Complete title: Candidate factors maintaining social anxiety in the context of psychotic experiences: A Systematic Review

Short running title: Factors related to social anxiety and psychosis

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Abstract

Social anxiety is common in psychosis and associated with impaired functioning, poorer quality of life and higher symptom severity. This study systematically reviewed factors maintaining social anxiety in people with attenuated, transient, or persistent psychotic experiences. Other correlates of social anxiety were also examined. MEDLINE, Embase, CENTRAL and PsycINFO were searched for relevant literature up to 19 October 2020. Forty-eight articles were eligible for narrative synthesis: 38 cross-sectional studies, eight prospective studies, one uncontrolled trial and one qualitative study. From 12060 participants, the majority was general population (n=8771), followed by psychosis samples (n=2532) and those at high-risk of psychosis (n=757). The methodological quality and risk of bias were assessed using the Mixed Methods Appraisal Tool. Ninety percent of studies were rated as high to very-high quality. Poorer quality studies typically failed to adequately control for confounds and provided insufficient information on the measurement validity and reliability. Prominent psychological factors maintaining social anxiety included self-perceptions of stigma and shame. Common correlates of social anxiety included poorer functioning and lower quality of life. In conclusion, stigma and shame could be targeted as a causal mechanism in future interventional studies. The integration of findings from this review lead us to propose a new theoretical model to guide future intervention research.

Keywords: Shame, Social Anxiety, Social Stigma, Models (Theoretical), Psychotic Disorders, Quality of Life

1. Introduction

Social anxiety disorder (SAD) is a common mental health problem for people at risk of psychosis (prevalence 6.1-42.3%)[1-3] or with an established psychotic disorder (pooled prevalence 16-26%).[4] SAD is characterized by exaggerated fears of evaluation by others, leading to distress and/or avoidance of social interactions.[5] It is a disabling disorder and a preceding cause of anxiety, affective and substance dependence/abuse disorders.[6] Many people with schizophrenia report having problems with social relationships and activities.[7] With comorbid SAD, people with schizophrenia report significantly lower functioning, lower self-esteem, higher symptom severity,[8] poorer quality-of-life (QoL),[9] higher depression[4] and higher rates of suicide attempts.[10] Despite SAD being a significant problem for people with psychosis,[4, 11] there has been little treatment-relevant research.[12]

Cognitive behavioral therapy (CBT) is a recommended psychological intervention for people with schizophrenia,[13,14] effectively reducing psychotic symptoms in people with psychosis or those at-risk of psychosis.[15-21] In addition to the evidence that CBT is the treatment of choice for a single diagnosis of SAD,[22, 23] the mechanisms of therapeutic change are increasingly well understood. In particular, the use of experiential exercises to help people with SAD learn the adverse effects of self-focused attention and safety-seeking behaviours are core components of recommended treatments.[24] However, clinical guidelines are silent on treatment choice when SAD is a comorbid condition,[12] and it remains to be ascertained how CBT for SAD in people with psychosis may reduce social anxiety.[12, 25, 26] Hence, further examination of the therapeutic mechanisms underpinning CBT for SAD in psychosis require further investigation.[12]

To understand mechanisms underpinning SAD and psychosis, we adhered to three principles recommended in the interventionist-causal model approach[27] to identify candidate

causal factors. These are: 1) a focus on a single factor that is measurable; 2) the putative causal process is amenable to change by the causal factor; and 3) the causal factor is integrated with a theoretical understanding to guide therapy. We set out to determine, integrate, and critically analyse the evidence for psychological factors in the maintenance of social anxiety in people with psychosis. Additionally, we explored other correlates of social anxiety.

2. Methods

2.1 Protocol and registration

The present systematic review was reported according to the Preferred Reporting Items of Systematic Reviews and Meta-analyzes (PRISMA).[28] The protocol was registered on PROSPERO and can be accessed at www.crd.york.ac.uk/PROSPERO/display_record.asp?ID= CRD42018117616.

2.2 Search strategy and information sources

Four databases were searched on 19 October 2020: Cochrane Central Register of Controlled Trials (1996 to October 2020); Embase (1947 to October 2020); Ovid MEDLINE(R) (1946 to October 2020); and PsycINFO (1806 to October 2020).

Search terms used for population were ((psychosis) or (psychotic) or (schizophreni*) or (schizoaffective) or (delusion*) or (paranoi*) or (clinical high risk*) or (ultra high risk*) or (attenuated) or (at risk mental state*) or (recent onset) or (first episode psycho*) or (early psycho*)) and outcomes were ((social anxi*) or (social phob*)). Limits were applied for English language and human. Electronic search strategies for Embase and MEDLINE are shown in *Supplementary Table 1*. A manual search was completed for identified articles from the electronic search, and their reference lists, those articles meeting criteria for inclusion were subjected to forward and backward citation to identify further eligible papers. The journal Schizophrenia Bulletin was hand-searched. Authors were contacted when published studies had insufficient data or where there was a need for more data to clarify results. We also asked active researchers for unpublished or recently submitted studies. Ten percent of study selection, data extraction and quality assessment were independently performed by two researchers with excellent agreement, the rest was performed by one researcher (*Supplementary Table 2*). Due to

difference in study designs, we used the Mixed Methods Appraisal Tool (MMAT)–version 2018[29] for critical appraisal. MMAT is widely used for evaluation of study strengths and weaknesses.[30]

2.3 Eligibility criteria

We examined studies involving people diagnosed with psychosis, those experiencing attenuated and milder forms of psychotic experiences (e.g., schizotypy), since psychotic experiences are seen in the general population,[31, 32] and distributed along a continuum.[31, 33]

2.3.1 *Inclusion criteria* were: 1) study samples included people diagnosed with schizophrenia and psychosis spectrum disorders or people deemed to be at high risk of developing psychosis and psychotic experiences; 2) analogue studies measuring psychotic-like experiences such as paranoia; and 3) measurement of any psychological factors linked to social anxiety and psychotic experiences.

2.3.2 *Exclusion criteria* were 1) literature reviews, single-case series or case reports; 2) studies of mixed diagnostic samples that do not present data in sub-groups or only provide pooled or aggregated data.

2.4 Data synthesis

We planned a narrative synthesis due to the anticipated high heterogeneity of populations, measurements, and outcomes. Psychological “maintenance factors” that lead to the persistence of social anxiety in psychotic experiences such as stigma, low self-esteem, and metacognition were considered. We also explored factors associated with social anxiety and referred to these as “correlated factors”.

3. Results

3.1 Identification of the studies

4527 records were identified through database searching and seven records from additional sources. After duplicates were removed, 3586 records were screened, resulting in 79 full-texts to be assessed against eligibility criteria. Excluded papers with reasons are presented in *Supplementary Table 3*. A total of 48 papers were included for narrative synthesis (*Figure 1*).

3.2 Study and participant characteristics

Included studies were cross-sectional (n=38), prospective (n=8), uncontrolled trial (n=1) and qualitative (n=1), published between 1992 and 2020, and originated from North America (n=15), UK (n=10), Asia (n=10), Europe (n=9), Australia (n=3) and Africa (n=1). The total number of participants across 48 studies was 12060, of which the majority were from the general population (n=8771); followed by people with established psychosis (n=2532) and high psychosis risk samples (n=757), other participant details see *Supplementary Table 4*.

3.3 Assessment of social anxiety or social phobia and psychosis

Table 1 shows the measures used to assess the level of social anxiety/social phobia and psychosis, including their brief details and evidence of psychometric properties. The Liebowitz Social Anxiety Scale,[34] the Social Interaction Anxiety Scale, and the Social Phobia Scale[35] were most frequently used for social anxiety or social phobia assessment. The Positive and Negative Syndrome Scale,[36] the Scale for the Assessment of Positive Symptoms[37] and the Scale for the Assessment of Negative Symptoms[38] were most commonly used to index psychosis.

3.4 Quality assessment

Using MMAT, methodological quality of included studies ranged from 2** to 5***** quality criteria met, of which 43 studies (89.6%) were met at least 4**** quality criteria *(Table*

2-3). The most frequent limitations were the absence of expected confounding or appropriate methods to control for confounders[10, 11, 25, 39-45] and failure to use measures with established validity and reliability.[39, 40, 44, 46-52] Other reasons for lower quality were the high risk of non-response bias,[53-55] insufficient representativeness of the study population[53, 56, 57] and incomplete outcome data,[40, 46] which decreased the generalizability of the results (*Supplementary Table 5*).

3.5 Psychological factors maintaining social anxiety in the context of psychotic experiences

Psychological factors maintaining social anxiety in people with psychotic experiences contexts were extracted and described (*Table 2*). We divided these factors into four main categories: Cognitive, Metacognitive, Behavioral and Other (*Supplementary Table 6*). Generally, the studies related to metacognitive factors revealed inconsistent patterns with social anxiety outcomes, while other factors appeared more consistent.

3.5.1 Cognitive factors

The most frequently reported factors were cognitive variables, with the most common being stigma and shame, followed by self-esteem, social rank, and negative self-referent appraisals.

3.5.1.1 Stigma and shame

Seven studies focused on stigma and shame.[25, 58-63] The presence of SAD was significantly associated with higher stigma and external shame amongst patients with First Episode Psychosis (FEP),[25, 59] and schizophrenia spectrum disorders (SZ).[58, 62] Amongst FEP, stigma (OR=1.3, p=0.018) and external shame (OR=1.1, p=0.039) were associated with social anxiety after controlling for depression.[59] Severity of social anxiety in FEP was significantly associated with childhood trauma; shame memories; traumatic impact from memories; and internal and external shame,[63] using the Trauma

and Distress Scale;[64] Centrality of Event Scale;[65] Impact of Event Scale-Revised;[66] Internal Shame Scale;[67] and Other as Shamer Scale,[68] respectively. A five-month follow-up study of SZ found that SAD at follow-up was predicted by the Discriminative Experiences of Stigma Scale[69] at baseline and negative symptoms (total R^2=0.46 and 0.42, $p<0.001$).[60] Amongst those at risk of psychosis internalized stigma did not predict social anxiety at six-month follow-up once baseline social anxiety was controlled for.[61]

3.5.1.2 Self-esteem

Five studies investigated low self-esteem in people with SAD and paranoia.[58, 70-73] SZ with SAD was associated with poorer self-esteem than those without SAD.[58, 73] Amongst FEP with generalized SAD, self-esteem was lower compared to FEP with non-generalized SAD and FEP without SAD.[71] Generalized SAD is characterized by a more pervasive fear of most social situations, whereas non-generalized SAD is restricted to more specific situations (e.g., a fear of public speaking but no experience of anxiety in casual social gatherings), according to DSM-IV.[74] Amongst FEP, SAD was associated with low self-esteem (β=-0.04, $p<0.001$, adjusted R^2=0.46).[70] A prospective study of SZ, SAD at six-month follow-up was predicted ($p<0.001$) by the level of self-esteem (R^2=0.06, $p<0.05$) after controlling SAD at baseline.[72]

3.5.1.3 Social rank

Three studies investigated how people compare themselves to others focusing on appraisals of social rank.[25, 59, 75] FEP plus SAD[25, 59] and SZ plus SAD[75] reported seeing themselves as having lower social rank compared to people with psychosis alone. Furthermore, FEP plus SAD reported lower social rank than those with only SAD.[25]

