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Impaired Introspective Accuracy in Schizophrenia: An Independent Predictor of Functional Outcomes

Juliet Silberstein, BA¹ and Philip D. Harvey, PhD^{1,2}

¹University of Miami Miller School of Medicine, Miami, FL, USA 33136

²Research Service, Bruce W. Carter VA Medical Center, Miami VA Healthcare System. Miami, FL, USA

Abstract

Introduction.—Individuals with schizophrenia present across a spectrum of symptomatology. Disability remains a debilitating reality across varying disease presentations and remains pervasive despite psychiatric medications. Cognition (neuro/social cognition) and negative symptoms have emerged as the strongest predictors of real-world disability, but account for <50% of the variance in outcomes.

Methods.—Our attempts to determine what accounts for the remaining 50% of variance has shown that poor introspective accuracy (IA) may be the most potent predictor of functional outcomes 25% of individuals with schizophrenia. We define IA as the adequacy of self-assessments of ability, skills, performance, or decisions. We suggest that IA is a progression of metacognition and can extend beyond cognition to include misestimation of prior and likely future performance in social or other adaptively relevant situations.

Results.—Additionally, IA is bidirectional and self-orientated. Emerging research has found that IA of neurocognitive ability better predicts everyday functional deficits than scores on performance-based measures or neurocognitive skills and has found that IA of social cognition accounts unique variance in real-world disability above social cognitive performance.

Discussion.—We argue that impaired IA, affecting 25–50% of patients with schizophrenia, in the absence or minimal presence of other impairments might be the most powerful predictor of functional outcomes.

Keywords

schizophrenia; metacognition; social cognition; neurocognition

Grave disability among individuals with schizophrenia remains widespread despite anti-psychotic medications and their effects on psychosis. Evidence indicates that nearly 80% of individuals with schizophrenia have persistent deficits in social functioning (Wiersma et al., 2000), and a dismal 10–20% are employed (Evensen et al., 2016; Mangalore & Knapp, 2007). Over the past decades, research has made substantial progress in illuminating the

processes that underlie functional outcomes in this complex disease. We have gained a greater appreciation for cognitive deficits and negative symptoms, which have been shown to be the two distinct domains that most consistently influence everyday outcomes.

Yet, progress has partially stalled. Research has consistently failed to account for everyday (real-world) outcomes, such as employment, independent living, and interpersonal relationships, at levels greater than >50% of the variance (Bowie et al., 2010; Bowie et al., 2008; Bowie, Reichenberg, Patterson, Heaton, & Harvey, 2006). Perhaps determination of additional variance in global outcomes has plateaued because schizophrenia presents across a spectrum; 25% have intact cognition (Bowie et al., 2007), 70% lack persistent negative symptoms (Bobes, Arango, Garcia-Garcia, & Rejas, 2010; Cohen, Natarajan, Araujo, & Solanki, 2013; Makinen, Miettunen, Isohanni, & Koponen, 2008), and 40% can achieve sustained remission with adherence to medication (Lambert, Karow, Leucht, Schimmelmann, & Naber, 2010).

We believe that there could be substantial benefits of reframing the evaluation of functioning and its predictors to focus on discrete predictors and outcomes. For example, research evaluating how global cognitive deficits correlate to deficits in global real-world outcomes would be less helpful than a study assessing social cognition, a subdomain of cognition, impacts a specific aspect of functional outcome like interpersonal relationships. A subdomain affecting a portion of patients in the absence or minimal presence of other impairments might interfere with the ability to live independently or maintain a relationship. Our attempts to determine subdomains of the most critical predictors of outcomes has shown that poor self-assessment of ability may be the most potent predictor of functional outcomes in a quarter of individuals with schizophrenia. Poor self-assessment of ability has been shown to be a significantly unique predictor that contributes a larger amount of variance than that accounted for by cognitive ability alone. As such, deficits in self-assessment may elucidate the determinants of the unaccounted 50% of variance in everyday outcomes. This paper will review why we believe impaired introspective accuracy (IA) should be considered an important independent research and treatment target.

First, we will define IA and discuss its relationship to metacognition. Second, we will describe how impaired IA impacts individuals with schizophrenia. Third, we will discuss how IA relates to other established predictors of outcomes. We will end with a discussion of the implications that the findings surrounding IA have on the future targets of research and clinical practice.

