Voices from the storm: A critical review of quantitative studies of auditory verbal hallucinations and childhood sexual abuse

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ABSTRACT
Although an association between hallucinations and sexual abuse has been documented, the relation between specifically auditory verbal hallucinations (AVHs) and childhood sexual abuse (CSA) is less clear. This study reviewed quantitative studies of AVHs and CSA. 36% of psychiatric patients with AVHs, and 22% of non-psychiatric patients with AVHs, reported CSA. At least 16% of the general population with auditory hallucinations also reported CSA. The majority of studies reviewed found that those with AVHs were more likely to be survivors of CSA than individuals without AVHs. 56% of psychiatric patients with CSA reported AVHs, and at least 21% of the general population with CSA reported auditory hallucinations. A majority of studies found survivors of CSA were more likely to report AVHs than individuals without CSA. Ability to impute a causal role for CSA was impaired by such studies' failures to control for potentially confounding variables. Yet, studies of AVH content showed links between the content of voices and the content of CSA in some voice-hearers. It is concluded that although a clear association between CSA and AVHs exists, there is not yet reliable quantitative evidence of a causal relation. Implications for mental health professionals and for future research, are discussed.

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1. Introduction
Recent decades have seen a number of shifts in the paradigm of hallucination research. First, a move has occurred away from studying such experiences within the context of specific psychiatric diagnoses, partly due to questions being raised as to the reliability and validity of certain diagnoses such as schizophrenia (e.g., Bentall, 2003; Boyle, 2002). This has resulted in the emergence of a complaint-oriented approach to psychopathology (Bentall, 2006; Frith, 1992), with researchers attempting to understand the causal mechanisms underlying the occurrence of hallucinations trans-diagnostically. As a result, a significant literature has been generated on the potential cognitive and neurocognitive mechanisms associated with hallucinations (e.g.,
Bentall, 1990; Jones, 2010; Seal, Aleman, & McGuire, 2004). The meaning of hallucinations has also been reconsidered, with a movement away from viewing such experiences as meaningless symptoms of a mental illness (Romme & Escher, 1993), and towards a re-conceptualization of them as inherently meaningful events often having their origins in earlier stressful or traumatic events in the individual’s life (Honig et al., 1998; Hornstein, 2009; Romme, Escher, Dillon, Corstens, & Morris, 2009; Romme, Honig, Noorthoom, & Escher, 1992). Such work follows on findings such as that of Romme and Escher (1989) who found 70% of individuals with auditory hallucinations first began to hear voices following a traumatic/ emotional event.

One traumatic event that has been found in many studies to be associated with the presence of hallucinations is childhood sexual abuse (CSA). In early studies Ellenson (1985, 1986) found that many female incest survivors experienced hallucinations in a range of modalities including the visual (e.g., shadowy figures, movements in peripheral vision), the auditory (e.g., intruder sounds) and specifically the auditory verbal (e.g., voices giving commands, voices persecuting the voice hearer, or voices helping the voice-hearer). Following this work, an extensive body of work has documented a relation between hallucinations and CSA (Janssen et al., 2004; Read, van Os, Morrison, & Ross, 2005).

A number of studies have further attempted to examine if CSA is associated with hallucinations in specific modalities. Given that intrusive images and auditions, believed to underpin some visual and auditory hallucinations respectively (see Jones, 2010), are underpinned by different cognitive systems (Hagenaars, Brewin, van Minnen, Holmes, & Hoogduin, 2010) it is plausible that different modalities of hallucinations may be preferentially associated with specific causes. Indeed, research (e.g., Read, Agar, Argyle, & Aderhold, 2003) has led to the suggestion that there is a specific relation between CSA and auditory verbal hallucinations (or ‘hearing voices’), with Hammersley and Fox (2006) arguing that in studies of psychosis and childhood trauma the link between CSA and auditory hallucinations “is consistently the most reliable finding” (p. 152). Going beyond association, results from quantitative studies have been used to argue that “child abuse is a causal factor for... voices commenting and command hallucinations” (Read et al., 2005, p. 330), yet the causal role of specifically CSA has not been addressed. However, clinical experience, first-person testimonies from individuals who hear voices (e.g., Romme et al., 2009), and case studies (e.g., Heins, Gray, & Tennant, 1990; Bahn & Lee, 2007; Kaufman, Birmaher, Clayton, Retano, & Wongchawart, 1997; Lysaker, Buck, & larocco, 2007) are all suggestive of a causal role for CSA in the development of auditory verbal hallucinations (AVHs).

1.1. Theoretical frameworks for an etiological role of CSA in the development of AVHs

A number of theoretical models provide a basis for conceptualizing how CSA may play an etiological role in the development of AVHs. Memory-based models of AVHs propose they result from the unintentional activation of memories (Waters, Badcock, Mitchie, & Maybery, 2006). Consistent with this model, more severe AVHs (but not visual hallucinations) in people diagnosed with schizophrenia have been found to be associated with worse performance on temporal context memory tasks (Breibon, David, Jones, Olslen, & Pilowsky, 2007). This dovetails well with the context memory deficits that have been argued to stem from traumatic events such as CSA (Steel, Fowler, & Holmes, 2005). Steel and colleagues argue that traumatic events are not processed in the normal manner by the hippocampus. During highly traumatic events, information by-passes the hippocampus and is processed via the amygdala, in order to enable a faster release of stress hormones (LeDoux, Iwata, Cicchetti, & Reis, 1988; Steel et al., 2005). Although this allows quicker processing, it does not allow the hippocampus to perform its normal role of integrating information within a spatial and temporal context (Brewin, 2001; Steel et al., 2005). Thus, potential context memory deficits resulting from CSA form a theoretical framework for understanding how such experiences may result in AVHs. If a review of the CSA and AVHs literature shows that the content of AVHs closely matches that of CSA experiences, then this would help support this memory-based model. However, if more subtle relations between AVHs and CSA are found then this would suggest a need to revise a simplistic memory-based model of AVHs.

