What is the prevalence of visual hallucinations in a first-episode psychosis population?

Allen, Sophie; Goodall, Thomas ; Jones, Christopher; James, Rachel; Surtees, Andrew

DOI:
10.1093/schizbullopen/sgad002

Schizophrenia Bulletin Open
https://doi.org/10.1093/schizbullopen/sgad002

What Is the Prevalence of Visual Hallucinations in a First-Episode Psychosis Population? A Systematic Review and Meta-analysis of the Literature

Sophie Allen[*,1,2], Thomas Goodall[3], Chris Jones[1], Rachel James[1,2], and Andrew Surtees[1,4]

[1]School of Psychology, University of Birmingham, Birmingham, UK; [2]Birmingham & Solihull Mental Health Foundation Trust, Birmingham, UK; [3]Changing Minds Psychology, Warrington, UK; [4]Birmingham Women's and Children's NHS Foundation Trust, Birmingham, UK

[*]To whom correspondence should be addressed; BSMHFT, Little Bromwich Centre, Hobmoor Road, Birmingham B10 9JH, UK; tel: 0121-301-0990, e-mail: sophie.allen7@nhs.net

***Background and Hypothesis*: This systematic review and meta-analysis review the literature regarding the prevalence of visual hallucinations in patients with first-episode psychosis. Previous reviews have focused on the prevalence of visual hallucinations in a general psychosis population, highlighting a weighted prevalence of 27%. However, no reviews have focused specifically on the experiences of those with a first episode of psychosis. Understanding "first-episode" experiences is crucial, as intervention during this "critical period" is thought to define long-term outcome. Therefore, it is important that the prevalence of different symptoms during this period is accurately represented. *Study Design*: Systematic searches yielded 15 studies to be meta-analyzed. Information to calculate event rates was extracted. Studies were rated for their methodological quality using a risk of bias tool. The quality of included studies varied; generalizability bias was the domain with the most risk of bias. *Study Results*: Prevalence rates were synthesized from the 15 papers included in the final analysis, which generated a weighted prevalence estimate of 33% of people with first-episode psychosis experiencing visual hallucinations. Subgroup analyses were carried out and did not demonstrate significant associations. *Conclusions*: This meta-analysis provides a robust estimate of 33% for the prevalence of visual hallucinations in first-episode psychosis; highlighting that visual hallucinations are relatively common experiences.**

Key words: psychosis/visual hallucinations/meta-analysis/first-episode

Introduction

Psychosis is defined by core clinical features, such as hallucinations, delusions and thought disorder and accompanied by a lack of insight, communication disorders, and reduced social functioning.[1] Psychosis is experienced across a broad spectrum of diagnoses, such as schizophrenia, schizo-affective disorder, and bipolar disorder. To support service delivery, understanding the prevalence of differing symptoms at different stages of psychosis is crucial. While visual hallucinations are among the most prevalent symptoms of psychosis[2] they have often been neglected in comparison to auditory hallucinations. Here, we review research on visual hallucinations in "first episode" psychosis.

First-Episode Psychosis

Definitions of "first-episode" psychosis vary, but typically refer to "people early in the course of a psychotic illness or treatment, rather than people who are truly in the midst of a first 'episode' of illness."[3] Understanding "first-episode" experiences is crucial, as intervention at this stage is thought to define long-term outcome.[4] The recognition of the processes involved in a first episode of psychosis has led to the development of specialist early intervention services designed to reduce treatment delay and increase access to evidence-based interventions.[5] This early-intervention paradigm is partially predicated on the basis of the "critical period hypothesis",[6] which argues that the early phase of psychosis (the first 2–5 years) is a critical period in which biopsychosocial influences are at their most malleable and dynamic. In addition to psychotic symptoms, people are affected by the biological changes and the social impact of the onset of the disorder, such as the effect on social relationships and employment.[7] Intervening during this phase is crucial and has been shown to improve understanding of symptom dimensions.[8]

Visual Hallucinations

Hallucinations are common symptoms of psychiatric disorders and can cause significant distress and

dysfunction.[9] Diagnostic manuals such as the DSM-V [1] highlight hallucinations as a primary symptom in psychotic disorders, however, within this category, auditory hallucinations tend to be more commonly explored.[10] Visual hallucinations are often overlooked, which may be due to traditional beliefs that these phenomena are related to organic disorders.[2] It may also be due to the difficulty in identifying particular criteria for the presence of visual hallucinations when other perceptual abnormalities may be reported.[2]

Visual hallucinations are defined as visual percepts, experienced when awake, in the absence of an external stimulus.[11] They are experienced by patients with conditions that span several fields such as neurological, psychiatric, and eye diseases, as well as nonclinical populations.[12] Visual hallucinations have been reported in 16%–72% of patients with psychotic disorders.[13] They are often distressing, involving figures, people, and animals,[14] can have a greater impact on a person's social functioning and relationships compared to auditory hallucinations, and are associated with an increased likelihood of intensive support and/or care via hospital services.[15] Previous reviews have focused on the prevalence and experiences of visual hallucinations in a general psychosis population, with a recent review highlighting a weighted prevalence of 27%.[2] However, no reviews have focused specifically on the experiences of those with a first episode of psychosis.[15]

Visual Hallucinations in First-Episode Psychosis

While much is known about the etiology, risk factors, treatment and outcomes for people with first-episode psychosis,[16] evidence on prevalence rates and phenomenology of symptoms in the first-episode population is less clear. The limited literature has led researchers to question whether the phenomenology in the young first-episode patient differs from those with a more established illness.[17] The studies that have explored visual hallucinations in first-episode psychosis have highlighted the need for further investigation to support "preventative action and symptom management".[9] Clark et al suggested that visual hallucinations in first-episode psychosis were indicative of a course characterized by reduced functioning.[9] In the first few years of illness onset, the presence of visual hallucinations was associated with greater disability, risk of relapse, and duration of psychosis in the past year, and consistent with prominent residual psychotic symptoms.[9] These findings are in line with studies showing a link between visual hallucinations and greater global illness severity [18] and anxiety levels.[19] Despite these results, research focusing on visual hallucinations remains relatively scarce[20] and inconsistent,[21] highlighting the need for a synthesis of current research.

