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[10.1016/j.schres.2017.04.029](https://doi.org/10.1016/j.schres.2017.04.029)

Document Version

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Citation for published version (APA):

McDonnell, J., Stahl, D., Day, F., McGuire, P., & Valmaggia, L. R. (2018). Interpersonal sensitivity in those at clinical high risk for psychosis mediates the association between childhood bullying victimisation and paranoid ideation: A virtual reality study. *Schizophrenia Research*, 192, 89-95.
<https://doi.org/10.1016/j.schres.2017.04.029>

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Interpersonal sensitivity in those at clinical high risk for psychosis mediates the association between childhood bullying victimisation and paranoid ideation: a virtual reality study.

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Running Title: Interpersonal sensitivity, bullying victimisation and paranoia.

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Total words abstract: 200

Total words (excluding abstract, tables, figures and references): 2,987

Abstract

Background: Experience of bullying victimisation in childhood and heightened interpersonal sensitivity have been independently linked to the clinical high risk for psychosis.

Aim: To examine the potential mediating effect of interpersonal sensitivity in explaining the link between childhood bullying victimisation and real-time paranoid ideation in adult participants at clinical high risk for psychosis.

Method: In a cross-sectional study data were collected for 64 individuals at clinical high risk for psychosis. Measures included history of bullying victimisation, interpersonal sensitivity and state paranoid ideation following exposure to a social virtual reality environment. The virtual reality scenario was a London Underground journey.

Results: Path analysis indicated that interpersonal sensitivity fully explained the significant association between severe bullying victimisation in childhood and paranoid ideation in the clinical-high risk group. Based on AIC criteria the best model selected was the full mediation model: severe bullying → interpersonal sensitivity → state paranoid ideation. The results suggest that severity of bullying is more important than frequency of bullying in explaining state paranoid ideation.

Conclusions: The significant role played by interpersonal sensitivity in the association between being bullied in childhood and paranoid ideation in the clinical high risk group suggests that this could become a target for intervention.

Keywords: bullying victimisation; paranoia; clinical high risk; interpersonal sensitivity; virtual reality; psychosis.

1 Introduction

Borne of research suggesting that there may be a specificity in the relationship between early adverse events and later development of psychotic symptoms (Bentall et al., 2012; Campbell and Morrison, 2007; Lopes, 2013), interest in a specific link between bullying victimisation and paranoid ideation has emerged (Valmaggia et al., 2015). Bullying victimisation has been linked with increased risk of psychotic experiences in clinical and non-clinical populations (van Dam et al., 2012) and high rates of bullying victimisation have been reported in people at Clinical High Risk (CHR) for psychosis (Addington et al., 2013; Stowkowy et al., 2016; Valmaggia et al., 2015) and in people with established psychosis (Trotta et al., 2013). The negative effects of bullying victimisation on mental health have been reported to exist independent of the occurrence of other adverse experiences in childhood such as sexual, physical and emotional abuse (Fisher et al., 2012; Lereya et al., 2015; Sansen et al., 2014). Childhood bullying victimisation has been linked to lower self-esteem and heightened interpersonal sensitivity in adult life (Butler et al., 2007). Interpersonal sensitivity describes a personality trait characterised by “*an undue and excessive awareness of, and sensitivity to, the behaviour and feelings of others... particularly to perceived or actual situations of criticism or rejection...*” (p.342 (Boyce and Parker, 1989). Interpersonal sensitivity has been implicated in the formation of paranoid ideation (Bell and Freeman, 2014; Freeman et al., 2005); and it was found to be heightened in those at CHR for psychosis (Masillo et al., 2012; Masillo et al., 2016). The core characteristics of paranoid ideation are its interpersonal nature and unfoundedness (Freeman and Garety, 2004). Adequate measurement should thus ensure that paranoid ideation is not an appropriate response to a genuinely hostile environment, or absent of an interpersonal context. This has been termed the ‘paranoia problem’ (Freeman, 2008) and cannot always be circumvented by traditional testing paradigms or by measuring trait or baseline paranoia. In recent years, a number of studies have emerged implementing Virtual Reality (VR) technology which allows for the study of paranoid ideation, elicited in laboratory settings, in real-time, using computer programmed characters (avatars) and life like social environments (Valmaggia et al.,

2016). The aim of the current study was to explore the potential mediating role played by interpersonal sensitivity in the association between self-reported experiences of childhood bullying victimisation and the occurrence of state paranoid ideation in a VR social environment.

