

Phenomenological and Cognitive Features Associated With Auditory Hallucinations in Clinical and Nonclinical Voice Hearers

James M. Gold^{*1,○}, Philip R. Corlett^{2,○}, Molly Erickson³, James A. Waltz^{1,○}, Sharon August¹, Jenna Dutterer¹, and Sonia Bansal^{1,○}

¹Maryland Psychiatric Research Center, Department of Psychiatry, University of Maryland School of Medicine, Baltimore, MD, USA; ²Department of Psychiatry, Connecticut Mental Health Center, Yale University, New Haven, CT and Wu Tsai Institute, Yale University, New Haven, CT, USA; ³Department of Psychiatry and Behavioral Neuroscience, University of Chicago, Chicago, IL, USA

*To whom correspondence should be addressed; Maryland Psychiatric Research Center, Department of Psychiatry, University of Maryland School of Medicine, 55 Wade Ave, Baltimore, MD 21228, USA; tel: 410 402 7871, fax: 410 402 7198, e-mail: jgold@som.umaryland.edu

Background and Hypotheses: Auditory verbal hallucinations (AVH) are central features of schizophrenia (SZ). However, AVH also occur in a small percentage of the general population who do not have a need for care, termed nonclinical voice hearers (NCVH). We sought to determine the degree to which the experience of AVH was similar in NCVH and in people with schizophrenia (PSZ) and evaluate the degree to which NCVH shared other features of SZ such as delusional beliefs, cognitive impairment, and negative symptoms. **Study Design:** We recruited 76 people with a DSM-V diagnosis of SZ/schizoaffective disorder (PSZ; 49 with current AVH, 27 without), 48 NCVH, and 51 healthy controls. Participants received a broad battery of clinician-administered and self-report symptom assessments and a focused cognitive assessment. **Study Results:** The AVH of NCVH and PSZ shared very similar sensory features. NCVH experienced less distress, had greater control over their AVH, and, unlike PSZ, rarely heard 2 voices speaking to each other. NCVH demonstrated a wide range of deeply held unusual beliefs, but reported less paranoia, and fewer first-rank symptoms such as passivity and alterations in self-experience. NCVH showed no evidence of cognitive deficits or negative symptoms. **Conclusions:** The AVH in NCVH and PSZ demonstrate important similarities as well as clear differences. Specific features, rather than the presence, of AVH appear to determine the need for care. NCVH do not share the cognitive and motivational deficits seen in PSZ. These results suggest that AVH and unusual beliefs can be separated from the broader phenotype of SZ.

Key words: psychosis/schizophrenia/positive symptoms/delusions/first-rank symptoms/psychic mediums

Introduction

Auditory verbal hallucinations (AVH) are considered a cardinal feature of schizophrenia (SZ). They occur in the majority of people with schizophrenia (PSZ) and often persist in spite of antipsychotic treatment often causing significant distress and frequently portending the most catastrophic outcomes: suicide and violence.¹⁻⁵ From a traditional categorical framework of psychiatric diagnosis, the presence of persistent hallucinations in the absence of a mood episode is nearly pathognomonic of a SZ diagnosis.

This view of the clinical significance of hallucinations has been challenged by multiple epidemiological studies that have reported the occurrence of AVH in a small percentage of the general population without the diagnosis of a psychotic disorder.^{6,7} While the prevalence of AVH varies widely across studies and methods, it has become clear that the experience of AVH is not limited to people with a diagnosis of severe mental illness.⁸ For members of the general population the experience of hallucinations is typically fleeting. However, there is a small group of people who report frequent AVH over a period of years who do not require psychiatric care.⁹ Many of these individuals often experience AVH in the context of spiritual beliefs and may identify themselves as psychic mediums, who can receive vocal messages from people and spirits who are not physically present.^{10,11} We refer to such individuals as nonclinical voice hearers (NCVH).

The AVH of NCVH can be evaluated as occurring on 2 different continua relative to SZ: (1) one of experience or (2) one of disorder. A continuum of experience suggests that AVH, while unusual, can occur fully independently of SZ or other psychiatric disorder. In that

conceptualization there is no reason to expect that AVH would be associated with other features of SZ such as cognitive and motivational impairments or delusion-like beliefs. Instead, there may be differences in the experience of AVH that explains why PSZ have a need for care while NCVH do not. There is suggestive evidence consistent with this view, as multiple studies have found that many NCVH experience a greater degree of control over, and less distress associated with their voices than do many PSZ.^{12–17}

In contrast, a continuum of disorder conceptualization suggests that NCVH occupy an intermediate position between health and SZ and might be considered an extreme form of schizotypy. In that case, one would expect NCVH to show a milder form of the SZ phenotype including cognitive impairment, unusual beliefs, and negative symptoms.¹⁸ Sommer et al.¹⁰ reported evidence partially consistent with this view, as their NCVH sample had elevated scores on the cognitive-perceptual, disorganization, and interpersonal scales of the Schizotypal Personality Questionnaire as well as elevated scores on the Peters Delusion Inventory relative to healthy controls. They also observed evidence of thought disorder,¹⁹ elevated rates of childhood trauma, and family history of psychosis, which are considered risk factors for SZ.^{20,21} However, their group of NCVH showed inconsistent and subtle evidence of cognitive deficits relative to controls—less than might be expected if NCVH are shifted further along the continuum towards SZ than is characteristic of schizotypy.²² Similarly, Peters et al. reported that their cohort with unusual experiences (most with hallucinations) had normal intelligence and no evidence of negative symptoms.²³ Thus, the available literature provides partial support for the heuristic value of both continua.

