



School of Psychology

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**Hearing Voices: A systematic review of the impact of
social isolation and an empirical study exploring
negative content and voice-related distress.**

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Preface

Around 10% of people will experience hearing voices, also known as auditory verbal hallucinations, at some point in their lives. Auditory hallucinations, the experience of hearing in the absence of external sound, exist along a spectrum of normal human experience. The experience can be both brief and comforting as well as persistent, negative, and disabling. People who hear voices do not always have an associated mental health condition, but some do. Experts by Experience have led the Hearing Voices Movement which emphasises that the experience of hearing voices should not be thought of as an abnormality to be eradicated per se, but rather a meaningful part of human experience. Psychological research and interventions are catching up with this perspective and are seeking to better understand and focus on reducing distress associated with hearing voices, if present, rather than reducing the voices themselves. This empirical study examined the impact that ways of thinking about and responding to voices has on distress in voice hearers. The systematic review aimed to understand the potential impact of social isolation arising from COVID-19 restrictions on auditory hallucinations in the general population.

The empirical study aimed to further our understanding of how distress associated with hearing voices is maintained. Previous research has found the content of voices, especially those which are negative, is an important factor in associated distress. This research looked at whether there are ways in which people who hear voices think about or respond cognitively to the voices, which increases their distress. The research was conducted online with adults who identified as hearing voices, both those who receive support from mental health services and those who do not. The participants were from diverse ethnic backgrounds. The results showed that both negative content and voice-

related distress were higher in those who had recently been in contact with mental health services. When examining what might mediate the relationship between negative content and voice-related distress, both responding mindfully to voices and the interpretation of loss of control, were mediating factors. The results support the use of psychological interventions that have an element of mindfulness training as well as Cognitive Behavioural Therapy that targets unhelpful cognitions such as the interpretation of loss of control. However, further research on interventions for hearing voices would benefit from including a comparison between approaches. Furthermore, the development of validated tools for measuring specific aspects of hearing voices such as negative content and voice-related distress would be helpful for future research that builds on these findings.

The systematic review examined the relationship between social isolation and auditory hallucinations in the general population in order to understand the potential effects of COVID-19 restrictions on auditory hallucinations. Previous theories have proposed that social isolation can trigger auditory hallucinations in those who are vulnerable to developing them. The review looked at research that examined social isolation and auditory hallucinations since 2001 to account for the changes that mobile phones and the internet have had on social connection. 16 studies were identified by searching electronic databases and reference lists. The studies were conducted in seven different countries between 2004 and 2021. The types of social isolation examined were COVID-19 restrictions, hospital quarantine, and general social isolation. Although the included studies were found to be of good quality, few of them directly examined the relationship between social isolation and auditory hallucinations. One study, conducted prior to COVID-19, found social isolation was not associated with auditory hallucinations. Another study, looking at the impact of COVID-

19 restrictions, found no change in severity of pre-existing auditory hallucinations. Many of the studies included in the review, despite having measured auditory hallucinations separately, combined all types of hallucinations or psychosis symptoms together when conducting their analysis. For example, in two studies social isolation was found to be associated with an increase in all types of hallucinations in an older population. However, it is not known whether this relationship would remain if just auditory hallucinations were examined. The review highlighted age, coronavirus infection, and pre-existing levels of isolation might influence whether social isolation affects auditory hallucinations. Further research looking at these factors and how they interact is needed to better understand the impact that COVID-19 restrictions may have on auditory hallucinations. In turn, this may indicate interventions that would alleviate the detrimental effects of social isolation arising from COVID-19 restrictions.

Both the systematic review and empirical paper contribute to our understanding of hearing voices in relation to factors that may increase voice-related distress and how the current COVID-19 pandemic may impact upon voice hearing. As distress relating to hearing voices exists both within the context of and independent of mental health diagnoses, it is important for research to examine this phenomenon outside of the constraints of psychiatric diagnosis in order to further the development of interventions to alleviate distress.

Paper 1: Systematic Literature Review

Auditory hallucinations and social isolation in the context of the COVID-19 pandemic: A systematic review.

Running title: Auditory hallucinations and COVID-19

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Abstract

Background

During the COVID-19 pandemic many countries have implemented public health measures that restrict physical social contact between people. There has been concern about the mental health consequences of social isolation arising from restrictions. The social deafferentation hypothesis proposes social isolation induces auditory hallucinations in individuals vulnerable to psychotic symptoms. This review aimed to examine whether social isolation arising from the COVID-19 restrictions could impact upon the development and severity of auditory hallucinations in the general population.

Methods

Electronic literature databases (PsycInfo, Medline, CINAHL, ASSIA and Scopus) were searched to identify studies that examined social isolation and auditory hallucinations published since 2001 and of any methodological design.

Results

16 papers published from 2004-2021 met the inclusion criteria. Few studies directly examined the relationship between social isolation and auditory hallucinations. Evidence from one study conducted prior to COVID-19 suggests auditory hallucinations are not associated with social isolation. No change in severity in pre-existing auditory hallucinations was found in a single study assessing the impact of COVID-19 restrictions. Social isolation was found to be associated with an increase in all types of hallucinations in an older

population in two studies.

Conclusions

This review found a lack of evidence linking COVID-19 restrictions with auditory hallucinations. Further research is needed that accounts for potential confounding variables of age, COVID-19 infection and pre-existing levels of isolation when evaluating the relationship between social isolation and auditory hallucinations. Heterogeneity and methodological design limited the conclusions that could be drawn from the studies in this review.

Keywords: social isolation, COVID-19, auditory hallucinations, hearing voices, social deafferentation, psychosis

Key practitioner message:

- Evidence is lacking to suggest COVID-19 restrictions, and associated social isolation, will increase reports of auditory hallucinations in the general population or increase the severity of pre-existing auditory hallucinations.
- A lack of evidence does not confirm there is no relationship between social isolation and auditory hallucinations. Further research is needed.
- This review discusses potential confounding variables of the impact of COVID-19 restrictions on auditory hallucinations. These include age, coronavirus infection and pre-existing levels of isolation.

Introduction

COVID-19, the disease caused by a coronavirus SARS-CoV-2, and first discovered in China in December 2019, was declared a world-wide pandemic by March 2020 (World Health Organisation, 2020c). Since then, the pandemic has had a catastrophic impact around the world: by May 2021 the death toll had passed three million and an estimated 160 million people had been infected (Johns Hopkins Coronavirus Resource Center, 2021). Furthermore, the COVID-19 pandemic has been linked to reduced psychological wellbeing in the general population and high levels of post-traumatic stress symptoms and depression have been reported in those infected with the virus (Vindegaard & Benros, 2020). However, as the pandemic continues, the true extent of its impact on psychological health and specific mental health symptoms is still emerging.

Most reviews to date examining the psychological impact of COVID-19, have focused on general psychological outcomes or more common psychological symptomatology such as post-traumatic stress symptoms, anxiety, and depression (Brooks et al., 2020; Vindegaard & Benros, 2020). One review by Brown et al. (2020) has examined the potential impact of COVID-19 on psychosis. This rapid review, conducted during the initial months of the COVID-19 pandemic, found moderate but poor-quality evidence of an increased rate of psychosis in those infected with coronavirus. In addition, there was limited poor quality evidence, based on one case study and one observational study, that the psychosocial stress of COVID-19 may be associated with the emergence of psychosis in previously unaffected individuals (Brown et al., 2020).

Psychosis comprises of a cluster of symptoms including auditory and visual hallucinations and delusions, all of which may have differing interactions with the social-

environmental changes brought about by COVID-19. The Brown et al. (2020) review included studies whose participants had a psychotic disorder, or were considered to be at high risk of developing psychosis, and had been exposed to an epidemic or pandemic. The review did not examine the impact of measures to curb disease outbreak on individual psychosis symptoms. There is an increasing emphasis within mental health research to focus on basic dimensions of functioning, as opposed to conducting research driven by disorder or diagnostic labels that are based on heterogeneous clusters of symptoms (Sanislow, 2020). Auditory hallucinations commonly occur in several different disorders, including disorders considered outside of the psychosis spectrum (Larøi et al., 2012), as well as within nonclinical populations (Johns et al., 2014). Auditory hallucinations may be affected by the circumstances arising from COVID-19 independent to psychosis generally. Therefore, it is important to examine auditory hallucinations independently of disorder labels such as psychosis (Cuthbert & Morris, 2021; Ford et al., 2014), to increase our understanding of the potential impact of crises such as the COVID-19 pandemic on mental health functioning.

Due to coronavirus being passed from one person to the next, predominantly by airborne droplets, effective and necessary measures to control the spread have included social distancing (more accurately described as physical distancing), national and local 'lockdowns' limiting social contact and freedom of movement and isolating those infected or exposed to infection. All these measures reduce and/or change the nature or quality of social contact. Every country in the world has been encouraged to put in place some degree of public health measures to reduce the spread of the disease (World Health Organisation, 2020b). In the UK, for example, there has been a series of national lockdowns where the public have been required to only leave their homes for exercise and essential shopping, to

work from home where possible, and avoid meeting with anyone from outside their household (Coronavirus Act, 2020). Although the evidence is clear that these restrictions are necessary to mitigate the catastrophic effects of COVID-19 (Matrajt & Leung, 2020), there has been concern that the social isolation resulting from these measures is negatively affecting the mental health of populations exposed to them (Druss, 2020; Holmes et al., 2020; Tso & Park, 2020; Usher, Bhullar, & Jackson, 2020).

Social isolation is defined as a lack of social contact, interactions, and relationships with others. Although COVID-19 restrictions by their very nature are likely to increase social isolation in the general population, there are many other factors which may influence someone's level of social isolation (for example, living arrangements, access to social spaces, personality, and motivational factors). Social isolation is theorised as a risk factor in the development and maintenance of poor psychological wellbeing and mental health conditions (Andersson, 1998). A recent overview of systematic reviews on the health consequences of social isolation and loneliness found that there is strong evidence that depression is associated with social isolation specifically, but there was a lack of evidence linking loneliness with depression (Leigh-Hunt et al., 2017). These results highlight that social isolation and loneliness are not synonymous and potentially have different psychological impacts (Wang et al., 2017). This is an important distinction in relation to COVID-19 measures where social isolation is enforced, but as individuals can stay connected through means other than face-to-face contact, measures may not necessarily cause feelings of loneliness.

A rapid review by Brooks et al. (2020) on the psychological impact of being quarantined following exposure to infectious disease highlights the potential for quarantine

to have negative effects on psychological health. Twenty-four papers on quarantine in the context of previous infectious disease outbreaks were included in the review. The review found that quarantine can have wide ranging negative psychological consequences, with low mood and irritability being the most prevalent, and several studies reporting negative psychological effects continuing for months after quarantine had ended (Jeong et al., 2016; Liu et al., 2012).

Evidence from historical experimental studies on sensory deprivation suggests that isolation is associated with an increased frequency in hallucinatory experiences (Davis, McCourt, Courtney, & Solomon, 1961; Schulman, Richlin, & Weinstein, 1967; Zubek, Pushkar, Sansom, & Gowing, 1961). The social deafferentation hypothesis proposes that social isolation induces auditory hallucinatory experiences that are often social in nature (e.g. hearing voices) in predisposed individuals via maladaptive changes in neuronal excitability in cortical areas associated with social cognition and speech perception (Hoffman, 2007, 2008). The underlying mechanisms of the social deafferentation hypothesis and causal relationships have yet to be clearly demonstrated empirically. However, observational data demonstrates an association between a reduction in social contact or social withdrawal and the onset of psychotic symptoms (Gayer-Anderson & Morgan, 2013; Tan & Ang, 2001) and auditory verbal hallucinations specifically (Hoffman, 2007). Furthermore, avoidance of social contact has been found to mediate the relationship between sexual trauma and the development of psychosis, including hallucinations (Murphy, Shevlin, Adamson, & Houston, 2013). These findings indicate that social isolation may play a role in the emergence of hallucinations in vulnerable individuals.

The link between loss of sensory input in sensory impairment and increasingly complex hallucinations is well established (see Marschall, Brederoo, Ćurčić-Blake, & Sommer, 2020, for a review). Recently, Shoham et al. (2020) found that social functioning mediates the relationship between lack of sensory input in sensory impairment and psychotic symptoms, pointing towards the potential of the social environment to influence symptom development. However, it is important to note that in the Shoham et al. (2020) study participants who screened positive for psychosis solely due to the presence of auditory or visual hallucinations were excluded from the analysis. Participants had to present with more than just hallucinations to meet the inclusion criteria for this study, which limits the conclusions that can be drawn specifically about hallucinations.

Auditory verbal hallucinations, or hearing voices, are not usually random speech or sounds but more often meaningful and personal dialogue that is social in nature, often compelling the hearer to engage in a conversational interaction (Hayward, 2003; Nayani & David, 1996). The existence of an association between sensory deprivation and hallucinations does not mean a relationship between social isolation and auditory verbal hallucinations can be assumed. However, there are indicators that reduced social contact could play a role in the development of, or influence the severity of, auditory verbal hallucinations. COVID-19 social distancing and isolation measures have vastly changed the social environment for many and for extended periods of time. Reviewing the possible association between reduced social contact and auditory verbal hallucinations will further our understanding of the impact of a global pandemic on mental health.

The aim of this review was to systematically examine empirical research that looked at auditory verbal hallucinations alongside social isolation, changes in social contact and/or reduced social contact. The main research questions were:

- 1) Is there a relationship between social isolation or reduced social contact and increased reports of auditory verbal hallucinations?
- 2) Is social isolation associated with a change in the nature or severity of auditory verbal hallucinations?
- 3) Can the current research identify any factors that might mitigate the impact of COVID-19 restrictions on auditory verbal hallucinations?

This review aimed to synthesise findings from research where social connectedness had been examined alongside auditory verbal hallucinations. It aimed to draw together findings from research on social isolation as well as research conducted in the context of, or including participants who were subjected to, some level of social restriction (e.g. hospital isolation). The review also aimed to critique the findings in relation to their relevance to understanding the potential effects of COVID-19 restrictions.

Method

Search Strategy

Studies were identified by searching five databases (PsycInfo, Medline, CINAHL, Applied Social Sciences Index Abstracts and Scopus) with the last search being conducted on 29th January 2021. The following key words were combined in keyword searches: auditory hallucinat*, hear* voice*, hallucinat*, psychosis, schizophrenia or psychotic; and quarantine, lockdown, shield*, social* isolat*, social* distan*, self isolat* or patient seclusion. Additionally, reference lists of included papers were manually searched.

Inclusion Criteria

Studies were eligible for inclusion if they were published in a peer reviewed journal, a full text manuscript was available in English and if they investigated the relationship between social isolation in human participants and auditory hallucinations. Data trends in internet access and mobile phone subscriptions show a sharp increase in the UK from the year 2000 and fixed telephone line subscriptions peaked in the same year (The World Bank, 2021). Internet and telephone access are important variables in social isolation as they enable a degree of connection and socialising through means other than fact-to-face contact. Therefore, only studies published from 2001 onwards were included. Any research methodology, both quantitative and qualitative, was included. Studies were only included if they utilised some form of measure of auditory hallucinations, either through interview, questionnaire, or symptom checklist. Studies which listed symptoms but did not demonstrate how the data on symptoms had been collected were excluded.

Due to the unprecedented nature of the social restrictions placed on populations during COVID-19 and limited research on its effects, the inclusion criteria aimed to include any study examining social isolation. For this reason, studies that captured social isolation arising from living situations, such as living alone, as well as those which included a more explicitly enforced social restriction, such as hospital quarantine, were included. Choice and preference are potentially important mediating or moderating factors. However, it was felt that studies examining social isolation arising from situations other than public health measures could still provide insights relevant to the COVID-19 situation.

