

Short Communication

Social skills, executive functioning and social engagement

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ABSTRACT

The study explored hypothesized mediation of social interaction skills between executive functions and social engagement among adolescents diagnosed with schizophrenia. Participants ($N = 92$; 62% boys; age = 16.8) were assessed four weeks after hospitalization using previously validated scales. A regression mediation analysis followed by Structural Equation Modeling (SEM; with bootstrap analysis) supported the hypothesis. Executive functions were significantly associated with communication skills, which in turn was associated with social engagement (indirect effect = 0.29; standardized). These findings highlight the importance of understanding the heterogeneity of executive functions among adolescent patients with schizophrenia, and the subsequent association with their social skills and engagement.

1. Introduction

Participating in meaningful and continuous social relationships is highly vital for patients with schizophrenia (Vázquez Morejón et al., 2018), and is associated with a decrease in symptom severity (Harvey et al., 2007) and improvement of metabolic syndrome (Badcock et al., 2018). Therefore, researchers have aimed to develop novel interventions focused on improving social engagement among patients diagnosed with schizophrenia (Webber and Fendt-Newlin, 2017).

However, these interventions have focused primarily on adults, although children and adolescents diagnosed with schizophrenia have demonstrated worse impairment in social interactions, as well as a poor prognosis in comparison with that of adult with schizophrenia (Addington and Rapoport, 2009). Furthermore, little is known regarding the cognitive mechanism which links individual neurocognitive characteristics with psychosocial functioning in adolescents with schizophrenia. A recent review suggested that neurocognitive capacity (reasoning; processing-speed; attention; working-memory; verbal-learning; visual-learning; verbal-comprehension; and verbal-fluency) is associated with better community functioning, yet not with general functional capability (Najas-García et al., 2018).

A particular aspect of neurocognitive capacity are executive functions, which refer to higher order thinking procedures, including regulation of responses, accurate prediction of outcomes and abstract reasoning (Chubarov et al., 2015; Shallice, 1982). Adolescents with

schizophrenia generally have deficits in executive functions in comparison with the healthy population (Kenny et al., 1997; Rapoport and Gogtay, 2011; Ueland et al., 2004), which are associated with 'psychotic-like experiences' (Blair et al., 2018). Furthermore, younger age at disorder onset has been correlated with more severe cognitive deficits (Rajji et al., 2009; Vyas et al., 2007).

Executive functions were established as related to social competence in a sample of children in the general population (e.g., Razza and Blair, 2009). Such cognitive capacities can explain reactions to daily-life situations; for instance, lower levels of goal-oriented inhibition were found to predict more impulsive aggression (Hecht and Latzman, 2018). The positive relationship between executive functions and patterns of social skills and communication was also found among children with autism spectrum disorder (Gilotty et al., 2002), as well as in children with other neurodevelopmental deficits, such as epilepsy (Healy et al., 2018).

To date, research regarding the relationship between executive functions and social engagement among adolescents with schizophrenia, as well as the mediating role of social skills, is scarce. Based on previous findings in other clinical and non-clinical populations (Healy et al., 2018; Razza and Blair, 2009), we hypothesized that social skills would mediate the relationship between executive functions and social engagement. In order to avoid using the same assessment method for different theoretical constructs, we implemented different methods to assess each construct (Fulmer and Frijters, 2009): for executive

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functions, we used a performance task, which evaluates the responses to daily-life situations which require self-regulation and planning, making predictions and abstract understanding (as opposed to lab-constructed cognitive tasks; see Chubarov et al., 2015). For social engagement, we relied on self-reports (Oakley et al., 1986), while social skills were assessed using an observational tool (Forsyth et al., 1999).

2. Methods

2.1. Participants

The sample included 92 adolescents (62% boys; mean age 16.8 years, SD = 2.01) who were hospitalized with a diagnosis of schizophrenia at a tertiary mental health center in Israel. The center admits patients from a large urban district, characterized by a homogeneous population. The vast majority were born in Israel (87%), and their parents' education was below average (Fathers/Mothers, respectively: 46.0%/46.0% did not graduate from high school, 23.0%/29.9% graduated from high school, 20.7%/17.2% obtained a bachelor degree or less in higher education, and 10.3%/6.9% held a master's degree or higher).

