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Adverse childhood experiences and hallucinations

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Abstract

Objective: Little information is available about the contribution of multiple adverse childhood experiences (ACEs) to the likelihood of reporting hallucinations. We used data from the ACE study to assess this relationship.
Methods: We conducted a survey about childhood abuse and household dysfunction while growing up, with questions about health behaviors and outcomes in adulthood, which was completed by 17,337 adult HMO members in order to assess the independent relationship of 8 adverse childhood experiences and the total number of ACEs (ACE score) to experiencing hallucinations. We used logistic regression to assess the relationship of the ACE score to self-reported hallucinations.
Results: We found a statistically significant and graded relationship between histories of childhood trauma and histories of hallucinations that was independent of a history of substance abuse. Compared to persons with 0 ACEs, those with 7 or more ACEs had a five-fold increase in the risk of reporting hallucinations.
Conclusion: These findings suggest that a history of childhood trauma should be looked for among persons with a history of hallucinations.

Keywords: Hallucinations; Childhood trauma; Child abuse; Adverse childhood experiences

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Introduction

Hallucinations are diagnostically nonspecific. Like fever, they alone are not pathognomonic for any disorder. They may occur in several conditions and disorders, from the delirium of severe physical illness and drug withdrawal to schizophrenia, bipolar disorder, and dissociative-identity disorder. Researchers have found a significant association between hallucinations and childhood trauma (Chu & Dill, 1990; Ellenson, 1985; Ensink, 1992; Famularo, Kinscherff, & Fenton, 1992; Heins, Gray, & Tennant, 1990; Kennedy et al., 2002; Whitfield & Stock, 1996), but no studies have shown a graded relationship between experiencing multiple forms of traumatic stress during childhood and these types of disorders.

In this study, we used data from the adverse childhood experiences (ACE) study (Anda et al., 1999; Dube et al., 2001; Felitti et al., 1998) to examine the relationship of childhood trauma to a history of hallucinations (the traumas included: abuse [emotional, physical, and sexual], witnessing domestic violence, parental separation or divorce, and living with substance abusing, mentally ill, or incarcerated household members as a child). Because the number of ACEs has repeatedly demonstrated a graded relationship to numerous health and social problems (Anda et al., 2001; Anda, Chapman, et al., 2002; Anda, Whitfield, et al., 2002; Dietz et al., 1999; Dube et al., 2001; Dube, Anda, Felitti, Chapman, & Giles, 2003; Dube, Anda, Felitti, Edwards, & Croft, 2002; Felitti et al., 1998; Hillis, Anda, Felitti, & Marchbanks, 2001; Hillis, Anda, Felitti, Nordenberg, & Marchbanks, 2000; Whitfield, Anda, Dube, & Felitti, 2003) we determined whether the relationship of the total number of ACEs (ACE score: range 0–8), to the risk of hallucinations was cumulative and graded. A statistical link between adverse childhood experiences and hallucinations would suggest that a history of childhood exposure to traumatic stress should be assessed among persons who report a history of hallucination. This information may help clinicians to provide more effective treatment for victims of traumatic stress.

Methods

The adverse childhood experiences (ACE) study is collaboration between Kaiser Permanente's Health Appraisal Center (HAC) in San Diego, and the Centers for Disease Control and Prevention. The objective is to assess the impact of numerous adverse childhood experiences on a variety of health behaviors and outcomes, and health care utilization (Felitti et al., 1998). The ACE study was approved by the institutional review boards of Kaiser Permanente, Emory University and the Office of Protection from Research Risks, National Institutes of Health.

Study population

The study population was drawn from the HAC, which provides complete and standardized medical, psychosocial, and preventive health evaluations to adult members of Kaiser Health Plan in San Diego County. In any 4-year period, 81% of the adult membership obtains this service and over 50,000 members are evaluated yearly; thus, HAC data represents the experiences and health status of a majority of adult Kaiser members in San Diego. The San Diego membership contains a small percentage of MediCal patients. Additionally, their HAC visits are primarily for complete health assessments rather than for symptom or illness-based care.

Persons evaluated at the HAC complete a standardized questionnaire that includes detailed health histories and health related behaviors, a medical review of systems, and psychosocial evaluations. This information was abstracted and is included in the ACE study database.

