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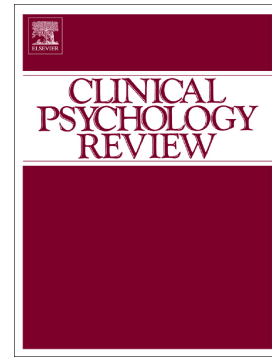
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Cognitive Insight: A Systematic Review

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Abstract

Cognitive insight is the ability to re-evaluate thoughts and beliefs in order to make thoughtful conclusions. It differs from clinical insight, as it focuses on more general metacognitive processes. Therefore, it could be relevant to diverse disorders and non-clinical subjects. There is a growing body of research on cognitive insight in individuals with and without psychosis. This review has summarised the current state of the art regarding this topic. We conclude that while cognitive insight in its current form seems valid for use in individuals with psychosis, it is less so for individuals without psychosis. Additionally, higher cognitive insight not always leads to better psychological functioning. For instance, higher levels of self-reflection are often associated with depressive mood. We therefore recommend the sub-components of cognitive insight to be studied separately. Also, it is unclear what position cognitive insight takes within the spectrum of metacognitive processes and how it relates to other self-related concepts that have been defined previously in literature. Combining future and past research on cognitive insight and its analogue concepts will help in the formation of a uniform definition that fits all subjects discussed here.

Keywords

Cognitive Insight; Thinking Styles; Beck Cognitive Insight Scale; Self-reflectiveness; Self-certainty; Overconfidence.

Introduction

Insight is a versatile concept that has been through several changes during the last century. Most prominently, it has been defined as an “aha-erlebnis”, a feeling one could experience when he or she finally finds a solution to a problem (Schilling, 2005). In medicine however, and more specifically in psychiatry, it has a different connotation. To our knowledge, the first paper on the issue of insight in a medical context was published in 1914. In this year, Babinsky wrote a paper on “anosognosia”, a term he used to denote the unawareness his patients with left hemiplegia had of their paralysis (Babinski, 1914). Not long thereafter, Lewis (1934) focussed on a lack of insight as a psychiatric problem. Regarding individuals with psychiatric problems he wrote that insight is “the amount of realization the patient has of his own condition”. He noticed that, contrary to neurotics, people with psychosis don’t have this realization. In this paper, Lewis defined good insight as “the correct attitude to morbid change in oneself and the realization that the illness is mental”. Since then, insight into illness is seen as a multidimensional concept (Amador et al., 1993; David et al., 1990). One of the most used definitions of insight has been coined by David (1990). He has broadened the definition of insight and described it as a composition of three segments: (a) the awareness of the illness, (b) treatment compliance, and (c) the attribution of symptoms to the disease.

Insight into illness originally focused mostly on psychotic disorders where it was crucial for diagnosis (Freedman & Sadock, 1975). However, a lack of insight into illness does not only occur in psychiatric disorders that feature psychotic episodes. In recent years, it has been investigated in numerous illnesses such as bipolar disorder (van der Werf-Eldering et al., 2011), anorexia nervosa (Arbel, Koren, Klein, & Latzer, 2013), dementia (Zanetti et al., 1999), and Alzheimer’s disease (Harwood, Sultzer, & Wheatley, 2000). Furthermore, insight into illness has shown to be of clinical relevance, as better awareness of illness significantly correlates with quality of life (Dias, Brissos, Frey, & Kapczinski, 2008), psychosocial functioning (Yen et al., 2007), less severe symptomatology (Mintz, Dobson, & Romney, 2003), better therapeutic compliance (Kao & Liu, 2010), and less readmissions (Drake et al., 2008). Therefore, it has been suggested that the improvement of insight should be a main target during treatment (Lincoln, Lüllmann, & Rief, 2007).

However, even in the broadened definition of David (1990), the concept of insight into illness or **clinical insight** as we will refer to it here, can be seen as superficial as it is perfectly possible that individuals who are suffering from a psychiatric disorder admit that they are mentally ill and do take their medication, but at the same time, do not fully understand the illness and all its consequences (Beck, Baruch, Balter, Steer, & Warman, 2004). Following this line of reasoning, recent views have regarded the concept of clinical insight as being too narrow. For instance, Beck and Warman (2004) state that a more complete view on the term ‘insight’ should include general metacognitive skills that allow awareness of misinterpretations and the ability to correct them, regarding events from the past, events that are happening and are about to happen. Metacognition has been suggested to involve monitoring and controlling a wide range of lower level cognition that influence and are influenced by mental disorders (Koechlin & Hyafil, 2007) such as sensory perception (Hall, Johansson, Tärning, Sikström, & Deutgen, 2010), error monitoring (Rinne & Mazzocco, 2014), and confidence adjustments (Chua et al., 2006). In other words, in addition to simply knowing you are ill and recognizing symptoms, any concept of insight should entail the full complexity of the effects the illness has on your mood, actions, thoughts, interpretations and beliefs. Beck et al. (2004) have

therefore proposed a more general and metacognitive conceptualization of insight, which they have called **cognitive insight**. This concept is defined by Beck et al. (2004) as the capability to distance oneself from erroneous beliefs and the ability to make a correct evaluation of one's interpretations using external feedback from others. This conceptualisation of insight is composed of two elements: self-reflectiveness and self-certainty. When someone is more self-reflective he or she is better able to consider different perspectives and evaluate alternative hypotheses in order to make a thoughtful conclusion. When individuals are too self-certain they are excessively convinced of the accuracy of their beliefs (Beck et al., 2004). It differs from clinical insight as it does not exclusively involve judgments about psychiatric challenges but it includes awareness of thought processes and reasoning styles (Jørgensen et al., 2015). In addition, cognitive insight holds the ability to appraise the limitations of our own thinking processes. This enables individuals with a psychiatric diagnosis to become able to recognize that their beliefs and thinking styles are fallible. As a result, it becomes more likely that their clinical insight is able to increase (Greenberger & Serper, 2010). Therefore, cognitive insight is a concept that includes cognitive processes that should support the development of clinical insight (Riggs, Grant, Perivoliotis, & Beck, 2012). In view of this, it was expected that clinical and cognitive insight would correlate. Indeed, most studies find a link between clinical and cognitive insight (Beck et al., 2004; Bora, Erkan, Kayahan, & Veznedaroglu, 2007; Chan, 2016; Engh et al., 2007; Favrod, Zimmermann, Raffard, Pomini, & Khazaal, 2008; Gori, Craparo, & Giannini, 2015; Lepage et al., 2008; Mass, Wolf, & Lincoln, 2012; Misdrahi, Denard, Swendsen, Jaussent, & Courtet, 2014; Ng, Fish, & Granholm, 2015; Pedrelli et al., 2004; Uchida et al., 2009; Vohs et al., 2015). However, some studies have failed to demonstrate this relationship (Ekinci, Ugurlu, Albayrak, Arslan, & Caykoylu, 2012; Greenberger et al., 2010; Tastet, Verdoux, Bergua, Destailats, & Prouteau, 2012; Tranulis, Lepage, & Malla, 2008; Van Camp, Oldenburg, & Sabbe, 2016; Zhang et al., 2016).