Social isolation and subjective feelings of loneliness are considered to be distinct but related concepts with only a weak to moderate correlation existing between them (Cornwell & Waite, 2009). And although loneliness is associated with psychosis generally (da Rocha, Rhodes, Vasilopoulou, & Hutton, 2018), it is not connected to hallucinations independently of other psychosis symptoms (Jaya, Hillmann, Reininger, Gollwitzer, & Lincoln, 2017). Therefore, this review focused on social isolation specifically and excluded studies that only examined subjective feelings of loneliness. Eligibility was assessed by the first author using a three-stage process of screening the titles, abstracts and then full texts. Where it was unclear whether a study met the inclusion criteria, a decision was reached in consultation with the second author.

Data Extraction

Data extraction was carried out by the first author by populating a data extraction table that captured relevant data and study characteristics including research design, participant characteristics and country. Data relevant to the aims of the review was

characteristics and duration of social isolation, occurrence of auditory hallucinations and any analysis of their relation to social isolation. Where a measure of psychotic experiences was used, data on this was also collected. Data extraction was carried out alongside a quality assessment of the study.

Quality Appraisal

A quality appraisal of included studies was carried out using the Quality Assessment Tool for Studies of Diverse Design (QATSDD; Sirriyeh, Lawton, Gardner, & Armitage, 2012). The QATSDD assesses overall quality of research and can be applied to studies of all designs and both quantitative and qualitative methodologies. The tool includes 16 criteria, of which two are specific to qualitative and two specific to quantitative studies. Studies are scored on a scale of 0 to 3 for each criterion; guidance notes are provided on how studies achieve each score. Each study can be awarded a quality score out of 42 which can be expressed as a percentage (100% = highest quality, 0% = poorest). The authors recommend providing an overall score for the body of evidence presented in a review by calculating the mean score of the included papers expressed as a percentage. The QATSDD has shown good inter-rater reliability ($\kappa=.715$) and test-retest reliability (Sirriyeh et al., 2012). During its development, face validity of the QATSDD was established by gaining feedback from health researchers (Sirriyeh et al., 2012). The tool has been used in several reviews of a similar format to the current one (Kwan, Gitimoghaddam, & Collet, 2020; Medford, Hare, & Wittkowski, 2018). The first author rated all included studies, 25% were rated by an independent researcher to determine inter-rater reliability.

Results

Literature Search Results

Database searches retrieved 1443 papers; 151 duplicates were removed. Citation list searches retrieved an additional 15 papers. Figure 1 illustrates the screening process in the Preferred Reporting Items for Systematic Reviews and Meta-Analysis flow diagram format (Page et al., 2021). Sixty-one papers were excluded after the full report was screened for eligibility. The majority were excluded because they did not include a measure of auditory hallucinations. A total of 16 studies were found to be eligible and were included in the review.

Overview of Included Studies

Table 1 provides details of the characteristics of included studies. The studies were conducted in seven different countries covering two continents (Europe = 10 studies, Asia = 6). The included studies were published between 2004 and 2021 and were highly varied in methodological design.

Figure 1

PRISMA Flow Diagram Summarising the Screening Process

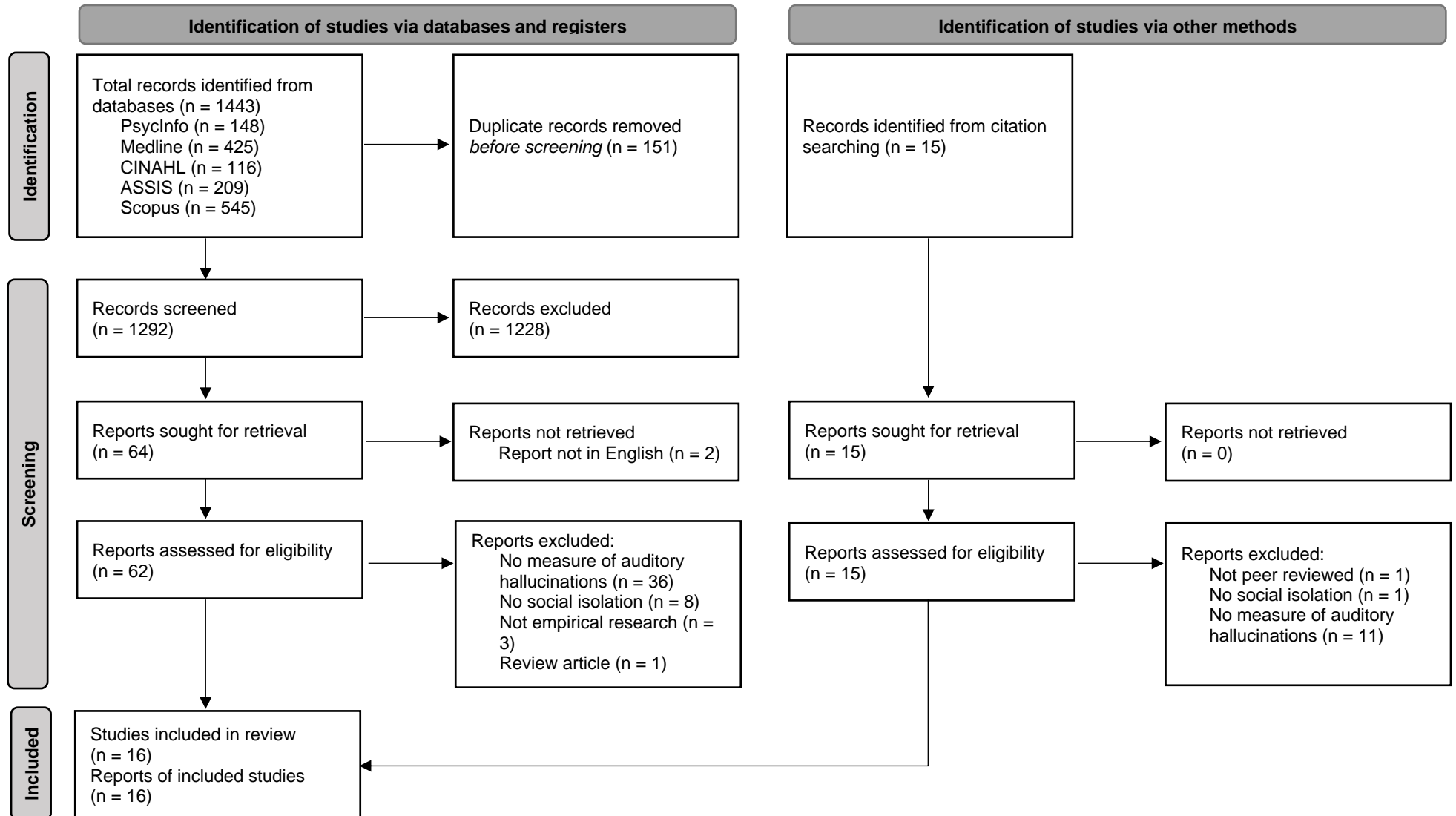


Table 1*Characteristics of Included Studies*

Authors	Data collection period	Country	Design	Social Isolation	Sample Size and Type	Measures
Bennett et al. (2020)	1991-2011	France	Longitudinal study	Childhood friendships	<i>N</i> = 333 Non-clinical	MINI
Bortolon et al. (2021)	2020	France	Cross-sectional study	National lockdown measures	<i>N</i> = 728 Non-clinical	CAPS
Butter et al. (2017)	2007	UK	Cross-sectional study	Social isolation in daily life (i.e. living alone)	<i>N</i> = 7403 Non-clinical	PSQ
Cheng et al. (2004)	2003	Hong Kong	Case series	Patient isolation in hospital	<i>N</i> = 10 Clinical (SARS infected)	symptom checklist (study specific)
D'Agostino et al. (2020)	2020	Italy	Case series	National lockdown measures	<i>N</i> = 6 Clinical (psychosis)	BPRS
El Haj et al. (2016)	<i>Not stated</i>	France	Case-control study	Social isolation in daily life (i.e. living alone)	<i>N</i> = 46 Clinical (probable Alzheimer's) & matched healthy controls	LSHS-R

Authors	Data collection period	Country	Design	Social Isolation	Sample Size and Type	Measures
Hao et al. (2020)	2020	China	Cross-sectional	Lockdown measures	<i>N</i> = 185 Clinical (non-psychotic psychiatric diagnoses) & healthy controls	symptom checklist (study specific)
Kim et al. (2018)	2015	South Korea	Cross-sectional study (retrospective)	Patient isolation in hospital	<i>N</i> = 40 Clinical (MERS infected)	symptom checklist (study specific)
Lee et al. (2021)	2020	South Korea	Cross-sectional	Social distancing rules	<i>N</i> = 400 Non-clinical	PQ-16
Lopes et al. (2020)	2020	UK	Randomised controlled study	Self-isolation and national lockdown measures	<i>N</i> = 361 Non-clinical	LSHS
Mak et al. (2009)	2005-2006	Hong Kong	Cross-sectional study (retrospective cohort)	Patient isolation in hospital	<i>N</i> = 90 Clinical (SARS infected)	SCID-I
Parry et al. (2020)	2017-2019	UK (international sample)	Qualitative	Self-reported social isolation	<i>N</i> = 74 Self-identified voice-hearers	MAVIC

Authors	Data collection period	Country	Design	Social Isolation	Sample Size and Type	Measures
Parry & Varese (2020)	<i>Not stated</i>	UK (international sample)	Qualitative	Self-reported social exclusion	<i>N</i> = 68 Self-identified voice-hearers	MAVIC
Quittkat et al. (2020)	2020	Germany	Cross-sectional study	National lockdown measures	<i>N</i> = 2233 Self-identified mental health disorder & healthy controls	CAHSA
Schlier et al. (2018)	<i>Not stated</i>	Germany	Longitudinal	Time spent alone and level of interaction with others	<i>N</i> = 75 Non-clinical	CAPE; LSHS-R; CAHSA
Sheng et al. (2005)	2003	Hong Kong	Cross-sectional study	Patient isolation in hospital	<i>N</i> = 102 Clinical (SARS infected)	NPSC

Note. SARS = Severe Acute Respiratory Syndrome; MERS = Middle East Respiratory Syndrome; MIN I= Mini International Neuropsychiatric Interview; CAPS = Cardiff Anomalous Perceptions Scale; PSQ = Psychosis Screening Questionnaire; BPRS = Brief Psychiatric Rating Scale; LSHS-R = Launay-Slade Hallucination Scale – revised; PQ-16 = Prodromal Questionnaire-16; LSHS = Launay-Slade Hallucinations Scale; SCID-I = Structured Clinical Interview for DSM-IV Axis I disorders; MAVIC = Manchester Voices Inventory for Children; CAHSA = Continuum of Auditory Hallucinations State Assessment; CAPE = Community Assessment of Psychic Experiences; NPSC = SARS Neuropsychiatric Symptoms Checklist

Study Themes

The studies examined social isolation either directly (when measured as part of the study) or indirectly (when the research was conducted within a context that included a social restriction). The studies were grouped thematically according to the study context or social isolation to synthesise the findings. The type of social isolation and/or study context will be referred to as the study theme. The studies covered the following themes:

- *COVID-19*: Six studies examined the psychological impact of COVID-19 because of infection and/or restrictions implemented to curb spread.
- *Other coronavirus outbreaks*: Four studies reported on the psychological impact of the outbreaks of Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) diseases, both caused by different coronaviruses and transmitted in similar ways to COVID-19. These studies included samples who had all been infected with SARS or MERS and were in hospital quarantine.
- *General social isolation*: Six studies were classed as encompassing general social isolation in daily routine. They all measured social isolation as distinct from loneliness.

Sample Characteristics

The studies included a total of 12,039 participants (62.76% female). Thirteen studies reported on adult samples, two on children and one longitudinal study collected data on participants in childhood and as adults.

Auditory Hallucination Measures

Two studies utilised the Continuum of Auditory Hallucinations State Assessment (Schlier, Hennig, & Lincoln, 2017), a psychometric measure of auditory hallucinations, and two studies used the Manchester Voices Inventory for Children (Parry & Varese, 2020), a self-report survey for children who hear voices. Six studies utilised a clinical interview schedule, either a standardised structured clinical interview or a study specific symptom checklist. A further six studies used a psychometric measure that contained at least one item measuring auditory hallucinations.

Study Design

Half of the included studies used a cross-sectional design. One study utilised a randomised controlled design where participants were randomised to an experimental condition of exposure to a news story about COVID-19 or a control condition of no exposure to the news story. One study used a case-controlled design where clinical cases were matched with healthy controls. Of the remaining studies, two had a longitudinal design, two were qualitative and two were case series.

Quality Appraisal Results

Table 2 shows the results of the quality appraisal for each study using the QATSDD tool. The studies have been ordered from most robust methodological design to least. Due to the included studies being heterogeneous in design, it is important to consider the robustness of the study design as well as the QATSDD score when appraising the quality of the evidence. Twelve studies were considered quantitative in design and were assessed

against the 14 generic criteria and the two quantitative criteria. Four studies, including case series where descriptive accounts of the cases were presented, were considered qualitative and assessed against the two qualitative criteria in addition to the 14 generic criteria. The mean percentage score and overall score for the body of research presented in this review is 64.73% ($SD = 10.29\%$). Three studies obtained a higher score than one standard deviation above the mean ($>75.02\%$). The two case series studies scored below one standard deviation below the mean ($<54.44\%$). Inter-rater reliability between the first author and an independent researcher's ratings of 25% of the studies was calculated ($\kappa = .716$) and revealed a moderate level of agreement (McHugh, 2012).

Issues involving data collection tools, contributing to a lower quality appraisal score, was a pattern across the studies. Three out of the 12 quantitative studies did not discuss the reliability and validity of the measures used. An additional four quantitative studies discussed the reliability and validity of the measures used but provided no statistical assessment of this. Half of the qualitative studies did not state a research question, which meant an appraisal of the applicability of the data collection tools in addressing the research question could not be assessed.

Limitations in the analytical methods employed by the included studies were highlighted during the process of quality appraisal. Half of the studies did not evidence any consideration of the sample size in relation to the analytical method, such as whether the sample size met statistical requirements, or whether data saturation had been achieved. Furthermore, two out of four qualitative studies did not assess the reliability of their analytical process.

In terms of co-production, 14 of the 16 studies showed no evidence of having involved clinical group representatives or community members in the design or development of their study. Two studies (Parry, Loren, & Varese, 2020; Parry & Varese, 2020) achieved the highest score for this criterion as they utilised a steering group of young people who hear voices and involved them in the design of the data collection methods.

The quality appraisal highlighted strengths in methodology and reporting across the studies. All the studies provided a description of the research setting, 12 of which scored the highest on this criterion by providing context for the study in the form of a detailed description of the target population and research problem. All the studies met the criterion for description of data collection procedure either partially or completely and 10 studies gave detailed recruitment data. Nine studies gave explicit aims and objectives for the research and 10 studies employed an appropriate analytical method that was able to answer the research question in detail.

A mean quality appraisal score was calculated for each theme. This enabled the synthesis of the findings for each theme to be considered in relation to the quality of the studies it included. The theme quality appraisal scores in order of highest to lowest were *general social isolation* (71.83%), *COVID-19* (61.51%), and *other coronavirus outbreaks* (58.93%).

