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Social exclusion and rejection across the psychosis spectrum: A systematic review of empirical research

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ABSTRACT

Social exclusion and rejection have deleterious effects on psychological well-being. Research documents the negative effects of social exclusion and rejection on psychiatric problems like depression, social anxiety disorder, and non-suicidal self-injury. Additionally, prior research suggests that individuals with and at-risk for psychosis spectrum disorders may also be negatively affected by exclusion and rejection. Moreover, those on the psychosis spectrum may be at an even greater risk to experience social exclusion due to poor social functioning and the stigma surrounding the disorder. This systematic review aimed to investigate how individuals across the psychosis spectrum respond to social exclusion and rejection. We systematically searched PubMed and PsycINFO databases to identify studies that met the following eligibility criteria: 1) investigated social exclusion or rejection, 2) targeted a psychosis-related sample or symptoms, and 3) was an empirical study. 13 studies satisfied our eligibility criteria and were subsequently reviewed. Despite methodological variation and samples spanning the psychosis spectrum, the majority of the literature supports the conclusion that those with psychosis spectrum disorders report similar levels of exclusion-induced distress compared to healthy controls, but process and cope with exclusion differently, both behaviorally and neurobiologically.

1. Introduction

Social exclusion and rejection challenge the fundamental human need to belong. Social rejection can be thought of as the negative evaluation by peers when one has an expectation of acceptance (Blackhart et al., 2009). Social exclusion is similar, though broader, and reflects being in a state of aloneness, separate from a peer group. Though slightly different experiences, they often overlap and are studied together (*e.g.*, Eisenberger et al., 2003). Research has shown that exclusion and rejection have a pernicious effect on mental health (Beeri and Lev-Wiesel, 2012; Cheek et al., 2019); physical health (Slavich et al., 2010; Senese et al., 2020), cognition (Baumeister et al., 2002; Xu et al., 2018), and overall wellbeing (Hitlan et al., 2006; Zadro et al., 2004). Moreover, the experience of and response to exclusion and rejection are critically implicated in the development of psychiatric symptoms and disorders (Beeri and Lev-Wiesel, 2012; Levinson et al., 2013; Platt et al., 2013).

The effects of social exclusion and rejection on psychosis spectrum disorders are less well understood. However, based on the social defeat hypothesis of schizophrenia (Selten et al., 2013), we would expect these experiences of exclusion and rejection to be related to the development and maintenance of psychotic symptoms and disorders. According to this hypothesis, individuals who experience chronic levels of social defeat are at an increased risk for the development of psychotic disorders, such as schizophrenia (Selten et al., 2013). This hypothesis is supported by the increased rates of psychotic disorders among groups experiencing social defeat, such as individuals who are migrants from developing countries, have grown up in urban environments, have hearing impairments, have lower IQs, and individuals who have experienced childhood trauma (Selten et al., 2013; van Os et al., 2010). Social exclusion and rejection are types of social defeat that might be experienced by individuals with and at-risk for psychosis spectrums disorders. With a shift toward focusing on social factors that are implicated in the development and maintenance of psychosis spectrum disorders (Anglin et al., 2020), a review of rejection and exclusion studies becomes particularly relevant.

Individuals with and at-risk for psychosis spectrum disorders are at a greater risk of social exclusion and rejection than typically developing peers. There are several factors that may increase the risk of social exclusion or rejection. For individuals along the psychosis spectrum deficits in social cognitive processes (Couture et al., 2006) may result in inaccurate interpretations of social information (Selten et al., 2017), leading to experiences of exclusion or rejection by peers. Moreover, these individuals have associated social skills deficits, which can contribute to exclusion and rejection. Individuals along the psychosis

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spectrum demonstrate significant impairments in social skills compared to healthy controls (Hooley, 2010; Mueser et al., 1991). Effective social skills are needed to properly engage with others and respond to others' social initiations (Bellack et al., 1990). Thus, social skills deficits may contribute to exclusion of typical social or culturally normative behavior. For example, individuals with schizophrenia are less likely to marry (MacCabe et al., 2009). Additionally, the cognitive disorganization aspect of schizotypy has been found to be associated with nervousness in large groups of people (Oezgen and Grant, 2018), potentially creating situations of social exclusion. These social cognitive, social skill, and cognitive deficits may increase the likelihood of exclusion and rejection from social interactions and social experiences, as well as contribute to the stigma experienced by people with psychosis spectrum disorders (Penn et al., 2000).

