Paranoia and Cycling: A General Population Study

Christopher Bonner

June 2020

Research submitted in partial fulfilment of the requirements for the degree of Doctor in Clinical Psychology (DClinPsy), Royal Holloway, University of London.

Acknowledgements

There are several people that I would like to acknowledge for the support and kindness they have shown me, not only during this research, but over the course of my clinical training. Firstly, I wish to thank my supervisor Dr Lyn Ellett for her advice, encouragement and record speed in replying to my many emails. Her patience and humour helped to make this a very positive learning experience. I would like to extend my gratitude to each cyclist who participated in the empirical study and offered valuable accounts of their personal experiences of cycling. I am also thankful to the cyclists who contributed to the development of the online survey and to Dr Heather Westwood for our joint research days and her support.

I am grateful for the friendships I made through studying at Royal Holloway. In particular, I want to thank Karan, Jon, Heather, Frankie, Emily, Frederike, Savani and Jackie for all the fun times over the past three years. I also wish to acknowledge my wider group of friends who have always helped to remind me that there is life beyond the doctorate.

I would like to thank my parents Kathleen and Denis for their constant love and for the selfless sacrifices they made over the years so that I could follow my ambitions. They will never know how much this has meant to me. My brothers Adrian and Thomas have been an incredible source of support to me and I want to thank them for their words of encouragement which have helped to keep me focused. Thank you to my second family the Maybanks who have provided me with a home on this side of the Irish Sea and who make weekends in Kent so special. Lastly, I want to thank my fiancée Abigail who has been my strength over the past few years. On this journey, her love and kindness has helped me more than anything else and I want to thank her for bringing so much happiness to my life.

Table of Contents

ACKNOWLEDGEMENTS……2
TABLE OF CONTENTS……3
LIST OF FIGURES AND TABLES……5

CHAPTER I: EXECUTIVE SUMMARY……6
Overview……6
Does Active Exposure to an Urban Environment Increase State Paranoia? A Systematic Review……6
Paranoia and Cycling: A General Population Study……10
Integration, Impact and Dissemination……13

CHAPTER II: DOES ACTIVE EXPOSURE TO AN URBAN ENVIRONMENT INCREASE STATE PARANOIA? A SYSTEMATIC REVIEW……14
ABSTRACT……14
INTRODUCTION……15
Prevalence of Paranoia in Clinical and Nonclinical Populations……16
Prevalence of Psychosis in Urban Environments……17
The Current Review……18
METHOD……19
Search Strategy and Selection Criteria……19
Inclusion and Exclusion Criteria……20
Study Selection……21
Data Extraction……23
Quality Assessment……23
Data Synthesis……25
RESULTS……25
Data Extraction……25
Assessment of Study Quality……38
Main Findings from the Data Synthesis……42
DISCUSSION……45
Implications for Theory and Clinical Practice……47
Strengths and Limitations of the Systematic Review……48
Limitations of Studies Presented in the Review……49
Directions for Future Research……50
Conclusions……51

CHAPTER III: PARANOIA AND CYCLING: A GENERAL POPULATION STUDY……52
ABSTRACT……52
INTRODUCTION……53
The Current Study……55
METHOD……56
Design……56
Participants……56
Measures……57
Procedure……59
Data Cleaning……60
Data Analysis……61
RESULTS……62
Demographic Information……62
Cycling Experience……63
Descriptive Statistics for State Paranoia Whilst Cycling……63
Group Differences……65

Hypotheses Testing……..…..... 66
DISCUSSION……..... 70
Main Findings…….…..... 70
Strengths and Limitations…….....….... 72
Future Research and Clinical Implications…….....….... 74
Conclusions…….....75

CHAPTER IV: INTEGRATION, IMPACT AND DISSEMINATION……. 76
OVERVIEW…… 76
INTEGRATION……..…. 76
User Involvement…….....…. 79
Participant Feedback……...……. 81
IMPACT……..…… 82
British Cyclists……...……..... 83
Members of the General Population……...…..…. 83
Service-Users Who Experience Paranoia and Clinicians Delivering Psychological Therapies……..……..……..……..... 84
Researchers Interested in the Explored Topics…….....…….. 85
DISSEMINATION……...…….. 86

REFERENCES……89
APPENDICES…….. 102
APPENDIX 1: QUALITY ASSESSMENT TOOL FOR QUANTITATIVE STUDIES……. 103
APPENDIX 2: MEASURES…….....107
Demographic Information……..... 107
Experiences of Cycling Questionnaire (Ellett et al., 2018)……..... 109
State Paranoia Scale (Ellett et al., 2018)……..……..……..... 111
Paranoia Scale (Fenigstein & Vanable, 1992)…….....112
APPENDIX 3: ETHICAL APPROVAL…….....113
APPENDIX 4: PARTICIPATION INFORMATION SHEET……..... 114
APPENDIX 5: CONSENT FORM…….....116
APPENDIX 6: DEBRIEF STATEMENT…….....117

List of Figures and Tables

List of Figures

Chapter II: Systematic Review

Figure 1. PRISMA flowchart diagram of study selection……22

List of Tables

Chapter II: Systematic Review

Table 1. Summary of study characteristics……..... 26

Table 2. Summary of study results……35

Table 3. Results of quality assessment……....39

Table 4. Prevalence of state paranoia post-urban exposure……43

Chapter III: Empirical Study

Table 5. Number of participants endorsing each state paranoia item whilst cycling……..63

Table 6. Number of participants evidencing paranoia for each SPS item……...64

Table 7. Number of SPS items endorsed with a paranoid response……..……64

Table 8. Demographic and cycling characteristics (total, urban and rural) and differences between groups (urban and rural)…….....65

Table 9. Ratings of key paranoid belief dimensions and correlations between each paranoid belief dimension and state paranoia whilst cycling……..... 66

Table 10. Behaviours exhibited by other road-user(s) during the specific incident and in general (n and %) and associated level of threat……...67

Table 11. Correlations between environmental factors and state paranoia scores…….. 68

Chapter I: Executive Summary

Overview

The overarching aim of this thesis was to examine the association between exposure to high-threat environments and self-reported 'in the moment' or 'state' paranoia. Chapter II takes a broader focus, presenting the findings from a systematic review of clinical and nonclinical studies which measured state paranoia immediately after exposure to an urban environment. Chapter III presents the findings of an empirical study which examined individual experiences of state paranoia among British cyclists. Reflections on the process of developing and conducting the research are offered in Chapter IV, together with a discussion on the integration of the findings, the potential impact on various beneficiaries and a plan for dissemination. A summary of Chapters II, III and IV is provided below.

Does Active Exposure to an Urban Environment Increase State Paranoia?

A Systematic Review

Introduction

'Paranoia' is used in everyday language to refer to suspicion or mistrust, however the term has also been used in clinical and nonclinical research to define personal beliefs that another individual has deliberate intentions to cause one harm, whether it be physical, social or psychological (Freeman & Garety, 2000). Whilst paranoia is a defining feature of various mental health disorders, there is increasing empirical evidence that the phenomenon is common within the general population (Bebbington et al., 2013; Freeman et al., 2005, 2011; Freeman, Loe et al., 2019). This research supports Strauss' (1969) Continuum Model of Paranoia which suggests that paranoia exists on a scale between normal and psychotic experience. Like clinical paranoia, research suggests that nonclinical paranoia can be preoccupying, distressing and it can have a considerable impact on wellbeing (Ellett et al., 2003; Freeman et al., 2011).

Researchers have aimed to identify and better understand risk factors for paranoia so that targeted interventions can be developed. Urbanicity has been identified as one such risk factor and it is now well established that the occurrence of psychosis is increased in urban

environments (van Os, 2004; Sundquist et al., 2004; Kirkbride et al., 2006). However, less is known about whether active exposure to urban environments increases psychotic symptoms (e.g. persecutory delusions) in individuals who are already diagnosed with a psychotic illness (Ellett et al., 2008) or whether it increases state paranoia (i.e. how paranoid people feel in a certain situation) in the general population. As the literature on state paranoia following active urban exposure had not yet been integrated, the current research aimed to systematically review relevant quantitative studies to address the following research questions:

1. Does exposure to an urban environment increase state paranoia and is this effect stronger in clinical than nonclinical populations?
2. What is the prevalence of state paranoia following active urban exposure?
3. What factors (individual and environmental) predict state paranoia following active exposure to an urban environment?
4. What interventions help to reduce distress associated with state paranoia following urban exposure?

Method

PsycINFO and PubMed databases were searched for relevant peer-reviewed articles using the following search terms: (‘paranoia’ OR ‘paranoid’ OR ‘psychosis’ OR ‘psychotic’ OR ‘schizophrenia’ OR ‘delusions’) AND (‘urban’ OR ‘urbanicity’ OR ‘city’ OR ‘busy’). The inclusion criteria were as follows: (a) experimental or cohort design, (b) active exposure to an urban environment (i.e. participants encountering or navigating through an urban environment as part of the study), (c) quantitative measurement of self-reported state paranoia following urban exposure, (d) virtual reality (VR) and non-VR methodologies, (e) clinical, nonclinical and mixed clinical and nonclinical samples and (f) adult samples. Studies which failed to measure state paranoia immediately after urban exposure were excluded, as were those which investigated psychotic symptoms other than paranoia.

Following the removal of duplicates, the search yielded 6,634 articles. The processing of screening all study titles identified n = 101 relevant articles, all of which were reviewed by abstract screening. Of these, n = 36 articles were excluded based on inappropriate design

and the remaining *n* = 65 articles were reviewed by full text screening. Of these, *n* = 51 studies were excluded in accordance with the inclusion and exclusion criteria, resulting in *n* = 14 relevant studies to be included in the review. An independent researcher repeated the screening process for 10% of the full-text articles.

Data from the 14 identified studies, including key features and main findings, were extracted and presented in tables to allow for comparison across studies. The methodological quality of all 14 studies was assessed using the *Quality Assessment Tool for Quantitative Studies* (QATQS; Thomas et al., 2004). Each study was rated as having 'weak', 'moderate' or 'strong' overall quality based on six individual domains: selection bias, study design, confounders, blinding, data collection methods, and withdrawals and dropouts. The above-mentioned independent researcher rated the quality of 25% of final studies using the QATQS. As the 14 papers differed considerably in terms of research design, participant sample, assessment measures and research questions, a narrative synthesis (as opposed to employing meta-analytic methods) was conducted to integrate the research evidence.

Results

All 14 identified studies were conducted in Europe, with the earliest published in 2007 and the most recently published in 2018. The combined sample size across studies was *n* = 821 (range = 15-200, median: 47). The mean age across studies was 32.2 years (SD = 7.86) and 57% of participants identified as female. Four studies consisted of a purely clinical sample, four comprised of nonclinical samples, and six recruited both clinical participants and nonclinical participants for a healthy control group. The studies varied in terms of design, with 10 employing experimental designs and four using cohort designs. Nine studies involved exposure to a VR urban environment, four involved exposure to a non-VR urban environment and one involved exposure to both VR and non-VR environments. Urban exposure duration varied across studies and ranged from four to 45 minutes (median = 10 minutes). The most commonly used measure of state paranoia was the *State Social Paranoia Scale* (SSPS; Freeman et al., 2007). Six studies measured state paranoia at pre-exposure and post-exposure, whereas eight studies measured state paranoia at post-exposure only.

Only one study was rated as having ‘strong’ overall quality (Ellett et al., 2008), with eight studies rated as ‘moderate’ and five studies rated as ‘weak’ in terms of overall quality. Studies which measured state paranoia pre- and post-exposure (compared to post-only studies), non-VR studies (compared to VR studies) and studies with nonclinical samples (compared to those with clinical samples) were superior in terms of overall methodological quality.

A narrative synthesis of the research findings revealed that state paranoia was commonly experienced following exposure to an urban environment. Of the studies which measured state paranoia before and after urban exposure, 83% found that paranoia increased following exposure, to varying levels of significance. Studies which measured state paranoia at post-exposure only reported prevalence rates of 47.5% to 65.6% (combined weighted average prevalence = 52%). State paranoia was found to be higher among clinical participants compared to healthy controls following urban exposure. Individual factors which predicted state paranoia following urban exposure included: trait paranoia (i.e. how paranoid people feel in general), depression, anxiety and various cognitive biases. Deprivation, population density, hostility and social rejection were among the environmental factors which predicted state paranoia following urban exposure. There was tentative evidence that engaging in computer-based Cognitive Behavioural Therapy (CBT) and VR Cognitive Therapy was associated with lower levels of state paranoia following exposure.

Discussion

The process of conducting the systematic review had several limitations, including the exclusion of grey literature and the lack of consideration of statistical power during the quality assessment of studies. Limitations of the studies included in the review (e.g. lack of blinding and failing to control for confounding variables) are also considered. The current review bears several implications for existing theories, clinical practice and prospective research, all of which are discussed in detail in Chapter II.

Paranoia and Cycling: A General Population Study

Introduction

Research has established that paranoia is not only prevalent in individuals with mental health difficulties, but also in members of the general population (Ellett et al., 2003; Freeman et al., 2005, 2011; Freeman, Loe et al., 2019; Lincoln & Keller, 2008). Research demonstrating the existence of paranoia in healthy individuals supports Strauss' (1969) Continuum Model of Paranoia which proposes that delusions and hallucinations lie on a scale between normal and psychotic experience. Strauss (1969) further proposed that an individual's position on the continuum is determined by four key paranoid belief dimensions: conviction, preoccupation, distress and impact on wellbeing. Empirical findings have supported this view. Ellett et al. (2003), for example, found that in a sample of 324 British university students, 47% of participants reported an individual experience of paranoid ideation. In addition to paranoia being common amongst the sample, the findings revealed that it was experienced as preoccupying and distressing and had an impact on wellbeing.

As well as examining individual experiences of paranoia, research has also investigated the impact of environmental factors on paranoia in both clinical and nonclinical populations. Urbanicity has been identified as one such risk factor and recent studies have found that population density (Vassos et al., 2012) and hostility (Veling et al., 2016) predict state paranoia in urban environments. Empirical findings also suggest that exposure to an urban environment increases state paranoia in individuals with a psychotic diagnosis (Ellett et al., 2008). In terms of nonclinical populations, (Ellett et al., 2018) conducted a pilot study involving a sample of 323 London cyclists and found that 70% of participants reported experiencing paranoia towards other road-users whilst cycling. Consistent with the Stress-Vulnerability Model (Zubin & Spring, 1977), state paranoia was found to be high even among cyclists with low levels of trait paranoia vulnerability. As the pilot study involved London cyclists only, it had yet to be determined whether the prevalence of state paranoia whilst cycling differed between urban and rural cyclists. Another identified gap in the literature was that the key paranoid belief dimensions associated with state paranoia whilst cycling had not yet been

investigated. Furthermore, the environmental factors that might predict state paranoia whilst cycling had yet to be explored.

The current study aimed to extend the findings of Ellett and colleagues' (2018) pilot study and address several gaps in the wider literature by testing the following three hypotheses and answering an additional research question.

Research hypotheses:

1. Consistent with the Stress-Vulnerability Model, state paranoia whilst cycling will be higher among urban cyclists compared to rural cyclists
2. Consistent with the Continuum Model of Paranoia, the four key paranoid belief dimensions (conviction, preoccupation, distress and impact on wellbeing) will each be associated with state paranoia whilst cycling
3. Threatening behaviours from other road-users and high density of other road-users will predict state paranoia whilst cycling

Additional research question:

1. Does state paranoia whilst cycling differ between London and non-London cyclists?

Method

A cross-sectional quantitative design was employed with a total of 1264 British cyclists completing an online survey via Qualtrics. The survey comprised of four self-report questionnaires assessing demographic information, cycling experiences (*Experiences of Cycling Questionnaire*, Ellett et al., 2018), state paranoia (*State Paranoia Scale*, Ellett et al., 2018) and trait paranoia (*Paranoia Scale*, Fenigstein & Vanable, 1992). Data analysis methods included: independent samples t-tests, correlational analyses and standard multiple regressions.

Results

Of the 1264 participants, 66% were male, 85.5% identified as White British, 74% were in a relationship, 76% resided in England and the mean age was 49.6 years (*SD* = 14.0, range = 18-91 years). Of the entire sample, 59% mostly cycled in rural areas compared with 41% who mostly cycling in urban areas. The findings revealed that state paranoia whilst cycling

was common among the sample, with 75% reporting and describing an individual experience of paranoia whilst cycling. Consistent with evolutionary accounts of paranoia (e.g. Ellett et al., 2003) and the Stress-Vulnerability Model (Zubin & Spring, 1977), state paranoia whilst cycling was significantly higher amongst urban compared to rural cyclists, however this significant difference did not remain when covariates were controlled for. Urban cyclists in the sample were younger, cycled more frequently and had higher levels of trait paranoia when compared with rural cyclists, which may have accounted for the difference in state paranoia. Individual experiences of paranoia were experienced as preoccupying and distressing, with high levels of conviction, and they had an impact on wellbeing. These findings were consistent with previous research (e.g. Ellett et al., 2003) and with Strauss' (1969) Continuum Model of Paranoia. They were also in keeping with contemporary conceptualisations of paranoia as a normal cognitive process which functions to detect threat to self from others and thus promotes safety and survival (Ellett & Chadwick, 2007).

In terms of the third hypothesis, threatening behaviours from other road-users and high density of other-road users were examined in relation to the individual experiences of paranoia that participants described. In addition, threatening behaviours from other road-users were examined in relation to general experiences of cycling. The results suggested that threatening behaviours from other road-users and high density of other road-users in relation to the individual experience of paranoia did not predict state paranoia whilst cycling, however threatening behaviours from other road-users in relation to general experiences were predictive of state paranoia whilst cycling. Finally, state paranoia whilst cycling was significantly higher among London cyclists compared to non-London cyclists. This may not be surprising considering the volume of traffic and associated increased risk to cyclists posed by the British capital.

Discussion

The strengths and limitations of the study are discussed in detail in Chapter III, together with implications for future research and clinical practice. It is hoped that the current findings will help to destigmatise and normalise paranoia whilst cycling and strengthen the view that it

is an ordinary and reasonable reaction to an environment containing high risk of both physical and interpersonal harm.

Integration, Impact and Dissemination

Chapter IV offers a reflection on the process through which the systematic review and empirical study were developed and undertaken as two unique, yet interconnected, pieces of research and considers how their findings contribute to the existing literature both individually and collectively. Aspects of the research which were not fully discussed in the previous chapters, such as cyclist involvement in the design phase of the empirical study and participant feedback, are also considered. Next, this chapter provides an overview of the potential impact of both research components on various beneficiaries, including cyclists, members of the general population, service-users, clinicians and researchers. Finally, this chapter summaries how the findings from the systematic review and empirical study will be disseminated to beneficiaries to optimise their impact.

Chapter II: Does Active Exposure to an Urban Environment Increase State Paranoia? A Systematic Review

Abstract

Paranoia (personal beliefs that another individual has deliberate intentions to cause one harm) is common in both clinical and nonclinical populations and can have a considerable impact on wellbeing. As such, researchers have aimed to identify key risk factors for the occurrence of paranoia in order to help develop targeted interventions. Urbanicity has been identified as one such risk factor and it is now established that the occurrence of psychosis is increased in urban environments. However, the impact of active urban exposure on 'in the moment' or 'state' paranoia in clinical and nonclinical populations had been less understood as the findings from relevant research studies had not yet been integrated. The aim of the current review was to (a) establish if active exposure to an urban environment increases state paranoia, (b) determine the prevalence of state paranoia following exposure, (c) identify factors which predict state paranoia following urban exposure and (d) identify interventions which help to alleviate associated distress. PsychINFO and PubMed databases were searched for existing quantitative studies which involved active participant exposure to an urban environment and measurement of self-reported state paranoia post-exposure. A total of 14 studies were identified as meeting the inclusion criteria, with a combined sample of n = 821 participants. A narrative synthesis of the data revealed that state paranoia generally increased following urban exposure, with prevalence ranging from 47.5% to 65.6% post-exposure (combined weighted average prevalence = 52%). Consistent with the Continuum Model of Paranoia (Strauss, 1969), clinical participants reported higher levels of state paranoia following urban exposure compared to nonclinical participants. Predictors of state paranoia following urban exposure included individual factors (e.g. trait paranoia, depression, anxiety, cognitive biases) and environmental factors (e.g. deprivation, population density, hostility, social rejection). The findings also suggested that state paranoia following urban exposure might be amenable to psychological interventions. Implications for existing theories, clinical practice and future research are discussed.

Introduction

'Paranoia' is commonly used in everyday language to describe feelings of suspicion or mistrust. However, the term 'paranoia' has also been used in clinical and nonclinical research to define personal beliefs that another individual has deliberate intentions to cause one harm, whether it be physical, social or psychological (Freeman & Garety, 2000). Believing that explicit harm from others is planned or intentional is a defining feature of paranoia and distinguishes it from other emotional and behavioural responses, such as anxiety or worry (Freeman & Garety, 2000). Paranoia is a core symptom in a range of mental health diagnoses, including: schizophrenia (Freeman, 2007; Freeman et al., 2013), bipolar disorder (Goodwin & Jamison, 1990; Goodwin, 2016) and major depression (Haltenhof et al., 1999; Salokangas et al., 2015). Empirical evidence suggests that patients with extreme forms of paranoia have an increased risk of suicide (Hor & Taylor, 2010), serious violence (Coid, Ullrich, Keers et al., 2013) and hospital admission (Castle et al., 1994).

In recent decades, researchers have begun to loosen paranoia from its association with diagnosable psychiatric disorders. In fact, there is a growing consensus that paranoia is common within the general population (Bebbington et al., 2013; Ellett et al., 2003; Fenigstein & Vanable, 1992; Freeman et al., 2005, 2011; Freeman, Loe et al., 2019; Lincoln & Keller, 2008) and that clinical and nonclinical paranoia exist on a continuum (Elahi et al., 2017; Freeman et al., 2010; Zavos et al., 2014). The Continuum Model of Paranoia, which was first proposed by Strauss (1969), suggests that paranoia exists on a scale from normal (e.g. mild suspicion about others' intentions) to psychotic experience (e.g. persecutory delusions). Considering the continuum model, there may be occasions when paranoid beliefs are accurate. However, extreme paranoid beliefs, which are often more disabling and a focus of clinical concern, are likely to be increasingly inaccurate (Raihani & Bell, 2019). Like clinical paranoia, nonclinical paranoia has been associated with various negative outcomes, including poorer physical health, suicidal ideation and weaker social cohesion (Freeman et al., 2011).

Prevalence of Paranoia in Clinical and Nonclinical Populations

Research has demonstrated that paranoia is highly prevalent in clinical populations, with prevalence rates of 49% to 85% among individuals with a non-affective psychosis, including Schizophrenia (Freeman et al., 2013; Freeman, Taylor et al., 2019; Sartorius et al., 1986). In addition, empirical findings suggest that paranoia is prevalent in over 70% of those presenting with a first episode of psychosis (Coid, Ullrich, Kallis et al., 2013). Individuals with psychosis tend to experience more extreme forms of paranoia, such as persecutory delusions, which are one of the most common and distressing symptoms of psychosis (Appelbaum, et al., 1999; Wessely et al., 1993). In addition to individuals with psychotic disorders, research has demonstrated a high prevalence of paranoia among those with other psychiatric diagnoses and medical disorders. Researchers have reported paranoia prevalence rates of 71% among patients with Alzheimer's Disease (Mizrahi et al., 2006), 56% among patients with Dementia with Lewy Bodies (Ballard et al., 1999), 56% in those with Generalised Anxiety Disorder (Mavissakalian et al., 1995), 54% among individuals with Depression (Salokangas et al., 2015) and 50% in those with Bipolar Affective Disorder (Goodwin, 2016).

Research has established that paranoia is not specific to clinical populations, with prevalence rates estimated at 15-30% in the general population (Bebbington et al., 2013; Freeman, 2007; Freeman et al., 2005) and 30-40% among samples of university students (Freeman et al., 2005). Furthermore, it is estimated that about 5% of the general population experience extreme forms of paranoia, such as persecutory delusions (Johns et al., 2004; Freeman et al., 2011; Bebbington et al., 2013). Research has also found that paranoia is common even among children aged between eight and 14 years in the United Kingdom (UK) and in Hong Kong (Wong, et al., 2014). As with clinical samples, empirical evidence suggests that paranoia in the general population can be persistent (Allen-Crooks & Ellett, 2014), distressing and preoccupying, and can have a considerable impact on wellbeing (Ellett et al., 2003; Freeman et al., 2011).