In addition to context memory deficits, source-monitoring (Johnson, Hashtroudi, & Lindsay, 1993) provides another mechanism through which CSA may result in AVHs. Bentall (1990) has argued that the ability to discriminate between real, external events and imaginary, self-generated events is a skill (which has been given a number of names; reality-testing, source-monitoring, self-monitoring), in which individuals draw on a number of specific properties of a given cognitive event to make a judgment (not necessarily a conscious one) as to its origin. Bentall proposed that a failure in this skill could result in AVHs, with internal events being misattributed to an external source. While individual studies have found evidence both for and against this proposal (see Aleman & Laroi, 2008 for a review), a recent meta-analysis found deficits in self-monitoring (the ability to recognize self-generated thoughts or actions as one’s own) to be more pronounced in people diagnosed with schizophrenia with AVHs than in such individuals without AVHs (Waters, Woodward, Allen, Aleman, & Sommer, in press).

One specific property of cognitions that has been shown to encourage source-monitoring errors is the amount of cognitive effort associated with their occurrence (Johnson et al., 1993), with spontaneously occurring cognitions (low cognitive effort) being more likely to be misattributed to a non-self source. Relating this to CSA, Hammersley et al. (2003) have noted that CSA is likely to produce intrusive memories, occurring automatically and with low cognitive effort, with such experiences potentially seeding AVHs. Allen, Coyne, and Console (1997) have further argued that trauma-induced dissociation may hamper reality-testing, leaving individuals “vulnerable to the nightmarish inner world” (p. 332).

What is known about the biological impact of CSA on the developing brain also suggests that such experiences may lead to neurological changes that predispose individuals to AVHs. The relatively new discipline of developmental traumatology (Crozier, Van Voorhees, Hooper, & De Bellis, 2011) has begun to trace the neurobiological impact of chronic trauma on the developing child. This considers how measurable aspects of traumatic experiences (such as the type, age of onset, and duration of child maltreatment) and other biopsychosocial factors (e.g., the child’s temperament, social support for the child and family) relate to specific neurobiological changes in the brain. While such studies have typically focused on the effects of childhood abuse per se, rather than the differential effects of specific types of abuse (e.g., sexual, physical, emotional), the results of such studies are consistent with abuse causing structural changes that may lead to AVHs. For example, changes in anterior cingulate cortex volume (Cohen et al., 2006; Kitayama, Quinn, & Brenner, 2006), superior temporal gyrus volume (De Bellis et al., 2002; Tomoda et al., 2011), and fractional anisotropy in the arcuate fasciculus1 (Choi, Jeong, Rohan, Polcari, & Teicher, 2009) have all been found to be associated with childhood abuse. All these areas have been found by both functional and structural neuroimaging (Allen, Laroi, McGuire, & Aleman, 2008) and electrophysiological (Heinks-Maldonado, Mathalon, Houde, Gray, & Ford, 2007) studies to be related to AVHs, and have been interpreted as relating to abnormal functioning in the normal cognitive mechanisms that allow us to recognize internally generated cognitions as self-produced (e.g.,

1 A measure of the connectivity between speech production areas (e.g., Broca’s area) and speech perception areas (e.g., Wernicke’s area).
Feinberg, 1978; Jones & Fernyhough, 2007; Seal, Aleman, & McCuirre, 2004). In addition to these findings, Read, Perry, Moskowitz, and Connolly (2001) have also noted similarities between abused individuals and people diagnosed with schizophrenia in terms of hyperresponsivity of the hypothalamic–pituitary–adrenal axis stress system (see Shenk, Noll, Putnam, & Trickett, 2010, in relation to CSA specifically), and hyperactivation of the dopaminergic system. Although much work remains to be done on developmental traumatology, at present it appears plausible that traumatic events (such as CSA) may be the cause of many of the gray and white matter changes, as well as hormonal and neurotransmitter abnormalities found in those with AVHs.

1.2. The present evaluation

Despite the confluence of good theoretical reasons for predicting a role of CSA in the etiology of AVHs with suggestions of a relationship derived from clinical experience, first-person testimonies from voice-hearers, and case studies, there has been no critical review of the empirical studies in this important area. The empirical establishment of a relation between CSA and AVHs would be important for a number of reasons. First, if an association does exist then this would have major implications for voice-hearers, mental health professionals, families, and researchers. This would be the case even if “the relation were not a causal one, as it would highlight the need to address the increased probability of the existence of CSA in individuals presenting with AVHs, and vice versa. Second, if evidence exists for a causal relation, this would have implications for our understanding of the mechanisms underlying AVHs, the design of interventions, and ultimately for our conceptualization of the meaning of AVHs themselves. Third, studies of any potential relation between the content of AVHs and CSA events could help inform theoretical models of the relation between them, particularly regarding the role of memory processes.

This study aimed to perform a critical review of studies reporting on AVHs and CSA to assess the current state of knowledge in this field. Three specific aims were defined: 1) To establish prevalence of CSA in individuals with AVHs, as well as the prevalence of AVHs in those who have undergone CSA, 2) To examine evidence that CSA may play a causal role in AVHs, including an examination of the relation between the content of AVHs and its relation (if any) to earlier CSA experiences, and 3) To examine implications of these findings for future research directions and clinical practice.

2. Method

Papers reporting on the quantitative relation between AVHs and CSA were searched for using the MEDLINE (via Ovid Web of Science: 1950–2010) and Scopus (1966–2010) databases. The search string employed was (abuse OR trauma OR assault) AND (hallucination* OR psychosis). In addition, citation reports were utilized, and reference lists examined for other papers that might be pertinent to the review. Inclusion criteria for the study were that the study should quantitatively examine the relation between CSA and AVHs. The review was designed to be trans-diagnostic and hence papers reporting on AVHs and CSA in individuals with any type of psychiatric diagnoses (e.g., schizophrenia, bipolar disorder) were included. Furthermore, as AVHs exist on a continuum stretching into the general population (Johns & van Os, 2001) papers reporting on CSA and AVHs in individuals from the general population without psychiatric diagnoses were also included. However, given that AVHs in those who have received psychiatric diagnoses are typically assessed using stricter diagnostic criteria (e.g., commonly excluding hypnagogia) than in studies of prevalence of AVHs in the general population, data from these two populations were to be analyzed separately. Studies which simply asked about, or reported on, “auditory hallucinations” and hence potentially included non-verbal auditory hallucinations (e.g., noises) as well as specifically auditory verbal hallucinations, were still to be included in this review. This decision was made on the basis that phenomenological surveys of auditory hallucinations show AVHs to be overwhelmingly the most common type of clinically relevant auditory hallucination (Nayani & David, 1996). Furthermore, a number of studies identified by this search used the term ‘auditory hallucinations’ to specifically refer to what were actually AVHs (e.g., Offen, Waller, & Thomas, 2003).