2 Methods

2.1 Design

This study employed a cross-sectional design.

2.2 Sample

Participants (N=65) were recruited the Outreach and Support in South London service (OASIS) which offers assessment and treatment to people at CHR for developing psychosis (Fusar-Poli et al., 2013). CHR individuals meet at least one of three criteria; (i) psychotic experiences of sub-threshold severity, (ii) psychotic experiences of psychotic intensity and frequency, which last less than one week and resolve without treatment or (iii) Functional impairment in the context of genetic risk or schizotypal personality disorder (Yung et al., 2005). The majority (80%) of those classified to be at CHR meet criterim (i) (Fusar-Poli et al., 2016)

One participant was excluded as a result of equipment malfunction leaving a total of 64 CHR participants.

2.3 Procedure

2.3.1 Virtual Reality Environment

The VR scenario was a London Underground tube train ride (developed by the Department of Computer Science at University College London), used in previous studies (Valmaggia et al., 2016).

The London Underground virtual environment was displayed using an immersive VR head mounted display with build-in headphones (VR 1280, Virtual Research Systems, Aptos, California). Participants boarded the Underground carriage and were asked to remain on board for two stops (approximately four minutes). While on board, participants could walk and move around the carriage, which was populated with avatars representing passengers of different ages, gender and ethnicity. The noise of the moving carriage, as well as background chatting and laughter could be heard through the headphones. Avatars did not speak to the participant, but if a participant looked at an avatar, they would look at the participant for a few seconds.

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*”. Participants were asked to complete the State Social Paranoia Scale after they left the virtual reality environment.

-- Figure 1 – VR Tube-

2.4 Measures

2.4.1 Socio-demographic information

Socio-demographic information was collected using a study-specific self-report questionnaire. This included gender, age, ethnicity, level of education, years in education, country of birth, migrant status and social class.

2.4.2 Bullying victimization.

Experiences of bullying victimisation in childhood and adolescence were recorded using the Retrospective Bullying Questionnaire (RBQ) (Schafer et al., 2004). Experiences during primary school and secondary school are assessed separately. The questions ask about verbal, physical, and indirect forms of bullying; and focus on the severity and frequency of the bullying experience. Frequency is assessed by asking the participant how often the bullying experienced occurred (on a

five point scale never to constantly); severity is assessed by asking the participant how serious they experienced the bullying attacks to be (not at all to extremely serious).

Following recommendations (Volk et al., 2014) we differentiated between severity and frequency. The highest frequency and highest severity scores were isolated and used for each participant irrespective of bullying type. Frequency and severity were thus each treated as separate predictor variables.

The RBQ has been shown to demonstrate a good degree of 2-week test-retest reliability (primary school scale $r=0.88$, secondary school scale $r=0.87$, trauma $r=0.77$) (Schafer et al., 2004).

2.4.3 Interpersonal Sensitivity.

Levels of interpersonal sensitivity were recorded for each participant using the Interpersonal Sensitivity Scale (IPSM)(Boyce and Parker, 1989). This 36-item self-report scale comprises five sub-scales: ‘Interpersonal Awareness’(e.g. of an item in this scale “I worry about the effect I have on other people”); ‘Need For Approval’(e.g. of an item in this scale “I feel secure when I’m in a close relationship”); ‘Separation Anxiety’ (e.g. of an item in this scale “I feel insecure when I say goodbye to people); ‘Timidity’ (e.g. of an item in this scale :I find it hard to get angry with people”) and ‘Fragile Inner Self’ (e.g. of an item in this scale: “If others knew the real me they would not like me”). A total score for the measure may also be generated. The IPSM has good psychometric properties (internal consistency $\alpha = 0.85$; 6-week test–retest reliability $r = .70$) (Boyce and Parker, 1989).