Table 2*Quality Appraisal Results and Methodological Design of Studies*

Study	Design	Quality Score[†]	Strengths	Limitations
Lopes et al. (2020)	Randomised controlled	69%	<ul style="list-style-type: none"> Explicit theoretical framework Clear description of research setting Clear description of data collection Detailed recruitment data Method of analysis fits research question Good justification for analytical method used 	No evidence of user involvement in design
El Haj et al. (2016)	Case-controlled	64%	<ul style="list-style-type: none"> Explicit theoretical framework Statement of aims/objectives Clear description of research setting Good rationale for data collection tool 	No evidence of user involvement in design
Schlier et al. (2018)	Longitudinal	79%	<ul style="list-style-type: none"> Explicit theoretical framework Statement of aims/objectives Clear description of research setting Clear description of data collection Good rationale for data collection tool Statistical assessment of reliability and validity of measurement tool(s) Data collection method fits research question Method of analysis fits research question Good justification for analytical method used Strengths and limitations critically discussed 	<ul style="list-style-type: none"> No evidence of sample size considered in terms of analysis No evidence of user involvement in design

Study	Design	Quality Score [†]	Strengths	Limitations
Bennett et al. (2020)	Longitudinal	67%	<p>Explicit theoretical framework</p> <p>Statement of aims/objectives</p> <p>Clear description of research setting</p> <p>Detailed recruitment data</p> <p>Method of analysis fits research question</p> <p>Good justification for analytical method used</p> <p>Strengths and limitations critically discussed</p>	<p>No statistical assessment of reliability and validity of measurement tool(s)</p> <p>No evidence of user involvement in design</p>
Butter et al. (2017)	Cross-sectional	81%	<p>Explicit theoretical framework</p> <p>Statement of aims/objectives</p> <p>Clear description of research setting</p> <p>Sample representative and of a reasonable size</p> <p>Clear description of data collection</p> <p>Good rationale for data collection tool</p> <p>Detailed recruitment data</p> <p>Method of analysis fits research question</p> <p>Good justification for analytical method selected</p>	<p>No evidence of user involvement in design</p>
Sheng et al. (2005)	Cross-sectional	74%	<p>Clear description of research setting</p> <p>Sample representative and of a reasonable size</p> <p>Clear description of data collection</p> <p>Good rationale for data collection tool</p> <p>Detailed recruitment data</p> <p>Statistical assessment of reliability and validity of measurement tool(s)</p> <p>Method of analysis fits research question</p>	<p>No evidence of user involvement in design</p>

Study	Design	Quality Score [†]	Strengths	Limitations
Bortolon et al. (2021)	Cross-sectional	64%	<p>Explicit theoretical framework</p> <p>Statement of aims/objectives</p> <p>Clear description of data collection</p> <p>Detailed recruitment data</p> <p>Data collection method fits research question</p> <p>Method of analysis fits research question</p> <p>Strengths and limitations critically discussed</p>	<p>No evidence of sample size considered in terms of analysis</p> <p>No statistical assessment of reliability and validity of measurement tool(s)</p> <p>No evidence of user involvement in design</p>
Mak et al. (2009)	Cross-sectional	64%	<p>Statement of aims/objectives</p> <p>Clear description of research setting</p> <p>Sample representative and of a reasonable size</p> <p>Good rationale for data collection tool</p> <p>Detailed recruitment data</p> <p>Strengths and limitations critically discussed</p>	<p>No evidence of sample size considered in terms of analysis</p> <p>No justification for analytical method selected</p> <p>No evidence of user involvement in design</p>
Quittkat et al. (2020)	Cross-sectional	64%	<p>Statement of aims/objectives</p> <p>Detailed recruitment data</p> <p>Method of analysis fits research question</p> <p>Strengths and limitations critically discussed</p>	<p>No evidence of sample size considered in terms of analysis</p> <p>No evidence of user involvement in design</p>
Hao et al. (2020)	Cross-sectional	62%	<p>Statement of aims/objectives</p> <p>Clear description of research setting</p> <p>Clear description of data collection</p> <p>Data collection method fits research question</p> <p>Method of analysis fits research question</p>	<p>No evidence of sample size considered in terms of analysis</p> <p>No evidence of user involvement in design</p>
Lee et al. (2021)	Cross-sectional	60%	<p>Statement of aims/objectives</p> <p>Clear description of data collection</p> <p>Detailed recruitment data</p>	<p>No evidence of sample size considered in terms of analysis</p> <p>No statistical assessment of reliability and validity of</p>

Study	Design	Quality Score [†]	Strengths	Limitations
			Data collection method fits research question Method of analysis fits research question	measurement tool(s) No evidence of user involvement in design
Kim et al. (2018)	Cross-sectional	57%	Clear description of research setting Good rationale for data collection tool Detailed recruitment data	No evidence of user involvement in design
Parry & Varese (2020)	Qualitative	76%	Good rationale for data collection tool Data collection tool fits research question Method of analysis fits research question Good justification for analytical method selected Assessment of reliability of analytical process Evidence of user involvement in design	No evidence of sample size considered in terms of analysis
Parry et al. (2020)	Qualitative	64%	Clear description of research setting Clear description of data collection Good justification for analytical method selected Assessment of reliability of analytical process Evidence of user involvement in design	No research question stated
D'Agostino et al. (2020)	Case series	50%	Clear description of research setting Evidence of sample size considered in terms of analysis Detailed recruitment data	No research question stated No assessment of reliability of analytical process No evidence of user involvement in design No discussion of strengths and limitations
Cheng et al. (2004)	Case series	40%	Clear description of research setting	No evidence of sample size considered in terms of analysis Very limited recruitment data No justification for analytical method selected No assessment of reliability of analytical process

Study	Design	Quality Score [†]	Strengths	Limitations
				No evidence of user involvement in design No discussion of strengths and limitations

Note. † Quality score determined using the QATSDD tool

Narrative Synthesis of Findings

COVID-19

Table 3 gives an overview and the findings of studies conducted in the context of COVID-19. Five studies looked at auditory hallucinations in community samples during restrictions in France (Bortolon, Capdevielle, Dubreucq, & Raffard, 2021), South Korea (Lee, Dean, Baxter, Griffith, & Park, 2021), the United Kingdom (Lopes, Bortolon, & Jaspal, 2020), China (Hao et al., 2020) and Germany (Quittkat et al., 2020). All studies looked at the relationship between characteristics of participants' social environment and the presence and severity of a variety of mental health symptoms. A further study reported on the increased presentations of brief psychotic episodes in patients admitted to a psychiatric hospital during the regional lockdown in Lombardy, Italy (D'Agostino et al., 2020).

There was no significant correlation found between length of isolation and hallucinations in two studies (Bortolon et al., 2021; Lopes et al., 2020) which had a combined sample of 1089 participants. The studies used the Cardiff Anomalous Perception Scale and the Launay Slade Predisposition to Hallucinations Scale which both indicate general hallucinatory experiences on a scale rather than utilise a cut off score that demonstrates the presence or not of hallucinations. The studies looked at hallucinatory experiences in general and did not report on auditory hallucinations specifically. The Lopes et al. (2020) study found no significant difference in hallucinatory experiences between those who were self-isolating (90% of participants), and those who were not. Data on this study was collected during the early stages of the initial lockdown in the UK in spring 2020. At the time, the mean self-isolation length of participants was 12.53 days. The mean length

of exposure to national lockdown restrictions in the Bortolon et al. (2021) study was 38.23 days.

Lee et al. (2021) looked at the impact of living arrangements and social network on mental health status in South Korea, which was not under national lockdown measures at the time of data collection. Participants were subjected to social distancing rules but had regular contact with an average of 13 people. Across the sample of 400, 16.25% reported auditory hallucinations. The study used the Prodromal Questionnaire (Ising et al., 2012), a self-report measure of psychotic disorders and prodromal period symptoms. There was no significant difference in scores on this measure between participants who lived alone and those who lived with others.

Three studies made comparisons with pre-pandemic data. Bortolon et al. (2021) found rates of anomalous perceptions during the national lockdown in France were not elevated when compared to a French sample before the pandemic. In contrast, Lee et al. (2021) found 12.75% of participants in their sample in South Korea to be at risk of psychosis which was higher than pre-pandemic levels of 6.6%. Quittkat et al. (2020) compared symptom severity of a wide range of mental health disorders in Germany during lockdown measures to retrospective reports of severity level in November 2019. They found no changes in auditory hallucination severity from pre-pandemic to during the lockdown. Although the study included a large sample ($N = 2233$), participants completed symptom specific measures based on the mental health disorder they self-identified as having. No data was given as to which disorder/s or how many participants completed the Continuum of Auditory Hallucinations - State Assessment (Schlier et al., 2017) that the study used.

Hao et al. (2020) compared rates of auditory hallucinations in psychiatric patients and healthy controls during strict restrictions covering a city in China. The psychiatric patients all had non-psychotic psychiatric diagnoses. They found no difference between psychiatric patients and healthy controls in reports of auditory hallucinations. The overall rate of auditory hallucinations across the sample was 4.3%. No comparison to rates prior to restrictions were given.

D'Agostino et al. (2020) reported a case series of all patients admitted to a psychiatric ward presenting with a first episode of Brief Psychotic Disorder during the regional lockdown restrictions in the Lombardy region of Italy. The cases had experienced an average of 50.5 days of restrictions prior to admission and none had a psychiatric history. Of the six cases, one presented with auditory hallucinations. The authors hypothesis that the stress of home confinement and fear of COVID-19 infection may have triggered a psychobiological stress reaction leading to psychosis.

From studies conducted so far, there is no evidence of an association between reports of hallucinations and length of COVID-19 lockdown measures (Bortolon et al., 2021; Lopes et al., 2020). Compared to pre-pandemic, no changes in anomalous perception rates (Bortolon et al., 2021) and auditory hallucination severity (Quittkat et al., 2020) has been found in countries under lockdown restrictions . Rates of risk of psychosis have increased in South Korea, which at the time had avoided lockdown restrictions and had a low infection rate (Lee et al., 2021). Further, rates of auditory hallucinations in the South Korean sample were reported at 16.25% (Lee et al., 2021), higher than the 4.3% of a Chinese sample reporting auditory hallucination at the time of strict restrictions (Hao et al., 2020).

Table 3*Summary of Findings from COVID-19 Studies*

Study	Sample details	Social isolation description	Length of social isolation	Reporting of auditory hallucinations	Relevant findings
Bortolon et al. (2021)	<i>N</i> = 728 76% female <i>M</i> _{age} = 44.90 years <i>SD</i> = 15.95	National lockdown measures in France	<i>M</i> = 38.23 days <i>SD</i> = 8.42	Hallucinations (unspecified): CAPS mean score = 3.73 <i>SD</i> = 4.68	No significant correlation between hallucination score and length of isolation. Although perceived impact of lockdown was correlated with hallucinations, when added into a regression model the association was no longer significant. CAPS score in sample not elevated when compared to pre pandemic sample.
D'Agostino et al. (2020)	<i>N</i> = 6 50% female <i>M</i> _{age} = 53 years Range = 23-73	Regional lockdown restrictions in Lombardy, Italy	<i>M</i> = 50.5 days Range = 47-54	Auditory hallucinations: 17%	All patients indicated two main stressors: isolation from lockdown measures and fear of infection, as plausible cause for psychotic episode.
Hao et al. (2020)	<i>N</i> = 185 (<i>n</i> = 76 psychiatric patients, <i>n</i> = 109 healthy controls) 64% female <i>M</i> _{age} = 32.98 years <i>SD</i> = 11.42	City wide strict lockdown measures	Range = 19-22 days	Auditory hallucinations: 4.3%	No statistical difference in rate of auditory hallucinations between psychiatric patients and healthy controls. All auditory hallucinations reported were described as mild.
Lee et al. (2021)	<i>N</i> = 400	Social distancing rules in place	People participants had regular contact with <i>M</i> = 13.49 people	Auditory hallucinations: 16.25%	No significant difference in PQ-16 scores for single participants living alone vs singles living with family or married. Elevated psychosis risk reported in

Study	Sample details	Social isolation description	Length of social isolation	Reporting of auditory hallucinations	Relevant findings
	72% female 1% other $M_{\text{age}} = 31.68$ years $SD = 12.31$ Range = 18-72	across South Korea	$SD = 8.64$ Range = 0-62		sample compared to pre Covid-19. Loneliness, but not social network size, was found to account for variance in mental health status.
Lopes et al. (2020)	$N = 361$ 49% female $M_{\text{age}} = 46.03$ years $SD = 15.11$ Range = 18-76	Self-isolation following public health guidance and subsequent national lockdown in UK	$M = 12.53$ days $SD = 6.58$	LSHS mean score = 18.27 $SD = 7.40$	Length of self-isolation was not significantly correlated with hallucinatory experiences. No statistically significant difference between those isolating and those not in terms of hallucinatory experiences.
Quittkat et al. (2020)	$N = 2233$ 80.74% female 1.03% non-binary $M_{\text{age}} = 33.21$ years $SD = 12.74$ Range = 18-83	Lockdown measures in Germany	Range = 11-45 days	<i>Data not provided</i>	No substantial changes between auditory hallucination severity, as measured by the CAHSA, found between retrospective reports on November 2019 and during lockdown restrictions. No data given as to number of participants completing CAHSA.

Note. CAPS = Cardiff Anomalous Perceptions Scale; PQ-16 = Prodromal Questionnaire-16; LSHS = Launay-Slade Hallucinations Scale; CAHSA = Continuum of Auditory Hallucinations State Assessment

Other Coronavirus Outbreaks

Table 4 gives an overview of the findings of four studies that examined hallucinations in the context of other coronavirus outbreaks. Three studies included participants who had confirmed or suspected infections of SARS (Cheng, Tsang, Ku, Wong, & Ng, 2004; Mak, Chu, Pan, Yiu, & Chan, 2009; Sheng, Cheng, Lau, Li, & Chan, 2005) and one study where participants were infected with MERS (Kim, Yoo, Lee, Lee, & Shin, 2018). All four studies had a combined sample of 236 participants who were all subjected to patient isolation whilst being treated in hospital. The combined prevalence of auditory hallucinations whilst admitted to hospital across all the studies was 4.66% of participants.

Sheng et al. (2005) looked at the impact of several factors on psychosis symptoms including length of stay in hospital. They found that the length of hospital stay ($M = 20.5$ days), was not associated with psychosis symptoms. However, 33% of the variance in psychosis symptoms among the sample of 102 SARS patients was explained by SARS symptoms, death of a family member to SARS, and steroid treatment. This study gathered data on average 42 days after discharge from hospital. Participants were asked about their recollection of symptoms during their hospital stay. 3.9% of participants remembered experiencing auditory hallucinations during their hospital stay. Whereas, at the time of data collection, 1% reported on-going auditory hallucinations.

Mak et al. (2009) also examined rates of psychotic symptoms over time. They found 3.3% of participants in their sample of 90 SARS patients reported auditory and visual hallucinations during admission. Following this, 4.4% of participants reported post-SARS psychotic symptoms but all recovered at 30 months post SARS infection. No detail was given on the rates of auditory hallucinations within the participants reporting post-SARS psychotic

symptoms. The authors stated that isolation was one of many risk factors that could account for the psychiatric morbidities in their sample. However, no analysis of this was undertaken.

Kim et al. (2018) differentiated between suspected ($n = 10$) and confirmed ($n = 24$) cases of MERS in their sample. 6% of the sample reported auditory hallucinations, all of which were confirmed cases of MERS. Cheng et al. (2004) reported 20% of their sample of 10 SARS patients experienced auditory hallucinations whilst in hospital. The authors of this case series reported the hallucinations were resulting from steroid therapy used to treat SARS and that symptoms subsided within 3-5 days with neuroleptic medication.