Studies were excluded if they examined CSA in relation to hallucinations per se, rather than in relation to specifically auditory or auditory verbal hallucinations (e.g., Whitfield, Dube, Felitti, & Anda, 2005), or if they examined AVHs in relation to childhood trauma per se, and not specifically CSA (e.g., Dorahy et al., 2009; Goff, Brotman, Kindlon, Waites, & Amico, 1991; Ross, Anderson, & Clark, 1994). These criteria also led to the exclusion of studies which examined the relation of childhood trauma per se, to hallucinations per se (e.g., Janssen et al., 2004; Perona-Garcelen et al., 2010). Studies were also excluded if they included a mixed sample of participants with either CSA and/or adult sexual abuse, and did not report sub-analyses for participants with specifically CSA (e.g., Kilcommons, Morrison, Knight, & Lobban, 2008; Morrison & Petersen, 2003).

3. Results

3.1. Prevalence studies

Seven studies were identified that reported on either the prevalence of AVHs in individuals who had received psychiatric diagnoses and who had experienced CSA, or on the prevalence of CSA in those with psychiatric diagnoses and AVHs. These studies are summarized in Table 1. Psychiatric diagnoses given to individuals in these studies included bipolar disorder, depression, dissociative disorder, post-traumatic stress disorder, schizophrenia, and substance abuse. A weighted mean showed that 36% of psychiatric patients with AVHs reported CSA, and that 56% of psychiatric patients with CSA reported AVHs. Anketell et al.’s (2010) study of patients with PTSD had a notably lower rate of CSA in patients with AVHs than the other studies identified. This is likely to be because such patients, by definition, had experienced some form of trauma, and given the documented relation between trauma per se and hallucinations (Read et al., 2005), this made the association between specifically CSA and AVHs weaker.

Three studies were identified that examined the relation between AVHs and CSA in individuals without psychiatric diagnoses, and were hence not directly comparable to the seven studies highlighted above. These are presented in Table 2. Honig et al. (1998) and Andrew, Gray, and Snowden (2008) both employed what has been termed “healthy voice-hearers” (Moritz & Larøi, 2008, p. 104); individuals who regularly hear voices but have not been in contact with psychiatric services. The combined data from these two studies showed that 22% of healthy voice-hearers had experienced CSA, a figure somewhat lower than that for those with psychiatric diagnoses. The third study identified (Shevlin, Dorahy, & Adamson, 2007) reported not on individuals who necessarily regularly heard voices, but on a lifetime history of any experience of auditory hallucinations as assessed by the question “Have you ever had the experience of hearing things other people could not hear, such as noises or a voice?” This data was hence analyzed separately from the findings of Honig et al. (1998) and Andrew et al. (2008) as it was not directly comparable.

In this study, Shevlin et al. (2007) analyzed data on auditory hallucinations and CSA collected as part of the National Comorbidity Survey, a large epidemiological dataset (N=8000) from a sample of non-institutionalized general population members aged between 15 and 54 in the USA. Although, as noted, this study asked about all forms of auditory hallucinations, including noises, as described in the Method section of this paper, it seems fair to assume the majority of such experiences were AVHs (Nayani & David, 1996). However, the
Table 1
Auditory verbal hallucinations (AVH) and childhood sexual abuse (CSA) in psychiatric patients.

<table>
<thead>
<tr>
<th>Study</th>
<th>Population (diagnoses)</th>
<th>N (male: female)</th>
<th>Assessment tools for:</th>
<th>If had AVHs, what % had CSA?</th>
<th>If had CSA, what % had AVHs?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honig et al. (1998)</td>
<td>Psychiatric patients with AVHs</td>
<td>33 (8:25)</td>
<td>1. Author’s questionnaire</td>
<td>33% (11/33)</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>(schizophrenia 18; dissociative disorder, 15)</td>
<td></td>
<td>2. Author’s questionnaire</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Read and Argyle (1999)</td>
<td>Psychiatric patients with CSA</td>
<td>22 (10:12)</td>
<td>1. Medical recordsb</td>
<td>N/A</td>
<td>53% (9/17)</td>
</tr>
<tr>
<td></td>
<td>(main diagnoses were depression 8; schizophrenia 4)</td>
<td></td>
<td>2. Medical records</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hammersley et al. (2003)</td>
<td>Psychiatric patients (all bipolar)</td>
<td>96 (32:64)</td>
<td>1. SCIDb</td>
<td>37% (11/30)</td>
<td>73% (11/15)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Therapist report</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offen et al. (2003)</td>
<td>Psychiatric patients with AVHs majority schizophrenia</td>
<td>26 (19:7)</td>
<td>1. BAVQ</td>
<td>38% (10/26)</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Author’s questionnaire</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Read et al. (2003)</td>
<td>Psychiatric patients (consecutively admitted patients, main diagnoses were depression 8; schizophrenia 28)</td>
<td>200 (109:91)*</td>
<td>1. Medical recordsd</td>
<td>39% (21/54)</td>
<td>53% (21/40)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Medical records</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Andrew et al. (2008)</td>
<td>Psychiatric patients with AVHs no diagnoses reported</td>
<td>22 (13:9)</td>
<td>1. PSYRATS-AH</td>
<td>50% (11/22)</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. PDS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anketell et al. (2010)</td>
<td>Psychiatric patients (post-traumatic stress disorder)</td>
<td>20 (19:1)</td>
<td>1. PANSS</td>
<td>15% (3/20)</td>
<td>43% (3/7)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. PDS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weighted average</td>
<td></td>
<td>36% (67/185)</td>
<td></td>
<td>56% (44/79)</td>
<td></td>
</tr>
</tbody>
</table>