Objectives and Method

As with clinical insight, the concept of cognitive insight was primarily designed for schizophrenia patients and patients with other psychotic disorders. This is because a limited capacity to re-evaluate anomalous experiences is a manifest symptom in individuals with psychosis (Beck et al., 2004). In addition, the delusions present in this group of patients are often very persistent, which indicates that these patients lack the capacity to correct their specific misinterpretations. Furthermore, it seems as if they less easily respond to corrective feedback of others (Beck & Warman, 2004). Therefore, Beck et al. (2004) have created a definition of cognitive insight that focussed on individuals with a psychotic disorder. However, since then there is a growth in research regarding cognitive insight in numerous subjects, even in healthy individuals. Because former reviews on cognitive insight have focussed on psychosis (Nair, Palmer, Aleman, & David, 2014; Riggs et al., 2012), important questions remain unanswered. In the current review, several will be addressed: 1. What is the state of the art in research concerning cognitive insight in psychotic disorders? 2. What does research to date tell us about the validity of cognitive insight in psychiatric disorders without psychosis? 3. What are the outcomes of the investigations in a healthy population? 4. Does the concept of cognitive insight, its definition and its measurement fit all the discussed target groups? 5. What are the implications for further research? To answer these questions, the current paper has reviewed all articles that have focused on cognitive insight, regardless of the diagnosis. We searched the databases Web of Science, PubMed and Science Direct for relevant papers using the search term "Beck Cognitive Insight Scale" or "cognitive insight". In PubMed and Web of Science we searched in

“topic”, whereas the search term was entered in the “abstract, title or keywords” section of Science Direct. This generated 228 results from Web of Science, 176 results from PubMed, and 107 results from Science Direct. The found papers were screened for relevance and included if they had been published in a peer-reviewed English-language journal and were published from 2004 up until March 2016. The search for relevant papers was completed by bibliographic cross-referencing. In order to keep the broadness of this review, all papers that discussed cognitive insight were included. In this manner we selected 106 articles on cognitive insight. In addition, 37 papers were added as background information. A detailed list of the included articles can be obtained on simple request to the authors.

Measuring cognitive insight

The current most widely used operationalization of cognitive insight is called the Beck Cognitive Insight Scale (BCIS; Beck et al., 2004). This 15-item self-assessment questionnaire consists of two subscales. The self-reflectiveness subscale includes nine items. It assesses the objectivity, openness to feedback and reflection. The second subscale is called self-certainty and consists of 6 items. Within this subset of questions, respondents are asked if they jump to conclusions, are certain about being right, and it assesses their resistance to correction or feedback. The two subscales are scored in opposite directions. By subtracting the score on the self-certainty subscale to the score on the self-reflectiveness subscale, a composite index is obtained. This composite index was designed because the level of self-certainty could diminish the ability to be self-reflective. The internal consistencies found regarding the subscales of the BCIS are described in Table 1. Because both subscales of the BCIS consist of less than 10 items, all these α values are considered to be within an acceptable range (Cortina, 1993; Holden, Fekken, & Cotton, 1991).

To our knowledge, only two studies tried to find cut-off scores for the BCIS. In the first study 418 non-psychiatric students and 93 outpatients with schizophrenia or schizoaffective disorder participated. It was not able to find a good limit to the scores of the scale (Martin, Warman, & Lysaker, 2010). In the second one, Kao, Wang, Lu, and Liu (2011) found that a cut-off score of three on the composite index discriminated between patients and controls. No cut-off scores of the self-reflectiveness subscale and the self-certainty subscale were mentioned. The investigation of Kao et al. (2011) included 118 outpatients with schizophrenia and 507 non-psychiatric individuals. Both investigations (Kao et al., 2011; Martin et al., 2010) did not include the negative and positive symptom severity of the patients. As will be described in more detail below, these symptoms can influence cognitive insight (Beck et al., 2004). Misdrahi et al. (2014) divided their participants in patients with ‘high cognitive insight’ and those with ‘low cognitive insight’. High cognitive insight was defined as scores that were situated at the last tertial of the distribution of the BCIS scores. In their sample, this cut-off score was eight on the composite index scale. They used this score as an indicator of good cognitive insight. For self-reflectiveness they used a cut-off score of sixteen or higher. They did not include a cut-off score for the self-certainty subscale. In general, it is suggested that individuals who display more positive symptoms would display lower rates on the composite index and the self-reflectiveness subscale, and higher self-certainty scores (Beck et al., 2004).

Cognitive insight in psychotic disorders

Schizophrenia spectrum and other psychotic disorders

As mentioned in the introduction, the concept of cognitive insight was originally designed with the symptoms of schizophrenia, schizoaffective disorder and other schizophrenia spectrum disorders in mind. Thus, most of the investigations to date targeted these diagnoses. In this paper, we will refer to this group as individuals with a psychotic disorder.

Beck et al. (2004) hypothesised that the BCIS should discriminate between individuals with and without a psychotic disorder and that patients who are currently more symptomatic display lower levels of cognitive insight in comparison to patients in remission. These hypotheses were confirmed in the first study regarding the BCIS (Beck et al., 2004) where it was demonstrated that it differentiated between patients with a diagnosis of a psychotic disorder and patients without (i.e. major depressive disorder), as the latter group displayed higher rates on self-reflectiveness and the composite index and lower rates on the self-certainty subscale. Research by Kimhy et al. (2014) was in line with these results as they found higher rates of self-certainty and lower rates of self-reflectiveness in schizophrenia when compared to healthy controls. Another study included individuals with and without delusion proneness (Warman & Martin, 2006). They found that delusional proneness goes together with higher levels of both self-certainty and self-reflectiveness. However, the latter correlation diminished after rumination was controlled for, suggesting that self-reflectiveness could share similarities with rumination (Carse & Langdon, 2013). One study failed to support the hypothesis of Beck et al. (2004), as it found higher rates of self-reflectiveness in participants with a psychotic disorder in comparison to their control group (Lincoln, Möbius, Huber, Nagel, & Moritz, 2014). The authors did not discuss this finding. As demonstrated in Tabel 2, most studies have found the expected relationship between positive symptomatology and cognitive insight. That is, more positive symptoms go along with worsened cognitive insight. However, there are papers that describe unexpected results such as Engh et al. (2009) who demonstrated that positive symptoms, such as solitary hallucinations, were correlated with higher self-reflectiveness. In addition, it has been found that participants with current active delusions had a higher score on the self-reflectiveness subscale in comparison to the patients with no active positive symptoms (Warman et al., 2007). The authors argued that, shown in a study by Moritz, Woodward, Whitman, and Cuttler (2005), patients with active delusions often change their minds when exposed to information that was not in line with their beliefs. Warman et al. (2007) suggest that this could be due to intact self-reflective behaviour but that their overconfidence keeps them from making the right decisions. Guerrero and Lysaker (2013) have tried to explain the mixed results in research regarding cognitive insight and symptomatology in psychotic disorders by suggesting that the relationship between cognitive insight and symptomatology is affected by a factor called 'socially naïve self-appraisal'. This socially naïve view of the self was explained by the authors as "the extent to which our self-appraisal is informed or in touch with social perception". In their study they found that when someone has a view on his or herself that is not tempered by the perception of others, i.e. a socially naïve self-appraisal, it leads to more self-confidence and less self-reflectiveness, which could be a risk factor for more positive symptoms.

Functional outcome and cognitive insight in psychotic disorders

One of the first studies that mentioned the clinical relevance of cognitive insight was Favrod et al. (2008). This study found that patients with schizophrenia (n = 158) who were living in nursing homes had lower scores on the composite index than those living independently. O'Connor et al. (2013) have assessed the relationship between cognitive insight and outcome measures (employment, relationships, living status and GAF-scores) in first episode psychosis. They found that higher cognitive insight but not clinical insight was related to higher GAF-scores and better psychosocial functioning at 12 months. Therefore, they concluded that cognitive insight is more associated to outcome measurements than clinical insight. This is supported by the positive association that was found between quality of life and cognitive insight (Giusti et al. 2013; Phalen, Viswanadhan, Lysaker, & Warman 2015). In addition, the study by Giusti et al. (2013) found self-reflectiveness to be the best predictor of global functioning. A study by Raffard et al. (2013) has demonstrated that the processes underlying the abilities for making treatment decisions (i.e. educational level, cognition, cognitive distortions) and medication adherence go along with better self-reflectiveness. Importantly, other studies in psychotic disorders have failed to support the clinical relevance of cognitive insight. The study by O'Connor et al. (2013) used regression analysis to show that the composite index of cognitive insight was not a good predictor of functional outcome. In fact, this composite index was found to be negatively correlated to the subjective quality of life in 71 individuals with schizophrenia, even when mood and anxiety were controlled for (Kim, Lee, Han, Kim, & Lee, 2015) and a lower level of self-reflectiveness was correlated with a higher subjective experience of recovery (Giusti et al., 2015). One other study did not find a relationship at all between the composite index of cognitive insight and quality of life (Carlson et al., 2009) and the study by Engh et al. (2007) did not find any difference in self-reflectiveness nor self-certainty for inpatients and outpatients with schizophrenia.