Not only do an individual's deficits and behaviors impact their likelihood of experiencing stigma, social exclusion, and rejection, but their surrounding community plays a role as well. Individuals on the psychosis spectrum are particularly prone to suffering from stigma and discrimination (Angermeyer and Matschinger, 2003; Dickerson et al., 2002; Wood et al., 2017), which may increase their risk for experiences of social exclusion and rejection. For example, Penn et al. (2000) found that individuals expressed they would be less likely to interact with individuals with schizophrenia that were rated as being more "strange" and lacked certain social skills. Similarly, Zborowski and Garske (1993) found that females interviewing men with high schizotypy features felt more angry, more anxious, and less curious when the men displayed unusual mannerisms, inappropriate affect, or tangential, off-topic, or illogical responses. The interviewers' negative feelings were elicited by common nonverbal and verbal behaviors associated with psychosis, despite there being no ill intention of the interviewees. Individuals on the psychosis spectrum are also more likely to face discrimination in health care and the workplace and be perceived as lazy, overdramatic, dangerous, and even violent (Gonzalez-Torres et al., 2007; Link et al., 1999). People may distance themselves from those with psychosis spectrum disorders as a result of the prejudice surrounding this group of mental illnesses (Angermeyer and Matschinger, 2003). Further, patients may internalize this stigma and become less motivated to engage in social interactions and more likely to isolate themselves (Gonzalez-Torres et al., 2007; Lysaker et al., 2007).

This transactional type of relationship can also be seen within family interaction patterns, where interactions depend on multiple parties and could potentially result in social rejection. Strachan et al. (1989) found that patients with schizophrenia displayed more criticism toward their parents who had been rated high in expressed emotion (EE), as opposed to patients interacting with low EE parents. This finding demonstrates an interplay between a parent's behavior and their child's response, possibly impacted by the presence of psychosis. Amaresha and Venkatasubramanian (2012) assert that these negative interaction patterns including hostility, unmanaged anger, irritation, critical comments, and rejection even affect a person's likelihood of symptom relapse and trajectory of illness. This is just one example of the complex relationships that may exist between a person with psychosis, their exchanges within the family or community, and their potential experiences of social rejection. This research demonstrates that individuals with psychosis spectrum disorders are certainly at high risk for and likely experiencing social exclusion and rejection in their day-to-day lives. Thus, understanding the consequences of exclusion and rejection on symptoms and overall wellbeing becomes important for interventions and recovery goals.

The primary aim of this review is to evaluate the role of exclusion and rejection on individuals with psychosis spectrum disorders. To date there are a handful of studies that examine the consequences of social exclusion and rejection across the psychosis spectrum, from healthy populations' schizotypal traits to full threshold psychosis, but there are currently no reviews of social exclusion and rejection as they relate with symptoms affiliated with psychosis. Pulling these studies together and looking not only at full threshold psychosis, but also at studies that include healthy adults or a clinical high risk population, is important for building a foundation on which to understand the effects of social exclusion and rejection on psychosis-related symptoms. This review is important because of its consideration of psychosocial experiences that may affect the development and outcomes of psychotic disorders. Ultimately, an improved understanding could help guide future research and interventions for psychosis spectrum disorders.

2. Methods

We used PubMed and PsycINFO databases to systematically search the literature. We used the following key search terms including *psychosis and social rejection OR social exclusion, OR ostracism*, and *schizophrenia* and *social rejection OR social exclusion OR ostracism*. We conducted the search dating from January 1970 to January 2020. Our PubMed search resulted in 1656 articles and our PsychINFO search returned 2188 articles. Then article titles and abstracts were screened by all authors, and articles were included if they met the following criteria: 1) investigated an aspect of social exclusion or rejection, 2) targeted a psychosis-related sample or symptoms, and 3) was an empirical study. We did not include articles that studied related constructs such as discrimination, social alienation, and stigma. Additionally, articles were excluded if they were dissertations, review articles, theoretical papers, case studies, or conference presentations. After narrowing down articles based on inclusion/exclusion criteria and removing duplicates, our search yielded a total of 13 relevant studies (Table 1).

3. Results

The results of this review can be divided into three groups: healthy adults, clinical risk, and schizophrenia. There are a total of 13 papers, with five papers focused on a healthy adults group, one paper on those at clinical risk, and seven papers on individuals with schizophrenia.