Considering the high prevalence and considerable impact of paranoia in both clinical and nonclinical populations, research has aimed to identify key risk factors for the occurrence

of paranoia in order to help develop targeted interventions. There is convincing evidence that factors which increase the risk for paranoia are the same among clinical and nonclinical populations (Meisel et al., 2018). Such risk factors include: insecure attachments (Lavin et al., 2020; Pickering, et al., 2008), childhood adversity, abuse and trauma (Bentall et al., 2012; Reininghaus et al., 2016), sleep deprivation (Kahn-Greene, et al., 2007), low socio-economic status (Anderson & Freeman, 2013; Freeman et al., 2011) and negative social comparison (Cotier & Toulopoulow, 2017; Freeman et al., 2005). Urbanicity is another key risk factor with epidemiological studies reporting higher rates of psychosis (van Os, 2004; Sundquist et al., 2004; Kirkbride et al., 2006) and nonclinical paranoia (Freeman et al., 2011; Johns et al., 2004) in urban areas. In addition to current urban living, an important body of literature suggests that urban birth and urban upbringing predict the later development of psychosis (Lewis et al., 1992; Marcelis et al., 1998; Pedersen & Mortensen, 2001).

Prevalence of Psychosis in Urban Environments

Prevalence studies have predominantly focused on examining the prevalence of psychosis in urban environments, rather than of specific individual symptoms of psychosis, such as paranoia. This is not in keeping with literature more broadly or with the move to examine the prevalence of paranoia and the impact of idiosyncratic experiences of paranoia on individuals. The association between urbanicity and psychosis was first proposed by Faris and Dunham (1939), who found that schizophrenia was more prevalent in the centre of Chicago city compared to the surrounding areas, irrespective of race and nationality. Findings from contemporary research have confirmed that the occurrence of psychosis is higher in urban environments (van Os, 2004; Sundquist et al., 2004; Kirkbride et al., 2006). In fact, it is reported that the prevalence of psychosis is, on average, two times higher in urban areas than rural areas (Söderström et al., 2017). Investigations across various national contexts have produced convincing evidence supporting this association between current urban living and the development of psychosis. Allardyce et al. (2001) found that the incidence of schizophrenia was 61% higher in an urban area in South London than in a rural area in Scotland. Similarly, Kelly et al. (2010) found that the risk of schizophrenia in males living in urban areas in Ireland

was almost two times higher than that of males living in rural areas of Ireland, with a similar trend observed in females.

Most prevalence studies have suggested that the relationship between urbanicity and the development of psychosis cannot simply be attributed to the fact that there are more people with risk factors in urban areas (e.g. Kelly et al., 2010; Vassos et al., 2012). Various hypotheses have been proposed to explain this correlation, many of which emphasis the role of environmental factors. Such factors include: population density (Vassos et al., 2012), ethnic density (Schofield et al., 2017), selective migration (Spauwen et al., 2004), social adversity (Heinz et al., 2013), social fragmentation (Zammit et al., 2010), social deprivation (Kirkbride et al., 2014), treatment delay (Boonstra et al., 2012) and treatment practices (Wimberley et al., 2016). However, research has yet to determine how these factors interact to make urban living a risk factor for the onset of psychotic illnesses (Conus et al., 2019; Söderström et al., 2016).

The Current Review

Whilst it is established that the occurrence of psychosis is increased in urban environments (van Os, 2004; Sundquist et al., 2004; Kirkbride et al., 2006) and associated with urban birth and urban upbringing (Lewis et al., 1992; Marcelis et al., 1998; Pedersen & Mortensen, 2001), less is known about whether active exposure to urban environments increases psychotic symptoms (e.g. persecutory delusions) in individuals who are already diagnosed with a psychotic illness (Ellett et al., 2008) or whether it increases state paranoia in the general population. Furthermore, whilst the prevalence of paranoia had been examined more generally in clinical and nonclinical populations and the prevalence of psychosis had been studied in urban environments, the literature on state paranoia following active urban exposure had not yet been integrated and was subject to a systematic review. Additionally, data from research studies which examined the influence of individual and environmental factors on state paranoia following active urban exposure, as well as those which assessed interventions designed to reduce associated distress, had yet to be synthesised.

Therefore, the central aim of the current study was to systematically review the literature reporting experimental and cohort studies measuring state paranoia following active

exposure to an urban environment or a busy social environment (hereafter referred to as active exposure to an urban environment). The review addressed the following questions:

1. Does exposure to an urban environment increase state paranoia and is this effect stronger in clinical than nonclinical populations?
2. What is the prevalence of state paranoia following active urban exposure?
3. What factors (individual and environmental) predict state paranoia following active exposure to an urban environment?
4. What interventions help to reduce distress associated with state paranoia following urban exposure?

Method

Search Strategy and Selection Criteria

This study involved a systematic identification and review of the relevant literature examining the association between active exposure to an urban environment and levels of self-reported state paranoia post-exposure. The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA; Moher et al., 2009) guided the current systematic, evidence-based review. This method uses a 27-item checklist of items deemed essential for the transparent reporting of a systematic review and produces a four-phase flow diagram summarising the process through which papers were identified, screened, assessed for eligibility and included for review (Liberati et al., 2009). The PRISMA diagram also presents the number of papers excluded at each stage of the process together with the reasons for exclusion.

Two electronic databases, PsycINFO and PubMed, were searched up to and including August 2019 for publications relating to paranoia (paranoia, paranoid, psychosis, psychotic, schizophrenia, delusions) and urbanicity (urban, urbanicity, city, busy). The Boolean operator ‘AND’ was used to combine the two search item categories, and the Boolean operator ‘OR’ was used between the search terms within each set of brackets.

Inclusion and Exclusion Criteria

The inclusion and exclusion criteria for the review were as follows:

Inclusion criteria:

(a) Experimental or cohort design

(b) Active exposure to an urban environment (e.g. street or underground train) or busy social environment (e.g. café or bar) (i.e. participants encountering an urban/busy social environment as part of the study)

(c) Quantitative measurement of self-reported state paranoia immediately following urban exposure

(d) Virtual reality (VR) and non-VR designs

(e) Clinical, nonclinical and mixed clinical and nonclinical samples

(f) Adult samples (18+ years)

(g) Available in English language

(h) All dates of publication

(i) All geographical locations

Exclusion criteria:

(a) Lack of active exposure to an urban environment

(b) Lack of quantitative measurement of state paranoia post-exposure

(c) Prevalence studies, qualitative designs, narrative reviews, systematic reviews and meta-analyses

(d) Unavailable in English

(e) Child/adolescent samples (0-17 years)

(f) Studies which investigated psychotic symptoms other than paranoid ideation (e.g. studies which investigated hallucinations only)

(g) Studies which failed to measure state paranoia immediately after urban exposure (e.g. studies which measured state paranoia following an intervention aimed at alleviating distress)

Study Selection

Initial searches of the two databases identified *n* = 13,720 studies and a further *n* = 7 studies were identified through screening citations and reference lists of the relevant studies. Of this total of *n* = 13,727 studies, *n* = 7,093 duplicates were removed, leaving *n* = 6,634 studies for eligibility screening. Eligibility was established in three stages: title, abstract and full text screening.

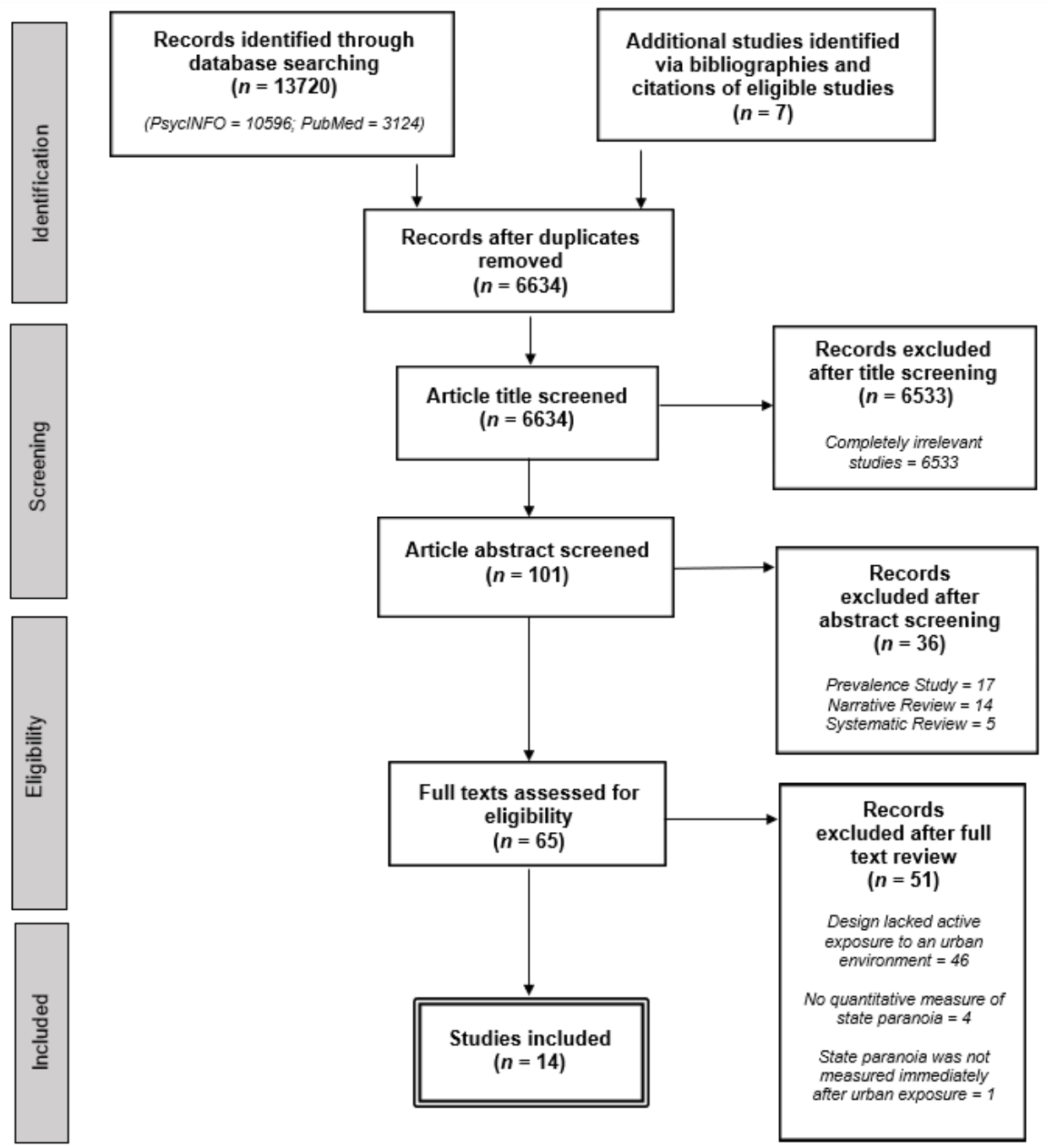
In the first stage, the titles of *n* = 6,634 studies were screened and those which appeared to be completely irrelevant were discarded whilst those which seemed relevant were selected for an abstract screening. During this initial screening stage, *n* = 6,533 studies were excluded. Examples of studies excluded during the title screening phase included: 'Electroconvulsive therapy in palliative care', 'Traffic-related air pollution and brain development' and 'Cardiovascular health monitoring in patients with psychotic illnesses'. During the title screening process, *n* = 101 studies were deemed relevant and were selected for abstract screening. Any abstracts which the reviewer felt might match the inclusion criteria were selected for a full text review whilst those which clearly did not match the inclusion criteria were excluded. Subsequent to abstract screening, *n* = 36 studies were excluded due to inappropriate design (*n* = 17 prevalence studies, *n* = 14 narrative reviews and *n* = 5 systematic reviews) and *n* = 65 studies were selected for a full text screening to determine if they met the specific inclusion and exclusion criteria. Of these, *n* = 51 studies were excluded because their design either lacked active exposure to an urban environment (*n* = 46), lacked a quantitative measure of state paranoia post-exposure (*n* = 4) or because state paranoia was not measured immediately following urban exposure (*n* = 1). The systematic review found *n* = 14 studies which matched the specific inclusion and exclusion criteria, and these were included in the review. It is important to highlight that of these 14 studies, *n* = 2 were linked (Pot-Kolder et al., 2018; Veling et al., 2016) with both studies using the same sample. However, as these two studies investigated different outcomes, they are listed as two separate studies in this review.

After the final papers were identified, an independent researcher repeated the screening process for 10% of the 65 studies that underwent a full-text screening (*n* = 7). The

seven papers were selected at random using an online 'research randomiser' tool (Urbaniak & Plous, 2015). There were no disagreements about the inclusion and exclusion of papers, with inter-rater agreement weighted at k = 1.00. Figure 1 displays the PRISMA flowchart which details the systematic search and screening process.

Figure 1

PRISMA flowchart diagram of study selection



Data Extraction

Data from the 14 identified studies were extracted in two stages. In the first stage, each full text was reviewed in detail and a data extraction form was completed capturing the key features of each paper. A summary table (see Table 1 in the Results section) was developed which presents the key features of each study and allows for comparison across studies. The summary table reports the following key features of each study:

i. The first author and year of publication
ii. The sample characteristics, including the total sample size and the population examined
iii. The geographical location of recruitment and specific site where reported
iv. The study design (experimental or cohort)
v. The experimental environment (VR or non-VR)
vi. The nature of the exposure to an urban environment
vii. The duration of the exposure to an urban environment
viii. The quantitative measure(s) of state paranoia used
ix. State paranoia measurement time points

The second phase of data extraction involved reviewing each paper in detail and extracting the key findings relating to state paranoia. This data was organised and condensed into a second summary table (see Table 2 in the Results section) to allow for comparisons across studies. Table 2 reports the following information from each study:

i. Author (first author and year)
ii. Research Question/Hypothesis
iii. State paranoia measurement time points
iv. Key Results

Quality Assessment

The quality of all final texts was assessed using the *Quality Assessment Tool for Quantitative Studies* (QATQS; Appendix 1) developed by the Effective Public Health Practice

Project (EPHPP; Thomas et al., 2004). The QATQS was chosen from the outset of the study as it is a standardised method which can be used to assess the methodological quality of a range of study types (Thomas et al., 2004). Furthermore, the tool has been shown to have good test-retest reliability and has been evaluated for content and construct validity (National Collaborating Centre for Methods and Tools, 2019). The QATQS includes items on the following six domains to assess for the potential of methodological flaws: selection bias, study design, confounders, blinding, data collection methods and attrition. When assessing the quality of a study using the QATQS, each of the six methodological items receives either a 'weak', 'moderate' or 'strong' quality rating depending on answers to specific questions within each domain. A global quality rating for the study can then be calculated based on the ratings of the six individual components. If none of the six methodological components receive a 'weak' rating, the study receives a 'strong' global quality rating. If one of the methodological items is rated as 'weak', the study receives a 'moderate' global quality rating. Finally, if two or more of the methodological items are rated as 'weak', the paper receives a 'weak' global quality rating.

The quality of the 14 final texts was assessed by the current author using the QATQS. Following this, the above-mentioned independent researcher rated the quality of 25% of these texts (n = 4) using the same quality assessment tool. These four studies were selected at random using the online randomisation tool cited above. There was disagreement on the global quality rating of one study (inter-rater reliability weighted as k = .89). Consensus was reached following review and re-examination of the rating criteria. Table 3 in the Results section presents the individual domain quality ratings and global quality ratings for all 14 studies included in the review. Given the variability across studies in terms of measurement time points (pre- and post-measurement versus post-measurement only), experimental environment (VR versus non-VR) and sample (clinical versus nonclinical), the quality ratings of all final studies were considered in terms of these three categories.

Data Synthesis

As the 14 papers included in the review differed considerably in terms of research design, participant sample, assessment measures and research questions, a narrative synthesis of the research findings (as opposed to employing meta-analytic methods to report and integrate the research evidence) was conducted. The narrative synthesis was conducted following the guidelines outlined by Popay et al. (2006). Narrative synthesis is an approach which relies predominantly on the use of words and text, as opposed to statistical means, to organise, condense and explain the findings from multiple studies (Popay et al., 2006). However, the process involves more than simply describing and summarising the key characteristics of the studies included in the review. Narrative synthesis allows exploration of similarities and difference between studies, investigation of relationships within the data and assessment of the strength of the evidence and produces a summary of knowledge related to the specific review question (Lisy & Porritt, 2016). Importantly, the PRISMA statements, checklist and flow diagram were utilised to guide appropriate, effective and transparent synthesising and reporting of data.

Results

Data Extraction

The first stage of the data extraction process involved identifying and reporting the key characteristics of the 14 identified studies. The key characteristics are reported in turn below and are also summarised in Table 1.

Author and Year. Of the 14 included studies, the earliest published was in 2007 (Valmaggia et al., 2007) and the most recently published was in 2018 (Pot-Kolder et al., 2018).

Sample Characteristics. Sample sizes ranged from *n* = 15 (Freeman, Waller et al., 2015) to *n* = 200 (Freeman et al., 2008), with the median sample size of *n* = 47. A total of *n* = 821 participants took part in the studies included in the review. Of the 821 participants, *n* = 354 (43%) identified as male and *n* = 467 (57%) identified as female. One study recruited a

Table 1

Summary of study characteristics

Author (first author and year)	Sample characteristics	Country and Recruitment Location	Study Design	Experimental Environment	Exposure Type	Exposure Duration	State Paranoia Measure	Measurement Time Points
Broome et al. (2013)	Nonclinical only *N* = 32 Healthy students	United Kingdom (UK); University of Warwick	Cohort	Virtual Reality (VR)	VR environment depicting a street in a deprived urban area in Birmingham	4 minutes	State Social Paranoia Scale (SSPS)	Post-exposure only
Ellett et al. (2008)	Clinical with a Nonclinical Control group *N* = 60 Patients with persecutory delusions (*n* = 30) and healthy controls (*n* = 30)	UK; London	Experimental	Non-VR	Being accompanied to a busy shopping street and independently purchasing a newspaper	10 minutes	Visual Analogue Scales (VAS) SSPS	Pre- and post-exposure
Fornells-Ambrojo et al. (2008)	Clinical with a Nonclinical Control group *N* = 40	UK; <u>Clinical Group</u> Two specialist early intervention in	Experimental	VR	VR environment depicting a London Underground train carriage	4 minutes	SSPS	Post-exposure only

	Individuals with persecutory delusions in the context of Schizophrenia or Schizoaffective Disorder (*n* = 20) and nonclinical individuals (*n* = 20)	psychosis services in London <u>Control Group</u> The Institute of Psychiatry, King's College London and University College London			containing neutral Avatars			
Freeman et al. (2008)	Nonclinical only *N* = 200 Members of the general public	UK; Members of a local adult population in London	Cohort	VR	VR environment comprising a London Underground train ride populated by neutral Avatars	4 minutes	SSPS VAS	Post-exposure only
Freeman et al. (2014)	Nonclinical only *N* = 60 Female members of the general population with paranoid thinking in the past month, but with no	UK; Members of the general population in London	Experimental	VR	Two VR train rides: one at normal height and one at reduced height	12 minutes (Each train ride lasted 6 minutes)	SSPS	Pre-exposure Post-train ride at normal height Post-train ride at reduced height

	history of severe mental illness							
Freeman, Emsley et al. (2015)	Clinical only *N* = 59 Patients with current persecutory delusions	UK; Six NHS Trusts in London	Experimental	Non-VR	Going to a shop in a busy local shopping street and making a purchase (e.g. milk)	10 minutes	VAS SSPS Schizotypal Symptoms Inventory-Paranoia (SSI-P)	Pre- and post-exposure
Freeman, Waller et al. (2015)	Clinical only *N* = 15 Individuals with persecutory delusions in the context of Schizophrenia	UK; Four NHS Trusts in London	Cohort	Non-VR	Walking down a local busy street pre- and post-Cognitive Behavioural Therapy (CBT) intervention	10 minutes	VAS SSPS	Pre-exposure Post-exposure Post-exposure following CBT intervention
Freeman et al. (2016)	Clinical only *N* = 30 Patients with persecutory delusions	UK; Adult mental health services in Oxford Health NHS Foundation Trust	Experimental	Mixed VR and Non-VR	Initial real-life exposure (e.g. walking to a local shop) Two VR environments: an underground train ride with avatars and a lift with avatars	5 minutes 30 minutes	VAS	Pre- and post-exposure

Hesse et al. (2017)	Clinical with a Nonclinical Control group *N* = 41 Patients with psychotic disorder (*n* = 21) and healthy controls (*n* = 20)	Germany; <u>Clinical Group</u> Department of Psychiatry and Psychotherapy of the University of Tübingen <u>Control Group</u> University of Tübingen	Experimental	VR	VR environment depicting an open-plan office with virtual work-colleagues	25 minutes	SSPS	Pre-exposure Post-VR session 1 Post-VR session 2
Nettle et al. (2014)	Nonclinical only *N* = 52 Healthy students	UK; Newcastle University	Experimental	Non-VR	Participants were assigned to deliver questionnaires to houses in either a deprived neighbourhood or an affluent neighbourhood	45 minutes	PCL - conviction subscale	Post-exposure only
Pot-Kolder et al. (2018)	Clinical with a Nonclinical Control group *N* = 170 Recent onset psychosis (*n* = 55), Ultra-high risk for psychosis (*n* = 20), Siblings of	The Netherlands; <u>Psychosis, UHR and Sibling Groups</u> 5 psychiatric units in the Netherlands <u>Control Group</u>	Experimental	VR	VR café with varying levels of social stress	16 (Each VR experiment lasted 4 minutes)	SSPS	Post-experiment 1 Post-experiment 2 Post-experiment 3 Post-experiment 4

	psychotic patients (*n* = 42), Healthy controls (*n* = 53)	Schools, dental practices, and staff offices at a psychiatric institution in The Hague						
Valmaggia et al. (2007)	Clinical only *N* = 21 Individuals with an 'at-risk' mental state	UK; Outreach and Support in South London (OASIS)	Cohort	VR	VR environment depicting a London Underground train ride populated with avatars	4 minutes	Virtual Reality Questionnaire – persecution subscale	Post-exposure only
Veling et al. (2014)	Clinical with a Nonclinical Control group *N* = 41 Patients with first episode psychosis (n = 17) Healthy controls (n = 24)	The Netherlands; <u>Clinical Group</u> Specialist service for early psychosis in The Hague <u>Control Group</u> Delft University of Technology	Experimental	VR	VR environment depicting a café with avatars	16 (4 VR experiments lasting 4 minutes each)	SSPS	Post-exposure 1 Post-exposure 2 Post-exposure 3 Post-exposure 4
Veling et al. (2016)	Clinical with a Nonclinical Control group *N* = 170	The Netherlands;	Experimental	VR	VR environment depicting bar with avatars	16 (4 VR experiments lasting 4	SSPS	Post-exposure 1 Post-exposure 2

	Recent onset psychosis (*n* = 55),Ultra-high risk for psychosis (*n* = 20), Siblings of psychotic patients (*n* = 42), and Healthy controls (n = 53)	<u>Psychosis, UHR and Sibling Groups</u> 5 psychiatric units in the Netherlands <u>Control Group</u> Schools, dental practices, and staff offices at a psychiatric institution in The Hague	minutes each)	Post-exposure 3 Post-exposure 4

female-only sample (Freeman et al., 2014). The mean age of participants across the 14 studies was 32.2 years (SD = 7.86). Seven of the 14 studies provided a breakdown of participants in terms of ethnicity. Of these seven studies, *n* = 6 employed samples which consisted of mostly participants who identified themselves as white, ranging from 57.1% (Valmaggia et al., 2007) to 96.6% (Freeman et al., 2016). Only *n* = 1 study (Fornells-Ambrojo et al., 2008) recruited a sample which consisted of mostly participants who identified themselves as Black, Asian or minority ethnic (BAME) (72.5%).

