

## Tactile, Olfactory, and Gustatory Hallucinations in Psychotic Disorders: A Descriptive Study

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### Abstract

**Introduction:** Hallucinations are a common feature of psychotic illness and occur across diagnoses. While auditory and visual hallucinations are known to represent common features of psychosis, tactile, olfactory, and gustatory hallucinations (TOGHs) are often believed to be rare in primary psychotic illness. The present study examined hallucinations across sensory modalities in patients with primary psychotic disorders by diagnosis and in association with mood and psychotic symptoms. **Materials and Methods:** In this descriptive study we examined diagnostic and symptom data from a large cohort of patients with schizophrenia (n = 133), schizoaffective disorder (n = 101), or bipolar I disorder (n = 186). **Results:** TOGHs were common (20% of the total sample), and occurred across all diagnostic categories, although at different rates by diagnosis. TOGHs were correlated with each other and with other hallucinations, and were associated with specific clinical features such as somatic delusions, delusions of control, thought broadcasting, earlier age at onset, and a lifetime history of depressive episodes. **Conclusion:** In the present sample, hallucinations in all modalities occurred in patients across diagnoses suggesting that no one type of hallucinatory experience is pathognomonic to any given diagnosis. Additionally, TOGHs were present in patients across diagnostic groups and were associated with specific symptoms and earlier age of onset. Implications for clinical practice and clinical and neurobiological research are discussed.

Ann Acad Med Singapore 2009;38:383-7

**Keywords:** Bipolar disorder, Schizophrenia, Schizoaffective disorder

### Introduction

Hallucinations are a hallmark symptom of schizophrenia and are commonly observed in other psychotic disorders. Auditory hallucinations (AH) are the most common subtype [74% of patients with schizophrenia (SZ)] based on The International Pilot Study on Schizophrenia,<sup>1</sup> but the occurrence of non-AH in psychotic patients has been less well characterised. Reported rates of visual hallucinations (VH) in patients with SZ vary widely, ranging from 16% to greater than 60%;<sup>2-4</sup> olfactory, gustatory, and tactile hallucinations are generally believed to be rare in patients with primary psychotic illness. It is often taught that tactile hallucinations are associated with drug abuse, toxicity or withdrawal and that olfactory hallucinations are indicative of temporal lobe epilepsy. Similarly, olfactory and gustatory hallucinations would frequently lead to a brain scan in the search for a brain lesion, including a localised tumour. A study of patients with SZ or schizoaffective disorder (SZA)

reported that only 11% of patients experienced olfactory or gustatory hallucinations and 17% experienced tactile hallucinations.<sup>4</sup> However, earlier reports suggest that non-AH were more common than is usually reported,<sup>5</sup> and Small et al<sup>6</sup> found that 38% of patients with SZ reported olfactory hallucinations. The perception that tactile, olfactory, and gustatory hallucinations [we will refer to this group of phenomena as tactile, olfactory, and gustatory hallucination (TOGH)] occur rarely in psychotic disorders and more commonly in secondary psychotic conditions has led physicians to consider the presence of TOGHs as indication of organic illness.

The incidence of hallucinations varies by diagnosis, but their presence is not disease-specific.<sup>7,8</sup> Although hallucinations are common in all psychotic illnesses, the report of hallucinations decreases the likelihood of diagnosing bipolar disorder (BD) by clinicians.<sup>8</sup> One study of patients recruited based on hallucination status regardless

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of diagnosis found that any modality of hallucination may occur in patients with any type of psychosis including SZ, mood disorders, and those with organic aetiology.<sup>9</sup> In that study, AH and VH were common in all disorders, but TOGHs were most often experienced by patients with SZ. Another large retrospective study reported that VH occur in 22% of patients with SZ and 17% of patients with BD.<sup>10</sup> A much smaller study has reported that patients with SZA, depressed subtype, experienced higher rates of VH and tactile hallucinations than patients with SZA, bipolar subtype or patients with SZ.<sup>4</sup> Focusing on phenomenology instead of diagnosis, Muesser et al<sup>4</sup> found that TOGHs were strongly correlated with each other and with severity of delusions in patients with SZ and SZA. Similarly, Baethge et al<sup>7</sup> found that olfactory hallucinations were more commonly associated with delusions (90.9% in BD and 95.7% in SZ) than were VH (58.8 % in BD and 83.3 % in SZ).