Estimates of prevalence rates of visual hallucinations in first-episode psychosis have varied hugely, with some studies putting these as low as 1 in 8[22] and others finding that most patients with first-episode psychosis experience visual hallucinations.[23] Given the importance of the first episode of psychosis for treatment outcomes, it is crucial that the prevalence of different symptoms during this period, and how they are experienced by people with first-episode psychosis, are accurately represented. Calculating a pooled estimate of prevalence of visual hallucinations in first episode of psychosis is crucial to understand how common this experience is; this can normalize service users' experiences and enhance clinicians' understanding of such phenomena. Further, it is important to understand the factors that may have contributed to such disparate estimates.

Rationale

Prevalence rates of visual hallucinations have been identified in broad psychosis populations, with a weighted prevalence of 27%.[2] Whilst research into these experiences has increased over recent years, it has produced widely varying estimates of prevalence and has focused specifically on more severe or chronic psychosis presentations. The rate at which these symptoms are present during the "critical period" of psychosis is not well-documented. Having a greater understanding of the characteristics of this sample may support future exploration in both research and clinical practice to support the development of more meaningful assessments.

Therefore, the present systematic review and meta-analysis aims:

1. To synthesize existing literature and calculate pooled prevalence estimates for rates of visual hallucinations in first-episode psychosis populations
2. To assess how the rate of visual hallucinations in first-episode psychosis populations has changed over time
3. To evaluate the impact of different factors, such as assessment measures, service context, and participant characteristics on the rates of visual hallucinations in first-episode psychosis populations.

Methods

Search Strategy

A systematic search of the literature was carried out in December 2021. The search terms were guided by those used in previous reviews on related topics.[2,24,25] The databases PsycINFO, Embase, Medline, and Web of Science (1967–December 2021) were used to search the literature using the terms in table 1. Search terms for visual hallucinations and first-episode psychosis were then combined using the "and" function and all papers

Table 1. Search Terms Used for the Systematic Literature Review

Construct	Search Strategy Number	Search Terms	Combined	Combined
First-episode psychosis (population)	1	"first-episode" "first-episode psychosis" "first-episode schizophrenia" "early schizophrenia" "early psychosis" "recent onset" "Early Intervention Services" "EIS"	OR	
				AND
Visual Hallucinations (outcome)	2	"visual hallucinations" "non-auditory hallucinations" "VH" "visions" "visual perceptions" "visual perceptual abnormalities" "perceptual abnormalities" "visual disturbances"	OR	

exported to be searched. The keywords were searched for anywhere in the text.

Paper Selection

The full search strategy, using Preferred Reporting Items for Systematic reviews and Meta-Analyses guidelines, is described in figure 1. Titles and abstracts were screened by inclusion and exclusion criteria (Supplementary table 1) and removed if they met any exclusion criteria or did not meet all inclusion criteria. If this could not be determined from title and abstract, the full paper was screened. Prevalence was too broad a construct to be usefully included in the search terms. Therefore, the reporting of prevalence was hand-searched in the full text of the articles after the title screen had been completed.

Data Extraction

Data extracted from each paper included demographic information, broad study characteristics, and information on the reported rates of visual hallucinations. Where necessary, authors were contacted and asked to provide missing data. All data were extracted by the author and the reliability of data extraction was cross validated by a second rater with no errors or discrepancies noted.

Quality Review

A Quality Assessment Framework (Supplementary table 2) was developed based on The Cochrane Collaboration Risk of Bias Tool[26] and an appraisal tool tailored specifically for the evaluation of studies estimating rates of prevalence.[27] This was designed to measure the methodological limitations of a study in relation to the goals of the meta-analysis and assessed risk of bias across 6 domains: selection bias, performance bias, detection bias, statistical bias, reporting bias, and generalizability. Each study was given the rating low, medium, or high risk.

Results

The search identified 2384 articles, which was reduced to 1711 once duplicates were removed. These articles were then screened by title which excluded 1571 studies and then by abstract which excluded a further 100. Reasons for exclusion at this stage were studies whose participants did not meet the criteria for a first episode of psychosis (eg, neurodegenerative disorders, chronic schizophrenia diagnoses) and review articles not reporting novel empirical data. The remaining 40 articles were screened in detail, and 12 studies were eligible for this review. The reference lists of these 12 articles and of relevant reviews were screened, where 2 more articles were identified; these 2 articles were conducted prior to the databases publication date (before 1967). For completeness, a google scholar search was also undertaken, where one further article was identified[17]; this article included adolescents and young people up to the age of 25 years old, and therefore used keywords that were not included in this review's original search terms. Another search was conducted using the search terms "adolescent" and "young people" and it did not return any further relevant articles. In total, 15 studies were eligible for the meta-analysis.

Prevalence rates were synthesized, and random and fixed effects models were generated based on the 15 papers included. Subgroup analysis was conducted to assess levels of heterogeneity between studies; the impact of study-level risk of bias; the impact of measures frequently used to identify visual hallucinations and the impact of service context. A meta-regression was conducted to evaluate how participant characteristics, such as age and sex, impacted overall prevalence estimates; as well