3.5.1.4 Negative self-referent appraisals

Negative self-referent appraisals were investigated in four studies[43, 76, 77] including one qualitative study.[78] SZ who had higher social anxiety rated themselves more negatively ($r=0.74$, $p<0.001$), while those with lower social anxiety rated themselves more positively ($r=-0.37$, $p<0.004$).[76] SZ (persecutory delusions) and social phobia showed no significant differences in automatic thoughts, underlying assumptions and core beliefs.[43] In people with early operationalized psychosis, ideas of reference was found directly related to social anxiety (standardized path coefficient $\beta=0.26$, $p=0.002$), using path analysis.[77]

A qualitative approach was used to examine interpersonal threat experiences in people with SZ (persecutory delusions) and SAD, between the two groups there were three major processes including 'experience of threat', 'reactions' while under threat, and subsequent 'reflections' on threat situations. There were differences found only in the SZ group, which were poor metacognitive awareness in perceptual experiences, inability to stand back from the threat following the event and lack of narrative coherence.[78]

3.5.2 Metacognitive factors

Six studies examined metacognitive factors in social anxiety amongst patients with psychosis. Metacognitive factors included Theory of Mind (ToM);[73, 79, 80] metacognitive mastery;[81] mentalization;[82] or reasoning biases.[46]

Starting with *ToM* findings, compared to FEP, people with SAD alone had higher scores for emotional recognition tasks.[80] In another study comparing those with FEP and SAD, there were no significant differences in emotional recognition.[80] Comparing SZ and SZ plus SAD there were no differences in emotional recognition.[73] In SZ, the level of

ToM and paranoia were combined for cluster analysis. Those with SZ in the high-middleToM/paranoia+ group (where paranoia+ refers to significantly higher paranoia than paranoia-) reported greater social anxiety level than other groups (poorestToM/paranoia+; highestToM/paranoia- and low-middleToM/paranoia-).[79]

With regards to *metacognitive mastery*,[83] (the ability to utilize knowledge of mental states to intentionally manage conflicts and subjective distress), SZ with intermediate levels of mastery reported higher social anxiety than those with low and high mastery group ($p<0.05$).[81] When assessed separately for the SZ with or without SAD groups, there were no significant correlations between *mentalization* and social anxiety.[82]

Lastly, *reasoning biases*, including personalizing and externalizing biases were measured amongst three groups: SZ, SZ with SAD and normal control. Compared across three groups, there were no significant differences levels of personalizing bias. SZ with SAD reported a significantly lower level of externalizing bias than control.[46]

3.5.3 Behavioral factors

Social avoidance has been examined in a single-arm trial using Virtual Reality to deliver a treatment to enhance social skills in SZ. This found improved social anxiety (effect size=0.48, $p<0.05$) and reduced social avoidance (effect size=0.58, $p<0.05$) at post-treatment and follow-up, respectively.[55]

One study investigated post-event processing (PEP)[53]–a ruminative process occurring after a distressing social event and attempts to reduce the likelihood of negative social consequences.[84] In other words, PEP is a covert behaviour that functions as a safety behaviour preventing disconfirmation of negative social anxiety beliefs. This study included undergraduate students in the game to assess the perception of exclusion, and

two confederates as additional participants to act and lead participants believing that they were excluded.[53] The game was preset so that in the first five passes the participant received the ball twice, then the two confederates chose to toss the ball to each other for the duration of the game–the participant was socially excluded. PEP, SIAS and GPTS-PP were measured at pre- and post-social exclusion intervention, and 24-hour and 1-week followed-up. It was found that higher levels of social anxiety and paranoia predicted the higher PEP after the intervention (SIAS: B=0.36, $p<0.001$ and GPTS-PP: B=0.16, $p<0.05$) and one-week later (SIAS: B=0.09, $p<0.05$ and GPTS-PP: B=0.09, $p<0.05$).

3.5.4 Other maintenance factors

Other factors maintaining social anxiety in psychosis were examined including attachment,[45, 85, 86] empathy[87] and intolerance of uncertainty.[88]

Three studies examined self-reported *attachment*. FEP plus SAD or SAD alone reported better adult attachment than those with FEP and normal controls.[86] Amongst ultra-high risk (UHR) participants, an insecure adult attachment was associated with social anxiety using SIAS ($\beta=0.47$, $p<0.001$, $R^2=0.22$) and SPS ($\beta=0.39$, $p<0.01$, $R^2=0.15$) and the relationship between adult attachment and SIAS was mediated by depression.[85] However, amongst people with UHR, there were no significant correlations between social anxiety and insecure anxious attachment, or avoidant attachment.[45]

Empathy was reported using the Interpersonal Reactivity Index,[89] consisting of cognitive (perspective taking and fantasy scales) and affective components (empathic concern and personal distress scales). Amongst FEP, the lower perspective-taking of empathy scale was associated with higher social anxiety ($r=-0.51$, $p=0.004$). Other empathy scales were not associated with social anxiety.[87]

People with Psychotic-Like Experiences (PLE) with SAD reported higher *Intolerance of Uncertainty (IU)* than those with SAD alone and healthy controls ($p<0.001$).[88]

3.6 Correlates of social anxiety

Correlates were categorized into seven groups: functioning, QoL, well-being, family factors, personality factors, anomalous experiences and others (subclinical paranoia, persecutory threat, traumatic experiences, suicidality and hopelessness, social anhedonia and executive functioning; see *Table 3*). Evidence related to correlates of social anxiety generally showed consistent findings, associations with functioning and QoL/well-being were commonly investigated compared to others.

3.6.1 Functioning

Ten studies reported on SAD and functioning across psychosis groups.[10, 42, 47, 50-52, 71, 73, 76, 90] FEP plus generalized SAD reported a lower level of premorbid social functioning and daily functioning compared to FEP plus nongeneralized SAD or FEP alone.[71] In SZ, those with SAD returned lower functioning scores than SZ alone.[10, 50] The lower level of Social Functioning Scale (SFS)[91] was related to the greater social anxiety amongst FEP,[42] and SZ.[76] Furthermore, in SZ the lower SFS was associated with the higher social anxiety in a cross-sectional study ($\beta=-0.42$, $p<0.001$, adjusted $R^2=0.255$)[90] and a longitudinal study ($\beta=-0.33$, $p<0.001$, adjusted $R^2=0.212$).[52] Lower social anxiety was associated with the higher SFS ($\beta=-0.56$, $p<0.001$, adjusted $R^2=0.66$)[51] and SFS Engaging in conversations subscale ($\beta=-0.61$, $p<0.001$, adjusted $R^2=0.35$).[73] A prospective study of SZ reported that higher level of SFS was not associated with

worsening social anxiety at 5-year follow-up, the development of worsened of social anxiety defined by an LSAS score ≥30% from the baseline value.[47]

3.6.2 Quality of life and well-being

Nine studies examined QoL related to SAD with psychosis.[10, 44, 47-49, 52, 62, 71, 92] In FEP, those with generalized SAD reported lower QoL than FEP with nongeneralized SAD or FEP alone.[71] Amongst SZ, those with SAD significantly reported lower QoL than those with SZ alone.[10, 44, 62] Additionally, a higher severity of social anxiety was associated with a lower level of QoL.[48, 49, 92] In prospective studies of SZ, higher social anxiety was associated with lower QoL (β=-0.01, p=0.005, adjusted R^2=0.167),[52] and lower QoL predicted increased social anxiety at 5-year follow-up (adjusted OR 0.85, p<0.05) after adjusting the baseline social anxiety.[47]

When QOL is conceptualized as the broader notion of wellbeing, those with SZ and SAD had significantly lower well-being compared to those without SAD.[50] Also, amongst SZ higher SAD was associated with lower well-being,[41] and the higher social anxiety was prospectively associated with the lower patients' well-being (β=-0.25, p<0.001, adjusted R^2=0.234).[52]

3.6.3 Family factors

A study of FEP found that parental rearing style reported by those with SAD (FEP plus SAD or SAD alone) revealed higher dysfunctional paternal indifference ($F_{1,97}$=5.6, p<0.05) and abuse ($F_{1,97}$=6.1, p<0.05) than those without SAD (FEP alone and normal control).[86] Furthermore, higher social anxiety in SZ was significantly associated with the higher paternal rejection, but not maternal rejection. Those with SZ who scored their key

relatives (e.g., spouse, father or mother) as more critical and hostile towards themselves reported higher scores on social anxiety.[54]

3.6.4 Temperament and personality factors

In an analogue study, general population were interviewed using Munich-Composite International Diagnostic Interview (M-CIDI)[93] to define any/subclinical/clinical paranoid or phobia symptoms. They were then observed prospectively including completed temperamental and personality measurements. Lifetime comorbid condition (paranoia and social phobia symptoms) was associated with behavioral inhibition temperament (Relative Risk=26.22, $p<0.001$) and harm avoidance personality (Relative Risk=1.12, $p<0.001$) compared to individuals without a history of social phobia or paranoid symptoms.[56] In SZ, those with SAD had higher harm avoidance and lowered self-directed personality than those without SAD ($t=4.203$, $p<0.0001$ and $t=4.447$, $p<0.0001$).[62]

3.6.5 Anomalous experiences

Two virtual reality studies examined perceptual disturbances in SZ.[39, 40] The first study provided avatars with happy and neutral face conditions to evoke patients' social anxiety. Amongst SZ higher social anxiety was correlated with higher PANSS negative subscales: blunted affect and passive/apathetic social withdrawal, when evoked by happy ($r=0.55$, $p=0.034$ and $r=0.54$, $p=0.039$) or neutral faces ($r=0.54$, $p=0.039$ and $r=0.66$, $p=0.008$), respectively.[39] Another avatar study in SZ reported higher social anxiety in the happy condition, compared to normal controls ($t=-5.00$, $p<0.01$). In SZ group, the higher social anxiety was related to the higher schizotypal ambivalence ($r=0.56$, $p<0.01$) and social anhedonia scores ($r=0.38$, $p<0.05$) when evoked by happy conditions, and related

to the higher schizotypal ambivalence scores (r=0.54, p<0.01) when evoked by angry conditions.[40]

3.6.6 Other factors

In a general population prospective study, *sub-clinical paranoid* symptoms were a predictor of the development of social phobia, controlling for neuroticism (OR=2.62; 95%CI=1.57-4.36; p<0.001).[57]Amongst FEP, those with SAD expressed more *persecutory threat* than those with FEP alone.[11] Considering reported *traumatic experiences*, people with SAD (FEP plus SAD or SAD alone) reported higher emotional abuse (F1,97=4.8, p<0.05) and sexual abuse (F1,97=3.7, p<0.05) than those without SAD (FEP alone and normal controls).[86]

Regarding *suicidality and hopelessness*, those with SZ and SAD reported a higher number of suicide attempts (F5.19, p<0.03) and lethality of suicide attempts (F34.14, p<0.001) compared to SZ alone.[10] SZ with SAD reported lower hope than those without SAD (t=2.710, p<0.01),[62] and the lower hope was associated with higher social anxiety (r=-0.44, p<0.001).[94] *Social anhedonia* was investigated in SZ, where greater social anhedonia correlated with higher social anxiety.[41]

SZ were investigated for *executive functioning*, delusion severity and social anxiety. SZ who had impaired cognitive flexibility plus a significant delusion (PANSS Delusions Score≥5) reported higher social anxiety (LSAS: F=4.12, p<0.05) than other groups (impaired cognitive flexibility plus no delusion, not impaired plus no delusion, not impaired plus delusion).[95]

4 Discussion

This review sought to identify, describe, and critically analyze candidate factors that maintain social anxiety in people experiencing psychosis. We synthesized the data using interventionist-casual model criteria that stipulate the candidate factors should be: 1) measurable; 2) amenable to change in a putative casual process; and 3) theoretically relevant. We also justified the factors and developed an integrated-theoretical model for improvement of targeted treatment of SAD with psychosis.