Our goal was to evaluate the evidence for these 2 models by comparing NCVH to PSZ with and without current hallucinations as well as healthy controls. We performed detailed clinician-rated and self-report assessments of the phenomenology of their AVHs as well as hallucinations in other modalities so that we could evaluate the degree to which the experienced hallucinations were similar in NCVH and PSZ. To evaluate the continuum of disorder, we conducted a broad assessment of other psychiatric symptoms, unusual experiences and beliefs, and affective experience. We also delivered a targeted cognitive assessment including measures of premorbid intellectual ability²⁴ as well as the Processing Speed, Working Memory, and Verbal learning subtests from the MATRICS Consensus Cognitive battery.²⁵ There is robust evidence that PSZ perform approximately 1 standard deviation below the healthy population mean in each of these areas.²⁶ To the degree that NCVH is on the continuum of illness, we would expect to see evidence of impairment relative to controls in each of these domains. Structural and functional neuroimaging and EEG results from this cohort will be reported elsewhere.

METHODS

Participants

A total of 76 people with a DSM-5²⁷ diagnosis of SZ or schizoaffective disorder, were recruited from the outpatient clinics of the Maryland Psychiatric Research Center, other nearby outpatient clinics, and from the outpatient clinics at Yale University. Diagnosis was established using the Structured Clinical Interview for DSM-5.²⁸ All PSZ were clinically stable outpatients who had been receiving the same antipsychotic medications at the same dose for at least 4 weeks prior to study participation. PSZ were recruited with varying severity of AVH ranging from no voices in the past week ($N = 27$), moderately severe voices over the last week (scores of 3–4 on the Brief Psychiatric Rating Scale (BPRS)²⁹ hallucinations item, $N = 16$) and severe voices over the past week (scores of 5–6, $N = 33$). Healthy control subjects (HCs, $N = 51$) were recruited via online advertisements and local bulletin boards. They were screened using the Structured Clinical Interview for DSM-5 and the SZ Related Disorders sections from the Structured Interview for DSM-5 Personality Disorders.³⁰ All HCs were not taking psychotropic medication, had no current Axis I disorder or Axis II SZ spectrum disorder, neurological disorder, or cognitively impairing medical disorder, with no history of psychotic disorders in first-degree relatives. We recruited 48 NCVH using a variety of methods including print and online advertisements seeking people who were clairaudient, mailing of flyers to people who had websites claiming to be psychic mediums, in-person approaches at alternative health fairs where psychic mediums were offering services to the general public, and word-of-mouth among study participants. NCVH were screened with the same methods used with HCs, with the same inclusion and exclusion criteria. None of the NCVH evidenced the functional impairment required for a diagnosis of SZ, or evidence the interpersonal deficits characteristic of Schizotypal Personality Disorder. [Table 1](#) shows the demographic features of the groups as well as results of statistical tests. Given the older age and higher proportion of female sex in the NCVH group compared to the other groups, these variables were used as co-variables in all analyses. All participants provided informed consent for protocols approved by the University of Maryland and Yale Institutional Review Boards.

Assessments

In order to evaluate the phenomenology of AVH we used the clinician-rated Chicago Hallucinations Assessment Tool (CHAT).³¹ The CHAT has items addressing the *sensory* features of AVH including how often they occur, how long the AVH lasts, the loudness of the voices, and the complexity of the content. Other items address the *cognitive* features of the AVH, such as the extent to which they capture attention, interrupt other thought processes,

Table 1. Participant Characteristics

	HCs (N = 51)	NCVH (N = 48)	PSZH* (N = 49)	PSZH* (N = 27)	Statistic	P-value	Post hoc test [r (P)]					
							HCS- NCVH	HCS- PSZH+	HCS- PSZH-	HCS-PSZH-	NCVH- PSZH+	NCVH- PSZH-
Age (y)	38.61 (12.89)	48.67 (10.33)	35.88 (12.93)	34.26 (11.55)	F = 12.47	<.001	-4.15 (<.001)	1.13 (0.67)	1.52 (0.43)	5.23 (<.001)	4.97 (<.001)	0.56 (0.94)
Gender (F M)	30 21	34 14	17 32	7 20	$\chi^2 = 20.77$	<.001	$\chi^2 = 1.56$, P = .21	$\chi^2 = 5.84$, P = .02	$\chi^2 = 7.66$, P = .006	$\chi^2 = 6.09$, P = .01	$\chi^2 = 7.88$, P = .005	$\chi^2 = 0.62$, P = .43
Race (Asian African American Caucasian Other)	5 9 32 5	1 5 37 5	2 14 28 5	2 11 13 1	$\chi^2 = 15.26$	0.08	$\chi^2 = 4.08$, P = .25	$\chi^2 = 2.60$, P = .46	$\chi^2 = 5.29$, P = .15	$\chi^2 = 5.83$, P = .12	$\chi^2 = 11.81$, P = .008	$\chi^2 = 2.34$, P = .50
Participant education	16.16 (2.23)	15.52 (2.29)	13.92 (2.15)	14 (2.10)	F = 10.05	<.001	1.4 (0.5)	4.71 (<.001)	3.99 (<.001)	3.27 (0.01)	2.75 (0.03)	-0.14 (1)
WTAR	113.85 (13.14)	112.88 (9.87)	103.87 (13.71)	103.96 (15.44)	F = 7.21	<.001	0.35 (0.99)	3.72 (0)	3.11 (0.01)	3.3 (0.01)	2.78 (0.03)	-0.03 (1)
MD processing speed	54.85 (12.57)	53.48 (8.51)	42.09 (11.54)	42.58 (13.02)	F = 14.43	<.001	0.56 (0.94)	5.37 (<.001)	4.39 (<.001)	4.6 (<.001)	3.78 (0)	-0.17 (1)
MD working memory	53.57 (8.49)	50.88 (8.36)	45.11 (12.03)	42.04 (12.12)	F = 9.71	<.001	1.23 (0.61)	3.99 (<.001)	4.61 (<.001)	2.61 (0.05)	3.43 (0)	1.22 (0.61)
MD verbal learning	48.23 (8.19)	47.00 (7.51)	41.11 (10.34)	42.38 (9.25)	F = 6.47	<.001	0.65 (0.92)	3.87 (<.001)	2.7 (0.04)	3.09 (0.01)	2.07 (0.17)	-0.59 (0.94)
CPZ dose equivalent (mg/d)	n/a	n/a	448.25 (257.28)	374.44 (302.68)	t = 1.12	0.26	n/a	n/a	n/a	n/a	n/a	1.12 (0.26)
Age of onset of voices (y)	n/a	15.16 (11.88)	19.20 (5.80)	23.19 (8.71)	F = 2.97	0.056	n/a	n/a	n/a	-1.40 (0.34)	-2.43 (0.04)	-1.55 (0.27)