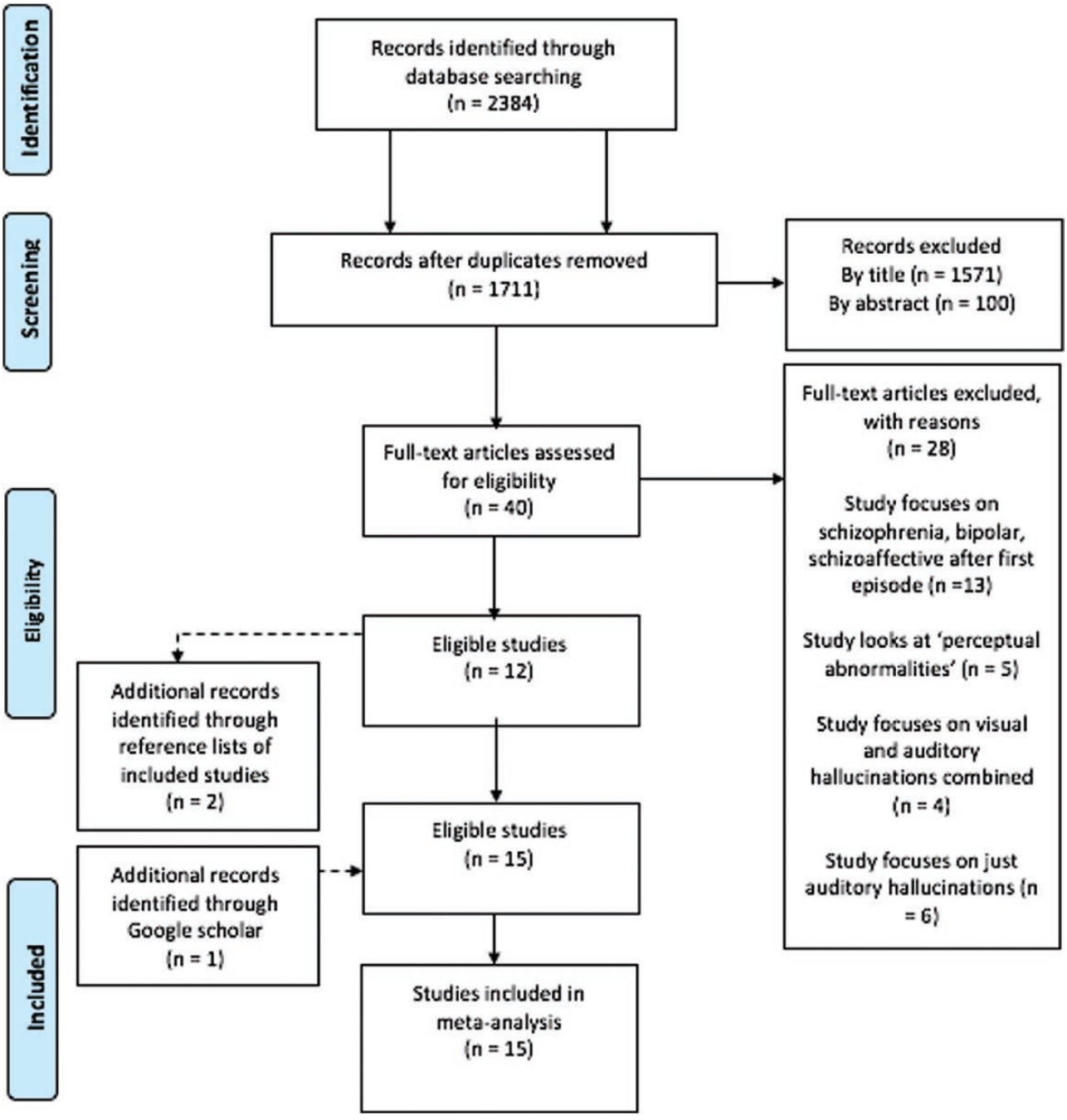

Fig. 1. Study selection.Adapted PRISMA flow diagram (Moher et al[58]).

as assessing how the rate of visual hallucinations has changed over time.

Study Quality

The quality framework yielded a high quality of studies overall (table 2). The majority of studies reported both low and medium risk of bias. Twelve of the studies did not report high risk of bias in any domains and one study did not report low risk for any of the domains[33]. However, for 3 studies there was high risk in the 3 domains of detection, statistical, and reporting bias, questioning the validity of the study designs to accurately measure the specific event rate. The one domain that had the majority of medium risk of bias ratings was that of generalizability. This could reflect the specific nature of the population being studied and the difficulty in generalizing the specific symptomology to the wider psychosis population. The included studies are representative of the research literature in this area at the time of writing and therefore are included despite high and medium risks of bias.

Table 2. Quality Framework Results

Study	Study Design	Selection bias	Performance Bias	Detection Bias	Statistical Bias	Reporting Bias	Generalizability Bias	Quality Index
Aynsworth (2017)[28]	PCS							75%
Caton (2005)[29]	PCS							75%
Chapman (1966)[30]	PCS							50%
Clark et al (2017)[9]	PCS							83%
Dudley et al (2013)[15]	PCS							66%
Dudley et al (2019)[22]	PCS							91%
Galetti et al (2017)[21]	RCS							75%
Goghari & Harrow (2016)[31]	RCS							91%
Jablensky et al (1992)[32]	RCS							100%
Longden et al (2016)[23]	PCS							83%
McKetin et al (2018)[33]	PCS							41%
Norman et al (2005)[34]	PCS							83%
Rajapakse et al (2011)[17]	RCS							75%
Solesvik et al (2016)[35]	PCS							91%
Young (1974)[36]	PCS							50%

Note: RCS, Retrospective Case Cohort Study; PCS, Prospective Case Cohort Study.

Meta-Analysis

Fixed Effect and Random Effects Models. There was clear evidence of nonlinearity in the distribution of prevalence rates within the primary studies when using the fixed effects model, however, there was no evidence of nonlinearity when using the random effects (RE) model (Supplementary figure 1). Therefore, the summary effect size and 95% confidence intervals (CI) were calculated using the RE model. The RE model accounts for variation between studies as a result of idiosyncrasies in the methodologies of the primary studies, as is commonly seen in psychological research[37]. The Restricted Maximum Likelihood estimator[38] was used as the appropriate method for the calculation of the variation of the true effect. This estimator has been shown to be more robust to deviations from normality[39].