2.4.4 State Paranoid Ideation.

Paranoid ideation about the VR experience was measured using the 10-item State Social Paranoia Scale (SSPS). Participants are asked to rate how much they agree with each of the items when thinking about the virtual reality situation they just experienced. Example of items are: “Someone was hostile towards me”; “Someone was trying to make me distressed”. Each item is scored on a 5-point scale (from ‘do not agree’ to ‘totally agree’). Higher scores indicate greater levels of paranoid thinking. The SSPS has displayed excellent internal reliability ($\alpha=0.91$), good test-retest reliability

($r = 0.73$) and clear convergent validity as assessed by both independent interviewer ratings and self-report measures (Freeman et al., 2007).

2.5 *Statistical Analyses*

Data were analyzed using SPSS v22.0 (IBM-Corporation, 2013) and Mplus v7.3 (Muthén and Muthén, 2011).

Path analysis was conducted using Mplus to assess possible mediating effects of interpersonal sensitivity in the relationship between childhood bullying and state paranoia.

Mediation is a hypothesised causal chain in which one independent variable X (Severity of Bullying in Figure 2) affects a mediating variable M (Interpersonal Sensitivity), which in turn affects the outcome variable Y (Paranoid Ideation), for more details please see (Baron and Kenny, 1986; MacKinnon et al., 2007). If the intervening mediator M explains the correlation between X and Y, we have a full mediational model. If X still has an effect on Y after including the mediator M in the model, the model is consistent with partial mediation. The total effect of X on Y can therefore be divided in an indirect effect via the mediator M and a direct effect of X on Y.

Path analysis allows fitting a proposed model simultaneously and is used to assess if a set of multivariate, observational data ‘fits’ well with an assumed causal model in which variables are organised based on pre-existing theory, a priori assumptions and research (Pedhazur, 1982). The hypothesized causal model is represented using a path diagram.

For each of the two predictor variables (frequency and severity of bullying), we compared full and partial mediation processes for the two proposed pathways: frequent bullying → interpersonal sensitivity → state paranoia (models a and b, table 3); and severe bullying → interpersonal sensitivity → state paranoia (models c and d). We compared those four hypothesized four theoretical models with a full (model e) and partial (model f) mediation model by which both variables are mediated by interpersonal sensitivity and a simple regression model with both variables predicting state paranoia without an mediator (model g).

2.5.1 *Model comparison and selection*

We compared the evidence of support for each of the six models using an information theoretic approach by comparing Akaike's Information Criterion (AIC) (Burnham and Anderson, 2002; Stahl et al., 2014). AIC is a measure of the goodness of fit of a model, which includes a penalty for the number of variables estimated and attempts to select a conservative model that best explains the data with a minimum number of estimated parameters. AIC chooses amongst several competing models the model that predicts best in a new data set. The best model is identified by the lowest AIC. Unlike model selection based on null hypothesis testing, AIC model selection allows an assessment of the quality of other models by assessing AIC-related measures (ΔAIC_i , Akaike weights and evidence ratio). ΔAIC_i is the difference in AIC between model i and the best model. As a rule of thumb, a ΔAIC_i value > 4 suggests that model i has substantially less support and a $\Delta AIC_i > 10$ that model i can be dismissed (Burnham and Anderson, 2002). An Akaike weight can be interpreted as an estimate of the probability that model i is the best model among the candidate set of models. The evidence ratio for a given model i is the ratio of the weights of the best model and of model i .

Path model assessments compare the fit of the predicted covariances matrix relative to the observed covariance matrix. For AIC model comparison we can compare non-nested models with the same set of observed variables. We therefore used the full set of observed variables in the analyses and fixed the paths (covariances) that were not of interest to zero. For example, if we want to determine the AIC for the path model frequent bullying \rightarrow interpersonal sensitivity \rightarrow state paranoia we need to include the variables frequency in the model but constrain all of its paths to zero.

