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Meaning-making processes across the lifespan: An investigation of the developmental course of metacognitive capacity

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Abstract

Deficits in metacognitive capacity (i.e., the ability to integrate knowledge of oneself and others into a cohesive whole) have been shown to lead to poor functional outcome in psychosis. However, there is a gap in the literature concerning the role of metacognition in typically developing populations, which makes it difficult to define what level of metacognition is normative and at what point deficits in metacognition suggest pathology. To explore this issue, we utilized cross-sectional design to assess metacognitive capacities among 69 neurotypical adults whose ages varied from 18 to 65 using the Metacognitive Assessment Scale – Abbreviated (MAS-A) and then compared those with MAS-A scores from a second previously gathered sample of 360 adults diagnosed with psychosis across four key developmental windows: emerging adulthood, early adulthood, middle adulthood, and late adulthood. Our findings suggest that in our overall sample, individuals with psychosis had significantly lower levels of metacognitive capacity across all domains assessed by the MAS-A in comparison to neurotypical individuals. Additionally, our data suggest a deleterious effect of psychosis such that individuals with psychosis showed significantly lower metacognition in each developmental stage. Additionally, these differences were largest in emerging and late adulthood and for both groups awareness of others stood out as the single metacognitive domain which was significantly less impaired among older groups. Our results suggest a developmental course for metacognitive capacity such that awareness of others is the sole domain that grows over the lifespan.

Keywords

Lifespan; Metacognition; Development

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Declaration of competing interest

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1. Introduction

The underlying processes that allow for the formation, maintenance, and evolution of a sense of self, others, and one's community across the lifespan (McLean et al., 2007; McLean and Pasupathi, 2012; Semerari et al., 2003) have been of considerable interest across multiple disciplines. Within the field of psychopathology, and in particular for the study of psychosis, these issues are important, since compromises in these forms of awareness have been broadly observed and linked with prolonged psychosocial dysfunction (Lysaker et al., 2021a). One specific approach to understanding these forms of awareness has used the integrated model of metacognition to explore how deficits in metacognition in psychosis may lead to a fragmented sense of self and others characterized by a failure to effectively integrate cognitive, affective and embodied experiences in a larger and evolving sense of oneself and others as beings in the world (Lysaker et al., 2020b; Semerari et al., 2003).

While this work has suggested significant and unique links between decrements in metacognitive capacity and a range of assessments of concurrent and prospective functioning, including domains of key interest in psychosis such as identity, social connection, motivation and negative symptoms (Arnon-Ribenfeld et al., 2017; Luther et al., 2017; Lysaker et al., 2020c; Mediavilla et al., 2021), metacognitive capacity has not been formally explored in neurotypical populations and little is known about its developmental trajectory. Thus, a formal exploration of metacognitive capacity in typically developing populations is necessary to deepen our understanding of the role of metacognitive capacity in formation of one's sense of self. The present study sought to begin to examine issues using cross-sectional data to explore differences in the developmental course of metacognition between adults with and without psychosis.

1.1. Metacognition and the integrated model

Metacognition has been broadly defined as the ability to examine one's own cognitive processes (Flavell, 1979). Given that the definition of metacognition is broad, researchers have applied it in varying levels of complexity, ranging from simple awareness of cognitive experiences to the integration of knowledge about one's thoughts and experiences to form a cohesive sense of self (Lysaker et al., 2018). For example, some simply define metacognition as the process of thinking about thinking (Thielsch et al., 2015). Others have focused on error monitoring (Seow et al., 2021) or one's particular attitudes and thoughts about one's own cognitive processes and emotions (Wells, 2013). Other still have emphasized how metacognition is intimately related to how persons make sense of and respond to psychosocial challenges dynamically over time (Semerari et al., 2003).

The integrated model of metacognition (Lysaker et al., 2020c) was developed on the basis of early work by Semerari et al. (2003). It is unique, relative to previous models of metacognition, in its conceptualization of metacognition as a capacity which allows for the synthesis of granular psychological experiences (i.e., embodied experiences, thoughts and emotions) into cohesive wholes which include the recognizably distinct kinds of purposes, relationships and possibilities which make up our sense of self and others across our lives. Thus, within this model, metacognitive capacities are instrumental for making sense of emergent possibilities and challenges and allow for evolving cooperative bonds

with others and an even larger sense of community membership (Lysaker et al., 2021a, 2021b). Operationally, metacognitive capacity is divided into four domains: self-reflectivity (awareness and understanding of one's own mental states), awareness of others' mental states (awareness of others' unique thoughts and emotions) decentration (understanding that others' interests and motives are independent of oneself), and metacognitive mastery (the ability to integrate knowledge of both others and one's own mental states to respond to psychosocial challenges) (Lysaker et al., 2020c; Semerari et al., 2003).