Neurocognition and cognitive insight in psychotic disorders

A lack of insight has been explained through multiple models. The first model is called the 'clinical model' and here a lack of insight is seen as a primary symptom of the illness (Cuesta & Peralta, 1994). The second model is the 'psychological denial model' where a lesser amount of insight is explained as a coping strategy. Using this coping strategy, patients try to protect themselves against distress (Moore, Cassidy, Carr, & O'Callaghan, 1999). Similarly, Lewis (1934) stated that the unawareness of illness could be caused by vanity, or the attempt by patients to protect their self-esteem. Thirdly, a loss of insight into illness can be interpreted through a 'neuropsychological model'. Here, it is suggested that poor insight is caused by deficits in neurocognitive functioning (Lysaker & Bell, 1994). Following this line of reasoning, one would expect neurocognitive performance to be correlated to the level of insight. Several studies, which are displayed in Table 3, have explored this link. In the studies that have focussed on psychotic disorders, only three out of the thirteen articles found a positive correlation between self-reflectiveness and better neurocognitive functioning. Most studies link more self-certainty to worse neurocognitive functioning. In psychosis this has been supported by a recent meta-analysis by Nair et al. (2014) investigating the neurocognitive underpinnings of cognitive insight. Here, self-certainty was found to be negatively associated with overall cognition and memory and the composite index showed significant positive correlations with overall cognition and memory. No correlation with self-reflectiveness was found. In addition, it was found that when

individuals with schizophrenia have more cognitive complaints, their self-reflectiveness was lower and self-certainty was higher (Tastet et al., 2012).

Riggs et al. (2012) published a qualitative study of cognitive insight in schizophrenia. In this study, a model of cognitive insight was proposed in which neurocognition is more closely linked to cognitive insight than clinical insight. However, this assumption was made on the basis of the results of only two studies that failed to find a link between clinical insight and neurocognitive functioning (Buchy et al., 2009; Lepage et al., 2008). The hypothesis made by Riggs et al. (2012) that neurocognitive impairments limit the formation of cognitive insight, which in turn limits the growth of clinical insight can be questioned since several more recently published studies find a link between neurocognitive functioning and both clinical and cognitive insight (Cooke et al., 2010; Gilleen et al., 2011; O'Connor et al., 2013). Moreover, three studies were unable to find neurocognitive underpinnings of cognitive insight but did, however, find neurocognitive correlates of clinical insight (Burton et al., 2011.; Ng et al., 2015; Vohs et al., 2015). These results show that the relationship between cognitive insight, clinical insight and neurocognition is more complex than previously suggested.

Neural correlates of cognitive insight in psychotic disorders

To investigate if the neuroanatomical correlates that underlie cognitive insight are associated with the neurocognitive correlates presented above, several lines of research have focused on the neural associations of cognitive insight (see Table 4). Taken together, these studies find that the hippocampus, the fornix, the DMN, the pre-frontal cortex, the dorsolateral PFC, and the ventrolateral PFC are the neural regions of interest in cognitive insight. These results support the findings of previous research that investigated the neurocognitive correlates of cognitive insight, as these regions are linked to memory, learning and executive functioning. However, some studies have only focused on specific neural regions of interest (Buchy et al., 2009; van der Meer et al., 2013), a method that ignores the possibility that more brain regions are involved in the formation of cognitive insight.

Improving cognitive insight in psychotic disorders

The studies that are reviewed here have investigated cognitive insight in individuals with a psychotic disorder in a longitudinal design to examine if it fluctuates over time or whether it can be affected by treatment. In one naturalistic longitudinal study, cognitive insight of patients with schizophrenia was assessed at admission and at discharge from a psychiatric unit (Bora et al., 2007). This investigation found that self-certainty scores did not differ between the two time points. They did however find an improvement in self-reflectiveness and in the overall composite index of the BCIS. This improvement was not related to a reduction of symptoms. Another study that used a longitudinal design (Lysaker et al., 2011) included patients with schizophrenia or schizoaffective disorder in a post acute phase of their illness. By comparing their self-reflectiveness and self-certainty at baseline and after six months, the authors found that cognitive insight is a constant construct in individuals with a psychotic disorder who are stabilized. The studies that have measured cognitive insight before and after a specific treatment are listed in Table 5. In sum, previous research has found that when symptoms of patients are stable and they receive no intervention, their scores on the BCIS remain the same (Lysaker et al., 2011). Through therapeutic intervention, cognitive insight can improve. This is

especially the case after CBT (Granholm et al., 2005; Penn et al., 2009) and MCT (Lam et al., 2015). However, some studies do not replicate these findings (Balzan et al., 2013; Perivoliotis et al., 2010; Premkumar et al., 2011; van Oosterhout et al., 2014). Remarkably, it is found that higher levels of pre-treatment cognitive insight are associated with a more effective therapy in terms of a decrease in symptoms (Burton et al., 2011; Granholm et al., 2005; Perivoliotis et al., 2010; Premkumar et al., 2011). Following this line of research, one could hypothesize that actively improving cognitive insight prior to treatment might enhance effectiveness of that treatment. It would thus be interesting for future research to investigate whether a form of cognitive insight enhancing pre-treatment causes additional decline of symptoms.

Cognitive insight in non-psychotic disorders

Anxiety disorders

Two articles have looked into the association between anxiety and cognitive insight in individuals with psychosis. The study by Colis, Steer and Beck, 2006, showed that anxiety was significantly related to higher scores on the composite index of the BCIS and self-reflectiveness. The other study did not find any association between cognitive insight and anxiety (Buchy et al., 2009). The only specific anxiety disorder that was assessed in the context of cognitive insight is obsessive-compulsive disorder (OCD). While the diagnosis of OCD originally required that patients must be aware of the irrational and illogical nature of the obsessions and compulsions (Kozak & Foa, 1994), the current edition of the diagnostic and statistical manual of mental disorders (DSM), the DSM-5, has included the possibility that individuals with OCD have a limited awareness or a loss of clinical insight in the irrationality of their beliefs that underlie their OCD (American Psychiatric Association, 2013). Indeed, there is a study that supports the lack of clinical insight in OCD, where it was found that only 13% of the individuals diagnosed with OCD were sure that nothing disturbing would happen if they did not act on their compulsions (Foa & Kozak, 1995). The only study that has included cognitive insight in OCD was conducted by Shimshoni, Reuven, Dar, and Hermesh (2011). They tried to find a link between clinical and cognitive insight in OCD and found that the BCIS did not correlate with any of the clinical insight measures they included. In this study, all clinical insight scales were observer-rated. The authors explained their finding by suggesting that patients with OCD may demonstrate different levels of insight regarding their OCD-relevant thought patterns in comparison to their general thought patterns (i.e. cognitive insight) (Shimshoni et al., 2011).