Overall, rates of psychosis symptoms, and auditory hallucinations specifically, in those infected with SARS reduced over time following treatment, recovery and discharge from hospital (Cheng et al., 2004; Mak et al., 2009; Sheng et al., 2005). Length of hospital stay was not associated with psychosis (Sheng et al., 2005). However, SARS symptoms and steroid treatment were found to explain some of the variance in psychosis symptoms (Chen et al., 2020). This was supported by the SARS case series which suggested associated steroid treatment, rather than isolation itself, may be more of a risk factor for developing hallucinations (Cheng et al., 2004).

Table 4*Summary of Findings from Other Coronavirus Outbreaks Studies*

Study	Sample details	Description of social isolation	Length of social isolation	Reporting of auditory hallucinations	Relevant findings
Cheng et al. (2004)	<i>N</i> = 10 60% female <i>M</i> _{age} = 34.8 years <i>SD</i> = 15.6 Range = 18-74	Patient isolation whilst in hospital due to being infected with SARS	<i>Not reported</i>	Auditory hallucinations: 20%	Hallucinations diagnosed as being organic and resulting from steroid therapy given to patient to treat SARS. Treated with neuroleptic medication and symptoms subsided in 3-5 days.
Kim et al. (2018)	<i>N</i> = 34 (<i>n</i> = 10 suspected, <i>n</i> = 24 confirmed) 64.7% female <i>M</i> _{age} = 46 years <i>SD</i> = 20.41 Range = 21-86	Patients quarantined in hospital whilst treated for suspected or confirmed MERS	<i>Not reported</i>	Auditory hallucinations: 6%	Only confirmed cases of MERS exhibited psychiatric symptoms including the two cases of auditory hallucinations reported. No analysis of length of stay in hospital and presence of psychiatric symptoms conducted.
Mak et al. (2009)	<i>N</i> = 90 62.2% female <i>M</i> _{age} = 41.1 years <i>SD</i> = 12.1	Patient isolation whilst in hospital due to being infected with SARS	Median hospital admission = 27 days Range = 19-112	Auditory hallucinations: 3.3%	Four participants reported post-SARS psychotic symptoms (unspecified), all had recovered at 30 months post SARS. No analysis of length of stay and psychiatric symptoms. Isolation stated as being one of many risk factors that could account for psychiatric morbidities in sample.

Study	Sample details	Description of social isolation	Length of social isolation	Reporting of auditory hallucinations	Relevant findings
Sheng et al. (2005)	<p>$N = 102$</p> <p>66% female</p> <p>$M_{\text{age}} = 37.6$ years</p> <p>$SD = 12.4$</p>	<p>Patient isolation whilst in hospital due to being infected with SARS</p>	<p>Mean acute hospital stay = 17.2 days</p> <p>$SD = 6.1$.</p> <p>Mean total duration of hospital admission = 20.5 days</p> <p>$SD = 5.6$</p>	<p>Auditory hallucination: 3.9% (acute phase)</p> <p>1% (average 42 days post discharge from hospital)</p>	<p>33% variance in psychosis explained by SARS symptoms, family member having died from SARS, and steroid treatment. Length of stay in hospital not associated with psychosis symptoms.</p>

Note. SARS = Severe Acute Respiratory Syndrome; MERS = Middle East Respiratory Syndrome

General Social Isolation

Table 5 provides an overview of the findings of six studies that examined the association between social isolation and hallucinations. The studies utilised diverse designs of case-controlled (El Haj, Jardri, Laroï, & Antoine, 2016), longitudinal (Bennett, Surkan, Moulton, Fombonne, & Melchior, 2020; Schlier, Winkler, Jaya, & Lincoln, 2018), cross-sectional (Butter, Murphy, Shevlin, & Houston, 2017) and qualitative (Parry et al., 2020; Parry & Varese, 2020). Overall, the studies were of consistently high quality with quality appraisal scores ranging from 62% to 79%.

Butter et al. (2017) used the Psychosis Screening Questionnaire (Bebbington & Nayani, 1995) in a large sample of 7403 participants age 16 years and over. The study found 4.4% of the whole sample reported hallucinations but did not differentiate between auditory and visual hallucinations. Latent class analysis was used to identify three types of social isolation: those who reported feelings of loneliness (5.1%), those who were physically isolated (2.4%) and a baseline class of those who were not socially isolated (92.2%). The class of physical isolation included those who had little or no communication with others, no close friends, and no close relatives, but did not necessarily live alone or feel lonely. The feeling lonely class was characterised as living alone and feeling socially isolated but, in contrast, this class did not have limited communication with others. Compared to those who were not socially isolated, the physically isolated participants were significantly more likely to report hallucinations ($OR = 1.93$, $95\% CI = 1.15-3.23$). Hallucinations were not increased in the lonely class.

El Haj et al. (2016) looked at the association between hallucinations and social isolation in a sample of 22 participants with a diagnosis of probable Alzheimer's disease at

the mild stage and 24 healthy matched controls. In this study, social isolation was measured against seven criteria including living alone, no contact with neighbours or friends, never going out of the house and no participation in community activity. Auditory and visual hallucinations were measured on a combined scale. High levels of social isolation were found to predict hallucinations in both the Alzheimer's group ($\beta = .53$, adjusted $R^2 = .28$, $t = 2.76$, $p < .05$) and healthy controls ($\beta = .51$, adjusted $R^2 = .26$, $t = 2.80$, $p = .01$).

Schlier et al. (2018) used a longitudinal design to directly examine the social deafferentation hypothesis of hallucinations. A community sample of 75 participants completed social isolation measures and several hallucination scales daily for three weeks. The study looked at hallucinatory experiences across a spectrum. Some degree of auditory hallucinatory experience was reported by 37.3% of the sample over the 3-week period. Hallucinatory spectrum experiences were not found to be associated with time spent alone or having few interactions with others. The lack of association was maintained when auditory hallucinations were examined independently.

The Bennett et al. (2020) study looked at the impact of childhood social isolation on the prevalence of psychotic experiences as an adult using a community sample from an ongoing prospective cohort study. The amount and quality of friendships between age 7 to 10 was used as the social isolation indicator. There was a 1.2% prevalence of auditory hallucinations in the sample at the second data collection time point where participants had an average age of 30. Individuals who were socially isolated as a child were more likely to report two or more psychotic experiences as an adult than those who were not socially isolated. There was no difference between those who were and were not socially isolated in

reports of one psychotic experience. Gender, age, and general health status was controlled for in the analysis.

The two qualitative studies were carried out by the same authors and both conducted a Foucauldian-informed narrative analysis on data gathered on an online platform. It is unclear whether the studies report on the same or overlapping data, but both had large sample sizes of 74 (Parry et al., 2020) and 68 (Parry & Varese, 2020). Both studies reported on the experiences of young people who self-identified as hearing voices. Participants reported the experience of hearing voices made them more socially isolated, and that social isolation exacerbated voices and voice-related distress (Parry et al., 2020). Social isolation was one of several commonly attributed causes of hearing voices in participant accounts (Parry & Varese, 2020). Parry and Varese (2020) hypothesise that this causal attribution is related to the relational function of hearing voices as meeting social needs.

The results of the studies in this theme varied across the age groups of participants. In both studies that found an association between general social isolation and hallucinations (Butter et al., 2017; El Haj et al., 2016), the participants were representative of an older age group. In contrast, in the Schlier et al. (2018) study that found no association between social isolation and hallucinations, the average age of participants was 25 years old. However, although not statistically examined, one of the qualitative studies reported social isolation as being a commonly attributed cause of hearing voices in childhood (Parry & Varese, 2020). None of the studies examined the impact of age on hallucination reports alongside social isolation.

Table 5

Summary of Findings from General Social Isolation Studies

Study	Sample details	Description of social isolation	Length of social isolation	Reporting of auditory hallucinations	Relevant findings
Bennett et al. (2020)	<i>N</i> = 333 62% female <i>M</i> _{age} = 30 years Range = 25-37	Amount and quality of friendships at age 7 to 10	Retrospective score of social isolation given for a 3-year period	Auditory hallucinations: 1.2%	After controlling for gender, age and general health status, individuals who were socially isolated in childhood were no more likely than those who did not experience social isolation to experience one psychotic experience in young adulthood ($p = 0.74$). However, they were more likely to report two or more psychotic experiences ($OR = 11.5$, 95% CI: 2.5, 52.0, $p = 0.002$).
Butter et al. (2017)	<i>N</i> = 7403 57% female <i>M</i> _{age} = 51.12 years <i>SD</i> = 18.59	3 groups identified in sample: <ol style="list-style-type: none">1. Lonely: 5.1%2. Physically isolated: 2.4%3. Not socially isolated: 92.2%	<i>Not reported</i>	Hallucinations (all types): 4.4%	Compared to those not socially isolated, participants who were physically isolated were significantly more likely to report hallucinations. Hallucinations were associated with having little or no communication with others (physical isolation) rather than with feeling lonely.
El Haj et al. (2016)	<i>N</i> = 46 (<i>n</i> = 22 Alzheimer's patients, <i>n</i> = 24 matched healthy controls) Clinical: 73% female <i>M</i> _{age} = 71.55 years <i>SD</i> = 5.71	High endorsement of living alone, no close relatives, never calls anyone, no personal contact with neighbours, alone for > 9 hours per day, never goes out of the house, and no	<i>Not reported</i>	Clinical: mean LSHS-R score = 14.14 <i>SD</i> = 4.30 Control: mean LSHS-R score = 7.08 <i>SD</i> = 4.35	Significant correlation between hallucinations and social isolation in clinical group ($r = .53$, $p = 0.01$) and healthy controls ($r = .56$, $p < 0.01$). Social isolation found to predict hallucinations in clinical sample and control sample.

Study	Sample details	Description of social isolation	Length of social isolation	Reporting of auditory hallucinations	Relevant findings
	Control: 62.5% female $M_{age} = 68.17$ years $SD = 7.74$	participation in community activity.			
Parry et al. (2020)	$N = 74$ 61% female 21% non-binary $M_{age} = 15.05$ years $SD = 2.83$ Range = 13-18	Self-reported social isolation driven by fear of disclosing experiences.	<i>Not reported</i>	Auditory hallucination: 100%	Hearing voices was reported to increase social isolation. Social isolation was reported to exacerbate voices and voice-related distress.
Parry & Varese (2020)	$N = 68$ 61% female 14% non-binary $M_{age} = 14.91$ years $SD = 2.77$ Range = 13-18	Self-reported social isolation.	<i>Not reported</i>	Auditory hallucination: 100%	Social isolation, together with structural inequalities and relational traumas, commonly attributed cause of voice-hearing in participants accounts. Researchers hypothesise that this attribution is related to relational function of voices as meeting social needs.
Schlier et al. (2018)	$N = 75$ 65% female $M_{age} = 25.03$ years $SD = 8.82$ Range = 18-66	Social isolation measured by time spent alone and level of interaction with others.	Social isolation measured daily over 3-week period	Auditory hallucination: 37.3%	Hallucination spectrum experiences were not predicted by time spent alone ($OR = 1.06, z = 0.52, p = 0.601$) or few interactions with others ($OR = 1.16, z = 1.09, p = 0.275$) on same day. No association between social isolation indicators and auditory hallucinations specifically.

Note. LSHS-R = Launay-Slade Hallucination Scale – revised; CI = confidence interval.

Discussion

This review aimed to establish whether there is a relationship between social isolation and auditory hallucinations, and, if so, whether social isolation changes the nature and/or severity of auditory hallucinations. It also aimed to extrapolate from current research any factors that might reduce the impact of COVID-19 restrictions on auditory hallucinations. Although all studies included in the review measured auditory hallucinations, very few directly examined auditory hallucinations in the analysis. Most used a measure of psychosis symptoms generally or all types of hallucinations. This limited the conclusions that can be drawn from this review specifically about auditory hallucinations. The results on psychosis symptoms more broadly have been included as they provide information that is relevant to developing an understanding of the potential relationship between social isolation and auditory hallucinations and indicate areas for further research.

Auditory Hallucinations and Social Isolation

This review found good quality evidence, albeit from a single study, that auditory hallucinations (as opposed to psychosis symptoms in general) were not associated with social isolation in the form of increased time spent alone and having few interactions with others (Schlier et al., 2018). In terms of COVID-19 restrictions, this review found one study that demonstrated no change in severity in pre-existing auditory hallucinations when comparing pre-pandemic to during lockdown (Quittkat et al., 2020). Although, the results from this study need to be interpreted with caution as the rate of participants reporting auditory hallucinations in the study sample was not clear. When comparing two studies included in the review, auditory hallucination rates were higher in a sample living with no

lockdown restrictions at the time (Lee et al., 2021) compared to a sample living under strict lockdown (Hao et al., 2020). However, no statistical analysis of this difference has been undertaken. This review did not reveal any findings that indicated factors that might mitigate the impact of COVID-19 restrictions on auditory verbal hallucinations.

The findings of this review do not support Hoffman's social deafferentation hypothesis that proposes social isolation can trigger auditory hallucinations of a social nature in vulnerable individuals (Hoffman, 2007, 2008). The lack of evidence linking social isolation and auditory hallucination development may not necessarily mean social interaction is an unimportant environmental factor, but rather it may be the quality of social interaction that is important rather than the amount of interaction. In contrast to the social deafferentation hypothesis, the social defeat hypothesis purports it is not the lack of social contact per se but rather the experience of being marginalised by others that is implicated in the development of psychosis (Selten & Cantor-Graae, 2005, 2007). The social defeat hypothesis proposes that an accumulation of experiences of being excluded increases the risk of psychosis by heightening sensitivity of the mesolimbic dopamine system (Selten, Booij, Buwalda, & Meyer-Lindenberg, 2017; Selten, van der Ven, Rutten, & Cantor-Graae, 2013; Selten, van Os, & Cantor-Graae, 2016). Social defeat is theorised to be a common factor resulting from different types of social adversities and exclusion. In a cross-cultural sample, current experiences of social defeat were found to be associated with increased levels of psychotic symptoms (Jaya & Lincoln, 2016). Importantly, the Schlier et al. (2018) study included in this review examined social deafferentation (social isolation) alongside social defeat and its association with hallucination spectrum experiences. They found social defeat was consistently associated with hallucinatory experiences in contrast to the social

deafferentation indicators of time spent alone and few social interactions which were not. The study also found specifically social exclusion was associated with hallucinatory experiences rather than just unpleasant interactions. As COVID-19 restrictions are mostly implemented across populations, these findings indicate the restrictions are unlikely to be a risk factor for increased reports of auditory hallucinations. However, quarantining infected individuals, if experienced as an exclusionary practice, could be a risk.

Psychosis and Social Isolation

In terms of wider psychosis symptoms, the evidence was mixed. This review found good quality evidence of there being no association between all types of hallucinations and length of social isolation from COVID-19 measures (Bortolon et al., 2021; Lopes et al., 2020), and no association between psychosis symptoms and length of hospital stay in SARS patients (Sheng et al., 2005). In contrast, there was good quality evidence from one study that psychosis risk had increased during the COVID-19 pandemic, compared to pre-pandemic levels in South Korea (Lee et al., 2021). Furthermore, reports of hallucinations were found to be higher in those who were socially isolated in terms of living arrangement and daily routine in two good quality studies (Butter et al., 2017; El Haj et al., 2016). The mixed results regarding psychosis and social isolation reflects the growing evidence that multiple environmental, social and psychological factors, and their complex interactions, are implicated in the emergence of psychosis (Bentall, 2015).