The integrated model of metacognition offers several advantages for studying alterations in the formation, maintenance, and evolution of one's sense of self, others, and community for people with psychosis. For example, simply defining metacognition as awareness of one's cognitions may fail to fully capture the struggles persons with psychosis face when apprehending not just specific elements of experience but the larger meanings those experiences may have both to them and others (Schnakenberg Martin and Lysaker, 2021). By contrast, the integrated model of metacognition focuses on the impact that failures to integrate information has on one's ability to use the social context to make meaning of experiences, resulting in decreased agency and community participation (Lysaker et al., 2021a). In parallel, metacognition is related to but distinct from other social cognitive process such as Theory of Mind (ToM; Pinkham et al., 2016). Thus, metacognition goes beyond offering an explanation for why persons with psychosis may make inaccurate evaluations or judgements and begins to explain why a person's sense of themselves and their place in the world can appear to be degraded.

1.2. Metacognition and development

To date, research on metacognitive capacity has primarily focused on whether deficits exist in different forms of mental illnesses and psychosocial disadvantage. This has included studies documenting metacognitive compromise in people with schizophrenia-spectrum disorders, personality disorders, post-traumatic stress disorder, bipolar and depressive disorders, substance use, and life altering medical challenges such as HIV (Lysaker et al., 2011; Lysaker et al., 2015a, 2015b, 2015c; Lysaker et al., 2018; Outcalt et al., 2016). Less work has considered metacognition as a developmental process; hence, it is unclear whether differences between persons with psychosis and others who are neurotypical emerge at a particular point in time and whether metacognitive abilities grow or degrade over time. For example, following a neurodegenerative viewpoint (Rao et al., 2015), one might expect that metacognition might decline with age in persons with psychosis; however, from a more Eriksonian view of development (Erikson, 1968), one might expect metacognition to improve across the lifespan. Notably, research has found that recovery is a common outcome for persons with psychosis (Leonhardt et al., 2017), suggesting that improvements in metacognition may occur over time.

Exploration of findings from healthy control groups suggest the possibility of a developmental component of metacognitive capacity (Davis et al., 2020; Ladegaard et al., 2014). Specifically, a study using a college sample found mean levels of metacognitive capacity to be lower than those found in middle-aged samples (Davis et al., 2020; Hasson-Ohayon et al., 2015; Ladegaard et al., 2014). Understanding whether persons with psychosis

diverge more or less from neurotypical groups at different ages or whether metacognition improves or declines over time could have important implications for both intervention and understanding the course of psychosis.

1.3. The current study

The current study aimed to determine whether metacognitive capacity differed between adults with psychosis and neurotypical adults at four different key developmental stages: emerging adulthood, early adulthood, middle adulthood, and late adulthood. As a secondary aim, we explored whether age was related to overall metacognition and the different facets of metacognition for both the psychosis and neurotypical groups. Based on previous findings, we predicted that the psychosis group would have poorer metacognition than the neurotypical group at all four time points. The literature on metacognition and development, however, is less clear, and we entertained two competing hypotheses. First, given the possibility of neurodegeneration, it is possible that with time the metacognitive capacity of the psychosis group would decline. Alternatively, in light of literature on the frequency of recovery from psychosis (Leonhardt et al., 2017), it is possible that the converse could be true, with metacognition improving over time for the psychosis group. In light of work on human development suggesting that with time persons form deeper bonds with their communities (Erikson, 1968), we expected that metacognition should improve for the neurotypical group.

2. Methods

2.1. Participants

Sixty-nine adults were recruited for the neurotypical group from the greater Indianapolis area as a part of a larger study exploring disorganization, cognition, and insight in serious mental illness (SMI). Participants were considered eligible for the neurotypical group if they: 1) did not meet criteria for any psychotic disorder, past or current, had no history of mood disorders, did not have a past or current history of substance use disorders as assessed by the Mini International Neuropsychiatric Interview (MINI; Lecrubier et al., 1997), and if they denied any other active psychopathology; 2) were between ages 18–65; and 3) were proficient in English. Participants were excluded if they had: 1) documented history of intellectual disability; or 2) history of head injury resulting in a loss of consciousness >5 min or any history of traumatic brain injury.