Note: WTAR, Wechsler Test of Adult Reading (A neuropsychological assessment tool used to provide a measure of premorbid intelligence); MD, MCCB (MATRICS Consensus Cognitive Battery) Cognitive Domain; CPZ, Chlorpromazine equivalent dose (dose of antipsychotic that is comparable to 100 mg of Chlorpromazine). Italicized p-values indicate statistical significance.

*This information was obtained for 40 NCVH, all 49 PSZH+, and 22 PSZH- (of which, 6 had never experienced auditory hallucinations).

interfere with processing other sounds, and the person's ability to control their experience of AVH. The *emotional* consequences of hearing AVH is evaluated by items addressing the amount and extent of negative content (such as voices that are critical or threatening) as well as the frequency and severity of distress associated with experience of hearing the voices. In addition, we administered the self-report Launay Slade Hallucinations Scale (LSHS) which is widely used in the literature.³² We evaluated the broader extent of symptoms using the BPRS and the Clinical Assessment Interview for Negative Symptoms (CAINS).³³ We used the Peters Delusion Inventory (PDI) and General Conspiracists Belief (GCB) scale to evaluate unusual beliefs.^{34,35} The PDI enquires about a wide range of unusual beliefs including passivity experiences, grandiose, persecutory, religious beliefs, and a wide range of unconventional beliefs. The GCB assesses concerns over government malfeasance, malevolent global conspiracies, cover-up of information about the existence of aliens, etc. (supplementary figure 1). We administered the Aberrant Salience Inventory³⁶ (supplementary figure 2) to assess attributions of unusual significance to everyday events and heightened sensory and emotional experience thought to be consistent with Kapur's aberrant salience model of the development of psychosis.³⁷ We administered the Positive and Negative Affect scale³⁸ to assess their predominant emotional experience, and the Childhood Trauma Questionnaire (CTQ)³⁹ as early trauma has been identified as a risk factor for AVH.²¹ Finally, we created a 10-item Schneiderian First Rank Symptom (FRS) scale that evaluated the presence of voices talking to each other, experiences of passivity and altered control.⁴⁰⁻⁴² A FRS score was derived by taking self-reported items from the PDI, the Community Assessment of Psychic Experience,⁴³ and the Scales for the Assessment of Positive Symptoms (SAPS⁴⁴; see supplementary section 3 for the items). This broad assessment approach allowed us to characterize the phenomenology of voice hearing, as well as other aspects of psychopathology and experience that might differentiate the groups of voice hearers.

Data Analysis

For most analyses, we split the PSZ group into those with current hallucinations (PSZH+) and those without current hallucinations as documented on the BPRS (PSZH-). We used ANCOVA, controlling for the effects of age and gender, to compare the 4 groups (HCs, NCVH, PSZH+, and PSZH-), followed by post hoc *t*-tests. HCs did not receive the CHAT or the CAINS, and the analyses of those measures only included the NCVH, PSZH+, and PSZH-.

RESULTS

The NCVH were significantly older than the other 3 groups and had a higher proportion of females than the 2 PSZ

groups (table 1). Across all groups, the majority of participants identified as Caucasian (47%), while 18% identified as African American, 7% as Asian, and 12% as other. PSZH+ and PSZH- completed fewer years of education than the other groups, who did not differ from one another.

Cognitive Performance

As seen in table 1, the NCVH and HCs scored very similarly to each other, and significantly higher than PSZ on the WTAR and the MCCB Processing Speed, Working Memory, and Verbal Learning domain scores. Thus, NCVH do not share the broad cognitive impairment that is characteristic of PSZ.