4.1 Psychological maintenance factors

We identified a number of factors from the eligible studies included in the current review. We clustered the findings according to Cognitive, Metacognitive and Behavioral factors. Amongst people with psychosis or schizophrenia who had an additional diagnosis of SAD, there were higher levels of perceived stigma and shame, lower levels of self-esteem and social rank and more negative self-appraisals. These findings were derived from high quality studies.

Although there were identified metacognitive factors including ToM, metacognitive mastery, mentalization and reasoning biases, not all relationships between social anxiety and metacognition were linear. This is perhaps because those people with a lower level of metacognition might not be aware of a socially feared event, while those with higher level might have a better adaptation to deal with problems with social anxiety, resulting in reduced severity, when compared to those with a moderate level.[79, 81] It was evidenced that metacognitive beliefs were found to empirically contribute to social anxiety,[96] and metacognitive processes of people with psychosis can be changed in an experimental study.[97] Though there is promising evidence, findings on metacognitive factors were mixed and synthesis of these findings is made difficult by different approaches to the definition and measurement of metacognition.

We found limited evidence that behavioral factors have been systematically investigated. This is a neglected area of research and our findings show promise in delineating the role of social avoidance and other defensive behaviors (i.e., PEP) in the maintenance of social anxiety. Because safety behaviors, such as social avoidance play a role in maintaining social anxiety,[84] then intervention on these factors should reduce social anxiety experiences in psychotic contexts.

Importantly, although largely findings were drawn from cross-sectional studies, we found consistent evidence for the potential role of cognitive factors, which the candidate factors can be the *stigma and shame*. Because they fit with the substantial characteristics of potential mechanism in the interventionist-causal approach,[27] which the stigma and shame were measurable[67, 68, 98] and can be developed in the theoretical understanding to guide therapy.[59] Furthermore, these factors are likely to be amenable to change with psychological interventions targeting these factors as a causal mechanism. Therefore, cognitive factors such as appraisals of stigma and shame may be amenable for the development of interventionist-causal approaches to SAD in psychosis.

4.2 Correlates of social anxiety in psychosis

Social anxiety was frequently associated with two correlates including poorer functioning and lower QoL, followed by lower well-being, family factors and personality factors, anomalous experiences, and other correlates presented in the result section. From our review, lower functioning was consistently associated with higher social anxiety amongst people with psychosis. The poor functioning also influences the defeatist performance belief (DPB),[99] which is overgeneralized negative thoughts about one's ability to successfully perform tasks. This DPB is important because it can lead to preventing the initiation of goal-directed behaviors and engagement in social interactions.[99] We also commonly found that higher social anxiety was

related to poorer QoL and well-being. It is evident that lower QoL and lower well-being was associated with higher symptoms of psychosis.[100, 101] Notably we found consistent evidence that social anxiety was correlated with poorer functioning and QoL. It is important that functioning and QoL should be included as outcomes in future intervention studies targeting SAD in psychosis.[52, 102]

4.3 Integration of theoretical model and its implication

Based on our findings we propose a theoretical integration as shown in *Figure 2*, based on previous work on social anxiety;[103] paranoia;[32] and stigma.[59]

Three major processes of the model were constructed. We will use stigma and shame to explain the model. With the proximal social assumptions, individuals with bio-psycho-social vulnerabilities are, firstly, aware that other people are critical when encountering feared social situation. Due to negative processing the self as a social object, individuals may feel different, vulnerable or stigmatized, the *internalized negative self-representation* is formed.

Secondly, activation of the internalized self-representations, are then subject to metacognitive processing. The individual with internal stigma- and shame-based representations may perceive their *self as ridiculed* (e.g., I look awkward), or at risk of social *harm from others* (e.g., others are threatening). One can perceive threat at different level consistent with the hierarchy model (see the shading box in *Figure 2*).[32] Then, their perceived assumptions will be assessed relating to: social attitudes, called *other-to-self focus* (e.g., neighbors disgust people like me); and self-image, called *self-to-self focus* (e.g., I am indeed despicable).

Lastly, negative appraisals about stigma and shame result in *defensive behaviors* (e.g., avoiding eye contact), and *cognitive* (e.g., hypervigilance due to anticipating other attitudes) *and physical symptoms* (e.g., sweating, tremor) of anxiety. These symptoms interact in vicious circles

via PEP. These defensive behaviors also maintain and prevent disconfirmation of the negative belief of social anxiety in psychosis. *Negative consequences* may appear as poorer daily functioning, QoL, well-being, and increased hopelessness and suicidality. Additionally, although negative affect can be a negative consequence, nonetheless, it was not included in the model, because negative affect also increases accessibility of negative appraisals and feelings of stigma/shame that, in turn, increases social anxiety.

Our model aims to help people suffering from social anxiety in the context of psychosis. Although the psychological factors related to experiencing discrimination (stigma/shame) are not unique to SAD in psychosis, these factors are very relevant in SAD in psychosis compared to the established cognitive model of social anxiety.[84] Due to our findings being drawn mostly from cross-sectional studies with limited evidence of experimental and manipulationist tests, additional studies will be needed to develop better effective treatment of SAD in psychosis. Stigma and shame should be tested in interventionist-causal manipulation designs, using social anxiety as the dependent variable and stigma/shame as the mediator variables.

4.4 Strengths and limitations

This review has a number of strengths. The factors that maintain significant social anxiety problems in psychosis and other relevant correlates were thoroughly examined. We used rigorous methods (e.g., independent study selection), took a broad and inclusive approach, and assessed the quality of the literature. But there are also limitations to be considered. We did not include non-English-language studies and unpublished grey literature which may have resulted in publication bias and exclusion of some relevant evidence. However, we believe this limitation is minimal as we utilized a comprehensive literature searching and covered studies from diverse geographical regions (Africa, Asia-Pacific, North America, and Europe). Secondly, the quality

assessment, indicates that many studies did not address confounding factors and may not have proven the validity/reliability of study measures. This could lead to erroneous conclusions[104] and minimize trustworthiness[105] of a study. Majority of studies, nonetheless, were met at least 4**** (of 5*****) quality criteria. We observed a gender disparity across studies with men over-represented in the psychosis samples. In contrast, the general population and high-risk samples showed comparable proportions of male and female participants. Lastly, the heterogeneity of data prevented us from applying meta-analysis.

4.5 Directions for future research

Most studies were cross-sectional and conducted with Westernized English-speaking populations. Cross-cultural studies are required to improve understanding of the role that culture plays in the experience of stigma and the expression of psychopathology.[106] It is already known that the content of persecutory delusion is likely to depend on culturally prevalent threats or beliefs about malevolent influence[107, 108] and so it is relevant to examine whether these effects extend to social anxiety related beliefs and appraisals. The development of experimental designs using interventionist causal methods with targeted factor and focus whether modifying safety behaviors associated with reducing social anxiety in psychosis should be tested. Moreover, due to lack of evidence on other psychotic experiences, given the potential impact of psychotic experiences; for example, voices in social interactions,[109] this also seems to be an important topic for exploration.

Conclusion

Our analysis of the literature suggest that stigma and shame are key candidate psychological mechanisms with a strong role in maintaining social anxiety in the context of psychosis. Given the generally strong methodological quality of the included studies we can be

reasonably confident that these cognitive factors warrant further investigation. For example, further studies using psychometrically robust methods and applying mediation analyses will help disentangle the different factors involved the spectrum of problems from social anxiety to paranoia. Both stigma and shame meet the criteria for being treated as relevant factors in an interventionist-causal model that we offer. This clinical model could be used as a basis for treatment development. Given that social anxiety was reliably associated with poorer functioning and QoL there is an important clinical need to improve targeted treatments for these problems.

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Figure legends

Figure 1 Study selection process**.**

Figure 2 The cognition model processing of social anxiety to severe threat.

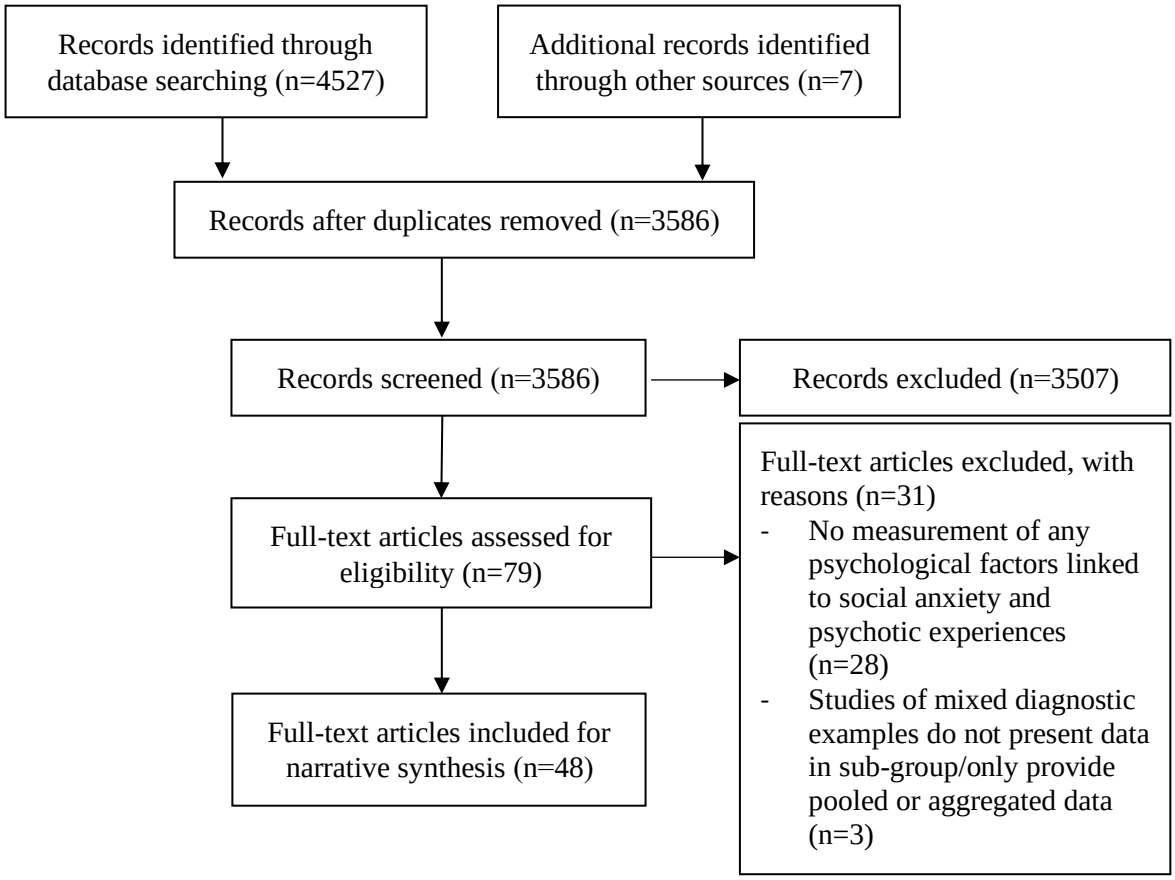

Figure 1 Study selection process.