The course of hallucinatory experiences is also variable. Patients usually do not experience simultaneous multi-modality hallucinations, with the exception of gustatory and olfactory hallucinations which occur in conjunction as often as they do independently.<sup>9</sup> On the other hand, the sensory modality in which hallucinations are experienced may vary within the same patient over the course of illness.<sup>9</sup>

In this study, we focused on TOGHs in a well-characterised patient sample with a variety of psychotic disorders, and examined whether any clinical or demographic factors were associated with their incidence. We hypothesised that TOGHs would be relatively common, present across diagnoses, and associated with the presence of specific clinical features. We predicted that TOGHs would be associated with symptoms that represent a breakdown in the experience of bodily integrity, specifically somatic delusions, thought broadcasting and delusions of control. Conversely, we predicted that TOGHs would not be associated with delusions of reference, persecutory, or grandiose delusions. It was also hypothesised that TOGHs would be associated with symptom severity and earlier age of onset, as we propose that these symptoms may represent more severe pathology.

## Materials and Methods

We studied 420 subjects aged 18 to 65 with diagnoses of SZ ( $n = 133$ ), SZA ( $n = 101$ ), or BD I ( $n = 186$ ). Subjects were recruited for a genetic association study of mood and psychotic disorders. Three hundred and fifty hospitalised subjects were recruited from an inpatient unit specialising in SZ and BD; 70 stable outpatients were referred from the hospital community for the genetic association study. The study was approved by the institutional review board, and all subjects provided informed consent.

More than 1600 consecutive admissions to the inpatient unit and 80 outpatient referrals from the hospital community were screened for the study. Patients were excluded if their symptoms could be attributed to a medical illness or substance use or if they carried a diagnosis of a developmental disorder or had a history of head trauma with loss of consciousness.

All patients were assessed by trained research staff. This staff included research assistants as well as attending psychiatrists who assessed patients in their care. The Structured Clinical Interview for DSM-IV-TR (SCID) was used to diagnose primary mood and psychotic disorders and comorbid substance and anxiety disorders. The substance use disorders module of the SCID does not obtain information on tobacco use patterns, and we did not assess tobacco use further in this study. The assessment also included the Positive and Negative Syndrome Scale (PANSS),<sup>11</sup> the Young Mania Rating Scale (YMRS),<sup>12</sup> and the Montgomery-Asberg Depression Rating Scale (MADRS)<sup>13</sup> to evaluate current psychotic and mood symptoms. The SCID assessment, including the assessment of all hallucination symptoms, was based on all available information, including hospital records and information from family members and outside treaters. The presence or absence of hallucinatory experiences in all sensory modalities was recorded as part of the SCID interview and formed the basis of the current analysis.

The psychiatrists and research staff were all trained in the assessments. To maximise consistency and reliability, we undertook monthly diagnostic reliability exercises where a study subject was interviewed in the presence of the entire research team. Each rater assessed the subject independently. Reliability was shown by the rate of agreement, as determined by fraction of raters who showed perfect agreement on a specific measure. Rates of agreement were perfect (1.0) for SCID diagnoses and near-perfect for current (major depression, 1.0; mania, 0.93) and past mood episodes (major depression, 0.90; mania, 1.0), and excellent for specific psychotic symptoms (persecutory delusion, 0.80; AH, 0.85).