Features of AVH

As seen in figure 1A, PSZH+ scored slightly higher than the NCVH on the BPRS Hallucination Item (statistics reported in table 2). As assessed by the CHAT (figure 1B), we observed that the sensory features of AVH were very similar between PSZH+ and NCVH. On average, both groups reported hearing voices more than once per week but less than daily, with the voice hearing experience lasting several minutes on each occasion. PSZH+ and NCVH reported the loudness as about the same loudness as the participant's own voice (figure 1B, Sensory domain; see also supplementary figure 4A). However, the groups differed on the cognitive and emotional features of their AVH: PSZH+ experienced more negative content and emotion distress (figure 1B, Emotion Scores; see also supplementary figure 4A). Notably, NCVH reported a greater degree of control over their voices, whereas PSZH+ reported that their AVH more frequently interrupted their train of thought, interfered with their perception of other sounds, and made greater demands on their attention than reported by NCVH (figure 1B, Cognitive Scores; see also supplementary figure 4A). The NCVH had significantly higher ratings on visual hallucinations than seen in PSZH+ (supplementary figure 4B). The NCVH and PSZH+ scored similarly to one another, and significantly higher than NCs and PSZH-, on the LSHS (figure 1C). The clearest difference between NCVH and PSZH+ was in the endorsement of FRS (figure 1D), such as the experience of hearing 2 voices talk to each other (46% if PSZH+ compared to 6% in NCVH; see supplementary figure 3B), consistent with data from Peters.²³

Unusual Beliefs

As seen in figure 2A, NCVH had higher ratings on grandiosity (mostly related to their psychic abilities) than either SZ group (statistics reported in table 2). In contrast, PSZH+ had significantly higher ratings on suspiciousness than NCVH with PSZH- scoring in an intermediate fashion (figure 2B). HCs scored significantly lower than

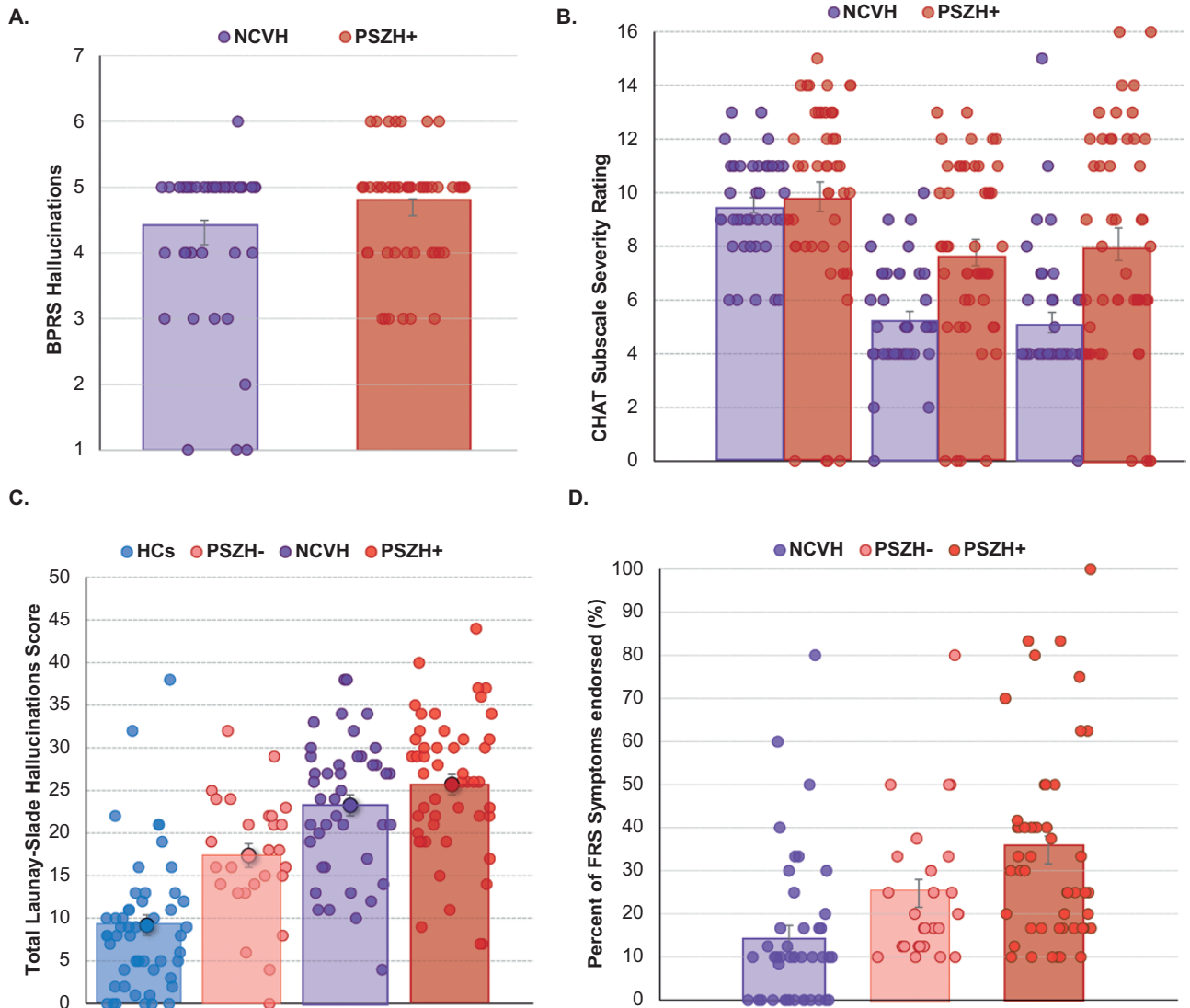


Fig. 1. Features of auditory verbal hallucinations (AVH). For all plots, individual data points indicate each subject’s respective score. A. Mean BPRS Hallucinations score per group; B. mean CHAT subscale severity score per group for NCVH and PSZH+, respectively; C. mean total LSHS score per group for all groups; D. percentages of Schneider’s First Rank Symptoms (FRS) endorsed per group.

the other 3 groups on the Peters Delusion Inventory (figure 2C). SZH+ and NCVH scored similarly to each other, with lower scores observed in PSZH-. The groups arrived at their total PDI scores by endorsing somewhat different items: NCVH reported more grandiosity whereas PSZH+ reported more suspiciousness and delusions of passivity/control (see supplementary figure 5A). NCVH had very similar levels of conviction and preoccupation to that seen in PSZ but show lower levels of distress associated with their beliefs than seen in PSZH+, consistent with their report of less distress associated with their AVH noted above (see supplementary figure 5B). NCVH endorsed significantly fewer Schneiderian FRS than did PSZH+ or PSZH- (figure 1D; supplementary figure 3A and B).

