

Paranoia and post-traumatic stress disorder in the months after a physical assault: a longitudinal study examining shared and differential predictors

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Background. Being physically assaulted is known to increase the risk of the occurrence of post-traumatic stress disorder (PTSD) symptoms but it may also skew judgements about the intentions of other people. The objectives of the study were to assess paranoia and PTSD after an assault and to test whether theory-derived cognitive factors predicted the persistence of these problems.

Method. At 4 weeks after hospital attendance due to an assault, 106 people were assessed on multiple symptom measures (including virtual reality) and cognitive factors from models of paranoia and PTSD. The symptom measures were repeated 3 and 6 months later.

Results. Factor analysis indicated that paranoia and PTSD were distinct experiences, though positively correlated. At 4 weeks, 33% of participants met diagnostic criteria for PTSD, falling to 16% at follow-up. Of the group at the first assessment, 80% reported that since the assault they were excessively fearful of other people, which over time fell to 66%. Almost all the cognitive factors (including information-processing style during the trauma, mental defeat, qualities of unwanted memories, self-blame, negative thoughts about self, worry, safety behaviours, anomalous internal experiences and cognitive inflexibility) predicted later paranoia and PTSD, but there was little evidence of differential prediction.

Conclusions. Paranoia after an assault may be common and distinguishable from PTSD but predicted by a strikingly similar range of factors.

Received 8 November 2012; Revised 16 January 2013; Accepted 31 January 2013; First published online 27 March 2013

Key words: Anxiety, delusions, paranoia, psychosis, PTSD.

Introduction

What are the potential psychological consequences of being physically assaulted? It is well recognized that a significant minority of people develop post-traumatic stress disorder (PTSD) (e.g. Kessler *et al.* 1995; Kleim *et al.* 2007; Darves-Bornoz *et al.* 2008). Less discussed is that an assault is likely to raise fears about the intentions of other people. Thoughts that other people are trying to harm you that are exaggerated or unfounded can be considered

paranoid (Freeman & Garety, 2000). Thus, being assaulted may understandably skew thinking in a paranoid direction. Consistent with this view, a number of cross-sectional studies in recent years have shown associations between being victimized, PTSD symptoms, and current persecutory ideation (e.g. Campbell & Morrison, 2007; Gracie *et al.* 2007). For example, an analysis of a national epidemiological survey found very strong associations of a probable diagnosis of PTSD with paranoid thinking, with an odds ratio of 3.5 for mild paranoia and an odds ratio of 27 for strong paranoia (Freeman *et al.* 2011). In this report we investigate for the first time: the occurrence of paranoia and PTSD longitudinally in the months immediately after an assault; how distinguishable paranoia is from PTSD; and, drawing

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upon cognitive models, the factors that lead each to persist over time.

Understanding PTSD

One perspective on understanding negative reactions to traumatic events such as an assault is provided by the PTSD model of Ehlers & Clark (2000). The central idea is that PTSD occurs when a trauma leads to a sense of current threat. The feelings of threat are hypothesized to arise from a combination of a poorly elaborated and uncontextualized emotional memory of the event that is easily triggered into consciousness and a range of related catastrophizing appraisals about the self or the world. Crucially, the way that the trauma is processed at the time – in particular, a reliance on data-driven processing (focusing on sensory impressions) – contributes to the likelihood of intrusive memories. The intrusive memories lead to appraisals of ongoing external or internal threat. Mental defeat at the time of the assault, the perceived loss of psychological autonomy, can set the tone of the future negative thoughts about the self in relation to the trauma. Importantly, the person with persistent PTSD tries to control or minimize the sense of threat, but with unhelpful strategies. For example, avoidance and other safety behaviours prevent the person learning that their catastrophic appraisals are inaccurate. Rumination keeps the trauma and unhelpful appraisals in the person's mind and prevents them from moving on with their lives, and attempts to suppress upsetting memories of the trauma lead to them bouncing back.

