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Charles Bonnet Syndrome: associations between psychosocial measures and visual hallucination characteristics in the visually impaired

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ABSTRACT

Background/aims The emotional response to Charles Bonnet Syndrome (CBS) (visual hallucinations in individuals with sight loss) is associated with negative affect, suggesting a link between psychological measures and hallucination characteristics. This study set out to investigate whether the association extends to a broader range of hallucination attributes and psychological measures, taking into account clinical factors likely to influence such associations.

Methods 70 participants with self-reported CBS completed an online survey assessing hallucination attributes of frequency, duration, emotional valence, distress, level of control over hallucinations and impact on quality of life (QoL). Anxiety and depression were measured using the Hospital Anxiety and Depression Scale while loneliness was assessed using the University of California Los Angeles (UCLA) Loneliness Scale. All three measures were combined as a mental health factor. Regression models tested relationships between hallucination attributes and mental health, controlling for age, sex assigned at birth, years of sight loss, years experiencing hallucinations, presence of migraine and visual field loss.

Results All visual hallucination attributes except level of control were associated with the mental health factor; higher factor scores were associated with more frequent, longer lasting, more unpleasant and more distressing hallucinations and also with a more negative impact of hallucinations on QoL. These associations were independent of years of sight loss and CBS.

Conclusion Mental health measures are linked to a wider range of CBS attributes than previously recognised, with greater clinical attention required to identify people with CBS who are experiencing psychological difficulties to help provide appropriate treatment and support.

Limitations The study did not include a control group of visually impaired participants without hallucinations and has an uneven representation across age and gender with a small sample size for the sub-group analysis. The study relied on self-reported online data without clinical assessment; details of participants' medication use were not collected.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Psychological variables such as anxiety and depression have been related to the emotional response to visual hallucinations in Charles Bonnet Syndrome (CBS). This study aimed to extend our understanding of the association between clinical and psychological attributes and the emotional response and characteristics of visual hallucinations.

WHAT THIS STUDY ADDS

⇒ Mental health measures (anxiety, depression and loneliness) were associated with the valence, level of distress and impact on quality of life of CBS and the frequency and duration of hallucinations.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Irrespective of whether visual hallucinations lead to a decline in mental health or mental health decline leads to a more negative appraisal of hallucinations or triggers their onset, improving psychological well-being in CBS is likely to improve clinical outcomes.

INTRODUCTION

Charles Bonnet Syndrome (CBS) was first introduced in the 1930s by de Morsier[1] to describe the vivid visual hallucinations experienced by Bonnet's grandfather, Charles Lullin.[2–4] It has been defined in several ways since then but was included for the first time in the WHO International Classification of Diseases 11th edition (ICD-11): *'Visual release hallucinations, also called Charles Bonnet Syndrome, refer to the experience of complex visual hallucinations in a person who has experienced partial or complete loss of vision.'* (ICD-11 9D56, 2019/2021). Release in this definition refers to the increased excitability caused by deafferentation of the visual cortex that is thought to underlie CBS.[5] The definition allows sight-loss related to conditions such as stroke affecting the visual pathways to be included and removes the restriction of the syndrome to the elderly that was present in early definitions to allow inclusion of visual hallucinations in younger adults, teenagers

and children.[6 7] A meta-analysis of CBS studies with data from more than 20 000 cases and multiple eye conditions found the prevalence of CBS to be 10.2% (95% CI 7.23% to 14.1%).[8] Age and female sex were found to increase the risk of CBS in the pooled data set, although these factors did not always reach statistical significance in the component studies.