As seen in Figure 2D, NCVH, PSZH+ and H- all scored significantly higher than did HCs on the General

Conspiracist Belief scale. On the Aberrant Salience Inventory, the HCs scored significantly lower than the other 3 groups, with the NCVH tending to have higher scores than the 2 SZ groups (see supplementary figure 3). Thus, the unusual beliefs and experiences of NCVH are not solely focused around their spiritual beliefs and ideas related to their psychic abilities. Further, despite similar scores on much of the PDI and GCB scales, the groups clearly separate on the Schneiderian First Rank Symptom items (figure 1D) which have long been considered as evidence of a psychotic disorder.⁴⁰

Emotional Experience and Negative Symptoms

The groups exhibited robust differences in emotional experience and in expressive and experiential negative

Table 2. Statistics

	ANCOVA [F(P)]	Post hoc test [t (P)]					
		HCS–NCVH	HCS–PSZH ⁺	HCS–PSZH ⁻	NCVH–PSZH ⁺	NCVH–PSZH ⁻	PSZH ⁺ –PSZH ⁻
Hallucinations							
BPRS hallucinations	249.62 (<.001)	-17.96 (<.001)	-22.02 (<.001)	0.17 (1.00)	-2.47 (0.07)	14.66 (<.001)	18.89 (<.001)
Total LSHS	39.48 (<.001)	-8.13 (<.001)	-9.81 (<.001)	-4.00 (<.001)	-0.98 (0.76)	2.95 (0.02)	4.27 (<.001)
CHAT sensory	90.64 (<.001)	<i>Not assessed in controls</i>			-1.76 (0.19)	9.72 (<.001)	13.24 (<.001)
CHAT cognitive	72.09 (<.001)				-4.94 (<.001)	5.9 (<.001)	11.94 (<.001)
CHAT emotional	53.71 (<.001)				-4.1 (<.001)	5.25 (<.001)	10.32 (<.001)
Unusual beliefs							
BPRS grandiosity	41.84 (<.001)	-10.94 (<.001)	-4.51 (<.001)	-1.41 (0.49)	6.36 (<.001)	7.55 (<.001)	2.39 (0.08)
BPRS suspiciousness	13.17 (<.001)	-0.78 (0.86)	-5.93 (<.001)	-3.31 (0.01)	-4.5 (<.001)	-2.36 (0.09)	1.67 (0.34)
Total PDI-40	25.61 (<.001)	-7.18 (<.001)	-7.48 (<.001)	-3.64 (0.00)	0.18 (1)	2.5 (0.06)	2.65 (0.04)
*Average conspiracy beliefs(GCB)	10.08 (<.001)	-5.14 (<.001)	-3.85 (0.00)	-2.58 (0.05)	1.46 (0.46)	1.82 (0.27)	0.65 (0.92)
Affect and negative symptoms							
PANAS negative affect	6.64 (<.001)	-0.34 (0.99)	-3.76 (0.00)	-3.25 (0.01)	-3.00 (0.02)	-2.66 (0.04)	-0.12 (1.00)
PANAS positive affect	8.10 (<.001)	0.67 (0.91)	3.85 (0.00)	4.13 (<.001)	2.76 (0.03)	3.19 (0.01)	0.93 (0.79)
CAINS MAP	17.05 (<.001)	<i>Not assessed in controls</i>			-4.22 (<.001)	-5.75 (<.001)	-2.54 (0.03)
CAINS EXP	13.29 (<.001)				-2.98 (0.01)	-5.15 (<.001)	-3.07 (0.01)
Childhood trauma							
CTQ emotional abuse	4.07 (0.01)	-3.47 (0.00)	-1.62 (0.37)	-1.46 (0.46)	1.86 (0.25)	1.48 (0.45)	-0.12 (1.00)
CTQ emotional neglect	2.70 (0.05)	-2.71 (0.04)	-1.73 (0.31)	-0.64 (0.92)	1.03 (0.73)	1.6 (0.38)	0.82 (0.85)

Note: BPRS, Brief Psychiatric Rating Scale; LSHS, Launay-Slade Hallucinations Scale; CHAT, Chicago Hallucinations Assessment Tool (*Sensory = Physical characteristics of a hallucination; Cognitive=Items related to interference with cognitive processes; Emotional = Items related to negative emotional valence of and distress caused by hallucination*); PDI-40, Peter’s Delusion Inventory (40-item);GCB, Generic Conspiracist Beliefs scale; PANAS, Positive and Negative Affect Scale; CAINS, Clinical Assessment Interview for Negative Symptoms; MAP, Motivation and Pleasure subscale; EXP, Expression subscale; CTQ, Childhood Trauma Questionnaire.

symptoms as seen in figure 3 (statistics in table 2). NCVH report significantly higher levels of positive affect and lower levels of negative affect than either SZ group on the PANAS. The increased negative affect in PSZ is consistent with the findings of increased levels of distress associated with AVH and unusual beliefs, noted above. On the CAINS, NCVH had substantially lower scores on both experiential and expressive negative symptoms.