2.5.2 *Model fit assessment*

The models' goodness of fit was further investigated with the χ^2 goodness-of-fit test, and assessing the Comparative Fit Index (CFI), the root mean square error of approximation (RMSEA) and

standardized root mean square residual (sRMR)(Hooper et al., 2008). The good fit of a target model is supported if the χ^2 goodness-of-fit test is not significant, the RMSEA value is < 0.05 (adequate fit: < 0.08), the CFI is > 0.95 (adequate fit: > 0.90) and sRMR < 0.05 (adequate fit < 0.08) (Hu and Bentler, 1999; Kline, 2011) .

Direct, indirect and total effects of the selected best models are presented with unstandardized and standardised regression coefficients. Bias-corrected bootstrapping was used to establish confidence intervals and statistical significance tests. The process was followed separately for primary school data and secondary school data.

3 Results

3.1 Socio-demographic Variables

Age, gender, ethnicity, years in education, employment, and migrant status are reported in Table 1.

-- Table 1 --

3.2 Bullying Victimization, Interpersonal Sensitivity and Paranoid Ideation

Levels of interpersonal sensitivity including the score for each subscale are reported in Table 2.

Bullying victimisation in this analysis was classified as frequent, moderate to severe bullying of either verbal, physical or relational types (see Table 2).

Table 2 also reports the results regarding paranoid ideation experienced in the VR environment.

-- Table 2 --

3.3 Primary School Bullying Victimization

Table 3 reports AIC model selection analyses results for primary schools. Based on AIC criteria the best model selected was the full mediation model “severe bullying \rightarrow interpersonal sensitivity \rightarrow

state paranoia” (model C). However, two other models were only slightly less likely to be the best model: the same mediation model with a direct effect (Model D, 1.43 less likely) and the full mediation model with both predictors (Model E, 1.83 less likely). Support for full or partial “frequent bullying → interpersonal sensitivity → state paranoia” (models A and B) is small with an evidence ratio of 5.5 and 6.2. There is little support for the regression model (model G). Mediation models including “Severe bullying” had a combined AIC weight of 0.9 which provides further support that “severity” in primary school is more important than “frequency” in explaining the degree of state paranoia”. The partial mediation model is presented as a path diagram with standardised regression coefficients. Interpersonal sensitivity significantly predicted paranoid ideation, and severe bullying significantly predicted interpersonal sensitivity. However, severe bullying did not significantly, directly relate to paranoid ideation but explained in our sample still about 50% of the total effect. Details about indirect, direct and total effects are presented in table 4.

--Table 3 and Table 4 --

3.4 Secondary School Bullying Victimization

The same seven models as in in the analyses of Primary School Bullying victimisation were assessed using information criteria (Table 3). Model selection reveals a similar picture although evidence for severity was less strong. Similar to the primary school analyses, AIC selected the best model full mediation model “severe bullying → interpersonal sensitivity → state paranoia” (model C). Three other models were only slightly less likely to be the best model: the same model with a direct effect (Model D, 1.2 less likely), the full mediation model with both predictors (Model E, 2.43 less likely) and the full mediation model (model A, 2.51 less likely).

Mediation models including the mediation path “severe bullying→interpersonal sensitivity→state paranoia” had a combined AIC weight of 0.77 compared to 0.39 for models with the path “frequent

bullying→interpersonal sensitivity→state paranoia” provides further support that severity of bullying is more important than frequency of bullying in explaining state paranoia.

Figure 2b shows the standardised parameter estimates for the partial mediation model. Interpersonal sensitivity significantly predicted persecutory ideation (standardised $\beta = 0.537$, $p < .001$), and severe bullying significantly predicted interpersonal sensitivity (standardised $\beta = 0.334$, $p = 0.013$). The indirect effect tested using bootstrapped standard errors was also significant (standardised $\beta = 0.179$, $p=0.023$). As in the previous analysis, severe bullying did not significantly, directly relate to persecutory ideation but interestingly was negative (standardised $\beta = -0.149$, $p =0.254$). This negative suppressor effect explains why the total effect of severity on state paranoia was very small and not significant (standardised $\beta = 0.03$, $p =0.815$).