Note. BAVQ = Beliefs About Voices Questionnaire (Chadwick & Birchwood, 1995), PSYRATS-AH = Psychotic Symptom Rating Scales—Auditory Hallucinations subscale (Haddock, MacCarron, Tarrier, & Faragher, 1999), SCID = Structured Clinical Interview for DSM–IV (First, Spitzer, Gibbon, Williams, & Benjamin, 1996), PANSS = Positive And Negative Symptom Scale (Kay et al., 1987), PDS = Posttraumatic Stress Diagnostic Scale (Foa, 1995).

a Author’s original figures for gender split (114:86) did not equal total sample (N = 200), each gender proportionately reduced here to make figures balance.

b Study asked about ‘auditory hallucinations’ and not AVHs specifically — see Method section for justification for inclusion.

findings of this study cannot be clearly seen to solely reflect specifically AVHs. This study found that of those reporting auditory hallucinations 7% reported being raped as a child, and 16% being molested as a child. Furthermore, of those who had experienced rape or molestation as a child, 21% and 16% respectively reported experiencing auditory hallucinations.

In addition to data presented in Tables 1 and 2, a number of other findings from these studies were noteworthy. First, in Offen et al.’s (2003) study more women (71%) with AVHs reported CSA than men (26%). Second, Read et al. (2003) found that experiencing multiple types of childhood trauma (e.g., CSA and childhood physical abuse) increased the probability of having AVHs. Shevlin et al. (2007) also found the same in their study of auditory hallucinations in the general population.

3.2. Limitations of prevalence studies

The first limitation of these studies was the reliability of the CSA rate estimates. A variety of methods were used ranging from face-to-face interviews (Honig et al., 1998), self-report questionnaires (Andrew et al., 2008), spontaneous disclosure to therapists (Hammersley et al., 2003), or medical chart reviews (Read et al., 2003), which will likely have resulted in varying rates of accuracy. For example, Read et al. (2003) note that prevalence of abuse reported to clinicians (and hence available from chart reviews) is lower than that reported to researchers (e.g., Wurr & Partridge, 1996). Furthermore, even when sexual abuse was inquired about by researchers, inter-rater reliability of the classification of such experiences was not always 100% (e.g., Honig et al., 1998). Overall, it is likely that the CSA figures given in these studies will be under, rather than over, estimates (Dill, Chu, Grob, & Eisen, 1991; Read, 1997).

A second limitation of many of the studies identified was problems arising from sampling issues. Psychiatric patients were often not randomly sampled, with some studies only including a specific subset of patients, such as those who had medication-resistant AVHs (Honig et al., 1998), those deemed suitable to enter a cognitive behavioral therapy trial (Hammersley et al., 2003), or those able to talk about their experiences without distress (Offen et al., 2003). One study (Honig et al., 1998) noted that many psychiatric patients invited to participate declined as they thought that the interview would be frightening. The external validity of these studies is limited therefore, and the results must be treated with some caution. However, it was noted that rates of CSA/AVHs reported by the study with the best sampling methodology (Read et al., 2003; who used consecutive admissions) were broadly consistent with the findings of the other studies reviewed (Table 1).

3.3. Control group and correlational studies

Although prevalence studies described above (Tables 1 & 2) show a high rate of CSA in individuals with AVHs, and vice versa, such data cannot offer support for a causal relation unless appropriate control groups are examined, and the impact of other potentially causative variables is controlled. Several studies attempted to address whether CSA played a causal role in AVHs by comparing levels of AVHs...
between those with and without CSA. Four such studies were found and are presented in Table 3.

Three of the four studies found AVHs to be more common in those with CSA, compared to controls without CSA (Hammersley et al., 2003; Read et al., 2003; Shevlin et al., 2007). These studies found a consistent pattern of auditory hallucinations being two to three times more common in those with CSA, and voices commenting or commanding being around six times common in those with CSA. Although, Üçok and Bikmaz (2007) failed to replicate this finding, they speculate that this may be due to their small sample size. However, as noted below, their study had sufficient power to detect relations between other forms of abuse and AVHs, suggesting that this was not the reason for their null finding. In addition to studies comparing rates of AVHs in those with and without CSA, Read et al. (2003) examined the impact of the type of CSA (incest and non-incest related) on AVHs. It was found that those who had experienced CSA involving incest (n = 25) had significantly higher rates of AVHs (32% had voices commenting) than those with CSA that did not involve incest (n = 6, 0% with voices commenting).

Although comparison of AVH rates between those with and without CSA (Table 3) is able to provide suggestive evidence as to whether CSA causes AVHs, a causal role for CSA would also make it more likely that CSA is present in those with AVHs, than those without AVHs. Four studies were found that reported data addressing this question. Three studies of these studies found higher rates of CSA in those with AVHs, compared to those without AVHs (Hammersley et al., 2003; Read et al., 2003; Sommer et al., 2010). Sommer et al. (2010) found higher mean levels of CSA in non-psychiatric patients with AVHs, as compared to those without AVHs. Hammersley et al. (2003) found a higher prevalence of CSA in individuals with auditory hallucinations (37% CSA prevalence) and specifically in those with voices commenting (55%), than in individuals without auditory hallucinations (6%) or without voices commenting (11%). Read et al. (2003) also found a higher prevalence of CSA in those with auditory hallucinations (39% CSA prevalence), voices commenting (42%), or voices commanding (43%) than in those with no auditory hallucinations (13%), no voices commenting (17%) or no voices commanding (18%). However, one study failed to replicate this finding, with Anketell et al. (2010) finding CSA was not significantly more common in PTSD patients with AVHs (15%) than PTSD patients without AVHs (20%). Yet, given that trauma of some form was, by definition, present in this sample, and that trauma is known to relate to hallucinations (Read et al., 2005), this potentially weakened the association between CSA and AVHs.

