

Hallucinations in the General Population

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Although hallucinations occur in a range of organic and psychiatric conditions, they are not invariably a sign of illness and also occur in “normal” individuals. Evidence indicates that psychotic hallucinations lie on a continuum with normal experiences, and many more people experience hallucinations than meet criteria for clinical psychosis. In addition to a symptomatic continuum between normal individuals and patients with psychosis, there is evidence that hallucinatory experiences in nonclinical and clinical samples may share the same underlying etiologic influences, including socio-demographic risk factors and neurocognitive mechanisms. Predictors of patient status include beliefs about hallucinations, negative mood, and perceived lack of control.

Introduction

In recent years there have been suggestions that psychosis exists in the general population as a continuous phenotype rather than as an all-or-none phenomenon [1]. Evidence in support of this continuum hypothesis has been reviewed in numerous recent papers [2–5]. This article reviews and summarizes the recent literature on hallucinations in the general population. This article highlights additional evidence for a continuum between nonclinical individuals and psychotic patients, not only in terms of prevalence of hallucinations but also in other aspects such as associated risk factors and underlying mechanisms. Lastly, the review discusses the implications of the psychosis continuum in terms of clinical outcome and risk of developing psychosis.

Prevalence and Nature of Hallucinations in Nonclinical Samples

Various measures have been used to explore the prevalence and character of hallucinatory experiences in the normal population. The Psychosis Screening Questionnaire (PSQ) [6] assesses psychotic symptoms in the past year and has

five questions on mania, thought insertion, paranoia, strange experiences, and hallucinations. The more comprehensive Composite International Diagnostic Interview (CIDI) contains 17 psychotic symptom items concerning delusions (13 items) and hallucinations (four items) [7]. The Community Assessment of Psychic Experiences [8] is a 42-item self-report questionnaire that measures subclinical dimensions of psychosis. Three correlated dimensions of positive (paranoia, hallucinations, grandiosity, first-rank symptoms), negative, and depressive experiences have been identified using principal components factor analysis. The most popular measure is probably the Launay-Slade Hallucinations Scale (LSHS) [9], which assesses predisposition to hallucinations. The original scale consisted of 12 items to which subjects responded either “true” or “false.” Bentall and Slade [10] modified the original scale and substituted the true-false response with a five-point Likert scale. Subsequent studies have examined the factor structure of this questionnaire in normal samples and found a two- or three-factor solution. Aleman *et al.* [11] identified three factors: 1) tendency toward hallucinatory experiences, 2) subjective externality of thought, and 3) vivid daydreams. Morrison *et al.* [12•] reported two factors: 1) visual hallucinations/ disturbances and 2) auditory or verbal hallucinations/ daydreaming. Recently, Waters *et al.* [13] administered the LSHS to 562 English-speaking students. Principal component analyses identified three factors characterized as 1) vivid mental events, 2) hallucinations with a religious theme, and 3) auditory and visual hallucinatory experiences. Larøi *et al.* [14] developed a revised version of the LSHS to include items on visual hallucinatory experiences, tactile and olfactory hallucinations, the experience of feeling the presence of someone close who has passed away, and hypnagogic and hypnopompic hallucinations. Two hundred and sixty-five French-speaking students completed this modified version of the LSHS, and principal components analysis showed four factors reflecting 1) sleep-related hallucinatory experiences, 2) vivid daydreams, 3) intrusive or vivid thoughts, and 4) auditory hallucinations. Principal components analysis of a further-revised version of the scale showed five factors, including an additional factor of visual hallucinations [15•]. Not surprisingly, the reported factors of the LSHS vary according to the items that are included. Nevertheless, the questionnaire provides data on the kinds of hallucinatory experiences reported by normal individuals, and there