Clinical and Research Implications

There are several potential confounding variables which were highlighted in this

review. In terms of general social isolation arising from daily routine and living arrangements, this review found a difference in the effect of isolation on rates of hallucinations across different age groups. Two studies demonstrated, in samples with mean ages of 51 years (Butter et al., 2017) and 72 years (El Haj et al., 2016), that individuals who were socially isolated were significantly more likely to report hallucinations. In contrast, in a much younger sample with a mean age of 25 years, hallucinations generally and auditory hallucinations specifically were not associated with social isolation (Schlier et al., 2018). This indicates there could be other factors linked to age, such as health conditions or use of technology for socialising, which may mediate the relationship between isolation and hallucinations in older age groups. There are generally high rates of social isolation and loneliness reported in older age groups which may leave them particularly vulnerable to detrimental effects from further social isolation (Blazer, 2020). In addition, analysis of a small sample found patients presenting with first episode psychosis during the COVID-19 pandemic are significantly older than those presenting with first episode psychosis prior to the pandemic (Esposito et al., 2021). Esposito et al. (2021) highlight how the stress and fear of COVID-19 is likely to be felt more keenly in older populations due to the higher mortality rate from COVID-19. Further research on the impact of social isolation and associated stress from COVID-19 specifically in older age groups is warranted.

Although this review found no association between length of COVID-19 restrictions and hallucinations, the COVID-19 studies were carried out early in the course of the pandemic, when participants had been living under restrictions for relatively short periods. In addition, the Schlier et al. (2018) study (that found no association between social isolation and hallucinations), although longitudinal in design, was conducted over a short

period of three weeks. It is likely that the longer social isolation is experienced, the more detrimental its effects, therefore the impact of COVID-19 restrictions on auditory hallucinations may only be detectable after prolonged isolation. Preliminary evidence from a study tracking mental health outcomes longitudinally in the general population in Germany indicates there may be a distinct group of people who are particularly vulnerable to experiencing poor mental health outcomes in the context of the pandemic restrictions (Ahrens et al., 2021). Conversely, a longitudinal study in England showed rates of anxiety and depression decreased over the course of lockdown after initially being high at the beginning (Fancourt, Steptoe, & Bu, 2021).

Another complicating factor is that the impact of coronavirus infection on the development of hallucinatory experiences is largely unknown. Several authors have suggested there may be a viral mechanism which causes psychosis symptoms (Butler, Pollak, Rooney, Michael, & Nicholson, 2020; Chacko et al., 2020; Smith, Komisar, Mourad, & Kincaid, 2020). In addition, psychosis is a known side effect of corticosteroids (Sirois, 2003), the recommended treatment for severe cases of COVID-19 (World Health Organisation, 2020a). Acute psychosis presentations were documented in SARS patients treated with corticosteroids (Cheng et al., 2004; Sheng et al., 2005). During the early stages of the pandemic, testing rates varied widely from country to country. Participants in the community samples in the COVID-19 studies may have been infected without knowing. Many studies either did not collect data on infection rates or relied on self-reports of possible infections based on symptoms rather than a confirmed test. Further research on the link between COVID-19 infection and psychosis symptoms should utilise more robust methodologies to reduce error and elucidate any causal relationship.

This review looked at auditory hallucinations in the general population as it is known they often occur in the absence of an associated psychiatric disorder (Baumeister, Sedgwick, Howes, & Peters, 2017). Although hallucinations are considered to exist along a continuum of normal human experience (DeRosse & Karlsgodt, 2015), there may be differing effects of social isolation in those who present with, or are at risk of, severe hallucinations and associated distress, compared to those who experience milder or less distressing hallucinations. Social isolation is reported as a common difficulty among people with psychosis (Morgan et al., 2012) and social isolation has been theorised to contribute to the development of distressing psychotic symptoms (Depp et al., 2016; Lim, Gleeson, Jackson, & Fernandez, 2014). It has been highlighted that those suffering with severe mental health disorders are at risk of poorer mental health outcomes due to the pandemic (Druss, 2020). Furthermore, a handful of studies have demonstrated a worsening of symptoms since the pandemic in those with pre-existing psychiatric disorders (Fernández-Aranda et al., 2020; Hao et al., 2020; Quittkat et al., 2020). Although this review did not detect an association between COVID-19 restrictions and auditory hallucinations, as individuals with severe mental illness have smaller social networks generally (Albert, Becker, McCrone, & Thornicroft, 1998), they may be more likely to be affected by restrictions on social interaction than the general population.

Strengths and Limitations

The strengths of this review are that it was systematically conducted and synthesised findings from diverse research areas. The overall quality rating for the body of evidence included in the review was good. However, interrater reliability on the QATSDD scoring

revealed only a moderate level of agreement, therefore, the quality scores should be interpreted with caution. The reliability of the QATSDD tool has previously been questioned as there is limited guidance around what constitutes a certain rating on each criterion and there is a lack of clarity on the scoring methods (Fenton, Lauckner, & Gilbert, 2015).

A limitation of this review was that the studies included were highly heterogenous in methodological design, outcomes, level of analysis and study context, limiting the synthesis of findings that could be achieved. Furthermore, the studies were conducted with distinct groups of participants, and in a handful of countries, which may limit the generalisability of the findings to large populations. This review did not collect data on the ethnic or racial backgrounds of the participants in included studies, which is an important factor as individuals from black and ethnic minority backgrounds are known to be disproportionately affected by the COVID-19 pandemic (Public Health England, 2020). Most studies included were cross-sectional in design which may only capture transient symptoms rather than long lasting changes in mental health. Although all studies measured auditory hallucinations, some studies did not include this measure in their analysis which limited the conclusions that could be drawn from them. Another limitation was that the screening for eligibility and data extraction was carried out by a single author increasing the risk of bias and error.

The review was carried out whilst the COVID-19 pandemic was still unfolding. As such, the initial aims of the review were developed at a time when the impact of the pandemic was largely unknown and there was great speculation about widespread mental health problems arising (Torjesen, 2020). Over the past year the psychological and social ramifications of the pandemic have become more apparent and stressors such as financial uncertainty, job loss, domestic violence, and long-term health implications from COVID-19

have been identified (Mental Health Foundation, 2020). This review could be criticised for taking a narrow view of the implications of COVID-19. The emergence of mental health difficulties in the context of COVID-19 need to be considered in the complexity of multiple and interacting social, psychological, and biological stressors in peoples' lives (Rose et al., 2020). In this way, it is difficult, and perhaps unnecessary, to separate the impact of social isolation from the complex fabric of life in a COVID-19 world.

Conclusions

The findings from this review suggest that there is no evidence to indicate social isolation is associated with auditory hallucinations, however, there is evidence to suggest social isolation is associated with increased reports of all types of hallucinations in older populations. The findings of this review indicate further research is needed that accounts for potential confounding variables of age, COVID-19 infection and pre-existing levels of isolation when evaluating the relationship between social isolation and auditory hallucinations. Heterogeneity and methodological design limited the conclusions that could be drawn from the studies in the review, although the quality of the included studies overall was good. These findings need to be considered alongside the emerging picture of the complex interaction of determinants of poor mental health in the context of COVID-19.

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Paper 2: Empirical Paper

Mediators of negative content and voice-related distress in a diverse sample of clinical and non-clinical voice-hearers.

Running title: Negative content and voice-related distress

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Abstract

Objectives

Negative content in hearing voices (i.e., auditory verbal hallucinations) has been associated with adverse clinical outcomes including voice-related distress. Voice appraisals and responding mindfully to voices is theorised to reduce voice-related distress. This study aimed to examine mediators of the negative content voice-related distress relationship in clinical (those who recently received input from mental health services) and non-clinical voice hearers.

Methods

121 adults (71.9% female; 35.5% mixed or non-white ethnic background) who hear voices were recruited online and completed self-report measures of negative content of voices, voice-related distress, mindfulness of voices, interpretation of loss of control, thought suppression and intrusion.

Results

Clinical voice-hearers had significantly higher levels of negative content, voice-related distress, and interpretation of loss of control, and lower levels of responding mindfully to voices than non-clinical voice-hearers. A mindful approach to voices and interpretation of loss of control mediated the relationship between negative content and voice-related distress across the whole sample. Thought suppression and intrusion did not mediate the relationship.

Conclusions

The results support the use of mindfulness based psychological intervention to reduce voice-related distress. Further development of valid and reliable measures specifically relating to constructs of voice content, voice-related distress and voice suppression will support further research in this area.

Keywords: hearing voices, auditory verbal hallucinations, mindfulness, distress, thought suppression

Practitioner points:

- Negative voice content and voice-related distress are significantly higher among voice-hearers who have been in contact with mental health services in the last six months.
- Mindfulness of voices and the interpretation of loss of control mediates the relationship between negative voice content and voice-related distress. This relationship is demonstrated in an ethnically diverse sample.
- Although conclusions about causation cannot be drawn from the findings, they do support the theoretical underpinnings of mindfulness-based approaches to reducing voice-related distress.
- These findings indicate that there are several factors that contribute to the maintenance of voice-related distress. Consideration of the need for a variety of psychological interventions for voice-related distress is discussed.

Introduction

Hearing voices, also referred to as auditory verbal hallucinations, are increasingly placed on a continuum of normal human experience (DeRosse & Karlsgodt, 2015). A high proportion of those who hear voices do not have a psychiatric diagnosis (Baumeister, Sedgwick, Howes, & Peters, 2017). It is estimated that up to 10% of the population will hear voices at some point in their lives (British Psychological Society, 2017). The prevalence of hearing voices in the general population has led to the hypothesis that it is not the presence of a voice that is distressing but rather there are other factors that lead to distress associated with hearing voices (Mawson, Cohen, & Berry, 2010). However, auditory hallucinations are considered a core symptom of psychiatric diagnoses that are conceptualised as residing along the schizophrenia spectrum, as outlined by the Diagnostic and Statistical Manual of Mental Disorders fifth edition (American Psychiatric Association, 2013; Arciniegas, 2015). Such disorders are characterised as severe and enduring, and are associated with high suicide rates, poverty and loss of functioning (Bentall & Morrison, 2002). Understanding factors that protect against psychological distress associated with hearing voices is an important research area to inform clinical interventions (Brett, Heriot-Maitland, McGuire, & Peters, 2014; Johns et al., 2014).

Research into auditory verbal hallucinations has found that the negative content of voices (for example derogatory remarks) is an important factor in clinical outcome. Negative content is associated with voice-related distress and higher rates of depression (Smith et al., 2006), as well as increased service use and need for care in voice-hearers (Beavan & Read, 2010; Johns et al., 2014). Voice content is a key difference between clinical and non-clinical voice-hearers with clinical voice-hearers (i.e., those who are in need of mental health care)

reporting predominantly negative voice content (Baumeister et al., 2017; Johns et al., 2014; Larøi et al., 2012). Furthermore, Rosen, McCarthy-Jones, Jones, Chase, and Sharma (2018) found negative voice content mediates the relationship between childhood adversity, a widely accepted risk factor for mental health difficulties in adulthood, and voice-related distress.

The impact of negative content has also been demonstrated in those who don't hear voices. In an experimental study using a simulation paradigm of auditory verbal hallucinations, negative voices were found to increase subjective levels of stress in healthy individuals immediately after exposure, and significantly more than when compared to neutral or ambient noise (Baumeister, Peters, Pruessner, Howes, & Chadwick, 2019). Furthermore, in the negative voice condition, more mindful appraisals of the voices were associated with lower levels of subjective stress. Although this study provides important experimental information regarding the role of negative voice content in contributing to distress, there are qualities to the experience of auditory verbal hallucinations that are difficult to simulate, such as coming from an unknown origin and often being personal in nature. The authors highlight that ethical constraints limited the degree to which simulated voices could be derogatory towards the hearer (Baumeister et al., 2019).

Despite the above findings, the importance of negative content has been largely neglected in the cognitive model of voices which focuses on beliefs and appraisals of voices (Larøi et al., 2019). Arguably, negative content is closely linked to beliefs about voices as subjective and contextual interpretations are needed in order for auditory hallucination content to be experienced as negative (Larøi et al., 2019).

The cognitive model of voice hearing proposes that emotional and behavioural responses are influenced by an individual's appraisal of the voices they hear (Chadwick & Birchwood, 1994; van der Gaag, Hageman, & Birchwood, 2003). A systematic review found appraisals of malevolence, supremacy, personal nature and attitudes of rejection and disapproval towards the voice hearer were most commonly associated with higher levels of distress (Mawson et al., 2010). The review highlighted the limited research, at the time, on attitudes of approval and acceptance of voices, their influence on distress, and the potential links between these attitudes and the hearer's behavioural response. Further research has demonstrated that the appraisal of malevolence is associated with the behavioural response of resistance, and the appraisal of benevolence is associated with engagement with voices (Peters, Williams, Cooke, & Kuipers, 2012). Overall, in the Peters et al. (2012) study, appraisals were found to be the biggest determinant of behavioural response and distress, independent of the severity of voices.

The Interpretation of Voices Inventory was developed to expand the measurement of beliefs and appraisals relating to voice hearing, encapsulating interpretations of loss of control, metaphysical beliefs and positive beliefs about voices (Morrison, Wells, & Nothard, 2002). Interpretations of voices have been significantly associated with voice characteristics (such as volume and duration), as well as voice-related distress (Morrison, Nothard, Bowe, & Wells, 2004). Specifically, this study found that an increased appraisal of loss of control from voices and high levels of metaphysical beliefs were associated with higher levels of distress in voice-hearers. Subsequent research has supported this finding in a larger sample of 101 voice-hearers (Varese et al., 2016).

Several studies have looked at more general cognitive processes within a psychological flexibility model (S. C. Hayes, Strosahl, & Wilson, 2011), which is thought to influence the maintenance of distress associated with hearing voices. Experiential avoidance, the negative appraisal of internal experiences leading to attempts to escape or suppress, has been examined for its association with voice-related distress (Morris, Garety, & Peters, 2014; Varese et al., 2016). Varese et al. (2016) found that high levels of experiential avoidance, as well as metaphysical beliefs about voices, predicted increased voice-related distress independent of voice frequency and duration. In contrast, an earlier study found experiential avoidance was associated with depression and anxiety symptoms but not voice-related distress specifically (Morris et al., 2014). This pattern of association was also found for non-judgemental acceptance, an element of mindful behaviour. Furthermore, voice-related distress in the Morris et al. (2014) study was found to be associated with voice appraisal of malevolence, supporting the cognitive model of voice-related distress. However, as Varese et al. (2016) point out, these divergent findings may be a product of methodological differences and a small sample size ($N=50$) in the Morris et al. (2014) study being unable to detect small effects.

Mindful awareness of psychotic symptoms, including hearing voices, has been suggested as a way of developing a different relational approach to symptoms by lessening often habitual unhelpful responses such as engagement or resistance (Abba, Chadwick, & Stevenson, 2008). General mindfulness capability has been explored in voice-hearers and is found to negatively correlate with both voice-related distress (Úbeda-Gómez et al., 2015), and dysfunctional relationships with the voices (Perona-Garcelán, Rodríguez-Testal, Senín-Calderón, Ruiz-Veguilla, & Hayward, 2017). When specifically looking at mindfully relating to

voices, as measured by the Southampton Mindfulness of Voices Questionnaire, higher levels have been associated with lower voice-related distress (Dudley, Eames, Mulligan, & Fisher, 2018) and subjective distress at the time of hearing voices (Chadwick, Barnbrook, & Newman-Taylor, 2007). Increased mindfulness of voices was also found to be associated with lower levels of voice-related distress and less dysfunctional behavioural responses in a sample of voice-hearers with psychiatric diagnoses (Stephanie, Susan, Wei Lin, Monique, & Neil, 2018).