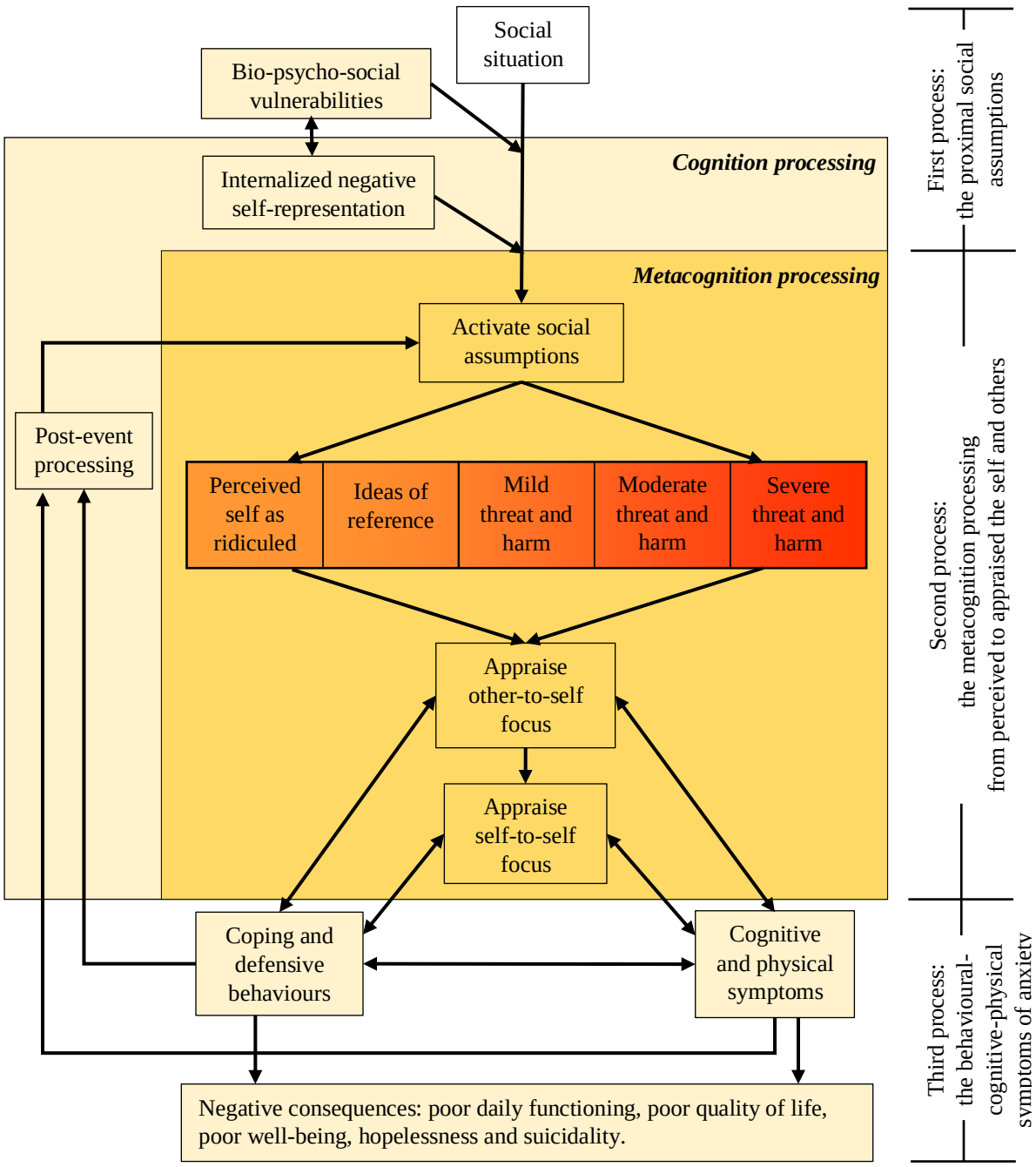

Figure 1 The cognition model processing of social anxiety to severe threat

Note: the orange-red shading box shows the intensity continuum of social anxiety to paranoia; the redder color the more paranoia, as followed: Perceived self as ridiculed/embarrassment (e.g., I look awkward/sick); Ideas of reference (e.g., people talking about me); Mild threat and harm from others (e.g., people trying to cause minor distress, such as irritation); Moderate threat and harm (e.g., people deliberately trying to approach me, such as being hostile towards me); and

Severe threat and harm (e.g., people trying to cause significant physical psychological or social harm).

Table 1 Measurements used to assess level of social anxiety or social phobia and psychosis

Measurements used for social anxiety or social phobia	Frequency of use	Measures	Items	Evidence of reliability/validity
Liebowitz Social Anxiety Scale (LSAS), LSAS self-rating (LSAS-SR)	18	Fear and avoidance of social situations and used mostly in the social anxiety research[34] and in schizophrenia[10]	24	Good reliability and validity in social anxiety,[110, 111] and good reliability in schizophrenia.[10]
Social Interaction Anxiety Scale (SIAS)	14	Anxiety in interpersonal encounters, used alongside with SPS and mostly in the social anxiety research[35]	20	Good reliability and validity,[35] good discriminant validity with SPS and SPAI.[112]
Social Phobia Scale (SPS)	6	Performance anxiety in situations where the individual fears being observed and scrutinized by others, used alongside with SIAS and mostly in the social phobia research[35]	20	Good reliability and validity,[35] good discriminant validity with SIAS and SPAI[112]
Fear of Negative Evaluation (FNE)	3	Anxiety about being negatively evaluated by others and mostly in the social phobia research[113]	12	Good reliability and validity[113]
State trait anxiety inventory (STAI)	3	Various experiences of anxiety including social anxiety. Trait anxiety refers to persistent anxiety, while State anxiety reflects momentary anxiety[114]	40	Good reliability[115] and validity[116]
Multidimensional Anxiety Questionnaire (MAQ)	3	Various experiences of anxiety including social anxiety, assessing worries about social embarrassment and social avoidance,[117] used in schizophrenia[118]	40	Good reliability and validity in people with mental illness, [117] and good validity in schizophrenia.[118]
Brief Social Phobia Scale (BSPS)	1	Fear, avoidance and physiological symptoms associated with common social situations[119]	11	Acceptable reliability and validity[119]
Social Avoidance and Distress Scale (SADS)	1	Fear, discomfort, subjective distress and the avoidance of social situations and used mostly in social anxiety[113]	28	Good reliability and validity[113]

Social Phobia and Anxiety Inventory (SPAI)	1	Somatic, cognitive, and behavioral aspects of social phobia across a wide range of social situations and settings[120]	45	Good reliability and validity,[120, 121] good discriminant validity with SIAS and SPS[112]
Interaction Anxiousness Scale (IAS)	1	Subjective experience of anxiety associate with social interactions[122]	15	Good reliability and validity[122]
Unsicherheits-Fragebogen (U-scale) †	1	Experiences of social anxiety[123]	65	The scale was proved to be valid and transferable across samples[124]
Simulated social interaction test (SSIT)	1	Social skills responded to eight social interactions (e.g., disapproval/criticism, social visibility/assertiveness)[125]	8	Good reliability and validity in schizophrenia[126]
Measurements used for characterizing psychosis	Frequency of use	Measures	Items	Evidence of reliability/validity
Positive and Negative Syndrome Scale (PANSS)	28	Psychopathology (positive, negative and emotional discomfort) in schizophrenia[36]	30	Good to excellent reliability[127]
Scale for the Assessment of Positive Symptoms (SAPS)	5	Positive symptoms of schizophrenia, used alongside with SANS[37]	34	Good validity and reliability[37]
Scale for the Assessment of Negative Symptoms (SANS)	5	Negative symptoms of schizophrenia, used alongside with SAPS[38]	25	Good validity and reliability[128]
Brief Psychiatric Rating Scale (BPRS)	3	Psychopathology during the week prior to the assessment[129]	18	Good validity and reliability[130]
Clinical Global Impression (CGI)	2	All symptomatology together (psychotic symptoms, anxiety, and depressive) in one number (CGI-severity subscale)[131]	1	Strong validity and good reliability, but lack of correlation coefficient with depression[132]
Green Paranoid Thoughts Scale–Persecutory Paranoia Subscale (GPTS)	1	Two specific subtypes of paranoia: social reference paranoia and persecutory paranoia[133]	16	Good validity and reliability[133]

Details of Threat questionnaire (DoT)	1	Nature of the perceived threat arising from persecutory delusions: the power of persecutor, the strength of delusional conviction, the perceived impact or awfulness of threat and perceived controllability of the threat[134]	4	NA
Community Assessment of Psychic Experiences (CAPE)	1	Lifetime prevalence of positive, negative and depressive symptoms on scales regarding frequency and distress in general population[135]	42	May overestimate the prevalence of positive symptoms, psychiatrists required to validate patient's self-report[136]
Paranoid checklist	1	A multi-dimensional representation of paranoid ideation rating on frequency, conviction and distress associated with paranoia[32]	18	Good validity and excellent reliability[32]
Inventory of hostility and suspiciousness	1	Paranoia and related concepts: Interpersonal Suspiciousness/Hostility, Negative Mood/Withdrawal, Anger/Impulsiveness, Mistrust/Wariness and Perceived Hardship/Resentment[137]	47	Satisfactory validity and reliability[137]

† Unsicherheits-Fragebogen scale assessing for social anxiety

Table 2 Studies addressing psychological maintenance factors of social anxiety in psychotic experiences contexts.

