The four-factor conceptualization of empathy in schizophrenia: A meta-analysis

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Abstract

Empathy is a complex construct, thought to contain multiple components. One popular four-factor conceptualization has been used extensively to measure empathy in schizophrenia research (empathic concern, perspective-taking, personal distress, and fantasy); however, no recent meta-analysis has been conducted on the four factors together. The goal of this meta-analysis was to examine self-reported empathy for each component in the four-factor conceptualization in people with schizophrenia as compared to healthy controls. A literature search revealed 33 schizophrenia studies that utilized this conceptualization. The Hedges' *g* standardized difference effect size was calculated for each component using a random effects meta-analytic model. Individuals with schizophrenia scored significantly differently from healthy controls on all components, exhibiting lower scores for empathic concern, perspective-taking, and fantasy, as well as greater scores for personal distress. Duration of illness significantly moderated the results for perspective-taking such that those with a longer duration exhibited greater deficits. Future work should examine in more detail the impact of heightened personal distress on empathic

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interaction and investigate the mechanism through which duration of illness impacts empathic components in people with schizophrenia.

Keywords: social cognition, Interpersonal Reactivity Index, duration of illness, perspective-taking, fantasy, personal distress

1. Introduction

Empathy is key to our interpersonal relationships, contributing to development of social networks (Salovey and Mayer, 1989) and acquisition of relationship-maintaining behaviors such as forgiveness and altruism (Eisenberg and Miller, 1987; Hoffman, 1981, 2000; McCullough et al., 1998; McCullough et al., 1997). Empathy is a complex construct with multiple components, most often measured in cognitive and affective domains. Research on empathy in people with schizophrenia has revealed deficits in this population in both commonly measured empathic components (Bonfils et al., 2016; Savla et al., 2013). However, reviews and meta-analyses examining empathy in schizophrenia have omitted empathic components that do not cleanly fit with conceptualizations of cognitive or affective empathy. Thus, although there is an abundance of literature to show deficits in cognitive and affective empathy, the field has yet to gain an in-depth understanding of deficits in other empathic components for people with schizophrenia.

Although cognitive and affective empathy have reached a general consensus in the field, a four-factor model of empathy has also become increasingly prominent. This four-factor model includes components that map onto affective empathy and cognitive empathy, but expands that conceptualization to also include personal distress and fantasy components (Davis, 1983). The empathic concern factor, which most clearly represents affective empathy, or the emotions felt in

response to the situations or experiences of another, corresponds to experiences of warmth, compassion, and concern for others. The perspective-taking factor, which most clearly represents cognitive aspects of empathy, corresponds to one's ability to take the perspective of others. Personal distress corresponds to the amount of unpleasant emotion experienced upon witnessing the negative situations of others (self-oriented distress), and fantasy corresponds to the tendency to place oneself into fictional situations and empathically relate to characters, as in books, movies, or daydreams (Davis, 1983).

Research in schizophrenia has investigated deficits in cognitive and affective empathy, but the literature on personal distress and fantasy are less clear. While consistent deficits in cognitive empathy (Savla et al., 2013) and affective empathy (Bonfils et al., 2016) have been found in people with schizophrenia, research on personal distress seems to indicate the opposite finding – that people with schizophrenia may experience an excess compared to healthy controls. This finding has been reported in several studies (e.g., see Andrews et al., 2013; Fujiwara et al., 2008; Gizewski et al., 2013; Montag et al., 2012a), but results across studies have yet to be meta-analyzed. Studies examining the fantasy component, on the other hand, report more disparate findings, with some finding significant deficits in schizophrenia samples (Derntl et al., 2012b; Fujiwara et al., 2008; Hooker et al., 2011; Lee et al., 2010) while others find fantasy abilities to be intact or trending toward greater levels in schizophrenia groups (Fischer-Shofty et al., 2013; Matsumoto et al., 2015; McCormick et al., 2012).

The omission of the personal distress and fantasy components from meta-analyses of empathy in schizophrenia has left a gap in the literature, considering the likely importance of these factors in the ability to empathically interact for people with schizophrenia. Personal distress, especially, may actually impede the ability to empathically respond to others. Studies

finding increased personal distress in schizophrenia align with a previous meta-analysis that found that people with schizophrenia experience heightened negative emotions compared to healthy controls when faced with neutral or even positive stimuli (Cohen and Minor, 2010). Some have argued that excess personal distress and negative emotion may work against successful empathic interaction, possibly overwhelming the person with schizophrenia, leading to a non-empathic experience or even disengagement from the social interaction (Horan et al., 2015). Understanding how levels of personal distress differ in schizophrenia compared to healthy controls is a key next step to identifying factors that negatively impact empathic interaction in this population.