ACE study design and questionnaire

The baseline data collection was divided into two survey waves using the methodology described by Felitti et al. (1998). Two weeks after their HAC evaluation, each person was mailed an ACE study questionnaire, that asked for detailed information about adverse childhood experiences (e.g., abuse and neglect), family and household dysfunction (e.g., domestic violence and substance abuse by parents or other household members), and questions about health related behaviors from adolescence to adulthood. Prior publications from the ACE study included respondents to Wave I (9,508/13,494; 70% response), conducted between August 1995 and March 1996. Wave II (8,667/13,330; 65% response) was conducted between June and October 1997. Wave II added detailed questions about health topics that analysis of Wave I had shown to be important (Dube et al., 2003; Felitti et al., 1998). The combined response rate for both survey Waves was 68% (18,175/26,824).

Exclusions from the study cohort

We excluded 754 respondents who coincidentally underwent examinations during the time frames for both survey waves, leaving 17,421 total respondents. After excluding 17 respondents with missing race information and 67 with missing education information, the final study sample included 95% of respondents (17,337/18,175; Wave I = 8,708, Wave II = 8,629).

Definitions of adverse childhood experiences

All ACE questions pertained to respondents' first 18 years of life ($\leq$18). For questions adapted from the conflict tactics scale (CTS; Straus & Gelles, 1990), response categories were "never," "once or twice," "sometimes," "often," or "very often."

Emotional abuse. Emotional abuse was defined by two CTS questions: (1)"How often did a parent, stepparent, or adult living in your home swear at you, insult you, or put you down?" (2) "How often did a parent, stepparent, or adult living in your home act in a way that made you afraid that you might be physically hurt?" Responses of often "or" very often "to either item defined emotional abuse during childhood.

Physical abuse. Physical abuse was defined by two CTS questions: "Sometimes parents or other adults hurt children. How often did a parent, stepparent, or adult living in your home (1) push, grab, slap, or throw something at you? or (2) hit you so hard that you had marks or were injured?" A respondent was defined as physically abused if the response was "often," or "very often" to the first question or "sometimes," "often," or "very often" to the second.

Sexual abuse. Four questions from Wyatt (1985) were adapted to define contact sexual abuse during childhood: "Some people, while they are growing up in their first 18 years of life, had a sexual experience

with an adult or someone at least 5 years older than themselves. These experiences may have involved a relative, family friend, or stranger. During the first 18 years of life, did an adult, relative, family friend, or stranger ever: (1) touch or fondle your body in a sexual way, (2) have you touch their body in a sexual way, (3) attempt to have any type of sexual intercourse with you (oral, anal, or vaginal) or (4) actually have any type of sexual intercourse with you (oral, anal, or vaginal)?" A "yes" response to any question classified a respondent as having experienced contact sexual abuse during childhood.

Battered mother. We used four CTS questions to define childhood exposure to a battered mother. "Sometimes physical blows occur between parents. How often did your father (or stepfather) or mother's boyfriend do any of these things to your mother (or stepmother)? (1) Push, grab, slap, or throw something at her, (2) kick, bite, hit her with a fist, or hit her with something hard, (3) repeatedly hit her over at least a few minutes, or (4) threaten her with a knife or gun, or use a knife or gun to hurt her." A response of "sometimes," "often," or "very often" to the first or second question or any response other than "never" to the third or fourth question defined a respondent as having had a battered mother.

Household substance abuse. Two questions asked whether respondents, during their childhood, lived with a problem drinker, alcoholic (Shoenborn, 1995), or anyone who used street drugs. An affirmative response to either question indicated childhood exposure to household substance abuse.

Mental illness in household. Childhood exposure to mentally ill household members was defined as a "yes" response to either of the following two questions. "Was anyone in your household mentally ill or depressed?" and "Did anyone in your household attempt to commit suicide?"

Parental separation or divorce. This ACE was defined as a "yes" response to the question "Were your parents ever separated or divorced?"

Incarcerated household member. This ACE was defined as having childhood exposure to a household member who was incarcerated.

History of alcohol or drug abuse among the respondents

Definition of substance abuse. Three questions were used to define substance abuse among respondents: (1) "Have you ever considered yourself to be an alcoholic?" (2) "Have you ever had a problem with your use of alcohol?" (3) "Have you ever used street drugs?" A "yes" response to any question defined substance abuse. Street drugs were defined by the respondent.