3.4. Limitations of between-group comparisons

Although evidence of both higher rates of AVHs in those with (compared to without) CSA, and higher rates of CSA in those with (compared to without) AVHs, is seemingly consistent with the hypothesis that CSA plays a causal role in the development of AVHs, the significant design limitations of the studies make this conclusion unreliable. A key limitation of all the studies of psychiatric patients reviewed above is their failure to control for potentially confounding variables which are likely to be present in individuals with CSA and which have been found by other studies to be associated with AVHs. A key such variable is emotional abuse. Üçok and Bikmaz (2007) although not finding individuals with and without CSA to differ in their levels of AVHs, did find that both AVHs and specifically commenting voices were more common in those who had experienced childhood emotional abuse, than those who had not experienced such abuse. Sommer et al. (2010) also found childhood emotional abuse levels to be greater in (non-psychiatric) voice-hearers than healthy controls. Other factors which were not controlled for by the studies above, but which have been found to be associated with AVHs include childhood physical abuse (Read et al., 2003), and bullying (Campbell & Morrison, 2007). Another potentially confounding variable is depression. Mundy, Robertson, Robertson, and Greenblatt (1990), in a study of homeless adolescents (N = 96), found a positive correlation between AVHs and extra-familial CSA (but not familial CSA). However, they

Table 3

<table>
<thead>
<tr>
<th>Study</th>
<th>Assessment tools</th>
<th>Comparison</th>
<th>Finding</th>
<th>Variables controlled for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hammersley et al. (2003)</td>
<td>As Table 1</td>
<td>Bipolar patients with CSA (n = 15)</td>
<td>1) Auditory hallucinations (AHs) were over 3 times more common in those with CSA (73%) compared to those without CSA (23%)&lt;sup&gt;⁎&lt;/sup&gt;</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bipolar patients with no CSA (n = 81)</td>
<td>2) Voices commenting were over 6 times more common in those with CSA (40%) compared to those without CSA (6%)&lt;sup&gt;⁎&lt;/sup&gt;</td>
<td>None</td>
</tr>
<tr>
<td>Read et al. (2003)</td>
<td>As Table 1</td>
<td>Psychiatric patients with CSA (n = 40)</td>
<td>1) AHs were nearly 3 times more common in those with CSA (53%) compared to those without CSA (18%)&lt;sup&gt;⁎&lt;/sup&gt;</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Psychiatric patients without CSA (n = 108)</td>
<td>2) Voices commenting were nearly 6 times more common in those with CSA (28%) compared to those without CSA (5%)&lt;sup&gt;⁎&lt;/sup&gt;</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3) Voices commanding were over 7 times more common in those with CSA (15%) compared to those without CSA (2%)&lt;sup&gt;⁎⁎&lt;/sup&gt;</td>
<td>None</td>
</tr>
<tr>
<td>Shevlin et al. (2007)</td>
<td>As Table 1</td>
<td>Individuals with CSA-rape (n = 174)</td>
<td>AHs were over twice as common in those with CSA-rape (21%) compared to those without CSA-rape (8%)&lt;sup&gt;⁎&lt;/sup&gt;</td>
<td>Sex, age, depression, urbanicity, income, drug &amp; alcohol dependence&lt;sup&gt;⁎&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Individuals without CSA-rape (n = 5732)</td>
<td>AHs were over twice as common in those with CSA-rape (16%) compared to those without CSA-rape (8%)&lt;sup&gt;⁎&lt;/sup&gt;</td>
<td>Sex, age, depression, urbanicity, income, drug &amp; alcohol dependence&lt;sup&gt;⁎&lt;/sup&gt;</td>
</tr>
<tr>
<td>Üçok and Bikmaz (2007)</td>
<td>1. SAPS, 2. CAQ</td>
<td>1st episode schizophrenia patients (n = 17) without CSA</td>
<td>No difference in levels of AVHs between the two groups or in levels of voices commenting.</td>
<td>None</td>
</tr>
</tbody>
</table>

Note. SAPS = Scale for Assessment of Positive Symptoms (Andreasen, 1984), CAQ = Childhood Abuse Questionnaire (Sar, Turkun, Yargic, & Kundakci, 1999).

<sup>⁎</sup> From the general population.

<sup>⁎⁎</sup> Statistically significant difference.

<sup>⁎</sup> After controlling for these variables those raped under the age of 16 years were 1.75 times more likely to have auditory hallucinations, and those molested under the age of 16 were 1.93 times more likely to have auditory hallucinations, both statistically significant differences.
also found depression to positively correlate with levels of AVHs, and their results section (although not entirely clear) appears to state that the correlation between extra-familial CSA and AVHs was not significant when depression levels were controlled for.

It is notable though that the study by Shevlin et al. (2007) of auditory hallucinations in the general population and their relation to CSA did control for levels of depression, and still found a significant relation between CSA and auditory hallucinations. Furthermore, in addition to controlling for depression, the study of Shevlin et al. offers some suggestive evidence that when controlling for levels of physical abuse and neglect, CSA may still be associated with a higher risk of AVHs and explain a unique amount of variance. Shevlin et al. found that, after controlling for age, sex, depression, urbanicity, income, drug/alcohol dependence, having one of four potential types of childhood trauma (neglect, physical abuse, rape, molestation) was associated with a 1.62 times increased probability of having AVHs. This probability increased to 2.36 times if someone had two of these traumas, and 4.15 times if someone had three of these traumas. It hence appears likely that the additive effects of either of the CSA traumas would lead to a significant increase in the probability of having AVHs over and above the effects of neglect or physical abuse. However, Shevlin et al.’s study was not designed to answer this question, and further research is needed to specifically address this question. A further problem for generalizing from this study is that it is unlikely that the types of auditory hallucinations reported by people in this study were like that of the complex and frequent AVHs found in voice-hearers who contact psychiatric services. In the general population the most common AVH is hearing one’s name called (Posey & Losch, 1983) and it may be that this was the sort of experience that many participants in Shevlin et al.’s study reported. The phenomenological similarity between such experiences and those of voice-hearers who contact psychiatric services is hence limited, and may be underpinned by different causal mechanisms (Jones, 2010).

