

Course of auditory hallucinations in childhood: results of the final 18-year follow-up study

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Background: Subclinical psychotic experiences such as auditory hallucinations (AH) may occur in the general population, in both children and adults. The current paper describes the third and final follow-up after 18 years of a longitudinal population-based case-control survey of (AH) in children aged 7 and 8 years at the time of the first interview.

Aims: The aim of the current study is to assess whether childhood AH may pose a risk on mental health in early adulthood.

Method: 150 participants (30% male, mean age 26.5 years) took part in the final follow-up assessment. They completed online self-report questionnaires on demographics, AH, trauma, cannabis use, healthcare and psychopathology. Data was summarized using descriptive statistics and chi-square analyses.

Results: The final assessment showed that n=4 participants reported AH since the previous assessment. A trend towards reporting more traumatic events was observed for participants with AH. Three of them had been or were in healthcare, all of which have used medication. There were no differences in mental health outcomes in the final assessment between participants who did and did not report AH at baseline.

Conclusions: Most of the AH which are reported at a very young age will disappear over time. Childhood AH was not associated with worse mental health outcomes in early adulthood 18 years later. Nonetheless, given the potential association to AH and traumatic events, reassuring children with AH and paying attention to possible trauma they have experienced is advised.

Keywords: auditory hallucinations; trauma; psychopathology

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Subclinical psychotic experiences such as auditory hallucinations may occur in the general population, in both children and adults (Maijer et al. 2018; Schultze-Lutter et al. 2020; Yates et al., 2021). In children, psychotic experiences are not associated with psychotic disorders (Sullivan et al., 2020; Steenkamp et al. 2021), but previous research shows a small risk for a transition to a clinical state (Lindgren et al. 2022). The current paper describes the third and final follow-up after 18 years of a longitudinal population-based case–control survey among children aged 7 and 8 years at the time of the first interview. In that baseline study, the prevalence and correlates of auditory hallucinations (AH) were studied, concluding that AH were mostly of limited functional impact, though there might be continuity with more severe psychiatric outcomes given the serious suffering in a subgroup of children (Bartels-Velthuis et al. 2010). The first follow-up after five years showed first onset of AH in middle childhood and that persistence of AH was associated with baseline AH severity (Bartels-Velthuis et al. 2011). The third, 11-year, follow-up revealed that AH in early childhood were mostly transitory, but AH in adolescence, especially when persistent, were associated with affective symptoms and environmental risk, in particular traumatic experiences (Bartels-Velthuis et al. 2016).

The aim of the current study is to assess whether AH in childhood may pose a risk on mental health in young adulthood.

Method

Procedure and participants

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. All procedures involving human subjects were approved by the Medical Ethics Review Board of the University Medical Center Groningen (UMCG), the Netherlands (dated 26 November 2019, METc number 2019/356, ABR number 67026.042.19). Because of the COVID-19 pandemic, administering the originally intended mini-SCAN interview at the participants' home had to be replaced by self-report questionnaires. Therefore, the procedure was adjusted, upon which we requested and obtained approval from both the Medical Ethics Review Board [approval letter sent by email, dated 2 December 2020, number M20.265050] and the funding organization Stichting tot steun VCVGZ [approval letter sent by email dated 25 September 2020]. For the current and final assessment, we made every effort to include as many participants from the baseline case-control sample (n=694) as possible. Therefore, we started the procedure at the Ministry of the Interior and Kingdom Relations to obtain access to the Municipal Administration to look up the current home addresses from all baseline participants. Permission for access to the Municipal Administration was obtained by decision letter 2020-0000156777 of 26 March 2020. After approval from the privacy officer of the UMCG, a colleague from the UMCG Information Management Department started retrieving the addresses from the Municipal Administration. As a result, we were able to send informed consent letters to n=604 persons. Written informed consent was received from n=177 intended participants, who were emailed a link to the questionnaires in Medoq, the non-patient section of RoQua, a Routine Outcome Monitoring tool within the University Medical Center Groningen (see also www.roqua.nl). Participants were requested to complete the questionnaires within one week; if needed, they twice received a reminder after two weeks. A digital 50 Euro gift card was sent upon completion of all questionnaires.