The fit of this model was found to be good, indicated by CFI, RMSEA and SRMR values (1, <0.001 and 0.009 respectively) and a non-significant chi square test of model fit ($\chi^2(2)=0.272$, $p=0.87$)

-- *Figures 2a and 2b*--

4 Discussion

To our knowledge this is the first study in a CHR group to examine the association between childhood bullying victimisation and state paranoid ideation with regards to the construct of interpersonal sensitivity, and its possible mediating effect. Further, it is one of the first studies to treat bullying victimisation according to its separate dimensions (frequency and severity) and to implement data modelling techniques to investigate the relationships within this particular variable set.

As previously reported (Valmaggia et al., 2015), CHR participants reported high rates of bullying victimisation in school and high levels of paranoid ideation in the virtual environment. Data provided best fit a mediation model in which the severity of bullying experience in primary school significantly predicted interpersonal sensitivity, which in turn significantly predicted state paranoid ideation. The direct effect of primary school bullying victimisation severity on state paranoid ideation was weak and not statistically significant. Similar results were found when modelling data pertaining to experience of secondary school bullying victimisation. While causality cannot be statistically supported due to limitations of the cross-sectional design, theoretically it is suggested that severe bullying victimisation may contribute to the development of interpersonal sensitivity, which enhances the risk of experiencing paranoid ideation later in life. However, the study was unable to address the ‘reverse causality hypothesis’ (van Winkel et al., 2013) inasmuch that psychological correlates, or incipient psychotic symptoms, may have been factors predisposing individuals to being bullied in the first place (Gillespie et al., 2001), specifically due to its contribution to poor interpersonal relationships. Longitudinal data are required to determine the direction of causality with greater confidence (Stapinski et al., 2015).

Whilst severity of bullying victimisation did significantly associate with state paranoid ideation and interpersonal sensitivity, there was little support that frequency of bullying victimisation was associated with either. Reasons for this are tentative but it is possible that the psychological mechanisms which underpin the experience of severe bullying victimisation may share similarities with those for ‘potentially traumatic events’ whereby the magnitude of the event may prompt an affective and behavioural response which galvanises particular negative beliefs and/or schemas about self and/or others which consequently persist over time (Campbell and Morrison, 2007). This may indicate a potential benefit of incorporating assessment and treatment of adverse life events like severe bullying victimisation into therapeutic intervention.

4.1 Limitations

The study's cross-sectional design and use of self-report measures limits the ability to assert causality but also may have incurred potential biases. Nonetheless, a number of studies with longitudinal designs have found evidence to support causality in the association between bullying victimisation and paranoid ideation, as well as the reliability of self-report measures of bullying victimisation, although these are not without caveats (Shakoor et al., 2015; Wolke et al., 2014). As mentioned above, 'reverse causality hypothesis' can not be excluded and the standard mediation model makes the unverifiable assumption that there is no unmeasured confounder between predictor, mediator and outcome (Emsley et al., 2010).

Separating of frequency and severity items of the RBQ is novel and is one of the first examples of treating a victimisation event such as bullying victimisation as dimensional. While this approach may benefit further research into the specificities of dose-response relationships between trauma and symptoms, there is a current lack of psychometric validation of using these specific items in isolation.

Our findings suggest that underlying interpersonal sensitivities are a component of the formation of state paranoid ideation triggered by the virtual reality environment, however we did not examine trait paranoia and it is worth mentioning that previous studies have proposed that interpersonal sensitivity, mistrust, ideas of reference and ideas of persecutions are components of the hierarchy of trait paranoia (Bebbington et al., 2013; Freeman et al., 2005).

