Social defeat predicts paranoid appraisals in people at high risk for psychosis

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Abstract

Background

The experience of social defeat may increase the risk of developing psychotic symptoms and psychotic disorders. We studied the relationship between social defeat and paranoid appraisal in people at high risk for psychosis in an experimental social environment created using Virtual Reality (VR).

Method

We recruited UHR (N=64) participants and healthy volunteers (N=43). Regression analysis was used to investigate which baseline measures predicted paranoid appraisals during the VR experience.

Results

At baseline, UHR subjects reported significantly higher levels of social defeat than controls (OR=.957, (CI) .941 – .973, p<.000). Following exposure to the VR social environment, the UHR group reported significantly more paranoid appraisals than the controls (p<.000). Within the UHR sample, paranoid appraisals were predicted by the level of social defeat at baseline, as well as by the severity of positive psychotic and disorganised symptoms.

Conclusion

In people who are at high risk of psychosis, a history of social defeat is associated with an increased likelihood of making paranoid appraisals of social interactions. This is consistent with the notion that social defeat increases the risk of developing psychosis.

1.1 Introduction

Only a minority of individuals at Ultra High Risk (UHR) for psychosis goes on to develop a psychotic disorder. Recent research suggests that this may reflect increased exposure to or an increased vulnerability to social stressors (or both) in this subgroup(Corcoran et al., 2003; Corcoran et al., 2012; Thompson et al., 2007). However, the mechanisms by which stress influences the onset of psychosis remain unknown. Previous studies have suggested that lower perceived social rank is associated with paranoid ideation(Atherton et al., in press; Freeman et al., 2014; Gilbert et al., 2005) and it has been proposed that the cumulative effect of prolonged exposure to social adversity and exclusion can lead to a state of 'social defeat', which may confer an increased risk of psychosis (Johnson et al., 2011; Selten, 2013; Selten and Cantor-Graae, 2005; Wicks et al., 2005). The concept of social defeat originates from animal research after it was observed that when an animal is put in a cage with another animal, they fight for dominance. If these fights occur over a prolonged period of time the defeated animal develops symptoms of stress and displays behavior similar to that expressed in depressed humans(Bjorkqvist, 2001). In humans the definition of social defeat is more complex than in animals, because humans also generate a perception or appraisal of their position in the world(Gilbert, 2000; Gilbert and Gerlsma, 1999; Taylor et al., 2011). Appraisal theory proposes that the emotional response and physiological activation that occur in a situation are dependent on the appraisal, or meaning, given to what just occurred and on whether we think we will be able to cope with what just happened(Lazarus, 1991). In line with this theoretical framework, cognitive models of psychosis propose that early stressful events may result in a cognitive vulnerability which influences the interpretation and appraisal of daily stressors, and increases the likelihood that anomalous experiences develop into a psychotic disorder(Bentall et al., 2007; Freeman et al., 2002; Garety et al., 2007; Garety et al., 2001; Morrison and Wells, 2003).

It is difficult to assess real time appraisals in social situations in life. However, research using virtual reality to study in vivo and in situ reactions to social situations allows the measurement of real-time physiological activation and the assessment of thoughts, mood and symptoms as they

occur(e.g.(Fornells-Ambrojo et al., 2013; Freeman et al., 2005; Freeman et al., 2003; Stinson et al., 2010; Valmaggia et al., 2007; Veling et al., 2014)).

The aim of the present study was to use Virtual Reality (VR) to contribute to examine the putative relationship between social defeat and paranoid appraisal in social situations in people at UHR for psychosis. Neither social defeat, or its relationship with experimentally-induced paranoid ideation have been studied in UHR subjects before. Our first hypothesis was that UHR individuals would report higher levels of social defeat than controls. Our second prediction was that when exposed to a virtual social environment, the UHR group would report more paranoid appraisals than controls. Finally, we tested the hypothesis that that within the UHR sample, the level of social defeat would predict the severity of paranoid ideation induced by the VR environment.

2.1 Design and Methods

This was a cross-sectional comparison study. UHR participants and Healthy Controls (HC) were compared to establish levels of social defeat and to study the relationship between social defeat and the appraisal of a VR social environment. Regression was then used to investigate which baseline measures predicted paranoid appraisals following the VR experience.