The psychosis sample consisted of 360 adults in outpatient mental health treatment with a confirmed diagnosis of schizophrenia ($n = 219$) or schizoaffective disorder ($n = 105$) using the Structured Clinical Interview for DSM-IV or DSM-5. Participants were recruited for studies from a Veterans' Affairs Medical Center and a community mental health center in Indianapolis, Indiana as well as two partial hospitalization programs and one outpatient clinic in Newark and Piscataway, New Jersey. All participants were in a non-acute phase of illness, defined by no hospitalizations or changes in housing or medication within 30 days of study enrollment.

2.2. Measures

Metacognitive capacity was assessed with the Metacognition Assessment Scale-Abbreviated (MAS-A; Semerari et al., 2003), which is a rating scale used to measure an individual's ability to form complex and integrated concepts of oneself and others. The MAS-A includes four domains which are rated in a Likert scale format: 1) "self-reflectivity," which is the ability to understand one's internal mental states; 2) "understanding of others' minds," which is the ability to infer and understand others' mental states; 3) "decentration," which represents the understanding that others' interests and motives are independent of oneself; and 4) "mastery," which measures the ability to use metacognitive knowledge about oneself and others to cope with psychological distress. Using this measure, raters indicate whether participants have demonstrated a particular level of functioning for each scale in a hierarchal manner. Total score values range from 0 to 28, with higher scores being reflective of more complex notions of oneself and others and the ability to apply this knowledge appropriately (i.e., higher metacognitive capacities).

The Indiana Psychiatric Illness Interview (IPII; Lysaker et al., 2002) was used as the basis for MAS-A ratings of metacognitive capacity for the psychosis group. In this study two versions of the interview were deployed. For the psychosis group the standard IPII was used. This interview is divided into five sections: 1) initial rapport is established as participants are asked to tell the detailed story of their lives, beginning with their earliest memory; 2) participants are asked to discuss whether they believe they have a mental illness and if so, how they think about it; 3) participants are asked to describe what has changed and not changed as a result of mental illness; 4) participants are asked to discuss the degree of control mental illness has had over their lives and the lives of others and what efforts they and others have taken to control it; and 5) participants are asked about what they expect in their future.

For the neurotypical group, a modified version of the IPII for control groups (IPII-C) that focuses on an emotionally challenging event that has occurred since adolescence was utilized. This version of the IPII follows the same five part format: 1) initial rapport is established as participants are asked to tell the detailed story of their lives, beginning with their earliest memory; 2) participants are asked to discuss whether they have experienced a psychological or emotionally distressing crisis event that has occurred since adolescence and how they think about it; 3) participants are asked to describe what has changed and not changed as a result of that event; 4) participants are asked to discuss the degree of control that event has had over their lives and the lives of others and what efforts they and others have taken to control it; and 5) participants are asked about what they expect in their future.

2.3. Procedures

All procedures were approved by the relevant institutional review boards, and all participants provided informed consent. Once eligibility was established, neurotypical participants were administered the IPII-C and the psychosis participants were administered the IPII. IPIIs were then transcribed and deidentified. Raters then read each transcript and generated scores for each of the MAS-A subscales. MAS-A raters were trained by the senior author and were blind to the participants' identities and scores on any other tests administered.

2.4. Analyses

Analyses were conducted in four steps. First, the demographic characteristics of each group were compared. Second, MAS-A scores for psychosis and neurotypical groups were compared using independent samples *t*-tests. Next, the relationships between age and metacognition were explored using Pearson Product-Moment correlations for the overall sample as well as subgroups derived from four a priori defined age groups defined using a synthesis of Erikson's (1968) lifespan development model and Arnett's (2000) model of emerging adulthood: emerging adulthood (18–31), early adulthood (32–48), middle adulthood (49–56), and late adulthood (57+). We then completed an initial MANOVA to explore main and indirect effects of age group on metacognition and its components. Finally, differences in the developmental course of metacognition for individuals with psychosis and controls for each age group were explored using one way ANOVA.

3. Results

3.1. Sample characteristics

Our overall sample of neurotypical participants ($N = 69$) tended to be middle-aged ($M = 44.93$, $SD = 13.00$), predominately female (62.0 %), college educated (54 % with at least a bachelor's degree) and white (60.8 %). The mean age of the psychosis group was 43.96 years (range: 18–71; SD = 12.39). This sample was 76 % male ($n = 275$), predominately Black (54.2 %), and high school educated (76 % with high school degree or higher). Groups did not significantly differ on age ($t = -0.62$, $p = 0.539$), but differed significantly on gender ($X^2 = 69.25$, $p = 0.000$), race ($X^2 = 34.76$. $P = 0.000$), and level of education ($X^2 = 66.34$, P = 0.000). Notably, level of education related to self-reflectivity for the neurotypical group ($r = 0.25$, $p = 0.041$), but related to overall metacognition ($r = 0.16$, $p = 0.014$), decentration ($r = 0.14$, $p = 0.031$), and mastery (r = 0.14, $p = 0.032$) for the psychosis group. Data for overall metacognition and its subdomains were normally distributed in both the overall sample and within each a priori defined age group. The additional assumptions of ANOVA (i.e., sample independence and homogeneity of variance) were met.

