power of 0.90 with a mixed ANOVA design (see ‘Statistical Analysis’ below). Within each group, a sample size of 45 could detect medium-to-large correlations (i.e., *r* = 0.40) with 80% power.

Measures

*Clinical assessment*

Psychiatric diagnosis status was first informed by medical record review, which was provided by treating psychiatrists, and then individually determined by the CB-SCID-I/P (So et al., 2003). Level of depression was assessed on the Calgary Depression Scale for Schizophrenia (CDSS; Addington et al., 1990). Each of the nine items is rated on a 4-point Likert scale (from 0 to 3). High internal consistency of the CDSS was reported in a Chinese sample (Xiao et al., 2009). The internal consistency of CDSS was excellent in our sample (ω = 0.91). Severity of schizophrenia symptoms was assessed using the Positive and Negative Syndrome Scale (PANSS; Kay et al., 1987). According to Emsley et al. (2003), the PANSS items can be divided into five factors: positive, negative, disorganised, depression/anxiety, and excitement. In order to avoid overlap with affective symptoms measured by the CDSS, the current analysis in relation to specific schizophrenia symptoms would focus on the first three factor scores only. The internal consistencies of these variables were good in this sample (ω = 0.89 (total), 0.85 (positive), 0.90 (negative), and 0.79 (disorganised)). These clinical ratings and diagnostic interviews were administered by graduate-level psychologists trained and supervised by a clinical psychologist (SHS) and a psychiatrist (SSC), both with more than 20 years of clinical experience. Regular meetings were held between the interviewers and the clinicians to ensure quality of symptom ratings and diagnostic assessment.

*Intellectual assessment*

As a recruitment screening measure, intellectual ability was determined by using the short form of the Wechsler Adult Intelligence Scale - Version IV Hong Kong (WAIS-IV[HK]; Wechsler, 2014) for the SSD group only. Patients who had an estimated IQ score below 70 were screened out from the study.

*Autobiographical Memory Test (AMT, Williams & Broadbent, 1986)*

In this study, ten words that represented various emotions were used as autobiographical memory recall cues. These cue words were drawn from Debeer et al. (2014), Barry et al. (2019a, 2021) and Hallford (2020a) and were further translated into Chinese. The five positively valenced cues referred to ‘capable’, ‘success’, ‘surprised’, ‘satisfied’, and ‘confident’; the five negatively valenced cues referred to ‘alone’, ‘desperate’, ‘jealous’, ‘ashamed’, and ‘failed’. The positive and negative words were presented alternately, one at a time, to elicit recall of ten personal memories in total. All participants were presented with the same set of cue words in a fixed order.

Following Debeer et al. (2014) and Mediavilla et al. (2021), participants were prompted to verbally recall a personal memory (in Cantonese Chinese) within 60 seconds, without specifying the requirement to recall a specific memory. If the memory they recalled fell into one of the following categories, they were asked to recall another memory: (i) occurred within the past seven days, (ii) was a memory that had already been mentioned earlier within the same task, (iii) was unrelated to themselves or the cue valence.

Following Hallford et al. (2020a) and Lam et al. (2022), specificity of responses was coded as follows: A ‘specific memory’ pertains to a discrete event that occurred on a particular day, within 24 hours. An ‘extended memory’ pertains to an event that lasted longer than a day. A ‘categoric memory’ pertains to repeated events or a memory that summarised similar events. An ‘associate memory’ pertains to nouns or hypothetical thoughts given as associations to the cue word but are not past events. ‘Omission’ was coded if no relevant response was provided. Frequency counts for each type of response were recorded separately for positive and negative memories, although the current hypotheses concerned specific memories only. Detailedness was coded separately for internal details and external details (Kyung et al., 2016). Internal details refer to those directly related to the described event, including time, place, perception and sensation, thought and emotion. External details refer to semantic information (e.g., factual knowledge), repetition of details or multiple events given, and metacognitive statements or editorialising (e.g., elaboration and self-reflection). The number of internal and external details from all responses were reported for positive and negative memories respectively.