Although these studies show an association of increased mindfulness and lower levels of distress, the directionality cannot be inferred from the cross-sectional designs. Lower levels of distress could, for example, facilitate more mindful awareness in voice-hearers. Dudley et al. (2018) found that mindfulness of voices mediated the relationship between self-compassion and severity of voices, but, to a more significant degree, self-compassion mediated the relationship between mindfulness of voices and severity of voices. It is important to note this study examined mediating influences on severity of voices, rather than voice-related distress. Experts by experience have highlighted that reducing the negative impact on wellbeing whilst hearing voices, rather than elimination of voice hearing all together, is a more important clinical outcome (Corstens, Longden, McCarthy-Jones, Waddingham, & Thomas, 2014).

Theoretical frameworks propose that mindfulness may be helpful for voice-hearers through several processes, one being that mindful acceptance replaces suppression or experiential avoidance which maintains voice-related distress (Strauss, Thomas, & Hayward, 2015). Separately, Larøi et al. (2019) proposes a theoretical model where negative voice content is reinforced by attempts to suppress, which results in increased voice-related

distress. Both thought suppression and the experience of perceiving thoughts as intrusions, as measured by the White Bear Suppression Inventory, have been found to be associated with susceptibility to hearing voices in large non-clinical samples (Alderson-Day et al., 2019; McCarthy-Jones & Fernyhough, 2006). However, the exploration of thought suppression in populations of people who hear voices and its potential role in maintaining distress has been limited.

Considering the evidence that negative voice content is associated with voice-related distress, but little is known about the process that may underpin this relationship, there is a need to examine potential mediating factors that may be maintaining distress. Identifying strong mediators in this relationship could elicit therapeutic targets for reducing distress associated with hearing voices. It is also important to consider the variation that may exist in these mediators between those who hear voices, and are in need of mental health care, and those who hear voices but cope well.

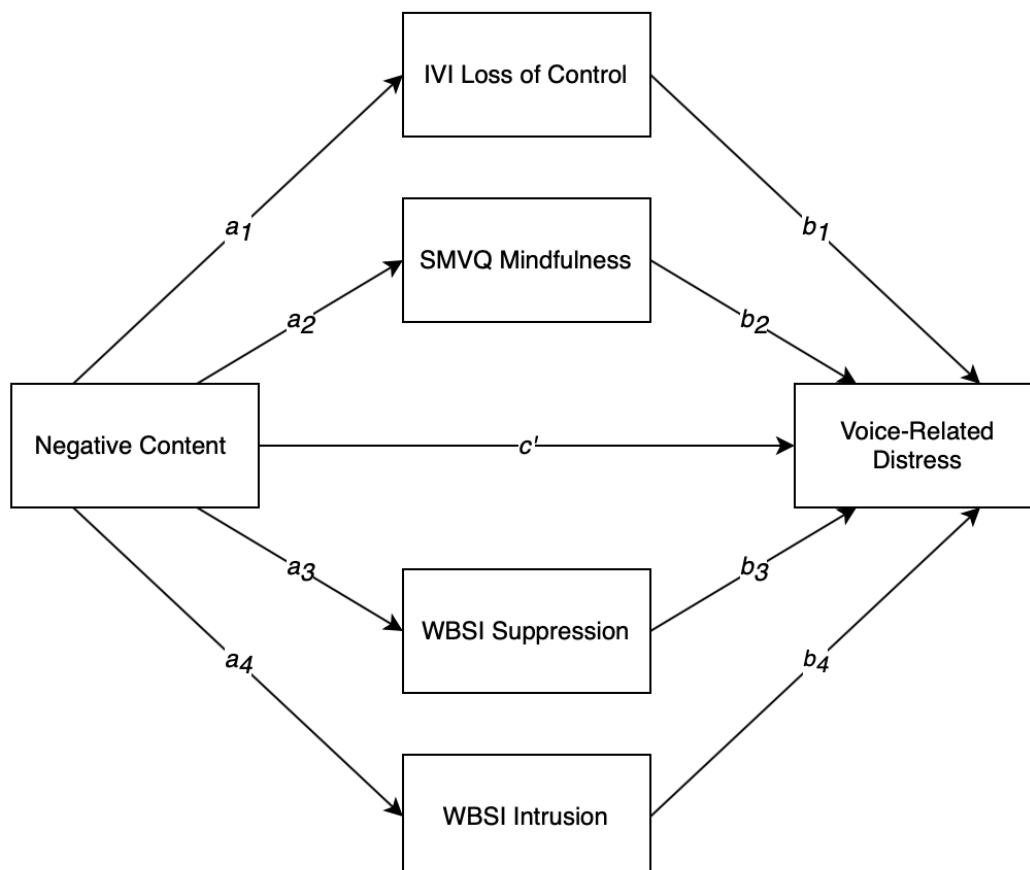
This research aims to examine negative voice content and voice-related distress in a community sample of voice hearers both with and without the need for care. It employs a cross-sectional design to examine potential mediating factors of the voice content and distress relationship that has been indicated by previous research. Specifically: the role of mindfulness of voices, thought suppression, intrusions, and the interpretation of loss of control. This study examines the following hypotheses:

1. Clinical voice-hearers will report a significantly higher level of negative voice content and voice-related distress than non-clinical voice-hearers.

2. Clinical voice-hearers will report significantly higher interpretations of loss of control, suppression, and intrusion but lower levels of mindfulness of voices than non-clinical voice-hearers.
3. Level of negative voice content will be positively correlated with level of distress in the combined clinical and non-clinical sample.
4. Mindfulness, interpretation of loss of control, suppression, and intrusion will all mediate the relationship between negative content and voice-related distress in the combined clinical and non-clinical sample (see Figure 1 for the proposed mediation model).

Figure 1

Proposed Parallel Mediation Model Showing Direct Effect Pathways



Method

Participants

One hundred and seventy-five adults who hear voices consented to take part in the study by completing an online consent form. Fifty-four were excluded as they completed less than 90% of the study questions and/or had spent less than 5 minutes completing the study (an estimated minimum time needed to read and answer all the questions).

Completion time has been found to be a reliable indicator of meaningless data on internet-based questionnaires (Leiner, 2019). Data from 121 participants was included for further analysis.

For part of the analysis participants were divided into two groups, *clinical* ($n=75$) and *non-clinical* ($n=46$). Allocation to the clinical group was determined based on participants having received support from mental health services in the last six months. Data was gathered on self-identified mental health condition or diagnosis. However, recent contact with mental health services was deemed to be a more valid indicator of current mental health functioning as a diagnosis could be historical. Demographic and clinical characteristics for the total sample and clinical and non-clinical groups are shown in Table 1.

Table 1*Demographic and Clinical Characteristics of Participants*

		Total Sample (N=121)	Clinical Group (N=75)	Non-Clinical Group (N=46)
<i>Age</i>	18-25	66 (54.5%)	36 (48%)	30 (65.2%)
	26-35	32 (26.4%)	21 (28%)	11 (23.9%)
	36-45	11 (9.1%)	9 (12%)	2 (4.3%)
	46-55	7 (5.8%)	6 (8%)	1 (2.2%)
	56-65	5 (4.1%)	3 (4%)	2 (4.3%)
<i>Sex</i>	Female	87 (71.9%)	55 (73.3%)	32 (69.6%)
	Male	28 (23.1%)	18 (24%)	10 (21.7%)
	Not stated	6 (5%)	2 (2.7%)	4 (8.7%)
<i>Ethnicity</i>	White British	48 (39.7%)	35 (46.7%)	13 (28.3%)
	White Irish	2 (1.7%)	2 (2.7%)	0 (0%)
	White Other	28 (23.1%)	23 (30.7%)	5 (10.9%)
	Mixed White and Black Caribbean	1 (0.8%)	0 (0%)	1 (2.2%)
	Mixed White and Black African	1 (0.8%)	1 (1.3%)	0 (0%)
	Mixed White and Asian	5 (4.1%)	2 (2.7%)	3 (6.5%)
	Mixed Other	11 (9.1%)	3 (4%)	8 (17.4%)
	Indian	1 (0.8%)	0 (0%)	1 (2.2%)
	Pakistani	0 (0%)	0 (0%)	0 (0%)
	Bangladeshi	0 (0%)	0 (0%)	0 (0%)
	Chinese	7 (5.8%)	1 (1.3%)	6 (13%)
	Asian Other	4 (3.3%)	1 (1.3%)	3 (6.5%)
	Black African	5 (4.1%)	2 (2.7%)	3 (6.5%)
	Black Caribbean	2 (1.7%)	2 (2.7%)	0 (0%)
	Black Other	0 (0%)	0 (0%)	0 (0%)
	Arab	1 (0.8%)	0 (0%)	1 (2.2%)
	Other Ethnic Group	5 (4.1%)	3 (4%)	2 (4.3%)
<i>Employment status</i>	Student	43 (35.5%)	24 (32%)	19 (41.3%)
	Unemployed	26 (21.5%)	19 (25.3%)	7 (15.2%)

		Total Sample (N=121)	Clinical Group (N=75)	Non-Clinical Group (N=46)
	Retired	3 (2.5%)	2 (2.7%)	1 (2.2%)
	Employed	49 (40.5%)	30 (40%)	19 (41.3%)
<i>Socio-economic Classification</i>	Managerial/administrative/professional	27 (22.3%)	15 (20%)	12 (26.1%)
	Intermediate occupations	8 (6.6%)	4 (5.3%)	4 (8.7%)
	Small employers & own account workers	2 (1.7%)	2 (2.7%)	0 (0%)
	Lower supervisory and technical	2 (1.7%)	1 (1.3%)	1 (2.2%)
	Semi-routine and routine occupations	11 (9.1%)	8 (10.7%)	3 (6.5%)
<i>Mental health condition/ diagnosis</i>	No	33 (27.3%)	5 (6.7%)	28 (60.9%)
	Yes	88 (72.7%)	70 (93.3%)	18 (39.1%)
	Schizophrenia	31 (25.6%)		
	Anxiety	29 (24%)		
	Depression	27 (22.3%)		
	PTSD	17 (14%)		
	Personality Disorder	14 (11.6%)		
	Bipolar Disorder	11 (9.1%)		
	Eating Disorder	10 (8.3%)		
	Psychosis	8 (6.6%)		
	OCD	7 (5.8%)		
	Autism	5 (4.1%)		
	ADHD	4 (3.3%)		
	Substance abuse/addiction	3 (2.5%)		
	Phobia	1 (0.8%)		

Measures

A study specific demographic information questionnaire was used to obtain age, gender, ethnicity, employment status and information relating to clinical group assignment from participants.

The National Statistics Socio-economic Classification (NS-SEC; Rose & Pevalin, 2003) self-coded version was used to determine socio-economic classification of working or previously employed participants. It differentiates between five classes (see Table 1).

The Auditory Vocal Hallucination Rating Scale Questionnaire (AVHRS-Q; Steenhuis et al., 2019) is a 17-item self-report measure that gives an overall severity score for auditory verbal hallucinations (ranging from 0, mild to 14, severe). The measure contains fifteen 4- and 5-point Likert scale items and two 10-point scale items. The measure covers several characteristics of auditory verbal hallucinations including frequency, duration, location, volume, negative content, anxiety, and interference with daily functioning. The AVHRS-Q has been translated into several languages as well as the English version that was used in this study. The Dutch version has been shown to have good internal consistency ($\alpha = .78 - .87$), to be strongly correlated ($r = .90$) with the AVHRS (a structured clinical interview on which the AVHRS-Q is based) and was found to measure auditory hallucination severity distinct from general psychological distress (Steenhuis et al., 2019).

A score of negative content was produced by combining items 9 and 10 from the AVHRS-Q, which rate content on a scale from always positive to always negative and the degree of unpleasantness to negative content. These combined items give a negative content score ranging from 0, always positive, to 8, highly negative. A voice-related distress score was produced by combining items 11, 16 and 17 on the AVHRS-Q. These relate to

whether the voices cause anxiety or fear, frequency that the hearer is bothered by the voices and how severely they suffered, and gave a score ranging from 0, no distress, to 22, high level of voice-related distress.

The *Interpretation of Voices Inventory* (IVI; Morrison et al., 2002) has twenty-six 4-point Likert scale items and examines the beliefs that voice-hearers hold about their voices. It is composed of three subscales of metaphysical beliefs, positive beliefs, and beliefs about loss of control. The IVI interpretation of loss of control was the only subscale used in the analysis. The IVI loss of control subscale comprises of five items rating the interpretation of loss of control because of hearing voices (e.g., They mean I will lose control of my behaviour). Total score ranges from 5, no interpretation of loss of control, to 20, high endorsement of loss of control. The subscale has demonstrated internal consistency ($\alpha = .88$), good test-retest reliability ($r = .77$) in a sample of 132 participants (Byrne & Morrison, 2010).

The *White Bear Suppression Inventory* (WBSI; Wegner & Zanakos, 1994) is a 15-item self-report measure, originally developed to assess peoples' tendency to suppress thoughts. Subsequent studies have suggested the measure contains at least two constructs (see Schmidt et al., 2009, for a review). As well as suppression, it most consistently captures a construct of intrusions which relates to the difficulty in controlling unwanted thoughts through the perceived experience of intrusive thoughts. This study utilized the factor structure proposed by Schmidt et al. (2009), which takes into account previous findings across studies using the WBSI in several different languages. They propose two subscales within the WBSI, five items relating to suppression and four items relating to intrusion. In this format the WBSI has a score range on the suppression subscale of 5 to 25 (for high

endorsement of thought suppression), and the intrusion subscale has a score range of 4 to 20 (for high endorsement of intrusions). This version of the WBSI has demonstrated reliability; the suppression and intrusion subscales both have good internal consistency, $\alpha = .78$ and $.84$ respectively (Schmidt et al., 2009).

The *Southampton Mindfulness of Voices Questionnaire* (SMVQ; Chadwick et al., 2007) measures the degree to which individuals respond mindfully to the voices they hear. It has 12 items, all of which are scored on a 7-point Likert scale. The measure covers four linked elements of mindfulness; mindful observation, letting go, absence of aversion, and non-judgement. The scale has a total score range of 0 to 72, with higher scores representing a higher degree of tendency to respond mindfully to voices. The SMVQ has shown good internal reliability ($\alpha = .84$) and moderate concurrent validity with general mindfulness measures (Chadwick et al., 2007).

Procedure

Ethical approval was gained from the Cardiff University School of Psychology Ethics Committee. Recruitment was carried out by promoting the study on a study specific Twitter account and distributed by organisations supporting individuals who hear voices (e.g., Hearing Voices Network, Platform and Hafal). Information about eligibility criteria (hearing voices in the last 6 months, 18 years and over) was distributed with the link to the full study information, consent form and questionnaires, which were all hosted on the online secure platform Qualtrics. Participants who consented to take part in the study were given the opportunity to enter a prize draw to win a £50 voucher. Recruitment was conducted from June to November 2020 when a sufficient sample size for the planned analysis had been

reached. To achieve .8 power in percentile bootstrap mediation analysis, Fritz and MacKinnon (2007) recommend a sample size of at least 78 when both *a* and *b* path effect sizes are medium (0.39), and a sample of 162 when effect sizes are halfway between small and medium (0.26).