Although ICD-11 reserves CBS for complex hallucinations, the most common visual hallucinations experienced in CBS are formless and simple (dots, flashes and swirling fireworks),[9] although it is difficult to distinguish clinically whether such simple experiences are caused by a release mechanism or by neural signals generated in the retina and propagated to the brain. Complex visual hallucinations containing formed, recognisable objects such as faces, people and animals[4 10–12] are less frequent than simple hallucinations. Most people are not troubled by their hallucinations, but between 33%[7 13] and 55%[14] find them unpleasant, disturbing and distressing. This negative emotional valence has been associated with hallucination characteristics such as their frequency, duration and intrusiveness, although it does not seem to relate to the content of the hallucinations.[13] Being informed about CBS and reassured it does not indicate a cognitive or mental illness is thought to reduce stress and anxiety[12] and reduce the risk of negative valence hallucinations.[13] Some studies have found living alone and loneliness can also be associated with CBS.[15] Higher depressive symptom scores have been reported in CBS compared with people with eye disease without hallucinations,[16] though not all studies have confirmed this association.[17] Scott *et al*[18] found higher levels of emotional distress and lower quality of life in CBS compared with eye disease controls.

A study exploring associations between the emotional valence of CBS, measures of mental health (negative affect and loneliness) and quality of life (QoL) found significant associations between these measures.[14] Mental health (anxiety and depression) has also been associated with how often younger age adults experience hallucinations.[7] However, it is not clear whether mental health measures also influence other aspects of CBS. It is also possible that factors such as how long one has experienced CBS, having continuous CBS hallucinations or susceptibility to migraine (a condition also associated with increased visual cortical excitability and visual aura (hallucinations)),[19] could influence associations between CBS and mental health. This study therefore set out to understand relationships between a broader range of CBS hallucination characteristics and measures of anxiety, depression and loneliness, controlling for a range of demographic and clinical factors.

MATERIAL AND METHODS

The data reported here are from a study evaluating the effectiveness of behavioural techniques in reducing the impact of visual hallucinations funded by a grant from the Macular Society and an internship from the Thomas Pocklington Trust. Ethical approval was obtained from the Royal Holloway Ethics Committee (ID 3419).

Participants were recruited through CBS or sight loss charities and support groups (including Macular Society, Esme's Umbrella, Mary Carmel's Light US and the Canadian National Institute for the Blind). Additional recruitment was conducted via social media platforms, including Facebook groups and the Charles Bonnet Podcast. Recruitment materials stated that the study sought adults with any sight-loss condition who experience visual hallucinations. The study inclusion criteria were adults aged 18 years or older, with a visual impairment (bilateral or asymmetric) of any origin or registered as blind, who experience visual hallucinations without an auditory component. Participants with a history of stroke, epilepsy, any psychiatric or neurological disorder or who experienced hallucinations associated with multisensory components were excluded to reduce the possibility of hallucinations caused by other conditions.

The survey was administered via the Qualtrics online platform and included audio guides explaining the study details and informed consent process. A research assistant was available (via telephone or video call) to assist participants in completing the questionnaires. Participants were asked to provide informed consent or indicate if they required further information before proceeding.

The survey questions and scoring are presented in online supplemental materials. Hallucination questions were based on the North-East Visual Hallucinations Interview (NEVHI),[20] using a five-point Likert scale to assess the frequency and duration of hallucinations, their emotional valence, how distressing they were, the perceived level of control over the hallucinations and how much better QoL would be without hallucinations. A checklist of hallucination content was included, with a free text box to elaborate on the experiences. The Hospital Anxiety and Depression Scale (HADS) questionnaire[21] was used to assess anxiety and depression, and the UCLA Loneliness inventory[22] was used to assess loneliness. A question on whether participants experienced migraines (yes/no response) was added to the survey during the study.

Patient and public involvement

Two visually impaired volunteers provided feedback on the audio study information guides and on the on-line questionnaires from a user accessibility perspective.

Analysis methods

Based on a checklist of eye conditions, participants were categorised into those with loss of their central visual field with preserved peripheral vision (eg, wet age-related macular degeneration) or those with loss of their peripheral±central visual field (eg, eye enucleation, glaucoma, retinitis pigmentosa). For psychological and social measures, an exploratory factor analysis was conducted using the maximum likelihood method to reduce dimensionality and account for correlations

between anxiety, depression and loneliness. A latent 'mental health' factor was extracted with higher values indicating greater emotional distress (M=0, range ±1), capturing shared variance among the three measures for use in the regression models.[23 24] A series of linear regressions were performed to examine relationships between hallucination measures and mental health factor score, controlling for age, years since sight-loss diagnosis, years experiencing hallucinations, sex assigned at birth and visual field loss.