Of the 14 studies, four consisted of a purely clinical sample (*n* = 125), four comprised of nonclinical samples (*n* = 344) and six recruited both clinical participants and nonclinical participants for a healthy control group (*n* = 352). Of the four clinical studies, *n* = 104 participants had a clinical diagnosis of Schizophrenia, Schizoaffective Disorder, Delusional Disorder or Psychotic Disorder Not-Otherwise-Specified and *n* = 21 participants were at high risk of psychosis. Of the four nonclinical studies, three consisted of healthy student samples (*n* = 84), one consisted of members of the general population (*n* = 200), and one consisted of only female members of the general population (*n* = 60). Of the six studies involving a clinical group and a nonclinical control group, *n* = 143 participants had a psychotic diagnosis (e.g. Schizophrenia, Schizoaffective Disorder, Delusional Disorder or Psychotic Disorder Not-Otherwise-Specified), *n* = 20 participants were considered to be at ultra-high risk for psychosis, *n* = 42 participants were siblings of patients with a psychotic disorder, and *n* = 147 participants were healthy adults.

Recruitment Location and Site. All 14 studies were conducted in Europe; *n* = 10 in the UK, *n* = 3 in the Netherlands (two of which used the same sample) and *n* = 1 in Germany.

Study Design. The 14 identified studies varied in terms of design, with *n* = 10 employing experimental designs (six of which used methods of randomisation) and *n* = 4 employing cohort designs.

Experimental Environment. Of the 14 studies, *n* = 9 involved a VR environment, *n* = 4 involved a non-VR environment and *n* = 1 involved both VR and non-VR environments.

Exposure Type. Of the nine VR studies, *n* = 4 involved exposure to a VR underground train ride, *n* = 2 involved exposure to a VR café, *n* = 1 involved exposure to a VR urban street, *n* = 1 involved exposure to an VR open-plan work office and *n* = 1 involved exposure to a VR bar. Of the four non-VR studies, *n* = 3 involved in-vivo exposure to a busy urban street and *n* = 1 involved in-vivo exposure to either a deprived or affluent urban neighbourhood. In the study which involved both in-vivo and VR urban exposure, in-vivo exposure involved walking to a shop in a busy area and VR exposure involved exposure to a both a VR underground train ride and a VR elevator.

Exposure Duration. Exposure duration varied across studies and ranged from four minutes (Broome et al., 2013; Fornells-Ambrojo et al., 2008; Freeman et al., 2008; Valmaggia et al., 2007) to 45 minutes (Nettle et al., 2014), with the median exposure duration of 10 minutes.

Paranoia Measures. Measures of state paranoia used across the 14 studies included; the *State Social Paranoia Scale* (SSPS; Freeman et al., 2007) *n* = 11, *Visual Analogue Scales* (VAS) *n* = 5, the *Schizotypal Symptoms Inventory* (SSI; Hodgekins et al., 2012) paranoia subscale *n* = 1, the *Paranoia Checklist* (PCL; Freeman et al., 2005) conviction subscale *n* = 1 and the *Virtual Reality Questionnaire* (VRQ; Freeman et al., 2005) persecution subscale *n* = 1. Five studies used more than one measure of state paranoia.

Of the 14 included studies, *n* = 13 measured trait paranoia in addition to state paranoia. Measures of trait paranoia included the *Green Paranoid Thoughts Scale* (G-PTS; Green et al., 2008) *n* = 8, the *Positive and Negative Syndrome Scale* (PANSS; Kay, 1991) *n* = 4, the *Psychotic Symptoms Rating Scale* (PSYRATS; Haddock et al., 1999) *n* = 3, the *Scale for the Assessment of Positive Symptoms* (SAPS; Andreasen, 1984) *n* = 1, the *Safety Behaviours Questionnaire* (SBQ; Freeman et al., 2001) – persecutory items *n* = 1 and the *Paranoia Scale* (PS; Fenigstein & Vanable, 1992) *n* = 1.

Measurement Time Points. The number of times state paranoia was measured varied across the studies. Of the 14 studies, *n* = 5 measured state paranoia only once (post-exposure), *n* = 3 studies measured state paranoia twice (pre- and post-exposure), *n* = 3

studies measured state paranoia three times (pre-exposure and following two exposure trials) and *n* = 3 studies measured state paranoia four times (all post-exposure). Importantly, *n* = 6 studies measured state paranoia at pre-exposure and post-exposure, whereas *n* = 8 studies measured state paranoia at post-exposure only.

The second stage of the data extraction process involved identifying and reporting the key results from the 14 identified studies.

Key Results. The key findings from the 14 identified studies are presented in Table 2 below. It is important to re-emphasise that the 14 studies differed in terms of measurement time points, with *n* = 8 studies measuring state paranoia at post-exposure only. This meant that the findings from these studies focused mostly on the prevalence of state paranoia and predictors of state paranoia following exposure to an urban environment. However, the findings from the *n* = 6 studies which assessed state paranoia pre- and post-exposure mainly focused on the impact of urban exposure on state paranoia.

Table 2

Summary of study results

Author (First Author and Year)	Research Question /Hypothesis	State Paranoia Measurement Time Points	Key Results
Broome et al. (2013)	Virtual urban exposure would be able to generate paranoia comparable or greater than a previous study using VR indoor scenarios	Post-exposure only	• 65.5% reported state paranoia post-exposure • State paranoia post-exposure was not predicted by baseline depression, anxiety, trait paranoia, social anxiety, perceptual anomalies or worry
Ellett et al. (2008)	Exposure to a specific urban environment would lead to an increase in paranoia among individuals with persecutory delusions	Pre- and post-exposure	• Significant increase in state paranoia pre-post in the urban exposure group, but not in the mindfulness control group
Fornells-Ambrojo et al. (2008)	Exposure to a VR social scene would cause individuals with persecutory delusions to have paranoid thoughts about avatars	Post-exposure only	• 61% reported state paranoia post-exposure • No difference in paranoia post-exposure between the clinical and nonclinical group • Significant correlation between levels of trait paranoia and the occurrence of state paranoia post-exposure
Freeman et al. (2008)	A significant minority of the general population sample would have paranoid thoughts about avatars and these will be individuals prone to paranoid thoughts in day-to-day life	Post-exposure only	• 47.5% reported state paranoia post-exposure • Individuals with trait paranoia were twice as likely to experience state paranoia compared to those with no trait paranoia • State paranoia was strongly predicted by higher levels of anxiety, depression, worry and cognitive inflexibility
Freeman et al. (2014)	Lowering an individual's height in a VR social situation in comparison to normal height would lead to greater levels of paranoia	Pre- and post-exposure	• Changes in state paranoia from pre- to post-exposure were not reported • State paranoia was statistically higher among participants exposed to an urban environment at lowered height compared to participants exposed to the same urban environment at normal height

Freeman, Emsley et al. (2015)	Urban exposure would lead to an increase paranoia among individuals with persecutory delusions	Pre- and post-exposure	• Significant increase in state paranoia pre-post in the urban exposure group, but not in the neutral-task group • Increases in state paranoia were partially mediated by increases in anxiety, depression, negative beliefs about others and negative beliefs about self
Freeman, Waller et al. (2015)	To examine the effectiveness of a CBT intervention designed at helping patients with paranoid thoughts to feel less distressed when outside in busy streets	Pre- and post-exposure	• Increase in state paranoia following an initial exposure to a busy urban street (significance not reported) • A second exposure following the CBT intervention led to less paranoid responses than the initial exposure and a statistically significant reduction in distress associated with the belief
Freeman et al. (2016)	VR Cognitive Therapy, compared to VR exposure alone, would lead to generally lower levels of paranoia and a reduction in the degree of conviction with which the persecutory delusion was held	Pre- and post-exposure	• Increase in state paranoia from pre- to post-exposure (significance not reported) • Significant reduction in the levels of state paranoia following second exposure in the VR Cognitive Therapy group but not in the VR exposure-only group
Hesse et al. (2017)	In a VR open plan office scenario, rejection from colleagues would cause higher paranoid ideations in patients with psychotic disorders than in healthy controls	Pre- and post-exposure	• Clinical participants who encountered rejective avatars reported significantly higher levels of paranoia post-exposure compared to clinical participants who encountered cooperative avatars
Nettle et al. (2014)	Student visitors to a deprived urban neighbourhood would report greater levels of paranoia than those students who visited an affluent urban neighbourhood	Post-exposure only	• % of participants who experienced paranoia post-exposure was not reported • Students exposed to a deprived urban neighbourhood reported significantly higher levels of state paranoia than students who visited an affluent urban neighbourhood • A significant negative correlation between social trust and state paranoia post-exposure
Pot-Kolder et al. (2018)	The level and number of cognitive biases present would be positively associated with	Post-exposure only	• % of participants who experienced paranoia post-exposure was not reported

	the level of paranoid ideation when participants are exposed to increased social stress		• Higher belief inflexibility bias, attention to threat bias, external attributional bias and data-gathering bias were all significantly associated with higher levels of state paranoia post-exposure
Valmaggia et al. (2007)	Neutral behaviour by computer-generated characters in a typical social setting would be able to induce persecutory thoughts in participants with an 'at-risk' mental state	Post-exposure only	• 57% reported state paranoia post-exposure • Higher levels of trait paranoia, anxiety, stress and ideas of a fragile inner self were all strong predictors of state paranoia post-exposure
Veling et al. (2014)	To explore the level of paranoid thoughts experienced by patients with first episode psychosis and healthy controls in different social environments, manipulating two factors: population density and ethnicity of avatars.	Post-exposure only	• % of participants who experienced state paranoia post-exposure was not reported • State paranoia was higher among clinical participants compared to the healthy controls post-exposure; however, this difference was not statistically significant • Trait paranoia correlated strongly with state paranoia post-exposure in clinical and nonclinical participants
Veling et al. (2016)	Paranoia and social stress would increase with the degree of social stressors (population density, ethnic density and hostility) in a VR social environment	Post-exposure only	• % of participants who experienced state paranoia post-exposure is not reported. • Population density and hostility had a strong positive effect on state paranoia • Higher levels of trait paranoia, depression and social anxiety were all strongly associated with state paranoia post-exposure

Assessment of Study Quality

All 14 studies were assessed using the QATQS and varied in terms of study quality (see Table 3). Of the 14 studies, only *n* = 1 (7%) received a 'strong' global quality rating (Ellett et al., 2008), implying that this study was the least likely to be subject to bias as a result of participant selection process, study design, analysis or attrition. Over half of the studies (*n* = 8; Broome et al., 2013; Fornells-Ambrojo et al., 2008; Freeman et al., 2014; Freeman, Emsley et al., 2015; Freeman et al., 2016; Nettle et al., 2014; Pot-Kolder et al., 2018; Veling et al., 2016) received a 'moderate' global quality rating, indicating significant weaknesses in one area of study design quality. The remaining *n* = 5 (38%) studies (Freeman et al., 2008; Freeman, Waller et al., 2015; Hesse et al., 2017; Valmaggia et al., 2007; Veling et al., 2014) received a 'weak' global quality rating, suggestive of at least two areas of flawed design that may bias the findings. No studies were excluded from the review on the basis of weak global quality rating, however their limitations are considered in the 'Discussion' section of this review.

The ratings for the individual methodological components for each study are discussed in turn below.

Selection Bias. The EPHPP guidance outlines that there is less potential for selection bias when researchers randomly select participants from a comprehensive list of individuals in the target population. As none of the 14 studies used such recruitment methods, no studies were rated as 'strong' in terms of 'Selection Bias'. Most of the studies were rated as 'moderate' in this domain (*n* = 8), predominantly because their samples were recruited from a source (e.g. a mental health service) in a systematic manner. The EPHPP recommends assigning a 'weak' rating for 'Selection Bias' if recruitment involved self-referral methods, which was the case for *n* = 6 studies included 'in the current review.

Study Design. Of the 14 studies, *n* = 10 were rated as 'strong' in terms of 'Study Design'. This was primarily on the basis of experimental design and randomisation of participants to experimental conditions. Four studies were rated as 'moderate' in terms of

Table 3

Results of quality assessment

Author (first name and year)	Selection Bias	Study Design	Confounders	Blinding	Data Collection Method	Withdrawals and Dropouts	Global Quality Rating
Broome et al., (2013)	Weak	Moderate	Strong	Moderate	Strong	Strong	Moderate
Ellett et al., (2008)	Moderate	Strong	Moderate	Moderate	Strong	Strong	Strong
Fornells-Ambrojo et al., (2008)	Moderate	Strong	Strong	Weak	Strong	Strong	Moderate
Freeman et al., (2008)	Weak	Moderate	Strong	Weak	Strong	Strong	Weak
Freeman et al., (2014)	Weak	Strong	Strong	Moderate	Strong	Strong	Moderate
Freeman, Emsley et al., (2015)	Moderate	Strong	Moderate	Weak	Strong	Strong	Moderate
Freeman, Waller et al., (2015)	Moderate	Moderate	Weak	Weak	Strong	Strong	Weak
Freeman et al., (2016)	Moderate	Strong	Moderate	Moderate	Weak	Strong	Moderate
Hesse et al., (2017)	Weak	Strong	Strong	Weak	Strong	Strong	Weak
Nettle et al., (2014)	Weak	Strong	Strong	Moderate	Moderate	Strong	Moderate
Pot-Kolder et al., (2018)	Moderate	Strong	Strong	Weak	Strong	Strong	Moderate
Valmaggia et al., (2007)	Weak	Moderate	Weak	Weak	Moderate	Strong	Weak
Veling et al., (2014)	Moderate	Strong	Weak	Weak	Strong	Strong	Weak
Veling et al., (2016)	Moderate	Strong	Strong	Weak	Strong	Strong	Moderate

‘Study Design’ because they employed a cohort design. No studies received a ‘weak’ rating for ‘Study Design’.

Confounders. Of the 14 studies, *n* = 8 received a ‘strong’ rating for ‘Confounders’, mostly on the basis that they reported the number of confounding variables controlled for, the method of control and the findings from the relevant statistical analyses performed to assess for difference. Of the remaining six studies, *n* = 3 reported the confounding variables and how they were controlled for but failed to report supporting statistical findings and thus received a ‘moderate’ rating in this domain. The other *n* = 3 studies were rated as ‘weak’ for ‘Confounders’ as they lacked reference to confounds or measures to control for same.

Blinding. Blinding was only applicable for studies which involved randomisation of participants to experimental condition (*n* = 6). In accordance with the EPHPP guidance, studies receive a ‘strong’ rating for ‘Blinding’ if the outcome assessors were not aware of the intervention or exposure of participants and if the participants were not aware of the research question. Studies which report one but not both criteria receive a ‘moderate’ rating and those which do not report either criteria or where blinding is not applicable receive a ‘weak’ rating. Of the 14 studies, none received a ‘strong’ rating for ‘Blinding’. Of the six studies which used randomisation methods, *n* = 5 received a ‘moderate’ and *n* = 1 received a ‘weak’ rating for ‘Blinding’. The remaining *n* = 8 studies received a ‘weak’ rating as blinding was not applicable to their design, resulting in a total of *n* = 9 studies receiving a ‘weak’ rating for ‘Blinding’.

Data Collection Methods. Most studies used valid and reliable measures of state paranoia and were therefore rated as strong in terms of ‘Data Collection Methods’ (*n* = 11). Of the remaining three studies, *n* = 2 were rated as ‘moderate’ because they used either subscales of valid and reliable measures or adapted versions. Finally, *n* = 1 study (Freeman et al., 2016) received a ‘weak’ rating as state paranoia was measured using Visual Analogue Scales only, the validity and reliability of which were not described. It is important to highlight that all of the studies rated as ‘weak’ or ‘moderate’ in terms of ‘Data Collection Methods’ assessed other variables (e.g. trait paranoia, anxiety, depression) using valid and reliable

measures. However, the quality of 'Data Collection Methods' in the current review was assessed in terms of state paranoia measures only.

Withdrawal and Dropouts. All studies were rated as 'strong' in terms of 'Withdrawals and Dropouts' (*n* = 14) as there was an 80-100% completion rate across all studies.

Next, the quality ratings of all final studies were considered in terms of the following three categories:

i. Measurement time points (pre- and post-measurement versus post-measurement only)
ii. Experimental environment (VR versus non-VR)
iii. Sample (clinical versus nonclinical)

Quality Ratings Based on Measurement Time Points. Of the *n* = 6 studies which measured state paranoia pre- and post-exposure, *n* = 1 was of strong quality (16.6%), *n* = 3 were of moderate quality (50%) and *n* = 2 were of weak quality (33.3%). Of the *n* = 8 studies which measured state paranoia at post-exposure only, none were of strong quality, however *n* = 5 were of moderate quality (63%) and only *n* = 3 were of weak quality (37%). The overall quality of studies which measured state paranoia pre- and post-exposure (66.6% rated as strong or moderate) was only slightly better than the overall quality of studies which measured state paranoia at post-exposure only (63% rated as strong or moderate).

Quality Ratings Based on Experimental Environment. Of the *n* = 4 non-VR studies, *n* = 1 (25%) was of strong quality, *n* = 2 (50%) were of moderate quality and *n* = 1 (25%) was of weak quality. Of the *n* = 9 VR studies, none were of strong quality, *n* = 5 (55.5%) were of moderate quality and *n* = 4 (44.4%) were of weak quality. The *n* = 1 study which involved a mixed VR and non-VR design was rated as having moderate overall quality. The overall quality of the non-VR studies was superior to that of the VR studies, with 75% of non-VR studies receiving a strong or moderate quality rating, compared with 55.5% of VR studies.

Quality Ratings Based on Sample. Of the *n* = 4 clinical studies, none were rated as strong, *n* = 2 were rated as moderate and *n* = 2 were rated as weak. Of the *n* = 4 nonclinical studies, none were rated as strong, *n* = 3 were rated as moderate and *n* = 1 were rated as

weak. Of the *n* = 6 clinical studies with a nonclinical control group, *n* = 1 was rated as strong, n = 3 were rated as moderate and n = 2 were rated as weak. Overall, studies with nonclinical-only samples were of higher quality (75% rated as strong or moderate) compared to studies with mixed clinical and nonclinical samples (66.6% rated as strong or moderate) and studies with clinical-only samples (50% rated as strong or moderate).

Main Findings from the Data Synthesis

Does Exposure to an Urban Environment Increase State Paranoia? Of the *n* = 6 studies which measured state paranoia pre- and post-urban exposure, *n* = 5 found that state paranoia increased following exposure to an urban environment (Ellett et al., 2008; Freeman, Emsley et al., 2015; Freeman, Waller et al., 2015; Freeman et al., 2016; Hesse et al., 2017). Of these five studies, *n* = 3 found significant increases in state paranoia from pre- to post exposure (Ellett et al., 2008; Freeman, Emsley et al., 2015; Hesse et al., 2017), whereas *n* = 2 did not report the significance of the increase observed (Freeman, Waller et al., 2015; Freeman et al., 2016) as this was not the focus of these studies. Of the five studies which reported increases in paranoia from pre- to post-exposure, *n* = 1 was rated as strong (Ellett et al., 2017), *n* = 2 were rated as moderate (Freeman, Emsley et al., 2015; Freeman et al., 2016) and *n* = 2 were rated as weak (Freeman, Waller et al., 2015; Hesse et al., 2017). The remaining study which measured state paranoia before and following urban exposure (Freeman et al., 2014) did not report the change in state paranoia following exposure as, again, this was not the key focus of this study. This study was rated as moderate in terms of overall quality.

Is This Effect Stronger in Clinical Than Nonclinical Populations? Of the *n* = 6 studies which included a healthy control group, *n* = 3 found that clinical participants reported significantly higher levels of state paranoia post-urban exposure compared to healthy controls (Ellett et al., 2008; Hesse et al., 2017; Veling et al., 2016). Two studies found that post-exposure state paranoia scores were higher in clinical participants than healthy controls, but the difference was not significant (Fornells-Ambrojo et al., 2008; Veling et al., 2014). The difference in post-exposure state paranoia scores between clinical and nonclinical participants was not reported in the remaining study (Pot-Kolder et al., 2018).

Prevalence of State Paranoia Following Urban Exposure. Of the *n* = 8 studies that measured state paranoia at post-exposure only, *n* = 4 reported the prevalence of state paranoia following urban exposure (Broome et al., 2013; Fornells-Ambrojo et al., 2008; Freeman et al., 2008; Valmaggia et al., 2007). As can be seen in Table 4 below, the prevalence of state paranoia following urban exposure ranged from 47.5% (Freeman et al., 2008) to 65.6% (Broome et al., 2013). The weighted average prevalence rate for each of the four studies is also presented in Table 4, as is the combined weighted average prevalence rate (52%).

Table 4

Prevalence of state paranoia post-urban exposure

Study	Sample size	Prevalence rate	Weighted average prevalence rate
Broome et al. (2013)	32	65.5%	7.16%
Fornells-Ambrojo et al. (2008)	40	61%	8.33%
Freeman et al. (2008)	200	47.5%	32.42%
Valmaggia et al. (2007)	21	57%	4.09%
			52% (total)

Of these *n* = 4 studies, two were rated as having moderate overall quality (Broome et al., 2013; Fornells-Ambrojo et al., 2008) whereas two were of weak quality (Freeman et al., 2008; Valmaggia et al., 2007).

Factors Which Predict State Paranoia Following Urban Exposure. Most studies included in the review (*n* = 11) examined correlates (e.g. sociodemographic and environmental factors) and predictors (e.g. affective and cognitive variables) of state paranoia following exposure to an urban environment. Six studies found that higher levels of trait paranoia predicted state paranoia post-urban exposure (Fornells-Ambrojo et al., 2008; Freeman et al., 2008; Valmaggia et al., 2007; Veling et al., 2014; Veling et al., 2016). Other predictors of state paranoia post-exposure included: depression (Freeman et al., 2008; Freeman, Emsley et al., 2015; Veling et al., 2016), anxiety (Freeman et al., 2008; Freeman, Emsley et al., 2015; Valmaggia et al., 2007), social anxiety (Veling et al., 2014; Veling et al., 2016), worry (Valmaggia et al., 2007), stress (Valmaggia et al., 2007), preservation (Valmaggia et al.,

2007), perceptual anomalies (Freeman et al., 2008), loneliness associated with the family situation (Freeman et al., 2008), experience of playing computer games (Freeman et al., 2008) and immersion in VR (Valmaggia et al., 2007). Broome et al. (2013), which was rated as having 'moderate' overall quality, found that state paranoia post-exposure was not predicted by trait paranoia, depression, anxiety, social anxiety, worry or perceptual anomalies. Similarly, Valmaggia et al. (2007) found that baseline depression was not predictive of state paranoia post-exposure, although this study was found to be of 'weak' overall quality.

Nettle et al. (2014) found that students who visited a deprived urban neighbourhood had significantly higher levels of state paranoia following the visit than students who visited an affluent urban neighbourhood. Moreover, the researchers found a significant correlation between lower levels of social trust and higher levels of state paranoia and a marginal correlation between lower levels of personal trust and higher levels of state paranoia. Interestingly, Freeman et al. (2014) found that participants who were exposed to a VR urban environment at a reduced height had significantly higher levels of state paranoia compared to individuals exposed to the same VR urban environment at normal height. In addition, the researchers found a significant positive correlation between social comparison and state paranoia. Hesse et al. (2017) found that social rejection was associated with state paranoia post-exposure. Veling et al. (2016) also examined the relationship between social stressors and state paranoia and found that population density and hostility both predicted state paranoia post-exposure whereas ethnic density did not.

Pot-Kolder et al. (2018) found that the following four cognitive biases predicted state paranoia following urban exposure: data gathering, belief inflexibility, attention to threat and external attribution. Similarly, Veling et al. (2014) found that two cognitive biases (jumping to conclusions and attention to threat) predicted state paranoia post-exposure. Freeman et al. (2008) found that cognitive inflexibility, interpersonal sensitivity, negative beliefs about self and negative beliefs about others all predicted state paranoia post-exposure, but that data gathering style did not. Valmaggia et al. (2007) found that ideas of fragile inner self predicted state paranoia post-exposure.

In summary, key predictors of state paranoia following urban exposure included: trait paranoia, underlying emotional difficulties such as depression and anxiety, and specific cognitive biases such as attention to threat.

Interventions Which Help Reduce State Paranoia Following Urban Exposure. Of the 14 studies, only *n* = 2 tested the effectiveness of psychological interventions on state paranoia following urban exposure. Using a sample of 15 patients with persecutory delusions, Freeman, Waller et al. (2015) examined the effectiveness of a Cognitive Behavioural Therapy (CBT) intervention designed at helping patients to feel less distressed when outside in busy streets. The researchers found that the intervention led to less paranoid responses than an initial pre-intervention exposure and significantly less distress associated with paranoia. However, as reported above, this study was assessed as having a 'weak' overall quality. Similarly, Freeman and colleagues' (2016) study, which was rated as 'moderate' in terms of overall quality, found that the participant group who received VR Cognitive Therapy had significantly lower levels of state paranoia post-exposure compared to the exposure-only group. Overall, these findings suggest that paranoia following urban exposure might be amenable to psychological interventions.