Instruments

All questionnaires were self-report and administered online.

Sociodemographic questionnaire: 10 items on sociodemographic information were included. Questions were asked about gender, birthyear, education, work, relationship status and living situation.

Screening question on AH: all participants were first screened on AH with the following question: 'In the past seven years, have you heard one or more voices that only you and no one else could hear?' Participants answering positively on this question were also administered the AVHRS-Q.

Assessment of AVH: the 17-item AVHRS-Q (Van de Willige et al. 2010; Steenhuis et al. 2019), i.e., the self-report version of the Auditory Vocal Hallucination Rating Scale interview (Bartels-Velthuis et al. 2012) was administered. This questionnaire measures several characteristics of AH, such as voices speaking separately or simultaneously, frequency, duration, location, form of address, loudness, (severity of) negative content, anxiety, interference with daily life and with thinking, control, attribution, frequency and intensity of distress or suffering. The AVHRS-Q has good internal consistency, convergent validity and divergent validity (Steenhuis et al. 2019).

Traumatic experiences were assessed with the Trauma Screening Questionnaire (TSQ; Brewin et al. 2002). The experience of a traumatic or stressful event was first assessed using eight predefined events: performing sexual acts against one's will, bodily harm, mental/emotional cruelty, long-term neglect, having experienced a psychotic episode, having witnessed a disaster, war or accident, death of parents, being bullied or other event. Scoring options consist of 0 = 'not experienced', 1 = 'once' and 2 = 'more than once'. Subsequently, ten items addressed subjective reactions to traumatic

events in the past week; five re-experiencing symptoms and five hyperarousal symptoms, with scores 0 = 'no or <twice in the past week' and 1 = 'yes, at least twice in the past week'. A total score of five or more on the subjective reactions scale is considered a risk factor for developing post-traumatic stress disorder (PTSD) (Kenardy et al. 2006). For the current study, the following variables were used: the number of traumatic events, the percentage of participants experiencing more than 1 traumatic event, the number of traumatic reactions and the percentage of participants at PTSD risk.

Cannabis use was assessed using a 22-item self-report questionnaire about use of tobacco, alcohol, cannabis and other substances (based on the Composite International Diagnostic Interview, CIDI; Andrews and Peters 1998). Similar to previous publications on this sample (see Bartels-Velthuis et al. 2016), the three items regarding cannabis were used, namely whether the participant has ever used cannabis (yes/no), in the past year (yes/no) and the age at first use.

Health care consumption was determined by asking 1 screening question and, if relevant, 7 follow-up questions (max. 8 items). All participants were first asked if they were currently, previously or never receiving care for mental health complaints. Follow-up questions consisted of age at receiving care, type of complaints (anxiety, depression, psychotic experiences, personality problems or other), use of medication, type of help (psychologist, psychiatrist, other) and hospitalization. Follow-up questions were asked for both current and previous health care consumption. For the purpose of this study all items were described.

Psychopathology was assessed using the 53-item Brief Symptom Inventory (BSI; Derogatis 1993). This instrument is used to identify self-reported clinically relevant psychological symptoms in adolescents and adults. The 53 items cover nine symptom dimensions: Somatization (7 items), Obsession-Compulsion (6 items), Interpersonal Sensitivity (4 items), Depression (6 items), Anxiety (6 items), Hostility (5 items), Phobic anxiety (5 items), Paranoid ideation (5 items) and Psychoticism (5 items). Each item (e.g., 'your feelings being easily hurt') is ranked on a 5-point scale ranging from 0 (not at all) to 4 (extremely). Rankings characterize the intensity of distress during the past seven days. Dimension scores are calculated by summing the values for the items included in that dimension, divided by the number of items endorsed in that dimension. The instrument showed to have good internal consistency, test-retest reliability and validity (Derogatis 1993).