2.1.1 Participants

Participants meeting criteria for the UHR mental state for psychosis, aged 18-35, were recruited over a three year period from the Outreach and Support in South London (OASIS) service, a clinical service within the South London and Maudsley NHS Foundation Trust for people at heightened risk of developing psychosis(Fusar-Poli et al., 2012). UHR participants were identified according to PACE criteria(Yung et al., 1998) using the Comprehensive Assessment of At Risk Mental States CAARMS(Yung et al., 2005b).

HC participants were recruited from the same area of London through advertisements in the local press and the Mindsearch volunteers scheme at the Institute of Psychiatry, and were matched at group level

for age, ethnicity, and gender. A cut-off score of 18 or higher on the PQ was applied to control for the possible presence of at risk mental states in HC.

2.1.2 Measures

Socio-demographic information

Socio-demographic and psychosocial variables were recorded during a clinical assessment using the First Contact With OASIS Questionnaire, a non-standardised questionnaire modelled on the Census 2001 collection form(Fusar-Poli et al., 2010). Social class was estimated using information on parental occupation according to the National Readership Survey social grades classification, and for the purposes of statistical comparison, participants' social class was assigned to one of two broad categories considered to represent 'middle/upper class' and 'working class' social classes.

2.1.2.1 Comprehensive Assessment of the At Risk Mental State

The Comprehensive Assessment of the At Risk Mental State (CAARMS) is a semi structured interview designed to assess attenuated psychotic symptoms in people at UHR. The scale has a total of 27 items which can be clustered in seven subscales and has been shown to have excellent reliability and validity(Yung et al., 2005b). Three subgroups of UHR can be identified using the CAARMS: genetic risk (schizotypy or a first-degree relative with a psychotic disorder, both with recently marked social decline), attenuated psychotic symptoms (subclinical psychotic symptoms, not fulfilling the criteria of psychosis), and patients who have experienced a brief limited intermittent psychosis (full-blown psychosis of ≤1 week with spontaneous remission).

2.1.2.2 Prodromal Questionnaire

The Prodromal Questionnaire (PQ)(Loewy et al., 2005) is a self-report screening questionnaire assessing prodromal and psychotic symptoms which aims to identify individuals who may benefit from a clinical diagnostic interview. The 92 true/false items can be divided into four major subscales: (1) positive symptoms; (2) negative symptoms; (3) disorganized symptoms; and (4) general symptoms.

The PQ has good psychometric properties(Loewy et al., 2005).

2.1.2.3 Entrapment and Defeat Scales

The Social Entrapment and Defeat Scales are two 16 item scales measuring Entrapment and Defeat. Participants are asked to rate themselves a five point scale. An example of an Entrapment Item is: 'I am in a situation I feel trapped in'; 0=Not at all like me to 4=Extremely like me. An example item from the Defeat scale is: 'I feel that life has treated me like a punchbag'; 0=Never to 4=Always. Good psychometric properties for the Entrapment and Defeat Scales have been established(Gilbert and Allan, 1998). Previous research has suggested that the scales measure the same construct and should be used together(Taylor et al., 2009).

2.1.2.4 Social Comparison Scale

The Social Comparison Scale is an 11-item scale measuring how participants rate themselves from 1 to 10 in relation to others. For example, the scale asks 'In relation to others I generally feel: Incompetent 1 2 3 4 5 6 7 8 9 10 Competent'. The Social Comparison Scale has good psychometric properties (Allan, 1995).

2.1.2.5 *Social Defeat Composite Score*

The Entrapment and Defeat Scales and the Social Comparison Scale were added up to form a social defeat composite score. The internal consistency of the scale was high with a Cohen alpha of .878.

2.1.2.6 Depression Anxiety and Stress Scales

The Depression Anxiety and Stress Scales (DASS) is a 42-item measure of current (over the last week) states of depression, anxiety and stress(Lovibond and Lovibond, 1995). Each sub-scale consists of 14-items with a four point severity scale (ranging from 0=Did not apply to me to 3=Applied to me very much or most of the time); higher scores indicate greater distress.

2.1.2.7 Virtual Reality State Social Paranoia Scale

The State Social Paranoia Scale (SSPS)(Freeman et al., 2007) is a 20-item self report questionnaire examining paranoia, specifically paranoid ideation about virtual reality avatars. Each of the 20 items is rated on a five point scale from 1='Do not agree' to 5='Totally agree', with higher scores indicating higher endorsement. The SSPS asks about positive, neutral and paranoid appraisal of the VR environment. The SSPS examines recent paranoid thinking within a controlled social situation rather than assessing stable, trait paranoia. Based on the dataset, responses were grouped into four ordinal categories (corresponding to scores <10; 11–15; 16–25; >26).