Discussion

The current systematic review synthesised the data from existing quantitative studies which involved experimental or cohort designs, active participant exposure to an urban environment and immediate measurement of self-reported state paranoia post-exposure. The purpose of the review was to: (a) establish if active exposure to an urban environment increases state paranoia and if this effect is stronger for clinical than nonclinical populations, (b) determine the prevalence of state paranoia following exposure, (c) identify individual and environmental factors which predict state paranoia following urban exposure and (d) identify interventions which help to alleviate associated distress following urban exposure. It was hoped that synthesising these findings would add to the existing evidence base about the impact of urbanicity on paranoia and highlight implications for existing theories, future clinical practice and future research.

In summary, this review identified 14 studies which involved active exposure to an urban environment and immediate measurement of state paranoia post-exposure. The most apparent finding was that all 14 studies clearly demonstrated that paranoia was commonly experienced following exposure to an urban environment. This was true for both clinical and nonclinical participants. These findings are consistent with previous studies reporting high rates of psychosis (van Os et al., 2004; Sundquist et al., 2004; Kirkbride et al., 2006) and nonclinical paranoia (Freeman et al., 2011; Johns et al., 2004) in urban areas. The majority of studies (83%) found that state paranoia increased following urban exposure, with prevalence rates ranging between 47.5% to 65.6% (combined weighted average prevalence = 52%). In line with previous findings (Bebbington et al., 2013; Freeman, 2007; Freeman et al., 2003; 2013; Freeman, Loe et al., 2019; Sartorius et al., 1986), state paranoia was generally found to be higher among clinical participants compared to healthy controls following urban exposure.

Trait paranoia was found to be the most common individual predictor of state paranoia following urban exposure. Other individual predictors of state paranoia following urban exposure included affective factors such as depression and anxiety, and cognitive biases such as data gathering, cognitive inflexibility and attention to threat. The review also identified a range of environmental predictors, including deprivation, population density, hostility and social rejection, which is consistent with previous research (Anderson & Freeman, 2013; Freeman et al., 2005, 2011; Vassos et al., 2012). However, there were some discrepancies between the reviewed studies in terms of certain predictor variables. Taking baseline depression as an example, some studies found that depression was a strong predictor of state paranoia following urban exposure (e.g. Freeman et al., 2008), whereas other studies did not (e.g. Broome et al., 2013). It is important to consider the different factors which might have accounted for such variations in findings, including: the populations examined, sample sizes, the methodologies employed (including exposure type and duration) and the outcome measures used. With this in mind, it was unsurprising that Freeman and colleagues' (2008) study and Broome and colleagues' (2013) study yielded different findings.

Engaging in computer-based CBT and VR Cognitive Therapy was found to be associated with lower levels of state paranoia following urban exposure. This is consistent with previous literature demonstrating the efficacy of psychological interventions and, in particular, CBT in treating paranoid delusions (see review by Zimmermann et al., 2005). However, as only two studies in the current review examined the impact of psychological interventions on state paranoia following urban exposure, and considering that they were rated as 'weak' and 'moderate' in terms of methodological quality, there is a pressing need for targeted interventions to be developed, delivered and evaluated. However, to ensure the development of effective interventions, researchers first need to better understand the mediators and moderators of paranoia in urban environments.

Implications for Theory and Clinical Practice

The findings revealed that state paranoia following urban exposure was common in nonclinical participants, which supports the Stress-Vulnerability Model (Zubin & Spring, 1977). When applied to paranoia, the Stress-Vulnerability Model suggests that the level of paranoia is contingent on the current level of interpersonal threat in the environment. Urban environments contain high levels of social stressors (e.g. population density and hostility from others) which may be experienced as threatening. It is therefore understandable and perhaps unsurprising that state paranoia was found to be high following urban exposure even among individuals with low levels of trait paranoia vulnerability. The finding that state paranoia following urban exposure was common in nonclinical participants also supports the Continuum Model of Paranoia (Strauss, 1969), which postulates that paranoid cognitions fall on a scale between normal and psychotic experience. In addition, the finding that trait paranoia was predictive of increased state paranoia following exposure to an urban environment further supports the Continuum Model of Paranoia. It is also important to highlight that the emotional and cognitive factors found to predict state paranoia following active urban exposure are consistent with a Cognitive Model of Paranoia (Freeman et al., 2002).

In terms of application to clinical practice, further research is imperative to better understand the mechanisms associated with paranoia in urban environments and to better

support individuals experiencing paranoia. When working with individuals with psychosis and other disorders with a high prevalence of paranoia, particularly during assessment and formulation, clinicians should consider the impact of frequent, and often unavoidable, exposure to urban environments. In addition, it may be important for clinicians to be mindful that psychotic symptoms might be elevated at the beginning of sessions if individuals have been exposed to urban environments whilst travelling or making their way to their appointment. The current review highlights the need for further research to examine the effectiveness of specific psychological techniques (e.g. behavioural experiments and mindfulness exercises) in reducing paranoia and subsequent distress experienced following urban exposure. This would allow clinicians to incorporate evidence-based interventions into therapy, which in turn might help to alleviate paranoid symptomatology resulting from urban exposure and possibly improve overall psychological wellbeing. Services could benefit from developing targeted interventions based on CBT, such as that described by Freeman, Waller and colleagues (2015), aimed at helping patients with paranoid thoughts to feel less distressed and better able to cope when outside in busy environments. The fact that 10 of the 14 included studies used VR technology to expose participants to an urban environment and measure state paranoia is a clear indication of the role of technology, and in particular VR methods, in the development and delivery of future clinical interventions.

Strengths and Limitations of the Systematic Review

The current systematic review had several key strengths. This review was the first to have examined the relationship between active urban exposure and state paranoia exclusively. Furthermore, the independent researcher's involvement in terms of providing second ratings during the screening and quality assessment stages helped to increase scientific rigour and minimise potential bias in the review.

The process of conducting the systematic review had a number of limitations. Firstly, the findings referred to published literature only, with all grey literature being excluded to obtain studies of optimum quality. However, the exclusion of grey literature meant that the findings reported in this review may be a biased representation of studies which found high prevalence

of, and increases in, state paranoia following urban exposure. It is possible that studies which found low prevalence rates in state paranoia, or that it does not increase following urban exposure, may be underrepresented in published literature. Secondly, the nature of the search terms used (e.g. 'psychosis' and 'urban') identified an enormous number of studies, the vast majority of which were completely irrelevant to the research question. For this reason, it was decided to search two databases only for relevant papers. Whilst this was in line with the university's requirements regarding the minimum number of databases to be used when conducting a systematic review, confining the search to two databases might have resulted in appropriate papers stored in other databases (e.g. Scopus and Web of Science) being missed. An additional limitation of the review was that it could be argued that studies which involved exposure to a virtual reality café or bar (e.g. Pot-Kolder et al., 2018; Veling et al., 2014; Veling et al., 2016) did not involve 'urban exposure' per se. However, the rationale for including these studies was that they examined predictors of state paranoia following exposure to a busy social environment and to exclude them would have limited the scope of the review. Lastly, the appraisal tool used (QATQS) is a generic tool which fails to assess additional factors likely to be important in terms of overall research quality, such as statistical power. For this reason, obtaining second ratings from an independent researcher was important in establishing the reliability of the initial ratings.

Limitations of Studies Presented in the Review

Of the studies included in the review, over half had significant weaknesses in one area of study design quality and 36% had significant weaknesses in at least two areas of study design quality. This indicated that a high proportion of studies had flaws in their design which made them susceptible to bias. The most common reasons for this were a lack of blinding, a lack of consideration or control of important confounding variables and poor selection methods (e.g. self-referral). Failing to control for variables reduces confidence that the association between urban exposure and state paranoia was not confounded by other variables (e.g. age, gender, trait paranoia, depression, etc.) likely to affect the relationship. However, it is worth noting that omitting reference to confounding variables and control methods may reflect word

count limitations set by the publishing journal as opposed to deficiencies in execution (Fox et al., 2016). During the quality assessment, studies were penalised if their design was non-experimental (e.g. cohort design). Experimental studies which failed to refer to blinding methods in their publication (e.g. Hesse et al., 2017) were also penalised during the quality assessment.

Another important consideration was the substantial variation in outcome measures used to assess state paranoia as this would likely have affected the comparison of results. Furthermore, statistical findings relevant to this review's research question were not always reported, which meant that calculating effect sizes for all studies was not possible. Some studies involved small sample sizes (e.g. Broome et al., 2013; Freeman, Waller et al., 2015) which affected the power of results. Broome et al. (2013), for example, was unable to find any baseline predictors of state paranoia following urban exposure which was attributed to the small sample size. Recruitment for nonclinical studies relied heavily on university students, which typically presents a much younger population that would not be representative of the general population. An additional limitation was that the majority of studies reviewed recruited samples low in ethnic diversity which meant that they only captured the experiences of particular ethnic groups.

Directions for Future Research

This review identified several directions for future research. Given that only one of the 14 final texts was considered to be of strong methodological quality, there is a need for researchers to ensure more robust methodologies and higher quality research designs when investigating the impact of urbanicity on state paranoia. Furthermore, to better understand the impact of active urban exposure on state paranoia (i.e. whether state paranoia increases following urban exposure) as opposed to merely focusing on prevalence, future research should aim to measure state paranoia pre- and post-exposure and not only post-exposure. As there were discrepancies between studies in terms of which factors were found to predict state paranoia during urban exposure, further research examining correlates and predictors may clarify the pathways linking active urban exposure and state paranoia. Some of the more

recent studies included in this review (Hesse et al., 2017; Veling et al., 2016) have made progress with this endeavor by manipulating independent variables such as population density, ethnic density, hostility and social rejection to determine their effect on levels of paranoia experienced in urban environments. To extend this research further, future studies should explore the relationship between urban exposure and state paranoia across a range of minority groups (e.g., BAME, people with physical disabilities, sexual orientation and gender minorities).

Future research should also examine other important variables, including the severity of paranoia, as well as the frequency and duration of exposure to urban environments. Research methodologies could incorporate behavioural experiments or graded exposure to urban environments to determine if such techniques help to reduce state paranoia. Furthermore, none of the studies included in the review involved a follow up, so longer term effects of urban exposure were not assessed. Future research would benefit from employing longitudinal designs to allow for longer term effects to be measured and better understood.

Conclusions

This systematic review of 14 studies with a total of 821 participants revealed that state paranoia generally increases following urban exposure, with paranoia prevalence rates ranging from 47.5% to 65.6% (combined weighted average prevalence = 52%). Consistent with the Continuum Model of Paranoia (Strauss, 1969), clinical participants reported higher levels of state paranoia following urban exposure compared to nonclinical participants. Trait paranoia was found to be a significant predictor of state paranoia following urban exposure. The current review identified additional individual factors, as well as environmental factors, which predict state paranoia following urban exposure. Future research is warranted to refine our understanding about how urban exposure evokes paranoid thoughts which could help to design specific, targeted interventions for individuals who experience paranoia. There is tentative evidence that paranoia might be amenable to such interventions.

Chapter III: Empirical Study

Paranoia and Cycling: A General Population Study

Abstract

'Paranoia' has been used to describe personal beliefs that another individual has deliberate intentions to cause one harm. Whilst paranoia is typically associated with severe mental health difficulties, research has established that it is also common in the general population. In a recent study, Ellett et al. (2018) found that 70% of a sample of 323 London cyclists reported experiencing 'in the moment' or 'state' paranoia towards other road-users whilst cycling. To extend these findings, and based on existing theories and literature, the current study aimed to test the following hypotheses: (a) state paranoia whilst cycling will be higher among urban cyclists compared to rural cyclists, (b) four key paranoid belief dimensions (conviction, preoccupation, distress and impact on wellbeing) will each be associated with state paranoia whilst cycling and (c) threatening behaviours from road-users and high density of road-users will predict state paranoia whilst cycling. A cross-sectional online quantitative design was employed, and a total sample of 1264 British cyclists was recruited. The results revealed that 75% of participants reported and described an individual experience of paranoia whilst cycling. As predicted, state paranoia whilst cycling, as assessed by the *State Paranoia Scale* (Ellett et al., 2018), was significantly higher among urban cyclists compared to rural cyclists, however there was no significant difference when covariates were controlled for. Individual experiences of paranoia whilst cycling were experienced as preoccupying and distressing, with high levels of conviction, and they had an impact on wellbeing. All four key paranoid belief dimensions were highly correlated with state paranoia whilst cycling. Finally, general experiences of threatening behaviours from other road-users were predictive of state paranoia whilst cycling. It is hoped that these findings will help to destigmatise and normalise paranoia whilst cycling and strengthen the view that it is a common, ordinary and reasonable reaction to an environment containing high risk of both physical and interpersonal harm.

Introduction

Paranoia is characterised by the belief that another individual is, or intends to, cause one deliberate harm, whether it be physical, social or psychological (Freeman & Garety, 2000). The perception that harm from others is planned or intentional is a defining feature of paranoia and distinguishes it from other emotional and behavioural responses, such as anxiety or worry (Freeman & Garety, 2000). Whilst paranoia is a defining characteristic of a range of mental health diagnoses, including Schizophrenia (Freeman et al., 2013), Bipolar Disorder (Goodwin, 2016) and Depression (Salokangas et al., 2015), research has established that it is also common in the general population (Bebbington et al., 2013; Ellett et al., 2003; Fenigstein & Vanable, 1992; Freeman et al., 2011, Freeman, Loe et al., 2019; Lincoln & Keller, 2008) and among university students (Freeman et al., 2005). Empirical evidence suggests that paranoia in the general population is associated with poorer physical health, suicidal ideation and weaker social cohesion (Freeman et al., 2011). Despite its disadvantages, paranoia can be effective in situations involving real threat and this might explain its prevalence in normative populations and why clinical paranoia is so resistant to change (Ellett & Chadwick, 2007).

Research demonstrating the existence of paranoia in healthy individuals (e.g. Freeman et al., 2011; Bebbington et al., 2013) supports Strauss's (1969) Continuum Model of Paranoia which proposes that delusions and hallucinations lie on a scale between normal and psychotic experience. With increasing empirical evidence, this conceptualisation of paranoia has become widely accepted. Once considered a single construct, paranoia is now viewed more generally as a hierarchical concept, ranging from everyday emotional concerns such as feelings of vulnerability and mild suspicion, to more intense forms of paranoia such as persecutory delusions prevalent in individuals with acute psychosis (Freeman et al., 2005). Contemporary research findings continue to endorse this dimensional view of paranoia (e.g. Hajdúk et al., 2019). Strauss (1969) further proposed that an individual's position on the continuum is determined by four key paranoid belief dimensions. These include the individual's level of conviction in the belief, their level of preoccupation with the belief, the amount of distress caused by the belief and the subsequent impact on their wellbeing.

In a nonclinical study, Ellett et al. (2003) investigated individual experiences of paranoia among 324 British university students. Paranoia was measured via the widely used *Paranoia Scale* (PS; Fenigstein & Vanable, 1992) and a qualitative questionnaire assessing idiosyncratic experiences relating to one specific experience of paranoia. Furthermore, personal experiences of paranoia were assessed along the four key paranoid belief dimensions described above. The researchers found that 47% of participants reported an individual experience of paranoid ideation which included a clear intention to harm from others. The findings demonstrated that paranoia was common among the sample, it had an impact on wellbeing, and it was experienced as preoccupying and distressing. These findings offered further support for Strauss's (1969) view that key belief dimensions of paranoia determine one's position on the continuum.

As well as examining individual experiences of paranoia, research has also investigated the impact of environmental factors on paranoia in both clinical and nonclinical populations. Whilst it is well established that the incidence of psychosis is elevated in urban environments (van Os, 2004; Sundquist et al., 2004, Kirkbride et al., 2006), more recent studies have found that population density (Veling et al., 2016; Vassos et al., 2012), social adversity (Heinz et al., 2013), social rejection (Hesse et al., 2017) and hostility (Veling et al., 2016) predict state paranoia (i.e. how paranoid people feel in a certain situation) in urban environments. Furthermore, research has shown that exposure to an urban environment increases state paranoia in individuals with a psychotic diagnosis (Ellett et al., 2008).

Recent research has also started to examine state paranoia following exposure to an urban environment in the general population. For example, Ellett et al. (2018) investigated whether urban cycling, a naturalistic high-threat environment, was associated with state paranoia. Of the 323 participants in the study, 70% reported experiencing paranoia towards other road-users whilst cycling in London. Consistent with the Stress-Vulnerability Model (Zubin & Spring, 1977), state paranoia was found to be high even among cyclists with low levels of trait paranoia vulnerability (i.e. how paranoid people feel in general). It is understandable and reasonable that such a high percentage of people experience paranoia

whilst cycling in London, considering the level of real threat that the British capital poses to cyclists. In fact, it has been reported that approximately two-thirds of fatal or serious cycling accidents occur in urban areas, particularly at or near junctions (Department for Transport, 2009). In addition to the threat of physical injury, cyclists are confronted with interpersonal threat as most cycling accidents result following impact with drivers of other motor vehicles. It is therefore important to further understand the extent to which environmental factors predict state paranoia whilst cycling.

The Current Study

The current study sought to extend Ellett and colleagues' (2018) pilot study by addressing several gaps in their research and from the wider literature outlined above. In applying the Continuum Model of Paranoia (Strauss, 1969), the current study investigated, for the first time, individual experiences of paranoia whilst cycling in a general population sample in the United Kingdom (UK). In the first nationwide study of its kind, state paranoia whilst cycling was assessed in both urban and rural cyclists. Up until now, it had not yet been examined if rural cyclists in Britain also experience state paranoia whilst cycling. In addition, differences in state paranoia between urban and rural cyclists had yet to be investigated. Another identified gap in the literature was that the key paranoid belief dimensions (degree of conviction, preoccupation, distress and impact on wellbeing) associated with state paranoia whilst cycling had not yet been investigated. Furthermore, the various environmental factors that might predict state paranoia whilst cycling, such as threatening behaviours from other road-users and density of other road-users, had yet to be explored. Finally, as the pilot study had examined London cyclists only, it had yet to be determined if state paranoia differs between London and non-London cyclists.

Based on these research aims and previous literature, the three research hypotheses and additional research question were therefore as follows:

Research hypotheses:

1. Consistent with the Stress-Vulnerability Model, state paranoia whilst cycling will be higher among urban cyclists compared to rural cyclists

2. Consistent with the Continuum Model of Paranoia, the four key paranoid belief dimensions (conviction, preoccupation, distress and impact on wellbeing) will each be associated with state paranoia whilst cycling
3. Environmental factors (threatening behaviours from other road-users and high density of road-users) will predict state paranoia whilst cycling

Additional research question:

1. Does state paranoia whilst cycling differ between London and non-London cyclists?

Method

Design

A cross-sectional quantitative design was used to assess differences in state paranoia whilst cycling between urban and rural cyclists.

Participants

Power Analysis. A power analysis was conducted to determine the number of participants required for the study. The study was powered for the primary research hypothesis (state paranoia whilst cycling will be higher among urban cyclists compared to rural cyclists). It was not possible to use data from the pilot study (Ellett et al. 2018) in the power calculation for the current study as the pilot study mainly focused on prevalence and did not specifically address the urban versus rural question. Whilst some research studies have compared rural and urban environments in terms of paranoia (e.g. Johns et al., 2004), unfortunately means, standard deviations and effect sizes have not been reported. In the absence of any relevant literature, a conservative estimate of a small effect size was used (0.2, Cohen, 1992). To detect a mean difference between urban and rural cyclists with a small effect size (0.2, Cohen, 1992), power at 0.8 and $\alpha = .05$, a minimum total sample size of 786 (393 per group) was required for the proposed study.

Sample. The inclusion criteria for the study were that participants were adults aged 18 years or over who resided in the UK at the time of the study and who cycled regularly (self-

reported frequency of at least once per month). There were no exclusion criteria. The total number of participants who took part in the study was 1264.

Recruitment. Participants were recruited through various means of opportunity sampling, including email contact with cycling clubs throughout the UK and by posting on national online cycling forms and social media groups. Participants were given the option of entering a prize draw to win a £100 Amazon voucher as an incentive to partake in the research study.

Attrition. A total of 2007 members of the UK general population were presented with the participant information sheet after activating the link to the survey. Of these, only 18 decided not to partake and 1989 consented to participate in the study. Of the 1989 participants, 722 (36%) ceased participation part way through and 1267 (64%) completed the survey. The data of three participants were removed during the data cleaning stage as they did not meet the inclusion criteria in terms of age, resulting in a final sample of 1264 participants.

Measures

All self-report measures are provided in Appendix 2.

Demographic Information. Participants provided information about their gender, ethnicity, marital status and UK geographical region using a check box response format, as well as providing their age (in years).

Experiences of Cycling Questionnaire (Ellett et al., 2018). Consistent with Ellett et al. (2018), participants' personal experiences of cycling were assessed, including: regularity (daily, weekly or monthly), most frequent purpose (leisure, commuting to work or both), most common environment (urban or rural) and average length of cycle journey (in minutes). Additional items were added to the *Experiences of Cycling Questionnaire* to address novel questions in the current study. Participants were asked to select from a pre-determined list any threatening behaviours that they ever experienced from other road-users whilst cycling. This pre-determined list, which comprised of seven threatening behaviours (verbal aggression, dangerous overtaking, driving too close alongside, tailgating, nonverbal

aggression, being blocked or cornered and deliberately making impact with the bicycle), was compiled following consultation with four cyclists during the design phase of the research (see Chapter IV). Participants were then asked to rate on a 10-point Likert scale how threatened they have felt by each of the threat behaviours they selected (1 = Not at all; 10 = Extremely).

Participants were then asked if they ever thought that another road-user was deliberately trying to harm, hurt or upset them whilst cycling, consistent with previous research (Ellett et al., 2003). Participants who answered 'yes' were subsequently asked to describe one such experience and to assess this experience along the key paranoid belief dimensions of conviction, preoccupation, distress and impact on wellbeing. Consistent with Ellett et al. (2003), participants rated each paranoid belief dimension on a 5-point Likert scale (1 = Not at all; 5 = Very much). In addition, participants were asked to rate on a 5-point Likert scale how busy the road was in terms of other road-users (1 = Not at all; 5 = Extremely) and to rate on a 5-point Likert scale how much the density of other road-users contributed to their distress (1 = Not at all; 5 = Very much). Participants were also asked to identify from the same pre-determined list referenced above any threat behaviours that they experienced from other road-users during the described incident and to rate on a 10-point Likert scale how threatened they felt by each of the behaviours that occurred (1 = Not at all; 10 = Extremely).

State Paranoia Scale (SPS; Ellett et al., 2018). The SPS is a 4-item scale assessing state paranoia vis-à-vis another person. Consistent with previous research (Ellett et al., 2018), participants were asked to rate how they perceive other people driving cars, lorries and buses when they are cycling by marking responses on a 7-point scale anchored with two opposing statements. The four paranoia items are: (1) "Friendly towards me", vs. "Hostile towards me", (2) "Wants to please me" vs "Wants to upset me", (3) "Wants to help me" vs "Wants to harm me", and (4) "Respects me" vs "Has it in for me". For all items, the paranoid end of the scale contains both an explicit threat and malevolent intention, therefore clearly measuring state paranoia (Ellett et al., 2018). High ratings indicate higher levels of state paranoia (possible range = 4-28). The SPS has been shown to have good internal consistency in previous studies (Cronbach's alpha = 0.92, Ellett et al., 2013; 0.85, Ellett et al., 2018). In the current study the

Cronbach's alpha was 0.88. Furthermore, the authors found a significant correlation between the SPS and the *Paranoia Scale* (Fenigstein & Vanable, 1992), a validated measure of trait paranoia (r = .415, p = .0005). These findings confirm the construct validity of the SPS. However, is important to note that the test-retest reliability of the SPS has not yet been established.