The Omnibus Test. The aim of this review was to synthesize existing literature and calculate the pooled prevalence estimates for rates of visual hallucinations in a first episode of psychosis population. Psychosis affects 0.7% of the population and a recent review reported that the weighted prevalence of visual hallucinations in a general psychosis population as 27%. In comparison, the RE model in this review generated a weighted prevalence estimate of 33% of people with first-episode psychosis experiencing visual hallucinations (figure 2; $z = 10.92$, $P = < .0001$; 95% CI: 27.01 to 38.83).

Heterogeneity. A high level of heterogeneity in the primary studies was observed (Higgins $I^2 = 87.7\%$, $tau^2 = 0.0109$, $P < .01$). This finding prompted further examination of the factors that may account for the high levels of inconsistency in the reporting of prevalence in the primary studies[40].

Impact of Influential Studies . The impact of disproportionately influential studies was assessed using a "leave-one-out" analysis, in which the RE model was calculated with each of the primary studies removed in turn and change in weighted average effect size (ie, influence) and the change in heterogeneity (ie, discrepancy) was recorded. Two studies were found to be discrepant from the remaining literature and influential upon the overall synthesis. The RE model was recalculated with the removal of the 2 studies showing disproportionate influence. The corrected RE model reported a synthesis of prevalence = 0.3269 (95% CI: 0.28 to 0.37). The corrected RE model evidenced a <1% decrease relative to the uncorrected estimate, reporting a non-substantive effect. The studies were re-reviewed to identify any factors that might indicate that they should be removed from the analysis. As no risk of bias factors could be identified within these studies that may account for their substantial discrepancy from the rest of the literature, they were not removed from subsequent analysis.

Subgroup Analyses. To understand the relationship between the findings and the methodological heterogeneity, subgroup analyses were conducted.

The Impact of Symptom Measures. To quantify the impact on prevalence rate of how visual hallucinations (VH) are measured, a subgroup analysis was undertaken to compare the 3 different types of measures (psychotic symptoms measure; visual hallucination measure; self-report). The estimate of prevalence for the psychotic symptom measure was prevalence ratio (PR) = 0.31 (95% CI: 0.24 to 0.37) as compared to the estimates of prevalence for the self-report

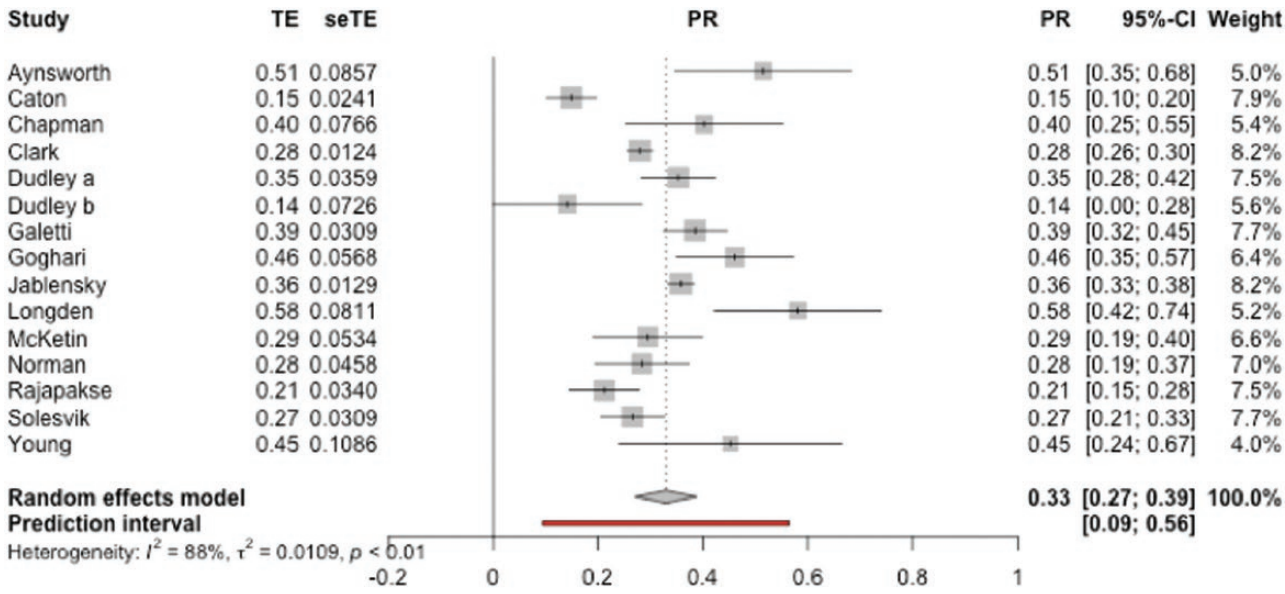

Fig. 2. Forest plot of prevalence rates.

which was PR = 0.40 (95% CI: 0.23 to 0.56) and visual hallucination measure which was PR = 0.33 (95% CI: 0.13 to 0.53). The difference between the 3 types of symptom measure was not statistically significant ($X^2 = 1.11$, $P = .57$).

The Impact of Service Context. As highlighted in the study characteristics, studies were conducted in different service settings. A subgroup analysis was undertaken to compare the 2 different types of services (a first-episode psychosis-specific service, such as Early Intervention services vs community services). The estimate of prevalence for the community service was 0.33 (95% CI 0.24 to 0.41) as compared to the estimates of prevalence for first episode of psychosis-specific service which was PR = 0.33 (95% CI: 0.24 to 0.42). The difference between the 2 types of service context was not statistically significant ($X^2 = 0.01$, $P = .92$)

The Impact of Year of Publication Date. Visual hallucinations have been under-reviewed in the psychosis literature and it is thought that more recently we have developed a better understanding of such phenomena. To estimate whether the prevalence has changed overtime, the year of publication of the study was regressed to the treatment outcome using meta-regression. The association between year of publication and prevalence rates did not show statistical significance (($\beta = -0.0009$, $z = -0.64$, $P = .52$).

