Published in final edited form as:

Schizophr Res. 2013 July ; 147(0): 410–411. doi:10.1016/j.schres.2013.04.033.

Tinnitus: A potential confound when assessing perceptual abnormalities in ultra-high risk youth

Derek J. Dean* and **Vijay A. Mittal**

Department of Psychology and Neuroscience, University of Colorado Boulder, United States,
Center for Neuroscience, University of Colorado Boulder, United States

Dear Editors

Attenuated positive symptoms (APS) and global decline in functioning identify adolescents and young adults at ultra high-risk (UHR) for psychosis. Auditory hallucinations, one of several perceptual abnormalities that are characteristic of APS (Miller et al., 2003; Yung et al., 2012), include hearing a name called when no one is around, hearing mumbling or perhaps voices, and other sounds in the absence of an external stimulus. Because UHR individuals often report vague symptoms and may present with disorganized communication, it is possible that clinicians and researchers unaware of common medical conditions may misattribute medical issues with prodromal symptoms (Freudenreich et al., 2007). Because APS are assessed in an increasing number of settings (by a number of individuals without formal medical training), it is important to be aware of these issues. To illustrate this issue, a recent case in our UHR clinic endorsed hearing a ringing noise, which he found confusing and distracting. At least twice a month, the noise continued for 10 min or more. When he could not locate the source, the participant reported that he felt the ringing was a warning that something wrong was going on, which would lead him to leave the area. In this letter we discuss the issue of tinnitus, which is also characterized by the perception of sound without an external stimulus (Henry et al., 2005).

There are two types of tinnitus: objective (OT) and subjective (ST) (Henry et al., 2005). Objective tinnitus occurs when both the patient and the clinician can hear the sound coming from inside the patient's body (e.g., a pulsation sound synchronous with the heartbeat). ST occurs when one hears a sound without being able to locate the origin (e.g. ringing in the ears). Tinnitus accompanies hearing loss, inner ear damage (e.g., cochlea), and hyperacusis (increased sensitivity to sound) because the inner ear, when damaged, is more susceptible to high frequency sounds (Henry et al., 2005). Tinnitus occurs chronically in 15–20% of the population (50 million Americans), although many more people experience symptoms of ST after exposure to loud sounds (Bulbul et al., 2009).

Although elderly individuals are more likely to report and seek treatment for tinnitus symptoms, a growing number of young adults may also experience symptoms because of noise-induced hearing loss (NIHL) (Bulbul et al., 2009). Recent research suggests that the proliferation of portable listening devices (PLD) are partly responsible for NIHL in adolescents and young adults (McNeill et al., 2010) as they operate with headphones that can deliver potentially harmful loud music (>80 dBA) directly into the listener's ear (Bulbul et al., 2009). Other risk factors for NIHL in young people include attending rock concerts, occupational noises from construction sites, and exposure to loud noises while serving in the military (Peng et al., 2007). Hearing loss in young people often develops over time, so

*Corresponding author at: University of Colorado Boulder, Department of Psychology and Neuroscience, CB 345 Muenzinger Psychology, Boulder, CO 80309, United States. Tel.: +1 303 492 4616.

symptoms of ST may occur or increase in frequency in a similar fashion to auditory hallucinations in UHR (Peng et al., 2007). As adolescents and young adults represent the typical age range seen for UHR assessments, NIHL is certainly something to consider.

There is a considerable symptom overlap between auditory perceptual aberrations that occur in UHR and symptoms of ST. For example, Table 1 outlines characteristics of ST that may be endorsed with common UHR assessment measures. Furthermore, several sequelae of tinnitus may be confused for prodromal characteristics and symptoms; reports of feeling irritable, distracted, and difficulties concentrating are features of tinnitus and UHR. In addition, tinnitus can be a source of stress leading to a decline in functioning (Zirke et al., 2013), which can be mistaken for the social and role decline characteristics of the prodrome (Yung et al., 2012). Finally, stress and sleep deprivation are also known to exacerbate symptoms of tinnitus (Zirke et al., 2013) and an adolescent presenting with chronic stress may report accompanying increases in symptoms (e.g., hearing things no one else can hear or hyperacusis) appearing to be a prodromal issue.