There is less evidence linking abilities to relate to fantasy characters to empathic or functional outcomes, but some literature shows a significant association between greater fantasy abilities and increased hallucinations and delusions (Sparks et al., 2010), and heightened fantasy abilities in relatives of people with schizophrenia have been associated with measures of psychosis risk (Montag et al., 2012b). Further, although no research to our knowledge has investigated this, it seems plausible that deficits in the ability to relate to fantasy characters may add another layer of difficulty to interpersonal interaction, where conversations may center on popular television shows or movies. That is, if the ability to empathize with a fictional character is impaired, then everyday conversations about those experiences may also be negatively affected. In addition, reduced ability to relate to fantasy characters may limit the experience or enjoyment of recreational activities like reading or watching fiction, which could contribute to poorer quality of life.

In addition to our lack of knowledge about deficits across components in the popular four-factor empathy model, the body of literature has yet to inform whether empathic deficits are

dependent on duration of illness. This question is of the utmost importance – if empathic skills are found to be intact or considerably less impaired for those early in the course of illness, there are ramifications for intervention design to better prevent decline in empathic abilities. A meta-analytic framework offers the opportunity to assess any moderating role of duration of illness on each of the empathic components. Although few studies have specifically examined the impact of duration of illness on empathy, more literature has investigated the impact on broader social cognitive deficits. This work has been mixed, with some studies indicating a longer course of illness is associated with greater deficits in empathy (Montag et al., 2007) and others indicating social cognitive abilities decline over the course of illness (Kucharska-Pietura et al., 2005); however, others indicate deficits begin early, but remain stable (Green et al., 2011; Pinkham et al., 2007).

Taken together, despite great advances in our knowledge about empathy in schizophrenia, there are still important gaps in our understanding. The four-factor model has been used predominantly in the form of the Interpersonal Reactivity Index (IRI; Davis, 1983), a self-report instrument designed to assess empathic tendencies in each of the four components. Yet, only one meta-analysis to our knowledge attempted to synthesize the literature on the IRI in schizophrenia, and it included only six studies (Achim et al., 2011) and did not address moderators. The current study includes a set of meta-analyses designed to explore empathic differences between those diagnosed with schizophrenia and healthy controls using the popular four-factor conceptualization of empathy (via the IRI). As research on empathy is on the rise, and substantial literature using the IRI has accrued, synthesizing this literature is timely and necessary to further our understanding of how we might most helpfully intervene on the empathy construct.

This project aimed to quantify the standardized mean difference between schizophrenia and healthy controls for each component of the four-factor conceptualization of empathy (Davis, 1983): 1) Empathic concern; 2) Perspective-taking; 3) Personal distress; and 4) Fantasy. It further aimed to examine the role of duration of illness for each of these components. We hypothesized that healthy controls would score higher for empathic concern and perspective-taking and lower for personal distress; due to mixed findings in the literature, analyses examining the standardized mean difference for fantasy abilities were considered exploratory. Moderator analyses examining duration of illness were also considered exploratory.

2. Method

The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Moher et al., 2009) were followed in order to maintain a high level of meta-analytic quality. The checklist with descriptions of each item and locations where they are addressed in the manuscript is available from the authors.

2.1. Literature Search

Studies were identified using a variety of methods. We searched *PsycINFO, PsycARTICLES, Web of Science Core Collection, Pubmed,* and *EMBASE* for studies available up to July 28th, 2015. To be included, studies were required to compare individuals with schizophrenia to healthy controls using the IRI and be written in English. All searches used the exploded terms "empath*" and "schizo.*" English language filters were applied when possible. We also searched reference sections of key meta-analyses and conceptual articles in related areas (Bora et al., 2009; Derntl and Regenbogen, 2014; Fett et al., 2011; Savla et al., 2013). Finally, we contacted authors when additional information was needed in order to code an otherwise eligible study.

2.2. Coding

Studies were coded in accordance with a codebook developed based on suggestions from Card (2012) and Lipsey and Wilson (2001). Sample-level information included year, publication type, and country. Age, gender (percent female), and race were all coded, but only 7 (21%) studies reported information for race or ethnicity, so the variable is not described further. Variables coded only in the schizophrenia samples included diagnosis (percent schizophrenia, percent schizoaffective disorder, and percent other psychotic disorder) and duration of illness, when available.

2.2.1. **Effect size**.

2.2.2. Hedges' g was calculated for each sample based on means and standard deviations of each group, representing the standardized mean difference between the schizophrenia group and healthy controls on the empathy components (as measured by the IRI subscales). When means and standard deviations were not reported, but other statistics such as independent samples *t*-values were available, Hedges' *g* was calculated from these values. Positive values of *g* signified higher scores in healthy controls and negative values signified higher scores in the schizophrenia group. Data were initially coded into Excel where effect sizes were calculated. All data were then checked before being aggregated into SPSS version 23.0, and later imported into Comprehensive Meta-Analysis, Version 2 (CMA; Borenstein et al., 2011).