Understanding paranoia

The paranoia spectrum that we have been studying comprises ideas of reference and of persecution. Our theoretical understanding has been influenced by models of anxiety disorders, since cognitions of current threat are clearly central to both experiences (Freeman *et al.* 2002). Affective processes, especially anxiety, worry, negative beliefs about the self and interpersonal sensitivity, are given a central role in this paranoia model. It is hypothesized that the individual experiences a changed (and confusing) anomalous internal state (e.g. perceptual disturbances occur). This may be triggered by, for example, life events, difficulties with sleep, or illicit drugs. In essence, the person feels different and this needs an explanation. Importantly, a negative affective state makes a threatening interpretation likely: anxiety leads to the anticipation of danger; negative beliefs about the self and interpersonal sensitivity highlight the person's vulnerability to harm; and engagement in worry results in more negative, implausible ideas. The fears reach

a delusional level of conviction when reasoning biases, such as belief inflexibility and jumping to conclusions, are present. Many of the same processes contribute to the persistence of the paranoid fears. These include, just as for anxiety disorders, maladaptive attempts to reduce the threat such as safety behaviours, thought suppression, worry and rumination. For example, individuals with persecutory delusions may not travel on a bus for fear of attack and therefore fail to learn that they were safer than they had realized.

Current study

One method used to test models of PTSD has been the longitudinal investigation of individuals in the months after a trauma (e.g. Dunmore *et al.* 2001; Halligan *et al.* 2003; Kleim & Ehlers, 2008). We used this method to study both paranoia and PTSD after individuals had attended hospital following injuries received in an assault. The individuals were also initially assessed for factors predictive of PTSD from the model of Ehlers & Clark (2000) and factors predictive of paranoia from the model of Freeman *et al.* (2002) and then followed up over the following 6 months. We were mindful of what has been termed 'the paranoia problem' (Freeman, 2008), the difficulty of determining whether persecutory ideation is unfounded. This difficulty is obviously exacerbated in individuals who have just been victimized, who may understandably be in fear of a repeated attack. Therefore in our assessment of paranoia we: explicitly excluded thoughts concerning the perpetrator of the assault; used self-report and interviewer-rated methods; assessed for paranoid responses that the person acknowledged as exaggerated; assessed associated but different phenomena (ideas of reference); and also used a virtual reality experimental method. This is arguably the most detailed battery of paranoia measures used in a study.

Study hypotheses

In the Diagnostic and Statistical Manual of Mental Disorders, 4th edition, text revision (DSM-IV-TR) description of PTSD it is noted that 'persecutory ideation can be present in some severe and chronic cases' (APA, 2000). In contrast, we hypothesized that persecutory ideation is relatively common in people after an assault, and especially common in those with PTSD reactions. We expected raised rates of paranoia to be apparent across all forms of our assessment battery, and hence that reports of paranoia from the self-report, interviewer and experimental methods of assessment would be positively correlated. It was hypothesized that reports of PTSD and paranoia symptoms would be separable, distinct experiences, as tested by factor analysis; that is, paranoia would not simply be

a symptom of PTSD, nor PTSD simply a reaction to paranoid experiences. The strongest element of assault studies is the longitudinal design. We hypothesized that paranoia and PTSD would share many of the same predictors (e.g. worry, insomnia, interpersonal sensitivity, safety behaviours), since perceptions of threat are central to both experiences. However, we also expected there to be differential predictors of the two experiences. Perceptual anomalies were hypothesized to be one of two key differential predictors. In the context of an individual feeling anxious, the additional occurrence of odd internal perceptual experiences would lead to delusional ideas via a sense of 'things not seeming right'. Perceptual anomalies are commonly reported by patients with schizophrenia (e.g. Bunney *et al.* 1999; Parnas *et al.* 2003), often considered to be a product of core cognitive dysfunction underlying psychosis (e.g. Maher, 1988; Uhlhaas & Mishara, 2007), and have been found in two virtual reality studies to be differential predictors of the occurrence of paranoid ideation and social anxiety (Freeman *et al.* 2005, 2008a). In contrast, it was hypothesized that how the trauma was processed at the time, and consequent disorganized memories of the event, would be particularly linked to PTSD symptoms. Disturbance in autobiographical memory of the traumatic event is considered a core feature of PTSD (e.g. Foa *et al.* 1995; Brewin *et al.* 1996; Ehlers & Clark, 2000).

Method

Participants

A total of 106 individuals were recruited to the study. The inclusion criteria were: experienced a distressing assault within the previous month; attended the Accident and Emergency (A&E) Department at King's College Hospital, London for related injuries; were aged 18–65 years; and could attend a baseline assessment between 4 and 6 weeks after the assault. The main exclusion criteria were: the assault was part of on-going abuse; a history of diagnosed severe mental illness (schizophrenia spectrum disorders or bipolar disorder); diagnosed alcohol or drug dependence; and insufficient command of English so that the assessments could not be completed. The study was called 'Reactions to an Assault' and participants were informed that:

Every year several thousand people pass through the Accident and Emergency Department after an assault. This study concerns reactions to the assault over the next six months. We want to find out how many people have difficulties coping with the incident (e.g. remain distressed by it) and how many people are relatively unaffected by the

incident (e.g. rarely think about it). Importantly, we want to identify the factors that may lead to the different reactions.