2.1.3 Transition to psychosis

The onset of psychosis in the UHR group was defined using the criteria for transition to psychosis in the CAARMS(Yung et al., 2005a). A first episode diagnosis of psychosis was made by a member of the clinical team and confirmed by the team psychiatrist.

2.1.4 The Virtual Reality Environment

The virtual environment (developed by the Department of Computer Science at University College London) was a tube train ride modelled on the interior of a London Underground train carriage (see Figure 1), and was identical to that outlined in previous research(Freeman, 2008; Freeman et al., 2008). The environment was designed to be perceived as a neutral experience by a majority of the general population. The environment was displayed in colour via a lightweight headset; the display used was a Virtual Research VR 1280 (VR Systems, Aptos, California), with a resolution of 1280x1024 pixels, 60° diagonal field of view and a refresh rate of 60 Hz. Participants entered the train and were asked to remain on the train during the first stop, then disembark at the second stop. The journey time was approximately four minutes. Background noises were played using a Creative sound card, mimicking noises associated with a London Underground train ride (e.g., a 'mind the closing doors' announcement when the doors were closing, fragments of passenger conversation, background

noise of the moving train). Participants wore a headset and could move through the virtual environment by walking and whole body turning.

Prior to beginning the VR session, verbal instructions were provided by the researcher. Participants were asked to "Try and form an impression of what the people in the tube think about you and what you think about them". After the tube ride experience participants were asked to complete the post-VR measures.

Figure 1. Virtual Reality London Underground train carriage

2.1.5 Statistical Analyses

Analyses were conducted using SPSS v.21 (SPSS Inc., Chicago, USA). Demographic differences between groups were calculated using chi square or independent samples t-test. Group differences in baseline variables were explored using the Mann-Whitney U test, Kruskal –Wallis H, and independent samples t-test. Ordinal Logistic Regression (LOGIT) was applied to explore baseline of predictors of paranoid ideation in the VR environment.

3.1 Results

3.1.1 Participant Characteristics

Sixty-five UHR participants and 45 HCs were recruited for the study. One HC participant was excluded from subsequent analysis due to a score in excess of 18 on the PQ positive symptom

subscale. The VR equipment failed during the testing of one HC participant and one UHR participant, so their data were also excluded from the final analysis. The analysis thus involved data from 64 UHR and 43 HC participants.

The two groups were matched for age, gender, and ethnicity, as well as migration status. There were significant group differences in employment status, level of education and social class: unemployment was more common in UHR participants, whereas HC participants were more likely to have achieved a higher level of education and to have come from a 'middle class' background (see Table 1).

Table 1 Demographic Characteristics of the sample

	UHR N=64	HC N=43	Test
Age (years)	**Mean**		
	22.55 (Sd 4.01)	24.02 (Sd 4.01)	t = -1.857 (df 105) p=.066
Gender	**N (%)**	**N (%)**	
Male	38 (59.4)	20 (46.5)	χ^2=.1.714 (df 1) p=.190
Female	26 (40.6)	23 (53.5)	
Ethnicity			
Black	19 (29.7)	10 (23.3)	χ^2= .899 (df 3) p = .826
White British	23 (35.9)	16 (37.2)	
White Other	11 (17.2)	7 (16.3)	
Other	11 (17.2)	10 (23.3)	
Employment Status			
Employed	16 (25)	20 (46.5)	χ^2=27.297 (df 2) p<.001
Student	12 (18.8)	20 (46.5)	
Unemployed	36 (56.3)	3 (7)	
Level of Education			
Higher education or degree	8 (12.7)	14 (32.6)	χ^2=12.314 (df 3) p=.006
A-level or further education	33 (52.9)	25 (58.1)	
GCSE level or vocational	18 (28.6)	4 (9.3)[Fisher]	
No qualification	4 (6.3) [Fisher]	0 [Fisher]	
NRS Social grade			
Higher	19 (33.3)	25 (61)	χ^2=11.895 (df 2) p=.003
Middle	18 (31.6)	13 (31.7)	
Lower	20 (35.1)	3 (7.3)[Fisher]	

UHR: Ultra High Risk ; HC: healthy controls ; Sd: standard deviation.
NRS: National Readership Survey social grades classification

3.1.2 Between Group Comparisons

Levels of social defeat in UHR subjects

Consistent with our first hypothesis, the UHR group had higher levels of social defeat than the HC group (See table 2).