2.3. Meta-Analytic Method

Prior to running meta-analytic statistics, descriptive statistics were conducted. We used one-study removed sensitivity analyses to assess for the presence of outliers (Borenstein et al., 2009). This analysis runs the meta-analysis repeatedly, each time with a single sample removed.

If this produced a substantial change in the meta-analytic point estimate for any given study, it was examined as a potential outlier. To assess risk of publication bias, we used Duval and Tweedie's (2000) trim and fill approach. This procedure examines observed effects and "trims" extreme values from small samples. But, this artificially reduces variance, so extreme effects are then replaced but with mirrored values on the other side of the mean to retain adjustments to the effect size. This new effect size can be compared to meta-analytic results. If there are no differences, or the difference is small, greater confidence can be had that publication bias has minimal effects on results (Borenstein et al., 2009; Card, 2012).

2.3.1. Main analyses.

Effect sizes were calculated using a random effects model. This method accounts for both within-study and between-study variability (Lipsey and Wilson, 2001) and allows generalizations to be made from results beyond included studies. Separate meta-analyses were conducted for each empathic component: empathic concern, perspective-taking, personal distress, and fantasy. Individual effect sizes were weighted by the inverse variance to account for standard error in effect size estimates (Card, 2012; Lipsey and Wilson, 2001). Hedges' *g* is similar to Cohen's *d*, so mean effect sizes were interpreted with Cohen's (1992) guidelines: effect sizes ≤.20 were considered small, effect sizes of .50 were considered medium, and effect sizes ≥.80 were considered large. All meta-analytic calculations were conducted using the CMA computer program (Borenstein et al., 2011).

2.3.2. Heterogeneity and moderator analyses.

The *Q*-statistic was calculated to assess the presence of heterogeneity (Card, 2012) and the I^2 index was calculated (Higgins and Thompson, 2002) to assess how much of the variation was due to between-studies variability (Huedo-Medina et al., 2006). Moderator analyses were

conducted when *Q* was significant and I^2 was 25% or greater. Due to the low power of the *Q* statistic to detect heterogeneity when *k* is small, $p < .10$ was considered to suggest moderation (Higgins and Thompson, 2002). If moderator analyses were warranted, meta-regressions were conducted using a random effects model to examine the impact of duration of illness. Significant beta weights ($p < .05$) and decrease in the I^2 index indicated significant moderation. All moderator analyses were conducted in CMA (Borenstein et al., 2011).

3. Results

3.1. Study Selection & Characteristics

A total of 33 independent samples were included in the meta-analyses of empathic concern, perspective-taking, and personal distress; 31 were included for fantasy. See Figure 1 for a flow chart of article identification. A total of 1,260 participants with schizophrenia and 1,086 healthy controls were included in the meta-analysis. See Table 1 for detailed characteristics at the individual sample level, and Table 2 for aggregated study characteristics.

3.2. Sensitivity Analyses

Examination of one-study removed sensitivity analyses and forest plots (available upon request from the authors) indicated, across meta-analyses, that no study needed to be removed as an outlier. Point estimates of effect sizes with studies removed did not greatly differ from overall mean effect sizes, indicating all samples could be retained for main analyses.

3.3 Main Analyses

All meta-analyses exhibited significant main effects, indicating differences between healthy controls and people with schizophrenia on all four empathy components, though these differences varied in magnitude and direction. See Table 3 for summary results of the four components, and see Figures 1-4 in the supplemental online material for forest plots of each

meta-analysis. As hypothesized, participants with schizophrenia evidenced significant deficits (compared to healthy controls) in empathic concern (0.29, 95% CI [0.18, 0.41]) and perspective taking (0.55, 95% CI [0.43, 0.67]), while showing elevated personal distress (-0.72, 95% CI [-0.86, -0.58]). These were all medium effects. In exploratory analyses, fantasy exhibited a positive mean effect size of small magnitude (0.19, 95% CI [0.08, .030]), indicating people with schizophrenia report being less able to relate to fantasy characters. Across meta-analyses, moderate to high heterogeneity was detected, with all I^2 estimates surpassing the 25% threshold to examine moderating variables (see Table 3).

Duration of illness was tested as a continuous moderator. Based on the results of meta-regression analyses, duration of illness significantly moderated the relationship between sample (i.e., schizophrenia vs. healthy control) and the perspective-taking component such that for every one year increase in duration of illness, the standardized mean difference effect size is strengthened by 0.022, indicating those with a more chronic course have greater impairments in emotional perspective-taking than those earlier in the course of illness. This significant finding was accompanied by a decrease in the I^2 index of 27.21%, indicating a substantial reduction in heterogeneity when duration of illness is controlled. There was also a trend ($p = 0.08$) in the same direction for empathic concern, such that the standardized mean difference is strengthened by .016 with every one year increase in duration. This trend-level association was accompanied by a 26.85% decrease in the I^2 index. Duration of illness did not significantly moderate personal distress or fantasy (Table 4).