3.2. Group differences in metacognitive capacity

Groups were first compared on total metacognitive capacity and its subdomains (i.e., self-reflectivity, awareness of others, decentration, and mastery) using independent samples *t*-tests (see Table 1 for means and standard deviations). Results of these analyses suggest that in the overall sample, individuals with psychosis showed significantly lower total metacognition ($t_{(427)} = -8.63$, $p = 0.000$, d = 1.03), self-reflectivity ($t_{(427)} = -7.74$, p = 0.000, d = 0.97), awareness of others ($t_{(427)} = -9.14$, p = 0.000, d = 1.10), decentration ($t_{(427)} = -7.35$, p = 0.000, d = 1.00), and metacognitive mastery ($t_{(427)} = -5.16$, $p = 0.000$. d = 0.67).

3.3. Relationships between age and metacognitive capacity

Next, we sought to explore the relationship between age and metacognitive capacity in both the overall sample and four key stages of adult development (i.e., emerging, early, middle, and late adulthood). When looking at the overall sample, age was significantly positively

related to awareness of others in the neurotypical sample ($r = 0.26$, $p = 0.031$) and in those with psychosis ($r = 0.14$, $p = 0.010$). However, age did not relate to the other domains of metacognition in either group.

To further understand the relationships between age and metacognitive capacity, we split the data into four groups that prioritized both power and developmental stages (ages 18–31, 32–48, 49–56, and 57+). An initial MANOVA examined age group and presence of psychosis as independent variables and total metacognition, self-reflectivity, awareness of others, decentration, and mastery as dependent variables. It showed significant multivariate effects of presence of psychosis (neurotypical versus psychosis: $p < 0.001$) and age group ($p < 0.05$). Additionally, the interaction effect of age group and presence of psychosis was significant for awareness of others ($p < 0.05$). We next compared individuals with psychosis and controls on metacognition in each of these age groups using univariate ANOVA. A general trend emerged with controls showing significantly higher levels of metacognition and its subdomains in each age group. Notably, effect sizes were most pronounced in emerging and late adulthood. Specifically, differences in total metacognition were large in emerging adulthood ($\eta^2 = 0.19$), medium in early ($\eta^2 = 0.09$) and middle ($\eta^2 = 0.08$) adulthood, and large in late adulthood ($\eta^2 = 0.36$). A detailed report of these results can be found in Table 2.

4. Discussion

This study aimed to compare the developmental trajectory of metacognitive capacity in individuals with psychosis with a neurotypical sample. In particular, in a cross-sectional design, we compared the metacognitive capacity of a psychosis and neurotypical group across emerging adulthood, early adulthood, middle adulthood, and late adulthood. As anticipated, the psychosis group had poorer metacognition relative to the neurotypical group in all four eras of adult life. This is consistent with previous assertions that metacognitive deficits are prevalent in psychosis across adulthood.

When we explored the relationship of metacognition with age, we found that among both samples, greater awareness of others was associated with aging, with this result being somewhat stronger among the neurotypical group. This general trend suggests that, in both people with and without psychosis, as we age, we become better able to understand the experiences of others. By contrast, differences in the ability to form a cohesive sense of self grew greater with age between groups. This may suggest a failure to maintain expected developmental gains in self-reflectivity over time for people with psychosis.

Of note, the finding that overall metacognitive capacity does not appear to increase with age is surprising, given our a priori expectation that the ability to abstract and self-reflect would increase across the lifespan. Indeed, our data suggest that one's abilities to self-reflect and use metacognitive knowledge to cope remain constant across adulthood, but that our ability to appreciate the perspectives of others increases with age. On the surface, these findings seem counterintuitive due to evidence from other models of the self, such as autobiographical reasoning and mentalizing, which suggest one's ability to self-reflect increases across the lifespan (Pasupathi and Mansour, 2006; Habermas and Bluck, 2000;

Singer and Bluck, 2001). However, the fact that our sample's mean age was midlife (i.e., mean age of 44) suggests the possibility that aspects of metacognition may have developed and stabilized in adolescence or emerging adulthood.