The Impact of Age and Sex. To further calculate the impact of age and sex upon prevalence rates over time, the mean age, and sex (proportion of males) of participants reported in each study was regressed to the weighted prevalence using meta regression. The association between mean age of participants and prevalence rates ($\beta = -0.0088$, $z = -0.8813$, $P = .4$) did not show statistical significance. The association between proportion of males in each study and prevalence rates ($\beta = 0.0432$, $z = 0.147$, $P = .884$) also did not show statistical significance.

The Impact of Publication and Small Study Biases. Analysis highlighted possible evidence of publication bias in the distribution of prevalence (figure 3). The effect of publication bias was simulated using a trim-and-fill procedure[41]. The trim and fill procedure yielded a corrected RE model of prevalence = 0.305 (95% CI: 0.2399 to 0.3701). The corrected RE model evidenced an approximately −7.3584% decrease relative to the uncorrected estimate. Accordingly, the correction for publication did not result in a significant change in the meta-analytic synthesis and did not change the substantive conclusions from this analysis.

Discussion

The prevalence of visual hallucinations in a first-episode psychosis population was systematically reviewed and meta-analyzed. This was the first study to meta-analyze data specific to these symptoms and population. The use of a robust and standardized search strategy improved the accuracy of estimates, with strict inclusion and exclusion criteria enhancing the internal validity of findings. Overall, visual hallucinations were estimated to have a prevalence rate of 33% amongst people experiencing their first episode of psychosis. This is significantly higher than the general population estimate (6%)[42] and marginally higher than rates of visual hallucinations in a psychosis spectrum population as reported in a recent meta-analysis (27%)[2]. The subgroup analyses within this review did not demonstrate significant associations between prevalence

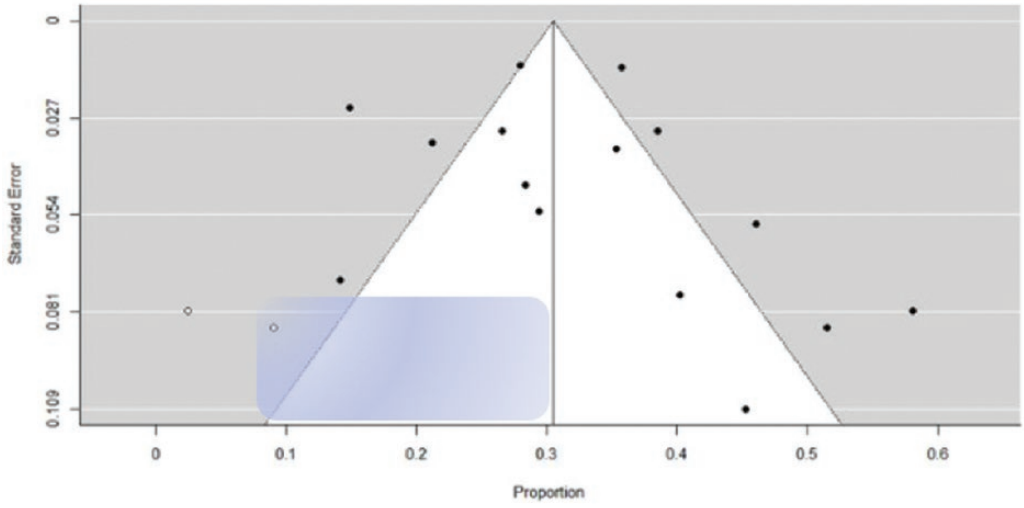

Fig. 3. Funnel plot of the prevalence rates.The 95% confidence interval of the expected distribution of prevalence is shown as an inverted "funnel". The bottom left section of the funnel is that associated with null or small effects in small sample sizes. The clear dots are imputed by the trim and fill procedure.

rates and the assessment tools used; the impact of service context; publication date of reviewed studies or participant characteristics. The results discussed here have clinical implications for people experiencing their first episode of psychosis and how such symptoms are understood and managed.

Experience of Visual Hallucinations

Hypotheses have been explored that may explain the higher rate of visual hallucinations in first-episode psychosis versus the broader psychosis spectrum, compared to other reported symptoms such as auditory hallucinations, where prevalence rates appear to remain consistent across illness trajectory (60%–80%)[43]. It can be argued that visual hallucinations are notably more distinct than auditory hallucinations. The occurrence of auditory hallucinations is linked to one's inner speech and is the result of the internalization of external dialogues during psychological development[44,45]. Auditory hallucinations are experienced across the lifespan; different disorders; and clinical and nonclinical populations[24]; highlighting that they are not diagnostic of just psychosis and appear to have less prognostic value when compared to other symptomatology, such as negative symptoms[9]. Therefore, auditory hallucinations can be seen as "part of the self"[46], whereas visual hallucinations are often only associated with clinical populations and may be experienced as external to oneself and therefore more distressing[47]—with this in mind, they may be more likely to be reported at high rates during the early phase of psychosis.

People may appraise the experience of visual hallucinations as a threat to their physical or psychological well-being[48]. Therefore, the distressing nature of seeing an image external to oneself and interpreting this as a threat may result in more reporting and higher rates of prevalence in the first-episode population, than the general psychosis population, who may be more accustomed to these experiences. Clark et al identified that visual hallucinations almost invariably co-occurred with other hallucination modalities, mainly auditory hallucinations, in an enduring psychosis population.[9] Given that auditory hallucinations are often focused on more, this may explain the reduction in prevalence rates of visual hallucinations following the first-episode, because they may be overlooked[9].

Psychosis is a highly stigmatized disorder; therefore, it is understandable that people may fear that their diagnosis will impact how others relate to them[49]. However, studies measuring perceived and experienced stigma in first-episode psychosis samples report lower rates of experienced stigma ranging from 6% to 43% compared to the broader population; this suggests that experienced stigma may increase with duration of illness[50]. This may explain the higher rates of prevalence of visual hallucinations in first-episode, as people feel more able to report their distressing symptoms during this phase of their illness, before levels of perceived stigma increase.

