

# Sensory modulation and daily-life participation in people with schizophrenia

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## Abstract

Schizophrenia is considered to be an extreme mental health disturbance that affects a person's well-being and participation in everyday activities. Participation in meaningful everyday occupations is an important component of recovery from mental illness, the ultimate goal of mental health services. The participation restrictions of people with schizophrenia have been widely investigated through different factors, such as illness symptoms and course, cognition, and demographic data; however, the resulting explanations were incomplete. The purpose of the study was to explore the contribution of sensory modulation (SM), in addition to cognition and schizophrenia symptoms, to participation in daily life activities of people with schizophrenia. Forty nine in-patients with schizophrenia (study group) and 32 adults without mental illness (control group) comprised the study. They were assessed for their participation patterns, sensory modulation processes, cognitive functioning and symptoms severity. Results indicate significant differences between the study groups in most measurements addressed: participation (diversity and satisfaction), sensory modulation scores (intensity of the response and frequency of response), and cognitive measurements. The most contributive parameters for the prediction of participation dimensions among people with schizophrenia were negative symptoms severity and general cognitive status. In conclusion, people with schizophrenia experience SM disorder with an under responsive tendency. However the complex condition of schizophrenia dominates its influence on participation dimensions.

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## 1. Introduction

Schizophrenia is considered to be an extremely debilitating mental health condition that affects 1% of the world's population [1]. The treatment for schizophrenia is challenging both with respect to its therapeutic and its economic aspects. It is a persistent condition that has long-lasting effects on the health, well-being and participation in everyday activities of individuals with schizophrenia and entails high levels of health care expenditures, social payments and family involvement [1,2]. Today, primary goal of mental health services for individuals with mental illness is recovery [3]. Although a variety of definitions for recovery of mental illness are found in the literature, most highlight participation in meaningful everyday occupations as its significant component [3,4]. Participation is particularly relevant in schizophrenia, since this illness has been

found to impede function and participation in many areas of life such as self-care, care of others, home maintenance, employment and personal communication [1,5–7]. People with schizophrenia tend to participate in fewer activities of daily life and their participation is less frequent [5–7].

In recent decades, the participation restrictions of people with schizophrenia have been extensively investigated. Research has indicated that these restrictions are related to a variety of factors, such as its symptoms, cognition [8–12], the course of the illness and various demographics factors [13,14]. Although these factors have been shown to correlate highly with participation in everyday activities among individuals with schizophrenia, they do not completely explain the variance found in their functional profiles [8,9,13].

Currently, much attention has been focused on the impact of sensory modulation (SM) dysfunction on everyday participation [15,16]. SM is defined as the central nervous system's capacity to regulate and organize the degree, intensity and nature of one's responses to sensory input in a graded and adaptive manner. Thus, SM enables one to achieve and maintain efficient behavioral responses, which in turn facilitate effective daily

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adaptation [16]. Sensory modulation disorder (SMD) interferes with modulation across one or multiple sensory systems [17–19], and is manifested in reduced participation in daily life occupations [15,20]. Subtypes of SMD include sensory over-responsivity (SOR), in which non-painful sensations are perceived as abnormally aversive, irritating [16–18] or painful [21,22]; and sensory under-responsivity (SUR), which manifests as decreased and/or delayed responses to stimuli [16–18]. Most of the knowledge is based on studies focusing on pediatric population [15–25], however SMD has also been documented in adulthood [26,27], although prevalence among adults has not yet been reported. Studies examining aspects of mental health among adults with SMD found a positive relationship between anxiety and sensitivity to environmental stimuli, as well as correlations between affect and sensory patterns [28,29]. Moreover, in comparison to controls, adults with over-responsivity demonstrate depression, anxiety and maladjustment, as well as lower scores in the physical and mental dimensions of health related quality of life assessments [30].

Only a few studies have examined the occurrence of SMD in schizophrenia, but their findings have reported that people with schizophrenia experience a high rate of neurodevelopmental sensory modulation deficits (e.g. [26,31–33]). These deficits have been identified at very early stages of cortical and subcortical visual, auditory and somato-sensory processing [32,34]. Moreover, it has been suggested that a person may manifest abnormal patterns of sensory processing prior to the onset of schizophrenia and that these abnormal patterns may even factor in the emergence of the condition [32–35]. All sensory modalities were found to be affected in schizophrenia; however the most significant impairments were found in the visual and auditory systems [34,36]. Within the population of individuals with mental illness, people with schizophrenia tend to avoid sensory stimuli more so than individuals with bipolar disorder [26,37].