A final significant limitation of the current study is lack of power to investigate moderating effects which was demonstrated by explorative analyses which can be found in the online supplementary material. It is clear that not all individuals who are severely bullied go on to develop interpersonal sensitivity and/or state paranoid ideation. Investigation into those factors which exert a protective or moderation effect is required.

4.2 Conclusions

Findings from the current study are consistent with a theoretical model proposing that interpersonal sensitivity mediates the association between severe childhood bullying victimisation and paranoid ideation in those at CHR. Acknowledging and addressing a hypersensitivity to interpersonal rejection may ameliorate paranoid ideation in individuals at CHR.

Acknowledgements

We would like to thank the participants and OASIS. We also acknowledge Prof Paul Chadwick for his advice regarding this study, Dr Angus Antley, Prof Daniel Freeman and Prof Mel Slater for their guidance and recommendations regarding the VR Lab.

Dr Valmaggia was supported by the Brain and Behaviour Research Foundation (NARSAD Young Investigator Award) and the Psychiatry Research Trust (Peggy Pollack Research Fellowship).

We also would like to express our gratitude to the National Institute for Health Research (NIHR) Biomedical Research Centre for Mental Health at South London and Maudsley NHS Foundation Trust and King's College London. The views expressed are those of the author(s) and not necessarily those of the NHS, the NIHR or the Department of Health.

Conflict of Interest

None.

Ethical Approval:

Research ethics approval was obtained from the National Research Ethics Service (Ethics REC number 08/H0722/45).

Funding:

Brain and Behaviour Research Foundation (NARSAD Young Investigator Award) and Psychiatry Research Trust (Peggy Pollack Research Fellowship). awarded to Dr Valmaggia.

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Figure 1. Virtual Reality London Underground train carriage

Figure 2a) Primary schools: Partial mediation model: Severity of bullying and Interpersonal sensitivity mediate paranoid ideation in VR.

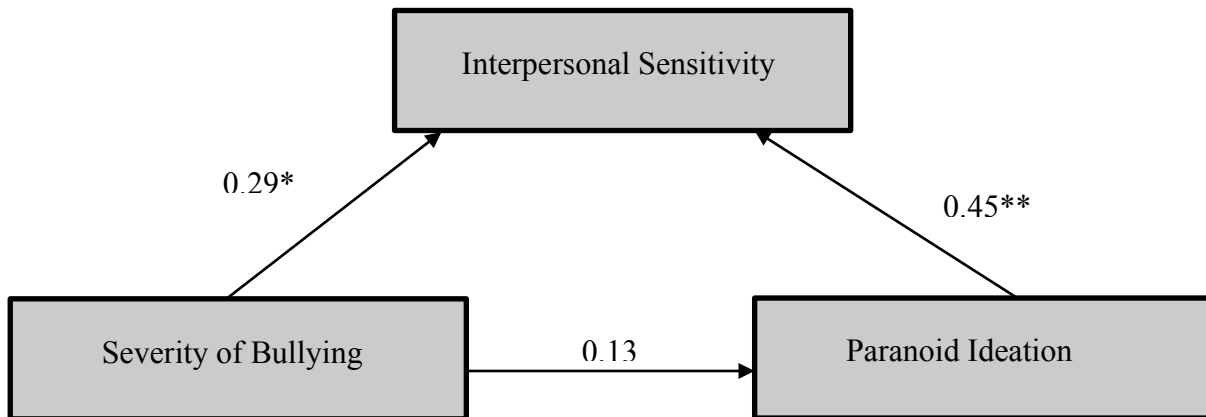
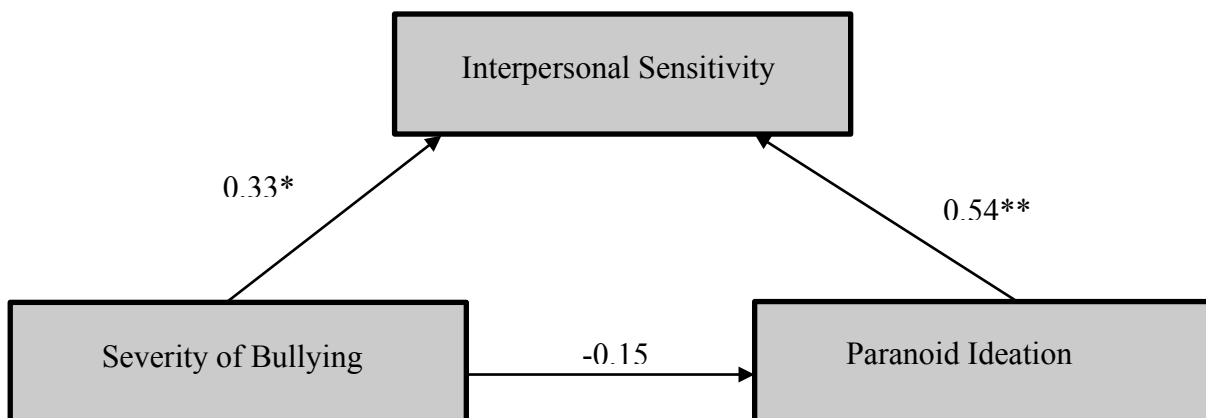