Table 2. Between group comparisons

		UHR N=64	HC N=43	Test	Sig
Composite score Social Defeat		135.42 (Sd 39.09)	78.30 (Sd 31.78)	Z=-6.321	p<.001
	Social Defeat	33.44 (Sd 14.16)	15.05 (Sd 10.48)	Z=-6.083	p<.001
	Social Entrapment	29.31 (Sd 17.31)	9.83 (Sd 11.10)	Z=-5.749	p<.001
	Social Comparison Scale (reversed scores)	71.19 (Sd 16.74)	53.42 (Sd 14.56)	Z=-5.097	p<.001
DASS					
	Depression	21.10 (Sd 12.13)	3.23 (Sd 4.08)	Z=-7.274	p<.001
	Anxiety	14.38 (Sd 10.32)	2.05 (Sd 2.48)	Z=-7.014	p<.001
	Stress	20.57 (Sd 12.06)	5.72 (Sd 5.64)	Z=-6.325	p<.001
Prodromal Questionnaire					
	Positive	17.97 (Sd 11.45)	4.51 (Sd 4.03)	Z=-6.287	p<.001
	Negative	10.33 (Sd 5.10)	2.37 (Sd 2.88)	Z=-6.921	p<.001
	Disorganised	6.47 (Sd 3.92)	2.42 (Sd 2.16)	Z=-5.236	p<.001
	General	7.14 (3.96)	1.93 (Sd 2.43)	Z=-6.260	p<.001

UHR: Ultra High Risk ; HC: Healthy Controls; Sd: standard deviation.

3.1.2.1 Depression, Anxiety, Stress an PQ at baseline

As would be expected, there were also significant group differences in baseline levels of depression, anxiety and stress as well as all the subscales of the PQ between UHR and HC (See table 2).

3.1.2.2 Paranoid appraisals in a VR social environment

In line with our second prediction, following exposure to the virtual environment, the UHR group reported more paranoid appraisals than HC; HC participants were more likely to interpret the virtual environment as positive, while there were no significant differences in neutral interpretations (see Table 3).

Table 3. Interpretation of VR environment, measured by the State Social Paranoia Scale

	ARMS N=64	**HC** N=43	**Test**	**Sig**
Positive Mean, SD	10.44 (4.52)	13.52 (4.15)	Z=-3.594	p<.001
Neutral Mean, SD	12.58 (4.48)	14.55 (4.91)	Z=-1.942	p=.052
Paranoid Mean, SD	20.33 (11.01)	11.69 (2.93)	Z=-4.382	p<.001

Sd: standard deviation.

3.1.3 Relationship between Social Defeat and Paranoid Ideation

Social Defeat was strongly associated with group status at baseline: the odds ratio was .957, with 95% confidence interval (CI) of .941 – .973, p<.000. We therefore decided to explore the relationship between paranoid ideation following VR only in the UHR group.

3.1.3.1 Possible confounders

To control for confounders a further analysis in the UHR group compared social defeat scores between potential confounders variables. No significant differences were found in social defeat scores between

different ethnic groups (χ^2(3) =1.259, p=.739); employment status (χ^2(2)=4.447, p= .108); level of education (χ^2(3)=4.567, p=.206); and NRS social grade (χ^2(2)=4.784, p.091).

3.1.3.2 CAARMS subgroups

The majority of UHR (N=48, 75%) participants met criteria UHR presented with attenuated psychotic symptoms; eleven 17%) met criteria for genetic risk with or without attenuated psychotic symptoms; and five (8%) UHR individuals experienced a brief limited intermittent psychosis (BLIP). The mean social defeat score for the attenuated psychotic symptoms group was 136 (Sd 36.2); for the genetic risk group it was 149 (Sd 46.6) and for the BLIP group it was 89 (Sd 18.8). This difference between the three groups in social defeat scores was statistically significant (*χ^2(2)*=7.364, p=.025).