Analysis

Analyses were carried out using the software package IBM SPSS Statistics version 28 (IBM Corp., Armonk, NY, USA). Education was categorized into low, middle and high education (based on the central bureau of statistics in the Netherlands; de Vries 2021). Work and relationship status were dichotomous categorizations (yes/no). Living situation was categorized into living with parents, alone, friends, partner, or other. A severity index of AH was computed by recoding the answers from individual items to '0' (none to mild consequences) or '1' (considerable to severe consequences) in line with previous publications on this sample (Bartels-Velthuis et al. 2011;2016). Subsequently, a sum score of the recoded items was created, ranging from 0 to 14. Items regarding the number of voices, localization of voices and hypnagogic/hypnopompic hallucinations are not included in the severity index (see also Bartels-Velthuis et al. 2012).

First, we planned to examine the data descriptively and visualize the number of participants taking part at the different time-points. This is important as participants had the option to join the assessment, regardless of whether they participated in a previous assessment. Subsequently, the course of AH at the different time-points was examined for the participants who took part at all assessment points. In order to examine differences between voice hearers and non-voice hearers at T3 on all outcome assessments at T3, descriptive statistics was computed using means and standard deviations for continuous outcome measures (age, AH severity, number of traumatic events and traumatic reactions, age of first-time use of cannabis and psychopathology assessments) and

frequencies and percentages for categorical outcome measures (sex, education, work, relationship status, living situation, % experiencing at least one traumatic event, ever used cannabis, used cannabis in the previous year, previous or current mental health care consumption). In order to examine how voice hearers and non-voice hearers at T0 differed on all outcome assessments at T3, descriptive and inferential statistics were computed using means, standard deviations and independent samples t-test for continuous outcome measures, and frequencies, percentages and Pearson's chi-square tests for categorical outcome measures. All assumptions were checked beforehand and corrected if necessary.

Results

In total, 150 of the 177 participants who provided informed consent actually completed all questionnaires (30% male, mean age 26.5 years (SD 0.35)). The other 27 participants did not complete the online questionnaires within the required time-frame and were therefore not included in the analyses. The 150 T3 participants (22%) were compared to the 544 participants (78%) who did not take part at T3 on a number of T0 variables. No significant differences between these two groups were found in terms of the presence of AH ($\chi^2(1) = 2.18, p = .14$), severity of AH ($t(345)=1.16, p=.22$), urbanicity ($(\chi^2(1) = 0.75, p = .39)$), internalising behaviour ($t(422)=-.72, p=.47$) and externalising behaviour ($t(422)=1.55, p=.12$). For an overview of numbers of participants in the four measurements see table 1. From the 150 participants of the last time-point, 88 took part at all time-points. The course of AH for these 88 participants is presented in table 2.

Table 1.

Participants partaking at different time-points (n=694)

	T0 (n=694)	T1 (n=337)	T2 (n=293)	T3 (n=150)	N (%)
AVH+	347 (50%)	55 (16%)	15 (5%)	4 (3%)	
	1	0	0	0	247 (35.6%)
	1	0	0	1	22 (3.2%)
	1	0	1	0	66 (9.5%)
	1	0	1	1	22 (3.2%)
	1	1	0	0	114 (16.4%)
	1	1	0	1	18 (2.6%)
	1	1	1	0	117 (16.9%)
	1	1	1	1	88 (12.7%)
Total					694

*Note. 0 = did not participate, 1 = did participate.

Table 2.

Course of AVH for participants partaking at all time-points (n=88)

	T0	T1	T2	T3	N (%)	Course
AVH	0	0	0	0	40 (45%)	Referent
	0	0	0	1	1 (1%)	Incident
	0	0	1	0	1(1%)	Remitted
	0	0	1	1	N/A	Persistent
	0	1	0	0	3 (4%)	Remitted
	0	1	0	1	N/A	Persistent
	0	1	1	0	2 (3%)	Remitted
	0	1	1	1	N/A	Persistent
	1	0	0	0	29 (33%)	Remitted
	1	0	0	1	N/A	Persistent
	1	0	1	0	1 (1%)	Remitted
	1	0	1	1	N/A	Persistent
	1	1	0	0	10 (11%)	Remitted
	1	1	0	1	N/A	Persistent
	1	1	1	0	1 (1%)	Remitted
	1	1	1	1	N/A	Persistent

*Note. Referent, never heard voices; Incident: started hearing voices at last timepoint; Remitted, no longer hears voices at last time-point but at least once in the previous time-points; Persistent, hears voices at the last time-point and at least once before; N/A, not applicable (this combination of participation did not occur in the current dataset).