Affective disorders

One study has focused on the differences in cognitive insight between affective and non-affective diagnoses (Kumari, Chaudhury, & Kumar, 2013). The affective group included individuals diagnosed with bipolar disorder and major depressive disorder (MDD). Psychotic diagnoses were classified in the non-affective group, which was composed of mostly individuals with schizophrenia. This study found that self-certainty and the composite index of the BCIS were significantly higher in affective disorders in comparison to non-affective disorders. This unexpected result could be explained by an important limitation of this study, being that most of the individuals in both groups had psychotic

symptoms. In addition, although not significant, the affective group displayed more delusions in comparison to the non-affective group. In line with this, Colis et al. (2006) found that individuals diagnosed with MDD have higher scores on the composite index in comparison to psychotic disorders and bipolar disorder (Colis et al., 2006). On the other hand, in the original paper by Beck et al. (2004), no differences were found between patients diagnosed with schizophrenia, schizoaffective disorder or MDD with and without psychosis concerning their levels of self-reflectiveness. They did however notice that the levels of self-certainty were higher and the composite index was lower in the group with MDD and psychosis in comparison to the patients with MDD without psychotic symptoms. Remarkably, regarding the concept of cognitive insight, we found no studies that exclusively focus on MDD. This might be related to the statement of Beck et al. (2004) that individuals with MDD would retain the ability to reflect on their actions and are able to acknowledge that their conclusions were at times incorrect. On the other hand, a depressive state is often linked to cognitive distortions such as overgeneralizing and selective abstraction (e.g. Clak & Beck, 1999). Such faults in metacognitive thinking might imply a reduction in cognitive insight. Most studies that have investigated the relationship between depressive state and cognitive insight have focussed on subjects diagnosed with a psychotic disorder. Some of these studies have found no relationship between cognitive insight and depression rates (Beck et al., 2004; Engh et al., 2007; Pedrelli et al., 2004). An important finding is however that the majority of previous research did find that higher cognitive insight was related to more depressive feelings (Colis et al., 2006; Ekinici et al., 2012; Kao et al., 2011; Mass et al., 2012; Misdrahi et al., 2014; Warman & Martin, 2006). Two recent meta-analyses by Murri et al. (2015) and Palmer, Gilleen, and David (2015) indeed showed that higher levels of cognitive insight are accompanied by more depressive feelings in schizophrenia. In support of the latter findings, a study conducted by Granholm et al. (2005) in individuals with schizophrenia found that the levels of cognitive insight increased together with depressive symptoms midway through a psychotherapy treatment. The relationship between cognitive insight and depression has been suggested to be driven by the level of self-reflectiveness (Palmer et al., 2015). Which is plausible, as self-reflective behaviour can take on a ruminative quality typical of depressive thinking (David, Bedford, Wiffen, & Gilleen, 2012). The relationship between self-reflection and rumination appears to be accompanied by higher levels of self-stigma (Mak & Wu, 2006). Interestingly, a study of Eicher, Davis, and Lysaker (2013) found a negative relationship between self-compassion and the composite scale of cognitive insight.

Three studies have included individuals with bipolar disorder (Colis et al., 2006; Engh et al., 2007; Van Camp et al., 2016). In the first one, Colis et al. (2006) compared individuals with a psychotic disorder (paranoid schizophrenia or schizoaffective disorder), bipolar disorder and MDD. They found that self-reflectiveness and self-certainty in bipolar I disorder and psychotic disorder did not differ. In addition, when the last episode was manic in bipolar I disorder, the patients had a lower level of cognitive insight compared to patients in which the last episode was depression. The second study in bipolar disorder was performed by Engh et al. (2007). This research group studied the psychometric quality of the BCIS in individuals with bipolar disorder. In addition, they included individuals with schizophrenia and healthy controls. No significant differences were found between the mean scores of self-reflectiveness and self-certainty in any of the groups. Regarding the relationship between symptomatology and cognitive insight in bipolar disorder, there was no correlation between manic scores or depressive scores and cognitive insight. However, self-certainty was significantly related to the scores on the Young Mania Rating Scale (YMRS; Young, Biggs, Ziegler, & Meyer, 1978).

Unfortunately, the direction of this correlation and the mean scores of the YMRS were not mentioned in this study. These limitations make it difficult to determine if the participants were stable during the time of assessment. The internal consistency of the BCIS in bipolar disorder is described in Table 1. These scores indicate that the BCIS is a valid instrument for the assessment of cognitive insight in bipolar disorder (Beck et al., 2004).

Neurocognitive and neural correlates of cognitive insight in bipolar disorder

In opposition to studies in psychotic disorders, where cognition is more related to self-certainty, it seems that in bipolar disorder neurocognitive functioning is more strongly correlated to self-reflectiveness (Van Camp et al., 2016). However, only one study has focussed on this link (see Table 3). Future research is needed to confirm this finding. One study has included bipolar patients when assessing the neural correlates of cognitive insight (see Table 4). They were not able to find any association between cognitive insight and brain activity (Zhang et al., 2015).

Dementia

The only neurodegenerative disorders that have been studied in the light of cognitive insight are Parkinson's disease and Alzheimer's disease. Individuals with Parkinson's disease have a lack of insight in multiple pathological behaviours including their psychiatric symptoms (Fasano et al., 2010) and their social dysfunction (McKinlay et al., 2008). Only one study to date has assessed the cognitive insight of patients with Parkinson's disease (Mack et al., 2013). The authors compared Parkinson's patients with and without an impulse control disorder. The results showed that overall cognitive insight and self-reflectiveness were greater in patients with Parkinson's disease with an impulsivity problem. No significant difference was found for the self-certainty subscale. The second study in neurodegenerative illnesses and cognitive insight was performed in a group of patients with probable Alzheimer's disease. In these patients the mean scores on the self-reflectiveness subscale were significantly lower and the scores on the self-certainty subscale were significantly higher than in the healthy control group (Degirmenci, Degirmenci, Dügüncü, & Yilmaz, 2013).

Bronchial asthma

It is estimated that almost 15% of individuals who are suffering from bronchial asthma display severe alexithymia (Amore et al., 2013). Alexithymia is defined as a condition that makes individuals experience difficulties in expressing, describing and experiencing emotional feelings (Taylor, Bagby, & Parker, 1999). Alexithymia is related to a worsened outcome in patients with asthma and is linked to a reduced clinical insight (Mintz, Wise, & Helmkamp, 2003). Because of this, Innamorati et al., (2015) assessed the connection between cognitive insight and bronchial asthma. They found that patients with more severe airway obstruction who scored higher on the alexithymia scale reported more self-reflectiveness and in addition, more depressive symptoms.

Cognitive insight in healthy individuals

A study by Engh et al. (2007) that included a healthy control group found that the content of the BCIS can be misinterpreted as multiple items refer to psychotic experiences. This explanation was based

on the finding that their control group was unable to answer a high percentage of items on the self-reflectiveness subscale. Specifically the items 3, 5, 6 and 15 were left unanswered to a large degree. It is possible that the omission is caused by the content of the questions as these items could be interpreted as referring to psychotic-like experiences, and therefore were difficult to answer for the healthy controls. However, Warman et al. (2007) did not replicate this finding, as their control group did not indicate that they had difficulties in answering these specific questions. The internal consistency of the BCIS in healthy individuals is described in Table 1. Following the conclusion made by Beck et al. (2004), based on papers of Cortina (1993) and Holden et al. (1991), these results show that the BCIS is a valid measure to use in the general population.

Functional outcome, neurocognition and cognitive insight in healthy individuals

Recently, it was shown that the composite index of the beck cognitive insight scale was negatively correlated with quality of life in 420 undergraduates (Weintraub & Weisman, 2015). This could be linked to the reasoning of Orfei et al. (2011) who hypothesized that a more self-confident style and less self-reflectiveness would be more cognitively functional. This is an interesting idea as it might be that when healthy individuals display more self-confidence in their beliefs they might understand more objectively the reality and events. In addition, it is possible that less self-reflectiveness protects them against ruminating excessively (Takano & Tanno, 2009), a suggestion also in line with the emergent pattern throughout the current review that self-reflectiveness is associated positively with depressive feelings (Palmer et al., 2015). Regarding neurocognition, Orfei et al. (2011) conducted a study in 50 healthy participants and included cognitive insight and socio-demographic variables (age, education and gender). They found that better executive functioning goes together with more self-confidence and less self-reflectiveness and have taken these results to support their hypothesis. However, to our knowledge they did not document the raw BCIS scores, making it impossible to compare 'high' or 'low' scores with the results of previous studies.