3.4. Publication Bias

Trim and fill analyses found no evidence of publication bias for empathic concern, perspective-taking, or fantasy. For personal distress, the trim and fill procedure imputed two

values (the imputed funnel plot can be seen in the supplemental online material, Figure 5); however, revised summary statistics using these imputed values indicated a very similar effect size and confidence interval (Hedges' g = -.69; 95% CI [-.83, -.54]), differing from the non-corrected value by only .03. As the imputed and non-corrected effect sizes are nearly the same, publication bias can be considered minimal for the personal distress meta-analysis.

4. Discussion

This meta-analysis, including a total of 33 samples reporting results for empathy using the four-factor conceptualization (Davis, 1983), represents a substantial extension of the past effort to synthesize this literature in schizophrenia (Achim et al., 2011). Results of all four components were significant and appear robust to effects of outliers, suggesting that people with schizophrenia experience deficits in empathic concern, emotional perspective-taking, and the ability to relate to fictional characters, and at the same time experience heightened personal distress. Effects were similar to results of Achim and colleagues' (2011) meta-analysis, though the fantasy effect size was considerably smaller (g = .19) in this meta-analysis compared to the level previously reported (d = .45). Differences from that meta-analysis are not surprising, and in fact we might have expected more differences, considering that this meta-analysis includes five times as many samples as the meta-analysis by Achim and colleagues (2011).

The empathic concern component displayed an effect of small to moderate magnitude (g = 0.29), similar to a recent meta-analysis of affective empathy, which included many of the same studies in its self-report category (g = 0.22; Bonfils et al., 2016). Impairments in affective empathy are important to note, as affective empathy is key in the development of social networks (Salovey and Mayer, 1989) and altruistic behavior (Eisenberg and Miller, 1987; Hoffman, 1981,

2000), and aspects of empathy have been linked in schizophrenia specifically to social functioning (Michaels et al., 2014; Shamay-Tsoory et al., 2007; Smith et al., 2014).

The personal distress component, on the other hand, revealed a medium to large negative effect, indicating that compared to healthy controls, people with schizophrenia report heightened personal distress when confronted with the experiences and emotions of others. The personal distress empathic component has been debated in the literature, with some advocating that it should not be considered empathy at all (Corbera et al., 2013; Horan et al., 2015; Michaels et al., 2014) because it assesses self-oriented distress (Davis, 1983) rather than emotional-matching, which many consider key to the empathic experience of emotion (De Vignemont and Singer, 2006; Decety and Jackson, 2004; Derntl and Regenbogen, 2014). However, when observed as a separate factor as originally intended; (Davis, 1983)), findings indicate that individuals with schizophrenia perceive experiencing more personal distress than healthy controls.

This aligns with findings from a meta-analysis of laboratory studies investigating emotional experience conducted by Cohen and Minor (2010) in which people with schizophrenia displayed heightened aversive emotion in response to positive or neutral lab-based stimuli as compared to healthy controls. Though respondents did not differ substantially from healthy controls on experience of expected hedonic emotions, they were simultaneously experiencing negative emotions that were absent or lessened in healthy controls. This may reflect some aspect of emotion dysregulation in which individuals with schizophrenia are less able to downregulate negative emotion in situations that would otherwise be considered neutral or even pleasant, (as suggested by Cohen and Minor, 2010; Horan et al., 2006a; Horan et al., 2015; Strauss et al., 2013). In the case of personal distress, it may be normative to experience some distress when faced with the unpleasant experiences of others (as exhibited by non-zero means of healthy

control participants for this scale), but a failure to downregulate that emotion may characterize those with schizophrenia, leading to increased unpleasant emotion when dealing with others' situations.

Though personal distress may not directly measure the empathic experience, it is relevant to empathy research, as increased self-oriented negative emotions may impede empathic responding. For example, increased personal distress may require one to exert self-control in order to respond appropriately despite negative feelings. Research in the general population has shown that self-control is a limited resource that can be depleted (Baumeister et al., 1998; Muraven and Baumeister, 2000; Muraven et al., 1998), and this has been replicated in schizophrenia (Leung et al., 2014). Thus, if people with schizophrenia experience heightened negative emotions in response to the experiences of others, they may have to exert self-control in order to handle their internal experiences, reducing their cognitive resources available to display empathic responses and potentially build social connections. A complementary theory from Corbera et al. (2013) suggests that increased personal distress can push individuals with schizophrenia to withdraw from social situations entirely, completely negating any opportunity to respond empathically to the other. Future research should investigate these ideas to better understand how personal distress impacts empathic responding.