3.1. Healthy adults

The majority of research investigating schizotypy in healthy adults and its association with exclusion and rejection has come from one group out of Nottingham Trent University and Kings' College London. Generally, this group examined behavioral and neurobiological differences in healthy adults with high and low schizotypy (*e.g.*, Premkumar et al., 2018). Several of their studies used variations of the Social Interactions Picture Task as the rejecting stimuli. This task includes viewing images from the International Affective Pictures System and a professional online stock image company that depict rejecting, accepting, and neutral scenes. Following presentation of the images, neurobiological and behavioral assessments were used to measure how participants perceived the scenes.

Using functional magnetic resonance imaging (fMRI), comparing low schizotypy to high schizotypy participants, Premkumar et al. (2012) found that high schizotypy participants had reduced neural activation in the dorsal anterior cingulate cortex (dACC), right superior frontal gyrus, and left ventrolateral prefrontal cortex relative to low schizotypy participants when viewing rejection scenes. Of note, there were no differences in ratings of rejection, suggesting that behavioral emotional response to rejection was similar across groups, though neural activation differed. The authors suggest that given the role of these regions in emotional-decision making, emotion regulation, and empathy, these differences may indicate differential processing of and coping with rejection between these groups, at least at the neural level. One limitation to this paper is its relatively small sample size (high schizotypy $n = 12$, low schizotypy $n = 14$), but a later study by the same team found comparable results, with 41 healthy adults, where higher levels of positive schizotypy were found to be associated with

Table 1
Papers included in review.

Author, year	N	Diagnosis	Age M (SD) [range]	Gender (N, %F)	Social exclusion/rejection paradigm
Engel et al. (2016)	40 (schizophrenia/schizoaffective disorder) 40 (control)	Schizophrenia/schizoaffective disorder	SCZ group: 36.32 (10.58) [–] Control group: 26.45 (6.70) [–]	SCZ group: 20 (50%) Control group: 19 (47.5%)	Cyberball task
Gradin et al. (2012)	13 (schizophrenia) 16 (control)	Schizophrenia	SCZ group: 41.23 (11.78) [–] Control group: 40.87 (11.72) [–]	SCZ group: 2 (15%) Control group: 9 (56%)	Cyberball task w/ fMRI
Lee et al. (2014)	15 (schizophrenia) 16 (control)	Schizophrenia	SCZ group: 30.7 (6.6) [–] Control group: 27.4 (6.9) [–]	SCZ group: 5 (33%) Control group: 7 (44%)	fMRI w/ virtual handshake task
Lincoln et al. (2018)	25 (high-risk for psychosis) 40 (control) 40 (anxiety disorder control)	Clinical high risk	Psychosis group: 34.72 (14.05) [–] Control group: 40.03 (10.78) [–] Anxiety disorder group: 42.23 (11.64)	Psychosis group: 18 (72%) Control group: 27 (67.5%) Anxiety disorder group: 25 (62.5%)	Cyberball task
Perry et al. (2011)	21 (schizophrenia) 20 (control)	Schizophrenia	SCZ group: 42.7 (10.1) [–] Control group: 44.0 (13.1) [–]	SCZ group: 14 (67%) Control group: 12 (60%)	Cyberball task
Pillny and Lincoln (2020)	42 (inclusion condition) 42 (exclusion condition)	None (healthy)	IC: 26.3 (6.04) [18–63] EC: 27.7 (10.3) [18–63]	IC: 26 (62%) EC: 20 (48%)	Cyberball task
Premkumar et al. (2012)	12 (high schizotypy) 14 (low schizotypy)	None (healthy)	HS: 30.00 (10.58) [–] LS: 28.64 (6.07) [–]	HS: 9 (75%) LS: 12 (86%)	fMRI with online and offline social rejection image task
Premkumar et al. (2014)	41	None (healthy)	21.1 (1.8) [18–45]	26 (63%)	Social interactions picture task/EEG recording
Premkumar et al. (2015)	41	None (healthy)	21.07 (1.82) [–]	26 (63%)	Social interactions picture task/EEG recording
Premkumar et al. (2018)	318	None (healthy)	24.6 (7.88) [19–66]	260 (82%)	Adult Rejection Sensitivity Questionnaire
Reddy et al. (2019)	35 (schizophrenia) 34 (control)	Schizophrenia	SCZ group: 49.7 (10.5) [–] Control group: 48.5 (7.8) [–]	SCZ group: 10 (31%) Control group: 12 (36%)	Cyberball task
Sokunbi et al. (2014)	13 (schizophrenia) 16 (control)	Schizophrenia	SCZ group: 41.22 (11.78) [–] Control group: 41.56 (11.92) [–]	SCZ group: 2 (15%) Control group: 9 (56%)	Cyberball task w/ fMRI
Sundag et al. (2018)	20 (persecutory delusions) 40 (control)	Schizophrenia with persecutory delusions	PD group: 38.70 (12.87) [18–65] Control group: 40.03 (10.78) [18–65]	PD group: 12 (60%) Control group: 27 (67.5%)	Cyberball task

decreased N100 activity in the dACC to rejection *versus* neutral scenes (Premkumar et al., 2014). The authors suggest that this difference in neural processing might indicate an impairment in encoding rejection information.