Conclusion

While the concept of cognitive insight was originally designed with the diagnosis of schizophrenia and schizoaffective disorder in mind (Beck et al., 2004), it is now applied in bipolar disorder (Colis et al., 2006; Engh et al., 2007; Van Camp et al., 2016), major depressive disorder (Beck et al., 2004; Colis et al., 2006), obsessive compulsive disorder (Shimshoni et al., 2011), Parkinson's disease (Mack et al., 2013), Alzheimer's disease (Degirmenci et al., 2013), and even in non-clinical participants (Degirmenci et al., 2013; Giusti et al., 2013; Kao et al., 2011; Martin et al., 2010; Warman, Lysaker, & Martin, 2007; Wüsten & Lincoln, 2015).

Cognitive insight in psychotic disorders

In most research regarding psychotic disorders, the expected negative relationship between self-reflectiveness and positive symptoms and positive association between self-certainty and positive symptomatology is found (Beck et al. 2004; Bora et al. 2007; Bruno et al. 2012; Buchy et al. 2009; Kumari et al. 2013; Lysaker et al. 2010; Pedrelli et al. 2004; Perivoliotis et al. 2010; Uchida et al. 2014;

Vohs et al. 2015; Warman et al. 2007). The majority of previous research in psychosis shows a positive correlation between cognitive insight on one hand and memory, learning (Buchy et al., 2009; Engh et al., 2011; Lepage et al., 2008; O'Connor et al., 2013; Orfei et al., 2010) and executive functioning (Cooke et al., 2010; Gilleen et al., 2011; Kao et al., 2013; O'Connor et al., 2013; Raffard et al., 2014) on the other. It has to be noted though, that in some investigations an extensive neurocognitive battery that assesses many neurocognitive functions was used (Buchy et al., 2010; Burton et al., 2011; Cooke et al., 2010; Engh et al., 2011; Gilleen et al., 2011; Lepage et al., 2008; Orfei et al., 2010), while others examine only two or three neurocognitive domains (Garcia et al., 2012; Kao et al., 2013; Vohs et al., 2015). Future studies should adopt a common methodology. We stress this because, taking into account previous studies that show the possibility of cognitive enhancement (for meta-analysis see Wykes et al., 2011), it is important from a therapeutic viewpoint to investigate whether the enhancement of specific neurocognitive functions by the use of cognitive remediation therapy can lead to an increase in cognitive insight. Surprisingly, to date, no investigation has focused on the improvement of cognitive insight via the enhancement of neurocognitive functioning. Although, Burton et al. (2012) did add the BCIS in their study regarding a cognitive training for schizophrenia patients, they did not include their findings regarding cognitive insight in their results or discussion section.

Cognitive insight in non-psychotic disorders and healthy individuals

Research in affective disorders shows that not only psychotic symptoms influence self-reflectiveness and self-certainty. In bipolar disorder, manic symptoms are correlated to higher self-certainty (Engh et al., 2007). Although only based on two studies (Colis et al., 2006; Engh et al., 2007), it is possible that the level of cognitive insight in bipolar disorder and schizophrenia or schizoaffective disorder may be analogous. Because only individuals with bipolar I disorder can display psychotic symptoms in their manic episode, it could be that the way they reflect on their experiences and the self-certainty they exhibit are more similar to the values observed in psychotic disorders than to those in bipolar type II disorder. Unfortunately, the study by Engh et al. (2007) and Van Camp et al. (2016) did not differentiate between bipolar I and II disorder. It would be valuable to differentiate between the subtypes of bipolar disorder in future research. Multiple studies have found a positive connection between cognitive insight and depressive symptomatology (Colis et al., 2006; Ekinci et al., 2012; Granholm et al., 2005; Kao et al., 2011; Mass et al., 2012; Misdrahi et al., 2014; Warman & Martin, 2006). This relationship is driven by self-reflectiveness (Palmer et al., 2015). Only two studies included MDD (Beck et al., 2004; Colis et al., 2006) with mixed results. It seems that, as with psychotic symptoms, the level of acute depressive symptoms might be closely linked to the level of cognitive insight. The positive relationship between insight and depressive feelings might be seen as 'depressive realism', because individuals who encounter depression have a more accurate view on themselves and the world they live in (Haaga & Beck, 1995).

Regarding anxiety in psychosis, mixed results are found (Buchy et al. 2009; Colis et al., 2006). The only study that has reported cognitive insight in an anxiety disorder (OCD) has only focused on the lack of its relationship with clinical insight (Shimshoni et al. 2011). They did not investigate the link between cognitive insight and symptomatology. Additionally, in Parkinson's disease it was found that higher self-reflectiveness is associated with more impulsivity problems (Mack et al., 2013), whereas in Alzheimer's disease, cognitive insight and more specifically self-reflectiveness seems to be lower in

comparison to healthy individuals (Degirmenci et al., 2013). Lastly, in bronchial asthma more severe airway obstruction is related to higher self-reflectiveness (Innamorati et al., 2015).

According to Beck et al. (2004), it should be possible to discriminate between healthy individuals and people with a psychotic disorder regarding the level of cognitive insight. While some investigations support this hypothesis (Giusti et al., 2013; Kao et al., 2011; Martin et al., 2010; Warman et al., 2007), several others have not found such a difference (Engh et al., 2007; Pu et al., 2013; Raffard et al., 2014).

Validity of cognitive insight

On the base of the previous studies mentioned above, we could assume that there is no conclusive evidence that cognitive insight in its current form is applicable in subjects with and without psychosis. Although it is clear that this could be due to the lack of research regarding cognitive insight in individuals without a psychotic disorder, it could also be explained by some of the disadvantages of the current most widely used operationalization of cognitive insight, which is the BCIS. First of all, because individuals have to reflect on their way of reasoning and information processing, self-report questionnaires such as the BCIS require a certain level of self-reflective capacities to begin with. Also, even though a person is very self-reflective about his behaviour and conclusions, it could be that he still finds it very hard to reach an accurate conclusion about his beliefs. This reasoning is applicable in individuals with psychosis, but can also be true in individuals who encounter a depression, as these individuals seem to be more likely to (over) self-reflect. However, they are often not able to produce the right conclusion about their beliefs. Therefore, it is possible that subjects are not completely able to estimate their own level of self-reflection and self-certainty. A study by Köther et al. (2012) applied the Reading the Mind in the Eyes test (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb 2001) and the BCIS to individuals with schizophrenia and schizoaffective disorder. In the Reading the Mind in the Eyes test, subjects are presented a series of photographs of eyes of other individuals. They are asked which word best reflects what the person on the presented pictures is thinking or feeling. Köther et al. (2012) found that individuals with schizophrenia or schizoaffective disorder who had a high self-reflectiveness score were more certain of their false responses on the Reading the Mind in the Eyes test. This could reflect the difficulty that patients have in correctly identifying their own amount of self-reflective and self-certain behaviour. Furthermore, as suggested by Beck and Warman (2004), some patients are able to have good adaptive appraisals and reappraisals about their beliefs in situations that are not related to their symptoms, which can possibly influence the scores on the BCIS. It would be interesting for future research to include both a self-reported measurement of cognitive insight and a measurement of insight that is rated by a clinician. In addition, as already mentioned in Orfei et al. (2011), the added value of the BCIS composite index can be questioned. This because the composite index scale can have the same result with a different combination of scores on the self-reflectiveness and self-certainty subscales. Meaning that a similar result on the composite index can coincide with two very different thinking styles. Furthermore, to date there is no consensus about the cut-off scores of the BCIS scales and no normative data of the BCIS has been published. Importantly, a high overall cognitive insight score does not always represent high self-reflectiveness and low self-certainty. In addition, the emphasis of the BCIS lays on unusual experiences or, in other words the experience of a psychosis, which makes it a difficult questionnaire to fill in by non-psychotic individuals. More

specifically, in a study by Engh et al. (2007) it was found that a large part of the healthy control group did not respond to items 3, 5, 6 and 15 because these items referred to psychotic-like experiences. However, when cognitive insight is described as: a concept that focuses on being able to consider more than one explanation, the change of perspective that individuals hold, making alternative hypotheses and being able to reject wrong convictions (Beck & Warman, 2004), it creates the impression that cognitive insight focuses on more general metacognitive processes that are not related to a specific illness and include general thought patterns. With this definition in mind, it should be possible to assess cognitive insight in a variety of diagnoses and even in individuals that do not suffer from psychiatric disorders. To achieve this, it could be useful to develop a measure of cognitive insight that has less of a focus on abnormal thoughts or experiences.