From the 88 participants who took part at all time-points, only one participant reported AH at T3, who had an incident course. The majority of the participants reported remitted AH (n=47, 59%), of whom 29 stopped hearing AVH after the baseline period at T0. Almost half of the participants partaking at all time-points had referent AH (n=40, 45%) and thus did not report AVH at any time-point.

The outcome of voice hearers (n=4) and non-voice hearers (n=146) on all outcome measures is presented in table 3. We observed a trend that the T3 voice-hearers had experienced more traumatic events, reported more healthcare consumption (3 out of 4, but not for psychotic complaints), were younger at first healthcare consumption, and 3 out of 4 currently or previously used medication.

Table 3.

Differences between voice hearers vs non-voice hearers at T3 on all outcome measures at T3 (n=150)

		AH+ (N=4, 3%)	AH- (N=146, 97%)	Total (N=150)
Age (M, SD)		26.3 (0.40)	26.5 (0.35)	26.5 (0.35)
Sex (female, N, %)		1 (25%)	104 (71.2%)	105 (70%)
Education (N, %)				
	Low	0	8 (5.5%)	8 (5.3%)
	Middle	1 (25%)	36 (24.7%)	37 (24.7%)
	High	3 (75%)	102 (69.9%)	105 (70%)
Work (yes, %)		4 (100%)	119 (81.5%)	123 (82.0%)
Currently in a relationship (yes, %)		3 (75%)	97 (66.4%)	100 (66.7%)
Living situation (N, %)				
	With parents	1 (25%)	13 (8.9%)	14 (9.3%)
	Alone	2 (50%)	18 (12.3%)	20 (13.3%)
	With friend	0	7 (4.8%)	7 (4.7%)
	With partner	1 (25%)	79 (54.1%)	80 (53.3%)
	Other	0	29 (19.9%)	29 (19.3%)
AH severity T3 (M, SD)		4.25 (3.40)	N/A	N/A
Trauma				
	Nr. of traumatic events (M, SD, N=77)	7.00 (3.00)	5.28 (4.55)	5.35 (5.50)
	% experiencing at least 1 traumatic event	3 (75.0%)	72 (49.3%)	75 (50.0%)
	Nr. of traumatic reactions (M, SD)	5.33 (4.16)	1.43 (2.04)	1.58 (2.24)
	% PTSD risk	1 (25%)	8 (5.5%)	9 (6.0%)
Cannabis use				
	Ever used (yes, %)	1 (25%)	90 (61.1%)	91 (60.7%)