Conceptualization of Introspective Accuracy

The conceptualization of deficits in awareness in individuals is not new. Unawareness of illness has been known to be a feature of schizophrenia since the first descriptions of the condition in the early 1900's. At the time, insight was viewed as binary and dependent on whether individuals acknowledged their illness and understood that their psychotic symptoms were not veridical. More nuanced definitions of clinical insight have since emerged that consider the level of awareness individuals have regarding multiple aspects of their illness (e.g. symptoms and need for treatment) (Beck, Rector, Stoler, & Grant, 2009;

Riggs, Grant, Perivoliotis, & Beck, 2012). Detailed reviews of awareness of illness (e.g., Nair, Aleman, & Davis, 2013) have also examined the correlation with cognitive performance, suggesting that impairments in clinical insight are correlated with cognitive deficits in a small, but consistent manner.

It has become clear that unawareness, accompanied by perception biases, also extends to awareness of cognition. This relatively new emphasis on processing of thoughts has been termed metacognition and is most simply defined as *thinking about thinking*. Metacognition involves the faculties that allow a person to understand their own thoughts and feelings and the thoughts and feelings of others. More complex understandings of metacognition define it as encompassing reflection on discrete mental states of self and others which can subsequently inform synthesis of an integrated representation of self and others (Lysaker & Dimaggio, 2014).

We define IA as how well individuals evaluate their own abilities, skills, performance, and decisions. IA of cognitive ability can describe impairments that result from errors in the metacognitive process. Much of the current body of research has focused on the accuracy of self-ratings of cognitive ability or immediately prior performance, and as such, corresponds to discrete acts of metacognition. However, we view IA as a progression of the metacognitive construct for a few reasons. First, IA overlaps but is not synonymous with the other metacognitive subdomains, including self-reflection, Theory of Mind (ToM), clinical insight, and cognitive insight. Second, IA can also be applied to many different domains beyond cognition. The subsequent discussion will explore the aspects that make IA a progression of the metacognition construct.

Differences between IA and Subdomains of Metacognition

Let's first consider the difference between IA and self-reflection. The metacognitive domain of self-reflection applies to thinking about one's own mental states, both cognition and emotion. Self-reflection has been defined as step-wise process spanning from discrete acts including self-awareness of one's own mental states to how one's mental states influence their behaviors to much more complicated, synthetic acts that result in an integrated self-understanding (Dimaggio & Lysaker, 2014; Lysaker et al., 2011; Lysaker, Buck, Taylor, & Roe, 2008; Lysaker & Dimaggio, 2014). Both metacognitive self-reflection and IA require self-assessment. However, self-reflection focuses on the content of thoughts whereas IA focuses on the correctness.

IA should be considered distinct from the metacognitive (or social cognitive) subdomain of Theory of Mind (ToM). ToM is other-focused and refers to the ability to infer the thoughts and emotions of others. (Dimaggio & Lysaker, 2010; Nelson, Stuart, Howard, & Crowley, 1999). In contrast, IA is self-focused (Koren, Seidman, Goldsmith, & Harvey, 2006b). To provide an example, someone who inaccurately believes that they can correctly recognize emotions might incorrectly perceive someone as angry (poor IA and poor ToM) and act accordingly. Conversely, an individual who acknowledges they have poor emotional recognition might first ask the person if they are angry before responding (good IA and poor

ToM). The divergence between IA and ToM underscores the potential importance of IA as an independent research and clinical targets.

The bidirectional nature of errors associated with limitations in IA represents a point of contrast between the IA construct and cognitive insight, which is geared only toward overconfidence in the validity of beliefs (Medalia & Thysen, 2010), and the clinical insight concept, wherein awareness of abnormal experiences is intrinsically unidimensional. While IA refers to inaccurate self-assessments of abilities, skill performance, and decisions, having subpar IA does not indicate whether a person over- or under- estimates their abilities. We label the direction of misestimation as Introspective Bias (IB). Thus, while IA refers to the degree of correspondence between one's estimation of his/her abilities and his/her actual abilities (past and future) IB refers to the direction of inaccuracy if it occurs. IA and IB are related since an individual with impaired IA will either over or under- estimate. Thus, every deficit in IA corresponds to an IB to a greater or lesser extent. Both over- and under-estimation (positive or negative IB) can be harmful to functional outcomes. For example, a person who over-estimates their ability may incorrectly believe they can utilize maps and public transportation schedules to locate an appointment but gets lost. A person who under-estimates their ability may incorrectly believe they lack social skills to engage in a conversation and may choose to withdrawal socially, even if their true limitation is anxiety and not competence. While both directions of IB can contribute to functional deficits, early evidence suggests overestimation of ability predicts outcomes more strongly in individuals with schizophrenia than underestimation (Gould, Sabbag, Durand, Patterson, & Harvey, 2013; Silberstein, Pinkham, Penn, & Harvey, 2018).