Cognitive insight and more specifically its underlying concepts self-reflection and self-certainty can easily be taken to reflect a broader sense of metacognitive self-perception that is unrelated to illness. In this sense it has had an analogue metacognitive conceptualisation in the literature which is private self-consciousness. Private self-consciousness refers to an acute sense of self-awareness. It is the inspection and evaluation of our thinking and feelings (Grant, Franklin, & Langford, 2002). Unlike the current view on cognitive insight, that is, the higher cognitive insight, the less psychotic symptoms (Beck et al., 2004), it was argued by Ingram (1990) that being excessively self-focused could contribute to psychopathology (Ingram, 1990). Indeed, early research has found a positive association between being highly self-focused and depression (Musson & Alloy, 1988), anxiety (Carver & Scheier, 1986), social phobia (Buss, 1980) and even psychosis (Smari, Stefansson, & Thorgilsson, 1994). In the original article of cognitive insight, Beck et al. (2004) have defined it as being composed of two separate components, being: (a) the overconfidence patients have in the veracity of their beliefs and (b) the capacity to consider feedback from others and alternative explanations regarding their mental productions. The self-reflectiveness subscale of the BCIS emphasizes the feedback received from others and the willingness to take this into account, whereas private self-consciousness, that is comparable with self-reflectiveness, highlights the introspective capacities. Although the definition of the two concepts differ somewhat, it seems that research investigating both finds similar results. That is, a positive relationship between a cognitive style of being overly self-reflective and psychiatric symptoms (eg. depression) (Colis et al., 2006; Ekinici et al., 2012; Granholm et al., 2005; Kao et al., 2011; Mass et al., 2012; Misdrahi et al., 2014; Warman & Martin, 2006). It was even suggested that too much self-absorption is a feature that is common to all psychiatric disorders (Ingram, 1990). On the other hand, self-certainty also has a large body of research history even before the conceptualisation of cognitive insight by Beck et al., (2004). As early as 1988 overconfidence in judgments was found in individuals with psychotic symptoms (Huq, Garety, & Hemsley, 1988) and in depression this positive association was also discussed (Dunning & Story, 1991). Instead of the current tendency in research that is to discuss cognitive insight as a whole, we state that self-certainty and self-reflectiveness must be considered in more detail separately. This is because we hypothesize that very high levels of self-reflectiveness might not be something we should indiscriminately pursue, as it is linked to higher levels of anxiety (Colis et al., 2006) and depression (Colis et al., 2006; Ekinici et al., 2012; Granholm et al., 2005; Kao et al., 2011; Mass et al., 2012; Misdrahi et al., 2014; Warman & Martin, 2006). While most studies on cognitive insight have included all scales of the BCIS (Beck et al., 2004; Bora et al., 2007; Ekinici et al., 2012; Favrod et al., 2008; Mass et al., 2012; Misdrahi et al., 2014; Pedrelli et al., 2004; Van Camp et al., 2016; Vohs et al., 2015), others have only incorporated the Self-Reflectiveness and Self-Certainty

subscale (Engh et al., 2007; Ng et al., 2015; Tastet et al., 2012) or only the Composite Index (Carlson et al., 2009; Eicher et al., 2013; Lepage et al., 2008; O'Connor et al., 2013; Weintraub & Weisman, 2015). This being said, we should keep in mind the similarities concepts such as self-reflectiveness, self-consciousness, and self-certainty share with other self-related metacognitive concepts such as described above and even metacognition in general. The question can then of course be asked: Are they fundamentally different? In other words, do they measure a distinct concept that requires a metacognitive thinking style or are they all measurements of metacognitive thinking? Originally, metacognition was mostly used in the field of learning where it was defined as the thinking about our own thinking (Flavell, 1979). To date, the concept of metacognition has been expanded where it now includes a spectrum of processes that are involved in the understanding, controlling and adaptation of thinking itself (Wells & Cartwright-Hatton, 2004). As such, the concepts that are the main focus of the current review: self-reflectiveness and self-certainty would fit quite well within this broader conceptualisation of metacognition. While recent research indeed linked metacognitive functioning to cognitive insight (Bruno et al., 2012; de Vos et al., 2015; Kanie et al., 2014; Vohs et al., 2015), Giusti et al. (2013) did not find a correlation between metacognitive functions and cognitive insight. In order to gain a more thorough understanding of cognitive insight as a concept and its underlying processes, it is thus important to study its differences and similarities with other self-related concepts of metacognition and so demarcate its place within the entire spectrum of metacognition.

In addition, the shortcomings of previous research might explain the inconclusive results regarding cognitive insight in individuals that have never experienced a psychosis. First, cognitive insight is often added as an “extra” in the discussed studies. Therefore, the results regarding cognitive insight are often neglected. Second, the majority of previous studies included participants with low or average symptoms severity (Colis et al., 2006; Giusti et al., 2013; Pedrelli et al., 2004; Uchida et al., 2014), and some did not mention the symptom severity of the participants (Beck et al., 2004; Misdrahi et al., 2014). In addition, most investigations used a cross-sectional design (Bora et al., 2007; Bruno et al., 2012; Buchy et al., 2009; Ekinci et al., 2012; Kimhy et al., 2014; Lincoln et al., 2014; Misdrahi et al., 2014; Pedrelli et al., 2004; Uchida et al., 2014; Van Camp et al., 2016; Vohs et al., 2015; Warman & Martin, 2006). There is need for further research with a longitudinal design (such as the studies of Granholm et al., 2005 and Perivoliotis et al., 2010) and studies that include individuals that encounter high symptom severity at the time of assessment (Warman et al., 2007) to investigate if cognitive insight is state or trait dependent.

Clearly, cognitive insight and the studies that have investigated it have suffered somewhat from conceptual and methodological shortcomings. Nevertheless, some important conclusions can still be made regarding the relationship cognitive insight has with symptoms and functional outcome measures that have implications regarding the model of Riggs et al. (2012). Therefore, we have constructed a revised model that incorporates the most recent data on cognitive insight that are discussed in this review (see figure 1, right panel). In this new model, the dotted lines refer to the elements that need further research. Full lines represent relationships that have been most widely studied. To our opinion, the following elements of the original model should be reconsidered in light of recent studies as they find results that contradict some of the original hypothesis. First of all, cognitive insight is most valuable when viewed as its underlying concepts. Thus, we have separated these in the revised model. In the original model (Figure 1, left panel) Riggs et al. (2012) argued that neurocognition makes it possible for cognitive insight to increase, which in turn helps the