The initial years of illness onset are typically the worst symptomatic period in the course of psychosis, suggesting that in the later course of the illness, rates of visual hallucinations decrease to similar levels as found in other types of psychotic disorders[31]. In support of this, Dudley et al[22] found that visual hallucinations may be transitory for many early intervention service users, which could explain the lower prevalence rates following transition from first-episode psychosis to the broader population.

Another potential area to acknowledge is that psychotic symptoms are not independent of one another, and if we posit that appraisal and sense-making influence how

visual hallucinations might be reported, it may be necessary to acknowledge that broader "sense-making" of unusual experiences during first-episode psychosis happens at a far greater rate than those who have lived with psychosis for a longer time. Therefore, visual hallucinations may be reported less outside of first-episode as broader sense-making of psychosis and symptoms "improves"; suggesting that reduction in rates of visual hallucinations may be less about a reduction in the phenomenology, but an increased ability of the individual to reconcile these as symptoms and thus feel the need to report them as such later on in the pathway.

It is evident from the various arguments identified that there is not a clear evidence base for why visual hallucinations seem to occur more frequently in first-episode psychosis, which highlights the need for further exploration of such phenomena. It is also important to acknowledge that the specific mechanisms of visual hallucinations are not known in the literature and a full theoretical understanding of these symptoms remains elusive. Rather, the understanding of these mechanisms leans into the theoretical understanding of trauma responses[51].

Heterogeneity and Subgroup Analyses

High levels of heterogeneity were identified (I^2 = 87.7%). Several possible reasons for this were examined statistically. Analysis on the methodological quality of the studies found no significant differences in estimates of prevalence. Subgroup analyses showed no significant differences between groups based on method of measurement of visual hallucinations or service context. Given the relative lack of research specifically on visual hallucinations, they are often assessed using a general symptom measure [28]. These measures tend to demonstrate poor levels of adequacy with regard to criteria specific to assessing visual hallucinations, however, the results from this review suggest that the type of measure used does not affect prevalence estimates.

A further possible reason for the high heterogeneity could be difficulty in defining first-episode psychosis and therefore, the variability in populations studied. Clearly defining the term "first-episode psychosis" has proved difficult within practice[3]. Whilst samples continuously use differing definitions, the ability to assess these groups robustly decreases. This lack of clarity with regards to defining first-episode could support the nonsignificant results of service context on prevalence of visual hallucinations. The slightly higher prevalence rate of visual hallucinations in first episode compared to general psychosis populations may be because first-episode groups are not subject to the potential stigma that may arise throughout the duration of a psychotic episode; this may also be true of the views and decisions held in regards to medication compliance and illness severity by clinicians[52]. Therefore, this population may be more representative of the true experience of psychotic phenomena, resulting in higher reporting of these symptoms[53].

Meta-Regression Analyses

The influence of participant characteristics on prevalence estimates was assessed via a meta-regression; no significant associations were found. Men usually develop the illness at age 18–25, while in women, the mean age of onset is 25–35 [54]. These statistics align with the reviewed studies, where the majority of participants were male with a mean age of 24.7 years. Due to the proportion of males to females reported, meta-regression is a limited way in which to measure these effects. The nonsignificant results in this review suggest that men and women experience similar prevalence rates of visual hallucinations despite the age of illness onset.

A meta-regression was conducted to assess whether publication date impacted upon prevalence estimates, with no significant associations found. The historic focus of the psychosis literature on auditory hallucinations as core diagnostic characteristics overshadowed research on other modalities, with early interest in models of visual hallucinations in psychosis lapsing for a while[13]. This may have been due to the more frequent occurrence of auditory hallucinations, with the rise in pharmacological use, therefore, making them seemingly more receptive to treatment[18].

It is important to note that all of the studies included in this review were conducted in the Western world, therefore, providing a particular viewpoint on psychosis and its associated symptoms. Cross-cultural studies have reported a higher rate of visual hallucinations in non-Western cultures[32], and have suggested that this is due to the influence of culture on the expression of symptoms[18]. More recent research has highlighted cultural differences in attribution and reporting of symptoms and help-seeking[55]; all of which could impact upon prevalence estimates within this specific population.

Limitations

The majority of the studies did not have a particular focus on visual hallucinations and a number of them used adapted auditory hallucination assessment measures and interventions to explore symptoms, suggesting that they are experienced in similar ways[56]. The small number of studies in the review supports the view that visual hallucinations can often get overlooked in clinical practice, therefore, data collected with the specific purpose of investigating visual hallucinations might have provided more in-depth information[35].

Future Research and Clinical Implications

This review has highlighted that visual hallucinations are highly prevalent and more common in a first-episode

population; therefore, it is important for clinicians to routinely ask about the presence of visual hallucinations to aid this process of assessment and to help normalize these experiences which can cause distress and suffering[15]. Further exploration of the phenomenological aspects of visual hallucinations, such as the role of stigma and shame in the onset and maintenance of such phenomena[46] as well as the particular mechanisms of psychological and psychiatric interventions is required to understand the difference in prevalence rates during and following the first episode of psychosis[31]. In addition to this, adaptations of auditory hallucination measures and interventions are not sufficient to explore the true experience of visual hallucinations, therefore resources specific to these symptoms is required[57].

Conclusion

This meta-analysis provides a robust estimate of 33% for the prevalence of visual hallucinations in first-episode psychosis. Sub-group analysis revealed no significant associations between prevalence rates and service context; participant characteristics; publication date and assessment methods, suggesting that further, more detailed exploration is required. This review has highlighted that visual hallucinations are relatively common experiences and the reporting of these may not be representative of the person's experience of them. Future research and clinical pathways should explore ways in which specific support is offered to those experiencing their first episode of psychosis in the identification of symptoms such as visual hallucinations and investigate how best to offer this support, to ensure a positive recovery outcome.

Supplementary Material

Supplementary data are available at *Schizophrenia Bulletin Open* online.