is some evidence that these are fairly stable over time [12•,16,17]. In addition, the factor structures in nonclinical samples are similar to those obtained in a clinical sample [18]. Results of studies using such measures are consistent with the existence of a continuum of psychotic phenomena in the general population. Therefore, several student and community surveys have shown that more people experience hallucinations than come into contact with medical or psychiatric services [2]. However, this continuum also reflects quantitative and qualitative differences between psychiatric patients and nonpatients, and “less psychotic” experiences are reported more frequently in nonclinical samples. Johns *et al.* [19] analyzed responses on the PSQ collected in the Fourth National Survey of Ethnic Minorities. **The annual prevalence of hallucinatory experiences (hearing or seeing things that other people could not) was 4% in a sample of 2800 white respondents.** More recently, Johns *et al.* [20•] used data from another large cross-sectional survey of the British population to examine the distribution and correlates of self-reported hallucinatory experiences. After excluding people with probable psychosis, data were available for 8520 individuals. **Five and a half percent of this sample reported one or more psychotic symptom as measured by the PSQ. For hallucinations, 4.2% of the sample said there had been times when they heard or saw things that other people could not, but only 0.7% reported hearing voices saying words or sentences** when there was no one around who might account for it. Larøi and Van der Linden [15•] examined various characteristics of reported hallucinatory experiences, including prevalence, frequency, degree of control, and emotional reaction. The highest prevalence rates were for the intrusive or vivid thought factor (63%), followed by the daydreaming factor (58%). The least prevalent were the auditory hallucination (25%) and visual hallucination (29%) factors. Similarly, participants reported high frequency rates for the daydreaming (32%) and intrusive or vivid thought (23%) factors. Items in the daydreaming factor were perceived as being highly controllable, whereas the opposite was found with items in the auditory hallucinations factor. Negative (compared to positive) emotional reactions were greater for all the factors except daydreaming. In terms of prevalence and frequency rates for individual items, the most prevalent were items related to vivid thoughts, sleep-related hallucinations, and daydreaming. The item “I have been troubled by hearing voices in my head” was endorsed by 23% of the sample, but only 9% said this occurred frequently. Control over the experiences was correlated with emotional reaction: the lower the degree of control, the more the participants perceived the experiences as negative.

Detailed interview measures are needed to fully understand the nature of psychotic experiences reported by individuals in nonclinical samples. Brett (2005, Unpublished PhD thesis, University of London) has developed a **semi-structured interview to assess anomalous experiences in**

patient and nonpatient samples. The Anomalous Experiences Inventory and Appraisals of Anomalous Experiences interview assess the phenomenology of such experiences, together with their antecedents, appraisals, and emotional and behavioral responses. Principal component analyses showed five trait factors, and hallucinations contributed to two of the factors: paranormal and/or hallucinatory experiences (visual and somatic hallucinations), and first-rank symptoms (voices, loud thoughts). Brett compared three groups of participants using this measure: an undiagnosed group reporting anomalous experiences, a diagnosed group of patients with psychosis, and an “at risk” group of clients at high risk of developing psychosis. In support of the continuum hypothesis, participants in all three groups reported experiences from all five trait factors. However, there were significant differences in the type and frequency of anomalies reported across the groups. In particular, first-rank symptom anomalies were more frequent in the diagnosed group.

In addition to surveys of adult samples, research has reported the presence of hallucinations in individuals from other populations who do not have psychosis, such as children, adolescents, and the elderly. Hallucinations in childhood and adolescence are not necessarily an indication of psychosis, but are frequently associated with a range of other mental health problems. Yoshizumi *et al.* [21] examined the prevalence of hallucinatory experiences in a nonclinical sample of 761 Japanese children aged 11 to 12 years. Hallucinations (auditory, visual, or combined) occurred in 21.3% ($n=81$) of the children in the sample. The most common auditory hallucination (58.3%) was hearing their names called or being addressed by single words (“Hey” or “Hello”). The most commonly reported visual hallucinations (60.9%) involved seeing a human image such as a friend, a deceased person, an unknown person, or a human body part. Children who had hallucinations had more significant psychopathology (depression, anxiety, dissociative experiences) than those who had never experienced hallucinations. Larøi *et al.* [17] investigated the influence of age on the prevalence of hallucination-proneness by comparing a sample of young ($n=230$) and elderly adults ($n=183$) on their modified LSHS. The young subjects were university students (average age, 21.6 years) and the elderly subjects were active, noninstitutionalized subjects (average age, 68.6 years). Although there was no group difference in mean scores on the LSHS, there were significant differences between the two groups depending on the LSHS factor. Young subjects endorsed significantly more items relating to vivid daydreams and intrusive or vivid thoughts, whereas elderly subjects reported significantly more auditory, visual, and sleep-related hallucinations.

Associated Risk Factors

Psychotic symptoms in the general population are associated with certain risk factors (eg, urban residence and younger age group), and these risk factors mirror those for clinical

psychosis [22]. In addition, individual symptoms of hallucinations and delusions seem to have specific correlates, suggesting different risk factors for particular symptoms. Johns *et al.* [20•] found that neurotic disorder, victimization experiences, average and below average intelligence quotient, alcohol dependence, and female gender were associated with self-reported hallucinatory experiences. There also was a trend for an association between hallucinations and black ethnic group, replicating the finding of Johns *et al.* [19] from an earlier UK national survey. Larøi *et al.* [17] suggested that neuroticism may play an important role in the development of hallucinations in young adults, but may be less pertinent for the development and/or maintenance of hallucinations in later life. They examined the association between personality characteristics and hallucination-proneness in a young adult and an elderly sample. Neuroticism was significantly associated with hallucination-proneness in the young sample, and Openness to Experience correlated with hallucination-proneness in the young and elderly subjects. Larøi and Van der Linden [15•] found that approximately 25% of their participants completing the LSHS reported that their hallucinatory experiences occurred in the context of a particularly difficult or stressful life event. However, very few participants in that study indicated having had hallucinatory experiences when under the influence of alcohol and/or drugs.