Definition of a history of hallucination. A history of hallucination was defined as a "yes" response to the question, "Have you ever had or do you have hallucinations (seen, smelled, or heard things that weren't really there)?"

Statistical analysis

All analysis was conducted using SAS software (Version 8.2, Cary, NC). Adjusted odds ratios (ORs) and 95% confidence intervals (CI) were obtained from logistic regression models that estimated the

likelihood of hallucination history by each of eight ACE categories. The number of ACEs was summed for each respondent (ACE score: range 0–8). Due to small sample sizes, ACE scores of seven or eight were combined in one category (≥7). Thus, analyses were conducted with the summed score as seven dichotomous variables (yes/no) with 0 experiences as the referent. Covariates in all models were included using a priori reasoning rather than step-wise selection and included age (continuous variable), sex, race, and education (high school diploma, some college, or college graduate versus less than high school). Income was not available for the study subjects, and we used educational attainment as a proxy for SES.

We previously reported the graded relationship of ACEs to alcohol abuse (Anda, Chapman, et al., 2002; Anda, Whitfield, et al., 2002; Dube et al., 2002) and drug abuse (Dube et al., 2003; Felitti et al., 1998), which can contribute to hallucinations. The model that controlled for substance abuse served two purposes. First, evidence of mediation by substance abuse in the relationship between ACEs and hallucinations could be assessed. Second, we were able to determine the strength of the relationship between ACEs and hallucinations independent of any mediating role of substance abuse. In addition, we present the prevalence of hallucination by ACE score separately for persons with and without substance abuse histories. To test for a trend (graded relationship) between the ACE score and the risk of hallucinations, we entered ACE score as an ordinal variable into logistic models, with adjustment for the demographic covariates (sex, age, race, and education). We used this test to assess the consistency of the association between the ACE score and hallucinations between the full and reduced models, by examining if the 95% confidence intervals overlapped.

Results

Characteristics of study population

The study population included 9,367 (54%) women and 7,970 (46%) men. The mean age (standard deviation) was 57 (15.3) years. Seventy-five percent of participants were White, 39% were college graduates, 36% had some college education, and 18% were high school graduates. Only 7% had not graduated from high school.

Adverse childhood experiences

The prevalence of each individual ACE and of ACE scores is shown in Table 1. Sixty-four percent of respondents reported at least one of the eight ACE categories (Table 1).

Substance abuse

Substance abuse prevalence was 22.9%. Men had a higher prevalence of substance abuse than women (27.1% vs. 19.4%, respectively).

History of hallucination

The prevalence of hallucination history was 2.0% and was similar for men and women (1.8% and 2.2%, respectively).

Table 1
Prevalence of each category of adverse childhood experience and ACE score by sex

	Women (N = 9,367) (%)	Men (N = 7,970) (%)	Total (N = 17,337) (%)
Adverse childhood experience (ACE)			
Emotional abuse	13.1	7.6	10.5
Physical abuse	27.0	29.9	28.3
Sexual abuse	24.7	16.0	20.7
Battered mother	13.7	11.5	12.7
Household alcohol/drug abuse	29.5	23.8	26.9
Mental illness in household	23.3	14.8	19.3
Parental separation or divorce	24.5	21.8	23.3
Incarcerated household member	5.2	4.1	4.7
Number of adverse childhood experiences (ACE score)			
0	34.5	38.0	36.1
1	24.5	27.9	26.0
2	15.5	16.4	15.9
3	10.3	8.6	9.5
4	7.2	5.0	6.2
5	4.3	2.7	3.6
6	2.3	1.0	1.7
>7	1.4	.5	1.0

Individual ACEs and the risk of hallucination

The risk of hallucination was increased 1.2- to 2.5-fold by any ACE, regardless of the category (Table 2). Because we found no substantial differences in these risk estimates between men and women, we combined their data.