Application of IA beyond Cognition

Finally, IA can be applied to domains in addition to cognitive and mental states. A simple example of this would be overestimation of one's own skills. A person who has difficulty evaluating their ability to write a check or utilize an automatic teller machine might be unable to attain financial independence because of the resulting uncertainties about which activities they can perform and how much help they need. A more complex application includes prior and likely future performance in social or other adaptively relevant situations (Harvey & Pinkham, 2015). Impaired IA in the context of predicted future ability, skill, performance, or decisions could result in over- or under-estimating the likelihood of success in future behaviors, which could then guide behavior accordingly. This differs from prospective memory which is the ability to remember to do things in the future.

Deficits in IA are not global, meaning a patient might have insight in one domain or subdomain and lack it in another (Medalia & Thysen, 2010). For example, a person might overestimate their ability to complete acts of everyday living but accurately acknowledge their disability maintaining a conversation. Importantly, we, and others, have also found that IA deficits across various domains have negative consequences on morbidity and mortality as these impairments impact medication adherence, suicidality, everyday activities, vocational functioning, and social outcomes (Green et al., 2011; Holshausen, Bowie, Mausbach, Patterson, & Harvey, 2014; McKibbin et al., 2004; Patterson et al., 1997).

IA and schizophrenia

Our initial work with individuals with schizophrenia has found IA impairments in the domains of neurocognitive performance, social cognitive performance, and functional abilities (Bowie et al., 2008; Bowie et al., 2006; Bowie et al., 2007; Durand et al., 2015; Gold et al., 2012; P. D. Harvey et al., 2012; Keefe et al., 2015; Riggs et al., 2012; Sabbag et al., 2011). Individuals with schizophrenia have been shown to have impaired IA of empathy and that the accuracy of their assessment was not correlated to cognitive deficits (Konstantakopoulos et al., 2014). These studies have shown that patients' self-assessments do not correlate with clinicians' assessments or objective performance on relevant tests such as cognition and functional capacity (Bowie et al., 2007; Durand et al., 2015; McKibbin, Patterson, & Jeste, 2004; Patterson et al., 1997; Sabbag et al., 2011). Significantly, 50% of patients with schizophrenia show some level of deficits in IA with 25% of patients overestimating their skills, ability, and the correctness of their test responses (Gould et al., 2015; Silberstein et al., 2018). Overall, impaired IA in schizophrenia has been demonstrated across a multidimensional continuum (Harvey & Pinkham, 2015), with overestimation, in particular, predicting impaired outcomes across vocational, residential, and social domains (Harvey & Pinkham, 2015; Pinkham et al., 2018; Sabbag et al., 2011; Silberstein et al., 2018).

Neurocognitive IA

Neurocognitive deficits are recognized as a central component of schizophrenia with at least 70–75% of patients performing below the general population across cognitive tasks. Greater cognitive impairment has been linked to reduced IA (Bowie et al., 2007). However, the correlation between neurocognition and IA has been shown to be small and evidence suggests mean scores on performance-based neurocognitive tests do not differ across levels of IA (Nair et al., 2013). Patients' self-reported cognitive skills consistently do not correlate with their performance on cognitive tasks or with clinician reports of their cognitive capacity (Duran et al., 2015; Moritz et al., 2016). Between 28% and 52% of individuals with schizophrenia who show cognitive deficits fail to indicate that they have any problems (Medalia & Lim, 2004; Medalia & Thysen, 2008; Medalia, Thysen, & Freilich, 2008), and our own work has demonstrated that 25–50% of patients' overestimate their abilities when compared to both clinician ratings and performance on neurocognitive tests (Bowie et al., 2007; Sabbag et al., 2011; Sabbag et al., 2012). Impairments in IA of neurocognition and global neurocognitive ability appear to independent risk-factors and it is unlikely that neurocognition is a critical moderator of IA.