Using the same sample of healthy adults as that in the 2014 paper ($n = 41$), Premkumar et al. (2015) tested whether neurological activity during an EEG at P200 and P300 was increased during passive viewing of rejection scenes, as well as whether neurological activity at these time points was associated with schizotypy. They found increased P200 activity in the dACC to rejecting *versus* neutral scenes, as well as increased P300 activity in the midline to rejecting *versus* neutral scenes. They assert that both these findings reflect an attention to and preparation for rejection-related information. In examining the relationship between neural activity and positive and negative schizotypy, the findings were mixed. They note positive schizotypy was associated with reduced P200 amplitude and negative schizotypy was related to greater P300 activity at the midline and P200 activity at the middle occipital gyrus. Ultimately, from this pattern of findings the authors assert that positive schizotypy was associated with reduced attention to rejection, whereas negative schizotypy was associated with a heightened attention to rejection.

This relationship between type of schizotypal traits and rejection sensitivity was examined behaviorally as well, by Premkumar et al. (2018) using the Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE) to measure schizotypal traits. As opposed to the study discussed earlier by Premkumar et al. (2012), which did not find differences in behavioral emotional responses to rejection between low and high schizotypy groups, this study did find that schizotypal traits significantly predicted rejection sensitivity among a sample of 318 university students. More specifically, negative and disorganized traits, though not positive traits, were found to be significant predictors of rejection sensitivity. Furthermore, psychological quality of life mediated the relationship between interpersonal schizotypal traits and rejection sensitivity. The authors assert that this mediation suggests that self-esteem and better social functioning could be pathways to ameliorate the experience of rejection sensitivity in a high schizotypy group.

To further examine social exclusion experiences in healthy adults, Pillny and Lincoln (2020) investigated the relationship between social exclusion and motivation loss resembling negative symptoms. This study used the Cyberball paradigm (Williams et al., 2000; Williams and Jarvis, 2006). Cyberball is an online ball-tossing paradigm, where a ball is virtually passed between two cartoon players and the participant. The participant is led to believe that the virtual players are actually other participants playing the task in neighboring labs. The task typically consists of an inclusion condition, where the participant receives the ball about a third of the time, and an exclusion condition, where the participant receives the ball twice at the beginning of the task and does not receive it again thereafter.

Using the Cyberball task, with healthy adult participants from the community ($n = 84$), Pillny and Lincoln (2020) found that relative to an inclusion condition, participants experiencing exclusion had a loss of motivation. Moreover, repeated experiences of social exclusion, as

assessed by the Ostracism Experience Scale, were positively associated with negative symptom scores, as assessed with the Clinical Assessment Interview for Negative Symptoms (CAINS) (Engel et al., 2014). The authors contend that these results are consistent with the social defeat theory of schizophrenia. As individuals experience chronic social exclusion, they develop negative symptoms, in particular low motivation, and thus may be more likely to further avoid social interactions later on, potentially creating a cycle of exclusion and increasing negative symptoms.

3.2. Clinical risk

To date, there is only one paper investigating the experience of exclusion or rejection in individuals at a clinical high risk (*i.e.*, attenuated positive symptoms) for psychosis (Lincoln et al., 2018). In this paper, clinical high risk (CHR) individuals ($n = 25$), anxiety controls (AC) ($n = 40$), and healthy controls (HC) ($n = 40$) were all assessed on negative emotions and paranoid beliefs before and after participating in the Cyberball task. They were also assessed for type of emotion regulation (ER) strategies. All three groups reported feeling a moderate level of exclusion following the task – there was no difference among the groups in how excluded they felt after the Cyberball task. In regard to clinical symptoms, the CHR group experienced a significantly greater increase in paranoid beliefs following exposure to exclusion as compared to the AC and HC groups, suggesting that a paranoid response to social rejection is specific to those at-risk for psychosis, and not generalized to those with social or other anxiety disorders. Notably, the difference between the CHR group and the two control groups was mediated by baseline self-reported negative emotion (higher negative emotion at baseline in the CHR group explains some of the difference in paranoia following exclusion). The difference between the CHR and HC groups, but not the AC group, was further mediated by baseline emotion regulation as well (more dysfunctional and less functional ER strategies in the CHR group compared to the HC group explains some of difference in paranoia). Taken together, the findings from this study support the idea that a paranoid response to social exclusion may be related to negative emotional state and dysfunctional emotion regulation, both of which seem to be more common in people at clinical high risk for psychosis.