Figure 2b) Secondary schools: Partial mediation model: Severity of bullying and Interpersonal sensitivity mediate paranoid ideation in VR



Tables

Table 1. Socio-demographic characteristics

		N=64
Age	<i>Mean (SD)</i>	22.5 (4.0)
Gender n (%)	<i>Male</i>	38 (59.4%)
	<i>Female</i>	26 (40.6%)
Ethnicity n (%)	<i>Black</i>	19 (29.7%)
	<i>White British</i>	23 (35.9%)
	<i>White Other</i>	11 (17.2%)
	<i>Other</i>	11 (17.2%)
Country of birth n (%)	<i>UK</i>	54 (84.4%) ^a
	<i>non-UK</i>	10 (15.6%) ^a
Migrant status n (%)	<i>non-migrant</i>	41 (64.1%)
	<i>1st-gen migrant</i>	9 (14.1%)
	<i>2nd-gen migrant</i>	14 (21.9%)
Education	<i>Mean years (SD)</i>	13.25 (2.3)
Social Economic Status n (%)	<i>Middle class</i>	29 (45.3%)
	<i>Working class</i>	28 (43.8%)
	<i>Unknown</i>	7 (10.9%)
Occupation n (%)	<i>Unemployed</i>	36 (56.3%)
	<i>Student</i>	12 (18.8%)
	<i>Employed</i>	16 (25.0%)

Table 2. Assessment outcomes**Scores on the Interpersonal Sensitivity Measure**

			N=61
Interpersonal sensitivity	Interpersonal awareness	Mean (SD)	21.44 (4.8)
	Need for approval	Mean (SD)	23.97 (4.2)
	Separation anxiety	Median (IQR)	24 (9.0)
	Timidity	Mean (SD)	21.1 (4.8)
	Fragile inner self	Mean (SD)	12.36 (4.3)
	Total	Mean (SD)	101.52 (17.6)

Bullying status

			N=62
Retrospective Bullying Questionnaire	Victim (PS)	n (%)	25 (40.3%)
	Victim (SS)	n (%)	33 (53.2%)
	Victim (Stable)±	n (%)	17 (41.5%)
	Victim (Ever)	n (%)	41 (66.1%)

PS = Primary school, SS= Secondary school, Stable = Both primary and secondary school
 ± Of those bullied *

Scores on the State Social Paranoia Scale (SSPS) after VR

			N=64
SSPS	SSPS (Positive)	Mean (SD)	10.44 (4.5)
	SSPS (Neutral)	Mean (SD)	12.58 (5.5)
	SSPS (Paranoid Ideation)	Median (IQR)	15.5 (17.5)

Table 3. Mediation analysis of primary school and secondary bullying with state paranoid ideation via IPS. AIC and AIC related measures are presented for seven different path models fro primary and secondary schools