That the specific focus was upon paranoia and PTSD was not explained until the end of the study in order not to bias the sample during recruitment and testing.

Recruitment took place prospectively over 12 months and a detailed record was kept. Using the hospital computer records, all the A&E attendees recorded as having been assaulted, within the correct age range, were written to and then contacted by telephone. In the course of the year 1482 people attended the A&E department following an assault; of these, 851 people had working contact details, and 426 people were successfully reached by telephone (there were at least four attempts to reach individuals at the contact numbers). A total of 175 people were uninterested in the study, 75 people were ineligible, and 176 people agreed to take part. In all, 106 people attended the baseline assessment and 70 people did not attend the arranged appointment. The hospital records had information on the age and sex of the A&E attendees, and therefore it was possible to compare the group tested with the non-participants. Overall, the group tested did not significantly differ from those 1376 hospital attendees who were not tested either in sex ($\chi^2_{(1)}=2.52$, $p=0.112$), or in age ($t_{1480}=-1.65$, $p=0.100$).

Broadly, the types of assault experienced were confrontations ($n=33$) (e.g. the person tried to break up a fight but got punched and jumped on), random attacks ($n=24$) (e.g. the person was walking down the street when hit from behind and attacked by a group of boys), muggings ($n=22$) (e.g. on the way home from work, a man grabbed the person's bag, and the victim did not let go and was then punched), one-off attacks from family member or friends ($n=19$) (e.g. an argument with a friend led to being attacked) and attacks in the context of work ($n=8$) (e.g. support worker attacked by boy being looked after). All participants reported sustaining injuries during the assault. Injuries reported included minor cuts/bruises ($n=59$), major cuts/bruises ($n=71$), unconsciousness ($n=7$), broken bones ($n=28$), head injuries ($n=31$), injuries to internal organs ($n=4$), facial injuries/scars ($n=45$), stab wounds ($n=1$), and other injuries such as broken teeth ($n=29$). The clear majority of participants had injuries in two or more of these injury categories; only 19 people (12.9%) reported injuries in just one category. A total of four people reported only minor cuts and bruises.

Assessments

The study variables are summarized in Table 1. For the assessment of paranoia and PTSD we used self-report,

Table 1. Summary of the study measures

Variable	Measure
PTSD	
PTSD severity (self-report)	Posttraumatic Diagnostic Scale (PDS)
PTSD severity (interviewer)	PTSD Symptom Scale (PSSI)
PTSD diagnosis (interviewer)	Structured Clinical Interview for DSM-IV
Triggered PTSD symptoms (virtual reality)	Virtual Reality PTSD Scale
Paranoia	
Paranoia severity – ideas of reference (self-report)	Green <i>et al.</i> Paranoid Thoughts Scale (GPTS) – part A
Paranoia severity – persecution (self-report)	GPTS – part B
Paranoia total (self-report)	GPTS – part A and B
Paranoia severity (self-report)	Four visual analogue scales
Paranoia (interviewer)	Positive and Negative Symptom Scale (PANSS)
	Psychotic Symptoms Rating Scale (PSYRATS)
Triggered paranoia (virtual reality)	State Social Paranoia Scale (SSPS)
Processing during trauma	
Perceived threat to life during trauma	Thoughts and Feelings During the Assault Scale
Negative emotions during trauma	Thoughts and Feelings During the Assault Scale
Mental defeat during trauma	Mental Defeat Scale
Cognitive processing during the assault (data-driven processing, lack of self-referent processing and dissociation)	Cognitive Processing Questionnaire (State Dissociation Scale; Data-Driven Processing Scale; Lack of Self-Referent Processing Scale)
Trauma memory	
Memory disorganization	Trauma Memory Questionnaire
Characteristics of unwanted memories	Intrusions Qualities Questionnaires
Post-trauma responses	
Cognitive responses to trauma memories (suppression of trauma memories, rumination on trauma, numbing)	Response to Intrusion Questionnaire
Safety behaviours	Safety Behaviour Questionnaire
Negative thoughts about self	Posttraumatic Cognitions Inventory
Negative thoughts about others (overgeneralized danger)	Posttraumatic Cognitions Inventory
Self-blame	Posttraumatic Cognitions Inventory
Perceived negative responses of others	Perceived Negative Responses of Others
Perceived social support	Crisis Support Scale
General psychological processing	
Worry	Penn State Worry Questionnaire (PSWQ)
Catastrophizing	Catastrophizing Interview
Negative and positive beliefs about others	Brief Core Scheme Scales (BCSS)
Inter-personal sensitivity	Interpersonal Sensitivity Scale (IPS)
Cognitive flexibility	Cognitive Flexibility Scale (CFS)
Anomalous experiences	Cardiff Anomalous Perceptions Scale (CAPS)
Cannabis used in past month	Maudsley Addiction Profile (MAP)
Current psychological problems	
Anxiety and depression	Depression Anxiety Stress Scales (DASS)
Insomnia	Insomnia Severity Index (ISI)