3.3. Schizophrenia

Seven papers focused on social exclusion among those diagnosed with schizophrenia or schizoaffective disorders. All studies except for one (Lee et al., 2014) used the Cyberball paradigm to create the experience of social exclusion. The majority of these studies found no significant differences in exclusion-induced social distress between groups, but rather found significant differences in how those with schizophrenia processed and coped with social exclusion and rejection.

With the Cyberball paradigm, Engel and colleagues (Engel et al., 2016) found no difference between individuals with schizophrenia ($n = 40$) and healthy controls ($n = 40$) in the way that they experienced exclusion following the task. However, they did note that those with schizophrenia reported less positive emotion after an inclusion experience, which may reflect the social anhedonia often seen in individuals with schizophrenia (Cohen et al., 2005).

Also using the Cyberball paradigm, Sundag et al. (2018) studied individuals with schizophrenia ($n = 20$) presenting with persecutory delusions (PDs) and found no significant differences in emotional responses to exclusion between individuals with PDs and healthy controls ($n = 40$). However, individuals with PDs experienced a stronger increase in paranoia following exclusion compared to healthy controls. Baseline measurements of early maladaptive schemas (EMSs) mediated the relationship between group and the increase in paranoia. EMSs are self-defeating beliefs that are thought to arise from early adverse experiences and are triggered by situations perceived as similar to those adverse experiences (Sundag et al., 2018). Therefore, individuals with schizophrenia may demonstrate an increased sensitivity to social exclusion which could be linked to the presence of EMSs.

Perry and colleagues (Perry et al., 2011) and Reddy and colleagues (Reddy et al., 2019) both focused on the Need-Threat Scale often used with the Cyberball paradigm (Zadro et al., 2004). The Need-Threat Scale consists of four primary needs: belongingness, control, self-esteem, and meaningful existence. All together, these needs summarize an individual's affective experience in response to exclusion. In general, this scale measures security of needs and social stress, with higher scores on this index indicating a greater sense of security. Both Perry et al. (2011) and Reddy et al. (2019) found that individuals with schizophrenia and healthy controls experienced a decrease on the Need-Threat Scale when exposed to social exclusion. Perry et al. (2011) found that there were no significant differences between individuals with schizophrenia ($n = 21$) relative to healthy controls ($n = 20$) on the Need-Threat Scale immediately following exclusion. However, after an 8-minute delay, while both groups experienced a recovery of needs, the schizophrenia group experienced it to a significantly lesser extent than did the healthy controls. In contrast to other studies in this review, Reddy et al. (2019) found that relative to individuals with schizophrenia ($n = 35$), healthy controls ($n = 34$) experienced a significantly greater decrease on the Need-Threat Scale. Additionally, both groups experienced decreased working memory following exclusion, suggesting the cognitive consequences of exclusion may be comparable in healthy controls and individuals with schizophrenia. Furthermore, in contrast to Perry et al.'s (2011) findings, these results suggest that individuals with schizophrenia may actually demonstrate less of a negative affective response to exclusion, perhaps as a result of familiarity with social rejection (Reddy et al., 2019).