Responses were coded by two graduate-level psychologists trained by the joint-first authors. The coders were blind to the clinical status of the participants. A training protocol was developed by referencing previous studies (e.g., Hallford et al., 2020; Lam et al., 2022) and our previous experience in this area. Both coders were trained to code Chinese responses in the AMT using scripts from a separate pilot sample of 400 memories. At each training phase, both coders independently coded 50 responses and then had their ratings cross-checked. Disagreements were resolved through discussion with the joint-first authors. The training phase was repeated until the coders reached 90% convergence on both specificity and detailedness ratings. At the actual rating phase, each coder performed independent ratings for half of the study participants’ responses on specificity and detailedness respectively. Ten percent (90 memories) of the actual study data were randomly selected for second coding by the other coder. The two coders achieved a concordance rate of 90.0% for specificity and 99.0% for detailedness.

Procedure

The study procedure took place at a quiet laboratory at the first author’s university. Upon written informed consent, each participant was interviewed for the clinical ratings (and intellectual assessment for SSD), followed by two practice trials of the AMT and then the main AMT. Small breaks were arranged if needed. Participants were remunerated (HKD100 per hour of participation) for their time.

Statistical analysis

Analyses in relation to memory specificity were conducted according to the pre-registered plan. Analyses concerning detailedness of memories were developed after the initial stages of the project and were not pre-registered and so should be considered exploratory. Effects of group and cue valence on the number of specific memories were tested with mixed ANOVA, with group (i.e., SSD vs. HC) as between-subject factor and cue valence (i.e., positive vs. negative) as within-subject factor. Effects of PANSS factors on the number of specific memories for positive and negative words were tested by regression analyses, within the SSD group, without and then with CDSS score as covariates. As exploratory analyses, the above procedure was repeated for internal and external detailedness instead of specificity of memories.

Results

Sample characteristics

No SSD individuals were excluded from analysis. Four participants were excluded from the HC group as they were screened to have past/current psychiatric diagnoses. As shown in Table 1, the two groups in the final sample (n = 45 each) were matched on age and gender (*ps* > .050). The SSD group had lower family income and education level than the HC group (*ps* < .001). Within the SSD group, the average clinical rating scores were as follows: PANSS total (M = 45.22, SD = 12.43), PANSS positive (M = 12.27, SD = 5.54), PANSS negative (M = 12.20, SD = 4.58), PANSS disorganised (M = 9.09, SD = 2.54), and CDSS (M = 3.24, SD = 3.94). The average total score of PANSS corresponds to “mildly ill” in the Clinical Global Impressions (Leucht et al., 2005), and the average total score of CDSS was below the cut-off score of 5 for the presence of a major depressive episode (Xiao et al., 2009). The mean estimated IQ was 92.93 (SD = 10.05).

[Insert Table 1 here]

Specificity of autobiographical memories

The number of specific memories retrieved following positive cues were as follows: SSD = 2.51 (SD = 1.25); HC = 2.09 (SD = 1.40). The number of specific memories retrieved following negative cues were as follows: SSD = 1.76 (SD = 1.32); HC = 1.64 (SD = 1.23). Mixed ANOVA revealed no group x cue valence interaction effects on the number of specific memories (F(1, 88) = 0.79, *p* = .244, ηp2 = 0.02, 95% CI [0.00, 1.00]). There was no significant main effect of group on the number of specific autobiographical memories (F(1, 88) = 2.59, *p* = .269, ηp2 = 0.01). Within the SSD group, there were fewer specific memories for negative cue words than positive cue words (t(88) = -4.03, *p* <.001, *d* = -0.58, 95% CI [-0.90, -0.28]).

The correlations between the number of specific memories and symptoms are shown in Table 2. Within the SSD group, the number of specific memories retrieved following positive cues was associated with PANSS negative symptom score (B = -0.09, *p* = .023, 𝛽 = -0.34, 95% CI [-0.63, -0.05]). This association remained significant after controlling for CDSS total score (B = -0.11, *p* = .015, 𝛽 = -0.38, 95% CI [-0.69, -0.08]). There were no significant associations between the number of specific memories retrieved following negative cues and any of the symptom variables (*ps* > .050).