In this descriptive study, Fisher's exact tests (for categorical variables) and t-tests (for continuous variables) were used to compare demographic and clinical characteristics across groups. Because TOGHs are relatively infrequent and because hallucinations in these modalities were correlated in our sample ( $r = 0.412$ ,  $P < 0.01$ ), we analysed them in 1 category as TOGHs except where noted. In order to account for the shared effect of hallucinatory experiences, we examined only those patients reporting hallucinations, and divided them into 2 groups: patients reporting TOGHs (often in addition to AH and/or VH) and patients reporting AH/VH-only (unless otherwise

Table 1. Hallucination Frequency by Diagnosis as Percentage of Total Sample (n = 420)

|              | AH   | VH   | TH   | GH  | OH   | TOGH | Any  |
|--------------|------|------|------|-----|------|------|------|
| SZ           | 75.9 | 24.1 | 20.3 | 6.8 | 17.3 | 24.1 | 78.9 |
| SZA          | 68.3 | 28.7 | 20.8 | 2.0 | 22.8 | 29.7 | 73.3 |
| BD           | 27.4 | 16.1 | 8.1  | 2.2 | 8.1  | 11.8 | 41.4 |
| Total sample | 52.4 | 21.7 | 15.0 | 3.6 | 14.5 | 20.0 | 61.0 |

AH: auditory hallucination; VH: visual hallucination; TH: tactile hallucination; GH: gustatory hallucination; OH: olfactory hallucination; TOGH: tactile, olfactory, and gustatory hallucination; SZ: schizophrenia; SZA: schizoaffective disorder; BD: bipolar disorder

noted). For the purposes of those analyses, groups were labeled TOGH or AH/VH-only, respectively. Patients in the AH/VH-only group may have reported AH, VH, or both, but denied lifetime TOGHs.

## Results

As expected, hallucinations were common and seen across diagnoses (Table 1). AH were the most common, followed by VH and then TOGHs. Patients with BD and psychosis were less likely to hallucinate than those with SZ or SZA. Patients with TOGHs did not differ from patients with AH/VH-only on age at assessment, ethnicity, sex, or educational attainment (Table 2). All hallucination modalities were correlated with one another, with Pearson Correlations ranging from 0.256 ( $P < 0.01$ ) between AH and Gustatory/Olfactory hallucinations to 0.412 ( $P < 0.01$ ) between Tactile and Gustatory/Olfactory hallucinations.

Patients with TOGHs were compared to patients with AH/VH-only on clinical variables using *t*-tests for continuous variables and Fisher's exact test for dichotomous and ordinal variables (Table 3). Consistent with our *a priori* predictions, TOGHs were associated with somatic delusions, delusions of control, and thought broadcasting but not grandiose, paranoid, or bizarre delusions or delusions of reference. TOGHs were associated with lifetime history of a major depressive episode, earlier age of onset, and family history of mood disorders. There was no association between TOGHs and PANSS, YMRS, or MADRS scores, lifetime history of substance abuse or dependence, or family history of psychotic illness.

## Discussion

The present study examined hallucinatory experiences in patients with psychotic illness, focusing on TOGHs. As expected, rates of hallucinations across modalities differed by diagnostic group: patients with SZ and SZA reported higher rates of hallucinations than patients with BD across all sensory modalities. Meyer and Meyer<sup>8</sup> reported that mentioning hallucinations decreased the likelihood of diagnosing BD in a study in which psychiatrists were asked

Table 2. Demographic Features based on Hallucination Modalities

|                         | TOGH<br>(n = 84) | AH/VH-only<br>(n = 172) |
|-------------------------|------------------|-------------------------|
| Age                     | 37.8 (11.5)      | 38.1 (12.5)             |
| Gender (% male)         | 50.0             | 58.0                    |
| Ethnicity (% Caucasian) | 57.4             | 62.5                    |
| Education*              | 4.1 (1.7)        | 4.5 (1.7)               |

AH: auditory hallucination; TOGH: tactile, olfactory, and gustatory hallucination; VH: visual hallucination

No comparison was statistically significant

\* Note that education is coded based on the SCID Education and Work History scale: 1 = grade 6 or less; 2 = grade 7-12 (without graduating); 3 = high school grad or equivalent; 4 = part college; 5 = graduated 2 year college; 6 = graduated 4 year college; 7 = part graduate/professional school; 8 = completed graduate/professional school

to assign diagnoses to case vignettes. However, hallucinations in all sensory modalities were endorsed by patients with BD, suggesting that no one type of hallucinatory experience is pathognomonic to any given diagnosis.