Childhood Trauma

On the CTQ, NCVH reported significantly higher levels of Emotional Abuse and Emotional Neglect than did HCs. Neither PSZ group reported more abuse than HCs or NCVHs. None of the groups differed from HCs in reports of sexual abuse, physical abuse, or physical neglect (see supplementary figure 5; statistics in table 2).

DISCUSSION

Our results identify a mixture of both clear differences and clear similarities between NCVH and PSZH+. The NCVH group performed very similarly to the HCs (and very differently from PSZH+ and PSZH-) on multiple measures of cognitive abilities as well as reports of emotional experience and ratings of negative symptoms. This suggests that these are features associated with illness, and the functional disability that is characteristic of many

PSZ. In contrast, the sensory experience of AVH—how often they occur, how loud they are, how long the experience lasts, and the complexity of the content—is remarkably similar between NCVH and PSZH+, consistent with prior reports.¹¹⁻¹⁴ Thus, the regular experience of AVH in the absence of an observable source of this auditory signal over a period of years is not necessarily associated with the presence of a mental illness (ie, a need for care).

Although the quality of the AVH sensory experience is similar between NCVH and PSZ there are several key differences. First, the emotional response to voices differs between groups. In PSZ, the experience of AVH is often distressing, while that is rarely the case in NCVH. The distress in PSZ arises, in part, because the content of the voices is often critical, or threatening as noted by others.^{9,12,16} This is very rarely the case in NCVH, who typically report that the voices convey important and helpful information, and their ability to hear voices enhances their self-esteem. As psychic mediums, NCVH hear voices speaking to and through them. In contrast, the voices in PSZ are often demeaning of the hearer, or the voices are fully autonomous as in the experience of voices speaking to each other, a common experience in PSZ but rare in NCVH. Thus, the experience of self in relationship to voices is quite different in PSZ compared to NCVH.

A second key difference in the perceived sense of control: most NCVH have the ability to initiate and terminate

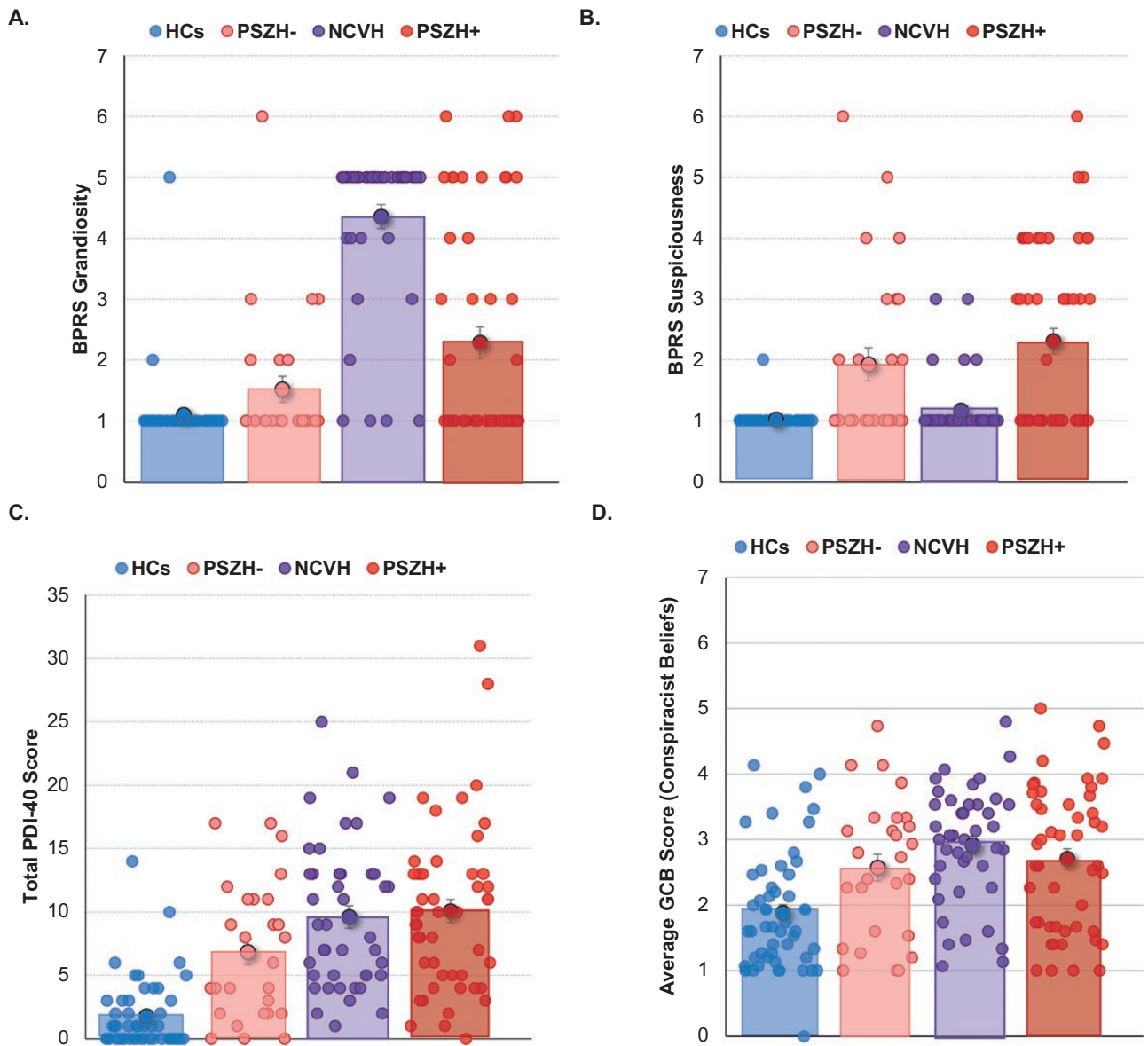


Fig. 2. Unusual beliefs. A. Mean BPRS Grandiosity scores for all groups; B. mean BPRS Suspiciousness score per group for all groups; C. mean number of items endorsed (Total score out of 40) on the Peter’s Delusions Inventory (PDI) score for all groups; D. mean number of items endorsed across the subscales of the General Conspiracist Belief scale.