	Used in the past year (yes, %)	0 (0%)	33 (36.7%)	33 (36.3%)
	Age first use (M, SD)	19.00 (0.00)	17.80 (2.62)	17.81 (2.60)
Mental Health care consumption (yes, n, %)	Never	1 (25%)	88 (60.3%)	89 (59.3%)
	Previous	2 (50%)	39 (26.7%)	41 (27.3%)
	Current	1 (25%)	19 (13.0%)	20 (13.3%)
Age of first use of mental health care (M, SD)		14.5 (4.9)	19.6 (6.0)	19.4 (6.0)
Ever been hospitalized for mental health complaints (yes, n, %)		0 (0.0%)	2 (3.4%)	2 (3.3%)
Previous mental health care				
Focused on (n, %):	Anxiety	1 (50.0%)	6 (14.3%)	7 (15.9%)
	Depression	0 (0.0%)	14 (33.3%)	14 (31.8%)
	Psychotic symptoms	0 (0.0%)	3 (7.1%)	3 (6.8%)
	Personality	0 (0.0%)	6 (14.3%)	6 (13.8%)
	Other	1 (50.0%)	13 (31.0%)	14 (31.8%)
Was delivered by (n, %):	Psychiatrist	0 (0.0%)	3 (5.2%)	3 (4.9%)
	Psychologist	2 (66.7%)	42 (72.4%)	44 (72.1%)
	Other	1 (33.3%)	13 (22.4%)	14 (23.0%)
Previous use of medication (yes, n, %)		2 (100%)	11 (26.2%)	13 (29.5%)
Current mental health care				
Focused on (n, %):	Anxiety	0 (0.0%)	3 (15.8%)	3 (15.0%)
	Depression	0 (0.0%)	6 (31.6%)	6 (30.0%)
	Psychotic symptoms	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Personality	1 (100.0%)	0 (0.0%)	1 (5.0%)
	Other	0 (0.0%)	10 (52.6%)	10 (50.0%)
Was delivered by (n, %):	Psychiatrist	0 (0.0%)	1 (5.3%)	1 (5.0%)
	Psychologist	0 (0.0%)	10 (52.6%)	10 (50.0%)
	Other	1 (100%)	8 (42.1%)	9 (45.0%)
Current Use of medication (yes, n, %)		1 (100%)	9 (47.4%)	10 (50.0%)
Psychopathology (BSI) (M, SD)	Somatization	1.00 (1.02)	0.31 (0.43)	0.33 (0.47)
	Obsession-Compulsion	1.96 (1.39)	0.73 (0.63)	0.77 (0.69)

	Interpersonal sensitivity	1.63 (1.19)	0.63 (0.61)	0.65 (0.65)
	Depression	1.14 (1.54)	0.57 (0.56)	0.59 (0.61)
	Anxiety	1.58 (1.66)	0.54 (0.66)	0.57 (0.71)
	Hostility	0.45 (0.25)	0.33 (0.39)	0.33 (0.53)
	Phobic Anxiety	0.85 (0.75)	0.36 (0.52)	0.37 (0.53)
	Paranoid Ideation	1.15 (0.97)	0.34 (0.41)	0.37 (0.45)
	Psychoticism	1.50 (1.78)	0.40 (0.46)	0.41 (0.55)

The differences between voice hearers (N=67) and non-voice hearers (N=83) at T0 on all outcome measures at T3 can be found in table 4. The results show no statistically significant differences between the two groups on all outcome measures over time.

Table 4.

Differences between voice hearers vs non-voice hearers at T0 on all outcome measures at T3 (n=150)

		AH+ (N=67, 44.7%)	AH- (N=83, 55.3%)	Significance test
Age (M, SD)		26.53 (0.37)	26.52 (0.34)	T(148)=-0.20, p=0.84
Sex (female, N, %)		52 (77.6%)	53 (63.9%)	X ² (150, 1)=3.34, p=0.07
Education (N, %)				
	Low	1 (1.5%)	7 (8.4%)	X ² (150, 2)=4.25, p=0.12
	Middle	15 (22.4%)	22 (26.5%)	
	High	51 (76.1%)	54 (65.1%)	
Work (yes, %)		47 (70.1%)	53 (63.9%)	X ² (150, 1)=0.66, p=0.42
Currently in a relationship (yes, %)		54 (80.6%)	69 (83.1%)	X ² (150, 1)=0.16, p=0.69
Living situation				
	With parents	5 (7.5%)	9 (10.8%)	X ² (150, 4)=2.52, p=0.64
	Alone	12 (17.9%)	8 (9.6%)	
	With friend	3 (4.5%)	4 (4.8%)	
	With partner	35 (52.2%)	45 (54.2%)	
	Other	12 (17.9%)	17 (20.5%)	
AH at T3 (yes)		1 (1.5%)	3 (3.6%)	X ² (150, 1)=0.64, p=0.42
Trauma				
	Nr. of traumatic (M, SD, N=77)	6.00 (5.20)	4.75 (4.69)	T(75)=-1.22, p=0.23
	% experiencing at least 1 traumatic event	36 (53.7%)	39 (47.0%)	X ² (150, 1)=0.67, p=0.41
	Nr. of traumatic reactions	1.16 (1.69)	1.98 (2.61)	T(75)=1.61, p=0.11
Cannabis use				