Citation	Design	Sample characteristic (N)	Measurements 1. Diagnostic criteria 2. Symptom scales		Maintenance factors	Findings	Quality criteria met†
			Psychosis	Social anxiety			
Michail et al. (2013) [25]	Cross-sectional	Total 135 FEP (60) FEP+SAD (20) SAD (31) NC (24)	1. ICD-10 2. PANSS	1. ICD-10 2. SIAS, SPS	**Stigma** - PBIQ **Shame** - OAS **Social rank** - SCS	FEP+SAD reported higher levels of PBIQ: entrapment, loss of social goals, poorer illness control and lower perceived social status (F1,79=14.5, F1,79=12 and F1,79=13.1 and F1,79=12 respectively) than FEP. Plus, FEP+SAD reported higher level of OAS (F1,135=123.1) and lower level of SCS (F1,135=49.6) than SAD. All ps<0.01.	4****
Gumley et al. (2004) [58]	Cross-sectional	Total 38 SZ (19) SZ+SAD (19)	1. DSM-IV 2. PANSS	1. DSM-IV	**Stigma** - PBIQ **Self-esteem** - RSES	SZ+SAD reported higher levels of PBIQ: self vs illness (F1,36=5.0, p<0.05); entrapment (F1,36=12.7, p<0.01); and shame (F1,36=10.6, p<0.01)) and lower level of RSES (F1,36=10.2, p<0.01) than SZ.	5*****
Birchwood et al. (2006) [59]	Cross-sectional	Total 79 SZ (56) SZ+SAD (23)	1. ICD-10 2. PANSS, IS	2. SIAS, FNE	**Stigma** - PBIQ **Social rank** - SCS **Shame** - OAS	SZ+SAD reported less controllable of being psychosis and more entrapping (multivariate F=15.6, p<0.001), and more SCS (F=27.4, p<0.001) compared to SZ. Regarding regression analysis, the PBIQ shame (OR=1.4, p=0.038), PBIQ group fit (OR=1.3, p=0.018) and OAS (OR=1.1, p =0.039) were associated with the presence of SAD, after controlling depression.	5*****
Lysaker et al. (2010) [60]	Prospective	SZ (78)	1. DSM-IV 2. PANSS	2. MAQ social anxiety	**Stigma** - ISMIS	Regarding stepwise regression, baseline ISMIS discrimination experience and PANSS negative symptoms significantly predicted MAQ social anxiety at five months, after controlling social anxiety at baseline (R^2=0.45, p<0.001).	5*****
Pyle et al. (2015) [61]	Prospective	CAARMS (288)	1. CAARMS 2. GPTS-PP	2. SIAS	**Stigma** - PBEQ	Based on hierarchical regression, SIAS at baseline predicted SIAS at six months (B=0.218, partial r=0.205, t=2.347, p=<0.05). Plus, internalized stigma: negative appraisal and social acceptance experiences, did not predict SIAS at follow-up.	5*****

Vrbova et al. (2017) [62]	Cross-sectional	Total 61 SZ (42) SZ+SAD (19)	1. ICD-10 2. PANSS, CGI	2. LSAS	**Stigma** - ISMIS	SZ+SAD reported higher level of ISMIS (t=4.251, p<0.0001).	5*****
Sutliff et al. (2015) [75]	Cross-sectional	Total 42 SZ (24) SZ+SAD (18)	1. DSM-IV 2. PANSS	2. LSAS	**Social rank** - SCS	SZ+SAD reported lower level of SCS than SZ (t=2.90, p=0.006).	5*****
Aherne et al. (2014) [63]	Cross-sectional	FEP (45)	1. ICD-10 2. Paranoid checklist	2. SIAS, SPS	**Shame** - TADS - CES - IES-R - ISS - OAS	Regression model showed TADS, CES, IES-R, ISS and OAS were associated with SPS (R^2=0.299, F1,37=6.587, p<0.000) and SIAS (R^2=0.242, F1,37=7.134, p<0.000). TADS, CES, IES-R, ISS and OAS was associated with paranoia (R^2=0.092, F4,37=3.007, p=0.032).	5*****
Romm et al. (2011) [70]	Cross-sectional	FEP (144)	1. DSM-IV 2. PANSS	2. LSAS-SR	**Self-esteem** - RSES	Regarding regression analysis, RSES and PANSS suspiciousness were associated with LSAS-SR (B=-0.04, p=0.000 and B=0.07, p=0.047, adjusted R^2 =0.46).	5*****
Romm et al. (2012) [71]	Cross-sectional	Total 144 FEP (30) FEP+NonGSAD (46) FEP+GSAD (68)	1. DSM-IV 2. PANSS, IS	2. LSAS-SR	**Self-esteem** - RSES	FEP+GSAD reported lower level of RSES than FEP+NonGSAD and FEP alone (F40.39, p<0.001).	5*****
Lysaker et al. (2008) [72]	Prospective	SZ (39)	2. PANSS	2. LSAS	**Self-esteem** - MSEI	Regarding regression analysis, baseline MSEI predicted LSAS at six months (R^2=0.06, p<0.05), after controlling for baseline LSAS (F2,36=17.93, p<0.001).	5*****
Lecomte et al. (2019)[73]	Cross-sectional	Total 47 SZ (25) SZ+SAD (22)	1. DSM-IV-TR	2. BSPS, SIAS	**Self-esteem** - SERS-SF **ToM** - FEIT - FEDT - METT - Emotional recognition (a real-life situation**)**	SZ+SAD reported lower level of SERS-SF compared to SZ (p<0.01). There were no significant differences between SZ and SZ+SAD for any of the total scores for emotional recognition.	5*****
Katherine et al. (2012) [43]	Cross-sectional	Total 48 SZ (13) SAD (13) Panic (10) NC (12)	1. DSM-IV-TR 2. PS	1. DSM-IV-TR 2. SIAS	**Negative self-referent appraisals** - SCQ - SAQ-R - EBS	There were no significant differences of automatic thought (SCQ), underlying assumptions (SAQ-R) and schema (EBS) between people with SZ (with persecutory delusions) and social phobia.	4****

Voges et al. (2005) [76]	Cross-sectional	SZ (60)	1. DSM-IV 2. PANSS	1. DSM-IV 2. SPAI	**Negative self-referent appraisals** - SISST	Patients reported SISST negative self-statement subscale positively correlated with lower level of SPAI (r=0.74, p<0.004).	5*****
Wong (2020)	Cross-sectional	SZ (137)	1. DSM-IV 2. SAPS, SANS	1. LSAS-SR	**Negative self-referent appraisals** - SUMD - IRIS - SPQ - SAPS	After removing all non-significant paths in the hypothetical model, the final model suggested only two direct paths to social anxiety: ideas of reference (standardized path coefficient β=0.26, p=0.002) and negative symptoms (β=0.29, p<0.001)	5*****
Stopa et al. (2013) [78]	Cross-sectional (Qualitative study)	Total 18 SZ (9) Social phobia (9)	1. DSM-IV-TR	1. DSM-IV-TR	**Negative self-referent appraisals** (interview)	Three common themes of interpersonal threat experiences were found in both groups: participants' experience of threat, reactions while under threat, and subsequent reflections on threat situations, as well as the superordinate theme of narrative coherence. Key differences emerged between the groups in their perceptual experiences, ability to stand back from the threat following the event, and narrative coherence.	5*****
Piccirillo et al. (2016) [53]	Cross-sectional	General population (179)	2. GPTS	2. SIAS	**Post-event processing** - PEP questionnaire	Higher SIAS and higher GPTS persecutory paranoia subscale (GPTS-PP) were significantly associated with higher levels of PEP at post social exclusion intervention (SIAS: B=0.36, p<0.001 and GPTS-PP: B=0.16, p<0.05) and one week later (SIAS: B=0.09, p<0.05 and GPTS-PP: B=0.09, p<0.05).	3***
Achim et al. (2013) [82]	Cross-sectional	Total 140 SZ (29) SZ+SAD (26) NC (84)	1. DSM-IV 2. PANSS	2. LSAS	**Mentalization** - BICS	Across all SZ patients or when assessed separately for the SZ− or the SZ+ groups, there were no significant correlations between level of LSAS and BICS. All ps>0.26.	5*****
Lysaker et al. (2010) [79]	Cross-sectional	Total 88 (all SZ) Paranoia+/Poorest ToM (14) Paranoia-/Low-middle ToM (29) Paranoia+/High-middle ToM (23) Paranoia-/Highest ToM (22)	1. DSM-IV 2. PANSS	2. LSAS	**Theory of Mind** - ToM test battery ‡	Paranoia+/high-middleToM group reported higher levels of LSAS than other groups: paranoia+/poorestToM; paranoia-/highestToM and paranoia-/low-middleToM (LSAS avoidance: F=5.03, p<0.01; and LSAS fear: F=3.31, p<0.05), where paranoia+ refers to significantly higher paranoia than paranoia-.	5*****
Pepper et al, (2018)[80]	Cross-sectional	Total 199 ASD (53) EP (51)	1. DSM-IV	1. ADIS-IV/V	**Theory of Mind**	SAD reported higher score of RMET (p<0.01) and Movie Still with (p<0.001) and without face (p<0.01) than EP.	5*****

		SAD (64) NC (31)			- FPRT - FBPST - FEEST - EQ - RMET - Movie Stills task (with and without face condition)	There were no significant differences of ToM (FPRT, FBPST, FEEST and EQ) between SAD and EP.	
Lysaker et al. (2011) [81]	Cross-sectional	Total 98 (All SZ) Low mastery (33) Intermediate-mastery (52) High mastery (13)	1. DSM-IV	2. MAQ social anxiety	**Metacognitive mastery** - MAS	Intermediate-mastery group reported more MAQ social anxiety (F=3.48, p<0.05).	5*****
Achim et al. (2016) [46]	Cross-sectional	Total 82 SZ (29) SZ+SAD (12) NC (41)	2. PANSS	1. DSM-IV 2. LSAS	**Reasoning bias** - brief-IPSAQ	SZ+SAD reported significantly lower level of brief-IPSAQ externalizing bias subscale than controls. There were no significant differences of brief-IPSAQ personalizing bias subscale amongst the three groups (F2,79=0.39, p=0.68).	4****
Rus-Calafell et al. (2014) [55]	Non-randomised controlled trials	SZ (12) Intervention: avatars for social skills enhancement	1. DSM IV-TR 2. PANSS	2. SADS, AI, SSIT	**Social avoidance** - SADS	When compared between pre- and post-treatment, and post-treatment and follow-up, patient reported significantly improvement of levels of social anxiety: SSIT anxiety subscale (F2,22=39.76, p<0.05, Cohen's d=0.48); and SADS avoidance (F2,22=14.80, p<0.05, Cohen's d=0.58).	4****
Gajwani et al. (2013) [85]	Cross-sectional	UHR (51)	2. SIPS	2. SIAS, SPS	**Attachment** - RAAS	RAAS was associated SIAS and SPS (β=0.47, p<0.001, R^2=0.22 and 0.39, p<0.01, R^2=0.15). A significant relationship between SIAS and RAAS was mediated by BDI (F 2,49=14.66, p<0.001, R^2=0.38).	5*****
Michail et al. (2014) [86]	Cross-sectional	Total 135 FEP (60) FEP+SAD (20) SAD (31) NC (24)	1. ICD-10 2. PANSS	1. ICD-10 2. SIAS, SPS	**Attachment** - RAAS	FEP+SAD and SAD reported higher level of insecure adult attachment than FEP and NC ($x^2$1=38.5, p<0.01).	5*****
Russo et al. (2018)[45]	Cross-sectional	Total 120 UHR (60) NC (60)	1. CAARMS	2. SSI social anxiety subscale	**Attachment** - PAM anxiety and avoidance subscale	Amongst UHR, there were no significant correlations between SSI social anxiety and insecure anxiety (r=0.36, p=0.07), and SSI social anxiety and avoidant attachment (r=0.28, p=0.14).	3***
Achim et al. (2011) [87]	Cross-sectional	Total 62 FEP (31) NC (31)	1. DSM-IV 2. PANSS	2. LSAS	**Empathy** - IRI	Amongst FEP, there was significant correlations between LSAS and IRI perspective taking subscale (r=-0.51, p=0.004).	5*****