We used separate logistic regression models to assess the association of the ACE score and substance abuse to a history of hallucination with each exposure treated as an individual independent variable (Table 3). In these individual models, we found a significant graded relationship between the ACE score and a history of hallucination (details below). Substance abuse was also associated with a history of hallucination (odds ratio = 3.0; $p < .001$). When we simultaneously entered the ACE score and substance abuse into a single (full) logistic model (Table 3), the graded relationship between the ACE score and a history of hallucination remained. There was a slight reduction in the OR strength for each ACE score in the full model, however, suggesting a mediating role for substance abuse in the ACE score-hallucination relationship. Adding substance abuse to the model with the ACE score improved the fit of the model significantly ($\chi^2 = 61$, $df = 1$, $p < .001$). Furthermore, the test for trend showed a 20% increased risk for hallucinations (Table 3).

ACE score and the adjusted prevalence of hallucinations by history of alcohol or drug abuse

We assessed the relationship between the ACE score and hallucinations separately for persons with and without substance abuse histories. We used multiple linear regression models to obtain the prevalence of

Table 2
Prevalence and risk of a lifetime history of a hallucination by category of adverse childhood experience[a]

Category of ACE	Prevalence and risk of ever having a hallucination		
	Sample size (*N*)	Prevalence (%)	Adjusted odds ratio[a]
Emotional abuse			
No	15,508	1.7	1.0 (referent)
Yes	1,829	4.3	2.3 (1.8–3.0)
Physical abuse			
No	12,425	1.7	1.0 (referent)
Yes	4,912	2.9	1.7 (1.4–2.1)
Sexual abuse			
No	13,751	1.7	1.0 (referent)
Yes	3,586	3.1	1.7 (1.4–2.1)
Battered mother			
No	15,136	1.9	1.0 (referent)
Yes	2,201	3.0	1.5 (1.1–2.0)
Substance abuse in home			
No	12,682	1.7	1.0 (referent)
Yes	4,655	2.8	1.4 (1.1–1.8)
Mentally ill household member			
No	13,978	1.6	1.0 (referent)
Yes	3,359	3.9	2.5 (2.0–3.1)
Parents separated/divorced			
No	13,306	1.8	1.0 (referent)
Yes	4,031	2.7	1.3 (1.1–1.6)
Incarcerated family Member			
No	16,528	2.0	1.0 (referent)
Yes	809	2.7	1.2 (.8–1.9)
Total	17,337	2.0	–

[a] Odds ratios adjusted for age at survey, sex, race and educational attainment.

hallucinations after adjusting for age, sex, race, and educational attainment. We found a graded increase in the prevalence of hallucinations for both groups ($p < .001$; Fig. 1).

Discussion

Data from our survey analysis of 17,337 HMO patients showed a significant and graded relationship between a history of childhood trauma (ACEs) and hallucinations. Hallucinations can be caused by various medical and psychiatric disorders, as shown in Table 4. A history of childhood trauma often underlies some of the psychiatric disorders in Table 4 (Belkin, Greene, Rodrigue, & Boggs, 1994; Briere, Woo, McRae, Foltz, & Sitzman, 1997; Bryer, Nelson, Miller, & Kroll, 1987; Burnam et al., 1988; Carlin & Ward, 1992; Ellason & Ross, 1995; Fondacaro, Holt, & Powell, 1999; Fromuth, 1986; Goodwin,

Table 3
Relationship of the ACE score to a lifetime history of hallucinations with and without adjusting for substance abuse[a]

	Individual models[a]		Full model[b]	
	N	Percentage	Odds ratio[c]	Odds ratio[c]
ACE score[b]				
0	6,225	1.3	1.0 (referent)	1.0 (referent)
1	4,514	1.5	1.1 (.8–1.5)	1.0 (.7–1.4)
2	2,758	2.3	1.6 (1.2–2.3)	1.5 (1.1–2.0)
3	1,650	2.9	2.1 (1.4–3.0)	1.7 (1.2–2.5)
4	1,071	2.6	1.8 (1.2–2.8)	1.5 (.9–2.3)
5	619	4.0	2.8 (1.7–4.4)	2.1 (1.3–3.4)
6	296	5.4	3.6 (2.0–6.2)	2.7 (1.5–4.7)
≥7	174	9.8	6.7 (3.8–11.8)	4.7 (2.7–8.4)
Substance use/abuse				
No	13,363	1.4	1.0 (referent)	1.0 (referent)
Yes	3,947	4.0	3.0 (2.3–3.8)	2.5 (2.0–3.2)
Total[d]	17,337	2.0	1.2 (1.2–1.3)	1.2 (1.1–1.3)

[a] Odds ratios for ACE score, substance use/abuse were obtained from separate models.
[b] Adjusts simultaneously for the ACE score.
[c] All odds ratios adjusted for age at survey, sex, race and education; the trend for increasing risk of hallucinations as the ACE score increases is significant ($p < .001$) for both the individual models and full model.
[d] Odds ratio in this row represents test for trend ($p < .05$), with ACE score as an ordinal variable.