RESULTS

88 participants responded to the survey, of which 18 were excluded for the following reasons: incomplete questionnaire (n=11), possible dementia or psychiatric condition (n=4 these participants had potential causes of hallucinations other than eye disease), brain injury (n=1), did not have hallucinations (n=1) and did not have sight loss (n=1).

Table 1 summarises demographic and clinical characteristics of the 70 participants included (countries of origin were: UK=58; USA=8, Canada=3; Australia=1). The mean age was 75.1 (SD 13.6) years, with 10 participants under the age of 60 years and the youngest being 38 years. 15 participants reported first experiencing hallucinations under the age of 60 years. The mean number of years since sight loss was 14.8 (SD 17.2) and the mean years since CBS onset was 5.3 (SD 7.2). The mean age at which CBS was first experienced was 69 years. Complex hallucinations were reported in more participants than simple hallucinations (45.7% vs 10.0%, geometrical patterns were classified as complex) and many participants (44.3%) experienced both categories. 24.1% of participants reported experiencing migraine. Further details of hallucination content and the continuous hallucination, migraine and visual field subgroups are presented in online supplemental materials sections 1 and 2.

Age-related macular degeneration (AMD) includes participants with wet or dry AMD subtypes, alone and in combination. Other macular disease describes juvenile and other macular disease causes. Multiple eye conditions describe combinations of AMD, cataract, glaucoma and diabetic retinopathy. Miscellaneous eye conditions include enucleation, retinitis pigmentosa, retinal haemorrhage, retinal detachment, congenital cataract and optic neuropathy. The Central nervous system (CNS)/visual pathway category includes participants with strokes or brain lesions affecting the visual pathways or visual cortex.

The percentage of participants reporting each response category for the hallucination questions is shown in figure 1 (see online supplemental materials section 2 for descriptive statistics).

Most participants experienced hallucinations daily or weekly (51.4% figure 1a) and for minutes or less (57.2% figure 1b) with one-third (27.1%) experiencing hallucinations continuously. 45.7% of participants (figure 1c) regarded their hallucinations as being of neutral valence, with 40.0% regarding them as 'occasionally unpleasant' or 'very unpleasant'. Over half of the participants (58.5% figure 1d) regarded their hallucinations as 'not distressing' or 'slightly distressing' with only 24.3% regarding them as 'very distressing' or 'extremely distressing'. The majority of participants (55.7% figure 1e) had no control over their hallucinations, with only a small proportion reporting they could 'always control them' (7.1%) or 'control them the majority of the time' (11.4%). 28.6% of participants indicated their QoL would be 'very much better' without hallucinations (figure 1f) and 15.7% indicated it would be 'much better' with only a quarter (25.7%) judging QoL would be 'the same'.

Table 1 Summary of participants' demographic and clinical characteristics

Demographics	
Age	75.1 (range 38–95 years; female M=73.6 years: male M=78.4 years)
Sex assigned at birth	Female n=48 (68.6%); male n=22 (31.4%)
Cause of visual impairment	
AMD	19
Other macular disease	6
Multiple eye conditions	25
Miscellaneous eye conditions	15
CNS/visual pathway	5
Visual field loss	
Central field	37
Peripheral±central	33
Migraine	
Migraine experienced	14 (of 58 asked questions) 24.1%
Sight loss onset (years)	14.8 (range 3 months to 76 years)
CBS onset (years)	5.3 (range 1 month to 27 years)
CBS onset age	69 (range 12–91 years)
CBS content	
Simple only	10.0%
Complex only	45.7%
Simple+complex	44.3%
Continuous hallucinations	
Continuous	28.6%
Episodic	71.4%

AMD, Age-related Macular Degeneration; CBS, Charles Bonnet Syndrome; CNS, Central Nervous System; M, mean.