Several studies used neuroimaging methods to assess differences in neural activity associated with rejection in individuals with schizophrenia. Using the Cyberball paradigm, Gradin et al. (2012), found that relative to healthy controls ($n = 16$), individuals with schizophrenia ($n = 13$) demonstrated significantly less activation in the medial prefrontal cortex (mPFC) and orbitofrontal cortex (OFC) during rejection. Moreover, reduced responses to rejection in the mPFC were associated with increased negative symptoms in individuals with schizophrenia. Of note, there were no differences in behavioral reports of needs or distress following rejection between the two groups. Sokunbi et al. (2014), also using the Cyberball paradigm, investigated fMRI brain signal complexity in individuals with schizophrenia ($n = 13$) and healthy controls ($n = 16$). As with other studies, behaviorally there were no differences between groups in self-reported social distress during the exclusion condition. However, individuals with schizophrenia exhibited a higher complexity of fMRI signal during the exclusion task in both regional and whole brain assessments, relative to the healthy controls. The authors suggest this finding is in line with the hypothesis that individuals with schizophrenia have higher overall neurobiological complexity which is indicative of neurobiological dysfunction. Lee et al. (2014) further investigated differences in neural response to exclusion, as indicated by a denied virtual handshake in the scanner, between individuals with schizophrenia ($n = 15$) and healthy controls ($n = 16$). Behaviorally, they note that both individuals with schizophrenia and healthy controls reported the same level of feeling refused, disliked, and threatened. Neurobiologically, individuals with schizophrenia had hypoactivity in the posterior superior temporal sulcus (pSTS) relative to healthy controls; they suggest this finding might indicate a failure to mentalize, noting the role of the pSTS in social cognitive processes like mentalizing.

4. Discussion

A total of thirteen studies were included in this review. These studies looked at the experience of social exclusion and rejection across the psychosis spectrum, including schizotypy, clinical high risk, and individuals

with psychotic disorders. Overall, individuals on the psychosis spectrum demonstrated similar experiences of distress in response to the experimental tasks and measures of social exclusion and rejection compared to healthy controls, but their neurobiological and behavioral responses over time differed from those of healthy controls, suggesting the possibility of differential coping responses.

4.1. Experience of exclusion

The majority of studies suggest that relative to control participants, individuals on the psychosis spectrum report similar levels of exclusion-related distress. In general, rejected individuals report more negative emotion and affect overall (Blackhart et al., 2009). Our findings suggest that individuals with and at-risk for psychosis spectrum disorders are not different from each other or from controls in their immediate experience of exclusion, as no study reported greater exclusion-related negative affect in schizophrenia or at-risk individuals in comparison to healthy controls. This finding suggests that individuals with or at-risk for psychosis spectrum disorders have initial experiences of exclusion comparable to healthy controls. It is possible that this lack of difference reflects a similarity in sensitivity to social affiliation or need for acceptance, though these processes should be further investigated. Unique to their study, Perry et al. (2011) assessed exclusion-related affect after a short delay in both controls and individuals with schizophrenia, which provides us with additional information on the duration of the experience of exclusion for individuals with schizophrenia. They found that both groups reported an immediate similar level of exclusion-related distress, and then experienced an emotional recovery following exclusion. However, the schizophrenia group experienced significantly less of a recovery than controls. This finding suggests a possible difference in coping ability between groups, with those with schizophrenia experiencing the negative effects of social exclusion for a greater length of time than controls. Perhaps this failure to cope is related to the increases observed in psychotic-like symptoms following exclusion in other studies (Lincoln et al., 2018; Pillny and Lincoln, 2020; Sundag et al., 2018). This failure to cope may also be due to an impairment of the stress response in individuals with schizophrenia. Jansen et al. (2000) assessed the stress response of individuals with schizophrenia, as well as healthy controls, and found that individuals with schizophrenia had a blunted cortisol response for psychosocial stress. Additionally, Reed et al. (2020) found that decreased vagal suppression as well as a blunted cortisol response increased the likelihood of psychosocial stress in patients with schizophrenia. Dysfunctional emotion regulation strategies, as noted by Lincoln et al. (2018), could also play a role in the failure to cope following exclusion. These difficulties in stress management may explain why the participants with schizophrenia were affected by the social exclusion over a longer period of time relative to healthy controls.

4.2. Psychotic symptoms

In general, the literature shows that exclusion and rejection experiences increase psychotic-like symptoms across the psychosis spectrum. Across these studies, relative to healthy controls, we see an increase in psychiatric symptoms, specifically paranoia, in patients (Sundag et al., 2018) and individuals at clinical high risk (Lincoln et al., 2018) following social exclusion. Pillny and Lincoln (2020) also found an increase in negative symptom scores on the Clinical Assessment Interview for Negative Symptoms in healthy adults following social exclusion. These findings are consistent with research on other psychiatric disorders, that experiences of exclusion and rejection heighten psychiatric symptoms. For example, individuals with chronic depression show a greater increase in negative emotions compared to healthy controls following exposure to social exclusion (Jobst et al., 2015), suggesting that exclusion may heighten depression symptoms. A similar effect on anxiety symptoms was implicated when socially anxious children were excluded, and their physiological experiences of anxiety intensified (Gazelle and Druhen, 2009). Even among nonclinical samples, social exclusion experiences have been found to predict socially anxious behaviors in future situations (Fung and Alden, 2017). Researchers should continue to explore the directional relationship of associations found between social rejection and other psychopathology as well, such as non-suicidal self-injury (Brunner et al., 2014) and psychosis. Our review is consistent with the idea that social exclusion and rejection may heighten already present psychiatric symptoms.