development of clinical insight. Recent studies find contradictory results, as there are studies that find a link between neurocognition and both clinical and cognitive insight (Cooke et al., 2010; Gilleen et al., 2011; O'Connor et al., 2013). In addition, three studies were unable to find neurocognitive underpinnings of cognitive insight but did find neurocognitive correlates of clinical insight (Burton et al., 2011.; Ng et al., 2015; Vohs et al., 2015). However, the link between self-certainty and neurocognition in psychosis (Nair et al., 2014) seems in accordance with most of the data reviewed here. On the other hand, in bipolar disorder, although only based on one study (Van Camp et al., 2016) neurocognition has been suggested to correlate to self-reflectiveness. In addition, the specificity of cognitive insight and its (in)dependency of metacognitive thinking needs further research. As the model of Riggs et al. (2012) already predicted, more self-reflectiveness and less self-certainty seems to have a positive effect on the treatment outcome (Burton et al., 2011; Granholm et al., 2005; Perivoliotis et al., 2010; Premkumar et al., 2011). Because cognitive insight is mostly studied in psychotic disorders, the model of Riggs et al. (2012) only focussed on positive and negative symptoms. To date, there are multiple studies that find a link between self-reflectiveness and self-certainty and other symptoms such as mood and anxiety. However, because of the lack of research in non-psychotic individuals we cannot at the moment make any conclusions regarding the link between symptomatology and the underlying processes of cognitive insight. Furthermore, in comparison to research on clinical insight, there is a lack of research on the relationship between cognitive insight and important functional outcome variables such as quality of life, treatment adherence, and living independently. Data on this matter are unclear, for some research on this topic shows that greater cognitive insight correlates with higher psychosocial functioning (Favrod et al., 2008) and better global functioning (Giusti et al., 2013; O'Connor et al., 2013), while other studies show an opposite pattern (Giusti et al., 2015; Kim et al., 2015; Weintraub & Weisman, 2015). Finally, in the model of Riggs et al. (2012) the causality between the different elements was unclear. The current literature still does not enable us to reveal clear-cut causality. For instance, does a lack of cognitive insight results in mood instability? Or is it because individuals are depressed their cognitive insight is reduced? Because these questions are still unanswered, we have changed the arrows of the original model into stripes that do not take a position on causality. The more research will expand in this field, the clearer the model of cognitive insight and its underpinnings will be. We can assume that future models will differ between diagnoses.

In conclusion, this review has summarised the current state of the art on the concept of cognitive insight. It has enabled us to conclude several key points. First of all, while cognitive insight in its current form seems valid for use in individuals with psychosis, it is less so for individuals without psychosis. Also, we recommend to examine the two underlying concepts of cognitive insight separately and not to place a main focus on the composite index. In addition, it could be helpful to adjust our view on cognitive insight, that is, we suggest that higher cognitive insight is not always correlated to a better psychological functioning. The latter recommendation is especially true for self-reflectiveness, which seems to coincide often with worse mood. Also, it is unclear what position cognitive insight takes within the spectrum of metacognitive processes and how it relates to other self-related concepts that have been defined previously in literature. Future research on insight should include studies that compare the different conceptualisations as to better define their overlap and differences. Combining future and past research on cognitive insight and its analogue concepts will help in the formation of a uniform definition that will fit all subjects discussed here.

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Table 1

Coefficient α for the self-reflectiveness and self-certainty subscales

Study	Participants	α S-R	α S-C
Beck et al. (2004)	Schizoaffective/Schizophrenia	0.67	0.61
	MDD	0.69	0.59
Pedrelli et al. (2004)	schizoaffective/schizophrenia	0.66	0.55
Mak & Wu (2006)	schizoaffective/schizophrenia	0.82	0.71
Engh et al. (2007)	schizoaffective/schizophrenia	0.72	0.63
	BD	0.73	0.61
	Healthy individuals	0.73	0.63
Favrod et al. (2008)	schizoaffective/schizophrenia	0.73	0.62
Martin et al. (2010)	Healthy Individuals	0.74	0.75
Shimshoni et al. (2011)	OCD	0.71	0.59
Van Camp et al. (2016)	BD	0.65	0.72

α S-R = Coefficient alpha of the self-reflectiveness subscale; α S-C = Coefficient alpha of the self-certainty subscale; MDD = major depressive disorder; OCD = Obsessive-Compulsive Disorder; BD = Bipolar Disorder.

Table 2

Found relationships in psychosis between positive symptoms, negative symptoms and cognitive insight

Study	Relationship with positive symptoms	Relationship with negative symptoms
Beck et al. (2004)	- CI & - SR	NM
Pedrelli et al. (2004)	+ SC	+ SC
Bora et al. (2007)	- CI, - SR & + SC	- SR
Warman et al. (2007)	- SR & + SC	NM
Buchy et al. (2009)	- CI & - SR	NM
Engh et al. (2009)	+ SR	NM
Lysaker et al. (2010)	+ SC	NM
Perivoliotis et al. (2010)	- SR	NM
Bruno et al. (2012)	+ SC	NM
Ekinci et al. (2012)	NC	NC
Giusti et al. (2013)	NC	NC
Kumari et al. (2013)	- CI	NM
Uchida et al. (2014)	- CI & + SC	NM
De Vos et al. (2015)	NC	NM
Vohs et al. (2015)	+ SC	+ SC

- = negative relationship, + = positive relationship, SR = self-reflectiveness subscale, SC = Self-certainty subscale, CI = Composite Index, NC = no correlation found, NM = not mentioned in study

Table 3

Overview of the studies that have focussed on the link between neurocognition and cognitive insight

Study	Participants	SR	SC	CI
Lepage et al. (2008)	30 schizophrenia, 7 schizoaffective, 5 psychosis NOS, 1 schizophreniform, 1 delusional disorder, 3 bipolar disorder, 4 undetermined	NC	- verbal learning & - memory	+ verbal learning & + memory
Buchy et al. (2009)	37 schizophrenia, 9 schizoaffective, 1 schizophreniform, 7 psychosis NOS, 1 delusional disorder, 5 bipolar disorder, 3 undetermined	+ verbal memory & + learning	NC	+ verbal learning & + memory
Cooke et al. (2010)	65 participants with schizophrenia or schizoaffective disorder	NC	- executive functioning	NM
Orfei et al. (2010)	60 schizophrenia	NC	- Working memory, -verbal memory, & - visual memory	+ working memory
Engl et al. (2011)	81 schizophrenia, 8 schizophreniform, 13 schizoaffective disorder	NC	- Verbal learning	NM
Burton et al. (2011)	38 schizophrenia, schizoaffective disorder, psychosis NOS, major depression with psychosis	NC	NC	NC
Gilleen et al. (2011)	31 schizophrenia	NM	NM	+ executive functioning & + memory
Orfei et al. (2011)	50 healthy participants	+ executive functioning, +	NC	+ executive functioning & +

		verbal memory, + logical reasoning & + visual memory		visual memory
Garcia et al. (2012)	72 schizophrenia or schizoaffective disorder	NC	NC	NC
Kao et al. (2013)	85 schizophrenia or schizoaffective disorder	+ executive functioning	- executive functioning & - attention	+ executive functioning
Giusti et al. (2013)		+ visual spatial intelligence & + logical capacity	- working memory & - executive functioning	NC
Raffard et al. (2014)	37 parents of patients with schizophrenia	NC	- Verbal comprehension & - executive functioning	+ verbal comprehension
NG et al. (2015)	141 schizophrenia and 52 schizoaffective disorder	NC	NC	NC
Van Camp et al. (2016)	42 bipolar disorder	+ speed of processing, + attention, memory, + visual learning & + executive functioning	- working memory	+ speed of processing, + working memory & + executive functioning

NC = No correlation, NM = not mentioned, - = negatively correlated with, + = positively correlated with

Table 4

Overview of the studies that have included the neural correlates of cognitive insight

Study	Participants	Method	Results
Buchy et al. (2009)	FEP	Structural MRI	SC – volume hippocampus CI + volume hippocampus
Buchy et al. (2012)	FEP	Structural MRI & DTI	SC + fractional anisotropy in the right fornix
Orfei et al. (2013)	Healthy individuals & schizophrenia	Structural MRI & DTI	SR + volume right vLPFC in schizophrenia
Pu et al. (2013)	Schizophrenia	multi-channel NIRS	SR + activation right vLPFC
Van der Meer et al. (2013)	Schizophrenia	Functional MRI	SR + activation vMPFC
Buchy et al. (2014)	Healthy individuals	Functional MRI	SR + activation vLPFC & - activation midbrain
Gerretsen et al. (2014)	Schizophrenia	Resting state Functional MRI	SC – connectivity in inferior FC SR & CI + connectivity with left ACC
Buchy & Lepage (2015)	Healthy individuals	Structural MRI	SR + thickness right vLPFC
Buchy et al. (2015)	Healthy individuals & FEP	Functional MRI	SR + activation bilateral vLPFC in FEP
Ćurčić-Blake et al. (2015)	Healthy individuals & Schizophrenia	Functional MRI	CI – activation in frontal SLF
Lee et al. (2015)	Schizophrenia & Schizoaffective	Functional MRI	CI + activity dLPFC & hippocampus
Zhang et al. (2015)	Bipolar disorder & Schizophrenia	Functional MRI	CI + activation PCC in schizophrenia
Buchy et al. (2016)	FEP	Structural MRI & DTI	SR + thickness vLPFC & SC - thickness vLPFC