Participants were excluded if they were diagnosed with any other medical neurological condition (i.e., movement disorder, epilepsy, and intellectual developmental disorder), severe vision impairment, or any substance use disorder. The study was approved by the Institutional Review Board and all participants and guardians signed an informed consent form (93% response rate). All participants were diagnosed independently by two experts in child and adolescence psychiatry according to the DSM-IV-R (American-Psychiatric-Association, 2000) criteria (data were collected during 2013, before the DSM-V was published).

2.2. Instruments

2.2.1. Executive functions

To assess the participants' cognitive capacities which are related to executive functioning processes, we utilized the Dynamic Occupational Assessment of Executive Functions (DOAEF), as a structured interview administered by trained mental health professional (Chubarov et al., 2015). The scales assess identification of daily-life situation causes (e.g., "Describe as many possible reasons as you can for the following situation: You come home and turn on the TV but nothing happens – the TV does not turn on"), the ability to generate a variety of solutions for daily-life problems (e.g. "Describe as many solutions as possible to the following situation: you need a new wallet. It costs 50 NIS but you have only 48 NIS. What do you do in order to acquire the wallet anyway?"), prediction of outcomes of daily-life situations (e.g., "Describe as many outcomes as possible to the following behavior: Habitually not preparing your homework"), and abstract reasoning (e.g., "Describe the similarities in the following two situations: (1) You bought a new shirt, but at home, when trying it on you found it to be too small; and (2) You bought ice cream but didn't check the change until getting home. When counting it, you discovered you were short—there was money missing") (16 items in total; Cronbach's $\alpha = 0.95$).

Table 1
Descriptive statistics and correlation matrix.

		Range	Mean	(SD)	Skewness	Kurtosis	1	2
1.	Executive functions	0–3	1.66	(0.73)	–0.38	–0.97	–	
2.	Communication skills	1–4	2.01	(0.72)	0.51	–0.52	0.67***	–
3.	Social engagement	1–5	1.47	(0.40)	1.26	1.58	0.37***	0.49***

*** $p < .001$, two-tailed.

2.2.2. Communication skills

Participants' interpersonal communication and social interactions were assessed using the Assessment of Communication and Interaction Skills (ACIS) (Forsyth et al., 1999). This is an observational tool, reported by a trained mental health professional, that was validated in previous studies and was found to be reliable in the current sample (20 items; Cronbach's $\alpha = 0.97$). It is composed of three main communication areas, namely physical (e.g., eye contact, posture), communication (e.g., response to questions), and interpersonal relationships (e.g., show interest and respect).

2.2.3. Social engagement

The participants' level of social engagement was assessed using the Role Checklist (Oakley et al., 1986), which focuses on a perceived load created by social obligations and participation (11 items; Cronbach's $\alpha = 0.76$). Participants were asked to rate on a scale from 1 ('not at all') to 5 ('very much') how each social role is perceived as demanding or as creating a subjective burden for them (e.g., being a student in high school, volunteering at least once a week, helping with home chores, etc.).

2.3. Procedure

The surveys including executive function assessment and social engagement were administered individually to each participant by a trained and experienced occupational therapist. The duration of each meeting was approximately 30 min, and the data were collected 4 to 5 weeks after the first day of the current hospitalization period (10.9% had no previous hospitalization, 64.1% had one, 19.6% had two, and 5.4% had three or more). At the same week of the meeting, patients were observed in at least two spontaneous social interactions within the hospital and were assessed using the ACIS guidelines (Forsyth et al., 1999).

2.4. Data analysis

The primary hypothesis was tested by mediation analysis using both regression analysis (Baron and Kenny, 1986) and structural equation modeling (Byrne, 2013). In this approach, a full mediation will be supported by: (a) a significant correlation between the independent and dependent variables; (b) a significant correlation between the independent and mediator variables; (c) a significant regression coefficient between the mediator and dependent variables, when controlling for the independent variable; and (d) a significant decline of the regression coefficient between the independent and dependent variables, when controlling for the mediator variable (tested by Sobel's test statistic). In the structural equation modeling, we performed bootstrap analysis (500 random samples) to obtain the 95% confidence-intervals (Hayes, 2009).