Paranoia Scale (PS; Fenigstein and Vanable, 1992). The PS was developed to measure self-reported trait paranoia in nonclinical samples and is one of the most widely used dimensional measure of general paranoia (Freeman et al., 2005). It consists of 20 items, each rated on a 5-point scale (1 = Not at all applicable to me; 5 = Extremely applicable to me). The authors validated the PS with 581 students and reported an overall alpha of .84 which implies good internal consistency. Cronbach's alpha in Ellett et al. (2018) and the current study were .86 and .89 respectively. Fenigstein and Vanable (1992) reported good test-retest reliability (.70). In addition, the authors found the PS to have good convergent and discriminate validity as the measure was negatively correlated with both interpersonal trust (r = -.30) and trust in close relationships (r = -.32) and positively correlated with anger (r = .45), a belief in the control of powerful others (r = .34) and a need for personal control (r = .29). The scale also demonstrates a normal distribution of scores with a mean total score of 42.7 (SD = 10.2) within a range of 20-100, with higher scores indicating higher levels of paranoia.

Procedure

Ethical approval was obtained from the University's Research Ethics Committee on 2nd February 2019 (application ID 1480; Appendix 3). Participants completed the entire research questionnaire online using Qualtrics software (Qualtrics, Provo, UT). Upon activating the link to the online survey, participants were first presented with a participation information sheet (Appendix 4) which summarised the broad aims and procedures of the study. The information sheet explained that participants were free to withdraw at any stage, without giving a reason. To ensure anonymity, participants were not asked for their name or contact details, however they were asked to provide a memorable word and their date of birth so that their data could be identified should they have wished to withdraw from the study at a later date. The

information sheet highlighted that individual data would be kept strictly confidential and would not be identified in any report or publication at any future time. Participants were advised that socio-demographic data was collected solely for the purpose of calculating the average age, gender distribution and ethnic diversity of the group of participants. After reading the information sheet, participants who were willing to partake in the study then completed an informed consent form online (Appendix 5).

Next, participants completed demographic information, followed by the Experience of Cycling Questionnaire, the SPS and the PS. The piloting process estimated an average completion time of 15 minutes. Upon completing the survey, participants who wished to be entered into the prize draw were asked for their email address and were informed that this would be stored separately to their survey responses so that their data could not be identified. Finally, participants were presented with a debrief statement (Appendix 6), which included the contact details of the researchers, should they have wished to discuss anything related to the study or their participation.

Data Cleaning

Skew, kurtosis, missing data and outliers were examined for each of the variables of interest. For variables where skew or kurtosis were identified (e.g. trait paranoia, length of average cycle, conviction, preoccupation, distress, threat associated with high density of other road users and threat associated with various behaviours of other road-users), a range of transformations were tried including: log10, square root, reciprocal and winsorizing. However, all variables continued to have significant skew or kurtosis even following transformations, which was to be expected considering the large sample size and the fact that many variables were measured using Likert scales. Despite some variables having non-normal distribution, there was no need to conduct non-parametric tests because of the sample size achieved. There was no missing data as a result of enabling 'forced choice' on Qualtrics. Inspection of boxplots for variables of interest identified some outliers in terms of age, average length of cycle, state paranoia and trait paranoia. All outliers were reviewed and retained as they were deemed to be legitimate scores.

Data Analysis

The preliminary statistical procedures and methods of statistical analyses used to test each research hypothesis are described below.

1. Descriptive statistics for demographic information, cycling experience and the SPS are first presented. In relation to the SPS, and consistent with previous research (Ellett et al., 2018), data are presented in terms of:
    (a) The number of participants endorsing each response category on the scale for each of the four items.
    (b) The proportion (*n* and %) of the total sample, urban sample and rural sample who provided a paranoid response (defined as endorsing 'maybe', 'probably' or 'definitely') for each item. The findings from the pilot study (Ellett et al., 2018) were included for comparison.
    (c) An item level analysis of paranoid responses by participant, in terms of total sample, urban sample and rural sample. The findings from the pilot study (Ellett et al., 2018) were included for comparison.
2. Chi-square analyses (Fisher's exact test) were used to identify any significant differences between urban and rural cyclists in terms of categorical sociodemographic variables (gender, ethnicity and marital status) and categorical cycling experience variables (regularity and purpose).
3. Independent samples t-tests were conducted to identify any significant differences between urban and rural cyclists in terms of the following scale variables: age, length of average cycling journey and trait paranoia.
4. An independent samples t-test was performed to test the primary research hypothesis that state paranoia whilst cycling would be higher among urban cyclists than rural cyclists.
5. Any differences found between the urban and rural groups on demographics and cycling experiences were controlled for in a one-way analysis of covariance (ANCOVA) to examine the impact of cycling environment (urban vs rural) on state paranoia whilst cycling after confounds were controlled for.

6. Pearson correlational analyses were undertaken to test the second research hypothesis that all four key paranoid belief dimensions (degree of conviction, preoccupation, distress, and impact on wellbeing) would be associated with state paranoia whilst cycling.
7. Pearson correlation analyses were conducted to examine the relationship between each of the environmental factors (threatening behaviours ever experienced from other road-users, threatening behaviours from other road-users during a specific incident and high density of other road-users during the same specific incident) and state paranoia scores.
8. A standard multiple regression was undertaken to test the third research hypothesis that threatening behaviours from other road-users during a specific incident and high density of other road-users during the same incident would predict state paranoia whilst cycling. Of these environmental factors, only those which were significantly correlated with state paranoia whilst cycling were entered into the regression model. All the assumptions for this multiple regression were checked and are reported.
9. A second multiple regression was undertaken to test the prediction that general experiences of threatening behaviours from other road-users (as opposed to those experienced during a specific incident) would predict state paranoia whilst cycling. Of the threatening behaviours, only those which were significantly correlated with state paranoia whilst cycling were entered into the regression model. All the assumptions for this multiple regression were also checked and are reported.
10. Finally, an independent samples t-test was undertaken to determine if there were significant differences in state paranoia whilst cycling between London residents and non-London residents.

Results

Demographic Information

Of the 1264 participants, 828 (66%) were male and the mean age of the sample was 49.6 years (*SD* = 14.0, range = 18-91 years). Of the entire sample, 1081 (85.5%) participants identified themselves as 'White British', 138 (11%) participants defined themselves as 'Other White', and the remainder of participants (3.5%) identified themselves as 'Mixed' (*n* = 19),

'Asian' (*n* = 18), 'Black' (*n* = 2) or from other ethnic groups (*n* = 6). Most participants resided in England (*n* = 961; 76%), with fewer participants living in Scotland (*n* = 240; 19%), Wales (*n* = 41; 3%) and Northern Ireland (*n* = 22; 2%). The majority of participants were married (*n* = 753; 60%), with fewer participants identifying as single (*n* = 210; 17%), cohabitating (*n* = 180; 14%), divorced (*n* = 56; 4%), widowed (*n* = 22; 2%), separated (*n* = 20; 2%), being in a civil partnership (*n* = 7; 0.6%) or other (*n* = 16%, 1%).

Cycling Experience

Of the 1264 participants, 747 (59%) reported that they mostly cycled in rural environments (defined as 'quiet country roads or areas with little traffic'), whereas 517 (41%) participants indicated that they mostly cycled in urban areas (defined as cities, town centres or busy areas with lots of traffic). The average self-reported length of journey was 93.6 minutes, with a median of 60 minutes and mode of 120 minutes (range = 2-500 minutes). Leisure was the most common purpose for cycling among participants (*n* = 627; 49.6%). Considerably fewer participants reported that they mostly cycled for the purpose of commuting to work (*n* = 72; 5.7%) and the remaining participants (*n* = 565; 44.7%) reported that they cycled for both leisure and commuting purposes. In terms of cycling frequency, 597 (47%) participants reported that they cycled daily, 598 (47%) participants reported that they cycled weekly and 69 participants (6%) reported that they cycled monthly.

Descriptive Statistics for State Paranoia Whilst Cycling

Table 5 shows the number of participants endorsing each response category for each of the four state paranoia items.

Table 5

Number of participants endorsing each state paranoia item whilst cycling (n = 1264)

	Definitely	Probably	Maybe	Unsure	Maybe	Probably	Definitely	
Friendly towards me	38 (3%)	249 (20%)	279 (22%)	271 (22%)	245 (19%)	143 (11%)	39 (3%)	Hostile towards me
Wants to please me	13 (1%)	64 (5%)	226 (18%)	592 (47%)	273 (22%)	74 (6%)	22 (2%)	Wants to upset me
Want to help me	15 (1%)	107 (8%)	343 (27%)	507 (40%)	233 (18%)	45 (4%)	14 (1%)	Wants to harm me
Respects me	17 (1%)	171 (14%)	294 (23%)	349 (28%)	284 (22%)	115 (9%)	34 (3%)	Has it in for me

Consistent with previous research (Ellett et al., 2018), taking a conservative definition of presence of state paranoia as endorsing 'Maybe', 'Probably' or 'Definitely' (i.e. excluding

'Unsure'), the proportion of the total sample (*n* = 1264), urban sample (*n* = 517) and rural sample (*n* = 747) evidencing state paranoia for each item is reported (see Table 6). The relevant findings from the pilot study (Ellett et al., 2018) are included for comparison.

Table 6

Number of participants evidencing paranoia for each SPS item (n and %)

SPS item	Total sample (*N* = 1264)	Urban (*n* = 517)	Rural (*n* = 747)	Ellett et al. (2018) (*N* = 323)
Hostile towards me	427 (34%)	207 (40%)	220 (29%)	187 (58%)
Wants to upset me	369 (29%)	168 (32%)	201 (30%)	145 (45%)
Wants to harm me	292 (23%)	130 (25%)	162 (22%)	95 (29%)
Has it in for me	433 (34%)	205 (40%)	228 (31%)	160 (50%)

As well as examining state paranoia response by each individual scale item, it was also informative to break down the data by participant. Consistent with the pilot study (Ellett et al., 2018), defining presence of state paranoia as endorsement of the paranoid pole of an item with a response of 'Maybe', 'Probably' or 'Definitely', yielded the following profile (see Table 7). Again, the relevant findings from the pilot study (Ellett et al., 2018) are included for comparison.

Table 7

Number of SPS items endorsed with a paranoid response

Number of SPS items	Total sample (*N* = 1264)	Urban (*n* = 517)	Rural (*n* = 747)	Ellett et al. (2018) (*N* = 323)
0 items	641 (51%)	232 (45%)	409 (55%)	94 (29%)
1 item	175 (14%)	73 (14%)	102 (13%)	54 (17%)
2 items	168 (13%)	80 (15%)	88 (12%)	54 (17%)
3 items	110 (9%)	51 (10%)	59 (8%)	51 (16%)
4 items	170 (13%)	81 (16%)	89 (12%)	68 (21%)

Of the total sample of 1264 participants, 623 (49%) participants endorsed at least one SPS item, evidencing state paranoia. Of the 517 urban cyclists, 285 (55%) endorsed at least one item, compared with 338 (45%) of the 747 rural cyclists. Ellett et al., (2018) found that a higher percentage of urban cyclists (70%) endorsed at least one item, evidencing state paranoia. Of the 266 London cyclists in the current study, 151 (57%) evidenced state paranoia whilst cycling, compared to 472 (47%) of the 998 non-London cyclists.

Group Differences

Results from chi-square analyses (fisher's exact test) and independent samples t-tests indicated statistically significant differences between urban and rural cyclists in terms of age, ethnicity, martial status, cycling regularity, cycling purpose, length of average cycling journey and trait paranoia. There was no statistically significant difference between the groups in terms of gender (see Table 8).

Table 8

Demographic and cycling characteristics (total, urban and rural) and differences between groups (urban and rural)

Variable	Total (N = 1264)	Urban (n = 517)	Rural (n = 747)	Test statistic	p-value
Age					
Mean (SD)	49.64 (13.96)	44.87 (13.44)	52.94 (13.35)	t = -10.54	p < .001
Range	18-91	18-91	18-86		
Gender (n and %)					
Male	828 (65.5%)	329 (63.6%)	499 (66.8%)	χ^2 = 1.13	p = .289
Female	420 (33.2%)	180 (34.8%)	240 (32.1%)		
Ethnicity (n and %)					
White	1219 (96.4%)	480 (92.8%)	739 (98.9%)	χ^2 = 32.9	p < .001
Non-White	45 (3.6%)	37 (7.2%)	8 (1.1%)		
Marital Status (n and %)	210 (16.6%)	123 (23.8%)	87 (11.6%)	χ^2 = 32.63	p < .001
Single	940 (74.4%)	353 (68.3%)	587 (78.6%)		
In a relationship	114 (9.0%)	41 (7.9%)	73 (9.8%)		
Other					
Cycling frequency (n and %)					
Daily	597 (47.2%)	363 (70.2%)	234 (31.3%)	χ^2 = 190.89	p < .001
Weekly	598 (47.3%)	129 (25.0%)	469 (62.8%)		
Monthly or less	69 (5.5%)	25 (4.8%)	44 (5.9%)		
Cycling purpose (n and %)					
Leisure	627 (49.6%)	86 (16.6%)	541 (72.4%)	χ^2 = 402.06	p < .001
Commuting	72 (5.7%)	67 (13.0%)	5 (0.7%)		
Both	565 (44.7%)	364 (70.4%)	201 (26.9%)		
Length of average journey (in minutes)					
Mean (SD)	93.62 (78.20)	45.51 (45.36)	126.92 (78.84)	t = -23.21	p <.001
Range	2-500	2-480	2-500		
Trait Paranoia					
Mean (SD)	29.37 (8.84)	30.11 (9.38)	28.85 (8.42)	t = 2.46	p = .014
Range	20-97	20-83	20-97		

Hypotheses Testing

Hypothesis 1. An independent-samples t-test was conducted to determine if there was a difference in state paranoia whilst cycling between urban cyclists and rural cyclists. There was homogeneity of variances, as assessed by the Levene's test for equality of variances (p = .528). State paranoia whilst cycling was higher in urban cyclists (M = 16.24, SD = 4.15, range = 4-28) compared to rural cyclists (M = 15.22, SD = 4.20, range 4-28), a statistically significant difference, *Mean difference* = 1.02, 95% CI [0.54, 1.48], $t(1262) = 4.23$, $p < .001$, with a small effect (d = .24).

A one-way ANCOVA was conducted to determine if the statistically significant difference in state paranoia whilst cycling between urban and rural cyclists remained after controlling for group differences in age, ethnicity, cycling frequency, cycling purpose, average length of cycling journey and trait paranoia. There was no significant difference between urban and rural cyclists on state paranoia scores when covariates were controlled for (p = .455), although age (p = .002), cycling frequency (p = .026) and trait paranoia ($p < .001$) were associated with higher state paranoia whilst cycling.

Hypothesis 2. Of the 1264 participants, 942 (75%) reported that they had experienced at least one incident in which they believed that another road-user was deliberately trying to harm, hurt or upset them. This cohort of participants described one such incident and rated their belief in terms of the four key dimensions. The mean scores for each of the four key belief dimensions, as well as the correlations between each dimension and state paranoia scores, are presented in Table 9.

Table 9

Ratings of key paranoid belief dimensions and correlations between each paranoid belief dimension and state paranoia whilst cycling (n = 942)

Belief dimension	Mean (SD) Range 1-5	Correlation (with state paranoia)
Conviction	4.48 (0.85)	$r(940) = .103$, $p = .002$
Preoccupation	4.08 (1.07)	$r(940) = .125$, $p < .001$
Distress	3.78 (1.17)	$r(940) = .172$, $p < .001$
Impact on Wellbeing	2.73 (4.21)	$r(940) = .217$, $p < .001$

As can be seen from Table 9, there were statistically strong positive correlations between all four key paranoid belief dimensions and state paranoia whilst cycling. That is higher levels of conviction, preoccupation and distress, and greater impact of wellbeing in relation to a specific incident, were all strongly associated with higher levels of state paranoia whilst cycling. Effect sizes for all four correlations were small.

Hypothesis 3. Of the participants who described an individual experience of paranoia whilst cycling (*n* = 942), the number who reported having experienced each of the threat behaviours from another road-user during a specific incident, and the associated level of threat, are presented in Table 10. The number of participants from the entire sample (*n* = 1264) who reported having ever experienced each of the threat behaviours from another road-user, and the associated level of threat, are also displayed in Table 10.

Table 10

Behaviours exhibited by other road-user(s) during the specific incident and in general (n and %) and associated level of threat

Behaviours	Specific incident (*n* = 942)		Ever experienced (*n* = 1264)	
	n (%)	Level of Threat Mean (SD) Range 1-10	*n (%)*	Level of Threat Mean (SD) Range 1-10
Verbal aggression	382 (41%)	5.89 (2.63)	1022 (81%)	5.15 (2.46)
Dangerous overtaking	434 (46%)	8.11 (2.05)	1214 (96%)	7.54 (2.20)
Tailgating	156 (17%)	7.48 (2.17)	608 (48%)	6.93 (2.31)
Driving close alongside	362 (38%)	8.29 (1.86)	759 (60%)	7.81 (2.09)
Nonverbal aggression	354 (38%)	5.56 (2.62)	1064 (84%)	4.67 (2.42)
Being blocked/cornered	176 (19%)	8.24 (2.02)	545 (43%)	6.97 (2.57)
Deliberately impact	61 (6%)	8.77 (2.42)	126 (10%)	9.17 (2.00)

The mean level of threat associated with the density of other road-users during a specific incident (*n* = 942) was 1.63 (*SD* = 0.97, range = 1-5).

Pearson correlations were conducted to examine the relationship between each of the environmental factors and state paranoia scores. The results revealed that all but one of the threatening behaviours experienced during the specific incident (being blocked or cornered), the density of other road-users during the specific incident and each of the threat behaviours

ever experienced were all significantly correlated with state paranoia scores (see Table 11). All correlations were positive, indicating that higher levels of threatening behaviours from other road-users and higher density of other road-users were associated with higher levels of state paranoia whilst cycling. Effect sizes were all small and ranged from .074 to .352.

Table 11

Correlations between environmental factors and state paranoia scores

Environmental Factors	Specific incident (n = 942)	Ever experienced (n = 1264)
Verbal aggression	$r(940) = .136$, $p = .008$	$r(1260) = .192$, $p < .001$
Dangerous overtaking	$r(940) = .114$, $p = .018$	$r(1260) = .254$, $p < .001$
Tailgating	$r(940) = .184$, $p = .021$	$r(1260) = .189$, $p < .001$
Driving too close alongside	$r(940) = .185$, $p < .001$	$r(1260) = .151$, $p < .001$
Nonverbal aggression	$r(940) = .106$, $p = .046$	$r(1260) = .181$, $p < .001$
Being blocked or cornered	$r(940) = .074$, $p = .330$	$r(1260) = .191$, $p < .001$
Deliberately making impact	$r(940) = .352$, $p = .005$	$r(1260) = .190$, $p = .033$
Density of other road-users	$r(940) = .086$, $p = .008$	N/A

A standard multiple regression was carried out with state paranoia as the dependent variable and all significant event-specific threat behaviours (verbal aggression, dangerous overtaking, tailgating, driving too closely alongside, nonverbal aggression and deliberately making impact) and density of road users as independent variables. There was independence of residuals, as assessed by a Durbin-Watson statistic of 1.742. There was homoscedasticity, as assessed by visual inspection of a plot of studentised residuals versus unstandardised predicted values. There was no evidence of multicollinearity, as assessed by tolerance values greater than 0.1. There were no studentized deleted residuals greater than ±3 standard deviations and no values for Cook's distance above 1. However, there were 12 leverage values greater than 0.2. Furthermore, the assumption of normality was not met, as assessed by a Q-Q Plot. As these two assumptions were not met, the results of the multiple regression should be interpreted with caution.

The seven independent variables did not account for a significant amount of variance in state paranoia whilst cycling ($R^2 = .63$, adjusted $R^2 = .20$; $F(7, 6) = 1.46$, $p = .331$). The partial regression coefficients showed that verbal aggression ($t(6) = .323$, $p = .244$), tailgating

($t(6) = -.464$, $p = .659$), driving too close alongside ($t(6) = -1.508$, $p = .182$), nonverbal aggression ($t(6) = -1.157$, $p = .291$), deliberately making impact ($t(6) = -.926$, $p = .390$) and density of other road-users ($t(6) = 1.692$, $p = .142$) were not independently associated with state paranoia whilst cycling, however dangerous overtaking was close to significance ($t(6) = 2.149$, $p = .052$).

A second standard multiple regression was carried out with state paranoia as the dependent variable and all significant threat behaviours ever experienced from another road-user (verbal aggression, dangerous overtaking, tailgating, driving too closely alongside, nonverbal aggression, being blocked or cornered and deliberately making impact) as independent variables. There was independence of residuals, as assessed by a Durbin-Watson statistic of 1.860. There was homoscedasticity, as assessed by visual inspection of a plot of studentised residuals versus unstandardised predicted values. There was no evidence of multicollinearity, as assessed by tolerance values greater than 0.1. There were no studentised deleted residuals greater than ±3 standard deviations and no values for Cook's distance above 1. The assumption of normality was met, as assessed by a Q-Q Plot. However, there were six leverage values greater than 0.2. As this assumption was not met, the results of the multiple regression should be interpreted with caution.

The seven independent variables did account for a significant amount of variance in state paranoia whilst cycling ($R^2 = .19$, adjusted $R^2 = .12$; $F(7, 82) = 2.73$, $p = .013$). However, the partial regression coefficients showed that verbal aggression ($t(82) = .273$, $p = .786$), dangerous overtaking ($t(82) = 1.603$, $p = .113$), tailgating ($t(82) = -.106$, $p = .915$), driving too close alongside ($t(82) = -.851$, $p = .397$), nonverbal aggression ($t(82) = .752$, $p = .454$), being blocked or cornered ($t(82) = 1.714$, $p = .090$) and deliberately making impact ($t(82) = .559$, $p = .577$) were not independently associated with state paranoia whilst cycling.

Additional Research Question. An independent samples t-test was undertaken to determine if there were differences in state paranoia whilst cycling between London residents and non-London residents. There was homogeneity of variances, as assessed by the Levene's test for equality of variances ($p = .642$). State paranoia whilst cycling was higher

among London residents (*n* = 266, *M* = 16.59, *SD* = 4.31) than non-London residents (*n* = 998, *M* = 15.39, *SD* = 4.14), a statistically significant difference (*Mean difference* = 1.20, 95% CI, -1.77 to -0.64, *t*(62) = -4.164, *p* <.001), with a small effect (*d* = .28).

Discussion

Main Findings

The empirical study firstly established that state paranoia whilst cycling is likely to be common among British cyclists, with 75% of the current sample reporting and describing an individual experience of paranoia, whereby they believed that another road-user was deliberately trying to harm, hurt or upset them whilst cycling. This finding supports the existing evidence demonstrating that individual experiences of paranoia (Ellett et al., 2003) and trait paranoia (Fenigstein & Vanable, 1992; Freeman et al., 2011; Lincoln & Keller, 2008) are common in the general population. It is interesting that the percentage of participants reporting idiosyncratic experiences of paranoia in the current study was much higher than found by Ellett et al. (2003) in their university student sample (47%). One possible explanation for this discrepancy is the high-threat environment in the current study, whereas environmental factors and associated level of threat were not measured in the Ellett et al., (2003) study.

In the current study 623/1264 (49%) participants endorsed at least one SPS item, evidencing state paranoia. This prevalence rate was considerably lower than that found by Ellett et al. (2018) in their pilot study, whereby 227/323 (70%) endorsed at least one SPS item. One possible explanation may be that the pilot study examined self-reported state paranoia in London cyclists only where risk of physical and interpersonal harm is likely greater, whereas the current study involved cyclists throughout the UK. When the responses of the London cyclists in current study were analysed as a separate cohort, the percentage endorsing at least one SPS item (57%) was higher than the entire sample, but lower than that found in the pilot study.

State paranoia whilst cycling, as assessed by total SPS scores, was significantly higher amongst urban compared to rural cyclists, however this difference did not remain when covariates were controlled for. It is interesting to consider why state paranoia might be so

common in high-threat interpersonal environments. According to Ellett and colleagues' (2003) evolutionary account of nonclinical paranoia, paranoia increases in environments containing high levels of threat due to its adaptive value. More specifically, this account views paranoia as a normal cognitive process which functions to detect threat to self from others and thus promotes safety and survival. The current findings complement those of other studies (e.g. Preti & Cella, 2010) which provide empirical support from the evolutionary perspective on paranoia.