FEP = individuals with first episode psychosis, MRI = Magnetic Resonance Imaging, DTI = diffusion tensor imaging tractography, vLPFC = ventrolateral Prefrontal Cortex, dLPFC = dorsolateral Prefrontal Cortex, NIRS = Near-infrared Spectroscopy, vMPFC = ventromedial Pre-frontal Cortex, FC = Frontal Cortex, ACC = anterior Cingulate Cortex,

SLF = Superior Longitudinal Fasciculus, PCC = posterior cingulate cortex, SC = Self-Certainty, SR = self-reflectiveness, CI = Composite Index, + = positive correlation, - = negative correlation

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Table 5

Studies that included cognitive insight before and after treatment

Study	Participating patients	Therapy	Results
Granholm et al. (2005)	Schizophrenia	24 weekly CBT sessions	<ul style="list-style-type: none"> • Participants in experimental group had significant growth in cognitive insight in comparison to control. • Increase in cognitive insight was correlated to reduction in positive symptoms. • The higher cognitive insight is at baseline, the more reduction of delusions after CBT.
Penn et al. (2009)	Schizophrenia / Schizoaffective	12 weekly CBT sessions	<ul style="list-style-type: none"> • At 12-month follow-up measurement experimental group had a not significant higher cognitive insight in comparison to controls.
Perivoliotis et al. (2010)	Patients with psychosis	An average of 8 months weekly or fortnightly CBT sessions	<ul style="list-style-type: none"> • The higher cognitive insight is at baseline, the more reduction of delusions after CBT.
Burton et al. (2011)	Patients with psychosis	Compensatory cognitive training program that took 3 months to complete	<ul style="list-style-type: none"> • No change in the experimental group after completion of the sessions. • A higher level of cognitive insight prior participating predicted a decline in depressive and positive symptoms after treatment.
Premkumar et al. (2011)	Schizophrenia / Schizoaffective	An average of 19 weekly or fortnightly CBT sessions	<ul style="list-style-type: none"> • The higher cognitive insight is at baseline, the more reduction of delusions after CBT.
Morrison et al. (2012)	Schizophrenia	CBT for 9 months	<ul style="list-style-type: none"> • Self-reflectiveness of treatment group showed a significant increase during treatment. • At 15-months follow-up, their self-reflectiveness was even higher than right after treatment.
Khazaal et al. (2011)	Patients with psychosis	An average of 11.7 weekly sessions of the Michael's	<ul style="list-style-type: none"> • The cognitive insight of the experimental group increased significantly after

		Game	completion of the sessions.
			<ul style="list-style-type: none"> • The less reflective participants were prior therapy, the more effective the training was.
Balzan & Delfabbro (2013)	Schizophrenia	8 sessions of Metacognitive training	<ul style="list-style-type: none"> • No improvement of cognitive insight.
van Oosterhout et al. (2014)	Schizophrenia	8 sessions of Metacognitive training	<ul style="list-style-type: none"> • No significant improvement of cognitive insight in experimental group.
Dikec & Kutlu (2015)	Schizophrenia	8 sessions of adherence therapy	<ul style="list-style-type: none"> • Small not significant change in cognitive insight after completion of the sessions.
Jørgensen and Licht (2015)	Schizophrenia	10 sessions of Guided Self-Determination	<ul style="list-style-type: none"> • No changes in cognitive insight in the experimental group after completing of the treatment.
Lam et al. (2015)	Schizophrenia	8 sessions of Metacognitive training	<ul style="list-style-type: none"> • Increase of cognitive insight after completion of sessions in experimental group.
Ussorio et al. (2015)	Patients with psychosis	8 sessions of Metacognitive training	<ul style="list-style-type: none"> • Experimental group showed significant increase in cognitive insight after training.

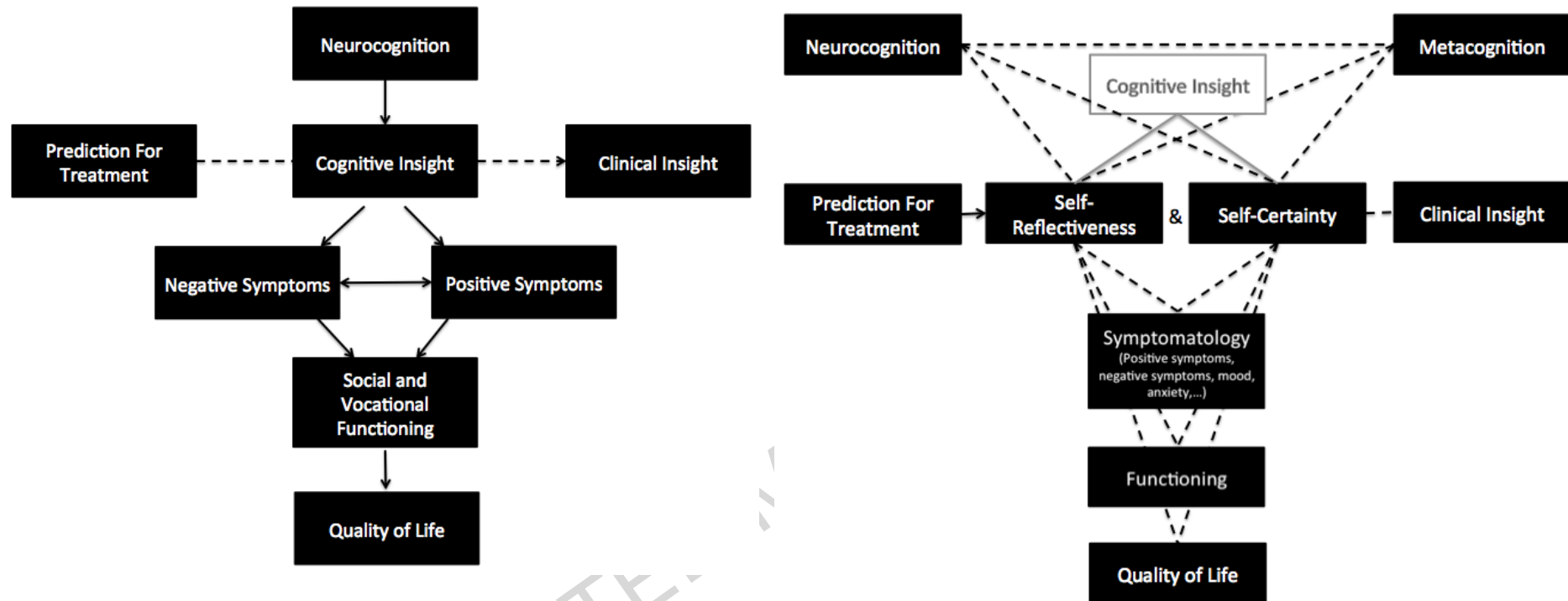


Figure 1. Theoretical model of cognitive insight. On the left, the model of Riggs et al. (2012) is shown. The right figure represents the revised model on cognitive insight, based on the most recent literature discussed in the current review. In the right figure, dotted lines refer to the elements that need further research. Full lines represent relationships that have been most widely studied.

Highlights

- There is a growth in research on cognitive insight in a variety of subjects.
- In individuals without psychosis, studies on cognitive insight show mixed results.
- Higher cognitive insight is not always psychologically more healthy.
- Sub-components of cognitive insight should be studied separately.
- Analogue concepts should be included when re-considering this concept.

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