3. Results

The psychometric characteristics were aligned with our expectations (Table 1). Communication skills and social engagement were ranked relatively lower on the scales, while normally distributed around the mean (as indicated by skewness and kurtosis). All three

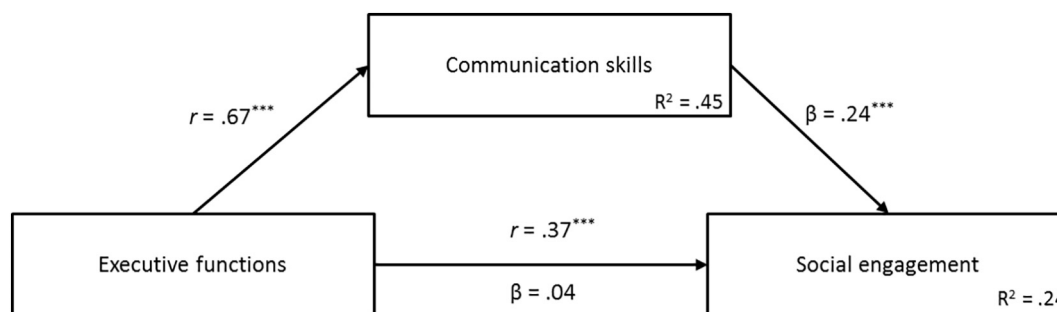


Fig. 1. Mediation of communication skills between executive functions and social engagement. Note. *** $p < .001$, two-tailed; Sobel's test statistics = 3.24, $p < .001$.

variables were significantly correlated; however, there were no significant mean-level differences in any of the variables based on gender or age.

The regression analysis supported the hypothesized mediation model (see Fig. 1). We found (a) a significant correlation between executive functions and social engagement ($r = 0.37$, $p < .001$); (b) a significant correlation between executive functions and communication skills ($r = 0.67$, $p < .001$); (c) a significant regression coefficient between communication skills and social engagement, when controlling for executive functions ($\beta = 0.04$, $p = ns$); and (d) a significant decline of the regression coefficient communication skills and social engagement (Sobel's test = 3.24, $p < .001$).

Mediation analysis using structural equation modeling yielded similar results. The mediation model had adequate model indices (CMIN/DF = 0.36; CFI = 1.00; RMSEA = 0.00), which were not significantly different when constraining the association between executive functions and social engagement to zero. Executive functions were significantly associated with communication skills ($\beta = 0.66$, $p < .01$, 95% CI = 0.51–0.80), which in turn was associated with social engagement ($\beta = 0.27$, $p < .01$, 95% CI = 0.19–0.37) (indirect effect = 0.29; standardized). Multiple-group analysis indicated that gender did not moderate the effects.

4. Discussion

The findings of the current study suggest a mechanism that explains the relationship between executive functions and the social engagement of adolescents with schizophrenia, which was mediated by communication skills. This means that within a population of adolescents with schizophrenia, deficits in executive functions, such as self-regulation and planning, are associated with lower levels of adaptive communication skills (e.g., use of gestures, sharing, and collaboration), which, in turn, explains the lower involvement in social activities.

While adolescents with schizophrenia generally demonstrate deficits in executive functions (Kenny et al., 1997; Rajji et al., 2009; Ueland et al., 2004), our model highlights the need to consider the heterogeneity of this population (e.g., Hubl et al., 2018) and its potential impact on social engagement. This is especially important when considering that previous research findings have consistently confirmed that social participation and support are essential for treatment and rehabilitation of patients with schizophrenia (Becker et al., 1997; Harvey et al., 2007; Vázquez Morejón et al., 2018).

Furthermore, while interventions which have focused on promoting social participation are considered highly beneficial (Webber and Fendt-Newlin, 2017), researchers and practitioners may also target executive functioning as a potential antecedent of social engagement – and use this information to refine their short and long-term goals of therapeutic interventions. This notion corroborates with others which have focused on personal characteristics or predispositions which may shape social interactions. For example, higher social self-efficacy was found to be associated with fewer negative symptoms, which in turn,

led to better social engagement among schizophrenia patients (Vaskinn et al., 2015).

The study included a comprehensive assessment using previously validated scales of a relatively large group of adolescents hospitalized with an established diagnosis of schizophrenia; however, some limitations should be acknowledged. Firstly, the study was based on a cross-sectional design. Future research should include longitudinal assessment in order to further support the hypothesized mediation model. In addition, other factors may be included as controllers, such as general social support, family relationships or personal attitudes toward social interactions (e.g., social goals) (Madjar et al., 2018). Although all participants were diagnosed by two independent psychiatrists and data were collected within one month of hospitalization, future research may also include assessment of their symptomatology according to a structured interview. Lastly, another future research direction is to include a comparison of this model with the healthy adolescent population. Despite these limitations, this study provides empirical evidence to the role of executive functions for social interaction skills and engagement, in a sample of adolescents with schizophrenia.

Conflict of interest

All other authors declare that they have no conflicts of interests.

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