It is important to consider that the significant difference in state paranoia whilst cycling between urban and rural cyclists did not remain when covariates were controlled for. In particular, age, cycling frequency and trait paranoia were associated with higher state paranoia when cycling. More specifically, urban cyclists in the sample were younger, cycled more frequently and had higher levels of trait paranoia, when compared with rural cyclists. It is possible that the urban cyclists had higher levels of state paranoia towards other road-users simply because they encounter more traffic, including drivers, other cyclists and pedestrians. In addition, as urban cyclists were found to cycle more regularly than rural cyclists, they are more frequently exposed to environments containing high risk of physical and psychological harm. This, in turn, might make urban cyclists more susceptible to state paranoia whilst cycling. This vulnerability to state paranoia whilst cycling was greater among cyclists who tend to experience everyday paranoia. However, consistent with Ellett et al. (2018), state paranoia was found to be high even among cyclists with low levels of trait paranoia vulnerability. This finding was not surprising considering the potential risk of physical and interpersonal harm involved in cycling.

As predicted, individual experiences of paranoia were experienced as preoccupying and distressing, with high levels of conviction, and they had an impact on wellbeing. These findings were consistent with previous investigations of individual experiences of paranoia (Ellett et al., 2003) and with Strauss' (1969) Continuum Model of Paranoia. These findings were also in keeping with contemporary conceptualisations of paranoia as a normal cognitive process which functions to detect threat to self from others, and thus promotes safety and

survival. Recent findings also suggest that paranoid thinking in healthy individuals could be an adaptive channel for restoring some aspects of physiological homeostasis following an interpersonal stressor (Clamor & Krkovic, 2018). Paranoia in this context can thus be both adaptive and advantageous.

Surprisingly, event-specific threatening behaviours from other road-users and high density of other road-users did not predict state paranoia whilst cycling when examined collectively or individually. One possible explanation for this may be the novel methods of identifying and assessing these environmental factors and associated level of threat. In addition, general experiences of threatening behaviours from other road-users did not predict state paranoia whilst cycling when examined individually; however, they were predictive of state paranoia whilst cycling when examined collectively. It is understandable that a combination of threatening behaviours from other road-users, such as verbal and nonverbal aggression and deliberately being blocked or cornered, would predict higher levels of paranoia whilst cycling.

Finally, state paranoia whilst cycling was significantly higher among London cyclists compared to non-London cyclists. This may not be surprising considering the high volume of traffic and associated increased risk to cyclists posed by the British capital. According to Transport for London (2019), 12 cyclists were killed, 770 were seriously injured and 3,973 were slightly injured in Greater London in 2018, all increases from the previous year. These increases in fatalities and injuries were reflective of the overall increase in cycling (Transport for London, 2019).

Strengths and Limitations

A significant strength of the current study was the large sample size, which ensured that the study was sufficiently powered. An additional strength was that the study examined paranoia in a naturally occurring high-threat environment and therefore maximised ecological validity, which is often lacking in studies involving laboratory manipulations.

The current empirical study also had several limitations which warrant consideration. Firstly, the mental health status of participants was not assessed. It is therefore possible that

the current sample was not an entirely nonclinical population, although this is the case for all studies involving members of the general population, many of which do not include diagnostic screens. A second shortcoming of the study was that participants' residential environment (urban or rural) was not measured. Whilst participants' most common cycling environment (urban or rural) was assessed, it would have been important to determine whether participants lived in an urban or rural environment. One might expect urban residents to have higher levels of paranoia than rural residents and this may have impacted experiences of state paranoia whilst cycling. However, as residential environment was not measured in the current study, it was not possible to control for this in any of the analyses. Furthermore, the study's cross-sectional design meant that causality could not be inferred. Despite this, the current findings helped to generate causal hypotheses (e.g. urban cycling increases state paranoia) to be tested in future research studies using appropriate designs (e.g. quasi-experimental or randomised controlled trial).

The current study highlighted important methodological issues concerning how best to measure nonclinical paranoia. The approach adopted in the current study and in the pilot study (Ellett et al., 2018) was to include an explicit threat and malevolent intention in scale items (e.g. SPS item 3, other road-users 'Want to harm me'). Whilst the inclusion of an explicit threat and malicious intention aimed to clearly measure paranoia, there is a risk that such items could have been misinterpreted as merely assessing fear of anxiety when cycling. A further critique of the SPS is that the four individual items may not represent clear bipolar constructs (e.g. 'Respects me' vs 'Has it in for me') and no psychometric analyses were conducted to confirm this. Additionally, the test-retest reliability of the measure has yet to be established. It is also possible that the SPS may not have been relevant to cyclists, however, the measure was validated in a previously published study which involved a sample of 323 London cyclists (Ellett et al., 2018) and was piloted with four cyclists as part of the current study.

An additional methodological weakness was that the *Experiences of Cycling Questionnaire* is not a standardised measure and therefore lacks validity and reliability. A related limitation was the novel process through which environmental factors (threatening

behaviours from other road-users and high density of other road-users) were identified and associated threat assessed. Furthermore, various other pre-existing vulnerability factors, both environmental (e.g. ethnic density, deprivation and social fragmentation) and individual (e.g. severity of paranoia, depression, social anxiety, general anxiety and cognitive biases), that may have influenced state paranoia whilst cycling were not assessed in the current research. An additional weakness of the empirical study was that participants were required to retrospectively recall a personal experience of paranoia and rate aspects of this experience based on memory. Whilst this is consistent with previous research (e.g. Ellett et al., 2003), such recollections may have been inaccurate and subject to biases. Empirical studies which measure state paranoia immediately after exposure to a high-threat environment (such as those included in the systematic review) reduce the potential of inaccurate or biased self-reports. A further limitation of the current study was the attrition rate (36%), however the large sample size achieved ensured that the study was sufficiently powered. Furthermore, data from participants who did not complete the survey was not retained which meant that it was not possible to compare completers versus non-completers.

Future Research and Clinical Implications

The current study highlighted a number of areas of future research. Firstly, virtual reality (VR) designs are increasingly being employed by researchers to measure and manipulate the severity of threat in virtual urban and social environments (Freeman et al., 2014; Veling et al., 2014; Veling et al., 2016). Future research methodologies employing simulated VR cycling environments would allow for threat severity to be more easily measured and manipulated. VR designs would also allow researchers to capture 'in the moment' state paranoia scores, rather than relying on participants' retrospective recall. In addition, physiological measures of stress could be used to validate and extend subjective ratings of state paranoia. Researchers could also use VR designs to conduct experimental studies in order to determine causality.

Future investigations could employ different paranoia groups (e.g. low nonclinical, high nonclinical and clinical paranoia) for comparison in terms of state paranoia associated with

environments high in physical and psychological risk. Additionally, a qualitative research study would offer a more detailed understanding of the phenomenological experience of paranoia whilst cycling, and the findings could be compared to paranoia experienced in other contexts. Future research should also focus on examining the effectiveness of psychological interventions for cyclists experiencing distress resulting from experiences of paranoia towards other road-users. Mindfulness, which has been credited as a non-stigmatising skill that reduces stress whilst enhancing attentional control and has shown health benefits with clinical paranoia (Chadwick et al., 2005, 2009, Ellett, 2013) and nonclinical paranoia (Shore et al., 2018), might be particularly helpful for cyclists before and after cycle journeys. However, it is important to emphasise that such interventions were not tested in the current study and further research is warranted.

Conclusions

The findings from the present research suggest that paranoia towards other road-users may be common among British cyclists. Urban cyclists reported significantly higher levels of state paranoia whilst cycling than rural cyclists, however the difference between the two groups did not remain when covariates were controlled for. Urban cyclists were younger, cycled more frequently and had higher levels of trait paranoia than rural cyclists and these factors may have accounted for the difference in state paranoia found. State paranoia whilst cycling was significantly higher among London residents than non-London residents. Individual experiences of paranoia whilst cycling were experienced as preoccupying and distressing, with high levels of conviction, and they had an impact on wellbeing. Each of these four paranoid belief dimensions were associated with higher levels of state paranoia whilst cycling. General experiences of threatening behaviours from other road-users were predictive of state paranoia whilst cycling when examined collectively. It is hoped that the current findings will help to destigmatise and normalise paranoia whilst cycling and strengthen the view that it is an ordinary and reasonable reaction to an environment containing high risk of both physical and interpersonal harm.

Chapter IV: Integration, Impact and Dissemination

Overview

The aim of this report is to firstly offer reflections on the process through which the systematic review and empirical study were developed and undertaken as two distinct yet interconnected pieces of research, and to offer an integration of their findings. User involvement and participant feedback relating to the empirical study are also discussed. Next, this report provides an overview of the potential impact of both research components on various beneficiaries, including cyclists, members of the general population, service-users, clinicians and researchers. Finally, this report summaries how the findings from the systematic review and empirical study will be disseminated and to whom, to optimise their impact.

Integration

Drawing upon the Continuum Model of Paranoia (Strauss, 1969) and in applying the Stress Vulnerability Model (Zublin & Spring, 1977) to paranoia, the overall objective of the systematic review and empirical study was to examine the association between exposure to a high-threat environment (urban environment broadly in the review and cycling environment in the empirical study) and self-reported state paranoia. In this way, a good degree of synergy was achieved between the systematic review and empirical study. In both the systematic review and the empirical study, and consistent with the wider literature in the field, paranoia was conceptualised according to Freeman and Garety's (2000) definition. These researchers defined paranoia as an individual's belief that a persecutor is intentionally causing or planning to cause harm, now or in the future. Their definition is consistent with theoretical and empirical viewpoints that paranoid delusions are dimensional in nature and, as such, this conceptualisation of paranoia has been widely used in both clinical (e.g. Green et al., 2006) and non-clinical (e.g. Ellett et al., 2003) research. This has allowed for greater confidence amongst researchers that the same phenomenon is being examined and in turn has created greater validity in research output (Freeman, 2007).

However, a limitation with this definition is that it does not include explicit reference to the legitimacy of the perception, i.e. if the threat is real or unfounded. Interestingly, 'paranoia'

is defined in the Oxford English dictionary (Oxford University Press, 2020) as ‘an individual wrongly believing that other people are trying to harm them’. It could be argued that by adopting Freeman and Garety’s (2000) definition of paranoia, which does not include the words ‘unfounded’ or ‘false’, the concept of paranoia is loosened and this might mean that the levels of paranoia detected in the systematic review and the empirical study do not truly represent genuine paranoia. However, determining the falsity of someone’s belief can be difficult. In the empirical study, for example, it would have been impossible to assess whether the threat from another road-user was real or not. Indeed, if a road-user genuinely did intend to cause a cyclist harm, they could deny it. However, what we can be confident of is that each individual cyclist in the empirical study had the perception that others were deliberately trying to cause harm, which meets the criteria set out by Freeman & Garety (2000). Furthermore, assessing the accuracy of such beliefs is perhaps of less importance given research evidence that nonclinical paranoid cognitions can be a risk factor for the later onset of psychotic experiences (Dominguez et al., 2011; van Os et al., 2000). It is also interesting to consider how the DSM-5 (American Psychiatric Association, 2013) has developed the definition of delusions, which are extreme forms of paranoia. Delusions are no longer required to be deemed false, which has previously been highlighted as an important factor in the literature (Coltheart, 2007). Furthermore, there is less focus on the requirement to have undisputable proof against the belief, which is not always available, and instead the belief simply needs to be deemed as “clearly implausible” (American Psychiatric Association, 2013).

Whilst the empirical study’s primary research hypothesis was established before the formation of the primary research question for the systematic review, the process of reviewing the wider literature illuminated additional avenues for investigation within the empirical study. More specifically, when reviewing the literature in relation to the systematic review, I gained an awareness of how particular environmental factors, such as population density and hostility from others, can predict state paranoia in urban environments. This provided the rationale for the empirical study’s hypothesis that high density of other road-users and threatening behaviours from other road-users would predict state paranoia whilst cycling. Furthermore,

the broader process of reviewing the literature when developing the systematic review demonstrated that, whilst rates of psychosis are higher in urban areas, there is a relative lack of research examining the prevalence of individual symptoms of psychosis, such as paranoia, in urban areas and the impact of urbanicity on individual symptoms. Interestingly, this is not consistent with the literature more broadly (see Introduction of systematic review) or with the move to examining individual symptoms of psychosis, including paranoia, in clinical (e.g. Freeman et al., 2013) and nonclinical samples (e.g. Ellett et al., 2003). This gave further weight to examining individual symptoms of paranoia among cyclists within the empirical study and, in particular, the research hypothesis regarding key paranoid belief dimensions. The relative lack of research investigating individual symptoms of paranoia experienced in high-threat environments highlights the value and contribution made by the empirical study.

Having considered the influence of background reading in shaping both research components, it is also important to reflect on the methodologies used. High-threat environments in studies included in the systematic review comprised of various real-life environments (e.g. busy urban streets and deprived and affluent areas) and virtual reality (VR) simulated environments (e.g. underground train rides, an urban street, cafés, etc.), whereas the high-threat environment examined in the empirical study was real-life cycling. It is important to consider that exposure in the studies included in the systematic review was active (i.e. it occurred during the experiment) and paranoia was assessed immediately afterwards. Conversely, in the empirical study, reporting of state paranoia in relation to exposure (i.e. cycling) was retrospective and participants were asked to rate dimensions of paranoia experienced during a past event. Furthermore, the studies included in the systematic review highlighted the increasing use of VR methodologies amongst researchers examining the association between paranoia and urban and social environments. Employing VR paradigms in this research area has several methodological advantages, for example, threat severity can be more easily manipulated and 'in the moment' paranoia more easily measured. In addition, exposure to the high-threat environment is consistent for all participants, whereas in the empirical study there was considerable heterogeneity in terms of reported cycling

experiences. The systematic review also illuminated the lack of research using simulated VR cycling environments. That said, there is a need for VR studies to have more robust methodologies and higher quality research designs, as studies within the systematic review which used VR exposure were rated as having poorer quality than those which used real-life exposure. In terms of sample, whilst the systematic review included studies with both clinical and nonclinical populations, the empirical study recruited members of the general population only. This is consistent with the move to investigate and better understand nonclinical paranoia as a phenomenon of interest in its own right, and recognise the impact of paranoid beliefs on healthy individuals. Further research in this area will also help to destigmatise paranoia and reinforce the view that it is an ordinary, rational and justified reaction to an environment containing high risk of physical and interpersonal harm (Ellett et al., 2018).

User Involvement

In line with the Department of Health's (2005) research strategy, it is recommended that research studies aim to involve service-users in the design and reporting of research. However, 'user involvement' does not just refer to patients or clients, but also to members of the general public. INVOLVE, which is a national advisory group funded by the National Institute for Health Research, defines public involvement in research as research being carried out 'with' or 'by' members of the public rather than 'to', 'about' or 'for' them. As the current empirical study investigated experiences of state paranoia in members of the general population (i.e. cyclists), it was decided to involve cyclists in the design and dissemination phases of the research. Cyclist involvement was consistent with the United Kingdom (UK) Standards for Public Involvement (INVOLVE, 2019). Four cyclists were contacted and agreed to become involved in the research. Their first research task involved developing likely responses to a survey question. As there was no valid and reliable questionnaire assessing threatening behaviours from other road-users, the four cyclists complied and shared lists of frequent behaviours they experienced from other road-users, which they perceived as threatening. Behaviours which were reported by three or more of the cyclists were included as potential answers to the question *'Please select any of the following behaviours that you*

have ever experienced from other road-users whilst cycling.' These included: verbal aggression, dangerous overtaking, tailgating, driving too closely alongside, nonverbal aggression, purposefully being blocked or cornered and deliberately making impact with the bicycle.

In addition, the four cyclists piloted the online survey and gave feedback on the participation information sheet, consent form, questionnaire items and debrief statement. Feedback was provided on the survey in terms of wording, presentation and overall impression. No spelling or grammatical mistakes were identified and the overall impression was that they survey was well designed, with one cyclist commenting; *"It was easy to follow and I think the order of starting with cycling experience and then broadening to wellbeing was good".* Two cyclists commented that the questionnaire was *"really speedy compared to most online questionnaires"* and they felt that this would encourage participants to both start and complete the survey. No changes to the participation information sheet, consent form or debrief statement were suggested, but amendments to the questionnaire itself were recommended by three cyclists.

One cyclist reported that the item *'Please describe an experience when you thought another road-user was deliberately trying to harm you'* felt "very leading" and suggested that the item should be preceded with *'Have you ever thought that another road-user was deliberately trying to harm, hurt or upset you whilst cycling?'* and asking only those who answered *'yes'* to describe one such experience. This recommended change was implemented. Two cyclists identified functional problems with the survey (e.g. date of birth and age could be entered in non-numerical format) which were corrected. Some of the recommended changes were unable to be implemented as they concerned the SPS (Ellett et al., 2018), a standardised measure of state paranoia. One cyclist reported finding the four SPS items confusing, commenting *"I could answer 'maybe' to both sides of the help/hurt scale for example. I would suggest replacing these with numerical scales which fit better with the rest of the survey and are a bit simpler to grasp".* The reasons why this suggestion could not be implemented was explained to this cyclist in question. When all appropriate functional and

contextual changes were made, the four cyclists completed the survey again to help estimate the completion time. Based on the average of their four timings, the estimated completion time was calculated (15 minutes) and included in the participation information sheet. Each of cyclists were made aware of their contributions to the research. It is planned that one of the four cyclists will be contacted by email in the near future and asked for feedback on a draft of a lay summary of the findings. Any appropriate recommended changes will be implemented before the lay summary is disseminated.

Participant Feedback

Of the empirical study's 1264 participants, 56 emailed to request a copy of the research findings. Many of these participants explained reasons why the research findings would be of interest to them, with one stating *"At our cycling club meetings, one of the constant topics of conversation amongst cyclists is 'the last near miss'"* and another reporting *"I run a small cycle tour company and it would be interesting to see the level of nervousness amongst cyclists as it is something we have experienced of with some of our clients, particularly women."* Many of these participants, and others who did not specifically request a copy of the findings, emailed to provide feedback regarding their experience of completing the online questionnaire. The vast majority of participant feedback was positive, with one responder stating *"We need more research like this. Well done and good luck with it!"* and another commenting *"I've shared this with my cycling group which has over 300 members. Thank you for researching this important topic."* It was encouraging that numerous participants made contact to suggest additional avenues for recruitment and I believe that this greatly contributed to the large sample size achieved.

Fewer participants emailed to share negative feedback regarding the questionnaire. One participant commented *"The question regarding 'length of average journey' is not meaningful for someone who uses his bike to pop down to the local shop but also spends all day on the bike for a local leisure ride or as part of a touring holiday."* Similar views were expressed by another participant who *explained "I decided abandon your questionnaire because questions like 'How long is your average journey?' just does not fit with how I do*

things". Upon reflection, recruiting a larger number of cyclists to pilot the questionnaire may have helped to identify further conceptual issues with the survey. Seven members of the public emailed to report difficulty accessing the survey. These individuals received a response with the correct link to the survey and accompanying instructions.

Impact

This body of work provides a unique contribution to the literature. Consistent with evolutionary models of paranoia (e.g. Ellett et al., 2003) and the Stress-Vulnerability Model (Zublin & Spring, 1977), the findings from both the systematic review and the empirical study demonstrated that 'in the moment' or 'state' paranoia was common following exposure to a high-threat environment. In terms of individual contribution, the systematic review revealed that participants generally experienced an increase in state paranoia following exposure to a high-threat environment (urban area) and this effect was stronger in clinical compared to nonclinical populations. However, despite the effect being stronger in clinical samples, the review clearly demonstrated that healthy individuals commonly experienced state paranoia following exposure to a high-threat environment. The empirical study provided further evidence that state paranoia following exposure to a high-threat environment (cycling) is common among nonclinical populations, with 75% of participants reporting and describing an individual experience of paranoia whilst cycling. These idiosyncratic experiences of paranoia were experienced as preoccupying and distressing, with high levels of conviction, and they had an impact on wellbeing. Urban cyclists reported higher levels of state paranoia whilst cycling compared to rural cyclists which may not be surprising given the increased risk of physical and psychological harm in urban environments. Both the systematic review and empirical study found that trait paranoia and hostility/threat from others were associated with state paranoia following exposure to a high-threat environment. The systematic review offered tentative evidence that state paranoia following exposure to a high-threat environment may be amenable to psychological interventions such as Cognitive Behavioural Therapy (CBT).

This section of the report discusses the potential impact of these findings on various beneficiaries and considers how to maximise this impact. The British Psychological Society

(BPS, 2018, p 1.) defines impact as 'an effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia'. Whilst the current research made a significant contribution to existing literature and theories, it has also advanced knowledge and understanding in other areas outside of academia, including clinical practice and society more broadly. The potential impact of the current research to cyclists, members of the general public, service-users, clinicians and researchers is considered below. It is important to emphasise that the broader impact of this research is likely to occur gradually over time, within a context of continuing future research.

British Cyclists

Cycling is becoming an increasingly popular mode of transport in the UK. In England, for example, 42% of people aged over five years have access to a bicycle (Department for Transport, 2019). Unfortunately, the physical dangers for British cyclists are undeniable. According to the Department for Transport (2017), cyclists are 15 times more likely than drivers to be killed on UK roads. Approximately two-thirds of fatal or serious cyclist accidents occur in urban areas (Department for Transport, 2009). Indeed, rural areas also pose significant physical risk to cyclists, with around half of cyclist fatalities occurring on rural roads (Department for Transport, 2009). In addition to the threat of physical injury, cyclists are confronted with interpersonal threat as most cycling accidents result following impact with drivers of motor vehicles. It is hoped that participation in the empirical study, as well as the dissemination of lay summaries of the findings, will help to destigmatise and normalise temporary paranoia whilst cycling and strengthen the view that it is common and an ordinary and reasonable reaction which promotes safety and survival in environments which contains high risk of both physical and interpersonal harm.

Members of the General Population

It is possible that an increased awareness of experiences for cyclists amongst members of the general population in Britain could encourage more people to cycle. If, for example, we consider an individual who decided to give up cycling several years ago following a distressing incident involving another road-user. This individual may be less reluctant to

return to cycling with the knowledge that thoughts about other road-users' intentions to cause harm or upset are common amongst cyclists and that such cognitions are often justified in high-risk situations. However, this hypothesis that members of the general population may be inspired to cycle with an increased awareness of cyclists' experiences has not been tested in the current study and requires investigation in future research. The empirical study findings may also have a potential impact on British road-users, including drivers of all vehicle types and pedestrians. One potential impact is that some road-users could develop a greater appreciation of the possible effects of their behaviour on cyclists, particularly in terms of paranoia and associated distress, preoccupation and impact on wellbeing. For some road-users, an increased understanding may result in them being more tolerant of and less hostile, aggressive and threatening towards cyclists.

Service-Users Who Experience Paranoia and Clinicians Delivering Psychological Therapies

The findings from both research components might encourage those affected by mild but distressing paranoid beliefs to access services and seek appropriate psychological support. The findings also add to the evidence base for normalising and destigmatising paranoid experiences during therapy, particularly in CBT (Garety et al., 2001). A potential impact for clinicians (e.g. psychologists, psychiatrists, nurses, occupational therapists, etc.) working with individuals who are affected by paranoia might be that they make greater efforts to normalise such experiences and validate associated distress during clinical appointments. Furthermore, paranoid experiences which are not in an extreme form may be overlooked by clinicians, so the findings could help clinicians to more readily identify and assess milder forms of paranoia. Additionally, clinicians can apply the continuum model to conceptualise paranoia, using it as a framework for better understanding and formulating service-users who present with mild, but distressing, paranoid cognitions. This will help to ensure that the most appropriate therapeutic interventions are developed and delivered. It could be beneficial for clinicians working with service-users with more extreme forms of paranoid cognitions (e.g. persecutory delusions) to assess the impact of high-threat environments on symptoms and to

help them to understand the impact of these environments on how they experience paranoia as part of their formulation. These recommendations are based solely on the findings from the clinical studies included the systematic review.

The findings from the systematic review suggest that it may be beneficial for clinicians to be more mindful of the impact of frequent, and often unavoidable, exposure to urban environments. It may be advantageous for psychologists to introduce behavioural experiments and mindfulness exercises into therapy and to evaluate their effect in terms of alleviating distress associated with exposure to urban and busy social environments. Indeed, services could benefit from developing targeted interventions based on CBT aimed at helping patients with paranoid thoughts to feel less distressed and better able to cope when outside in busy environments. Furthermore, there is a clear role for technology, including computer-based and VR platforms, in the delivery of future clinical interventions.