[Insert Table 2 here]

Detailedness of autobiographical memories

Number of internal details in positive memories are as follows: SSD = 11.3 (SD = 2.68); HC = 13.6 (SD = 3.70). Number of internal details in negative memories are as follows: SSD = 10.70 (SD = 3.59); HC = 12.60 (SD = 3.63). Number of external details in positive memories are as follows: SSD = 0.84 (SD = 0.95); HC = 4.82 (SD = 2.90). Number of external details in negative memories are as follows: SSD = 0.73 (SD = 1.32); HC = 4.76 (SD = 2.34).

Mixed ANOVA revealed no group x cue valence interaction effects on internal (F(1, 88) = 3.74, *p* = .378, ηp2 = 0.01) or external details (F(1, 88) = 6.66, *p* = .546, ηp2 = 0.00). There were significant main effects of group on both internal (F(1, 88) = 10.27, *p* < .001, ηp2 = 0.10, 95% CI [0.03, 1.00]) and external details (F(1, 88) = 101.54, *p* < .001, ηp2 = 0.54, 95% CI [0.42, 1.00]), where the SSD group recalled fewer internal and external details than the HC group.

As shown in Table 2, within the SSD group, there were no significant correlations between detailedness of positive or negative memories and PANSS total or factor scores, for both internal and external details (*ps* > .050).

Discussion

This study compared autobiographical memory recall between patients with early-stage schizophrenia spectrum disorder and age- and gender-matched healthy individuals. Autobiographical memories were individually elicited by positively- and negatively-valenced cue words. Responses were coded by trained coders, who achieved very high inter-rater reliabilities on both specificity and detailedness.

We found no significant group difference in specificity for both positive and negative autobiographical memories. One possible explanation for this unexpected finding is the relatively short duration of illness of our patient sample (3.5 years) compared to previous studies (e.g., >15 years in Barry et al., 2018, 2019b; Neumann et al., 2007). The PANSS scores of our patients were also on the low side compared with previous studies. Although it was our intention to include patients within ten years of their psychotic onset only so as to avoid complications (such as cognitive decline) from chronic patients, this recruitment criterion may have resulted in a clinically stable sample with rather narrow variability in clinical profile and AMT performance. Besides, we instructed participants to retrieve one more memory if their initial response was not related to the cue valence. This extra step might have benefited patients more than controls, leading to reduced group difference which might have otherwise been present. Our result may also suggest that given a bit more guidance, people with SSD can retrieve memories with higher specificity than expected.

We measured detailedness alongside specificity for a more comprehensive representation of AMT performance. Consistent with previous studies (reviewed by Berna et al., 2016), we found that patients with SSD recalled autobiographical memories with fewer internal and external details than healthy individuals. Our large effect sizes are comparable to previous studies that consisted of more chronic patient samples (*d* = -1.19 for negative cues and *d* = -1.33 for positive cues). This extends the current literature by suggesting that reduced detailedness of autobiographical memories is evident in schizophrenia even in the absence of reduced autobiographical memory specificity. Future research may consider examining detailedness of autobiographical memories in at-risk and first-episode samples to further elucidate the potential role of this construct in the development and maintenance of the disorder. Taken together with the specificity results, these findings further indicate that episodic specificity and detailedness may be related but independent constructs that are differentially associated with psychopathology (Hallford et al., 2020a; Kyung et al., 2016; Lam et al., 2022; Roberts et al., 2021).