Model	Path model	Mediation model	a) Primary school				b) Secondary school			
			AIC	ΔAIC_i	Akaike Weights	Evidence ratio	AIC	ΔAIC_i	Akaike Weights	Evidence ratio
A	FB→IPS→PI	Full	1366.02	3.43	0.07	5.54	1365.57	1.85	0.13	2.51
B	FB→IPS→PI	Partial	1367.62	5.03	0.03	12.32	1366.24	2.52	0.09	3.51
C	SB→IPS→PI	Full	1362.59	0	0.37	1	1363.72	0	0.33	1
D	SB→IPS→PI	Partial	1363.31	0.72	0.26	1.43	1364.1	0.38	0.27	1.2
E	SB&FB→IPS→PI	Full	1363.8	1.21	0.2	1.83	1365.54	1.82	0.13	2.48
F	SB&FB→IPS→PI	Partial	1366.25	3.66	0.06	6.23	1367.83	4.1	0.04	7.76
G	SB&FB→PI	None	1379.73	17.14	0	5261.01	1384.3	20.58	0	29352

AIC= Akaike's Information Criterion; ΔAIC_i = the difference in AIC between model *i* and the best model; FB= frequency of bullying; SB=severity of bullying; IPS=interpersonal sensitivity; PI=paranoid ideation. Bold indicates the best model.

Table 4. Standardised effects, unstandardised regression (beta) coefficients (95% Confidence Intervals) and robust p-values for significance tests for direct, indirect and total (direct + indirect) effects for the mediation models for best model : SB→ IPS→PI, partial mediation)

	Primary Schools			Secondary Schools		
	Standardized effect	β (95% CI)	p-value	Standardized Effect	β (95% CI)	p-value
Direct effects						
SB→IPS	0.289	3.48 (0.4 - 6.5)	0.025	0.334	4.425 (0.9 - 7.9)	0.013
IPS→PI	0.449	0.29 (0.2 - 0.4)	<0.001	0.537	0.343 (0.2 - 0.5)	<0.001
SB→PI	0.131	1.01 (-0.6 - 2.5)	0.21	-0.149	-1.259 (-3.4 - 0.9)	0.25
Indirect effect						
SB→PI	0.129	1.00 (0.2 - 2.2)	0.047	0.179	1.517 (0.4 - 3.1)	0.023
Total effect						
SB→PI	0.260	2.00 (0.3, 3.6)	0.018	0.03	0.258 (-2, 2.3)	0.82

β= unstandardised beta coefficient; CI= 95% confidence interval, bootstrapped; IPS= interpersonal sensitivity; SB,=severity of bullying; PI=paranoid ideation.

Supplementary material

We assessed the moderating effect of IPS on the relationship between severity of bullying and SSPS in primary and secondary schools using a regression model with IPS and severity of bullying and the interaction between IPS and bullying as independent variables and SSPS as dependent variable. For both school types the interaction between severity of bullying and SSPS was not significant. Confidence intervals of the standardized regression coefficients were extremely large which does not allow any further conclusions about the possible effects. In both school types IPS was positively related with SSPS while the effect of severity of bullying was not significant.

Primary school			
Independent variables	st. b (95% C.I.)	t	P
IPS	0.399 (-0.015 to 0.813)	1.893	0.058
Severity of Bullying	-0.049 (95% C.I. -1.327 to 1.229)	-0.074	0.941
Interaction IPS and severity	0.202 (-1.217 to 1.621)	0.279	0.780
Secondary School			
Independent variables			
IPS	0.589 (0.097 to 1.081)	2.344	0.019
Severity of Bullying	-0.013 (-1.218 to 1.192)	-0.021	0.984
Interaction IPS and severity	-0.163 (-1.582 to 1.256)	-0.226	0.821

Supplementary Table: Results of regression analyses with SSPS as outcome variable for a) primary school and b) secondary schools. Presented are standardized regression coefficient (95% confidence intervals) with t value and p value. IPS: Interpersonal Sensitivity