Evidence indicates an association between exposure to trauma and the development of hallucinations [23,24]. Janssen *et al.* [25] reported recently that childhood abuse is a risk factor for positive psychotic experiences in the general population. They analyzed data from a general population sample of 4045 individuals aged 18 to 64 years. Childhood abuse was assessed at baseline, and first onset incident positive psychotic symptoms were assessed using the CIDI and the Brief Psychiatric Rating Scale 2 years later. Childhood abuse reported at baseline predicted the development of positive psychotic symptoms (unusual thought content and hallucinations). Three levels of psychosis outcome were analyzed: subclinical symptoms, pathologic symptoms, and symptoms associated with need for care. There was a dose-response relationship between the frequency of reported abuse and these psychosis outcomes.

Psychologic Mechanisms

There is increasing evidence that processes associated with the etiology and maintenance of hallucinations in psychotic patients also operate in nonpatient samples. Cognitive models suggest that auditory hallucinations arise from the misattribution of inner speech to an external source. The tendency of psychiatric patients with hallucinations to externalize internal information has been shown in numerous studies [26]. Recent work has shown an external attributional bias in hallucination-prone participants, too. Larøi *et al.* [27] investigated reality monitoring functioning in hallucination-prone subjects. One hundred normal subjects were administered a reality monitoring task in which they had to identify the

source of presented words (previously presented by the experimenter, previously generated by the subject, or new). Subjects were grouped according to their scores on the LSHS. Hallucination-prone participants made significantly more source discrimination errors than subjects not prone to hallucination for self-generated items, and tended to misattribute these items to the experimenter. Levine *et al.* [28] reported that hallucination-prone individuals not only make external attributions for private events and experiences, but also are more likely to make external attributions to social-interpersonal events. They compared 42 university students with high and low scores on the LSHS, and found that hallucinatory predisposed individuals were less susceptible to a reinforcement paradigm on a "betting task" designed to encourage internal locus-of-control judgments. Therefore, the high LSHS scorers were less likely to respond to success by increasing their bet and to respond to failure by decreasing their bet than were low LSHS scorers. Allen (2005, Unpublished PhD thesis, University of London) examined speech appraisal in nonclinical hallucination-prone individuals, and replicated previous findings with clinical hallucinators [29]. Participants heard their prerecorded voice or someone else's voice, both of which were distorted on half the trials, and were required to identify the source of the speech ("myself," "not myself," "unsure"). There was a trend for high LSHS scorers to make more misattribution errors than low LSHS scorers and identify their own distorted speech as belonging to someone else. Supporting the continuum hypothesis, these hallucination-prone individuals exhibited a less prominent externalizing bias than patients on the paradigm. The high LSHS group misattributed their own distorted speech on 48% of the trials, whereas patients with hallucinations and delusions misattributed their distorted speech on nearly 70% of trials. One study did not find the expected externalizing bias on a source monitoring task. Larøi *et al.* [30] compared 16 hallucination-prone and 16 non-hallucination-prone subjects on a task that involved monitoring the source of routine motor actions. Subjects were asked to: perform the action, watch the experimenter perform the action, imagine him or herself performing the action, imagine the experimenter performing the action, or listen to the experimenter say the action verbally. After a delay, a list of actions was presented, and subjects had to identify each action as old or new and, if old, identify the source. The hallucination-prone participants confused two internal sources and attributed imagined actions performed by themselves to imagined actions performed by the experimenter. Although the results did not show a bias in attributing an internal to a real external source, they are consistent with the fact that hallucinations involve misidentification of internally generated cognitive events.

Hallucinatory experiences in normal individuals may have an underlying neural basis similar to that observed for psychotic hallucinations. Barkus (2004, Unpublished PhD thesis, Manchester Metropolitan University) examined the psychobiologic correlates of hallucination-proneness in a

student sample. Based on LSHS scores, participants were divided into high- medium- and low-proneness groups. They completed a signal detection task in which they were required to indicate when they detected the presence of a voice. Responses were coded as Hits, Misses, False Alarms, and Correct Rejections. The high-proneness group made more False Alarms than the other groups, reporting the presence of a voice when none was presented. Nine participants from the high-group also completed a functional neuroimaging study of the same task. The brain scanning results showed that False Alarms (hallucinatory-like experiences) activated similar brain regions to those associated with auditory hallucinations in patients with schizophrenia.