Regression analyses revealed that patients with more severe schizophrenia symptoms (especially on the negative dimension) reported fewer specific autobiographical memories when cued by positive words, even after the effect of depression was accounted for. As reported by Ricarte et al. (2012, 2014), the training effect on improvement in memory specificity is not via change in depression. Our finding adds to Harrison and Fowler (2004), where a lack of positive autobiographical memory specificity was associated with negative symptoms such as amotivation, and Edwards et al. (2020), where an intervention targeting positive autobiographical memory specificity led to improvement in motivation for patients with psychosis. Therefore, the association between memory specificity and negative symptoms (such as reduced experience of pleasure, decreased motivation, and increased tendencies to withdraw) is above and beyond the potential effect of depressive symptoms. Putting together the key findings in this study, the group difference in autobiographical memory retrieval lies in episodic detailedness rather than specificity of content, whereas the latter is more related to severity of schizophrenia symptoms. These findings revealed that reduced specificity may not be the most suitable or sole target for intervention (e.g., Memory Specificity Training; Barry et al, 2019b; Blairy et al., 2008) for schizophrenia; rather, training that focuses on improving details of recall may be more helpful.

Regarding the cue valence effect on autobiographical memory retrieval, we found that group comparisons on either specificity or detailedness did not differ between positive and negative cue words. Although this contradicts previous studies among people with schizophrenia (Barry et al., 2019a; Kaney et al., 1999; Neumann et al., 2007), meta-analyses indicate that there is little evidence, across psychiatric populations, for valence-related effects (Barry et al., 2021). It is also possible that the features of the AMT used here affected our ability to examine valence effects. For example, we gave participants specific instructions to retrieve a memory that is valence-congruent with the cue. Also, cues were presented in a fixed order to participants. More studies are needed to establish how differences in cuing methodology might differentially impact the valence of autobiographical memories that are retrieved in schizophrenia.

This study has several limitations. Firstly, the patient group was relatively mild in symptoms, potentially limiting the generalisability of our findings to a wider range of patients. Secondly, diagnoses were first based on medical notes and then confirmed by a structured clinical interview delivered by graduate-level psychologists. Although these junior staff members may not be expected to have the same level of expertise as qualified clinicians, the interviewers were for confirmatory purposes given that participants were already in attendance at a clinic for their SSD and, nevertheless, interviewers were specifically trained for this procedure and received regular supervision by experienced clinicians. Thirdly, the modest sample size of our patient group may have compromised the statistical power to detect effects smaller than those assumed in our a priori power analysis. In addition, they prevent us from examining the contribution of possible confounders within our analyses despite group differences in these variables (e.g., family income, education). As in most schizophrenia samples, our patients had lower family income and education level than diagnoses-free people (Hakulinen et al., 2019; Herold et al., 2022). Nevertheless, future studies with larger samples should take a full accounting of possible confounders either through participant matching or statistical control. Lastly, the cross-sectional design of this study has restricted our understanding of directionality of association and temporal changes. Future research in this area may consider including a more heterogeneous and representative clinical sample of schizophrenia, using various autobiographical memory assessment methods such as memory flexibility (Dritschel et al., 2014; Hitchcock et al., 2019; Piltan et al, 2021), and testing these over multiple time points.

In conclusion, this study revealed reduced detailedness in patients with schizophrenia spectrum disorders when recalling autobiographical memories. Regardless of their level of depression, patients with more severe schizophrenia symptoms tended to have greater difficulty in recalling autobiographical experiences in a specific manner, especially for negative memories.