Researchers Interested in the Explored Topics

This research is an important addition to the literature and one which has the potential to shape the direction of future research. There is a need for further research measuring state paranoia before exposure to high-threat environments (urban areas and cycling) as well as afterwards so that change can be measured. Continued investigation is warranted to better understand how individual and environmental factors interact to predict state paranoia following exposure to urban and cycling environments. Experimental methodologies which can manipulate factors such as population density, ethnic density, hostility and social rejection will help to determine their effect on levels of paranoia experienced after cycling or encountering an urban environment. Methodologies using simulated VR urban and cycling environments would allow for threat severity to be manipulated more easily and paranoia scores to be measured 'in the moment' as opposed to retrospectively.

Future researchers could employ different paranoia groups (e.g. low nonclinical, high nonclinical and clinical paranoia) to allow for comparison. Future research should also examine the severity of paranoia, as well as the frequency and duration of exposure to urban and cycling environments. Longitudinal studies would allow for longer term effects of urban

and cycling exposure to be assessed. In addition, a qualitative study whereby cyclists would be interviewed about their experiences of state paranoia whilst cycling could offer a more detailed understanding of the phenomenological experience of paranoia whilst cycling. This knowledge could be used to compare with paranoia experienced in other contexts as well as identifying other key areas for quantitative study. Future research should also focus on examining the effectiveness of psychological interventions for urban residents and cyclists who experience distress resulting from paranoia towards others. Mindfulness might be particularly helpful to residents of and visitors to urban areas and cyclists as it is a skill which reduces stress whilst enhancing attentional control.

Dissemination

To maximise the impact of this research, it is crucial that careful consideration is given to how the findings will be disseminated and to whom. The findings from both the systematic review and empirical study will be submitted for peer review and publication in academic journals. In terms of the systematic review, *Schizophrenia Research* and *The British Journal of Clinical Psychology* will be considered for submission. It is planned that the empirical study will be submitted to at least one of the following academic journals for peer review and publication: *Psychological Medicine*, *Psychiatry Research* and *The Journal of Behvaior Therapy and Experimental Psychiatry.* The impact factors of the five academic journals documented range from 2.189-5.641 according to Journal Citation Reports (Clarivate Analytics, 2019). These journals have been known to publish on the topics of clinical and nonclinical paranoia previously so publication of both pieces of research would ensure that the findings are communicated to academics and researchers within these specific fields. When preparing submissions for both the systematic review and empirical study, it will be imperative to give due consideration to the keywords and search terms so that the findings will be more easily accessible to interested audiences.

It is anticipated that all manuscripts prepared for publication, in terms of both the systematic review and empirical study, will be shared on Research Gate. This will ensure that the findings from both research components will be more widely available to researchers

interested in the fields of clinical and nonclinical paranoia, and indeed those interested in cycling research. In addition, I will seek opportunities to present the research findings at relevant academic conferences, such as at the British Psychological Society's (BPS) and the British Association for Behavioural and Cognitive Psychotherapies' (BABCP) annual conferences. The 2020 BPS and BABCP conferences have been cancelled due to the situation with COVID-19 and I aim to submit applications to present when new dates have been confirmed. It is hoped that the wider dissemination to both clinicians and researchers in the field of psychology will inspire further research to extend the findings of the systematic review and empirical study.

Individuals who experience and are affected by paranoia may be interested in the findings from both aspects of the research. Therefore, it is intended that lay summaries of both sets of findings will be shared with appropriate local groups (e.g. *The London Paranoia and Beliefs Network*) and national organisations (e.g. *The National Paranoia Network* and *The British Psychological Society's Faculty of Psychosis*). With regards to the empirical study, a lay summary of findings will be disseminated via email to all participants who requested them. I believe it is important that the findings of the empirical study are communicated with the general public, therefore an article will be written and submitted to the media (e.g. *The Guardian*) to seek a press release both online and in print. The findings of the empirical study are likely to be of particular interest to cyclists, both urban and rural. As such, it is anticipated that lay summaries of the empirical study will be shared with both local cycling groups (e.g. *London Cycling Campaign)* and national cycling organisations (e.g. *Cycling UK* and *British Cycling*). I also aim to increase awareness amongst road-users of the potential impact of their behaviours and associated distress on cyclists. Sharing the findings of the empirical study with road safety organisations (e.g. Road Safety GB) and campaigns (e.g. THINK!) is likely to help with this endeavor.

The entire body of work will also be shared on PURE, Royal Holloway's online institutional repository, for staff and student access. It was intended to disseminate the empirical study findings via PowerPoint presentation to staff and students at the Department

of Psychology at Royal Holloway, University of London in May 2020, however the presentations were cancelled due to the situation with COVID-19. Instead, a PowerPoint presentation with voice-over was created and made available to my research supervisor so that it can be shared with other Trainee Clinical Psychologists upon request. By doing so, it is hoped that this will improve trainees' theoretical understanding of nonclinical paranoia, highlight existing gaps in the literature and directions for further investigation, and encourage future studies that would build upon this thesis.

References

Allardyce, J., Boydell, J., van Os, J., Morrison, G., Castle, D., Murray, R. M., & McCreadie, R. G. (2001). Comparison of the incidence of schizophrenia in rural Dumfries and Galloway and urban Camberwell. *The British Journal of Psychiatry, 179,* 335-339.

Allen-Crooks, R., & Ellett, L. (2014). Naturalistic change in nonclinical paranoid experiences. *Behavioural and Cognitive Psychotherapy, 42*(5), 634-639.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (5th ed.)*. Arlington, VA: American Psychiatric Publishing.

Anderson, F., & Freeman, D. (2013). Socioeconomic status & paranoia: The role of life hassles, self-mastery, and striving to avoid inferiority. *The Journal of Nervous & Mental Disease, 201*(8), 698-702.

Andreasen, N. C. (1984). *The scale for the assessment of positive symptoms.* University of Iowa Press.

Appelbaum, P. S., Robbins, P. C., & Roth, L. H. (1999). Dimensional approach to delusions: Comparison across types and diagnoses. *American Journal of Psychiatry, 156*(12), 1938–1943.

Ballard, C., Holmes, C., McKeith, I., Neill, D., O'Brien, J., Cairns, N., Lantos, P., Perry, E., Ince, P., & Perry, R. (1999). Psychiatric morbidity in dementia with Lewy bodies: A prospective clinical and neuropathological comparative study with Alzheimer's disease. *The American Journal of Psychiatry, 156*(7), 1039–1045.

Bebbington, P. E., McBride, O., Steel, C., Kuipers, E., Radovanovic, M., Traolach, B., Jenkins, R., Meltzer, H. I., & Freeman, D. (2013). The structure of paranoia in the general population. *The British Journal of Psychiatry, 202*(6), 419-427.

Bentall, R. P., Wickham, S., Shevlin, M., & Varese, F. (2012). Do specific early-life adversities lead to specific symptoms of psychosis? A study from the 2007 The Adult Psychiatric Morbidity Survey. *Schizophrenia* Bulletin*, 38*(4), 734–740.

Boonstra, N., Sterk, B, Wunderink, L., Sytema, S., De Haan, L., & Wiersma, D. (2012). Association of treatment delay, migration and urbanicity in psychosis. *European Psychiatry, 27*(7), 500-505.

Broome, M. R., Zányi, E., Hamborg, T., Selmanovic, E., Czanner, S., Birchwood, M., Chalmers, A., & Singh, S. P. (2013). A high-fidelity virtual environment for the study of paranoia. *Schizophrenia Research and Treatment, 538185,* 1-7.

Castle, D., Phelan, M., Wessely, S., & Murray, R. (1994). Which patients with non-affective functional psychosis are not admitted at first psychiatric contact? *The British Journal of Psychiatry, 165*(1)*,* 101–106.

Chadwick, P., Hughes, S., Russell, D., Russell, I., & Dagnan, D. (2009). Mindfulness groups for distressing voice and paranoia: A replication and randomized feasibility trial. *Behavioural and Cognitive Psychotherapy, 37*(4), 403-412.

Chadwick, P., Newman-Taylor, K., & Abba, N. (2005). Mindfulness groups for people with psychosis. *Behavioural and Cognitive Psychotherapy, 33*(3), 351-359.

Clamor, A., & Krkovic, K. (2018). Paranoid delusions as an adaptive response to social evaluative stress? *Zeitschrift für Psychologie, 226*(3), 191-196.

Clarivate Analytics. (2019). *2019 Journal Citation Reports*. https://clarivate.com/webofsciencegroup/wp-content/uploads/sites/2/dlm_uploads/2019/08/JCR_Full_Journal_list140619.pdf

Cohen, J. (1992). Statistical power analysis. *Current Directions in Psychological Science, 1*(3), 98-101.

Coid, J. W., Ullrich, S., Kallis, C., Keers, R., Barker, D., Cowden, F., & Stamps, R. (2013). The relationship between delusions and violence: Findings from the East London first episode psychosis study. *JAMA Psychiatry, 70*(5), 465-471.

Coid, J. W., Ullrich, S., Keers, R., Bebbington, P., DeStavola, B. L., Kallis, C., Yang, M., Reiss, D., Jenkins, R., & Donnelly, P. (2013). Gang membership, violence, and psychiatric morbidity. *American Journal of Psychiatry, 170*(9), 985-993.

Coltheart, M. (2007). The 33rd Sir Frederick Bartlett lecture, Cognitive neuropsychiatry and delusional belief. *The Quarterly Journal of Experimental Psychology, 60*(8), 1041-1062.

Conus, P., Empson, L. A., Codeluppi, Z., Baumann, P. S., Söderström O., Söderström D., & Golay, P. (2019). City avoidance in the early phase of psychosis: A neglected domain of assessment and a potential target for recovery strategies. *Frontiers in Psychiatry, 10:* 342.

Cotier, F. A., & Toulopoilou, T. (2017). Negative social comparisons and psychosis proneness in a healthy adult population. *European Psychiatry, 46,* 51-56.

Department of Health. (2005). *Research Governance Framework for Health and Social Care.* (2nd ed.). https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/139565/dh_4122427.pdf

Department for Transport. (2009). *Collisions Involving Cyclists on Britain's Roads: Establishing the Causes.* https://webarchive.nationalarchives.gov.uk/20100203035343/http://www.dft.gov.uk/pgr/roadsafety/research/rsrr/theme1/ppr445.pdf

Department for Transport. (2017). *Reported Road Casualties in Great Britain: 2016 Annual Report.* https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/648081/rrcgb2016-01.pdf

Department for Transport. (2019). *Walking and Cycling Statistics, England: 2018.* https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/821842/walking-and-cycling-statistics-2018-accessible.pdf

Dominguez, M. D. G., Wichers, M., Lieb, R., Wittchen, H.-U., & van Os, J. (2011). Evidence that onset of clinical psychosis is an outcome of progressively more persistent subclinical psychotic experiences: An 8-Year cohort study. *Schizophrenia Bulletin, 37*(1), 84–93.

Elahi, A., Perez Algorta, G., Varese, F., McIntyre, J. C., & Bentall, R. P. (2017). Do paranoid delusions exist on a continuum with subclinical paranoia? A multi-method taxometric study. *Schizophrenia Research, 190,* 77-81.

Ellett, L., (2013). Mindfulness for paranoid beliefs: evidence from two case studies. *Behavioural and Cognitive Psychotherapy, 41*(2), 238-242.

Ellett, L., Allen-Crooks, R., Stevens, A., Wildschut, T., & Chadwick, P. D. (2013). A paradigm for the study of paranoia in the general population: The Prisoner's Dilemma Game. *Cognition & Emotion, 27*(1), 53-62.

Ellett, L., & Chadwick, P. (2007). Paranoid cognitions, failure, and focus of attention in college students. *Cognition and Emotion, 21*(3), 558-576.

Ellett, L., Freeman, D., & Garety, P. A. (2008). The psychological effect of an urban environment on individuals with persecutory delusions: The Camberwell walk study. *Schizophrenia Research, 99* (1-3), 77-84.

Ellett, L., Lopes, B., & Chadwick, P. (2003). Paranoia in a nonclinical population of college students. *The Journal of Nervous and Mental Disease, 191*(7), 425-430.

Ellett, L., Kingston, J., & Chadwick, P. (2018). State paranoia and urban cycling. *Psychiatry Research, 266,* 341-344.

Faris, R. E. L., & Dunham, H. W. (1939). *Mental disorders in urban areas: an ecological study of schizophrenia and other psychoses.* University Chicago Press.

Fenigstein, A., & Vanable, P. (1992). Paranoia and self-consciousness. *Journal of Personality and Social Psychology, 62*(1), 129-138.

Freeman, D. (2007). Suspicious minds: The psychology of persecutory delusions. *Clinical Psychology Review, 27*(4), 425-457.

Freeman, D., Bradley, J., Antley, A., Bourke, E., DeWeever, N., Evans, N., Černis, E., Sheaves, B., Waite, F., Dunn, G., Slater, M., & Clark, D. M. (2016). Virtual reality in the treatment of persecutory delusions: Randomised controlled experimental study testing how to reduce delusional conviction. *The British Journal of Psychiatry, 209*(1), 62-67.

Freeman, D., Dunn, G., Fowler, D., Bebbington, P., Kuipers, E., Emsley, R., Jolley, S., & Garety, P. (2013). Current paranoid thinking with patients with delusions: The presence of cognitive-affective biases. *Schizophrenia Bulletin, 39*(6), 1281-1287.

Freeman, D., Emsley, R., Dunn, G., Fowler, D., Bebbington, P., Kuipers, E., Jolley, S., Waller, H., Hardy, A., & Garety, P. (2015). The stress of the street for patients with persecutory delusions: A test of the symptomatic and psychological effects of going outside into a busy urban environment. *Schizophrenia Bulletin, 41*(4), 971-979.

Freeman, D., Evans, N., Lister, R., Antley, A., Dunn, G., & Slater, M. (2014). Height, social comparison, and paranoia: An immersive virtual reality experimental study. *Psychiatry Research, 218*(3), 348-352.

Freeman, D., & Garety, P. A. (2000). Comments on the content of persecutory delusions: Does the definition need clarification? *British Journal of Clinical Psychology, 39*(4), 407-414.

Freeman, D., Garety, P. A., Bebbington, P. E., Smith, B., Rollinson, R., Fowler, D., Kuipers, E., Ray, K., & Dunn, D. (2005). Psychological investigation of the structure of paranoia in a non-clinical population. *British Journal of Psychiatry, 186*(5), 427-435.

Freeman, D., Garety, P. A., & Kuipers, E. (2001). Persecutory delusions: Developing the understanding of belief maintenance and emotional distress. *Psychological Medicine, 31*(7), 1293-1306.

Freeman, D., Garety, P. A., Kuipers, E., Fowler, D., & Bebbington, P. E. (2002). A cognitive model of persecutory delusions. *British Journal of Clinical Psychology, 41*(4), 331-347.

Freeman, D., Loe. B. S., Kingdon, D., Startup, H., Molodynski, A., Rosebrock, L., Brown, P., Sheaves, B., Waite, F., & Bird, J. C. (2019). The revised Green et al., Paranoid Thoughts Scale (R-GPTS): Psychometric properties, severity ranges, and clinical cut-offs. *Psychological Medicine,* 1-10.

Freeman, D., McManus, S., Brugha, T., Meltzer, H., Jenkins, R., & Bebbington, P. (2011). Concomitants of paranoia in the general population. *Psychological Medicine, 41*(5), 923-936.

Freeman, D., Pugh, K., Antley, A., Slater, M., Bebbington, P., Gittins, M., Dunn, G., Kuipers, E., Fowler, D., & Garety, P. (2008). Virtual reality study of paranoid thinking in the general population. *The British Journal of Psychiatry, 192*(4), 258-263.

Freeman, D., Pugh, K., Green, C., Valmaggia, L., Dunn, G., & Garety, P. (2007). A measure of state persecutory ideation for experimental studies. *The Journal of Nervous and Mental Disease, 195*(9), 781-784.

Freeman, D., Pugh, K., Voronstova, N., Antley, A., & Slater, M. (2010). Testing the continuum of delusional beliefs. *Journal of Abnormal Psychology, 119*(1), 83-92.

Freeman, D., Taylor, K. M., Molodynski, A., & Waite, F. (2019). Treatable clinical intervention targets for patients with schizophrenia. *Schizophrenia Research, 211,* 44-50.

Freeman, D., Waller, H., Harpur-Lewis, R. A., Moore, R., Garety, P., Bebbington, P., Kuipers, E., Emsley, R., Dunn, G., Fowler. D., & Jolley, S. (2015). Urbanicity, persecutory delusions, and clinical intervention: The development of a brief CBT module for helping patients with persecutory delusions enter social urban environments. *Behavioural and Cognitive Psychotherapy, 43(*1), 42–51.

Fornells-Ambrojo, M., Barker, C., Swapp, D., Slater, M., Antley, A., & Freeman, D. (2008). Virtual reality and persecutory delusions: Safety and feasibility. *Schizophrenia Research, 104*(1-3), 228-236.

Fox, C. W., Paine, C. E. T., & Sauterey, B. (2016). Citations increase with manuscript length, author number, and references cited in ecology journals. *Ecology and Evolution, 6*(21), 7717-7726.

Garety, P. A., Kuipers, E., Fowler, D., Freeman, D. & Bebbington, P. E. (2001). A cognitive model of the positive symptoms of psychosis. *Psychological Medicine, 31*(2), 189-195.

Goodwin, F. K., & Jamison, K. R. (1990). *Manic-depressive illness.* Oxford University Press.

Goodwin, G. M. (2016). Bipolar disorder. *Medicine, 44*(11), 661-663.

Green, C. E., Freeman, D., Kuipers, E., Bebbington, P., Fowler, D., Dunn, G., & Garety, P. A. (2008). Measuring ideas of persecution and social reference: The Green et al. Paranoid Thoughts Scales (GPTS). *Psychological Medicine, 38*(1), 101-111.

Green, C., Garety, P. A., Freeman, D., Fowler, D., Bebbington, P., Dunn, G., & Kuipers, E. (2006). Content and affect in persecutory delusions. *British Journal of Clinical Psychology, 45(*4), 561-577.

Haddock, G., McCarron, J., Tarrier, N., & Faragher, E. B. (1999). Scales to measure dimensions of hallucinations and delusions: The psychotic symptom rating scales (PSYRATS). *Psychological Medicine, 29*(4), 879-889.

Hajdúk, M., Klein, H. S., Harvey, P. D., Penn, D. L., & Pinkham, A. E. (2019). Paranoia and interpersonal functioning across the continuum from health to pathological – Network analysis. *British Journal of Clinical Psychology, 58*(1), 19-34.

Haltenhof, H., Ulrich, H., & Blanenburg, W. (1999). Themes of delusion in 84 patients with unipolar depression. *Krankenhauspsychiatrie, 10,* 87-90.

Heinz, A., Deserno, L., & Reininghaus, U. (2013). Urbanicity, social adversity and psychosis. *World Psychiatry, 12*(3), 187-197.

Hesse, K., Schroeder, P. A., Scheeff, J., Klingberg, S., & Plewnia, C. (2017). Experimental variation of social stress in virtual reality: Feasibility and first results in patients with psychotic disorders. *Journal of Behavior Therapy and Experimental Psychiatry, 56,* 129-136.

Hodgekins, J., Coker, S., Freeman, D., Ray-Glover, K., Bebbington, P., Garety, P., Kuipers, E., Dunn, G., & Fowler, D. (2012). Assessing levels of subthreshold psychotic symptoms in the recovery phase: The Schizotypal Symptoms Inventory (SSI). *Journal of Experimental Psychopathology, 3*(4), 582-593.

Hor, K. and Taylor, M. (2010). Suicide and schizophrenia: A systematic review of rates and risk factors. *Journal of Psychopharmacology, 24*(4), 81-90.

INVOLVE. (2019). *UK Standards for Public Involvement Summary.* https://www.invo.org.uk/wp-content/uploads/2019/11/UK-standards-for-public-involvement-one-page.pdf

Johns, L. C., Cannon, M., Singleton, N., Murray, R. M., Farrell, M., Brugha, T., Bebbington, P., Jenkins, R., & Meltzer, H. (2004). Prevalence and correlates of self-reported

psychotic symptoms in the British population. *The British Journal of Psychiatry, 185*(4), 298-305.

Kahn-Greene, E. T., Killgore, D. B., Kamimori, G. H., Balkin, T. J., & Killgore, W. D. (2007). The effects of sleep deprivation on symptoms of psychopathology in healthy adults. *Sleep Medicine, 8*(3), 215-221.

Kay, S. R. (1991). *Positive and negative syndromes in schizophrenia: Assessment and research.* Brunner/Mazal.

Kelly, B. D., O'Callaghan, E., Waddington, J. L., Feeney, L., Browne, S., Scully, P. J., Clarke, M., Quinn, J. F., McTigue, O., Morgan, M. G., Kinsella, A., & Larkin, C. (2010). Schizophrenia and the city: A review of literature and prospective study of psychosis and urbanicity in Ireland. *Schizophrenia Research, 116*(1), 75–89.

Kirkbride, J. B., Fearon, P., Morgan, C., Dazzan, P., Morgan, K., Tarrant, J., Lloyd, T., Holloway, J., Hutchinson, G., Leff, J. P., Mallett, R. M., Harrison, G. L., Murray, R. M., & Jones, P. B. (2006). Heterogeneity in incidence rates of schizophrenia and other psychotic syndromes: Findings from the 3-center AeSOP study. *Archives of General Psychiatry, 63*(3), 250-258.

Kirkbride, J. B., Jones, P. B., Ullrich, S., & Coid, J. W. (2014). Social deprivation, inequality, and the neighborhood-level incidence of psychotic syndromes in East London. *Schizophrenia Bulletin, 40*(1), 169-180.

Lavin, R., Bucci, S., Varese, F., & Berry, K. (2020). The relationship between insecure attachment and paranoia in psychosis: A systematic literature review. *The British Journal of Clinical Psychology, 59*(1), 39-65.

Lewis, G., David, A., Andréassson, S., & Allebeck, P. (1992). Schizophrenia and city life. *The Lancet, 340*(8812), 137-140.

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P. A., Clarke, M., Devereaux, P. J., Kleijnen, J. & Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: Explanation and elaboration. *Journal of Clinical Epidemiology, 62*, e1-

e34.

Lincoln, T., & Keller, E. (2008). Delusions and hallucinations in students compared to the general population. *Psychology and Psychotherapy, 81*(3), 231-235.

Lisy, K., & Porritt, K. (2016). Narrative synthesis: Considerations and challenges. *International Journal of Evidence-Based Healthcare, 14*(4), 201.

Marcelis, M., Navarro-Mateu, F., Murray, R., Selten, J. P., & van Os. (1998). Urbanization and psychosis: A study of 1942-1978 birth cohorts in The Netherlands. *Psychological Medicine, 28*(4), 871-879.

Mavissakalian, M.R., Hamann, M.S., Haidar, S.A., & de Groot, C.M. (1995). Correlates of DSM-III Personality Disorder in Generalized Anxiety Disorder. *Journal of Anxiety Disorders, 9*(2), 103–115.

Meisel, S. F., Garety, P. A., Stahl, D., & Valmaggia, L. R. (2018). Interpersonal processes in paranoia: A systematic review. *Psychological Medicine, 48*(14), 2299-2312.

Mizrahi, R., Starkstein, S. E., Jorge, R., & Robinson, R. G. (2006). Phenomenology and clinical correlates of delusions in Alzheimer disease. *The American Journal of Geriatric Psychiatry, 14*(7), 573–581.

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLOS Medicine, 6*(7), e1000097.

National Collaborating Centre for Methods and Tools. (2019, August 17). *Quality assessment tool for quantitative studies.* McMaster University. http://www.nccmt.ca/resources/search/14

Nettle, D., Pepper, G. V., Jobling, R., & Schroeder, K. B. (2014). Being there: A brief visit to a neighbourhood induces social attitudes of that neighbourhood. *PeerJ, 2,* e236.

Oxford University Press. (2020). Paranoia. In *Oxford Learners Dictionary.* Retrieved from https://www.oxfordlearnersdictionaries.com/

Pedersen, C. B., & Mortensen, P. B. (2001). Evidence of a dose-response relationship between urbanicity during upbringing and schizophrenia risk. *Archives of General Psychiatry, 58*(11), 1039-1046.