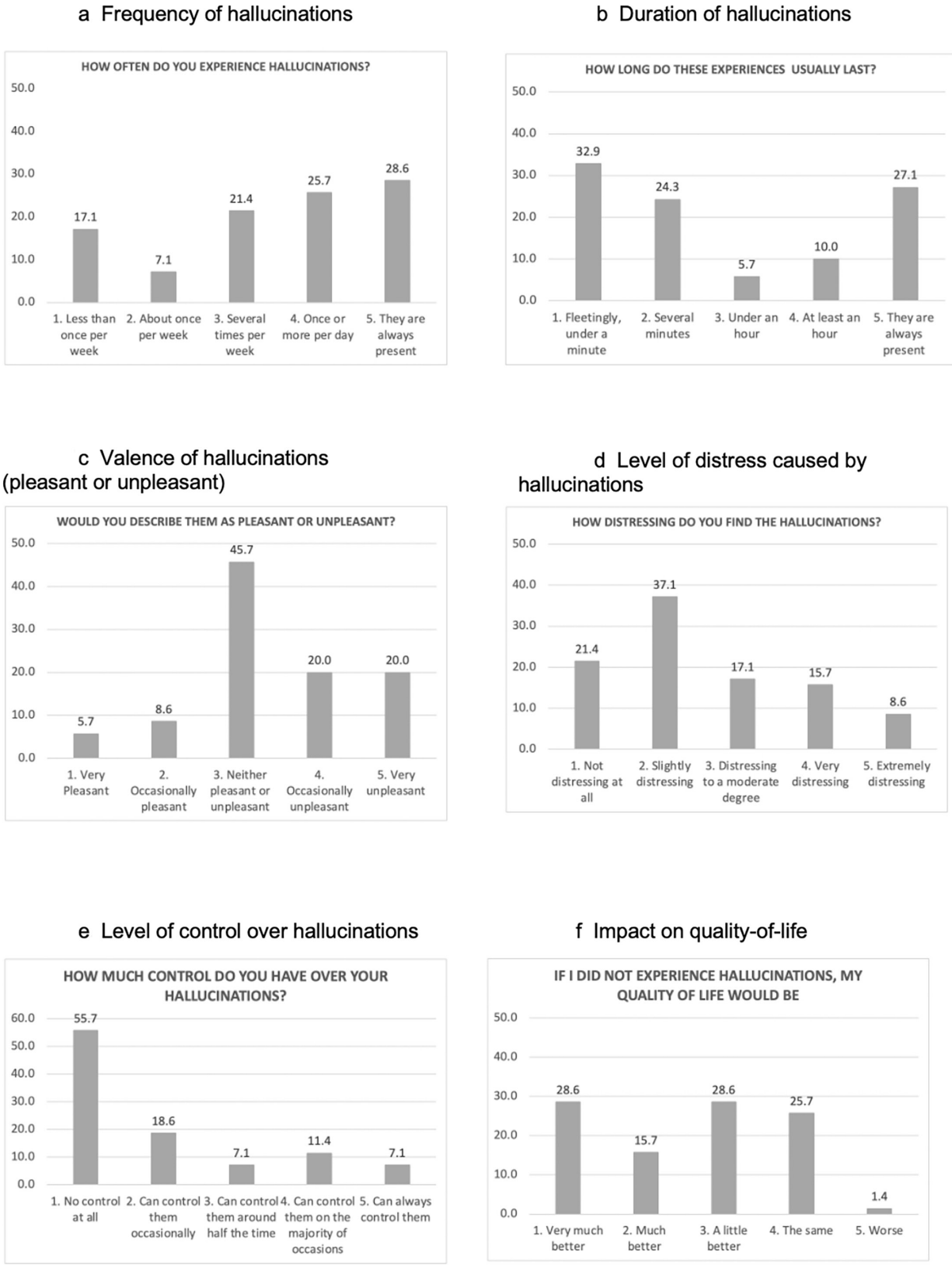

Figure 1 (a–f) The percentage of each response category in the hallucination questionnaire.