Additionally, we examined TOGHs in patients across diagnoses and in relationship to other clinical variables. Similar to hallucinations in general, patients across all diagnoses reported TOGHs, albeit at different rates, ranging from approximately 12% in BD to nearly 30% in SZA. The high rates of TOGHs in the present sample suggest that they are a common feature of idiopathic psychotic disorders, and not a marker of organic brain disease. In our experience, TOGHs are not usually assessed in routine clinical care and rarely play a role in the case formulation. Our findings suggest that these experiences are common and associated with specific additional features. We therefore recommend that clinicians address hallucinatory experiences with patients with affective illness in addition to those with primary psychosis, as these experiences are not uncommon in patients with BD. Additionally, it is recommended that clinicians ask specifically about TOGHs during clinical evaluation of patients with psychotic disorders, as these experiences are associated with specific clinical symptoms such as somatic delusions and depression.

It should be noted that there is an inherent problem in examining psychiatric symptoms by diagnosis when those symptoms are also an element of the diagnosis. Thus, our main predictions involved the association of TOGHs with other symptoms across diagnostic groups. As we predicted, TOGHs were also associated with somatic delusions, delusions of control, and thought broadcasting but not with other kinds of delusions. We expected somatic delusions to be associated with TOGHs because many patients report a complex of somatic delusions associated with hallucinatory experiences (e.g. delusion of rotting internal organs and an

Table 3. Clinical Characteristics Associated with TOGH

|                                      | <b>TOGH<br/>(n = 84)</b> | <b>AH/VH-only<br/>(n = 172)</b> | <b>Fisher's exact test<br/>(two-tailed)</b> |
|--------------------------------------|--------------------------|---------------------------------|---|
| Any delusion†                        | 96.4%                    | 93.0%                           | <i>P</i> = 0.214                            |
| Reference                            | 80.2%                    | 75.1%                           | <i>P</i> = 0.425                            |
| Persecutory                          | 68.7%                    | 64.5%                           | <i>P</i> = 0.573                            |
| Grandiose                            | 39.0%                    | 44.3%                           | <i>P</i> = 0.496                            |
| Somatic                              | 31.3%                    | 12.8%                           | <i>P</i> = 0.001**                          |
| Control                              | 34.6%                    | 21.3%                           | <i>P</i> = 0.030*                           |
| Broadcasting                         | 50.0%                    | 29.3%                           | <i>P</i> = 0.002**                          |
| Bizarre                              | 24.3%                    | 15.8%                           | <i>P</i> = 0.144                            |
| Major depressive episode†            | 66.7%                    | 51.7%                           | <i>P</i> = 0.016*                           |
| Manic episode†                       | 44.0%                    | 51.2%                           | <i>P</i> = 0.175                            |
| Catatonia†                           | 8.3%                     | 8.7%                            | <i>P</i> = 0.562                            |
| Negative symptoms†                   | 35.7%                    | 26.7%                           | <i>P</i> = 0.093                            |
| Comorbid substance abuse/Dependence† | 56.0%                    | 52.3%                           | <i>P</i> = 0.340                            |
| Family history of psychosis†         | 17.9%                    | 20.9%                           | <i>P</i> = 0.344                            |
| Family history of mood disorder†     | 56.0%                    | 43.6%                           | <i>P</i> = 0.042*                           |
|                                      |                          |                                 | <i>t</i> -test                              |
| Current symptoms                     |                          |                                 |   |
| PANSS Total                          | 71.1 (20.7)              | 72.7 (22.8)                     | 0.54  |
| PANSS Positive                       | 20.6 (7.3)               | 21.0 (7.3)                      | 0.45  |
| PANSS Negative                       | 16.4 (7.3)               | 15.8 (7.9)                      | -0.60                                       |
| PANSS General                        | 34.1 (10.7)              | 35.9 (11.9)                     | 1.16  |
| YMRS                                 | 14.2 (10.6)              | 16.8 (12.1)                     | 1.76  |
| MADRS                                | 15.4 (10.6)              | 15.5 (9.9)                      | 0.01  |
| Age of onset                         | 19.2 (5.6)               | 21.6 (7.3)                      | 2.64**                                      |