Other potentially confounding variables not controlled for by the studies reviewed in Table 3 include schizotypy and delusion-proneness. This is problematic as Sommer et al. (2010) have argued that trauma results in AVHs through its effects on schizotypy and delusion-proneness. In a correlational study Sommer et al. (2010) found that presence of AVHs was predicted by schizotypy (which correlated strongly with delusion-proneness) and a family history of AVHs (at trend level), but not by trauma levels (assessed by a composite measure of sexual, physical, and emotional abuse, as well as physical and emotional neglect levels). Sommer et al. interpreted their findings as suggesting that the relation between trauma and AVHs is due to childhood trauma leading to an “altered (more paranoid) perception of the world”, reflected in increased levels of schizotypy and delusion-proneness, “which in turn may confer risk to AVH” (p. 7).

In conclusion, the failure of studies comparing levels of AVHs in those with and without CSA to control for a comprehensive range of confounding variables means that at present the evidence that CSA plays a causal role in the development of AVHs is suggestive, but lacks internal validity.

3.5. Voice content studies

Another potential way to examine whether CSA influences AVHs is to examine the content of AVHs for verbatim or thematic links to CSA experiences (Hardy et al., 2005; Jones, 2010). Only a small number of such studies were found, yet all of these studies found links between voice-content and CSA in some voice-hearers. Read et al. (2003) found “many” (p. 12) examples of AVH content seeming to be directly related to documented CSA. One participant, whose records stated that they were “abused over many years through anal penetration with the use of violence” (ibid), had an AVH in which the perpetrator’s voice told the participant to touch children. Another participant who was sexually abused at age 8 also had AVHs which took “the form of the ‘voice of the abuser’” (ibid). Similarly, in a study of 17 psychiatric patients who had experienced CSA, Read and Argyle (1999) found that in three of the seven cases in which the content of the voices heard by patients was recorded, the content appeared to be related to the abuse they had experienced. For example, one patient heard command hallucinations to commit suicide, and identified the voice as that of the alleged perpetrator of the abuse. Another participant heard the voice of his abuser (his father) saying, “You have died” or “You were shot.”

Other studies were also identified that probed facets of AVH-content and its relation to CSA. Offen et al. (2003) examined if the properties of AVH differed between voice-hearers who had experienced CSA and those who had not. No differences in the benevolence, malevolence, resistance, engagement, and power of the AVHs were found. Similarly, Andrew et al. (2008) found that history of CSA did not predict voice-hearer’s beliefs about their voices’ malevolence, benevolence, or omnipotence. However, greater scores on the Impact of Events Scale (Horowitz, Wilner, & Alvarez, 1979), a measure of “the extent to which a traumatic event is reverberating in the mind” (Andrew et al., 2008, p. 1412) was associated with more malevolent, omnipotent, and less benevolent voices. Another factor related to the malevolence of AVHs has been found to be age at the time of CSA. Offen et al. (2003) found that CSA occurring at an earlier age was associated with a greater belief that the voices were malevolent.

4. Discussion

The studies reviewed in this paper showed a clear association between AVHs and CSA. First, in terms of CSA rates in those with AVHs, 36% of psychiatric patients with AVHs were found to report CSA. 22% of healthy voice-hearers (individuals who hear voices but who have not had contact with psychiatric services) also reported CSA. In the general population, 7% of those who reported auditory hallucinations (an unknown, but likely significant, subset of whom would have experienced specifically AVHs) were childhood rape survivors, and 16% were childhood molestation survivors. Second, in terms of AVH rates in survivors of CSA, 56% of psychiatric patients reporting CSA had AVHs. Additionally, at least 21% of CSA survivors in the general population also experienced auditory hallucinations, a significant but unknown subset of whom would have experienced specifically AVHs.

Studies reporting evidence that could be used to infer a causal relation between CSA in AVHs all suffered from significant methodological limitations (see below), and thus their results can only be seen as suggestive of a causal relation between CSA and AVHs. Three of the four studies reviewed that examined whether AVHs were more common in those with (as opposed to without) CSA (Hammersley et al., 2003; Read et al., 2003; Shevlin et al., 2007) found this to be the case. The broad picture which emerged from these three studies was that of CSA being associated with a doubling of risk of AVHs, and an approximately six-fold increase of AVHs involving voices commenting or commanding. Similarly, three of the four studies which examined whether those with AVHs had greater levels of CSA than individuals without AVHs found this to be the case (Hammersley et al., 2003; Read et al., 2003; Sommer et al., 2010).

Studies of the content of AVHs (Read et al., 2003; Read & Argyle, 1999) were found to show some links between AVH content (what is said by the voices, and the identity of the voices) and CSA (what was said during the abuse, and the identity of the abuser). Some evidence was also found that more impactful, as well as earlier, CSA was related to more malevolent voices. This suggests that, at a minimum, CSA informs the content of some AVHs, but does not allow us to infer that CSA directly causes these AVHs. Such findings are consistent with the wider literature on trauma (i.e., not restricted to CSA) and AVH content (e.g., Fowler, 1997; Hardy et al., 2005). For example, Hardy et
al. (2005) found the content of hallucinations (which were predominantly AVHs) in individuals with psychosis who had experienced trauma (e.g., sexual abuse, bullying, combat) was directly related to their earlier traumas in 13% of cases, and indirectly (i.e., thematically) to their trauma in 58% of cases. The most commonly indirectly associated trauma with patients AVHs was CSA, occurring in 29% of those with trauma. However, in the overall sample of individuals with hallucinations, only 31% of the overall sample had some form of association (i.e., direct or indirect) between their AVHs and traumatic events. It is notable how close this figure is to the average percentage of voice-hearers who have experienced CSA (Table 1).

Several limitations were evident in the studies reviewed, which impact upon the ability of this paper to establish reliable conclusions. First, percentage prevalence figures for CSA in psychotic patients with AVHs (and vice versa) are based on a small number of studies with relatively small sample sizes causing problems for external validity. Second, some of the studies included in this review asked about auditory hallucinations, per se, and hence could have included some non-verbal auditory hallucinations. However, as most clinically relevant auditory hallucinations are AVHs (Nayani & David, 1996), this is thought to be unlikely to have significantly affected the results of this review. Third, accurate assessment of presence of CSA is problematic. Yet, if anything, it appears likely that the rates reported in the studies reviewed were likely to be underestimates (Dill et al., 1991; Read, 1997).