IA of neurocognitive ability has been shown to be a more powerful predictor of everyday functional deficits than scores on performance-based measures of neurocognitive cognitive abilities or functional capacity (i.e. everyday skills). A study we conducted assessed the relative predictive power of neurocognitive IA, functional capacity, and neurocognitive performance with functional outcomes. The functional outcomes domains considered were everyday activities, work, and interpersonal relationships. IA of neurocognitive ability accounted for 42% of the variance in everyday activities, 37% of the variance in vocational outcomes, and 29% of the variance in interpersonal relationships when entered in a stepwise

regression analysis. Comparatively, neurocognitive test performance accounted for less than 5% of the variance across the three outcome domains in that analysis (Gould et al., 2015). These results indicate that IA of neurocognition more strongly predicted non-social functional outcomes (everyday activities) than social outcomes (interpersonal relationships). Importantly, IA of neurocognition may be the strongest predictor of non-social outcome, and more predictive than either cognition or functional capacity (Gould et al., 2015).

Social Cognitive IA

The consequences of impaired IA of social cognition on outcomes is an emerging research field. Data suggests that IA accounts for a unique variance of 6–8% in the prediction of social outcomes beyond social cognitive performance or clinician ratings, and that IA of social cognition has a moderate association to interpersonal and work outcomes (all $r = .32-.45$, $P < .001$) (Silberstein et al., 2018). Similar to the problems with validity of patients' ratings of their neurocognitive ability, self-rated social cognitive skills have previously been reported to be poorly related to objective social outcomes. Patients with schizophrenia have also been shown to make more high-confidence errors than healthy individuals on social cognitive tasks. That is, patients are less likely to realize when they are wrong in their judgments of social stimuli. When making social cognitive judgments of others' emotions or mental states, individuals with schizophrenia make more high confidence errors than healthy individuals (Kother et al., 2012; Moritz, Woznica, Andreou, & Kother, 2012). These high-confidence errors also are more likely to occur for more difficult stimuli, such as faces that display only mildly emotional expressions.

A recent study aimed at validating assessments of social cognition in schizophrenia found that self-reported confidence in performance on social cognitive tests, regardless of accuracy, was negatively correlated with everyday social outcomes rated by community informants (Pinkham, Harvey, & Penn, 2018). In fact, higher confidence ratings on the tests involved were much stronger correlates than task performance itself of more impaired social functioning. This correlation was higher, in fact, than the correlation between social outcomes and performance on any neurocognitive or social cognitive test. Important in terms of the independence of this construct, confidence ratings were not correlated with performance on measures of social competence (i.e., social skills), functional capacity, social cognition, or neurocognition. Important in terms of the integrity of the study, neurocognitive and social cognitive performance was correlated with performance-based measures of social competence and functional capacity.

A study we conducted asked participants to identify emotions from short video clips, perform as rapidly and efficiently as possible, and rate their confidence on each accuracy of each responses. As a proxy for effort, the time to complete each item was recorded. Individuals with schizophrenia did not adjust their effort between correct and incorrect items to the same degree as healthy individuals ($p < 0.001$) and their confidence was not as variable across trials where they made errors and were correct as healthy people as well (Cornacchio, Pinkham, Penn, & Harvey, 2017). When adjusting for performance, patients were relatively more confident when incorrect but not when correct than healthy controls. The implication is that impaired IA and social cognitive IB including over-confidence when

incorrect, are associated with basic challenges in performing and evaluating social cognitive abilities.

IA and IB of neuro- and social- cognition appear to predict everyday functional outcomes differentially. This finding aligns with a growing body of research that suggests subdomains of cognition and negative symptoms, the two constructs that have most consistently predicted outcome, have divergent associations. These findings correlate to the pattern of prediction found for IA. The emerging understanding of divergent patterns of predicting outcomes and reliable assessments present an opportunity to improve treatment targets and real-world outcomes for individuals with schizophrenia.

Divergent Patterns of Prediction:

- (1) Subdomains of Cognition: Social cognition predicts social (e.g. relationships) outcomes more than non-social outcomes (e.g. living independently) (Kalin et al., 2015; Pinkham et al., 2016). Neurocognition predicts non-social outcomes but predicts nonsocial outcomes to a considerably lesser extent (Depp et al., 2012; Fett et al., 2011).
- (2) Subdomains of Negative Symptoms: Emotional experience (e.g. avolition-asociality), a subdomain of negative symptoms, may impact social outcomes while expression of emotions (e.g. blunted affect) has a much reduced influence (Blanchard, 2006; Foussias, 2010; Harvey, Khan, & Keefe, 2017; Jang, 2016; Kring, 2013).
- (3) Subdomains of IA: IA and IB of neurocognition preferentially predicts non-social everyday functional outcomes while IA and IB of social cognition most strongly predicts real-world social outcomes (e.g. social acceptability and interpersonal relationships) (Gould et al., 2015; Silberstein et al., 2018).