	Ever used (yes, %)	45 (67.2%)	46 (55.4%)	$\chi^2(150, 1)=2.14, p=0.14$
	Used in the past year (yes, %)	17 (37.8%)	16 (34.8%)	$\chi^2(150, 1)=0.09, p=0.78.$
	Age first use (m, SD)	18.02 (2.64)	17.61 (2.58)	$T(89)=-0.76, p=0.45$
Mental Health care consumption (yes, n, %)	Never	38 (56.7%)	51 (61.4%)	$\chi^2(150,2) = 1.01, p=0.60.$
	Previous	18 (26.9%)	23 (27.7%)	
	Current	9 (10.8%)	9 (10.8%)	
Age of first use of mental health care (M, SD)		19.70 (5.4)	19.08 (6.5)	$T(42)=-0.34, p=0.74$
Ever been hospitalized for mental health complaints (yes, n, %)		0 (0.0%)	2 (6.3%)	$\chi^2(150,1)=1.87, p=0.17$
Previous mental health care				
Focused on (n, %):	Anxiety	4 (20.0%)	3 (12.5%)	$\chi^2(150,4)=8.37, p=0.08$
	Depression	8 (40.0%)	6 (25.0%)	
	Psychotic symptoms	3 (15.0%)	0 (0.0%)	
	Personality	2 (10.0%)	4 (16.7%)	
	Other	3 (15.0%)	11 (45.8%)	
Was delivered by (n, %):	Psychiatrist	2 (6.9%)	1 (3.1%)	
	Psychologist	20 (69.0%)	24 (75%)	
	Other	7 (24.1%)	7 (21.9%)	
Previous use of medication (yes, n, %)		6 (30.0%)	7 (29.2%)	$\chi^2(150,1)=0.01, p=0.95$
Current mental health care				
Focused on (n, %):	Anxiety	3 (27.3%)	0 (0.0%)	$\chi^2(150,3)=3.84, p=0.28$
	Depression	3 (27.3%)	3 (33.3%)	
	Psychotic symptoms	0 (0.0%)	0 (0.0%)	
	Personality	0 (0.0%)	1 (11.3%)	
	Other	5 (55.6%)	5 (55.6%)	
Was delivered by (n, %):	Psychiatrist	1 (9.1%)	0 (0.0%)	$\chi^2(150,2)=1.32, p=0.52$
	Psychologist	6 (54.5%)	4 (44.4%)	
	Other	4 (36.4%)	5 (55.6%)	
Current use of medication (yes, n, %)		4 (36.4%)	6 (66.7%)	$\chi^2(150,1)=1.82, p=0.18$
Psychopathology (BSI) (M, SD)	Somatization	0.34 (0.51)	0.32 (0.44)	$T(148)=-0.30, p=0.77$

	Obsession-Compulsion	0.80 (0.69)	0.74 (0.68)	T(148)=-0.50, p=0.62
	Interpersonal sensitivity	0.68 (0.57)	0.64 (0.71)	T(148)=-0.37, p=0.71
	Depression	0.60 (0.55)	0.58 (0.66)	T(148)=-0.22, p=0.83
	Anxiety	0.56 (0.60)	0.58 (0.79)	T(148)=0.19, p=0.85
	Hostility	0.36 (0.39)	0.31 (0.39)	T(148)=-0.70, p=0.48
	Phobic Anxiety	0.42 (0.58)	0.34 (0.48)	T(148)=-0.96, p=0.34
	Paranoid Ideation	0.38 (0.46)	0.35 (0.44)	T(148)=-0.41, p=0.68
	Psychoticism	0.39 (0.42)	0.42 (0.64)	T(148)=0.36, p=0.72

Discussion

Main findings

The current paper describes the third and final follow-up after 18 years of a longitudinal population-based case–control survey of auditory hallucinations (AH) in children aged 7 and 8 years at the time of the first interview. The aim of the current study was to assess whether AH in childhood may pose a risk on mental health in young adulthood. In the final follow-up assessment, four voice hearers were identified. Given this low prevalence, it was not possible to calculate the statistical significance of differences between voice hearers and non-voice hearers. However, a trend was observed towards a higher reporting of traumatic events, traumatic reactions and psychopathology for individuals reporting AH as compared to individuals without AH at T3. Three out of the four voice hearers had been or were in care. Our findings also show that baseline AH at age 7 and 8 years was not associated with mental health outcomes in adulthood 18 years later. The current findings therefore emphasize the transient nature of childhood AH.