Sensory modulation serves as a foundation for basic information processing. Thus, SMD may interrupt normal cognitive and emotional processing [38]. For example, impairments in SM lead to ‘perceptual incoherence’ and abnormal self-experience, which may in turn cause alterations of complex psychological functions (e.g. depersonalization, ambivalence, diminished sense of agency) and disturbances of various social behaviors and outcomes (e.g., difficulty interpreting social situations and categorizing emotional responses and facial expressions) [36,39,40]. However, little is known about the influence of SMD on participation in everyday life activities among people with schizophrenia. The purpose of the study was to explore the contributions of sensory modulation, cognition and schizophrenia symptoms to the participation of people with schizophrenia.

## 2. Methods

### 2.1. Participants

Eighty-one adults participated in the study. The study group comprised 49 individuals diagnosed by a psychiatrist

with persistent schizophrenia (men:  $N = 8$ , 16.3%; woman:  $N = 41$ , 83.7%) and the control group included 32 adults without mental illness (men:  $N = 7$ , 21.9%; woman:  $N = 25$ , 78.1%). Inclusion criteria for the study group were hospitalization up to 4 months and treatment with antipsychotic drugs for at least 4 weeks prior to the study’s launch. Individuals with intellectual disability, head injuries, physical disabilities and psychotic state due to substance or alcohol abuse were excluded. Participants with schizophrenia were recruited from the acute care units of a regional mental health center with the following characteristics: ages 20–60 (median = 31), 6–22 years of education (median = 12), disease onset from 13 to 29 years-of-age ( $M = 20.1$ ,  $SD = 4$ ), illness duration from 1 to 37 years ( $M = 12$ ,  $SD = 9.5$ ) and had experienced from 1 to 30 hospital admissions (median = 4). Most of study group participants were single ( $n = 28$ , 57.1%), living alone ( $n = 15$ , 30.6%) or with their parents ( $n = 12$ , 24.5%) in urban areas ( $N = 47$ , 95.6%). With respect to symptomatology, the study group participants experienced positive symptoms (range: 11–39,  $M = 19.8$ ,  $SD = 6.35$ ), negative symptoms (range: 12–65,  $M = 23.6$ ,  $SD = 8.6$ ) and general psychopathological symptoms (range: 21–79,  $M = 41.4$ ,  $SD = 14.3$ ).

The control group participants, recruited through convenience sampling, were matched to the study group by age and gender. These participants were 21–56 years of age (median = 29), had 12–21 years of education (median = 15), were single ( $n = 13$ , 40.6%) or married ( $n = 16$ , 50%), lived alone ( $n = 10$ , 31.25%) or with their family ( $n = 16$ , 50%) in urban areas (93.75%). No significant differences were found between the groups by age ( $Z = -.846$ ,  $p > .05$ ) or gender ( $\chi^2 = 0.39$ ,  $p > .05$ ). However, the groups differed by years of education ( $Z = -5.85$ ;  $p < .001$ ).

### 2.2. Measurements

#### 2.2.1. The Sensory Responsiveness Questionnaire (SRQ)

This 58-item questionnaire is used to clinically diagnose SMD [27] and provides cut-off scores for both under- and over-responsiveness. The SRQ presents a set of 58 typical scenarios occasionally encountered throughout daily life. Each scenario involves one sensory stimulus in one of the following modalities: auditory, visual, gustatory, olfactory, vestibular and somatosensory stimuli excluding pain. The items are stated in a manner that attributes a hedonic/aversive valence to the situation. The SRQ has two parts, each of which contains the identical 58 items; however in the first part the individual is asked to relate to the intensity of responses, while in the second, he/she is asked to relate to the frequency of responses. In this study, we used only the first part, the intensity scale. The participant rates the intensity of the hedonic/aversive response to the situation, with the anchors ‘not at all’ attached to the score of ‘1’ and ‘very much’ attached to the score of ‘5’. The intensity scale for measuring sensory responsiveness is unique to the SRQ. It was included in the tool because although different

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