The third empathic component, perspective-taking, was also consistent with hypotheses, revealing a moderate deficit for individuals with schizophrenia. The perspective-taking component most closely reflects cognitive empathy. Theory of mind is one aspect of cognitive empathy, and meta-analyses of this construct have consistently shown large deficits in people with schizophrenia (Bora et al., 2009; Savla et al., 2013; Sprong et al., 2007). Our effect is somewhat smaller (g = .55, compared to 1.10, .96, and 1.26 found in the previous 3 cited meta-

analyses). The smaller effect may be related to the content of the perspective-taking subscale, which primarily assesses emotional perspective-taking, whereas many theory of mind assessments focus only on the ability to discern thoughts and intentions, neglecting the emotional aspect of knowing the other (see Shamay-Tsoory et al., 2005 for a discussion of this issue). Alternatively, it could be that people with schizophrenia perceive themselves to be better at perspective-taking than is reflected in actual performance. Because most meta-analyses of theory of mind use only performance-based measures, deficits in performance that people with schizophrenia may not perceive could explain the larger effects found in those meta-analyses. This is consistent with literature showing that people with schizophrenia report themselves to be more empathic than do observers (Lysaker et al., 2013) or family members (Bora et al., 2008).

Analyses for the final empathic component, fantasy, were considered exploratory, as the literature shows mixed findings regarding the ability to relate to fictional characters for people with schizophrenia. Results revealed a small, but significant, deficit in fantasy abilities in the schizophrenia group. However, the size of the effect calls into question whether this has clinical relevance. Especially as compared to effects evident for other types of empathy (and IRI subscales), the fantasy effect is small, and ability to relate to fictional characters may not be necessary for empathic interaction. In fact, Davis (1983) asserted that associations between the fantasy subscale and interpersonal functioning were not expected because one's ability to get involved in fictional scenarios from books or movies was not relevant to social relationships, but rather may reflect aspects of emotionality. Thus, the fantasy component may be less useful in directly assessing empathic abilities than the other empathic components. However, some research indicates that reading fiction is associated with increased empathy and prosocial behavior (Johnson, 2012). In addition, given some literature linking fantasy abilities to increased

psychotic symptoms (Sparks et al., 2010) and psychosis risk (Montag et al., 2012b), future research may try to glean a better understanding of how fantasy abilities affect (or are affected by) illness course and symptoms.

Across empathy components, moderate to large heterogeneity was observed, indicating moderators were at work. For perspective-taking, those with a longer duration of illness exhibited a greater deficit in emotional perspective-taking, such that for every decade of illness we might expect a decrease in emotional perspective-taking on the order of a small effect size – 0.22. This finding is consistent with some literature asserting greater length of illness negatively impacts empathic abilities (Achim et al., 2011; Montag et al., 2007), but inconsistent with the meta-analysis conducted by Savla and colleagues (2013) that found duration of illness was not significantly associated with theory of mind. It may be that duration of illness has a greater impact on self-reported perspective-taking abilities (perhaps decreasing self-perception due to depleted confidence after years of illness) than on performance-based theory of mind assessments. Alternatively, emotional perspective-taking may be more directly impacted by duration of illness, as opposed to other forms of perspective-taking usually assessed in theory of mind measurement. Further research is needed to parse apart these possibilities.

There was also a trend ($p = 0.08$) in moderator analyses such that those with a greater duration of illness exhibited less empathic concern. Considering the notoriously low power of moderator analyses (Borenstein et al., 2009; Hedges and Pigott, 2004), we consider this trend as pointing toward possible future avenues for additional research. As the empathic concern and perspective-taking components map most closely onto affective and cognitive empathy, this pair of findings indicates duration of illness may be impactful for the most commonly measured and reported components of empathy. There are a multitude of potential reasons for increased deficits

with extended course of illness. First, it is possible that the reduced social network size experienced by many with schizophrenia (Horan et al., 2006b) results in a lack of opportunity to practice empathic skills, leading to empathic atrophy over time. Second, it could be that discrimination from others over time as a result of stigmatizing societal views contributes to reduced empathy felt for others. It might also be that cortical regions involved in empathic capacity are affected by long-term symptoms, or by use of antipsychotics over time. For example, research shows reductions in brain volume with extended duration of illness for some with schizophrenia (Haijma et al., 2013). However, these possibilities are speculative, and future research is needed to understand how duration of illness might affect empathic abilities.

Results should be interpreted in light of some limitations. This study focused on the most commonly used four-factor conceptualization of empathy and the IRI as a self-report measure of that conceptualization. Results may not generalize to other empathic conceptualizations and may not represent the complete picture regarding empathy deficits. However, while other meta-analyses have examined cognitive and affective empathy (Bonfils et al., 2016; Savla et al., 2013), only one other study has examined all four components measured here (Achim et al., 2011), and that was with a much reduced sample size. Additionally, not all moderators of interest could be examined here. For example, symptoms and medications were reported variably (both with regard to symptom assessment and scoring method), precluding examination of these potentially important moderators. Finally, this meta-analysis is not exempt from limitations of all meta-analyses; that is, there is always the threat of the "file drawer" problem, and meta-analytic results are limited by methodological shortcomings of the primary studies (Card, 2012). Regarding the former, there was evidence in the personal distress funnel plot of potential for missing study values. However, the effects of publication bias appear minimal, as the corrected

effect size computed with the trim and fill procedure differed from the observed effect by only 0.03. Regarding the latter, our results were limited by small samples that employed convenience sampling methods and often reported incomplete moderator data – these issues should be considered when interpreting our meta-analytic results.