Statistical Analyses

Analyses were carried out using IBM SPSS Statistics (version 26) for Mac. An α level of 0.01 was used due to multiple tests of difference being carried out. A Hotelling's T^2 test was used to examine the difference between the clinical and non-clinical groups on all measures. This test enables reporting on the difference between two groups on the combined means of two or more measures as well the difference in individual measure means. A parallel mediation analysis (model 4) was carried out using the PROCESS Macro version 3.5 (A. F. Hayes, 2017) to explore the mediating factors of negative content and distress. 95% percentile bootstrap confidence intervals, based on 5,000 bootstrap samples, were used to test for an indirect relationship via key variables. An indirect relationship is demonstrated when both confidence intervals are entirely above zero.

Results

Demographic factors of age, sex, ethnicity, and socio-economic classification were examined for their association with severity of voices, negative content, and voice-related distress. No significant association with demographic factors was found (see Appendix L for further details).

Difference Analysis

Mean scores for all cognitive variables and voice-related measures for the clinical and non-clinical groups are provided in Table 2. Prior to carrying out a Hotelling's T^2 test of difference, assumptions were assessed (see Appendix M for details).

There was a statistically significant difference between the clinical and non-clinical groups on the combined study variables ($F(7, 105) = 3.365, p = .003$; Wilks' $\Lambda = .817$; partial $\eta^2 = .183$).

Table 2*Scores on all Variables for the Clinical and Non-Clinical Groups*

<i>Variable</i>	Clinical		Non-Clinical	
	Range	<i>M (SD)</i>	Range	<i>M (SD)</i>
AVHRS-Q	0-14	6.96 (3.80)	0-14	3.67 (3.72)
Negative Content	0-8	5.10 (1.91)	0-8	3.60 (2.03)
Voice-Related Distress	0-22	12.06 (5.46)	0-22	7.95 (6.15)
IVI Loss of Control	5-20	10.70 (4.79)	5-20	8.17 (3.47)
SMVQ Mindfulness	7-65	32.96 (14.30)	11-65	40.19 (12.19)
WBSI Suppression	12-30	25.52 (4.51)	12-30	23.38 (5.46)
WBSI Intrusion	8-30	24.46 (5.29)	15-30	23.10 (4.68)

Note. AVHRS-Q = The Auditory Vocal Hallucination Rating Scale Questionnaire; IVI = The Interpretation of Voices Inventory; SMVQ = The Southampton Mindfulness of Voices Questionnaire; WBSI = The White Bear Suppression Inventory.

Hypothesis 1

Severity of voices, negative content and voice-related distress were significantly higher in the clinical group compared to the non-clinical group (all $p < .0005$).

Hypothesis 2

IVI control scores were significantly higher in the clinical group compared to the non-clinical group ($p = .003$). SMVQ scores were significantly lower in the clinical group compared to the non-clinical group ($p = .007$). There was no statistically significant difference between the groups on measures WBSI intrusion ($p = .168$) and suppression ($p = .026$).

Mediation Analysis

A parallel mediation analysis examined whether the relationship between negative voice content and distress was mediated by IVI Control, SMVQ, WBSI Suppression and WBSI Intrusion, as illustrated in the proposed mediation model (Figure 1). Prior to analysis, assumptions specific to mediation were checked (see Appendix N for further details). Outliers were detected using Mahalanobis distance, Cook's distance and Leverage and were excluded if they met the criteria for two or more (Aiken, West, & Reno, 1991). Two cases were identified as being outliers meaning 119 datasets were included in the mediation analysis. All predictor variables were correlated (see Table 3).

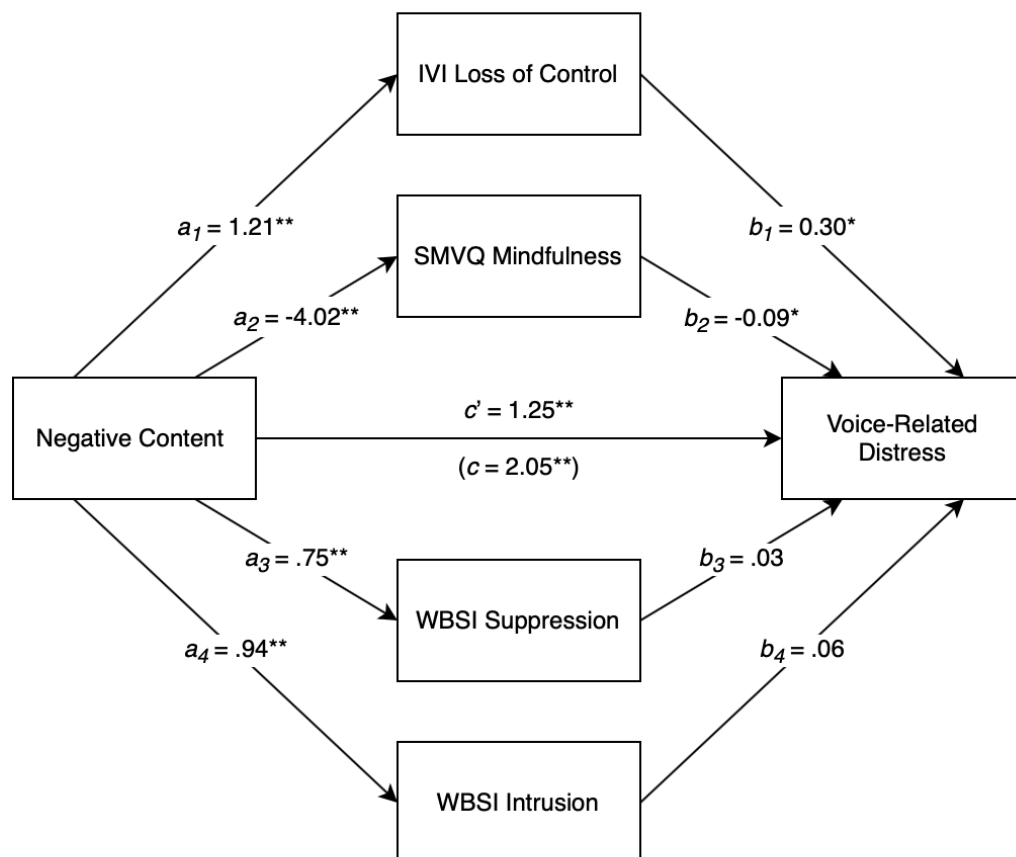
Hypothesis 3

Parallel mediation analysis found a positive total effect of negative content on voice-related distress ($c = 2.05$, $p = <.001$). Negative content positively correlated with voice-related distress. Figure 2 displays total and direct effects.

Table 3*Pearson's Correlation for all Predictor Variables (N=111)*

<i>Variable</i>	Negative Content	IVI Control	SMVQ	WBSI Suppression
IVI Control	.557**			
SMVQ Mindfulness	-.598**	-.672**		
WBSI Suppression	.333**	.431**	-.397**	
WBSI Intrusion	.382**	.537**	-.486**	.723**

Note. ** $p < 0.01$ (2 tailed); IVI = The Interpretation of Voices Inventory; SMVQ = The Southampton Mindfulness of Voices Questionnaire; WBSI = The White Bear Suppression Inventory.

Figure 2*Results of Parallel Mediation Analysis*

Note. Figure shows direct effects of negative content on mediator variables (a_{1-4}), mediator variables on voice-related distress (b_{1-4}) and negative content on voice-related distress (c'), as well as total effect of negative content on voice-related distress (c); * $p < .05$; ** $p < .001$

Hypothesis 4

Parallel mediation analysis found negative voice content indirectly influenced distress in the voice hearer through its effect on both interpretation of loss of control (IVI control) and mindfulness (SMVQ). No indirect effect was found for the WBSI subscales of intrusion and suppression. Table 4 displays the indirect effects and confidence intervals for all mediator variables.

High levels of negative voice content were associated with a higher degree of interpretation of loss of control ($a_1 = 1.21, p < .001$) and participants with a higher degree of interpretation of loss of control reported increased voice-related distress ($b_1 = 0.30, p = .0147$). IVI control exerts an effect of a 0.36-point increase on the voice-related distress scale for every 1-point increase on the negative content scale.

High levels of negative voice content were associated with less endorsement of mindfulness of voices ($a_2 = -4.02, p < .001$). Lower mindfulness of voices was associated with higher levels of voice-related distress ($b_2 = -0.09, p = .0195$). Mindfulness of voices exerts an effect of a 0.37-point increase on the voice-related distress scale for every 1-point increase on the negative content scale.

The overall mediation model was statistically significant ($p < .001$) and explained 61% of the variation in voice-related distress. However, negative content was found to influence voice-related distress independent of the indirect effects via the mediator variables examined ($c' = 1.25, p < .001$).

Table 4*Indirect Effects and Confidence Intervals*

	Indirect Effects [†]	95% Percentile Bootstrap Confidence Intervals	
		(Based on 5000 bootstrap samples)	
IVI Loss of Control	0.36	0.10	0.64
SMVQ Mindfulness	0.37	0.07	0.73
WBSI Suppression	0.02	-0.15	0.23
WBSI Intrusion	0.05	-0.21	0.31

Note. [†] Unstandardised indirect effects expressed as unit change on Voice-Related Distress scale; IVI = The Interpretation of Voices Inventory; SMVQ = The Southampton Mindfulness of Voices Questionnaire; WBSI = The White Bear Suppression Inventory

Discussion

Summary of Findings

The preliminary aim of this study was to investigate whether there was a difference between clinical and non-clinical groups on negative content, voice-related distress, mindfulness, interpretations of control, intrusion, and suppression. The secondary aim was to investigate the relationship between negative content and distress in the sample as a whole; specifically, whether mindfulness, interpretations of control, suppression, and intrusion mediate the negative content—distress relationship.

This study demonstrated a difference between clinical and non-clinical groups, with the clinical group reporting higher severity of voices, negative content, voice-related distress, interpretations of loss of control and responding less mindfully to voices. This is in line with previous findings that found differences between clinical and non-clinical voice-hearers in terms of negative voice content (Baumeister et al., 2017; Johns et al., 2014; Larøi et al., 2012).

Higher levels of negative content in voices were found to be associated with higher levels of voice-related distress, supporting previous findings (Rosen et al., 2018; Smith et al., 2006). When this association was explored further the relationship was mediated by mindfulness and interpretation of loss of control. Mindfulness has previously been found to mediate the negative content - distress relationship in a simulated, experimental study with non-voice-hearers (Baumeister et al., 2019). This study builds on these findings, confirming this pattern in voice-hearers across a spectrum of severity and level of need. The finding that interpretation of loss of control mediates the relationship between negative content

and distress increases the understanding from previous research that it is a predictor of voice-related distress (Varese et al., 2016).

Thought suppression and intrusion were not found to be mediators. This was unexpected as theoretically they could be considered the opposite of mindfulness, which is characterised as acceptance and non-judgemental observation of mental activity (Strauss et al., 2015). In a previous study, mindfulness of voices was found to predict lower levels of resistance to voices (a similar construct to suppression), as well as lower levels of distress (Stephanie et al., 2018). Potentially, suppression and intrusion, and their implications for voice-related distress, differ between those who have recently started hearing voices and those who have experienced them for a while. However, it is worth noting that the WBSI suppression and intrusion subscales relate specifically to thoughts, not voices. It could be that people who hear voices have differing tendencies for suppressing thoughts in comparison to suppression of mental activity experienced as auditory hallucinations. This may be an important differentiating point in future research that continues to build on theoretical models such as that proposed by Larøi et al. (2019) where suppression is implicated in voice-related distress. Although thought suppression and intrusions have been associated with susceptibility to hearing voices (Alderson-Day et al., 2019; McCarthy-Jones & Fernyhough, 2006), exploring these variables in voice-hearers would benefit from measurement tools that have been validated and found to be reliable for this specific use in this population.

Clinical Implications

Although the cross-sectional design of this study limits the conclusions that can be

drawn about the cause of voice-related distress, the findings that mindfulness mediates the relationship between negative content and voice-related distress supports the emerging evidence base for the use of mindfulness-based therapeutic interventions with people who are distressed by their voices (Strauss et al., 2015). A meta-analysis found mindfulness-based interventions to have a small but significant effect in reducing overall psychosis severity (Louise, Fitzpatrick, Strauss, Rossell, & Thomas, 2018). The research on mindfulness-based interventions specifically for distress associated with hearing voices, rather than psychosis, is less developed but shows promising results. A recent randomised controlled trial has shown a group mindfulness-based intervention to be effective at reducing voice-related distress, improving perceived controllability of voices and promoting recovery compared to treatment as usual (Chadwick et al., 2016). A small pilot study of an individual mindfulness-based intervention has demonstrated small to moderate effects in reducing the negative impact of voices (Louise, Rossell, & Thomas, 2019). The findings from these studies demonstrate mindfulness can have a positive effect on distress associated with hearing voices. However, previous research has found that mindfulness is not associated with level of functioning in voice-hearers, suggesting that mindfulness alone may not be sufficient in improving broader outcomes for voice-hearers (Morris et al., 2014; Stephanie et al., 2018).

The present study also suggests that interventions based on the cognitive model of voice-related distress, such as Cognitive Behavioural Therapy for Psychosis (CBTp), may be helpful in reducing voice-related distress if beliefs and appraisals such as the interpretation of loss of control are targeted. However, although CBTp has been found to be effective in reducing risky behaviour associated with compliance with command hallucinations by

targeting beliefs about the power of voices, (Trower et al., 2004), there is limited evidence that CBTp alone is effective in reducing voice-related distress (Birchwood et al., 2014).

So called 'third wave' behavioural interventions build upon the well-established cognitive behavioural model by integrating approaches of acceptance, mindfulness, and compassion. Third wave approaches such as Acceptance and Commitment Therapy (ACT) may offer a promising alternative to CBT for those distressed by voices. However, their specific utility in reducing distress in psychosis and hearing voices is yet to be clearly demonstrated. A meta-analysis found ACT to have negligible and non-significant effects on reducing psychosis symptoms (Louise et al., 2018). Furthermore, although an acceptance-based CBT approach for command hallucinations has been found to have positive outcomes, there was no increased benefit from this intervention on outcomes when compared to an active control of befriending (Shawyer et al., 2012).

Overall, this study supports the need to be able to offer a range of therapeutic interventions to voice-hearers as one approach is unlikely to benefit all. Further research on interventions for hearing voices would benefit from including a comparison between psychological approaches, rather than just comparing to treatment as usual.

Strengths and Limitations

Limitations exist around the use of select items from the AVHRS-Q to measure negative content and voice-related distress, which have not previously been examined for validity and reliability for this purpose. To our knowledge, there is currently no validated self-report measure of negative content in voices and as pointed out by Larøi et al. (2019), it is a difficult construct to measure objectively. Single and two item measures for distress and

negative content from the Psychotic Symptoms Rating Scales (PSYRATS), an interviewer administered measure with items on a 5-point Likert scale, have been widely used in previous research (Morris et al., 2014; Rosen et al., 2018; So, Begemann, Gong, & Sommer, 2016; Stephanie et al., 2018; Varese et al., 2016). The AVHRS-Q differs in that it is a self-report measure which enables ease of use in online research. Furthermore, the measures for distress and negative content in this study were made up of several items giving a greater score range (0 to 22 for distress, 0 to 8 for negative content) than those previously using items from the PSYRATS. Nonetheless, a further exploration into the psychometric properties and construct validity of these two approaches to measuring voice-related distress and negative content, and development of more robust measures, would be beneficial for further research examining voice-related distress.