AH: auditory hallucination; TOGH: tactile, olfactory, and gustatory hallucination; VH: visual hallucination

\**P* < 0.05; \*\**P* < 0.01

† variables coded as present or absent

associated smell, or delusion of organs being rearranged associated with bodily sensations of the same). The latter 2 delusions (of control, and of thought broadcasting) reflect, broadly speaking, a breakdown of boundaries between the person's perception of self and non-self. We predicted that these would also be associated with TOGHs because these hallucinations are often associated with a gross distortion in one's experience of one's own body.

The association between TOGHs and lifetime history of depressive episodes was unexpected. This finding was particularly striking because it was found when patients experiencing TOGHs were compared with patients experiencing AH/VH-only, and it did not exist between TOGHs and lifetime manic episodes or comorbid substance use disorders. This finding awaits replication in future studies.

We also found that TOGHs are associated with an earlier age of onset of psychotic illness. Earlier age of onset is considered a marker of more severe illness,<sup>14</sup> suggesting that TOGHs may occur in patients who are otherwise more severely ill. We did not collect chronological information on TOGHs, however, and we cannot speculate on whether these experiences were present early in the course of illness. It should be noted that TOGHs were not associated with severity of present exacerbation based on scores on the MADRS, YMRS, or PANSS. This indicates that TOGHs are not simply associated with acute symptom state, although they were associated with lifetime history of specific types of symptoms as described above. These complex relationships should be considered during clinical evaluation, as present state severity may not be indicative of the lifetime experience of specific symptoms or overall symptom severity.

The present study does have several limitations. First, our sample consisted largely of acutely ill inpatients at a tertiary referral center, limiting the generalisability of our findings to less severely afflicted populations. Second, we relied on patient report during structured interviews to ascertain most clinical variables, and distortions may be present in patient reports of age at onset, past mood and psychotic symptoms and other variables. Third, we did not record whether psychotic symptoms in BD were mood congruent or incongruent, although this detail may distinguish among groups of patients. Perhaps most importantly, TOGHs may be secondary to medical or neurological conditions in our patient population. We do not believe this is likely for 2 reasons. First, while we did not document neurological work-up to rule out organic brain disease as part of our research study, patients with presentations suggestive of underlying organic aetiology are routinely worked up as part of their clinical care in our institution and patients with neurological and medical conditions leading to psychosis were excluded from the study. Second, the comparable ages of the TOGH and AH/VH-only groups is reassuring that the age-related emergence of medical or neurological conditions did not impact our findings. However, while we expect that our findings would apply to idiopathic psychotic disorders and are unlikely to be explained by medical or neurological comorbidities, we cannot definitively rule out the possibility of organic causation of TOGHs in our sample, as comprehensive work-ups were not conducted as part of the study protocol, and medical work-ups may fail to screen for all possible organic causes of these experiences. Finally, while we examined patients with psychosis across several psychiatric disorders, we were not able to systematically examine patients with other disorders in which hallucinations are reported, including Major Depressive Disorder, OCD, and other conditions. Future work should examine TOGHs in other psychiatric conditions in which hallucinations are known to occur in terms of prevalence and association with other psychiatric symptoms.