Anxiety, depression and loneliness

The mean HADS anxiety score was 6.0 (SD 5.21, range 0–21), mean depression score was 5.0 (SD 4.59, range 0–18) and mean UCLA Loneliness score was 39.0 (SD 15.13, range 0–75). Anxiety and depression symptoms were positively correlated ($r(68) = 0.65$, $p<0.001$) and both anxiety and depression were positively correlated with loneliness ($r(68) = 0.51$, $p<0.001$; $r(68) = 0.65$, $p<0.001$). A latent 'mental health' factor accounted for 60.9% of the total variance, with strong loadings from

depression (0.91), anxiety (0.73) and loneliness (0.69). This was used as a composite measure of mental health in the regression models.

Associations between visual hallucination, mental health and clinical measures

A series of linear regressions were performed to examine the relationship between hallucination characteristics and the latent mental health factor derived from anxiety, depression and loneliness scores, controlling for age, years since sight-loss diagnosis, years experiencing hallucinations, sex assigned at birth and visual field loss. A summary of coefficients for each of the main measures of interest is shown in table 2. Collinearity was within the acceptable range (tolerance 0.98, Variance inflation factor (VIF) 1.02).

The mental health factor was a significant predictor of visual hallucination frequency, duration and valence, level of distress and negative impact on QoL. Hallucinations were more distressing in females than males and the mental health factor was a significant predictor of more distressing hallucinations. There were no significant predictors for the level of control participants had over their hallucinations and no significant associations of age, visual field loss, years of experiencing visual hallucinations and years since eye disease diagnosis with any hallucination measure.

Subgroup analysis

A series of non-parametric Mann-Whitney U tests (see online supplemental material S2) were conducted to compare participants by gender; duration of hallucinations (continuous vs intermittent); presence or absence of migraine; probable extent of visual field loss (central only vs central plus peripheral) and country of residence (UK vs overseas) across the main outcome measures. Median scores for each measure are presented in online supplemental table S2, together with the statistical test results. Although subgroup sizes were small and unbalanced so that this aspect of the study was underpowered, several significant differences were observed. Participants who experienced continuous hallucinations (n=20) reported significantly greater distress and negative impact on QoL, and scored higher on anxiety and the mental health factor. Participants with eye conditions associated with probable central and peripheral visual field loss experienced hallucinations more frequently, with a greater impact on mental health than those with central vision loss only. Participants from outside the UK (n=12) reported longer hallucination durations, greater distress and less perceived control compared with participants from the UK. There were no differences found for any measure between participants who did and did not experience migraine (Mann-Whitney tests all p>0.05).

Table 2 Summary of regression analysis for variables associated with visual hallucination characteristics

	B	Se B	β
Frequency			
Age	−0.01	0.01	−1.08
Years since diagnosis	0.007	0.01	0.09
Years experienced VH	−0.009	0.025	−0.05
Mental health	0.38	0.17	0.25*
Sex	0.12	0.36	
VF loss	0.65	0.35	
Duration			
Age	−0.01	0.02	−0.08
Years since diagnosis	0.005	0.01	0.05
Years experienced VH	0.03	0.03	0.11
Mental health	0.54	0.21	0.30*
Sex	−0.08	0.44	
VF loss	0.36	0.42	
Valence			
Age	0.02	0.01	0.2
Years since diagnosis	−0.01	0.01	−0.23
Years experienced VH	0.02	0.02	0.4
Mental health	0.53	0.12	0.46**
Sex	0.1	0.30	
VF loss	−0.02	0.25	
Level of distress			
Age	0.01	0.01	0.07
Years since diagnosis	−0.01	0.01	−0.07
Years experienced VH	0.02	0.02	0.1
Mental health	0.62	0.14	0.47**
Sex	0.74	0.30**	
VF loss	0.17	0.3	
Impact on QoL			
Age	−0.001	0.01	−0.02
Years since diagnosis	0.0005	0.01	0.01
Years experienced VH	−0.0003	0.02	−0.001
Mental health	−0.56	0.14	−0.44**
Sex	−0.59	0.30	
VF loss	−0.30	0.3	
Level of control			
Age	0.001	0.01	0.01
Years since diagnosis	0.01	0.01	0.14
Years experienced VH	−0.04	0.03	−0.23
Mental health	−0.22	0.17	−0.16
Sex	−0.14	0.36	
VF loss	−0.53	0.34	