Research and Clinical Significance of Introspective Accuracy and Bias

More work is needed to define and understand the significance of IA subdomains. Subdomains of IA that show promise and may bolster our understanding of disability in schizophrenia include comparison of global IA (e.g. overall neurocognitive ability) vs. momentary IA (e.g. in-the-moment decisions or answers) and IA of skills (e.g. functional capacity and social competence) and IA of decision making. Both IA/IB and negative symptoms have been shown to be independent, significant predictors of outcome yet little is known about their relationship. One study found that greater metacognitive deficits predicted increased expression negative symptoms in the future (P. H. Lysaker et al., 2015). The relationship between IA/IB and negative symptoms, specifically avolition, should be investigated in future studies. Future research must flesh out the importance and predictive patterns of IA/IB for everyday deficits among individuals with schizophrenia. We need to understand whether different trajectories of IB are uniformly explained by other measurable factors, such as mood state. For example, if underestimation of ability is associated with depression and overestimation is associated with elevations in mood state (or lack depression when it is warranted), then IB might be determined by mood state but would still require impairments in IA to be present..

However, it is not known whether the cognitive determinants of IA are associated with mood. Further, global biases induced by mood states that are not based on evaluation are not IB. IB originates when there is a situation where IA is required and a judgment is made about the quality or accuracy of a behavior, whether it is cognitive, social cognitive, or functional. Research to date does not address this consideration adequately. The current body research underscores the potential value of continued investigation of IA by suggesting that IA, combined with IB, is a potent, independent predictor of disability for individuals with schizophrenia. Impaired IA may factor into our understanding of the determinants of functional outcomes among individuals with schizophrenia.

IA represents a shift from holistic evaluation of the clusters of symptomatology that comprise schizophrenia to thinking about discrete symptomologies, much like the focus on psychopathology research has been suggested to be improved by focusing on research domains (e.g., rDOC; Insel, 2014). This shift could potentially open an exciting frontier of personalized assessments and effective treatments for schizophrenia. Importantly, screening for IA and IB is cheap and efficient. Self-reports lie at the crux of the clinically assessing IA. Impairments in IA can be easily defined by a certain level of discrepancy between how one rates one's abilities and achievements, and his/her actual performance or a high-contact informant's rating of his/her ability. The direction of the discrepancy is likely to have substantial functional implications. Individuals with schizophrenia that significantly overestimate their ability could be helped to attempt to match their aspirations to realistic assessment of abilities and past accomplishments and improve over time. Conversely, individuals that underestimate their ability could have their functioning bolstered by recognizing their competence and attempting tasks that are within their grasp. Thus, even a population whose neuro- and social cognitive ability often is poor could benefit from accurate self-assessment or experience additional challenges from inaccurate self-evaluation (Gould et al., 2015). Overall, impaired introspective accuracy, as easily indexed by difference scores between clinician ratings or task performance and self-reports, has been shown to be stronger predictor of everyday functional deficits in social, vocational, and everyday activities domains than scores on performance-based measures of neuro- and social cognitive abilities.

Since IA adds complexity to our understanding of metacognitive, early evidence of the effectiveness of metacognitive behavior therapy (MCT) suggests therapies tailored for impaired IA could be useful treatment targets. MCT is an emerging and promising field of cognitive behavior therapy in schizophrenia. Currently, the small number of randomized clinical trials and method variability within those trials limit the conclusions we can make about MCT. Despite these limitations, significant reduction in positive symptoms beyond medication has been a consistent effect of MCT (Jiang, et. al., 2015; Moritz et al., 2014; Pankowski, Kowalski & Gaweda, 2016). Recently interventions targeting IA and IB (specifically overestimation of error) have emerged. Importantly, patients showed improved quality of life after the intervention. (Moritz et al., 2011; Moritz et al., 2014) More randomized clinical trials on MCT with manualized methods as well as broadening this research to explore of MCT's effect on additional outcomes including negative symptomatology and everyday outcomes should be performed. Future work should also focus on the development of targeted therapies for IA. Overall, Evidence suggesting the

importance of IA for determination of disability suggests that treatments aimed at IA could likely play a critical role in improving substantial everyday disability in a substantial proportion of individuals with schizophrenia.

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