Although in the second and third follow-up of the case-control sample indications were found for associations with traumatic experiences or for a worse outcome, the results of this final study may be considered hopeful for those who experience AH at a young age.

One explanation for the rather favorable outcome may be that non-participants at T3 suffered from voice-hearing or broader psychopathology, and for that reason did not want to partake in the study. However, the missing analysis determined that participants and non-participants did not differ in terms of baseline presence or severity of AVH, urbanicity, as well as internalizing and externalizing behaviour. Another explanation could be that the study was performed in a rather rural environment which may possibly have a mitigating effect on developing psychopathology (March et al., 2008; Mortensen et al., 1999). Overall, the results underline findings from previous research, indicating that hallucinations in childhood are mostly transient and occur along a continuum from healthy to psychopathology-related phenomena (Maijer et al., 2019).

To the best of our knowledge this is the first study to examine children with AH at such a young age (7 to 8 years) with follow-up assessments throughout childhood, adolescence and young adulthood. The scarcity of research impedes us to put our results into perspective, and hinders the comparison with outcomes from other studies. As mental healthcare among youngsters is becoming more available and accessible, we hope that future outcomes of our sample will not deteriorate or perhaps improve with time (Fusar-poli et al., 2021).

Strengths and limitations

Strengths of this study are that we started data-collection from a substantial case-control sample of 694 young children (7/8 years old), whom we subsequently assessed at three time-points after baseline until adulthood (mean ages 13.1 years at T1, 18.9 years at T2 and 26.5 years at T3). Another strength is that at the final assessment care consumption was examined, providing the opportunity to compare this to the report of symptoms.

The final assessment was first foreseen as a face-to-face interview, but due to the Covid-19 restrictions, this was converted in an online-assessment. However, in hindsight, we argue that online data collection in this age group might have been beneficial for the participation rate.

A limitation of this study is that there was a considerable loss to follow-up at the final assessment (T3). The addresses of n=604 participants could be retrieved, of whom n=150 participated including n=88 taking part at all four time-points. As indicated, these 150 participants did not differ in baseline characteristics from non-participants. Overall, given the long follow-up period, the final response rate of 21.6% may be considered satisfactory. Another limitation is that no statistical analyses could be performed given the small number of persons with AH at the final assessment. We chose not to

perform multiple imputation as missing at random could not be assumed. Indeed, it might be that youngsters suffering from current psychopathology and/or AH might be less prone to participate in the follow-up assessments, resulting in underreporting of auditory hallucinations at the final assessment. The fact that only four participants (3%) reported AH at this time-point could be indicative of this. However, in comparison to other research (Maijer et al., 2019) this percentage appears to lie around the estimated percentage of AH in adults in the general population (5.8%) and therefore seems to be a realistic estimate.

Implications

In our (T3) sample, we observed a trend towards a higher reporting of traumatic events, traumatic reactions and psychopathology for individuals reporting AH as compared to individuals without AH. This is supported by research demonstrating a positive link between (multimodal) hallucinations and history of childhood trauma in childhood and adolescence (Medjkane et al., 2020). Despite the favorable outcome of our final study, we argue that it is still important to take the report of AH by youngsters seriously, especially when they also have experienced traumatic events. Talking about and, if necessary, seeking help in an early stage is important. For practical recommendations we refer to Maijer et al. (2019).

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Declaration of Interest

All authors declare no conflict of interest.

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Author Contributions

A.A.B.V. designed the protocol, secured the funding and collected the data. L.A.S. made the analyses. L.A.S. and A.A.B.V. drafted the manuscript. E.V. supervised the database. J.T.W.W. and E.V. contributed to the interpretation of the results and the revision of the manuscript. All authors approved the submitted version of the manuscript for publication.