Taken together, our results indicate significant deficits in empathic concern, perspective-taking, and fantasy, but heightened scores for personal distress, in people with schizophrenia as compared to healthy controls. Considering the extensive and ongoing use of this empathic conceptualization and the IRI, these results point to several avenues for future research. First, the role of emotion regulation in personal distress and subsequent empathic interaction should be investigated. Second, interventions based in the reading of fiction to enhance empathy could provide benefit to people with schizophrenia – future studies may consider investigating the use of these interventions to enhance social interactions in this group. However, research is also needed to further assess the relationship between fantasy skills and psychotic symptoms. Third, research is needed to determine the mechanism through which duration of illness impacts affective and cognitive empathy, and to identify ways to mitigate the negative impact of longer duration on those constructs. Finally, additional work is needed to examine further potential moderating variables, such as symptoms, medication, or services received.

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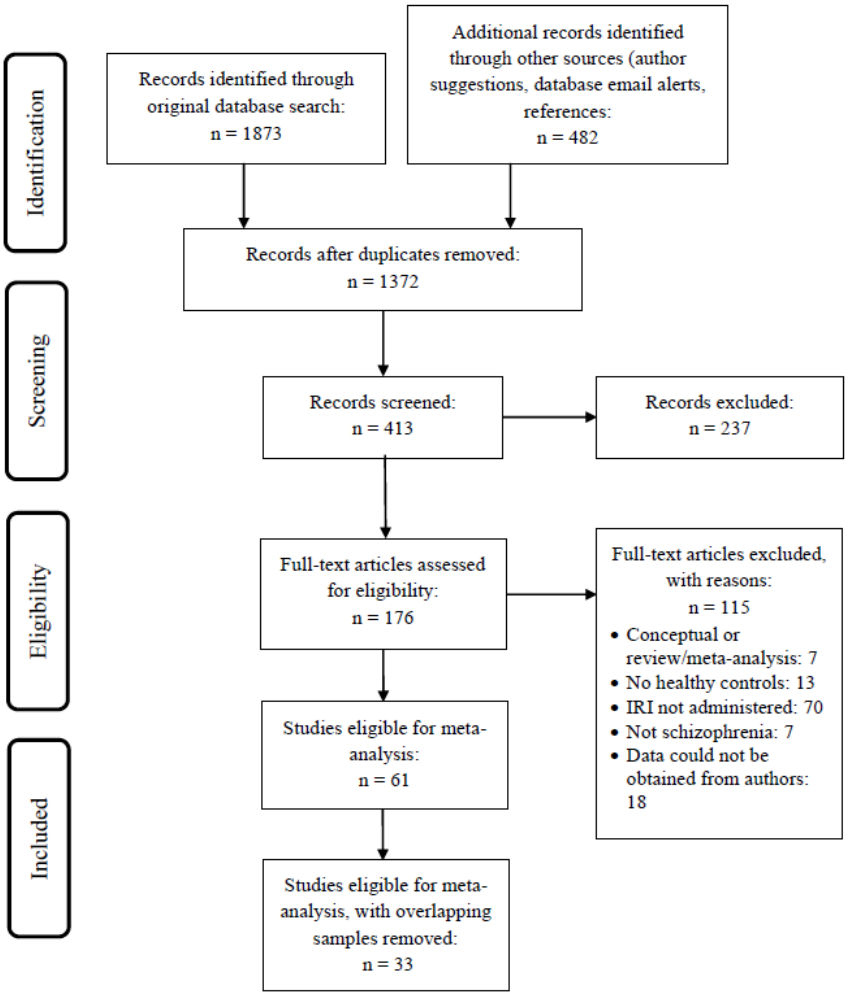

Figure 1. Literature Search Diagram (PRISMA)

Figure 1 Literature Search Diagram (PRISMA)