Factors related to social anxiety and psychosis							
Armando et al. (2013) [88]	Cross-sectional	Total 169 PLEs+SAD (32) SAD (96) Control Group (41)	1. CAPE	1. DSM-IV	**Intolerance of uncertainty** - IUS	PLEs+SAD reported higher levels of IUS and BDI-II, BAI and CAPE negative than those SAD alone (p<0.0001).	5*****

ADIS, Anxiety Disorders Interview Schedule for DSM-IV or V; AI, Assertion Inventory; ASD, Autism Spectrum Disorder; BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory; BDI-II, BDI 2nd edition; BFNE, Brief Fear of Negative Evaluation scale; BICS, Batterie Intégrée de Cognition Sociale; CAARMS, Comprehensive Assessment of At Risk Mental State; CAPE, Community Assessment of Psychic Experiences; CES, Centrality of events Scale; CGI, Clinical Global Impression; DSM-IV, Diagnostic and Statistical Manual of Mental Disorders 4th edition; DSM-IV-TR, DSM-IV Total Revision; EBS, Evaluative Beliefs Scale; EP, Early Psychosis; EQ, Empathy Quotient of Cambridge Behaviour Scale; ES, Effect Size; FBPST, False Belief Picture Sequencing Task; FEDT, Facial Emotion Discrimination Test; FEEST, Facial Expressions of Emotions: Stimuli and Tests; FEIT, Facial Emotion Identification Test; FEP, First Episode Psychosis; FNE, Fear of Negative Evaluation scale; FPRT, Faux Pas Recognition Task; GPTS, Green Paranoid Thoughts Scale; GSAD, Generalized SAD; IAS, Interaction Anxiousness Scale; ICD-10, International Classification of Diseases 10th edition; IES-R, Impact of Event scale-Revised; IHS, Inventory of Hostility and Suspiciousness; IPSAQ, Internal Personal and Situational Attributions Questionnaire; IRI, Interpersonal Reactivity Index; IRIS, Ideas and Delusions of Reference Interview Scale; IS, Insight Scale; ISMIS, Internalised Stigma of Mental Illness Scale; ISS, Internalised Shame Scale; IUS, Intolerance of Uncertainty Scale; LSAS, Liebowitz Social Anxiety Scale; LSAS-SR, LSAS Self Rating version; MAQ, Multidimensional Anxiety Questionnaire; MAS, Metacognition Assessment Scale; METT, Ekman's Micro-Expression Training Tool; MSEI, Multidimensional Self-Esteem Inventory; NC, Normal Control; OAS, Other as Shame Scale; PAM, Psychosis Attachment Measure; PANSS, Positive and Negative Syndrome Scale; PBEQ, Personal Beliefs about Experiences Questionnaire; PBIQ, Personal Beliefs about Illness Questionnaire; PEP, Post-Event Processing; PLE, Psychotic-Like Experiences; PS, Paranoia Scale; RAAS, Revised Adult Attachment Scale; RMET, Reading the Mind in the Eyes; RSES, Rosenberg Self-Esteem Scale; SAD, Social Anxiety Disorder; SADS, Social Avoidance and Distress Scale; SANS, Scale for the Assessment of Negative Symptoms; SAPS, Scale for the Assessment of Positive Symptoms; SAQ-R, Social Attitudes Questionnaire Revised; SCQ, Social Cognitions Questionnaire; SCS, Social Comparison Scale; SERS-SF, Self-Esteem Rating Scale-Short Form; SIAS, Social Interaction Anxiety Scale; SIPS, Structured Interview for Prodromal Syndromes; SISST, Social Interaction Self Statement Test; SPAI, Social Phobia and Anxiety Inventory; SPS, Social Phobia Scale; SPQ, Schizotypal Personality Questionnaire; SSI, Schizotypal Symptoms Inventory Brief Version; SSIT, Simulated Social Interaction Test; SUMD, Scale to Assess Unawareness of Mental Disorder; SZ, SchiZophrenia spectrum disorder; TADS, Trauma And Distress Scale; ToM, Theory of Mind; UHR, Ultra High Risk; VR-CBT, Virtual-Reality-based Cognitive Behavioural Therapy

† Scoring as number of quality criteria met; for example, 4**** means 4 criteria (of totally 5) of a study design were met.

‡ ToM test battery includes the Hinting Test, the Bell-Lysaker Emotional Recognition Task, the eyes test and the Picture arrangement subtest of Wechsler Adult Intelligence Scale III

Table 3 Studies addressing correlated factors of social anxiety in psychotic experiences contexts.

Citation	Design	Sample characteristic (N)	Measurements 1. Diagnostic criteria 2. Symptom scales		Correlated factors	Findings	Quality criteria met †
			Psychosis	Social anxiety			
Nemoto et al. (2020)	Prospective	SZ (118)	1. DSM-IV 2. PANSS, CGI severity scale	2. LSAS	**Quality of life** - WHO-QOL26 **Functioning** - GAF - SFS **Well-being** - SWNS	Regarding a stepwise regression adjusted with demographic data, change in LSAS was significantly associated with change of the outcome models in predicting WHO-QOL26 (β=-0.01, p=0.005, adjusted R^2=0.167), SFS (β=-0.33, p<0.001, adjusted R^2=0.212) and SWNS (β=-0.25, p<0.001, adjusted R^2=0.234).	4****
Kumazaki et al. (2012) [47]	Prospective	Total 36 SZ+Worsened ‡ LSAS (12) SZ+Stable LSAS (24)	1. ICD-10 2. PANSS	2. LSAS	**Quality of life** - WHO-QOL26 **Functioning** - GAF - SFS	WHO-QOL26 significantly predicted level of LSAS at follow-up (adjusted 0.85, p<0.05, respectively) after controlling baseline of LSAS. PANSS, SFS and GAF were not significantly associated with development of social anxiety.	4****
Vrbova et al. (2017) [62]	Cross-sectional	Total 61 SZ (42) SZ+SAD (19)	1. ICD-10 2. PANSS, CGI	2. LSAS	**Quality of life** - Q-LES-Q **Personality factors** - TCI-R **Hopelessness** - ADHS	SZ+SAD reported lower level of Q-LES-Q (t=4.863, p<0.0001) and ADHS (t=2.710, p<0.01) than SZ. SZ+SAD revealed higher level of TCI-R harm avoidance and lower self-directed subscales (t=4.203, p<0.0001 and t=4.447, p<0.0001) than SZ.	5*****
Kwong et al. (2017) [92]	Cross-sectional	SZ (159)	1. DSM-IV 2. PANSS	2. LSAS	**Quality of life** - SF-36 MCS and PCS subscales	Total score of LSAS significantly correlated with SF-36 MCS (r/t §=-0.484, p<0.001) and PCS (r/t=-0.302, p<0.001).	5*****
Lowengrub et al. (2015) [48]	Cross-sectional	Total 50 SZ (31) SZ+SAD (19)	1. ICD-10 2. PANSS, CGI	2. LSAS	**Quality of life** - SQLS	Total score of LSAS significantly correlated with SQLS (r=-0.47, p<0.01).	4****
Huppert et al. (2005) [49]	Cross-sectional	SZ (32)	2. PANSS, SAPS, SANS, IHS	1. DSM-IV, ADIS 2. SIAS, SPS	**Quality of life** - QOLI	Levels of QOLI significantly correlated with level of SPS (r=-0.48, p<0.01), SIAS (r=-0.48, p<0.01) and ADIS social phobia (r=-0.42, p<0.05).	4****
Blanchard et al. (1998) [41]	Prospective	Total 52 SZ (37) NC (15)	1. DSM-III-R 2. BPRS	2. BFNE, IAS	**Well-being** - WB **Social anhedonia** - SAS	Amongst SZ, level of SAS positively correlated with level of IAS and BFNE (r=0.64 and 0.48), while WB negatively correlated with level of IAS and BFNE (r=-0.52 and -0.48), all ps<0.005.	4****

Factors related to social anxiety and psychosis

Bipeta et al. (2016) [50]	Cross-sectional	Total 64 SZ (47) SZ+SAD (17)	1. ICD-10 2. PANSS	2. SIAS	**Well-being** - WHO-5 **Functioning** - GAF	SZ+SAD reported lower level of WHO-5 (t=2.66, p=0.01) and GAF (t=2.1437, p=0.036) than SZ.	4****
Romm et al. (2012) [71]	Cross-sectional	Total 144 FEP (30) FEP+NonGSAD (46) FEP+GSAD (68)	1. DSM-IV 2. PANSS, IS	2. LSAS-SR	**Quality of life** - QOLI **Functioning** - GAF - Premorbid adjustment scale	FEP+GSAD reported lower level of premorbid social functioning, academic functioning, GAF and QOLI (F=7.62 and 15.13, 12.51 and 10.91, all ps<0.001) than FEP and FEP+NonGSAD.	5*****
El-Masry et al. (2009) [44]	Cross-sectional	Total 107 SZ (67) SZ+SAD (19) SAD (21)	1. DSM-IV 2. SAPS, SANS	2. LSAS	**Quality of life** - SF-36	SZ+SAD reported lower levels of SF-36 subscales: general health, vitality, social function, role-emotional and mental health than SZ, all ps<0.05.	3***
Chudleigh et al. (2011) [42]	Cross-sectional	Total 60 FEP (20) At-risk of psychosis (20) NC (20)	1. CAARMS 2. BPRS	2. BSPS	**Functioning** - SFS - WHODAS	Amongst FEP, level of SFS: performance and competence of independence subscales correlated with BSPS (r=-0.52 and r=-0.58), plus level of WHODAS: self-care and getting along with people subscales correlated with level of BSPS (r=0.71 and r=0.53). All all ps<0.01.	4****
Voges et al. (2005) [76]	Cross-sectional	SZ (60)	1. DSM-IV 2. PANSS	1. DSM-IV 2. SPAI	**Functioning** - SFS	SPAI significantly correlated with SFS (r=-0.32, p<0.001).	5*****
Pallanti et al. (2004) [10]	Cross-sectional	Total 107 SZ (51) SZ+SAD (29) SAD (27)	1. DSM-IV 2. SAPS, SANS	1. DSM-IV 2. LSAS	**Quality of life** - SF-36 **Functioning** - SAS* **Suicidality** - Suicide behavior (by interview) and the number of lifetime suicide	SZ+SAD reported lower level of SAS* (F4.85, p<0.04), higher number of suicide attempts (F5.19, p<0.03) and lethality of suicide attempts (F34.14, p<0.001) than SZ. SZ+SAD reported lower level of SF-36: general health, vitality, social functioning, role-emotional and mental health subscales (F1,78=8.71, 4.79, 25.41, 9.94 and 8.96; p<0.01, p<0.05, p<0.001, p<0.01 and p<0.01, respectively) than SZ.	4****
Aikawa et al. (2018) [90]	Cross-sectional	Total 207 SZ (177) SZ+SAD (30)	1. DSM-IV 2. PANSS	1. MINI 2. LSAS	**Functioning** - SFS	Lower level of SFS, female, younger age of onset and longer untreated duration were associated with LSAS (β=-0.42, p<0.001, adjusted R^2=0.255).	5*****
Lecomte et al. (2019)[73]	Cross-sectional	Total 47 SZ (25) SZ+SAD (22)	1. DSM-IV-TR	2. BSPS, SIAS	**Functioning** - SFS	SIAS was associated with SFS engaging in conversations subscales (β=-0.61, p<0.001, adjusted R^2=0.35).	5*****