Emotion, particularly anxiety, has been implicated in triggering and maintaining hallucinations [31], and emotional dysfunction is considered central to psychosis [32]. Allen *et al.* [33] tested whether emotion (anxiety, depression, stress, self-focused attention) and reasoning (need for closure, extreme responding) predicted hallucinatory predisposition in nonclinical participants. A student sample ($n=327$) completed the LSHS and other measures of emotion and reasoning. Using multiple regression analysis, it was found that age, self-focus, extreme responding, and higher levels of anxiety were associated with hallucinatory experiences. Anxiety was the strongest predictor of hallucinations, which mirrors the importance of emotional processes in clinical hallucinations. van't Wout *et al.* [34] reported that, similar to psychotic patients, psychosis-prone individuals also show some abnormalities in emotion processing. High and low scorers on the LSHS were compared on an alexithymia questionnaire and four behavioral emotional processing tasks (affective priming task, emotional counting Stroop task, emotional chimeric faces task, and degraded facial affect recognition task). Consistent with other studies, hallucination-proneness was associated with increased subjective emotional arousal and fantasy-proneness. On the affective word-priming task, no priming effect was observed in high LSHS group.

The association between metacognitive beliefs and the presence of hallucinations in clinical samples [35] also has been observed in nonclinical samples [12•,36]. Positive and negative metacognitive beliefs have been found to be associated with predisposition to hallucinations. Larøi and Van der Linden [37] investigated the relative influence of positive compared to negative metacognitive beliefs in proneness to hallucinations and delusions in 331 nonclinical participants. Participants were divided into a non-hallucination—prone and a hallucination-prone group based on their scores on the LSHS. Hallucination-prone participants scored higher on the Meta-Cognitions Questionnaire compared with participants who were not prone to hallucinations, and positive and negative beliefs were good predictors of predisposition toward hallucinations. These included positive beliefs about worry, cognitive self-consciousness, and negative beliefs about the uncontrollability of thoughts and corresponding danger.

Clinical Implications

Given the evidence for a continuum of psychotic experiences in the general population, it is important to understand the mechanisms that mediate transition from having one or more psychotic symptoms to becoming a patient with a psychotic disorder. The probability of developing a psychotic disorder seems to increase in a dose-response fashion with the level of self-reported psychotic experiences [38]. In individuals with self-reported hallucinatory experiences, it has been found that the risk for onset of psychotic disorder is mediated by delusion formation and depression [39••]. A randomly selected general population cohort was interviewed with the CIDI at baseline and 1 and 3 years later. At year 3, a clinical interview also was done to identify onset of psychotic disorder. For individuals who reported hallucinatory experiences at baseline, the risk of psychosis at year 3 was much higher in those who developed delusional ideation at year 1 than in those who did not. The risk of psychosis also was higher in those with depression at year 1. Morrison *et al.* [40] compared beliefs about voices in 41 psychotic patients with auditory hallucinations and 39 nonpatients with a high predisposition to hallucinations, using the Interpretation of Voices Inventory [12•]. They found that the patients showed higher levels of negative interpretations of voices, and there was a trend for more interpretations regarding loss of control. Childhood hallucinations have variable long-term outcomes. Escher *et al.* [41] studied the course of voices during a 3-year period in a group of 80 children and adolescents (aged 8 to 19 years). The rate of voice discontinuation during this period was 60%. Predictors of persistence of voices were severity and frequency of the voices, associated anxiety/depression and lack of clear external triggers. Escher *et al.* [42] also found that individuals who felt overwhelmed by the experience of voices at baseline, as evidenced by more defensive coping responses, were more likely to develop depression during the 3-year follow-up period. All these findings support current cognitive psychologic models of psychotic symptoms [43••,44]. Therefore, the clinical outcome of hallucinatory experiences is related partly to the development of secondary beliefs and appraisals, mood, and behavioral responses.

Conclusions

There is increasing evidence for a continuum of psychotic experiences such as hallucinations in the general population. Measures of hallucinatory experiences have been developed and refined, and numerous studies have found that hallucinations are experienced by individuals from nonclinical samples of the population. There seems to be a symptomatic continuum between normal individuals and patients with psychosis, although there are some qualitative and quantitative differences between these groups in terms of the type and frequency of experiences reported. There is recent evidence that hallucinatory experiences in nonclinical and clinical

samples seem to share similar etiologic and maintaining influences. Risk factors such as neuroticism and trauma are associated with hallucinations regardless of patient status. In addition, the same psychologic processes seem to operate in patients with hallucinations and hallucination-prone individuals, for example, an external attributional bias or certain metacognitive beliefs. Predictors of clinical outcome in individuals with hallucinatory experiences include beliefs and appraisals, mood, and perceived control. These suggest targets for intervention in individuals who report hallucinations and seek help.

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