Table 1 - Studies included in meta-analyses

Citation (K=33)	**Country**	**SSD N**	**HC N**	**Duration of illness M**	**Duration of illness SD**	**Empathy Component**	**Hedges' *g***
(Achim et al., 2011)	Canada	31	31	1.7	1.2	IRI-EC	0.06
						IRI-PD	-0.47
						IRI-PT	0.19
						IRI-F	0.08
(Andrews et al., 2013)[t]	Australia	18	18	22.1	3.3	IRI-EC	0.37
						IRI-PD	-0.90
						IRI-PT	0.73
						IRI-F	0.49
(Brown et al., 2016)	Germany	17	17	9.3	6.9	IRI-EC	-0.12
						IRI-PD	-0.90
						IRI-PT	0.31
						IRI-F	0.11
(Chiang et al., 2014)	Taiwan	70	35	--	--	IRI-EC	0.85
						IRI-PD	0.3
						IRI-PT	0.59
						IRI-F	0.13
(Corbera et al., 2013)	United States	30	24	22.2	10.3	IRI-EC	0.29
						IRI-PD	-0.57
						IRI-PT	0.64
						IRI-F	0.07
(Corbera et al., 2014)[t]	United States	21	26	--	--	IRI-EC	-0.09
						IRI-PD	-0.44
						IRI-PT	0.62
						IRI-F	0.26
(Derntl et al., 2012b)	Germany	24	24	11.5	7.6	IRI-EC	0.29
						IRI-PD	-0.88
						IRI-PT	0.33
						IRI-F	-0.95
(Derntl et al., 2012a)[t]	Germany	15	15	7.30	5.3	IRI-EC	0.15
						IRI-PD	-1.09
						IRI-PT	0.06
						IRI-F	0.57
(Fischer-Shofty et al., 2013)[t]	Israel	34	44	11.78	7.0	IRI-EC	-0.10
						IRI-PD	-0.69
						IRI-PT	0.71
						IRI-F	-0.07
(Fujino et al., 2014)	Japan	69	69	13.1	9.7	IRI-EC	0.04
						IRI-PD	-0.57
						IRI-PT	0.54
						IRI-F	0.29
(Fujiwara et al., 2008)	Japan	24	20	10.4	8.4	IRI-EC	0.19

Citation (K=33)	Country	SSD N	HC N	Duration of illness M	Duration of illness SD	Empathy Component	Hedges' *g*
						IRI-PD	-0.71
						IRI-PT	0.65
						IRI-F	0.96
(Gizewski et al., 2013)	Germany	24	12	14.2	7.4	IRI-EC	0.62
						IRI-PD	-1.56
						IRI-PT	0.69
						IRI-F	0.00
(Haker and Rössler, 2009)	Switzerland	43	45	11	9.0	IRI-EC	0.20
						IRI-PD	-0.56
						IRI-PT	0.49
						IRI-F	0.36
(Hooker et al., 2011)	United States	21	17	--	--	IRI-EC	0.35
						IRI-PD	-0.32
						IRI-PT	0.58
						IRI-F	1.00
(Horan et al., 2014)	United States	30	24	26.8	11.5	IRI-EC	0.84
						IRI-PD	-0.37
						IRI-PT	0.76
						IRI-F	-0.03
(Horan et al., 2015)[t]	United States	145	45	19.9	--	IRI-EC	0.26
						IRI-PD	-1.04
						IRI-PT	0.63
						IRI-F	0.03
(Lam et al., 2014)[t]	China	58	61	13.4	8.8	IRI-EC	0.29
						IRI-PD	-0.27
						IRI-PT	0.23
						IRI-F	-0.19
(Lee et al., 2011)	United States	30	22	--	--	IRI-EC	0.73
						IRI-PD	-1.23
						IRI-PT	0.58
						IRI-F	0.15
(Lee et al., 2010)	South Korea	15	18	4.6	3.4	IRI-EC	0.65
						IRI-PD	-0.44
						IRI-PT	0.35
						IRI-F	0.91
(Lehmann et al., 2014)	Germany	55	55	10	7.7	IRI-EC	0.25
						IRI-PD	-1.14
						IRI-PT	-0.19
(Matsumoto et al., 2015)	Japan	17	18	15.2	7.9	IRI-EC	-0.09
						IRI-PD	-0.63
						IRI-PT	0.22
						IRI-F	-0.22

Citation (K=33)	Country	SSD N	HC N	Duration of illness M	Duration of illness SD	Empathy Component	Hedges' *g*
(McCormick et al., 2012)	United States	16	16	15.8	8.8	IRI-EC	-0.47
						IRI-PD	-1.51
						IRI-PT	0.26
						IRI-F	-0.32
(McGuire et al., 2015)[t]	Australia	24	20	22.71	10.2	IRI-EC	0.32
						IRI-PD	-0.62
						IRI-PT	0.36
						IRI-F	0.10
(Michaels et al., 2014)[t]	United States	52	37	14.8	8.7	IRI-EC	0.53
						IRI-PD	-1.07
						IRI-PT	1.02
						IRI-F	0.32
(Montag et al., 2012a)	Germany	145	145	10.4	9.5	IRI-EC	0.07
						IRI-PD	-0.99
						IRI-PT	0.35
(Montag et al., 2007)	Germany	45	45	11.6	9.6	IRI-EC	-0.17
						IRI-PD	-1.04
						IRI-PT	0.62
						IRI-F	0.10
(Regenbogen et al., 2015)	Germany	20	24	--	--	IRI-EC	0.13
						IRI-PD	-0.36
						IRI-PT	0.09
						IRI-F	0.84
(Shamay-Tsoory et al., 2007)	Israel	26	31	--	--	IRI-EC	0.50
						IRI-PD	-0.32
						IRI-PT	1.02
						IRI-F	0.49
(Singh et al., 2015)	India	14	14	9.26	6.4	IRI-EC	1.14
						IRI-PD	0.14
						IRI-PT	1.68
						IRI-F	0.11
(Smith et al., 2014)	United States	60	45	14.4	9.3	IRI-EC	0.46
						IRI-PD	-0.90
						IRI-PT	0.83
						IRI-F	0.31
(Sparks et al., 2010)	Australia	28	25	--	--	IRI-EC	1.29
						IRI-PD	-1.09
						IRI-PT	1.51
						IRI-F	-0.02
(Thirioux et al., 2014)	France	10	10	11.8	1.5	IRI-EC	-0.04
						IRI-PD	-1.52
						IRI-PT	0.75
						IRI-F	-0.32
(Wojakiewicz et al.,	France	29	27	8	8.0	IRI-EC	0.32