The measures completed by participants were chosen to target key areas hypothesised to be influential in the development of voice-related distress. Measures were also kept to a minimum to reduce the time taken for participation. However, there are potentially confounding variables that this study did not account for, such as current functioning, coping and medication use. Although it is possible that other factors affect current functioning, this needs to be borne in mind. With regards to the mediation analysis, it is important to note that this study found mindfulness and interpretation of loss of control to only partially mediate the effect voice content has on distress. This indicates that there are other potentially clinically relevant variables that mediate the relationship between content and distress. Furthermore, possible confounding variables, such as overall mood, were not controlled for within the mediation analysis.

The allocation to clinical and non-clinical groups was based on a question that was designed to reflect the need for care over the last 6 months. However, it could be that because of the care the clinical group participants received, at the time of undertaking the study they were coping well. Conversely, there may have been participants in the non-clinical group that needed care but had not received it for various reasons (e.g., service inaccessibility). Various approaches have been taken to distinguish between clinical and non-clinical voice-hearers; however, these often do not take into account how mental health difficulties fluctuate over time. Furthermore, the division into groups may well create a false dichotomy; mental health difficulties are better understood as existing along a continuum.

A particular strength of this study was that the sample was of a moderate to large size and was ethnically diverse. The problem of psychological research being predominantly undertaken with white and young participants limits the applicability to diverse groups. In this study, 35.5% of participants identified as being from a mixed or non-white ethnic background. Although the sample is biased towards those with access to the internet, online recruitment is likely to have increased the accessibility of this study to non-white ethnic groups.

Conclusion

Although this study demonstrated differences in voice-related, IVI control and mindfulness variables between clinical and non-clinical voice-hearers, group allocation may not accurately reflect participants' level of functioning. Mediation analysis revealed negative content influences distress indirectly through mindfulness and interpretation of loss of

control. These results are demonstrated in an ethnically diverse sample supporting the use of mindfulness-based interventions for voice-related distress with diverse populations in clinical practice.

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Internet Document

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Tables should be self-contained and complement, not duplicate, information contained in the text. They should be supplied as editable files, not pasted as images. Legends should be concise but comprehensive – the table, legend, and footnotes must be understandable without reference to the text. All abbreviations must be defined in footnotes. Footnote symbols: †, ‡, §, ¶, should be used (in that order) and *, **, *** should be reserved for P-values. Statistical measures such as SD or SEM should be identified in the headings.

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Appendix B: Quality Assessment Tool for Studies of Diverse Design Scoring Guidance

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- aetiology, assessment and treatment of the whole range of psychological disorders irrespective of age group and setting
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- Brief Reports and Comments.

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Tables

Tables should be self-contained and complement, not duplicate, information contained in the text. They should be supplied as editable files, not pasted as images. Legends should be concise but comprehensive – the table, legend, and footnotes must be understandable without reference to the text. All abbreviations must be defined in footnotes. Footnote symbols: †, ‡, §, ¶, should be used (in that order) and *, **, *** should be reserved for P-values. Statistical measures such as SD or SEM should be identified in the headings.

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For help with submissions, please contact: Hannah Wakley, Associate Managing Editor (bjc@wiley.com) or phone +44 (0) 116 252 9504.

Author Guidelines updated 14th October 2019

Appendix D: Ethical Approval for Paper 2

Dear Jessica,

The Ethics Committee has considered your revised PG project proposal: Are metacognitive processes associated with negative content in auditory verbal hallucinations? (Short title: Hearing voices and thinking styles (EC.20.04.14.6003R).

The project has been approved.

Please note that if any changes are made to the above project then you must notify the Ethics Committee.

Best wishes,
Adam Hammond

School of Psychology Research Ethics Committee

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CF10 3AT

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E-
bost: psychethics@caerdydd.ac.uk

Please note that I do not expect a response to this email outside of your normal working hours

Nid wyf yn disgwyl ymateb i'r ebost hwn y tu allan i'ch oriau gwaith arferol

Appendix E: Participant Information and Consent Form

Hearing Voices and Thinking Styles

Participant Information

Introduction

You are invited to take part in a research project that aims to explore your experience of hearing voices and how this relates to thinking styles. Please take the time to read the following information before you decide whether you would like to consent to take part in the study. The following information outlines why the research is being carried out and what it will involve.

The researchers

My name is Jessica Silver and I am a Trainee Clinical Psychologist on the South Wales Doctoral Programme in Clinical Psychology at Cardiff University. I am carrying out this study as part of my training. The research is being supervised by Dr Heledd Lewis (Consultant Clinical Psychologist, South Wales Programme in Clinical Psychology) and Dr Julian Pitt (Consultant Clinical Psychologist, Cwm Taf Morgannwg University Health Board).

What is the purpose of the research?

This study aims to gain an understanding of distress related to hearing voices. Not everyone who hears voices is affected by them in the same way, some people experience little distress and the voices they hear may even be comforting or a positive experience. However, some people who hear voices experience significant distress and are likely to experience a disruption to their usual activities and functioning. Research in the past has shown that there may be lots of different reasons why someone might find the experience of hearing voices distressing. Some of these reasons include how negative the voices are, the way someone thinks about hearing voices and the thinking styles they may use in response to hearing voices. This research aims to further understand what contributes to people experiencing negative voices in the hope that this may help the development of interventions to reduce distress relating to hearing voices.

Who can take part in the study?

We are looking for people who are aged 18 years or above and have heard one or more voices within the last month or so to consent to take part. You do not need to have a psychiatric diagnosis or consider yourself to have a mental health difficulty. We are looking for people who receive support from mental health services as well as those who do not receive any support. You may or may not experience distress from the voices you hear or this may change over time. Hearing voices are a common experience and individuals' experience of voices vary greatly. Some individuals experience them as distressing and difficult whilst others experience them as a positive and life enhancing.

What does taking part in the study involve?

Taking part in the study involves completing a series of questionnaires online. These questionnaires will cover basic demographic information, information about the voices you hear, how you feel about them and questions about your thinking style. The questionnaires involve a mixture of types of questions, some are open ended, and some ask you to rate how you feel on a scale. There is no right or wrong answer to any of the questions. Completing the questionnaires should take around 20 minutes. Your responses will be sent securely to the research team once you press submit. There is the option to be entered into a prize draw to win a £50 Amazon voucher for taking part in the study.

Consent to take part in the study

If you decide that you would like to take part in the research, you will be asked to complete a consent form before completing the study questionnaire. You are welcome to contact us to ask any questions before agreeing to take part in the study. Please find our contact details below.

What will happen to my information?

All information and responses you give to the questions when taking part in this research is strictly confidential. Your responses to the study questionnaire will be kept separate to the consent form. This will ensure that your responses to the study questionnaires remain anonymous. Information collected through completing the questionnaire and consent form online will be stored on a secure web-based drive hosted by Cardiff University. All of the information you provide will only be accessible to the researcher. You will only be contacted following your participation if you have entered the prize draw and you win the £50 Amazon voucher.

The responses from everyone taking part in the study will be collected together to be analysed. We will be looking for patterns of responses across groups of people taking part in the study. We will not be analysing individual responses to the questionnaires. The research will be written up into a report which we hope to publish in an academic journal. We may also present the research findings at relevant conferences. Individual responses and information will not be identifiable in the report or when the research findings are presented at conferences.

What are the potential disadvantages of taking part?

It is important to know that taking part in the study will involve answering questions about your experience of hearing voices. Some people find that their voices increase in intensity temporarily when they think or talk about hearing voices and this may cause you distress. You can cope with this temporary increase by using your usual coping strategies e.g. listening to music, distraction, social support, exercise etc. You can stop taking part in the study at any time. There will be information on support services for people who hear voices and general mental health at the end of the questionnaire. Taking part in the study will take about 20 minutes to complete the consent form and study questionnaire.

What are the benefits of taking part?

Whilst taking part in the study will not benefit you directly, it is hoped that the research will lead to an increased understanding of the distress some people experience related to hearing voices. This may help in developing interventions aimed at reducing the distress and helping people be better able to cope with hearing voices.

What will happen if I don't want to carry on with the study?

If at any point during the study you wish to withdraw please contact me by email. Even if you have completed the questionnaire you can still withdraw your information. I will ask you what you would like me to do with the information you have already provided by that point. If you would like me to destroy the information at any stage, this is absolutely fine and there will be no adverse consequences.

Who has reviewed the study?

This study has been reviewed by an independent group of people who sit on a Research Ethics Committee. This process is to protect your rights, safety and dignity. This study was reviewed and approved by the Cardiff University Research Ethics Committee on the 7/5/20.

Contact for further information?

If you would like any further information or have any questions about the study please feel free to contact us:

Researcher: Jessica Silver (Trainee Clinical Psychologist)

Email: silverj@cardiff.ac.uk

Research Supervisor: Dr Heledd Lewis (Consultant Clinical Psychologist)

Email: Lewish31@cardiff.ac.uk

What if I have concerns about this research study?

If you have concerns or complaints about this research study, please in the first instance contact the researchers above. If you do not feel we have adequately addressed your concerns you can raise them directly with the Ethics Committee by contacting the Secretary to the Ethics Committee by emailing psychethics@cardiff.ac.uk or by contacting them at the following address:

School of Psychology
Cardiff University
Tower Building
70 Park Place
Cardiff
CF10 3AT

Thank you for taking the time to read this information.

To take part in the study please complete the consent form on the next page.

Consent Form

Research Study: Hearing Voices and Thinking Styles

Researcher: Jessica Silver

Please read each statement and select 'Yes' to consent to take part in the study.

I confirm that I have read and understood the participant information. I have had the opportunity to consider the information provided, ask questions and have had these answered satisfactorily.

Yes

I understand that my participation in this study is entirely voluntary and that I am free to withdraw from the study at any time without giving reason. If I choose to withdraw from the study, there will be no adverse consequences.

Yes

I consent to completing the study questionnaire asking about my experience of hearing voices. I understand that my participation is anonymous, and my responses will be recorded without any identifiable information.

Yes

I understand that my information and responses to the questionnaire will be stored securely.

Yes

I understand that the research is looking at patterns across groups of people who hear voices and I understand I will not receive any feedback on my responses.

Yes

I understand that the research findings will be written up into a report and this will be submitted to an academic journal to be published.

Yes

I agree to take part in the Hearing Voices and Thinking Styles study.

Yes

Please enter your name:

The information provided on the consent form will be held in compliance with GDPR regulations. Cardiff University is the data controller and Matt Cooper is the data protection officer (inforequest@cardiff.ac.uk). This information is being collected by Jessica Silver. This information will be held securely and separately from the research information you provide. Only the researcher will have access to this form and it will be destroyed after 7 years. The lawful basis for processing this information is public interest.

Appendix F: Demographic Information Questionnaire**1. What is your age?**

Under 18 years

18-25

26-35

36-45

46-55

56-65

66-75

76-85

86+

2. What is your sex?

Male

Female

Prefer not to say

3. What is your ethnic group? Choose one option that best describes your ethnic group or background.

White:

Welsh/English/Scottish/Northern Irish/British

Irish

Gypsy or Irish Traveller

Any other White background, please describe

Mixed/multiple ethnic groups:

White and Black Caribbean

White and Black African

White and Asian

Any other Mixed/Multiple ethnic background, please describe

Asian/Asian British:

Indian

Pakistani

Bangladeshi

Chinese

Any other Asian background, please describe

Black/African/Caribbean/Black British:

African

Caribbean

Any other Black/African/Caribbean background, please describe

Other ethnic group:

Arab

Any other ethnic group, please describe

4. Which statement best describes your situation:

I am a student

I am retired

I currently have a job or have recently had a job

I am long-term unemployed

Appendix G: The National Statistics Socio-economic Classification Self Coded Method

This questionnaire has been removed by the author for copyright reasons.

Appendix H: The Auditory Vocal Hallucination Rating Scale Questionnaire (AVHRS-Q)

This questionnaire has been removed by the author for copyright reasons.

Appendix I: The Interpretation of Voices Inventory (IVI)

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Appendix J: The White Bear Suppression Inventory (WBSI)

This questionnaire has been removed by the author for copyright reasons.

Appendix K: The Southampton Mindfulness of Voices Questionnaire (SMVQ)

This questionnaire has been removed by the author for copyright reasons.

Appendix L: Analysis of Demographic Factors

Severity of voices, negative content and voice related distress and any association with demographic factors were assessed using the following tests:

Age – A Pearson's correlation revealed no significant relationship between age and voice variables.

Sex – An independent samples t-test was carried out to compare means between men and women. There was no significant difference between the two groups.

Ethnicity – Due to the small sample sizes for some ethnic groups, ethnicity was categorised into white ($n = 78$) and non-white/mixed ($n = 43$) ethnic groups. An independent samples t-test revealed no significant difference between the two groups.

Socio-economic Classification – A one-way ANOVA assessing the influence of socio-economic classification on voice variables revealed no significant influence.

An alpha level of 0.01 was used to determine significance due to the number of tests being carried out.

Appendix M: Additional details on assumptions checked prior to Hotelling's T^2

Prior to carrying out a Hotelling's T^2 test of differences between the clinical and non-clinical groups on all cognitive variables and voice related measures, assumptions were assessed. 2 variables (IVI Metaphysical and IVI Positive) were found to have a non-linear relationship with all other variables, as assessed via a scatter plot, and therefore were removed. There was a linear relationship between severity of voices, distress, negative content, IVI control, SMVQ total, WB Suppression and WB Intrusion scores in both clinical and non-clinical groups, as assessed by scatterplot. There was no evidence of multicollinearity, as assessed by Pearson correlation ($|r| < 0.9$).

Univariate outliers were found in the data, as assessed by inspection of a boxplot for values greater than 1.5 but less than 3 box-lengths from the edge of the box. Univariate outliers were investigated for data entry and measurement errors. Original response forms were screened for unusual patterns or indications of invalid responses. Questionnaire completion time was also taken into account. No reason was found to consider the univariate outliers anything other than genuinely unusual values, reflective of the participants sampled, therefore it was not deemed appropriate to remove these outliers at this stage.

There was 1 multivariate outlier in the data, as assessed by Mahalanobis distance ($p > .001$). The multivariate outlier was investigated for data entry and measurement error. The original response form was screened for unusual patterns or indicators of invalid responses. Questionnaire completion time was also taken into account. No reason was found to consider the multivariate outlier anything other than genuinely unusual values, reflective of the diversity of the participants sampled, therefore it was not deemed appropriate to remove this outlier.

Most scores were normally distributed for both clinical and non-clinical groups, as assessed by Shapiro-Wilk's test with Bonferroni correction ($p > .003$). 6 scores were statistically significant on Shapiro-Wilk's test indicating they were not normally distributed (Clinical group: negative content, IVI control, WB suppression, and WB intrusion scores. Non-clinical group: severity of voices, and IVI control scores). The QQ plots for scores where p equal to or $< .003$, indicating the assumption of normality had been violated, were reviewed. Visually the QQ plots indicated a reasonable degree of normality was reached. Furthermore, as Shapiro-Wilk's test is considered overly sensitive in data sets with >50 participants, the results of this test may indicate false positives.

There was homogeneity of variance-covariance, as assessed by Box's test of equality of covariance matrices ($p = .095$)

Appendix N: Additional details on assumptions checked prior to mediation analysis

In addition to the checks described in the main paper the following were also undertaken: Additivity was checked by calculating bivariate correlations for all predictor variables (negative content, IVI control, SMVQ total, WB suppression and WB intrusion). The assumption of approximate normality was satisfied, as assessed by visual inspection of a histogram. Linearity was checked by visual inspection of a P-P plot and deemed acceptable. The assumption of homogeneity was met.