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Prevalence and classification of hallucinations in multiple sensory modalities in schizophrenia spectrum disorders

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ABSTRACT

Background: Auditory hallucinations are experienced by 60–80% of all patients diagnosed with a schizophrenia spectrum disorder. However, in this patient group, the prevalence of hallucinations in multiple sensory modalities, i.e. multimodal hallucinations (MMHs), is unknown.
Aims: To assess the prevalence of MMHs in patients diagnosed with a schizophrenia spectrum disorder, data were analyzed from 750 patients who participated in the Dutch Genetic Risk and Outcome of Psychosis (GROUP) study.
Method: We drew on the section of the CASH (Comprehensive Assessment of Symptoms and History) that probes into the lifetime presence of auditory, visual, somatic/tactile, and olfactory hallucinations.
Results: A lifetime prevalence of 80% was found in this group for hallucinations in any of these modalities. Within the whole group, 27% of the participants reported unimodal hallucinations and 53% MMHs. There were no significant differences in prevalence rate for Dutch versus migrant participants from Morocco, Turkey, Surinam or the (former) Dutch Antilles.
Conclusion: We conclude that MMHs, rather than auditory hallucinations, are the most frequent perceptual symptom of patients diagnosed with a schizophrenia spectrum disorder. Our data also suggest that hallucinations experienced in a single sensory modality (notably auditory ones) stochastically increase the risk for more sensory modalities to join in. We recommend that future studies take into account all 14 sensory modalities in which hallucinations can be experienced. For this we provide a classification of MMHs that allows characterization of their serial versus simultaneous occurrence and their congruent versus incongruent nature.

1. Introduction

Of all patients diagnosed with a schizophrenia spectrum disorder, 60–80% experience auditory hallucinations (Waters et al., 2014) and a smaller proportion visual or other unimodal hallucinations. However, in this patient group, little is known about hallucinations in multiple sensory modalities, also known as multimodal hallucinations (MMHs). Below, we will explain that the term multimodal hallucination is used for both serial and simultaneous hallucinations occurring in different sensory modalities. As noted in a review (Waters et al., 2014) the nature of the relationship between hallucinations of different sensory modalities has hardly been examined. Although this situation is not unique for schizophrenia spectrum disorders (Waters et al., 2014), some studies indicate that the prevalence of multimodal hallucinations may be severely underestimated in this group (Goodwin et al., 1971) while others indicate that the presence of MMHs may be indicative of an underlying

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Table 1
Overview of studies describing multimodal hallucinations in the context of various psychiatric and somatic conditions.

Diagnosis	Study	Sensory modalities	Serially/simultaneously occurring hallucinations
Psychiatric disorders			
Schizophrenia	Goodwin et al. (1971)	Auditory and visual	Serially and simultaneously
Late onset schizophrenia	Hussein et al. (2012)	Not mentioned	Not mentioned
Late onset schizophrenia	Pearlson et al. (1989)	Not mentioned	Not mentioned
Late onset schizophrenia	Eissa et al. (2013)	Not mentioned	Not mentioned
Schizophrenia in Saudi Arabia	Zarroug (1975)	Auditory, visual, tactile	Simultaneously
Schizophrenia in Kenya	Ndetei and Singh (1983)	Not mentioned	Not mentioned
Borderline personality disorder	Yee et al. (2005)	Visual and olfactory	Not mentioned
Neurological disorders			
Temporal lobe epilepsy	Penfield and Perot (1963)	Auditory and visual, sometimes tactile and olfactory	Serially and simultaneously
Narcolepsy	Szűcs et al. (2003)	Hypnagogic hallucinations; tactile and visual	Not mentioned
Right temporo-basal tumor	Güzelcan et al. (2008)	Visual and tactile	Simultaneously
Right thalamic stroke	Mollet et al. (2007)	Auditory and visual	Simultaneously
Cerebrovascular accident presenting with peduncular hallucinosis	Dogan et al. (2013)	Auditory and visual	Simultaneously
Charles Bonnet syndrome	Alroe and McIntyre (1983)	Visual and olfactory	Simultaneously
Delirium tremens	Deahl (1987)	Auditory and visual	Simultaneously
Infectious disease			
Peduncular hallucinosis	Vita et al. (2008)	Auditory and visual	Simultaneously
Neuropsychiatry			
Lewy body disease	Aarsland et al. (2001)	Auditory and visual	Not mentioned
Substance abuse			
Ketamine use	Lim (2003)	Auditory and olfactory	Not mentioned
Alcohol hallucinosis	Bhat et al. (2012)	Auditory, visual, and tactile	Not mentioned
Drug and alcohol abuse	Scher and Neppe (1989)	Auditory, visual, and gustatory	Not mentioned
Iatrogenic cause			
Carbamazepine use	Benatar et al. (2000)	Auditory, visual, and tactile	Auditory and visual simultaneously