Clarifying whether auditory hallucinations are due to the emergence of thought disorder or another medical issue like tinnitus may help guide assessment, prevention, and treatment (Freudenreich et al., 2007). There are several steps that can help eliminate confusion between ST and auditory hallucinations. First, ST can occur binaurally or in just one ear alone. Second, ST may be experienced as a tone that can be matched to a tone on the musical scale, while auditory hallucinations associated with psychosis may vary more in pitch, tone, and emotional valence by resembling phonemes or words (Johns et al., 2002; Nam, 2005). Individuals experiencing tinnitus symptoms may benefit from consulting with an otolaryngologist to assess possible hearing loss. If possible, visitors to UHR clinics should be urged to discontinue listening to loud music with their PLD (about 70% of full volume) prior to assessment.

References

- Bulbul SF, Muluk NB, Cakir EP, Tufan E. Subjective tinnitus and hearing problems in adolescents. *Int J Pediatr Otorhinolaryngol.* 2009; 73 (8):1124–1131. [PubMed: 19467720]
- Freudenreich O, Holt DJ, Cather C, Goff DC. The evaluation and management of patients with first-episode schizophrenia: a selective, clinical review of diagnosis, treatment, and prognosis. *Harv Rev Psychiatry.* 2007; 15 (5):189–211.
- Henry JA, Dennis KC, Schechter MA. General review of tinnitus: prevalence, mechanisms, effects, and management. *J Speech Lang Hear Res.* 2005; 48 (5):1204–1235. [PubMed: 16411806]
- Johns LC, Hemsley D, Kuipers E. A comparison of auditory hallucinations in a psychiatric and non-psychiatric group. *Br J Clin Psychol.* 2002; 41 (Pt. 1):81–86.
- McNeill K, Keith SE, Feder K, Konkle AT, Michaud DS. MP3 player listening habits of 17 to 23 year old university students. *J Acoust Soc Am.* 2010; 128 (2):646–653. [PubMed: 20707434]
- Miller TJ, McGlashan TH, Rosen JL, Cadenhead K, Cannon T, Ventura J, McFarlane W, Perkins DO, Pearlson GD, Woods SW. Prodromal assessment with the structured interview for prodromal syndromes and the scale of prodromal symptoms: predictive validity, interrater reliability, and training to reliability. *Schizophr Bull.* 2003; 29 (4):703–715. [PubMed: 14989408]
- Nam EC. Is it necessary to differentiate tinnitus from auditory hallucination in schizophrenic patients? *J Laryngol Otol.* 2005; 119 (5):352–355. [PubMed: 15949097]
- Peng JH, Tao ZZ, Huang ZW. Risk of damage to hearing from personal listening devices in young adults. *J Otolaryngol.* 2007; 36 (3):181–185. [PubMed: 17711774]
- Yung AR, Fusar-Poli P, Nelson B. The ultra high risk approach to define psychosis risk. *Curr Pharm Des.* 2012; 18 (4):346–350. [PubMed: 22239565]

Zirke N, Seydel C, Szczepek AJ, Olze H, Haupt H, Mazurek B. Psychological comorbidity in patients with chronic tinnitus: analysis and comparison with chronic pain, asthma or atopic dermatitis patients. *Qual Life Res.* 2013; 22 (2):263–272. [PubMed: 22430181]

Table 1

Symptom overlap of subjective tinnitus and attenuated positive symptoms.

UHR assessment measures ask...	Subjective tinnitus characteristics
Have you been feeling more sensitive to sounds?	Sensitivity to sound
Do you ever hear unusual sounds like banging, clicking, hissing, clapping, ringing, in your ears?	Hearing ringing, banging, clicking, clapping in one or both ears.
Do you ever think you hear sounds and then realize that there is probably nothing there?	Sound without a clear external source
Do you ever feel that your ears are playing tricks on you?	Symptoms are described and/or annoying and distracting