Conflict of Interest

The authors have declared that there are no conflicts of interest in relation to the subject of this study.

References

1. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. *BMC Med.* 2013;17:133–137.
2. Waters F, Collerton D, Ffytche DH, *et al.* Visual hallucinations in the psychosis spectrum and comparative information from neurodegenerative disorders and eye disease. *Schizophr Bull.* 2014;40(suppl 4):S233–S245.
3. Breitborde NJ, Srihari VH, Woods SW. Review of the operational definition for first-episode psychosis. *Early Interv Psychiatry.* 2009;3(4):259–265.
4. Birchwood M. Pathways to emotional dysfunction in first-episode psychosis. *Br J Psychiatry.* 2003;182(5):373–375.
5. Griffiths R, Mansell W, Edge D, Tai S. Sources of distress in first-episode psychosis: a systematic review and qualitative metasynthesis. *Qual Health Res.* 2019;29(1):107–123.
6. Birchwood M, Todd P, Jackson C. Early intervention in psychosis. *Br J Psychiatry.* 1998;172(S33):53–59.
7. Marwaha S, Johnson S. Schizophrenia and employment. *Soc Psychiatry Psychiatr Epidemiol.* 2004;39(5):337–349.
8. Kuipers E, Garety P, Fowler D, Freeman D, Dunn G, Bebbington P. Cognitive, emotional, and social processes in psychosis: refining cognitive behavioral therapy for persistent positive symptoms. *Schizophr Bull.* 2006;32(suppl 1):S24–S31.
9. Clark ML, Waters F, Vatskalis TM, Jablensky A. On the interconnectedness and prognostic value of visual and auditory hallucinations in first-episode psychosis. *Eur Psychiatry.* 2017;41(1):122–128.
10. Arciniegas DB. Psychosis. *CONTIN. Lifelong Learn.* 2015;21(3 Behavioral Neurology and Neuropsychiatry):715–736.
11. Teeple RC, Caplan JP, Stern TA. Visual hallucinations: differential diagnosis and treatment. *Prim Care Companion J Clin Psychiatry.* 2009;11(1):26.
12. Onofrj, M, Thomas, A, Martinotti, G, *et al*. The clinical associations of visual hallucinations. In: *The Neuroscience of Visual Hallucination*. 2015:91–117.
13. Collerton, D, Dudley, R, Mosimann, UP. Visual hallucinations. In: Blom JD and Sommer I, eds. *Hallucinations, Research and Practice*. Springer-Verlag, NY: Springer; 2012:75–90
14. Dudley R, Wood M, Spencer H, Brabban A, Mosimann UP, Collerton D. Identifying specific interpretations and use of safety behaviours in people with distressing visual hallucinations: an exploratory study. *Behav Cogn Psychother*. 2012;40(3):367–375.
15. Dudley R, Collerton D, Nicholson M, Mosimann U. Clinical characteristics of disclosed visual hallucinations in users of an Early Intervention in Psychosis Service. *Psychosis.* 2013;5(2):127–133.
16. Schimmelmann BG, Huber CG, Lambert M, Cotton S, McGorry PD, Conus P. Impact of duration of untreated psychosis on pre-treatment, baseline, and outcome characteristics in an epidemiological first-episode psychosis cohort. *J Psychiatr Res.* 2008;42(12):982–990.
17. Rajapakse T, Garcia-Rosales A, Weerawardene S, Cotton S, Fraser R. Themes of delusions and hallucinations in first-episode psychosis. *Early Interv Psychiatry*. 2011;5(3):254–258.
18. Mueser KT, Bellack AS, Brady EU. Hallucinations in schizophrenia. *Acta Psychiatr Scand.* 1990;82(1):26–29.
19. Oorschot M, Lataster T, Thewissen V, Bentall R, Delespaul P, Myin-Germeys I. Temporal dynamics of visual and auditory hallucinations in psychosis. *Schizophr Res.* 2012;140(1–3):77–82.
20. de Leede-Smith S, Barkus E. A comprehensive review of auditory verbal hallucinations: lifetime prevalence, correlates and mechanisms in healthy and clinical individuals. *Front Hum Neurosci.* 2013;7:367.
21. Galletti C, Paolini E, Tortorella A, Compton MT. Auditory and non-auditory hallucinations in first-episode psychosis: differential associations with diverse clinical features. *Psychiatry Res.* 2017;254:268–274.
22. Dudley, R, Aynsworth, C, Mosimann, U, Taylor, JP, Smailes, D, Collerton, D, Urwyler, P. A comparison of visual hallucinations across disorders. *Psychiatry Res.* 2019;272:86–92.
23. Longden E, House AO, Waterman MG. Associations between nonauditory hallucinations, dissociation, and childhood