Attias, McCarty, Chandler, & Romanik, 1988; Greenwald, Leitenberg, Cado, & Tarran, 1990; Kennedy et al., 2002; Lewis, Moy, & Jackson, 1985; Livingston, 1987; Lundberg-Love, Marmion, Ford, Geffner, & Peacock, 1992; Pelcovitz et al., 1994; Read, 1997; Ross, Anderson, & Clark, 1994; Rose, Peabody, & Stratigeas, 1991; Sansonnet-Hayden, Haley, Marriage, & Fine, 1987; Shearer, Peters, Quaytman, & Ogden, 1990; Stein, Golding, Siegel, Burnam, & Sorenson, 1988; Swett, Surrey, & Cohen, 1990; Tsai, Feldman-Summers, & Edgar, 1979).

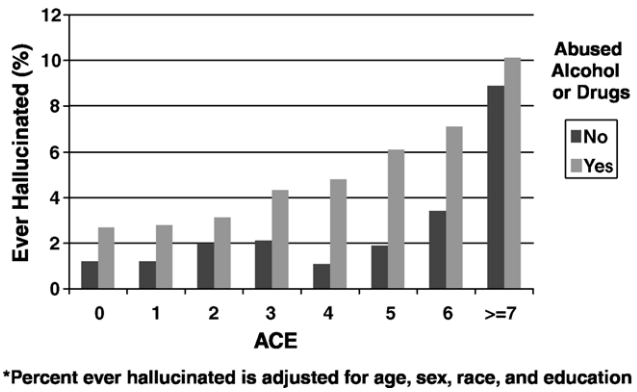

Fig. 1. History of hallucinations by ACE score and history of alcohol or drug abuse (percent ever hallucinated is adjusted for age, sex, race, and education).

Table 4
Examples of potential causes or associations of hallucinations

Psychiatric disorders (examples)	Medical disorders (examples)
Major depression	Thyrotoxicosis
Schizophrenia and other psychoses	Hyperadrenalcorticalism
Bipolar disorder	Meningitis
Dissociative identity disorder	Encephalitis
Alcohol or drug intoxication and withdrawal	Other acute CNS injury, septicemia, other severe systemic illness

Other studies that have examined psychiatric disorders where hallucinations are a symptom of psychosis, support our findings. Some show a direct relationship between hallucinations and a history of childhood trauma (Chu & Dill, 1990; Ellenson, 1985; Ensink, 1992; Famularo et al., 1992; Heins et al., 1990; Whitfield & Stock, 1996). Four studies of women inpatients or outpatients with predominantly psychotic diagnoses showed a prevalence of a history of childhood trauma across a range from 22% to 66% (Cole, 1988; Muenzenmaier, Meyer, Struening, & Ferber, 1993; Rose et al., 1991). Other studies on mixed genders of people with schizophrenia and other psychoses also found a high prevalence of a history of childhood trauma (Byrne, Velamoor, Sernovsky, Cortese, & Losztyn, 1990; Cole, 1988; Coons, Bowman, Pellow, & Schneider, 1989; Gleuck, 1963; Goff, Brotman, Kindlon, Waites, & Amico, 1991; Heads, Taylor, & Leese, 1997; Honig et al., 1998; Lipschitz et al., 1996; Lysaker, Meyer, Evans, Clements, & Marks, 2001; Muenzenmaier et al., 1993; Read & Argyle 1999; Teicher, Glod, Surrey, & Swett, 1993). Two prospective studies have reported a significant association between a history of childhood trauma and psychosis (Bagley & Ramsay, 1986; Jones, Rodgers, Murray, & Marmont, 1994). Three family studies showed an association between child maltreatment and subsequent psychotic disorders (Rodnick, Goldstein, Lewis, & Doane, 1984; Tienari, 1991; Walker, Cudeck, Mednick, & Schulsinger, 1981). Teicher et al. (1993) tested 253 adult psychiatric outpatients using the Limbic System Checklist-33, which includes brief hallucinatory events and is highly correlated with psychotisism. Using the Symptom Checklist-90-Revised, they found that child maltreatment was significantly associated with hallucinations and refractory psychosis.