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Table 1

*Sample characteristics*

|  |  |  |  |
| --- | --- | --- | --- |
|  | SSD (*n* = 45) | HC (*n* = 45) | Group Comparisons |
| Gender  Female (%)  Male (%) | 22 (48.9%)  23 (51.1%) | 22 (48.9%)  23 (51.1%) | χ2(1) = 0.00, *p* = 1.000 |
| Age, years: mean (*SD*) | 33.65 (12.69) | 33.93 (12.51) | t(88) = -0.11, *p* = .916 |
| Education Category (%)  Primary  Low Secondary  High Secondary  High Diploma/ Associate Degree  Bachelor  Master or above | 1 (2.2%)  8 (17.8%)  18 (40.0%)  13 (28.9%)  5 (11.1%)  0 (0.0%) | 0 (0.0%)  2 (4.4%)  1 (2.2%)  6 (13.3%)  21 (46.7%)  15 (33.3%) | χ2(5) = 47.24, *p* < .001 |
| Family Income (HKD)  <$4000  $4000-$10000  $10000-$19999  $20000-$29999  $30000-$50000  >$50000 | 6 (14.3%)  5 (11.9%)  12 (28.6%)  9 (21.4%)  5 (11.9%)  5 (11.9%) | 0 (0.0%)  0 (0.0%)  3 (6.7%)  9 (20.0%)  18(40.0%)  15 (33.3%) | χ2(5) = 28.68, *p* < .001 |
| Diagnosis:  Schizophrenia  Schizophreniform disorder  Delusional disorder  Schizoaffective disorder  Psychotic disorder NOS | 24  10  9  1  1 |  |  |
| Duration of illness (months) | 43.36 (38.54) |  |  |

Table 2

Correlation between AMT indices and symptom ratings in the SSD group (n = 45)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| r [95% CI] (p-value) | Specificity (positive) | Specificity (negative) | Internal details (positive) | Internal details (negative) | External details (positive) | External details (negative) |
| Specificity (positive) | / |  |  |  |  |  |
| Specificity (negative) | 0.55 [0.30,0.72] (<.001) | / |  |  |  |  |
| Internal details (positive) | 0.60 [0.37,0.76] (<.001) | 0.59 [0.36,0.75] (<.001) | / |  |  |  |
| Internal details (negative) | 0.20 [-0.10,0.46] (.194) | 0.54 [0.29,0.72] (<.001) | 0.69 [0.49,0.82] (<.001) | / |  |  |
| External details (positive) | 0.01 [-0.28,0.30]  (.943) | 0.13 [-0.17,0.41] (.387) | 0.31 [0.02,0.55] (.038) | 0.40 [0.13,0.62] (.006) | / |  |
| External details (negative) | 0.30 [0.01,0.55] (.043) | 0.38 [0.10,0.61] (.010) | 0.44 [0.16,0.65] (.003) | 0.56 [0.32,0.73] (<.001) | 0.45 [0.19,0.66] (.002) | / |
| CDSS | 0.01 [-0.28,0.30] (.943) | -0.09 [-0.38,0.21] (.542) | -0.04 [-0.33,0.25] (.769) | -0.03 [-0.32,0.26] (.821) | 0.04 [-0.26,0.33] (.791) | 0.08 [-0.22,0.36] (.610) |
| PANSS total score | -0.22 [-0.48,0.08] (.155) | -0.06 [-0.35,0.23] (.673) | -0.13 [-0.41,0.17] (.400) | 0.06 [-0.24,0.35] (.697) | 0.09 [-0.21,0.37] (.577) | -0.07 [-0.35,0.23] (.663) |
| PANSS Positive | -0.10 [-0.38,0.20] (.520) | -0.03 [-0.32,0.26] (.822) | -0.14 [-0.42,0.16] (.351) | -0.12 [-0.40,0.18] (.436) | 0.06 [-0.23,0.35] (.676) | -0.09 [-0.37,0.21] (.573) |
| PANSS Negative | -0.34 [-0.58,-0.05] (.023) | -0.06 [-0.34,0.24] (.716) | -0.15 [-0.42,0.15] (.329) | 0.15 [-0.15,0.42] (.338) | 0.14 [-0.16,0.42] (.349) | -0.05 [-0.34,0.25] (.757) |
| PANSS Disorganised | -0.11 [-0.39,0.19] (.454) | -0.03 [-0.32,0.27] (.859) | -0.00 [-0.30,0.30] (.982) | 0.17 [-0.13,0.44] (.257) | 0.11 [-0.19,0.39] (.475) | -0.17 [-0.44,0.13] (.267) |

Note: PANSS factor scores were computed according to Emsley et al. (2003). CDSS = Calgary Depression Scale for Schizophrenia.