While our findings do not provide specific information about the neurobiology of TOGHs, the fact that these experiences are correlated with other hallucination modalities and are common across psychotic disorders suggests that TOGHs may represent manifestations of the same pathological process leading to AH/VH, but extended into brain regions responsible for processing tactile, olfactory, and gustatory information. Hallucinations tend to be associated with activation in brain regions involved in normal sensory processing.<sup>15</sup> However, our findings of significant correlations across hallucination modalities

suggest some degree of shared neurobiology underlying these experiences. As detailed information regarding the neurobiology of AH and VH becomes available, we expect that this information will be relevant for TOGHs as well. For example, we would predict that postmortem and neuroimaging abnormalities identified in the auditory cortex in patients who experience auditory hallucinations may be mirrored in similar abnormalities in somatosensory, olfactory, and gustatory cortices in patients with TOGH. Such abnormalities may relate to deficient filtering of irrelevant stimuli in sensory cortices. Finally, the association of TOGHs with earlier age of onset may indicate that patients experiencing these symptoms have greater vulnerability to developing major psychiatric illness, or experience more severe symptoms or course. Longitudinal investigations and studies with at-risk or prodromal populations may help address these questions.

#### REFERENCES

1. Wing JK, Cooper JE, Sartorius N. *Measurement and Classification of Psychiatric Symptoms*, Cambridge, UK: Cambridge University Press, 1974.
2. Bracha HS, Wolkowitz OM, Lohr JB, Karson CN, Bigelow LB. High prevalence of visual hallucinations in research subjects with chronic schizophrenia. *Am J Psychiatry* 1989;146:526-8.
3. Jansson B. The Clinical significance of various types of hallucinations in young people. *Acta Psychiatr Scand* 1969;44:401-9.
4. Mueser KT, Bellack AS, Brady EU. Hallucinations in schizophrenia. *Acta Psychiatr Scand* 1990;82:26-9.
5. Pryse-Phillips W. Disturbance in the sense of smell in psychiatric patients. *Proc R Soc Med* 1975;68:472-74.
6. Small IF, Small JG, Anderson JM. Clinical characteristics of hallucinations of schizophrenia. *Dis Nerv Syst* 1966;27:349-53.
7. Baethge C, Baldessarini RJ, Freudenthal K, Streeruwitz A, Bauer M, Bschor T. Hallucinations in bipolar disorder: characteristics and comparison to unipolar depression and schizophrenia. *Bipolar Disord* 2005;7:136-45.
8. Goodwin DW, Alderson P, Rosenthal R. Clinical significance of hallucinations in psychiatric patients: a study of 116 hallucinatory patients. *Arch Gen Psychiatry* 1971;24:76-80.
9. Meyer F, Meyer TD. The misdiagnosis of bipolar disorder as a psychotic disorder: Some of its causes and their influence on therapy. *J Affect Disord* 2009;112:174-83.
10. Bowman KM, Raymond AF. A statistical study of hallucinations in the manic depressive psychoses. *Am J Psychiatry* 1931;88:299-309.
11. Kay SR, Fiszbein A, Opler LA. The Positive and Negative Syndrome Scale (PANSS) for schizophrenia. *Schizophr Bull* 1987;13:261-76.
12. Young RC, Biggs JT, Ziegler VE, Meyer DA. A rating scale for mania: reliability, validity and sensitivity. *Br J Psychiatry* 1978;133:429-35.
13. Montgomery SA, Asberg M. A new depression scale designed to be sensitive to change. *Br J Psychiatry* 1979;134:382-9.
14. Öngür D, Lin L, Cohen BM. Age of onset in psychotic disorders. *Compr Psychiatry* 2008;50:13-9.
15. Weiss AP, Heckers S. Neuroimaging of hallucinations: a review of the literature. *Psychiatry Res* 1999;92:61-74.