It is possible that cognitive functioning may also be affected by social exclusion experiences (Reddy et al., 2019). In the Reddy et al. (2019) paper reviewed here, there was a significant decline in working memory in both healthy controls and individuals with schizophrenia. This finding is consistent with prior literature on typically developing individuals which has shown that individuals demonstrate a decline in cognitive performance following experiences of exclusion and rejection (Baumeister et al., 2002; Hawes et al., 2012). It seems likely that those on the psychosis spectrum may also experience this decline in cognitive ability following exclusion, though more research is needed to replicate the results of Reddy et al. (2019).

4.3. Neurobiological response

While we note very little difference in self-reports of distress in response to exclusion compared to healthy controls, our findings suggest that individuals with and at-risk for psychotic disorders show different neurobiological responses to exclusion.

The neural correlates of social rejection in typically developing individuals are well-established. A recent meta-analysis identified neural correlates of social rejection in healthy controls including the anterior cingulate cortex, medial orbitofrontal cortex, and the ventromedial prefrontal cortex (Vijayakumar et al., 2017). We see some of these regions at play in the papers reviewed here. Across individuals with schizophrenia the findings of this review suggest atypical neural activation in social brain regions during experiences of social exclusion. More specifically, we note reduced neural activity in the pSTS (Lee et al., 2014), mPFC (Gradin et al., 2012), and orbital frontal cortex (Gradin et al., 2012). Importantly, reduced activation in the pSTS was negatively associated with psychotic symptoms, and reduced activity in the mPFC was negatively associated with positive symptoms in patients (Gradin et al., 2012; Lee et al., 2014). Given the roles of these regions in social processing (Blakemore, 2008; Van Overwalle and Baetens, 2009), these findings may suggest atypical processing of social feedback or information.

Along the same lines, research on those with schizotypal personality traits suggests a difference in neural activity in social brain regions. Premkumar et al. (2012) found a decrease in neural activity in the dACC, right superior frontal gyrus, and left ventromedial prefrontal cortex in individuals with high schizotypy relative to low schizotypy. Additionally, in healthy adults, reduced N100 dACC activity during an exclusion task was related to greater positive schizotypy symptoms (Premkumar et al., 2014). These findings are consistent with the hypoactivation noted in social brain regions in individuals with schizophrenia during social exclusion tasks.

Abnormal responses in social brain regions such as the mPFC and pSTS during a social task are consistent with prior literature in patients with schizophrenia which may suggest an overall problem in the processing of social information. Dodell-Feder et al. (2014) found reduced activity in the mPFC during a theory of mind task in schizophrenia patients relative to controls. Similarly, Baskak et al. (2015) found that a social defeat task resulted in a greater decrease in neural activity in the right ventrolateral prefrontal cortex in those with schizophrenia relative to controls.

Taken together these findings suggest disruption to typical social neural processes in individuals with and at-risk for psychosis spectrum disorders during experiences of social exclusion and rejection. The aberrations in neural activity found in these studies suggest a potential

failure to attend to and/or encode social information during an experience of social exclusion or rejection. These studies note differences in social brain regions involved in social cognitive processing, including the pSTS and the mPFC. The social cognitive hypothesis highlights a pathogenic process by which experiences of social exclusion lead to poor development of mentalizing capabilities, which results in inaccurate interpretations of others' social behaviors (Selten et al., 2017). Moreover, research suggests that social exclusion could lead to a sensitization to dopamine which may affect social brain regions such as the mPFC, the superior temporal sulcus, and the temporoparietal junction (Selten et al., 2017). These hypotheses may explain some of the neural abnormalities found in the reviewed studies. Moreover, deficits in social cognition have been shown to be associated with psychotic symptoms and social impairment in individuals with and at-risk for psychosis spectrum disorders (Addington et al., 2006; Lee et al., 2015; Mancuso et al., 2011). Thus, it is not surprising that we would see neural abnormalities in regions implicated in social cognitive processing.