Additional support from this notion comes from a case study by Lysaker, Buck, and Ringer (2006) that followed the course of therapy for a client who showed severe metacognitive deficits. Over the course of 32 months of therapy specifically focused on promoting metacognitive growth, an interesting pattern emerged wherein the client began to show increases in self-reflectivity and mastery almost immediately, but little to no change in the awareness of others domain until 17 months into therapy (Lysaker, Buck & Ringer, 2006). The pattern that emerged later in therapy appears to be a microcosm of what we observe in our sample (i.e., stable self-reflectivity, decentration, and mastery and delayed increases in awareness of others), suggesting the developmental milestones for adequate self-reflectivity and mastery may have already been met prior to adulthood. Thus, our results suggest that one's ability to comprehend the intentions of others increases across adulthood, while our ability to self-reflect and cope with distress remains constant.

Consideration of the developmental psychology literature provides additional context for the finding that awareness of others increases with age. For example, Erickson's theory of psychosocial development (Erikson, 1968) mirrors our observed pattern of increasing focus on the experiences of others across the lifespan. The initial stages of development encompassing birth to age 18 (i.e., trust vs. mistrust, autonomy vs. shame, initiative vs. guilt, industry vs. inferiority, and identity vs. role confusion) are fixated on increasing one's understanding of themselves in relation to their environment (McAdams et al., 1993; Sneed et al., 2006). As age increases, the concerns of this model turn outward and focus more on the development of meaningful relationships (i.e., intimacy vs. isolation) and contribution to one's larger community (i.e., generativity vs. stagnation). In the context of metacognitive development, it may be the case that people are not able to focus fully on others until they have a stable sense of self and identity. This self-awareness and understanding allows individuals to turn their focus outward and engage with others in a meaningful way.

Further analyses of differences in levels of metacognitive functioning between individuals with and without psychosis across four distinct age groups provide additional context for these findings. Our data suggest that individuals with psychosis have significantly lower metacognitive functioning than neurotypical individuals across all stages of adult development. This suggests that the presence of psychosis itself rapidly deteriorates metacognitive functioning such that individuals with psychosis show consistent deficits regardless of age. Alternatively, it is possible that those with psychosis may have lower metacognitive functioning prior to the onset of psychosis and that psychosis itself inhibits the gains in metacognitive growth observed in the neurotypical group. This further underscores that deterioration of metacognitive functioning may be an early warning sign of the onset of psychosis. Lastly, that the psychosis group showed increases in awareness of others across age groups adds to the literature suggesting that metacognition is a dynamic ability capable of being recovered through psychosocial intervention. This increased awareness of others may relate to studies of aging in psychosis, which show improved social support and functioning over time (Jeste et al., 2011).

These findings are congruent with the integrated model of metacognition of psychosis which views psychosis as a disorder of social dysfunction with an inward focus. According to this model, the development of a cohesive sense of self is an intersubjective process that is necessarily dependent on one's interactions with others (Hasson-Ohayon et al., 2015). One avenue to address these deficits in metacognition may be through psychosocial interventions targeting metacognition such as Metacognitive Reflection and Insight Therapy (MERIT). Trials of this intervention have evidenced its positive effects on metacognitive capacity, insight, social functioning, and negative symptoms (Minor et al., 2022; Vohs et al., 2014).

Although this study is bolstered by many strengths, there are a few notable limitations worth discussion. First is the use of a cross-sectional design, which may limit the generalizability of our findings. In addition, our analyses may not have been sensitive to idiographic factors that may impact metacognitive growth across the lifespan. Indeed, longitudinal studies focusing on other conceptualizations of metacognition, such as self-monitoring, find that these abilities increase across childhood and adolescence (O'Leary and Sloutsky, 2017; Roebers et al., 2019). Future studies should seek to explore the development of metacognitive capacity longitudinally to assess inter-individual changes in this capacity. Another limitation is our sample size; our final sample size for neurotypical participants was underpowered to detect small to medium effects, and thus was only powered to detect medium to large effects. Lastly, metacognition has been shown to be related to other forms of psychopathology such as personality disorders and post-traumatic stress disorder. Our screening for the neurotypical sample did not formally assess the presence of these disorders. Thus, our findings should be replicated with a larger sample controlling for relevant psychopatho-logical comorbidities.