organic etiology (Roberts, 1984; Albert, 1987), or, in children and adolescents, of a more severe expression of schizophrenia (David et al., 2011; Jardri et al., 2014; Cachia et al., 2015).

MMHs are also known as polymodal hallucinations, polysensual hallucinations, polysensory hallucinations, polysensorial hallucinations, intersensorial hallucinations, and fantastic hallucinations (Blom, 2010). In the literature these terms tend to be used interchangeably; however, in some cases they refer to hallucinations experienced in various sensory modalities simultaneously, while in others they refer to those experienced serially (Chesterman and Boast, 1994).

Whatever the reason, the literature on MMHs is scarce. The most extensive review to date was published by Chesterman and Boast in 1994 and the most recent review prior to that is a chapter in Specht's 1914 German textbook *Wahrnehmung und Halluzination* (Specht, 1914). During the 80-year intervening period, as well as during the 20 years since the publication of Chesterman and Boast, MMHs have mainly been referenced in case reports (Alroe and McIntyre, 1983; Scher and Neppe, 1989; Benatar et al., 2000; Lim, 2003; Szűcs et al., 2003; Yee et al., 2005; Mollet et al., 2007; Güzelcan et al., 2008; Vita et al., 2008; Bhat et al., 2012; Dogan et al., 2013), in the field of neuropsychiatry (Aarsland et al., 2001), and in studies in the field of transcultural psychiatry (Zarroug, 1975; Al-Issa, 1977; Ndetei and Singh, 1983; Kent and Wahass, 1996; Blom et al., 2010; Johns et al., 2002; Bauer et al., 2011; Hussein et al., 2012; Larøi et al., 2014; Lim et al., 2015; Luhrmann et al., 2015), see Table 1. Even classic authors such as Parish (1894), Bleuler (1911) and Jaspers (1965), who wrote extensively on hallucinations in various sensory modalities, treated the subject only cursorily. Table 1 provides an overview of studies we retrieved on MMHs experienced in the context of psychiatric *and* somatic conditions.

To further our understanding of MMHs and their prevalence rate in patients diagnosed with a schizophrenia spectrum disorder, we drew on data from the *Genetic Risk and Outcome of Psychosis* (GROUP) study, conducted in the Netherlands from 2004 through 2013 (Korver et al., 2012). Below, we present data from this study on hallucinations in various sensory modalities, address various conceptual issues pertaining to MMHs, and propose a classification of this neglected group of phenomena to serve both clinical and research purposes.

2. Method

2.1. Study design

A longitudinal cohort study on gene-environment vulnerability and resilience in patients diagnosed with a schizophrenia spectrum disorder (DSM IV classification), their unaffected family members, and non-related controls, was performed by the GROUP project. Individuals were recruited to elucidate etiological and pathogenetic factors influencing the onset and course of psychotic disorders. The study was conducted in the Netherlands within a consortium of four university psychiatric centers and 30 of their affiliated mental healthcare institutions (Korver et al., 2012). One of the instruments used was the CASH (*Comprehensive Assessment of Symptoms and History*) (Andreasen et al., 1992) which contains sections on the lifetime presence and the present state (i.e., past month) of hallucinations experienced in the auditory, visual, somatic/tactile, and olfactory modalities.

2.2. Subjects

Ethnicity was determined in the GROUP project by country of birth of grandfather and grandmother on the fathers' and mothers' sides. Thus, a subject was considered to be of Dutch ethnicity when three or more grandparents were born in the Netherlands. Mutatis mutandis, this rule applied to all ethnicities. Whenever less than three grandparents were born in the same country, the subject was said to have a mixed ethnicity. We selected all patients who had completed the study's baseline measurements and excluded those whose data were incomplete. Outcome measures were (1) the number of patients who had ever experienced any of the aforementioned types of hallucination, (2) the types of hallucination, and (3) their distribution.