*p<0.05, **p<0.01.
QoL, quality of life; VF, visual field; VH, visual hallucination .

DISCUSSION

This study investigated associations between a range of CBS characteristics, mental health measures and clinical

factors with the aim of better understanding their interrelationships. We included both eye and visual pathway conditions to reflect the recent ICD-11 definition of CBS but found the characteristics of CBS hallucinations in the combined group matched those in previous surveys of eye disease using a similar questionnaire.[13] Hallucinations were typically experienced daily and lasted minutes or seconds, with complex, or a mix of both simple and complex hallucinations, being most prevalent. Simple hallucinations alone were reported by only 10.0% of participants. A third of participants reported negative valence or distress. We found that more than half of the participants felt their QoL would be better without hallucinations. Although the impact of hallucinations on QoL has not been reported previously, our finding is consistent with previous reports of a reduction of QoL in CBS compared with eye disease without hallucinations.[18] The level of control over hallucinations in CBS has also not been described before, but we found around half of the participants reported they had some control over their hallucinations.

Associations between CBS, psychosocial and clinical measures

We examined relationships between different aspects of CBS hallucinations and mental health measures in a series of regression models, combining factor loadings for anxiety, depression and loneliness instead of individual scale scores because of strong correlations between them. This approach aligns with previous studies suggesting anxiety, depression and loneliness reflect a common psychosocial distress dimension.[23 24] The mental health factor was significantly associated with emotional valence (higher factor scores associated with more unpleasant hallucinations), consistent with Higgins *et al*[14] who found an association between emotional valence and the Positive and Negative Affect Schedule (PANAS) negative symptoms. Our findings suggest a similar association is found for a range of hallucination measures and that this may not be driven specifically by depression, loneliness or anxiety symptoms as variance was shared between these measures. The only hallucination measure not associated with the mental health factor was the perceived level of control over hallucinations. This question was included to explore whether people who have found ways of influencing hallucinations (eg, closing their eyes or distraction) have reduced psychological symptoms; however, although the association was in the expected direction (more control associated with reduced psychological symptoms), it was not significant. More information on the nature of the level of control may be required to demonstrate an association.

Factors not associated with hallucination measures

Age, gender, visual field involvement, years living with eye disease and years living with CBS were included in the analysis as potentially influencing the relationship between hallucination and mental health measures. Age was not found to be significant in any of the regression analyses. This may be because the majority of participants were elderly (only 10 were under the age of 60 years) and a more balanced sample of younger and older participants may be required to demonstrate age effects. The gender distribution of our sample (68% female) is similar to that found in previous studies[14 25] and may reflect the proportion of female members in our main sources of recruitment (eg, Macular Society 69% female unpublished membership survey 2022), a greater willingness among females to report symptoms or seek support and medical care and increased prevalence of age-related eye conditions in females due to sex differences in life expectancy.[26] Gender imbalance in the sample will limit the ability to detect gender differences in the association between mental health and hallucination measures, and while hallucinations were rated as more distressing in female than male participants, this did not reach statistical significance (p=0.067). Participants with sight-loss conditions associated with peripheral±central visual field loss experienced more frequent hallucinations than those with conditions associated with central field loss only (see online supplemental materials S2). Field loss has also been shown to influence other aspects of hallucinations, for example, patients who report both simple and complex hallucinations have been found to have greater visual field loss compared with those who report experiencing only one form.[27] However, the extent of visual field loss was not significant in our regression models and further studies are required to better understand the role of other clinical and demographic factors in the associations of hallucination measures with field loss.