Cacciotti-Saija et al. (2018)[51]	Cross-sectional	SZ (51)	1. DSM-IV-TR 2. SAPS, SANS	2. SIAS	**Functioning** - SFS	SIAS (β=-0.56, p<0.001) and SANS (-0.37, p<0.01) were associated with SFS (adjusted R^2=0.66).	4****
Khaliln et al. (1992)[54]	Cross-sectional	SZ (53)	1. ICD-9	2. U-Scale	**Family factors** - EMBU - AfS	Level of social anxiety (U-scale) positively correlated with a paternal rejection (p<0.005), but not correlated with mother. Those with SZ who scored their key relatives as more critical and hostile attributed to themselves (Afs) reported higher scores on social anxiety dimensions: fear of failure and criticism (p<0.01), social contact anxiety (p<0.001), inability to refuse (p<0.001) and decency (p<0.01).	4****
Michail et al. (2014)[86]	Cross-sectional	Total 135 FEP (60) FEP+SAD (20) SAD (31) NC (24)	1. ICD-10 2. PANSS	1. ICD-10 2. SIAS, SPS	**Family factors** - MOPS **Traumatic experiences** - CTQ	FEP+SAD and SAD reported higher level of traumatic experiences (CTQ: emotional abuse (F1,97=4.8, p<0.05) and sexual abuse (F1,97=3.7, p<0.05)) and dysfunctional parental behaviors (MOPS: paternal indifference (F1,97=5.6, p<0.05) and paternal abuse (F1,97=6.1, p<0.05)) than FEP and NC.	5*****
Schutters et al. (2012)[56]	Prospective	General population (2548)	1. DIA-X/M-CIDI	1. DSM-IV	**Personality factors** - RSRI - TPQ	Regarding multinomial logistic regression analysis, people having comorbid paranoid with social phobia associated with RSRI behavioral inhibition and TPQ harm/avoidance (Relative Risk=26.22 and 1.12, all ps<0.001), when compared to those without a history of social phobia or paranoid symptoms.	4****
Park et al. (2009)[40]	Cross-sectional	Total 54 SZ (27) NC (27)	1. DSM-IV-TR 2. PANSS, SAS**	2. STAI trait anxiety	**Anomalous experiences** - SAS	SZ reported higher level of STAI than NC in happy condition (t=-5.00, df=42.7, p<0.01). Amongst SZ, STAI correlated with SAS** in happy (r=0.56, p<0.01) and angry conditions (r=0.54, p<0.01), and with SAS in happy condition (r=0.38, p<0.05).	2**
Jang et al. (2005)[39]	Cross-sectional	Total 30 SZ (15) NC (15)	2. PANSS	2. STAI state anxiety	**Anomalous experiences**	Virtual avatar could evoke level of STAI, showing positive correlation between the STAI and PANSS negative subscales: blunted affect (evoked by happy avatar: r=0.549, p=0.034; and neutral avatar: r=0.536, p=0.039); and passive/apathetic social withdrawal (happy avatar: r=0.536, p=0.039; and neutral avatar: r=0.658, p=0.008).	3***
Lysaker et al. (2006)[95]	Cross-sectional	Total 71 (All SZ) WCST impaired+no delusions (39) WCST impaired+delusions (11)	1. DSM-III-R 2. PANSS	2. LSAS, STAI	**Executive functionings** - WCST	Patients having impaired cognitive flexibility with significant delusion group reported higher level of LSAS (F=4.12, p<0.05) than all other groups. Subgroup analysis showed this group reporting higher on LSAS particularly fear subscale (Fisher LSD p<0.05).	5*****

		WCST not impaired+no delusions (15) WCST not impaired+delusions (6)					
Rietdijk et al. (2009) [57]	Prospective	General population (7076)	1. DSM-III-R 2. CIDI Psychosis section	2. CIDI Social anxiety section	**Subclinical paranoia** - CIDI Psychosis section	Of 489 subjects who did have lifetime sub-clinical paranoid symptoms but no lifetime social phobia at baseline, 23 subjects (4.7%) developed social phobia (OR=4.07; 95% CI=2.50-6.63; p<0.001). The OR remained significant after controlling for neuroticism (OR=2.62; 95% CI=1.57-4.36; p<0.001).	4****
Michail et al. (2009) [11]	Cross-sectional	Total 111 FEP (60) FEP+SAD (20) SAD (31)	1. ICD-10 2. PANSS, DoT	1. ICD-10 2. SIAS, SPS, BFNE	**Persecutory threat** - DoT	FEP+SAD (n=9/20 (45%)) had higher number of express persecutory threat (DoT) than FEP alone (n=7/60 (11.6%)), $x^2 1=10.4$, p<0.01.	4****
Lysaker et al. (2008) [94]	Cross-sectional	SZ (143)	1. DSM-IV 2. PANSS	2. MAQ social anxiety	**Hopelessness** - BHS	MAQ social anxiety significantly correlated with BHS hope (r=-0.44, p<0.001).	5*****

ADHS, Adult Dispositional Hope Scale; ADIS, Anxiety Disorders Interview Schedule for DSM-IV; AfS, Angehbrigen-Fragebogen fur Schizophrene patienten (assessing for patient's attitude towards him); BHS, Beck Hopelessness Scale; BFNE, Brief Fear of Negative Evaluation scale; BPRS, Brief Psychiatric Rating Scale; BSPS, Brief Social Phobia Scale; CAARMS, Comprehensive Assessment of At Risk Mental State; CGI, Clinical Global Impression; CIDI, Composite International Diagnostic Interview; CTQ, Childhood Trauma Questionnaire; DIA-X/M-CIDI, Munich-CIDI (a modified CIDI version 1.2); DoT, Details of Threat questionnaire; DSM-III-R, Diagnostic and Statistical Manual of Mental Disorders 3rd edition Revision; DSM-IV, DSM 4th edition; DSM-IV-TR, DSM-IV Total Revision; EMBU, Egna Minnen av Barndoms Uppfostran (assessing for memories of parental behavior); FEP, First Episode Psychosis; GAF, Global Assessment of Functioning scale; GSAD, Generalized SAD; IAS, Interaction Anxiousness Scale; ICD-9, International Classification of Diseases 9th edition; ICD-10, ICD 10th edition; LSAS, Liebowitz Social Anxiety Scale; LSAS-SR, LSAS Self Rating version; MAQ, Multidimensional Anxiety Questionnaire; MINI, Mini International Neuropsychiatric Interview; MOPS, Measure Of Parental Style; NC, Normal Control; PANSS, Positive and Negative Syndrome Scale; Q-LES-Q, Quality of Life Enjoyment and Satisfaction Questionnaire; QoL, Quality of Life; QOLI, Lehman Quality Of Life Interview; RSRI, Retrospective Self-Report of Inhibition; SAD, Social Anxiety Disorder; SANS, Scale for the Assessment of Negative Symptoms; SAPS, Scale for the Assessment of Positive Symptoms; SAS, Social Anhedonia Scale; SAS*, Social Adjustment Scale score; SAS**, Schizotypal Ambivalence Scale; SF-36, 36-tem Short Form health survey (Mental and Physical Component Summary (MCS and PCS)); SFS, Social Functioning Scale; SIAS, Social Interaction Anxiety Scale; SPAI, Social Phobia and Anxiety Inventory; SPS, Social Phobia Scale; SQLS, Schizophrenia Quality of Life Scale; STAI, State Trait Anxiety Inventory; SWNS, Subjective Well-being under Neuroleptic drug treatment Short form; SZ, SchiZophrenia spectrum disorder; TCI-R, Temperament and Character Inventory-Revised; TPQ, Tridimensional Personality Questionnaire; U-Scale, Unsicherheits-Fragebogen scale (assessing for social anxiety); WB, Well-Being scale; WCST, Wisconsin Card Sorting Test; WHO-5, World Health Organisation-5 Well-Being Index; WHODAS, WHO Disability Assessment Scale II; WHO-QOL26, WHO-Quality of Life 26

† Scoring as number of quality criteria met; for example, 4**** means 4 criteria (of totally 5) of a study design were met.

‡ worsened means an LSAS total score a ≥30% increase from baseline.

§ r/t means Pearson's product-mean correlation analyzes and independent t-tests were performed to examine the relationships of SF-36 scores with continuous and categorical variables.

Supplementary table 1 Embase and MEDLINE electronic search strategies for psychological factors maintaining social anxiety in psychotic experiences or psychosis (searched date 19 October 2020)

Databases	Literature search strategies	N abstracts
Embase	1. psychosis.mp. or Psychotic Disorders/ 2. psychotic.mp. 3. Schizophrenic Psychology/ or Schizophrenia/ or schizophreni*.mp. 4. Schizoaffective.mp. 5. DELUSIONS/ or delusion*.mp. 6. Paranoid Disorders/ or paranoi*.mp. 7. 1 or 2 or 3 or 4 or 5 or 6 8. Clinical high risk*.mp. 9. Ultra high risk*.mp. 10. (Attenuated adj2 (psycho* or schizophreni*)).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word] 11. At risk mental state*.mp. 12. Recent onset.mp. 13. first episode psycho*.mp. 14. Early psycho*.mp. 15. 8 or 9 or 11 or 12 16. 7 and 15 17. 10 or 13 or 14 or 16 18. Social anxi*.mp. 19. Phobia, Social/ 20. social phob*.mp. 21. 7 or 17 22. 18 or 19 or 20 23. 21 and 22 24. limit 23 to english language 25. limit 24 to humans	2212
MEDLINE	1. psychosis.mp. or Psychotic Disorders/ 2. psychotic.mp. 3. Schizophrenic Psychology/ or Schizophrenia/ or schizophreni*.mp. 4. Schizoaffective.mp. 5. DELUSIONS/ or delusion*.mp. 6. Paranoid Disorders/ or paranoi*.mp. 7. 1 or 2 or 3 or 4 or 5 or 6 8. Clinical high risk*.mp. 9. Ultra high risk*.mp. 10. (Attenuated adj2 (psycho* or schizophreni*)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 11. At risk mental state*.mp. 12. Recent onset.mp. 13. first episode psycho*.mp. 14. Early psycho*.mp. 15. 8 or 9 or 11 or 12 16. 7 and 15 17. 10 or 13 or 14 or 16 18. Social anxi*.mp.	644

19. Phobia, Social/
20. social phob*.mp.
21. 7 or 17
22. 18 or 19 or 20
23. 21 and 22
24. limit 23 to english language
25. limit 24 to humans

Supplementary table 2 The process of study selection, data extraction, quality assessment and data synthesis.