3.1.3.3 Predictors of paranoid ideation

Depression, Anxiety, Stress, PQ subscales, and Social Defeat were considered together in logistic regression with Paranoid Ideation as the dependent variable.

As hypothesised Social Defeat was a significant predictor of Paranoid Ideation with an odds ratio of 1.023 (95% CI, 1.002 to 1.045), Wald χ^2((1) = 4.504, p = .034). Paranoid Ideation was also predicted by scores on the PQ Positive Subscale (OR of 1.240 (95% CI, 1.105 to 1.390), Wald χ^2((1) = 13.476, p < .000), and the PQ Disorganised Subscale (odds ratio of .588 (95% CI, .443 to .781), Wald χ^2(1) = 13.447, p < 000.

As illustrated in Table 4 baseline levels of Depression, Anxiety, and Stress and the PQ Negative and PQ General subscales were not significant predictors.

Table 4. Ordinal regression between paranoid ideation and baseline variables.

	OR	CI (95%)		Wald $\chi^2(1)$	Sign
Social Defeat	1.023	1.002	1.045	4.505	p=.034
DASS Depression	1.016	.932	1.108	.136	p=.713
DASS Anxiety	.976	.861	1.107	.141	p=.707
DASS Stress	1.080	.973	1.199	2.091	p=.148
PQ Positive	1.240	1.105	1.390	13.476	p<.001
PQ Negative	1.007	.837	1.212	.006	p=.939
PQ Disorganised	.588	.443	.781	13.447	p<.001
PQ General	.963	.753	1.232	.088	p=.767

OR: odd ratio, CI: confidence Intervals; PQ: Prodromal Questionnaire; DASS: Depression, Anxiety and Stress Scale

3.1.4 Transition to psychosis

Eight (12.5%) participants made a transition to psychosis in the two years following taking part to the study. No significant difference in social defeat scores was found between those who did and those who did not develop a psychotic episode z==1.155, p=.248).

Also no significant differences in paranoid ideation during the VR experiment were found between those who transitioned to a first episode of psychosis and those who did not (z=-1.361, p = .173).

4.1 Discussion

Our first hypothesis was confirmed: the UHR sample had higher levels of social defeat than HC participants. Also as predicted, following exposure to the virtual social environment, the UHR group were more likely to make paranoid appraisals of their experiences than the HC group. Finally, within the UHR group, the level of social defeat, was a significant predictor of paranoid ideations in the VR environment. The levels of positive attenuated and disorganised symptoms at baseline were also predictors of paranoid appraisals, but depression and anxiety were not.

Although previous studies have reported high rates of adverse life events in UHR individuals(Addington et al., 2013; Bechdolf et al., 2010; Falukozi and Addington, 2012; Thompson et al., 2009; Tikka et al., 2013) and abnormalities in the hypothalamic-pituitary-adrenal (HPA) axis, the main bodily response to stress(Aiello et al., 2012; Day et al., 2014; Walker et al., 2008), this study is the first to have shown that social defeat is more evident in UHR subjects than controls. The study also provided the first evidence that the level of social defeat predicted the extent to which UHR subjects made paranoid appraisals in a social setting. These findings are consistent with the proposal that social defeat is a key aetiological factor in the development of psychosis(Selten, 2013; Selten and Cantor-Graae, 2005). Social defeat is a particularly interesting risk factor, as research in experimental animals indicates that it is associated with neurobiological changes to brain dopamine function that are similar to those that occur in people at UHR for psychosis(Howes et al., 2009).

However, we also found that the severity of attenuated symptoms predicted VR-related paranoid ideation, and we cannot exclude the possibility that the association between social defeat and paranoid ideation was mediated by attenuated psychotic symptoms. The 2007 Adult Psychiatry Morbidly Survey, which surveyed 7,353 participants from the English general population 16 years and older, showed an association between prolonged exposure to victimisation and other social adversities and paranoia(Bentall et al., 2012). Moreover, lower perceived social rank has been found to be associated with paranoid ideation in healthy controls(Freeman et al., 2005; Gilbert et al., 2005) and in people with early psychosis(Allison et al., 2013), and paranoia in real life has been found to be associated with VR related paranoid ideation in VR in people with psychosis(Veling et al., 2014).