Pickering, L., Simpson, J., & Bentall, R. P. (2008). Insecure attachment predicts proneness to paranoia but not hallucinations. *Personality and Individual Differences, 44*(5), 1212-1244.

Popay, J., Roberts, H., Sowden, A., Petticrew, M., Arai, L., Rodgers, M., Britten, N., Roen, K., & Duffy, S. (2006). *Guidance on the conduct of narrative synthesis in systematic reviews: a product of the ESRC methods programme (Version I).* Lancaster, UK: University of Lancaster.

Pot-Kolder, R., Veling, W., Counotte, J., & van der Gaag, M. (2018). Self-reported cognitive biases moderate the associations between social stress and paranoid ideation in a virtual reality experimental study. *Schizophrenia Bulletin, 44*(4), 749-756.

Preti, A., & Cella, M. (2010). Randomized-controlled trails in people at ultra high risk of psychosis: A review of treatment effects. *Schizophrenia Research, 123*(1), 30-36.

Raihani, N. J., & Bell, V. (2019). An evolutionary perspective on paranoia. *Nature Human Behaviour, 3*(2), 114-121.

Reininghaus, U., Geyer-Anderson, C., Valmaggia, L., Kempton, M. J., Calem, M., Onyejiaka, A., Hubbard, K., Dazzan, P., Beards, S., Fisher, H. L., Mills, J. G., McGuire, P., Craig, T. K. J., Garety, P., van Os, J., Murray, R. M., Wykes, T., Myin-Germeys, I., & Morgan, C. (2016). Psychological processes underlying the association between childhood trauma and psychosis in daily life: An experience sampling study. *Psychological Medicine, 46*(13), 2799-2813.

Salokangas, R. K. R., Hietala, J., Heinimaa, M., From, T., Graf von Reventlow, W., Linszen, D., Dingemans, P., Birchwood, M., Patterson, P., Schultze-Lutter, F., Klosterkötter, J., & Ruhrmann, S. (2015). Causal connection between depression and paranoia. *European Psychiatry, 30*(1), 113.

Sartorius, N., Jablensky, A., Korten, A., Ernberg, G., Anker, M., Cooper, J. E., & Day, R. (1986). Early manifestations and first-contact incidence of schizophrenia in different cultures: A preliminary report on the initial evaluation phase of the WHO Collaborative Study on Determinants of Outcome of Severe Mental Disorders. *Psychological Medicine, 16*(4), 909–928.

Schofield, P., Thygesen, M., Das-Munshi, J., Becares, L., Cantor-Graae, E., Pedersen, C., & Agerbo, E. (2017). Ethnic density, urbanicity and psychosis risk for migrant groups: A population cohort study. *Schizophrenia Research, 190*, 82-87.

Qualtrics [computer software]. (2019). Provo, UT, USA.

Shore, R., Strauss, C., Cavanagh, K., Hayward, M., & Ellett, L. (2018). A randomised controlled trail of a brief online mindfulness-based intervention on paranoia in a non-clinical sample. *Mindfulness, 9*(1), 294-302.

Söderström, O., Empson, L. A., Codeluppi, Z., Söderström, D., Baumann, P. S., & Conus, P. (2016). Unpacking 'the City': An experience-based approach to the role of urban living in psychosis. *Health & Place, 42,* 104–110.

Söderström, O., Söderström, A., Codeluppi, Z., Empson, L. A., & Conus, P. (2017). Emplacing recovery: How persons diagnosed with psychosis handle stress in cities. *Psychosis, 9,* 322-329.

Spauwen, J., Krabbendam, L., Lieb, R., Wittchen, H. U., & van Os, J. (2004). Does urbanicity shift the population expression of psychosis? *Journal of Psychiatric Research, 38*(6), 613-618.

Strauss, J. S. (1969). Hallucinations and delusions as points on continua function. *Archives of General Psychiatry, 21*(5), 581-586.

Sundquist, K., Frank, G., & Sundquist, J. (2004). Follow-up study of 4.4 million women and men in Sweden. *British Journal of Psychiatry, 184*(4), 293-298.

The British Psychological Society. (2018). *Producing doctoral research with impact: A guide for doctoral programme providers and students.*

https://www.bps.org.uk/sites/www.bps.org.uk/files/Policy/Policy%20-%20Files/Producing%20doctoral%20research%20with%20impact.pdf

Thomas, B. H., Ciliska, D., Dobbins, M., & Micucci, S. (2004). A process for systematically reviewing the literature: Providing the research evidence for public health nursing interventions. *Worldviews on Evidence-Based Nursing, 1*(3), 176-184.

Transport for London. (2019). *Casualties in Greater London during 2018.* http://content.tfl.gov.uk/casualties-in-greater-london-2018.pdf

Urbaniak, G. C., & Plous, S. (2015). *Research Randomizer* (Version 4.0). Social Psychology Network. http://www.randomizer.org/

Valmaggia, L. R., Freeman, D., Green, C., Garety, P., Swapp, D., Antley, A., Prescott, C., Fowler, D., Kuipers, E., Bebbington, P., Slater, M., Broome, M., & McGuire, P. K. (2007). Virtual reality and paranoid ideations in people with an 'at-risk mental state' for psychosis. *The British Journal of Psychiatry, 191*(51), 63-68.

van Os, J. (2004). Does the urban environment cause psychosis? *The British Journal of Psychiatry, 184(*4), 287-288.

van Os, J., Hanssen, M., Bijl, R. V., & Ravelli, A. (2000). Strauss (1969) revisited: a psychosis continuum in the general population? *Schizophrenia Research, 45*(1-2), 11– 20.

Vassos, E., Pedersen, C. B., Murray, R. M., Collier, D. A., & Lewis, C. M. (2012). Meta-analysis of the association of urbanicity with schizophrenia. *Schizophrenia Bulletin, 38*(6), 1118-1123.

Veling, W., Brinkman, W-P., Dorrestijn, E., & van der Gaag, M. (2014). Virtual reality experiments linking social environment and psychosis: A pilot study. *Cyberpsychology, Behavior, and Social Networking, 17*(3), 191-195.

Veling, W., Pot-Kolder, R., Counotte, J., van Os, J., & van der Gaag. (2016). Environmental social stress, paranoia and psychosis liability: A virtual reality study. *Schizophrenia Bulletin, 42*(6), 1363-1371.

Wessely, S., Buchanan, A., Reed, A., Cutting, J., Everitt, B., Garety, P., & Taylor, P. J. (1993). Acting on delusions. I: Prevalence. *The British Journal of Psychiatry, 163*(1), 69–76.

Wimberley, T., Støvring, H., Sørensen, H. J., Horsdal, H. T., MacCabe, J. H., & Gasse, C. (2016). Predictors of treatment resistance in patients with schizophrenia: A population-based cohort study. *The Lancet, 3*(4), 358-366.

Wong, K. K., Freeman, D., & Hughes, C. (2014). Suspicious young minds: Paranoia and mistrust in 8- to 14-year-olds in the U.K. and Hong Kong. *The British Journal of Psychiatry, 205*(3), 221-229.

Zammit, S., Lewis, G., Rasbash, J., Dalman, C., Gustafsson, J. E., & Allebeck, P. (2010). Individuals, schools, and neighborhood: A multilevel longitudinal study of variation in incidence of psychotic disorders. *Archives of General Psychiatry, 67*(9), 914-922.

Zavos, H. M. S., Freeman, D., Haworth, C. M. A., McGuire, P., Plomin, R., Cardno, A. G., & Ronald, A. (2014). Consistent etiology of severe, frequent psychotic experiences and milder, less frequent manifestations: A twin study of specific experiences in adolescence. *JAMA Psychiatry, 71*(9), 1049-1057.

Zimmermann, G., Favrod, J., Trieu, V. H. & Pomini, V. (2005). The effect of cognitive behavioral treatment on the positive symptoms of schizophrenia spectrum disorders: A meta-analysis. *Schizophrenia Research, 77*(1), 1-9.

Zubin, J., & Spring, B. (1977). Vulnerability: A new view on schizophrenia. *Journal of Abnormal Psychology, 86*(2), 103-126.

Appendices

Appendix 1: Quality Assessment Tool for Quantitative Studies (QATQS; Thomas, Ciliska, Dobbins & Micucci, 2004)

QUALITY ASSESSMENT TOOL FOR QUANTITATIVE STUDIES

COMPONENT RATINGS

A) SELECTION BIAS

(Q1) Are the individuals selected to participate in the study likely to be representative of the target population?

1 Very likely
2 Somewhat likely
3 Not likely
4 Can't tell

(Q2) What percentage of selected individuals agreed to participate?

1 80 - 100% agreement
2 60 – 79% agreement
3 less than 60% agreement
4 Not applicable
5 Can't tell

RATE THIS SECTION	STRONG	MODERATE	WEAK
See dictionary	1	2	3

B) STUDY DESIGN

Indicate the study design

1 Randomized controlled trial
2 Controlled clinical trial
3 Cohort analytic (two group pre + post)
4 Case-control
5 Cohort (one group pre + post (before and after))
6 Interrupted time series
7 Other specify _____
8 Can't tell

Was the study described as randomized? If NO, go to Component C.

No Yes

If Yes, was the method of randomization described? (See dictionary)

No Yes

If Yes, was the method appropriate? (See dictionary)

No Yes

RATE THIS SECTION	STRONG	MODERATE	WEAK
See dictionary	1	2	3

C) CONFOUNDERS

(Q1) Were there important differences between groups prior to the intervention?

1 Yes
2 No
3 Can't tell

The following are examples of confounders:

1 Race
2 Sex
3 Marital status/family
4 Age
5 SES (income or class)
6 Education
7 Health status
8 Pre-intervention score on outcome measure

(Q2) If yes, indicate the percentage of relevant confounders that were controlled (either in the design (e.g. stratification, matching) or analysis)?

1 80 – 100% (most)
2 60 – 79% (some)
3 Less than 60% (few or none)
4 Can't Tell

RATE THIS SECTION	STRONG	MODERATE	WEAK
See dictionary	1	2	3

D) BLINDING

(Q1) Was (were) the outcome assessor(s) aware of the intervention or exposure status of participants?

1 Yes
2 No
3 Can't tell

(Q2) Were the study participants aware of the research question?

1 Yes
2 No
3 Can't tell

RATE THIS SECTION	STRONG	MODERATE	WEAK
See dictionary	1	2	3

E) DATA COLLECTION METHODS

(Q1) Were data collection tools shown to be valid?

1 Yes
2 No
3 Can't tell

(Q2) Were data collection tools shown to be reliable?

1 Yes
2 No
3 Can't tell

RATE THIS SECTION	STRONG	MODERATE	WEAK
See dictionary	1	2	3

F) WITHDRAWALS AND DROP-OUTS

(Q1) Were withdrawals and drop-outs reported in terms of numbers and/or reasons per group?

1 Yes
2 No
3 Can't tell
4 Not Applicable (i.e. one time surveys or interviews)

(Q2) Indicate the percentage of participants completing the study. (If the percentage differs by groups, record the lowest).

1 80 -100%
2 60 - 79%
3 less than 60%
4 Can't tell
5 Not Applicable (i.e. Retrospective case-control)

RATE THIS SECTION	STRONG	MODERATE	WEAK	
See dictionary	1	2	3	Not Applicable

G) INTERVENTION INTEGRITY

(Q1) What percentage of participants received the allocated intervention or exposure of interest?

1 80 -100%
2 60 - 79%
3 less than 60%
4 Can't tell

(Q2) Was the consistency of the intervention measured?

1 Yes
2 No
3 Can't tell

H) ANALYSES

(Q1) Indicate the unit of allocation (circle one)

community organization/institution practice/office individual

(Q2) Indicate the unit of analysis (circle one)

community organization/institution practice/office individual

(Q3) Are the statistical methods appropriate for the study design?

1 Yes
2 No
3 Can't tell

(Q4) Is the analysis performed by intervention allocation status (i.e. intention to treat) rather than the actual intervention received?

1 Yes
2 No
3 Can't tell

GLOBAL RATING

COMPONENT RATINGS

Please transcribe the information from the gray boxes on pages 1-4 onto this page. See dictionary on how to rate this section.

A	**SELECTION BIAS**	**STRONG**	**MODERATE**	**WEAK**	
		1	2	3	
B	**STUDY DESIGN**	**STRONG**	**MODERATE**	**WEAK**	
		1	2	3	
C	**CONFOUNDERS**	**STRONG**	**MODERATE**	**WEAK**	
		1	2	3	
D	**BLINDING**	**STRONG**	**MODERATE**	**WEAK**	
		1	2	3	
E	**DATA COLLECTION METHOD**	**STRONG**	**MODERATE**	**WEAK**	
		1	2	3	
F	**WITHDRAWALS AND DROPOUTS**	**STRONG**	**MODERATE**	**WEAK**	
		1	2	3	Not Applicable

GLOBAL RATING FOR THIS PAPER (circle one):

1	STRONG	(no WEAK ratings)
2	MODERATE	(one WEAK rating)
3	WEAK	(two or more WEAK ratings)

With both reviewers discussing the ratings:

Is there a discrepancy between the two reviewers with respect to the component (A-F) ratings?

No Yes

If yes, indicate the reason for the discrepancy

1	Oversight
2	Differences in interpretation of criteria
3	Differences in interpretation of study

Final decision of both reviewers (circle one):

1	**STRONG**
2	**MODERATE**
3	**WEAK**

Appendix 2: Measures

Demographic Information

Age:
____ years

Gender:
- Male
- Female
- Non-binary
- Prefer not to say

Marital status:
- Single
- Cohabitating
- Married
- Civil partnership
- Separated
- Divorced
- Widowed
- Other

Ethnicity:
- ***White***
  - English/Welsh/Scottish/Northern Irish/British
  - Irish
  - Any other White background
- ***Mixed/multiple ethnic groups***
  - White and Black Caribbean
  - White and Black African
  - White and Asian
  - Any other Mixed/multiple ethnic background
- ***Asian/Asian British***
  - Indian
  - Pakistani
  - Bangladeshi
  - Chinese
  - Any other Asian background
- ***Black/African/Caribbean/Black British***
  - African
  - Caribbean
  - Any other Black/African/Caribbean background
- ***Other ethnic group***
  - Arab
  - Any other ethnic group

Nearest UK geographical area:

England

East Midlands
East of England
London
North East
North West
South East
South West
West Midlands
Yorkshire and The Humber

Scotland

Aberdeen City
Aberdeenshire
Angus
Argyll and Bute
City of Edinburgh
Clackmannanshire
Dumfries and Galloway
Dundee City
East Ayrshire
East Dunbartonshire
East Lothian
East Renfrewshire
Eilean Siar (Western Isles)
Falkirk
Fife
Glasgow City
Highland
Inverclyde
Midlothian
Moray
North Ayrshire
North Lanarkshire
Orkney Islands
Perth and Kinross
Renfrewshire
Scottish Borders
Shetland Islands
South Ayrshire
South Lanarkshire
Stirling
West Dunbartonshire
West Lothian

Wales

Blaenau Gwent
Bridgend
Caerphilly
Cardiff
Carmarthenshire
Ceredigion
Conwy
Denbighshire
Flintshire
Gwynedd
Isle of Anglesey
Merthyr Tydfil
Monmouthshire
Neath Port Talbot
Newport
Pembrokeshire
Powys
Rhondda Cynon Taf
Swansea
The Vale of Glamorgan
Torfaen
Wrexham

Northern Ireland

Antrim and Newtownabbey
Armagh, Banbridge and Craigavon
Belfast
Causeway Coast and Glens
Derry and Strabane
Fermanagh and Omagh
Lisburn and Castlereagh
Mid and East Antrim
Mid Ulster
Newry, Mourne and Down
North Down and Ards

Experiences of Cycling Questionnaire (Ellett et al., 2018)

1. How regularly do you cycle?

Everyday Weekly Monthly

2. Do you cycle for

Leisure Commuting to work Both

3. How long is your average journey?

____ minutes

4. What type of area do you mostly cycle in?

Urban	Rural
(E.g. cities, town centres or busy areas with lots of traffic)	(E.g. quiet country roads or areas with little traffic)

5. Please select any of the following behaviours that you have ever experienced from other road-users whilst cycling:

Verbal aggression (e.g. shouting/swearing)
Non-verbal aggression (e.g. shaking fist/offensive gestures/honking/revving engine)
Dangerous overtaking (e.g. really fast and close when there is no room)
Tailgating (deliberately driving too close behind my bicycle)
Deliberately driving too close alongside me
Being blocked or cornered
Purposefully making impact with my bicycle
Other _____

6. In general, how threatened have you felt by each of these behaviours?

1 2 3 4 5 6 7 8 9 10
Slightly Threatened Extremely Threatened

NB: This Likert scale appears for each of the behaviours selected in Item 5

7. Have you ever thought that another road-user was <u>deliberately</u> trying to harm, hurt or upset you whilst cycling?

Examples might include physical harm (e.g. deliberately driving too close) or emotional upset (e.g. deliberately trying to intimidate you).

Yes No

NB: Only participants who answer 'Yes' to this item are presented with Items 8-16

8. Please describe an experience when you thought another road-user was deliberately trying to harm, hurt or upset you whilst cycling.

In relation to the experience you just described…

9. How convinced were you that the road-user was deliberately trying to harm, hurt or upset you?

1 (Not at all) 2 3 4 5 (Extremely)

10. How much did this feeling preoccupy you at the time?

1 (Not at all) 2 3 4 5 (Extremely)

11. How much distress did this experience cause you at the time?

1 (None at all) 2 3 4 5 (Severe)

12. How much impact did this experience have on your wellbeing?

1 (Not at all) 2 3 4 5 (Severe)

13. How busy was the road (in terms of drivers, cyclists, pedestrians)?

1 (Not at all) 2 3 4 5 (Extremely)

14. How much did the number of other road-users contribute to your distress?

1 (Not at all) 2 3 4 5 (Extremely)

15. Please select any of the following behaviours that you experienced from the other road user(s) in the example you just described

Verbal aggression (e.g. shouting/swearing)
Non-verbal aggression (e.g. shaking fist/offensive gestures/honking/revving engine)
Dangerous overtaking (e.g. really fast and close when there is no room)
Tailgating (deliberately driving too close behind my bicycle)
Deliberately driving too close alongside me
Being blocked or cornered
Purposefully making impact with my bicycle
Other _____

16. Please rate how threatened you felt by each of the behaviours that you experienced in the example you just described

1 2 3 4 5 6 7 8 9 10
Slightly Threatened Extremely Threatened

Note: This Likert scale appears for each of the behaviours selected in Item 15

State Paranoia Scale (SPS; Ellett et al., 2018)

Usually when I am cycling, I view people driving cars, lorries and buses as:

	Definitely	Probably	Maybe	Unsure	Maybe	Probably	Definitely	
Friendly towards me								Hostile towards me
Wanting to please me								Wanting to upset me
Wanting to help me								Wanting to harm me
Respects me								Has it in for me

Paranoia Scale (PS; Fenigstein & Vanable, 1992)

	Not at all applicable to me.	Slightly applicable to me.	Moderately applicable to me.	Very applicable to me.	Extremely applicable to me.
1. Someone has it in for me					
2. I sometimes feel as if I am being followed					
3. I believe that I have often been punished without cause					
4. Some people have tried to steal my ideas and take credit for them.					
5. My parents and family find more faults with me than they should.					
6. No one really cares much about what happens to you.					
7. I am sure I get a raw deal in life.					
8. Some people will use somewhat unfair means to get profit or an advantage, rather than lose it.					
9. I often wonder what hidden reason another person may have for doing something nice for you.					
10. It is safer to trust no one.					
11. I have often felt that strangers were looking at me critically.					
12. Most people make friends because friends are likely to be useful to them.					
13. Someone has been trying to influence my mind.					
14. I am sure I have been talked about behind my back.					
15. Most people inwardly dislike putting themselves out to help other people.					
16. I tend to be on my guard with people who are somewhat more friendly than I expected.					
17. People have said insulting and unkind things about me.					
18. People often disappoint me.					
19. I am bothered by people outside, in cars, in stores, etc watching me.					
20. I have often found people jealous of my good ideas just because they had not thought of them first.					

Appendix 3: Ethical Approval

From: Ethics Application System <ethics@rhul.ac.uk>
Sent: 02 February 2019 17:17
To: Bonner, Christopher (2017) <Christopher.Bonner.2017@live.rhul.ac.uk>; Ellett, Lyn <Lyn.Ellett@rhul.ac.uk>; ethics@rhul.ac.uk <ethics@rhul.ac.uk>
Subject: Result of your application to the Research Ethics Committee (application ID 1480)

PI: Dr Lyn Ellett
Project title: Paranoia and Cycling

REC ProjectID: 1480

Your application has been approved by the Research Ethics Committee.
Please report any subsequent changes that affect the ethics of the project to the University Research Ethics Committee ethics@rhul.ac.uk

Appendix 4: Participation Information Sheet

INFORMATION SHEET

What is the purpose of the study?

The purpose of the study is to find out more about how individuals feel when they are cycling and to understand the types of beliefs people hold about other road-users whilst cycling.

What do I have to do if I take part?

You will be asked to complete a web-based survey. You will be asked some simple questions about yourself (e.g. age, gender, ethnicity, nearest UK geographical area) and will be asked to complete some questionnaires to measure beliefs and emotions experienced whilst cycling. This will take around 15 minutes. Your responses will be held securely and anonymously.

Do I have to take part?

It is up to you to decide whether or not to take part. If you decide to take part, you are still free to withdraw at any time without disadvantage to yourself or without any obligation to give a reason. If you do not want to continue, you can simply exit before submitting your responses, and your responses will not be saved.

To ensure anonymity, you will NOT be asked for your name or contact details. You will be asked to provide a memorable word and your date of birth. This will be used to identify your data if you wish to withdraw from the study at a later date. You may ask to have your data removed by contacting the researcher and giving your memorable word and date of birth.

What are the incentives for taking part?

If you complete the survey, you will have the opportunity to be entered into a prize draw to win a £100 Amazon voucher. Participants who wish to be entered into the prize draw will be asked for their email address so that the winner can be contacted. All email addresses will be stored separately to survey responses so that individual data cannot be traced to the participant.

What are the possible disadvantages or risks of taking part?

There are no known disadvantages or risks associated with completing the questionnaires included in this study. It is not expected that you should feel discomfort or distress during or after taking part in this study, but if you do, please inform the researcher using the contact details provided. Alternatively, you can contact the Samaritans on 116 123 to discuss feelings of discomfort or distress. This service offers a safe place for you to talk about difficulties at any time.

Will my taking part in the study be kept confidential?

All information that is collected during the course of the research will be kept strictly confidential. Participants in the study will not be identified in any report or publication at any future time. Socio-demographic data (e.g. age, gender, ethnicity, etc.) will only be collected for the purpose of calculating the average age, gender distribution and ethnic diversity of the group of participants. The nearest UK geographical area data will only be used to compare urban and rural areas.

From whom can I get more information?

Please do not hesitate to contact the researchers

Mr Christopher Bonner (christopher.bonner.2017@live.rhul.ac.uk)

Dr Lyn Ellett (lyn.ellett@rhul.ac.uk)

This study has been approved by the Psychology Department Ethics Committee of Royal Holloway, University of London.

Appendix 5: Consent Form

Experiences of Cycling

CONSENT FORM

1.	Have you read the information provided about the study?	Yes/No
2.	Are you over 18 years of age?	Yes/No
3.	Do you understand that you are free to withdraw from the study at any time, without giving a reason?	Yes/No
4.	Do you agree to take part in the study?	Yes/No

Please enter your date of birth here: DD/MM/YYYY

Please enter your memorable word here: _____

Appendix 6: Debrief Statement

Experiences of Cycling

DEBRIEF STATEMENT

Thank you for taking part in this study. The aim of the study is to find out more about how people feel when they are cycling and to understand the types of beliefs people hold about other road-users whilst cycling. In this study, you were asked to fill in four questionnaires, which asked you about your regular cycling habits, whether you feel threatened by other road-users whilst cycling and whether you find cycling stressful. We are particularly interested to know more about the extent to which cyclists feel threatened by other road-users whilst cycling.

If you would like to discuss any aspect of this research, or would like to receive a summary of the findings, please contact us using the details below:

christopher.bonner.2017@live.rhul.ac.uk

lyn.ellett@rhul.ac.uk