More problematic were the sampling problems of many of the studies reviewed which necessarily impacted upon the external validity of their findings. However, it was noted that the results of the study with the best sampling methodology (Read et al., 2003, who employed consecutively admitted patients) found AVH/CSA prevalence consistent with the other studies in the review. Another major limitation of the studies reviewed here that attempted to address whether CSA plays a causal role in AVHs was their failure to control for potentially confounding variables, which raised questions as to their internal validity. Although it was noted that Shevlin et al.’s (2007) study suggested that CSA remained associated with a significantly increased risk of auditory hallucinations after controlling for age, sex, income, urbanicity, depression, alcohol/drug dependence, as well as neglect and physical abuse, this study examined auditory hallucinations in the general population and it is unclear the extent to which these are phenomenologically equivalent to the voices heard by those who seek help from mental health professionals for their AVHs. It also failed to control for delusion-proneness and schizotypy (Sommer et al., 2010). There remains the need for better controlled studies in those with extensive and complex AVHs. In addition to these general limitations, some evidence reviewed in this paper was consistent with CSA being an indirect cause of AVHs (Sommer et al., 2010), or not a causal factor at all, with childhood emotional abuse, and not CSA, being found to predict AVHs by one study (Üçok & Bikmaz, 2007). At present it is still unclear whether CSA plays a direct causal role, an indirect causal role, or no causal role in AVHs, although the latter appears the least likely of the three. There is the urgent need for large studies with more rigorous experimental designs in order to allow us to draw more reliable and valid conclusions (see below).

4.1. Implications for existing models of AVHs

Despite limitations highlighted above, the studies reviewed in this paper are able to suggest a number of ways in which existing theoretical models of the relation between these experiences may need to be modified. First, Offen et al’s (2003) finding that CSA occurring at an earlier age is associated with a greater belief that the voices were malevolent is interesting given the emerging literature on age-dependent effects of child abuse. The age at which abuse takes place has been shown to be associated with specific neural changes in the adult survivor of CSA. For example, Anderson et al. (2008) found hippocampal volumes were reduced in those who experienced CSA at ages 3–5 years and ages 11–13 years, corpus callosum volumes were reduced in those with CSA at ages 9–10 years, and activation in the frontal cortex was attenuated in subjects with CSA at ages 14–16 years. There is, therefore the need to adapt existing neurocognitive models of AVHs to account for age-specific effects of traumatic events such as CSA, rather than assume a uniform impact of CSA across childhood.

The relation between content of AVHs and earlier CSA experiences also has implications for memory-based neurocognitive models of AVHs. The finding that thematic links between CSA and the content of AVHs (e.g., the CSA having involved humiliation, and the AVH involving the abuser’s voice offering humiliating comments on novel on-going events) are more common than direct links (e.g., simply hearing what was said at the time of the abuse) suggests that a memory-based model may need revising. Research into memory has highlighted that it is typically a creative, (re-)constructive process rather than simply a matter of retrieving exact records of previous events (Conway & Pleydell-Pearce, 2000; Schacter & Addis, 2007). Furthermore, Buckner and Carroll (2007) have noted the extensive overlap in the brain network activated during functional magnetic resonance imaging studies of remembering the past, thinking about the future, and stimulus independent thought. We may, therefore, want to move away from a memory-based model which conceptualizes AVHs as static intrusions from memory, towards a model which views them as creative constructions based on an interaction between memory (particularly memories of trauma) and the voice-hearer’s normal verbal thought/inner speech processes involving on-going events in the world (McCarthy-Jones, forthcoming). Such a model would aim to reconcile two leading contemporary neurocognitive models of AVHs, namely inner speech-based and memory-based models (McCarthy-Jones, forthcoming), rather than view them as mutually exclusive accounts (Jones, 2010).

4.2. Future research

Large scale studies examining the relation between general childhood trauma and psychosis have controlled for a wide range of potentially confounding variables. For example, Janssen et al. (2004) controlled for variables including discrimination, drug use, education, ethnicity, marital status, unemployment, and urbanicity. However, such excellence in design has not been employed in studies that have assessed both CSA and AVHs specifically. There is the urgent need for large-scale and well-designed studies of the relation between childhood trauma (including specifically CSA) and AVHs, which control for the known potentially confounding variables, and separates out the effects of different types of childhood trauma.

How might such future research be designed to overcome the methodological limitations identified in the studies reviewed in this paper? First, all the studies reviewed here had a cross-sectional design, and longitudinal designs are likely to prove more informative, being better able to satisfactorily address issues of causation, as well as eliminating/minimizing the effects of retrospective reporting biases. Cross sectional studies of the relation between CSA and AVHs are likely to be valuable, but need to be designed to allow for levels of other potentially causative factors (physical and emotional abuse, depression, schizotypy) that will be controlled. In both longitudinal and cross-sectional study designs, methodological problems surrounding sampling are likely to be a key concern. In terms of longitudinal studies, issues as to whether participants who undergo CSA are particularly likely to drop-out or be removed from study participation need to be considered. In cross-sectional studies, the use of consecutively admitted psychiatric patients (e.g., Read et al., 2003), rather than use of specific subsets of the psychiatric voice-hearing population, would minimize sampling problems. Yet, this would still exclude individuals who hear voices, are not distressed by
them, and do not feel the need to contact mental health services. There is a need to engage this latter group in research. Given that the strongest predictor as to whether a voice-hearer approaches mental health services is negative voice content (Beavan & Read, 2010), there are likely to be more positive voices in non-patient populations. If such positive voices are related to CSA, the way in which these voices develop needs to be understood, perhaps occurring as a form of self-soothing or coping strategy (Romme et al., 2009). This important area remains to be addressed.