The mechanism of these hallucinations is unknown. While our results show that the link between having a history of childhood trauma and hallucinations is strong and graded, they do not show the actual mechanism. Repeated childhood trauma causes structural and neurochemical abnormalities in the brain and nervous system (Bremner, 2002; De Bellis, 2001); in situations where the trauma antedates the hallucinations, these abnormalities may play a role in triggering them.

The prevalence of childhood exposures we report is nearly identical to those reported in surveys of the general population. We found that 16% of the men and 25% of the women met the case definition for contact sexual abuse; a national telephone survey of adults in 1990 conducted (Finkelhor, Hotaling, Lewis, & Smith, 1990) using similar criteria estimated that 16% of men and 27% of women had been sexually abused. As for physical abuse, 28% of the men from our study had experienced this as boys, which closely parallels the percentage found (31%) in a recent population-based study of Ontario men that used questions from the same scales (MacMillan et al., 1997). The similarity of the estimates from the ACE study to those of population-based studies suggests that our findings are likely to be applicable in other settings.

Potential weaknesses in our study included the presence of only one screening question for a history of hallucinations, the self-report of the hallucinations, and lack of detailed information on other mental health

conditions. However, self-report is generally an accurate method of obtaining psychiatric and medical history, including among trauma survivors (Berger, Knutson, Mehm, & Perkins, 1988; Bifulco, Brown, Lillie, & Jarvis, 1997; Brewin, Andrews, & Gotlib, 1993; Brown, Scheflin, & Whitfield, 1999; Fergusson, Horwood, & Woodward, 2000; Robins et al., 1985; Wilsnack, Wonderlich, Kristjanson, Vogeltanz-Holm, & Wilsnack, 2002). Even people with schizophrenia and other psychoses have been found to report accurate histories (Read & Argyle, 1999; Read & Fraser, 1998; Read, Perry, Moskowitz, & Connolly, 2001; Read & Ross, 2003; Read, Stern, Wolfe, & Ouimette, 1997).

Our data and those of others suggest that a history of child maltreatment should be obtained by health care providers with patients who have a current or past history of hallucinations. This is important because the effects of childhood and adult trauma are treatable and preventable (Briere, 1996; Herman, 1992; Whitfield, 1995, 2003a, 2003b, 2004). Finding such a trauma-symptom or trauma-illness association may be an important factor in making a diagnosis, treatment plan, and referral and may help patients by lessening their fear, guilt or shame about their possibly having a mental illness. Because a history of hallucinations can be a marker for prior childhood trauma that may also underlie numerous other common health problems, exploration into childhood experiences in these patients may provide clinicians with valuable information that may lead to more effective management of these problems.

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Résumé

Objectif: Il existe peu de renseignements sur la façon dont des expériences néfastes multiples en enfance affectent la possibilité de rapporter des hallucinations. Les auteurs ont utilisé des données issues d'une étude spécialisée portant sur ce phénomène pour étudier les liens entre ces deux phénomènes.

Méthode: Nous avons mené une enquête sur les mauvais traitements des enfants et sur la dysfonction familiale des enfants grandissant dans ces milieux. Les questions portent sur le comportement sanitaire des victimes et les conséquences des agressions une fois adultes. 17,337 adultes membres d'un organisme de gestion de la santé (HMO) aux États Unis ont fait partie de l'enquête qui avait pour but d'évaluer la

relation indépendante entre d'une part, eight expériences néfastes en enfance et le nombre total de ces expériences, et d'autre part, les expériences hallucinatoires.
Résultats: Indépendamment de l'usage de stupéfiants, nous avons découvert un lien important entre les expériences de traumatisme en enfance et les expériences. Comparés aux personnes sans expériences néfastes, celles qui ont vécu seven incidents ou plus étaient five-fois plus aptes à rapporter des hallucinations.
Conclusions: Ces constats portent à croire que des traumatismes en enfance devraient être dévoilés lorsqu'on traite des personnes qui ont des hallucinations.

Resumen

Spanish-language abstract not available at time of publication.