5. Conclusion

Metacognitive capacity is a complex ability that allows individuals to synthesize discrete elements of inter and intrapersonal experiences into a cohesive whole. Hitherto, it had primarily been studied in SMI (e.g., psychosis, borderline personality disorder), where deficits have been evidenced to be associated with poorer outcome. Our novel study explored the developmental trajectory of metacognitive capacity in a typically developed population and its association with age. Our findings suggest that the sole element of metacognitive capacity that increases with age is awareness of other for both those with and without psychosis. Additionally, we found that those with psychosis show consistently lower levels of metacognition than controls in each stage of adult development. Our findings highlight the need for longitudinal studies exploring the individual factors that may influence increases in metacognitive capacity over the lifespan. Additionally, these findings suggest that intervening early with interventions targeting metacognitive capacity may be essential to reduce the impact of psychosis on individuals' lives. Lastly, given that metacognitive capacity is conceptualized as a dynamic ability, future research should focus on factors that promote higher levels of metacognitive reflection.

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References

Arnett JJ, 2000. Emerging adulthood: a theory of development from the late teens through the twenties. Am. Psychol 55 (5), 469. [PubMed: 10842426]

Arnon-Ribenfeld N, Hasson-Ohayon I, Lavidor M, Atzil M, Lysaker PH, 2017. A meta-analysis and systematic review of the association between metacognitive abilities, symptoms and functioning among people with schizophrenia. Eur. Psychiatry 46, 33–41. [PubMed: 28992534]

Davis BJ, Firmin RL, Lysaker PH, Salyers MP, McGrew J, Minor KS, 2020. An investigation of metacognition in schizotypy: evidence of linkage with negative traits. Transl.Issues Psychol.Sci 6 (1), 81.

Erikson Erik H., 1968. Identity: Youth and Crisis. No. 7. WW Norton & Company.

Flavell JH, 1979. Metacognition and cognitive monitoring: a new area of cognitive–developmental inquiry. Am.Psychol 34 (10), 906–911.

Habermas T, Bluck S, 2000. Getting a life: the emergence of the life story in adolescence. Psychol. Bull 126 (5), 748. [PubMed: 10989622]

Hasson-Ohayon I, Avidan-Msika M, Mashiach-Eizenberg M, Kravetz S, Rozencwaig S, Shalev H, Lysaker PH, 2015. Metacognitive and social cognition approaches to understanding the impact of schizophrenia on social quality of life. Schizophr. Res 161 (2–3), 386–391. [PubMed: 25499045]

Jeste DV, Wolkowitz OM, Palmer BW, 2011. Divergent trajectories of physical, cognitive, and psychosocial aging in schizophrenia. Schizophr. Bull 37 (3), 451–455. [PubMed: 21505111]

Ladegaard N, Larsen ER, Videbech P, Lysaker PH, 2014. Higher-order social cognition in first-episode major depression. Psychiatry Res 216 (1), 37–43. [PubMed: 24524945]

Lecrubier Y, Sheehan DV, Weiller E, Amorim P, Bonora I, Sheehan KH, Dunbar GC, 1997. The Mini International Neuropsychiatric Interview (MINI). A short diagnostic structured interview: reliability and validity according to the CIDI. Eur.Psychiatry 12 (5), 224–231.

Leonhardt BL, Huling K, Hamm JA, Roe D, Hasson-Ohayon I, McLeod H, Lysaker PH, 2017. Recovery and serious mental illness: a review of current clinical and research paradigms and future directions. Expert. Rev. Neurother 17 (11), 1117–1130. [PubMed: 28885065]

Luther L, Bonfils KA, Firmin RL, Buck KD, Choi J, Dimaggio G, Popolo R, Minor KS, Lysaker PH, 2017. Is metacognition necessary for the emergence of motivation in schizophrenia? A necessary condition analysis. J. Nerv. Ment. Dis 205 (12), 960–966. [PubMed: 29064949]

Lysaker PH, Clements CA, Plascak-Hallberg CD, Knipscheer SJ, Wright DE, 2002. Insight and personal narratives of illness in schizophrenia. Psychiatry Interpers.Biol.Process 65 (3), 197–206.

Lysaker PH, Buck KD, Ringer J, 2007. The recovery of metacognitive capacity in schizophrenia across 32 months of individual psychotherapy: A case study. Psychotherapy Research 17 (6), 713–720.

Lysaker PH, Buck KD, Carcione A, Procacci M, Salvatore G, Nicolò G, Dimaggio G, 2011. Addressing metacognitive capacity for self reflection in the psychotherapy for schizophrenia: a conceptual model of the key tasks and processes. Psychol. Psychother. Theory Res. Pract 84 (1), 58–69.