Citation (K=33)	Country	SSD N	HC N	Duration of illness M	Duration of illness SD	Empathy Component	Hedges' *g*
2013)						IRI-PD	-0.72
						IRI-PT	0.08
						IRI-F	-0.14

Note. [t] Supplemental information was provided by authors to assist in coding for these studies.

Table 2 - Study and Sample Characteristics

Sample Characteristics	Mean (SD)/Mean Percent	Range	K
Age, healthy controls	35.8 (5.5)	25.2-46.1	33
Age, schizophrenia spectrum	38.2 (5.7)	24.9-47.9	32
Female, healthy controls	35.9 (15.5)	0-60.0	33
Female, schizophrenia spectrum	31.9 (15.2)	0-53.3	33
Diagnosis			
Schizophrenia	94.4 (12.1)	57.1-100	33
Schizoaffective	4.8 (11.4)	0-42.9	33
Other Psychosis	0.8 (3.5)	0-19.4	33
Years since onset	13.6 (6.1)	1.7-26.8	27
Study Characteristics	**Mean (SD)/Percent**	**Range**	**K**
Sample type			
Published article	31 (93.9)	--	33
Poster (data from author)	2 (6.1)	--	33
Year	2012	2007-2016	33
SZ Sample size	38.2 (32.0)	10-145	33
HC Sample size	32.9 (24.9)	10-145	33
Total Sample size	71.1 (54.1)	20-290	33
Location			
United States	9 (27.3)	--	33
Abroad	24 (72.7)	--	33

Table 3 - Summary of Standardized Mean Difference Effect Size Results

Empathy	*k*	ES	*SE*	95% CI	*z*	*p*	*Q*	*p*	I^2

Component									
Empathic concern	33	0.29	0.06	[0.18, 0.41]	4.91	<0.001	56.68	0.005	43.54
Perspective-taking	33	0.55	0.06	[0.43, 0.67]	8.96	<0.001	58.72	0.003	45.50
Personal distress	33	-0.72	0.07	[-0.86, -0.58]	-9.87	<0.001	80.52	<0.001	60.26
Fantasy	31	0.19	0.06	[0.08, 0.30]	3.43	0.001	41.48	0.079	27.67

Note. *k* = number of studies used in the calculation of the mean effect size. ES = Hedges' *g* effect size statistic. *SE* = standard error. CI = confidence interval. *z* = test for statistical significance of the mean effect size. *p* = 2-tailed p-value associated with the test of statistical significance. *Q* = test for heterogeneity. I^2 = indicates the extent of between-study variability. Possible values range from 0-100%.

Table 4 - Duration of Illness Moderator Analyses

Empathy Component	***k***	***B***	***SE***	**95% CI**	***z***	***p***	I^2
Empathic concern	27	0.016	0.009	[-0.002, 0.035]	1.75	0.080	16.69
Perspective-taking	27	0.022	0.010	[0.001, 0.042]	2.12	0.034	18.29
Personal distress	27	0.003	0.011	[-0.019, 0.025]	0.29	0.775	9.03
Fantasy	25	-0.004	0.011	[-0.026, 0.017]	-0.40	0.688	17.10

Note. *k* = number of studies in the meta-regression. *B* = regression coefficient. R^2= R^2 analogue. SE = standard error. 95% CI = 95% confidence interval. z = test for statistical significance of regression coefficient, *B*. *p* = two-tailed *p*-value associated with the test of statistical significance. I^2 = indicates the extent of between-study variability.

Highlights

- Deficits in the Interpersonal Reactivity Index subscales were meta-analyzed
- People with schizophrenia were compared to healthy controls
- Deficits found for empathic concern, perspective-taking, and fantasy
- Schizophrenia group had heightened personal distress
- Duration of illness and percent female were significant moderators for some scales