4.4. Future directions

Though Perry et al. (2011) assessed distress after a brief period of time following the exclusion task, the majority of the studies did not look at how long distress or increased symptoms lasted following social exclusion or rejection. We have hypothesized that individuals with psychosis spectrum disorders may cope less well than healthy controls following rejection, but this hypothesis needs to be further tested with studies examining longer term effects of social exclusion and rejection.

Eight of the 13 studies employed the exclusion paradigm Cyberball (Engel et al., 2016; Gradin et al., 2012; Lincoln et al., 2018; Perry et al., 2011; Pillny and Lincoln, 2020; Reddy et al., 2019; Sokunbi et al., 2014; Sundag et al., 2018). Though a widely used paradigm across psychiatric disorders, it is not without its limitations. The Cyberball task typically uses deception to convince participants that the cartoon characters that pass the ball in the game are actually other participants playing the game in neighboring labs. Though some studies reviewed here (Gradin et al., 2012; Reddy et al., 2019; Sokunbi et al., 2014) varied the length of time taken for the characters to pass the ball to enhance the effect that real people are playing the game, the outdated nature of the software and the limited behavior of the cartoon characters could make the deception less believable. One study (Gradin et al., 2012) chose not to implement deception during the task, though they assert that this change did not affect the outcome of the paradigm. Additionally, while the Cyberball task appears to be sensitive to rejection resulting from expectancy violation, the typical neural responses the task invokes actually contrast with the neural responses seen during a social exclusion task that more directly involved negative peer feedback (Premkumar, 2012). While it is great to see the use of a well-validated task, there is room for growth to test other experiences of exclusion or rejection beyond this paradigm. A handful of the reviewed studies have done that (*e.g.* Lee et al., 2014), but there are other exclusion and rejection paradigms in the literature that would be interesting to examine within psychosis spectrum disorders. The *Chatroom* paradigm looks at peer rejection, with participants being led to believe that they have been rejected by people with whom they would have liked to interact (Guyer et al., 2009). Similarly the paradigm *Survivor* (Reijntjes et al., 2006) has participants led to believe that they are part of game in which different individuals are eliminated from the game by other players. Both of these paradigms offer a more personal aspect than the Cyberball game as participants are typically asked to fill out personal information that their "peers" in these games can use to determine whether they want to interact with them or vote them out of the game. Given the salience of interpersonal interactions, non-computerized games, such as the Yale Interpersonal Stressor Task (Stroud et al., 2000) might be a more ecologically valid assessment of exclusion and rejection. In this task, participants interact with confederates, posed as peers who ultimately exclude the participant from the exchange. Using ecological momentary assessment techniques might also be a way to gauge real-life experiences of social exclusion or rejection in individuals with and at-risk for psychosis spectrum disorders.

Additionally, there are other factors, including gender, age, race and ethnicity, or socioeconomic status that may mediate or moderate the experience of social rejection or exclusion for individuals with and at-risk for psychosis spectrum disorders. Moreover, the type of rejection (*e.g.*, gender-, appearance-, or parental-based rejection) might make a difference in the sensitivity or response to the experience of rejection or exclusion. In a study of parental acceptance, researchers found that the relationship between maternal neglect and positive symptoms in adults with schizophrenia was moderated by both gender and socioeconomic status (Akun et al., 2018). In our review, papers that focused on schizophrenia tended to have more males than females than the at-risk groups. It is possible that some of the differences between at-risk and schizophrenia could be related to gender. Taken together this work suggests that in order to better understand the effects of social exclusion or rejection, and inclusion, additional moderating or mediating factors need to be considered.

Finally, there are several constructs that may lead to or increase the likelihood of rejection and exclusion for individuals with and at-risk for psychotic disorders, for example stigma, expressed emotion, or social skills deficits. These constructs were not investigated in the articles reviewed, as the rejection and exclusion paradigms were more artificial and lacking context. Future research should investigate the effects of social exclusion and rejection within the contexts they are often experienced.

5. Conclusion

Though individuals with and at-risk for psychosis spectrum disorders may not exhibit differences in exclusion-induced distress, the evidence suggests that they may process and cope with exclusion in significantly different ways, both behaviorally and neurobiologically. Furthermore, the experience of exclusion may exacerbate psychotic symptoms, leading to increases in paranoia and decreases in social motivation. Much of the research has utilized the Cyberball paradigm and has largely looked at the short-term effects of social exclusion and rejection. Moving forward, future research should explore the use of more personally salient exclusion paradigms and investigate social exclusion's longer-lasting effects in order to paint a more holistic picture of how exclusion and rejection impacts those on the psychosis spectrum.

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