Lysaker PH, Dimaggio G, Wickett-Curtis A, Kukla M, Luedtke B, Vohs J, Davis LW, 2015. Deficits in metacognitive capacity are related to subjective distress and heightened levels of hyperarousal symptoms in adults with posttraumatic stress disorder. J.Trauma Dissociation 16 (4), 384–398. [PubMed: 26011671]

Lysaker PH, Kukla M, Dubreucq J, Gumley A, McLeod H, Vohs JL, Belanger EA, 2015. Metacognitive deficits predict future levels of negative symptoms in schizophrenia controlling for neurocognition, affect recognition, and self-expectation of goal attainment. Schizophr. Res 168 (1–2), 267–272. [PubMed: 26164820]

Lysaker PH, Vohs J, Minor KS, Irarrázaval L, Leonhardt B, Hamm JA, Wasmuth S, 2015. Metacognitive deficits in schizophrenia: presence and associations with psychosocial outcomes. J. Nerv. Ment. Dis 203 (7), 530–536. [PubMed: 26121151]

Lysaker PH, Irarrázaval L, Gagen EC, Armijo I, Ballerini M, Mancini M, Stanghellini G, 2018. Metacognition in schizophrenia disorders: comparisons with community controls and bipolar disorder: replication with a Spanish language Chilean sample. Psychiatry Res 267, 528–534. [PubMed: 29980133]

Lysaker PH, Kukla M, Leonhardt BL, Hamm JA, Schnackenberg Martin A, Zalzala AB, Gagen EC, Hasson-Ohayon I, 2020. Meaning, integration, and the self in serious mental illness: implications of research in metacognition for psychiatric rehabilitation. J.Psychiatr.Rehabil 43 (4), 275–283. 10.1037/prj0000436.

Lysaker PH, Minor KS, Lysaker JT, Hasson-Ohayon I, Bonfils K, Hochheiser J, Vohs JL, 2020. Metacognitive function and fragmentation in schizophrenia: relationship to cognition, self-experience and developing treatments. Schizophr.Res.Cogn 19 10.1016/j.scog.2019.100142.

Lysaker PH, Cheli S, Dimaggio G, Buck B, Bonfils K, Huling K, Wiesepape C, Lysaker JT, 2021. Metacognition, social cognition, and mentalizing in psychosis: are these distinct constructs when it comes to subjective experience or are we just splitting hairs? BMC Psychiatry 21, 329. 10.1186/s12888-021-03338-4. [PubMed: 34215225]

Lysaker PH, Hasson-Ohayon I, Wiesepape C, Huling K, Musselman A, Lysaker JT, 2021. Social dysfunction in psychosis is more than a matter of misperception: advances from the study of metacognition. Front. Psychol 14 10.3389/fpsyg.2021.723952.

McAdams DP, de St Aubin ED, Logan RL, 1993. Generativity among young, midlife, and older adults. Psychol. Aging 8 (2), 221. [PubMed: 8323726]

McLean KC, Pasupathi M, 2012. Processes of identity development: where I am and how I got there. Identity 12 (1), 8–28.

McLean KC, Pasupathi M, Pals JL, 2007. Selves creating stories creating selves: a process model of self-development. Personal. Soc. Psychol. Rev 11 (3), 262–278.

Mediavilla R, López-Arroyo M, Gómez-Arnau J, Wiesepape C, Lysaker PH, Lahere G, 2021. Autobiographical memory in schizophrenia: the role of metacognition. Compr. Psychiatry 109, 152254. 10.1016/j.comppsych.2021.152254. Advance online publication. [PubMed: 34174693]

Minor KS, Marggraf MP, Davis BJ, Mickens JL, Abel DB, Robbins ML, Lysaker PH, 2022. Personalizing interventions using real-world interactions: Improving symptoms and social functioning in schizophrenia with tailored metacognitive therapy. J. Consult. Clin. Psycho 90 (1), 18.

O'Leary AP, Sloutsky VM, 2017. Carving metacognition at its joints: protracted development of component processes. Child Dev 88 (3), 1015–1032. [PubMed: 27759890]

Outcalt J, Dimaggio G, Popolo R, Buck K, Chaudoin-Patzoldt KA, Kukla M, Lysaker PH, 2016. Metacognition moderates the relationship of disturbances in attachment with severity of borderline personality disorder among persons in treatment of substance use disorders. Compr. Psychiatry 64, 22–28. [PubMed: 26541558]

Pasupathi M, Mansour E, 2006. Adult age differences in autobiographical reasoning in narratives. Dev. Psychol 42 (5), 798–808. [PubMed: 16953687]