adversity in first-episode psychosis. *ISSN International Centre.* 2016;17(5):545–560.
24. Maijer K, Begemann M, Palmen S, Leucht S, Sommer I. Auditory hallucinations across the lifespan: a systematic review and meta-analysis. *Psychol Med.* 2018;48(6):879–888.
25. Correll, CU, Galling, B, Pawar, A, *et al*. Comparison of early intervention services vs treatment as usual for early-phase psychosis: a systematic review, meta-analysis, and meta-regression. *JAMA psychiatry.* 2018;75(6):555–565.
26. Higgins, J. P. T., Altman, D. G., Gotzsche, P. C., *et al*. The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. *BMJ*. 2011;343, d5928. doi:10.1136/bmj.d5928
27. Munn Z, Moola S, Riitano D, Lisy K. The development of a critical appraisal tool for use in systematic reviews addressing questions of prevalence. *Int. J. Health Policy Manag.* 2014;3(3):123–128.
28. Aynsworth C, Nemat N, Collerton D, Smailes D, Dudley R. Reality monitoring performance and the role of visual imagery in visual hallucinations. *Behav Res Ther.* 2017;97:115–122.
29. Caton CL, Drake RE, Hasin DS, *et al.* Differences between early-phase primary psychotic disorders with concurrent substance use and substance-induced psychoses. *Arch Gen Psychiatry.* 2005;62(2):137–145. doi:10.1001/archpsyc.62.2.137.
30. Chapman J. The early symptoms of schizophrenia. *Br J Psychiatry.* 1966;112(484):225–251.
31. Goghari VM, Harrow M. Twenty year multi-follow-up of different types of hallucinations in schizophrenia, schizoaffective disorder, bipolar disorder, and depression. *Schizophr Res.* 2016;176(2-3):371–377.
32. Jablensky, A, Sartorius, N, Ernberg, G, *et al*. Schizophrenia: manifestations, incidence and course in different cultures A World Health Organization Ten-Country Study. *Psychol Med Monogr Suppl.* 1992;20:1–97.
33. McKetin R, Hides L, Kavanagh DJ, Saunders JB, Dawe S. First psychotic episode risk markers for primary psychosis amongst people who use methamphetamine. *Schizophr Res.* 2018;199:456–457.
34. Norman RM, Scholten DJ, Malla AK, Ballageer T. Early signs in schizophrenia spectrum disorders. *J Nerv Ment Dis.* 2005;193(1):17–23.
35. Solesvik, M, Joa, I, Larsen, TK, *et al*. Visual hallucinations in first-episode psychosis: association with childhood trauma. *PLoS One.* 2016;11(5):e0153458.
36. Young B. A phenomenological comparison of LSD and schizophrenic states. *Br J Psychiatry.* 1974;124(578):64–74.
37. DerSimonian R, Kacker R. Random-effects model for meta-analysis of clinical trials: an update. *Contemp Clin Trials.* 2007;28(2):105–114.
38. Patterson HD, Thompson R. Recovery of inter-block information when block sizes are unequal. *Biometrika.* 1971;58(3):545–554.
39. Ban KY, Osborn DP, Hameed Y, *et al.* Personality disorder in an Early Intervention Psychosis cohort: findings from the Social Epidemiology of Psychoses in East Anglia (SEPEA) study. *PLoS One.* 2020;15(6):e0234047.
40. Higgins J, Thompson S, Deeks J, Altman D. Statistical heterogeneity in systematic reviews of clinical trials: a critical appraisal of guidelines and practice. *J Health Serv Res Policy.* 2002;7(1):51–61.
41. Duval S, Tweedie R. Trim and fill: A simple funnel-plot-based method of testing and adjusting for publication bias in meta-analysis. *Biometrics.* 2000a;56(2):455–463.
42. Kessler, RC, Birnbaum, H, Demler, O, *et al*. The prevalence and correlates of nonaffective psychosis in the National Comorbidity Survey Replication (NCS-R). *Biol Psychiatry.* 2005;58(8):668–676.
43. Lim, A, Hoek, HW, Deen, ML, *et al*. Prevalence and classification of hallucinations in multiple sensory modalities in schizophrenia spectrum disorders. *Schizophr Res.* 2016;176(2-3):493–499.
44. Vygotsky LS. The psychology of schizophrenia. *Soviet Psychology.* 1987;26(1):72–77.
45. Jones SR. Do we need multiple models of auditory verbal hallucinations? Examining the phenomenological fit of cognitive and neurological models. *Schizophr Bull.* 2010;36(3):566–575.
46. Morrison AP, Wells A, Nothard S. Cognitive factors in predisposition to auditory and visual hallucinations. *Br J Clin Psychol.* 2000;39(1):67–78.
47. McCarthy-Jones S. Is shame hallucinogenic? *Front Psychol.* 2017;8:1310.
48. Collerton D, Dudley R. A cognitive behavioural framework for the treatment of distressing visual hallucinations in older people. *Behav Cogn Psychother.* 2004;32(4):443–455.
49. Gilbert P. An introduction to compassion focused therapy in cognitive behavior therapy. *Int. J. Cogn. Ther.* 2010;3(2):97–112.
50. Corker, EA, Beldie, A, Brain, C, *et al*. Experience of stigma and discrimination reported by people experiencing the first episode of schizophrenia and those with a first episode of depression: the FEDORA project. *Int J Soc Psychiatry.* 2015;61(5):438–445.
51. Arndt S, Andreasen NC, Flaum M, Miller D, Nopoulos P. A longitudinal study of symptom dimensions in schizophrenia: prediction and patterns of change. *Arch Gen Psychiatry.* 1995;52(5):352–360.
52. Simonsen, C, Aminoff, SR, Vaskinn, A, *et al*. Perceived and experienced stigma in first-episode psychosis: A 1-year follow-up study. *Compr Psychiatry.* 2019;95:152134.
53. Robinson, D, Woerner, MG, Alvir, JMJ, *et al*. Predictors of relapse following response from a first episode of schizophrenia or schizoaffective disorder. *Arch Gen Psychiatry.* 1999;56(3):241–247.
54. McGrath, JJ, Saha, S, Al-Hamzawi, AO, *et al*. Age of onset and lifetime projected risk of psychotic experiences: cross-national data from the World Mental Health Survey. *Schizophr Bull.* 2016;42(4):933–941.
55. Singh, SP, Brown, L, Winsper, C, Gajwani, R, Islam, Z, Jasani, R, Birchwood, M. Ethnicity and pathways to care during first episode psychosis: the role of cultural illness attributions. *BMC psychiatry.* 2015;15(1):1–8.
56. Gauntlett-Gilbert J, Kuipers E. Visual hallucinations in psychiatric conditions: appraisals and their relationship to distress. *Br J Clin Psychol.* 2005;44(1):77–87.
57. Thomson C, Wilson R, Collerton D, Freeston M, Dudley R. Cognitive behavioural therapy for visual hallucinations: an investigation using a single-case experimental design. *Cogn. Behav. Ther.* 2017;10:e10.
58. Moher D, Liberati A, Tetzlaff J, Altman DG, Prisma G. Reprint—Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Phys Ther.* 2009;89(9):873–880.