No associations were found between hallucination measures and the number of years living with eye disease or CBS. These clinical aspects of CBS are rarely reported but are potentially important in helping understand psychological adjustments and visual system adaptation. Most participants had longstanding visual loss (mean duration 14 years) and the mean duration of CBS was 5 years, supporting the view that CBS is a longer-term condition than originally thought.[13] Psychological adjustment or visual system plasticity is likely to have occurred much earlier in the course of CBS, and studies with a higher proportion of very recent visual loss and CBS onset may be required to study such effects.

Migraine and CBS

Like CBS, migraine is thought to be associated with increased excitability in the visual cortex[19] and one might therefore expect the two conditions to be associated. In the current study, 24% of participants asked about the condition reported experiencing migraine, higher than the 4% prevalence of migraine expected in people aged 70 years or older.[28] Such evidence suggests people with migraine may be at increased risk of CBS once they develop visual impairment.

Study limitations

Although the study sample is small for a clinical epidemiological survey, the sample size of 70 is comparable to that used in other studies of associations between mental health measures and CBS.[14 29] However, the subgroup analyses are underpowered with an imbalance in group sizes and would require larger samples to reliably detect group differences. The absence of a control group of visually impaired participants without CBS limits the conclusions that can be made. Including a control group would enable mental health factors to be related more clearly to the presence of hallucinations rather than to vision loss. In common with many CBS studies, we did not seek to recruit equal numbers of male and female participants or equal numbers of participants across different age groups. Purposeful sampling or larger sample sizes would be required to detect effects related to age and gender. As this was an online study, there was no direct clinician involvement to assess measures such as visual acuity and to explore details of the visual phenomena reported. We also lacked detail of mental health history and current medication that might have influenced anxiety or depression symptoms, although it is of note that a previous psychiatric diagnosis was part of the exclusion criteria making it unlikely any participants were prescribed antidepressant medication.

Clinical and treatment implications

Our findings could be interpreted as indicating hallucinations of greater severity increase loneliness and anxiety and lower mood. However, it is equally plausible that people already experiencing anxiety, low mood or loneliness for other reasons rate their hallucinations as more significant. Anxiety, depression and loneliness might also act as triggers for hallucinations, leading to more frequent or prolonged episodes. The statistical methods used here are unable to distinguish which direction of causality accounts for the findings, and it is possible both directions contribute. However, the findings highlight the importance of considering mental health in the overall treatment of hallucinations, whether through reducing a predisposing mental health factor for hallucinations or a mental health consequence of hallucinations. Psychological interventions have a place in the treatment of CBS, particularly 'third wave' interventions that aim to change an individual's relationship to difficult and distressing experiences, including hallucinations.

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Contributors RW: conceptualisation; funding acquisition; methodology; project administration; supervision; writing—review and editing. LE: conceptualisation; methodology; formal analysis; investigation; writing—review and editing. DN: data collection and curation; investigation; project administration. HR: data collection and curation; investigation; project administration. HC: data collection and curation; investigation; project administration. FA: methodology; data collection and curation; investigation; project administration. KDM: methodology; data collection and curation; investigation; project administration. RT: methodology; data collection and curation; investigation; project administration. ML: methodology; formal analysis; writing—review and editing. DF: conceptualisation; methodology; formal analysis; investigation; writing—review and editing; producing tables; editing reference style; checking grammar and clarity. RW is the guarantor.

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Competing interests None declared.

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Patient consent for publication Not applicable.

Ethics approval This study involves human participants and was approved by Royal Holloway University of London ethics committee (ID 3419). Participants gave informed consent to participate in the study before taking part.

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