Pinkham AE, Penn DL, Green MF, Harvey PD, 2016. Social cognition psychometric evaluation: results of the initial psychometric study. Schizophr. Bull 42 (2), 494–504. [PubMed: 25943125]

Rao J, Chiappelli J, Kochunov P, Regenold WT, Rapoport SI, Hong LE, 2015. Is schizophrenia a neurodegenerative disease? Evidence from age-related decline of brain-derived neurotrophic factor in the brains of schizophrenia patients and matched nonpsychiatric controls. Neurodegener. Dis 15 (1), 38–44. 10.1159/000369214. [PubMed: 25531449]

Roebers CM, Mayer B, Steiner M, Bayard NS, van Loon MH, 2019. The role of children's metacognitive experiences for cue utilization and monitoring accuracy: a longitudinal study. Dev. Psychol 55 (10), 2077. [PubMed: 31343230]

Schnakenberg Martin AM, Lysaker PH, 2021. Metacognition, adaptation, and mental health. Biol. Psychiatry. 10.1016/j.biopsych.2021.09.028. S0006–3223(21)01745–5. Advance online publication.

Semerari A, Carcione A, Dimaggio G, Falcone M, Nicoló G, Procacci M, Alleva G, 2003. How to evaluate metacognitive functioning in psychotherapy? The metacognition assessment scale and its applications. Clin.Psychol.Psychother 10 (4), 238–261.

Seow T, Rouault M, Gillan CM, Fleming SM, 2021. How local and global metacognition shape mental health. Biol. Psychiatry 90 (7), 436–446. 10.1016/j.biopsych.2021.05.013. [PubMed: 34334187]

Singer JA, Bluck S, 2001. New perspectives on autobiographical memory: the integration of narrative processing and autobiographical reasoning. Rev. Gen. Psychol 5 (2), 91.

Sneed JR, Whitbourne SK, Culang ME, 2006. Trust, identity, and ego integrity: modeling Erikson's core stages over 34 years. J. Adult Dev 13 (3–4), 148–157.

Thielsch C, Andor T, Ehring T, 2015. Do metacognitions and intolerance of uncertainty predict worry in everyday life? An ecological momentary assessment study. Behav. Ther 46 (4), 532–543. [PubMed: 26163716]

Vohs JL, Lysaker PH, Francis MM, Hamm J, Buck KD, Olesek K, Mehdiyoun N, 2014. Metacognition, social cognition, and symptoms in patients with first episode and prolonged psychoses. Schizophr. Res 153 (1–3), 54–59. [PubMed: 24503175]

Wells A, 2013. Advances in metacognitive therapy. Int. J. Cogn. Ther 6 (2), 186–201.

Table 1

Averages for outcomes for the overall sample.

Outcome	m (SD)	m (SD)
	Psychosis (*n* = 360)	**Control (*n* = 69)**
Self-reflectivity	4.30 (1.41)	5.77 (1.61)
Awareness of others	2.88 (0.93)	4.04 (1.15)
Decentration	0.57 (0.71)	1.25 (0.66)
Mastery	3.54 (1.69)	4.70 (1.85)
Total metacognition	11.28 (3.84)	15.75 (4.48)

Table 2

ANOVA of differences in metacognition and emotion regulation within quartiles.

Outcome	Quartile		p(η^2)			p(η^2)			p(η^2)			p(η^2)
	18–36			37–49			50–55			55+		
	n = 83	*n* = 18		*n* = 119	*n* = 16		*n* = 102	*n* = 17		*n* = 56	n = 18	
	Psychosis	Control		Psychosis	Control		Psychosis	Control		Psychosis	Control	
Self-reflectivity	4.15	5.75	0.000 (0.19)	4.35	5.72	0.000 (0.01)	4.34	5.52	0.003 (0.07)	4.31	6.06	0.000 (0.21)
Awareness of Other	2.60	3.78	0.000 (0.19)	3.01	3.75	0.002 (0.07)	2.94	4.00	0.000 (0.13)	2.89	4.58	0.000 (0.35)
Decentration	0.43	1.22	0.000 (0.19)	0.62	1.09	0.020 (0.04)	0.63	1.18	0.005 (0.06)	0.56	1.47	0.000 (0.28)
Mastery	3.38	4.61	0.005 (0.08)	3.60	4.34	0.104 (0.02)	3.58	4.53	0.036 (0.03)	3.55	5.28	0.001 (0.15)
Total Metacognition	10.56	15.36	0.000 (0.19)	11.57	14.91	0.001 (0.08)	11.50	15.24	0.001 (0.09)	11.31	17.39	0.000 (0.29)