It is possible that the presence of attenuated positive symptoms increased emotional reactivity to the VR environment, which predisposed UHR subjects to paranoid interpretations. Previous research has shown a link between stress reactivity and momentary increases in positive symptoms when exposed to daily stressor(Myin-Germeys et al., 2005), which was specifically related to positive psychotic symptoms(Lataster et al., 2013). Further work exploring the interplay between these factors (social defeat, baseline positive symptoms, and 'in the moment' paranoid ideation during the VR), would

allow a better understanding of the elements that are critical to the processes underlying the experience of people at UHR in the VR environment. Unfortunately our sample size was not large enough to permit a mediation analysis to investigate the independence of positive symptoms and social defeat as predictors of paranoid ideation.

Attenuated disorganised symptoms showed a negative relationship with paranoid ideation in VR, in other words, lower levels of attenuated disorganised symptoms were associated with higher levels of paranoid ideation in the VR environment. Previous studies have reported that in people with schizophrenia, disorganised symptoms were associated with lower levels of mentalisation of other peoples beliefs and intentions, while patients with paranoid symptoms were more likely to attribute malevolent intentions to others(Frith, 2004; Montag et al., 2011) . Similar results were found in healthy participants with delusion proness(Fyfe et al., 2008) and schizotypy(Barrantes-Vidal et al., 2013a; Barrantes-Vidal et al., 2013b). It is possible that our result tap into the same process, however further research is needed to confirm this.

Contrary to our expectations depression and anxiety at baseline were not significant predictors of paranoid ideation in the VR environment. This could be due to the multi-collinearity between depression, anxiety, stress and paranoid ideation. Previous studies examining the link between depression and anxiety in UHR people found that they were not predictive of transition to psychosis(Fusar-Poli et al., 2014; Woods et al., 2009). An experience sampling study assessing predictors of momentary increases in paranoia found momentary anxiety but not depression to be predictive of paranoia(Thewissen et al., 2011). However, as depression and anxiety correlate with social defeat their shared variance could have prevented these variable to reach significance in the regression. Indeed, recent evidence shows that avoidance and escape coping styles are associated with a higher level of negative symptoms, depression and anxiety both in UHR(Lee et al., 2011; Masillo et al., 2012) and in adolescent form the general population(Lin et al., 2011).

An intriguing finding was the difference in social defeat score among different subgroups of UHR, with the genetic risk group showing higher levels of social defeat, followed by the attenuated psychotic

symptom group and the BLIP group reporting significantly lower scores. Caution is needed in interpreting this result as the BLIP group was small with only five participants. It has been suggested that BLIP may indicate that the individual is in the late prodromal phase and more likely to develop a psychotic episode(Nelson et al., 2011), however this does not explain while they would report lower scores of social defeat.

Social defeat at baseline and paranoid ideation in the VR environment did not distinguish those who went on to develop a psychotic episode, from those who did not. However it was not possible to investigate how social defeat and paranoid ideation relate to the risk of subsequently developing other mental health problems or long term functioning. However the sample size may not be large enough to provide sufficient power to identify differences between smaller subgroups defined by clinical and functional outcome.

Our findings add to the recent literature(Johnson et al., 2011; Taylor et al., 2011; Taylor et al., 2010) suggesting that the appraisal of defeat and entrapment contribute to the onset of psychopathology. Psychological models of psychosis suggest that adverse life events can influence the way we perceive ourselves, others, and the world around us. Alterations in appraisals have been found in people with schizophrenia(Garety et al., 2013; Peters et al., 2012) and in clinical and non-clinical individuals with psychotic experiences(Ward et al., 2014). It has been suggested that intervention approaches might focus on enhancing protective factors and resilience in coping with the consequences of social adversities(Gayer-Anderson and Morgan, 2013)**.**

4.2 Strengths and Limitations

A key strength of the study is that it explored the link between social defeat and Paranoid ideation in an ecologically valid and standardised social environment that could be could be manipulated experimentally. Nevertheless, the study had some limitations. There were significant differences between UHR and HC participants in social class, employment status, and level of education, and it is

possible that these factors contributed to the higher rate of social defeat in the UHR group. However a between group comparison in the UHR showed no significant differences with regard to these variables. Concerning the lack of prediction found for depression, anxiety and stress in predicting paranoid ideation in the VR environment, this should be interpreted with caution as the finding could be due to multi-coliinearity.. Finally, UHR individuals who present to early intervention teams may not be representative of all people at increased risk of developing psychosis, and the generalisability of results should be considered in in light of this.

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