In terms of the assessment of AVHs, psychometrically validated measures should be employed, with reliance not being solely placed on medical records. Not only would this enable a more reliable assessment of presence of AVHs, but also it would allow sub-analyses to examine whether specific properties of AVHs (e.g., malevolence, omnipotence, 3rd person voices) are more common in those who have experienced CSA. In addition to quantitative assessment of AVHs, it would prove to be beneficial to use qualitative methods to assess the content of the AVHs and to then explore potential relation to CSA experiences. While it is possible to get researcher-rated concordances between voice-hearer’s abuse experience and the content of the AVHs (e.g., Hardy et al., 2005) it is likely to be fruitful to also ask voice-hearer’s about their perceptions of the relation between their AVHs and CSA experiences. As many patients initially fail to link their AVHs to early experiences, it may be beneficial to examine links patients make between CSA and AVHs both before cognitive behavioral therapy and after. Accurate assessment of CSA is also crucial to such studies. Yet each method of assessment introduces its own biases. The studies examined in this review all failed to obtain objective evidence of sexual abuse (e.g., court records). Yet, studies which do rely on such records (e.g., Spataro, Mullen, Burgess, Wells, & Moss, 2004) also introduce new biases. For example, as Read et al. (2005) note, many of the children in such studies would have in the fortunate but rare position of no longer being at risk of on-going abuse, potentially being removed from their abusive environment and receiving support or therapy. Finally, despite the complaint-based approach to AVHs currently employed (Bentall, 2006), in which AVHs are presumed to have common underlying mechanism across a range of psychiatric diagnoses, it may be useful to examine if particular psychiatric diagnoses come to be more commonly associated with AVHs in which individuals have a history of CSA.

In addition to future research building on existing studies by addressing the same questions using improved experimental designs, a number of important un-investigated questions surrounding the relation between CSA (and abuse more generally) and AVHs remain to be addressed. First, studies need to differentiate between the potential of CSA to a) cause AVHs, and/or b) influence the content of AVHs. Second, there is the need to examine the different temporal relations that may exist between CSA and AVHs. Voice-hearer’s own reports of their experiences suggest that AVHs may have their onset either immediately following CSA, as well many years following CSA, likely after further stressful events or re-traumatization in adulthood (Romme et al., 2009). The ratio of these two types of temporal relation is unknown. Third, going beyond CSA, research should aim to understand what common factors associated with different forms of abuse may be connected to the development of AVHs. Here the concept of unification may be of use (Cicchetti & Rogosch, 1996). Unification refers to a single end point (in this case, AVHs) being reached by different developmental pathways. It should therefore be considered how a range of different forms of trauma experiences may lead to AVHs, and what common factors there are in such experiences. For example, it may be considered whether the particular form of the abuse (e.g., sexual, physical, emotional) is less influential in the potential future development of AVHs than the meaning of the experience to the individual (attributions of self-blame, feelings of shame) and the level of social support available after the trauma. For example, CSA has been found to be more likely to result in psychiatric disorders generally if the perpetrator was related to the victim, if force or threats were used, or if someone the victim told did not believe them, did not support them, or punished them for the abuse (Bulik, Prescott, & Kendler, 2001). Attributes made by survivors of CSA have also been found to effect outcome with, for example, self-blame being associated with increased PTSD symptoms and depression (Feiring, Taska, & Chen, 2002; Kolko, Brown, & Berliner, 2002).

Unification also highlights the potential importance of the individual case study as a complementary approach to large scale studies, as if CSA were to be a causal factor in only some, but not all cases of AVHs, then large scale studies may miss such relations (with such studies potentially finding CSA only weakly, but not significantly relating to AVHs). The consequences of AVHs being a heterogeneous phenomenon with potentially distinct sub-types (Dodgson & Gordon, 2009; Jones, 2010; McCarthy-Jones, forthcoming) with distinct causal mechanisms also needs to be considered. If CSA has a specific relation to only one type of AVH, this may be lost in the statistical noise of large scale studies. It is also known that childhood abuse per se (i.e., not limited to CSA) also has a dose–response relationship with psychosis, with mild, moderate and severe abuse being associated with 2, 11, and 48 times the likelihood of having ‘pathology level’ psychosis respectively, compared to individual with no childhood trauma (Janssen et al., 2004). Yet such facets of CSA have not been studied in relation to AVHs in such individuals. Furthermore, the impact of CSA by multiple perpetrators on AVHs also needs to be furthered considered by researchers (J. Dillon, personal communication). As attachment security mediates the relation between CSA and the emergence of trauma symptoms generally (Aspelmeier, Elliott, & Smith, 2007), there is hence likely to be a complex interaction between attachment style, coping strategies, stress-reactivity and CSA, which still needs to be examined in more detail in prospective studies. Genetic factors also need to be considered to examine whether CSA in individuals with specific genotypes is more likely to result in AVHs (see De Pradier, Gorwood, Beaufils, Adès, & Dubertret, 2010, for an example of this approach applied to bipolar disorder). It is hence clear that a genuine biopsychosocial investigation into this area is needed.

In conclusion, this review shows that there is a clear association between CSA and AVHs. It is important to stress though that the evidence suggests that not all individuals with AVHs have experienced CSA. The mere association between CSA and AVHs has important implications for mental health professionals working with individuals presenting initially with either CSA or AVHs. For example, it highlights the need for mental health professionals to ask voice-hearers about potential CSA experiences (although, again, not to assume that it is necessarily present), and, for those who have experienced CSA, to offer appropriate trauma-based interventions, such as trauma-focused CBT (Cohen, Mannarino, Berliner, & Deblinger, 2000). Asking about CSA is likely to be particularly important with individuals who have received a diagnosis of schizophrenia, whom previous research shows are less likely to be asked previous experiences of being abused (Read & Fraser, 1998). Guidelines as to when and how to ask about CSA have already been laid out (Read, Hammersley, & Rudegeair, 2007) and this review highlights the importance of implementing such guidelines with individuals with AVHs. Moving beyond simple association, there is not at present sufficient evidence to support a causal relation between CSA and AVHs, due to methodological limitations of existing studies impairing their internal and external validity. There remains an urgent need for well designed studies that attempt to test the hypothesis that CSA plays a causal role in the development of AVHs, and to examine potential mediators of such a relation (e.g., attributions of self-blame, isolation, shame). A serious commitment of time and resources to the investigation of the potentially causative relation between AVHs and CSA, in the context of an investigation into AVHs and abuse/trauma more generally, is the best way for researchers to honor the stories many voice-hearers themselves relate.
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