a voice hearing experience whereas most PSZ experience little ability to control their AVH. Some NCVH report always having this ability while others actively work at developing control over a period of years, often as part of a meditation practice. We suspect that the combination of the lack of control and the negative content of the voices serves to amplify the amount of distress that PSZ experience as suggested by others.^{9,11–13}

A third key difference involves the social context and social significance of the AVH. Many NCVH are actively involved in a community of people who have similar experiences or are trying to cultivate these abilities. Thus, their voice hearing ability is highly-valued in their social milieu and creates a bridge towards like-minded people. The

experience of many PSZ is nearly opposite: their having AVH is socially stigmatized and contributes to the profound social discomfort and isolation experienced by many PSZ.

Beyond the shared experience with AVH, NCVH are somewhat similar to PSZ with increased experience of trauma in childhood and in the extent and variety of their unusual beliefs, as evidence by significantly elevated rates of endorsement on the PDI and GCB scale. As might be expected, many NCVH believe they have unusual powers because of their ability to receive vocal messages (and other psychic abilities). Perhaps more surprising, however, is that many have unusual beliefs that have no direct connection to their voice hearing experiences. For

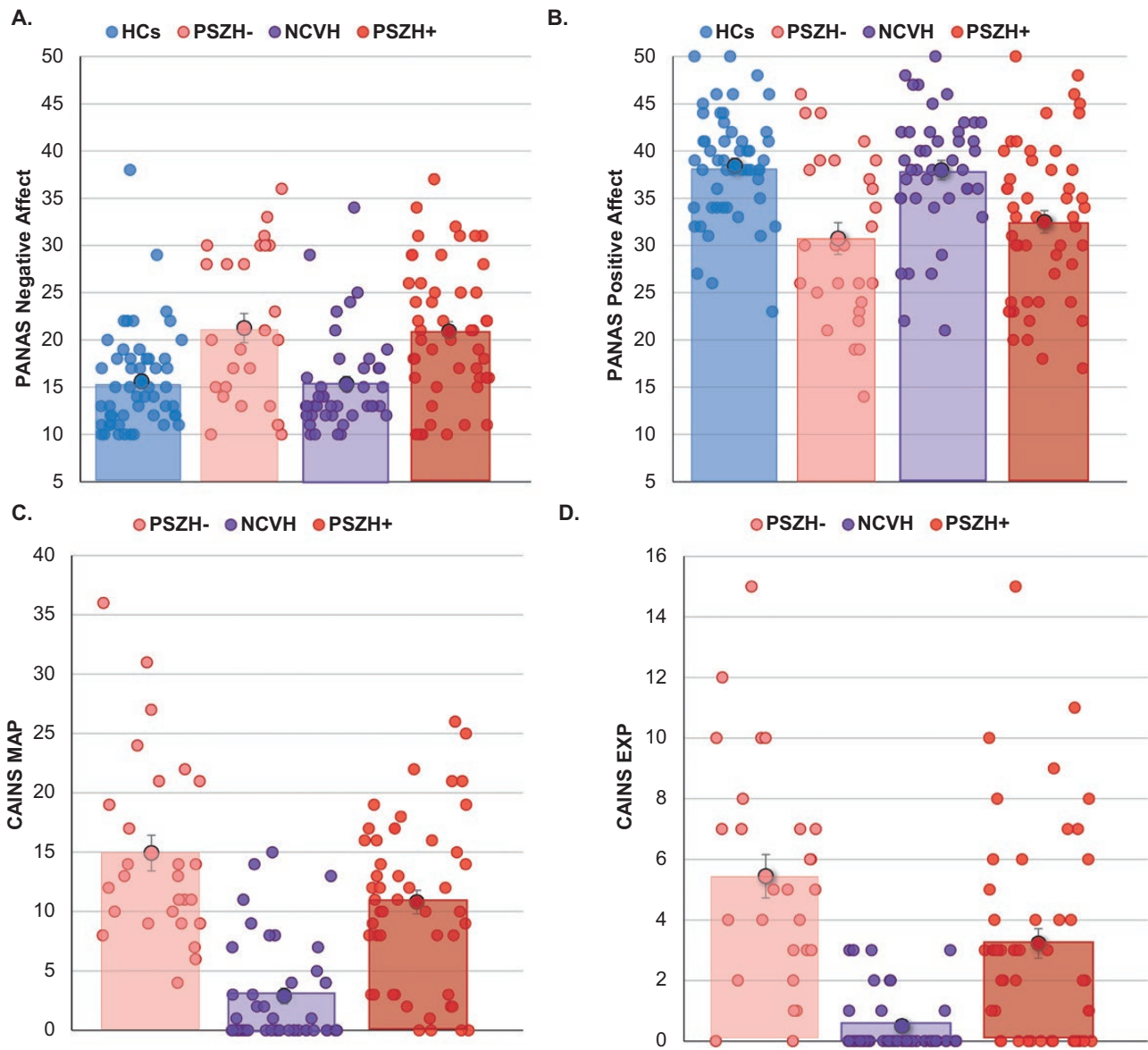


Fig. 3. Emotional experience and negative symptoms. A. Mean negative; and B. positive affect scores from the PANAS for each group; C. mean CAINS motivation and pleasure (MAP); and D. expression (EXP) scores for PSZH-, NCVH, and PSZH+.

example, many express concerns over government malfeasance and global conspiracies. Overall, the NCVH hold their beliefs with the same degree of conviction and preoccupation as seen in PSZ. However, NCVH do not experience the alterations of agency, concern over the control/ownership of their own thoughts and actions, or paranoia seen in PSZ. Prior studies have documented elevated PDI scores among adherences of New Religious Movements in the absence of distress resembling current findings.^{45,46} Thus, some unusual beliefs are much more associated with illness and distress than others.