Process	By whom	Remarks
Study selection		
1. Sampled 10% †	Independently screened by WA and NM.	Agreement of inclusion and exclusion between two reviewers was 93.19 percent with Cohen's kappa 0.67, p<0.001. The full-texts of all potential eligible studies were assessed against eligibility criteria by WA.
2. The rest of the records retrieved	Screened by WA	
Data extraction		
1. Sampled 10% †	Independently extracted by WA and NM.	Extracted items were included study and participant characteristics; details of the measurements; study methodology; outcomes; information for assessment of the risk of bias and variables related to study quality.
2. The rest of the records screened	Extracted by WA.	
Quality assessment		
1. Sampled 10% †	Independently assessed by WA and NM.	Quality and risk of bias tool using the Mixed Methods Appraisal Tool (MMAT)–version 2018.[29] There are 5 criteria of each study design, every criterion was rated as 'yes', 'no' or 'cannot tell' for every applicable item. The agreement results led to the rated overall quality score presenting number of criteria met. The score ranging from 1*, 2**, 3***, 4**** and 5***** quality criteria met were reported. All studies were included, and none was excluded based on quality assessment.
2. The rest of the records screened	Assessed by WA.	
Data Synthesis		
All eligible full-text articles	Synthesized by WA.	Included studies varied in study designs, populations, measurements and outcomes. Due to the heterogeneity of the studies included, a narrative synthesis was applied.

NM; Nicola McGuire, WA; Warut Aunjitsakul

† Disagreements between the two reviewers were resolved by consensus or consulting the research supervisors (Andrew Gumley and Hamish McLeod).

Supplementary table 3 List of excluded reasons with authors.

No	Reasons	Authors (Year)
1	No measurement of any psychological factors linked to social anxiety and psychotic experiences	Argyle, N (1990),[138] Badcock, J. C. et al. (2011),[139] de la Asuncion, J. et al (2015),[140] Hayes, R.L. et al (1996),[141] Lopes, B. C. (2013),[142] Park I-J et al (2016),[143] Martin, J.A. et al. (2001),[144] Freeman, D. et al. (2008),[145] Tone, E.B. et al. (2011),[146] Cooper, S. et al. (2016),[147] Prochwicz, K. et al. (2017),[148] Matos, M. et al. (2013),[149] Sun, X. et al. (2018),[150] Gilbert, P. et al. (2005),[151] Morrison, A.P. et al. (2015),[152] Rietdijk, J. et al. (2013),[1] Taylor, H.E et al. (2014),[153] Mueller, S.A. (2016),[154] Ghada, E-K. et al. (2010),[155] Penn, D.L. et al. (1994),[156] Mazeh, D. et al. (2009),[157] Gorun, A. et al. (2015),[158] Pisano, S. et al. (2016),[159] Lee, TY. et al. (2013),[160] Halperin, S. et al. (2000),[161] Kingsep, P. et al. (2003),[162] Pot-Kolder, R. et al. (2018),[163] Zaffar (2020)[164]
2	Studies of mixed diagnostic examples do not present data in sub-group or only provide pooled or aggregated data	Bosanac, P. et al. (2016),[165] Ciapparelli, A. et al. (2007),[166] Rusch, N. et al. (2009)[167]

Supplementary table 4 Participant characteristics (N total=12060).

Samples	n (%)		Total	Age (years)	
	Male	Female		Mean ± SD	Min-max
General population	4161 (47.4%)	4610 (52.6%)	8771	27.7 ± 4.9	16-50
With established psychosis	1670 (66.0%)	862 (34.0%)	2532	31.7 ± 6.9	18-57
With high psychosis risk	373 (49.3%)	384 (50.7%)	757	25.4 ± 5.1	16-58

Supplementary table 5 Quality assessment of the 48 studies included in the systematic review using the Mixed Methods Appraisal Tool (MMAT)–Version 2018.[29]

No	Citation	Screening questions		1. Qualitative					2. Quantitative non-randomised					3. Quantitative descriptive					Quality criteria met †
		SQ1	SQ2	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2	3.3	3.4	3.5	
1	Gumley et al. (2004) [58]	Y	Y						Y	Y	Y	Y	Y						5*****
2	Pallanti et al. (2004) [10]	Y	Y						Y	Y	Y	N	Y						4****
3	Jang et al. (2005) [39]	Y	Y						Y	N	Y	CT	Y						3***
4	Voges et al. (2005) [76]	Y	Y											Y	Y	Y	Y	Y	5*****
5	Lysaker et al. (2006) [95]	Y	Y											Y	Y	Y	Y	Y	5*****
6	Birchwood et al. (2006) [59]	Y	Y						Y	Y	Y	Y	Y						5*****
7	Lysaker et al. (2008) [72]	Y	Y											Y	Y	Y	Y	Y	5*****
8	Park et al. (2009) [40]	Y	Y						Y	N	CT	N	Y						2**
9	Michail et al. (2009) [11]	Y	Y						Y	Y	Y	CT	Y						4****
10	Lysaker et al. (2010) [79]	Y	Y											Y	Y	Y	Y	Y	5*****
11	Lysaker et al. (2010) [60]	Y	Y											Y	Y	Y	Y	Y	5*****
12	Lysaker et al. (2011) [81]	Y	Y											Y	Y	Y	Y	Y	5*****
13	Romm et al. (2012) [71]	Y	Y											Y	Y	Y	Y	Y	5*****
14	Schutters et al. (2012) [56]	Y	Y											Y	N	Y	Y	Y	4****
15	Kumazaki et al. (2012) [47]	Y	Y											Y	Y	N	Y	Y	4****
16	Achim et al. (2013) [82]	Y	Y						Y	Y	Y	Y	Y						5*****

17	Armando et al. (2013) [88]	Y	Y						Y	Y	Y	Y	Y					5*****
18	Gajwani et al. (2013) [85]	Y	Y											Y	Y	Y	Y	Y	5*****
19	Michail et al. (2013) [25]	Y	Y						Y	Y	Y	N	Y					4****
20	Stopa et al. (2013) [78]	Y	Y	Y	Y	Y	Y	Y										5*****
21	Michail et al. (2014) [86]	Y	Y						Y	Y	Y	Y	Y					5*****
22	Sutliff et al. (2015) [75]	Y	Y											Y	Y	Y	Y	Y	5*****
23	Lowengrub et al. (2015) [48]	Y	Y											Y	Y	N	Y	Y	4****
24	Achim et al. (2016) [46]	Y	Y						Y	N	Y	Y	Y					4****
25	Piccirillo et al. (2016) [53]	Y	Y											Y	N	Y	N	Y	3***
26	Vrbova et al. (2017) [62]	Y	Y											Y	Y	Y	Y	Y	5*****
27	Khaliln et al. (1992) [54]	Y	Y											Y	Y	Y	N	Y	4****
28	Blanchard et al. (1998) [41]	Y	Y						Y	Y	Y	N	Y					4****
29	Huppert et al. (2005) [49]	Y	Y											Y	Y	N	Y	Y	4****
30	Lysaker et al. (2008) [94]	Y	Y											Y	Y	Y	Y	Y	5*****
31	Romm et al. (2011) [70]	Y	Y											Y	Y	Y	Y	Y	5*****
32	Chudleigh et al. (2011) [42]	Y	Y						Y	Y	Y	N	Y					4****
33	Achim et al. (2011) [87]	Y	Y						Y	Y	Y	Y	Y					5*****
34	Katherine et al. (2012) [43]	Y	Y						Y	Y	Y	N	Y					4****
35	Pyle et al. (2015) [61]	Y	Y											Y	Y	Y	Y	Y	5*****
36	Kwong et al. (2017) [92]	Y	Y											Y	Y	Y	Y	Y	5*****

37	El-Masry et al. (2009) [44]	Y	Y		Y	N	Y	N	Y						3***
38	Aherne et al. (2014) [63]	Y	Y							Y	Y	Y	Y	Y	5*****
39	Bipeta et al. (2016) [50]	Y	Y							Y	Y	N	Y	Y	4****
40	Aikawa et al. (2018) [90]	Y	Y							Y	Y	Y	Y	Y	5*****
41	Rietdijk et al. (2009) [57]	Y	Y							Y	N	Y	Y	Y	4****
42	Rus-Calafell et al. (2014) [55]	Y	Y							Y	Y	Y	N	Y	4****
43	Pepper et al, (2018)[80]	Y	Y		Y	Y	Y	Y	Y						5*****
44	Lecomte et al. (2019)[73]	Y	Y		Y	Y	Y	Y	Y						5*****
45	Cacciotti-Saija et al. (2018)[51]	Y	Y							Y	Y	N	Y	Y	4****
46	Russo et al. (2018)[45]	Y	Y		Y	Y	N	N	Y						3***
47	Wong (2020)[77]	Y	Y							Y	Y	Y	Y	Y	5*****
48	Nemoto et al. (2020)[52]	Y	Y							Y	Y	N	Y	Y	4****

Y, Yes; N, No; CT, Can't tell

SQ1, Screening questions 1: Are there clear research questions?; SQ2: Do the collected data allow to address the research questions?; 1.1. Is the qualitative approach appropriate to answer the research question?; 1.2. Are the qualitative data collection methods adequate to address the research question?; 1.3. Are the findings adequately derived from the data?; 1.4. Is the interpretation of results sufficiently substantiated by data?; 1.5. Is there coherence between qualitative data sources, collection, analysis and interpretation?; 2.1. Are the participants representative of the target population?; 2.2. Are measurements appropriate regarding both the outcome and intervention (or exposure)?; 2.3. Are there complete outcome data?; 2.4. Are the confounders accounted for in the design and analysis?; 2.5. During the study period, is the intervention administered (or exposure occurred) as intended?; 3.1. Is the sampling strategy relevant to address the research question?; 3.2. Is the sample representative of the target population?; 3.3. Are the measurements appropriate?; 3.4. Is the risk of nonresponse bias low?; 3.5. Is the statistical analysis appropriate to answer the research question?

[†] Scoring as number of quality criteria met; for example, 4**** means 4 criteria (of totally 5) of a study design were met.

Supplementary table 6 Lists of identified maintenance and correlates of social anxiety in psychotic experiences including frequencies of identified significant factors of each study.

Maintenance factors	Frequencies of identified significant factors	Correlates	Frequencies of identified significant factors
Cognitive factors		**Functioning**	9/10
- Stigma and shame	6/7 †	**Quality of life**	9/9
- Self-esteem	5/5	**Well-being**	3/3
- Social rank	3/3	**Family factors**	2/2
- Negative self-referent appraisals	3/4 ‡	**Personality factors**	2/2
Metacognitive factors		**Anomalous experiences**	2/2
- Theory of Mind	1/3	**Other factors**	
- Metacognitive mastery	1/1	- Suicidality and hopelessness	3/3
- Mentalization	1/1	- Traumatic experiences	1/1
- Reasoning biases	1/1	- Executive functioning	1/1
Behavioral factors		- Subclinical paranoia	1/1
- Avoidance	1/1	- Persecutory threat	1/1
- Post-event processing	1/1	- Social anhedonia	1/1
Other maintenance factors			
- Attachment	2/3		
- Empathy	1/1		
- Intolerance of uncertainty	1/1		

† means that six out of seven studies showed that stigma and shame was significantly associated with social anxiety in psychotic experiences.
‡ One out of four study is a qualitative study.