The question remains how to understand the co-occurrence of AVH and unusual beliefs in NCVH. The co-occurrence of these experiences could be expected from a continuum of disorder perspective, as both hallucinations

and delusions are central features of SZ. From this perspective, NCVH might be understood as “fortunate schizotypes.” That is, they share AVH and unusual beliefs, observed in PSZ, with the critical exception being that the content of their unusual experiences and beliefs do not result in distress. Arguing against the notion that NCVH can be understood on a continuum of schizotypy is that fact that the NCVH showed no evidence of negative symptoms or cognitive impairment, both important features of SZ. The same critical differences arise when comparing NCVH with clinical high risk populations as the latter demonstrate cognitive impairment⁴⁷ and negative symptoms⁴⁸ while the former have more severe hallucinations and delusions than seen in clinical high risk populations yet experience less distress associated with

those experiences. In essence, NCVH offer a partial model of the 2 most important positive symptoms of SZ, but do not appear to be part of a single continuum that captures all of the central features of the illness.

As noted above, the NCVH performed very similarly to the HCs on each of the cognitive measures. This stands in some contrast to the study of Daalman et al.²² that reported subtle, but significant, differences between NCVH and HC across measures of word reading, crystallized verbal knowledge, short-term memory, and the Stroop interference condition, coupled with intact performance on verbal learning, verbal fluency, and fluid reasoning (intact performance in the latter 3 domains is not expected in PSZ). Moseley et al.⁴⁹ reported that NCVH performed below the level of controls on measures of word reading and fluid reasoning, but well above the word reading level of patients. Thus, NCVH do not show the pattern of substantial, generalized cognitive impairment that is prototypical of PSZ.⁵⁰ In our view, this is strong evidence against a continuum of disorder view of NCVH.

Do the striking similarities of AVH in NCVH and PSZ suggest that these phenomena arise from the same mechanism? Speculatively, the predictive coding model of AVH may provide an account for the AVH of both groups.^{51–53} Predictive coding models of perception emphasize that it is a highly active process where our prior beliefs are combined with incoming sensory evidence to make an inference about the source of our current experience. The reliability (or precision) of both priors and sensory evidence are evaluated in coming to a perceptual inference. For example, prior evidence would have greater precision than incoming sensory evidence when entering a darkened, but familiar room. In contrast, incoming sensory evidence offers greater precision than priors when entering a new, unfamiliar environment. Several influential theoretical accounts suggest that the experience of hallucinations and delusions might be explained by an overweighting of prior beliefs relative to sensory input.^{52,53} It is important to note that there is more than 1 pathway to overweighting of priors relative to sensory input. This can occur when the priors are more precise/strong than the sensory input and therefore receive greater weighting as in the darkened room example. This could also happen if the precision of sensory input is degraded, thereby increasing the relative weighting of priors. We speculate that the first path is more common in NCVH, many of whom experience great meaning from, and welcome, their AVH. In contrast, we suggest that degradation of sensory inputs maybe more common in PSZ given evidence for impaired auditory processing in PSZ.^{54,55} Both paths lead to the same outcome where perceptual inference is driven by priors that dominate sensory input, a mechanism contributing to AVH that we believe is shared across NCVH and PSZ. This speculative explanation would be consistent with the shared sensory experiences between the 2 groups, coupled with the differences in cognitive performance suggesting

widespread cortical compromise in PSZ, and the absence of such compromise in NCVH.

Our study also had a number of limitations. First, our sample sizes, particularly of NCVH are modest, only providing power to detect relatively large effect sizes. This is particularly important when we seek to make inferences based on the NCVH and PSZH+ performing in a similar fashion. Thus, our conclusion that NCVH do not have cognitive deficits may result from limited power to detect between- group differences. Second, as in PSZ, all information we have about the experience of AVH in NCVH is based on self-report. We imagine some readers may be skeptical about the reports of NCVH and wonder if they “make it up.” Several of the authors have spent considerable time speaking with PSZH+ about their experience of AVH over the course of their careers, and based on our time spent completing the interviews and symptom ratings with the NCVH, we were fully convinced that they were reporting real experiences that resembled the reports of PSZH+. We believe that the idea that someone would do a demanding and poorly compensated research study if they did not believe in the reality of their experiences strains credulity (though we cannot rule out that possibility). Again, the beliefs of the authors are unlikely to convince the skeptical reader. However, it is worth noting that the pattern of brain activity among NCVH when they were experiencing AVH is indistinguishable from that of PSZH+ when they experienced AVH.⁵⁶ Though not clearly direct evidence that the AVH of NCVH are identical to that of PSZH+, the imaging findings suggest that the experiences of both groups involve the same underlying circuitry. Thus, if NCVH are fabricating their hallucinations, it appears that they use the same circuitry as do PSZH+ when they report their AVH and doing a rather convincing job—with a few Schneiderian exceptions.

Supplementary Material

Supplementary material is available at <https://academic.oup.com/schizophreniabulletin/>.

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