PTSD, Post-traumatic stress disorder; DSM-IV, Diagnostic and Statistical Manual of Mental Disorders, 4th edition.

interviewer, and experimental methods. Paranoia was assessed at baseline with the: Green *et al.* Paranoid Thoughts Scale (GPTS; Green *et al.* 2008); positive items of the Positive and Negative Symptom Scale

(PANSS; Kay, 1991); the Psychotic Symptoms Rating Scale – delusions (PSYRATS; Haddock *et al.* 1999); and four visual analogue 0–100 scales (VAS) ('Since the assault, I feel suspicious of other people', 'Since

the assault, I feel fearful of all males', 'Since the assault, I feel fearful of all females', 'Since the assault, I feel more fearful of other people than I should'). For these assessments participants were reminded not to include thoughts or feelings about the person who recently assaulted them. We also assessed persecutory ideation using the identical virtual reality experimental methodology described in Freeman *et al.* (2008b). Individuals spent 4 min on a train ride populated by neutral computer characters, presented using a head-mounted display within a room where the person's movement could be tracked enabling a fully immersive experience, and were then assessed for paranoid responses using the State Social Paranoia Scale (SSPS) (Freeman *et al.* 2007). Because the environment is neutral, any perceived hostility is known to be unfounded. Consistent with factor-analytic and epidemiological studies of psychotic symptoms, our conceptualization of paranoia is that there is a hierarchy comprising ideas of reference and of persecution. Persecutory ideation, thoughts that a perpetrator is actively trying to harm the person, typically builds upon ideas of reference that the person is being monitored or communicated about (Freeman *et al.* 2005; Green *et al.* 2008). PTSD at baseline was assessed with the self-report Posttraumatic Diagnostic Scale (PDS) (Foa *et al.* 1997) and the interviewer version of the PTSD symptom scale (PSSI) (Foa *et al.* 1993), combined with the PTSD section of the Structured Clinical Interview for DSM-IV (SCID; First *et al.* 1996) to determine whether the symptoms had been present in the last month. We also assessed for PTSD symptoms during the virtual reality train ride, using a newly constructed 13-item state self-report scale, adapted from items in existing measures, assessing re-experiencing (e.g. 'Upsetting thoughts or images about the assault came into my head when I didn't want them to'), avoidance (e.g. 'I tried not to think about or have feelings about the assault') and arousal [e.g. 'I felt jumpy or easily startled (for example, by sudden noises)']. At the 3-month follow-up we used only the GPTS (Green *et al.* 2008), the paranoia visual analogue scales and the PDS (Foa *et al.* 1997). At the 6-month follow-up, which was prioritized above the 3-month assessment, we used all the measures listed above, apart from the virtual reality assessment. The reliability of the two assessors (postgraduate psychologists) for the PSSI, the PANSS positive items and the PSYRATS was assessed using 12 audiotapes of the assessments. The intra-class correlation coefficients indicated very high levels of reliability (PSSI=0.99, PANSS=0.92, PSYRATS=0.99).

At baseline there were assessments of descriptive information on the recent assault (Dunmore *et al.* 1999) and factors derived from the cognitive models of

paranoia and PTSD. For factors at the time of the trauma the Thoughts and Feelings During the Assault scale (Halligan *et al.* 2002, 2003); Mental Defeat Scale (Dunmore *et al.* 1999) and Cognitive Processing Questionnaire (Halligan *et al.* 2002; 2003) were used. Trauma memory was assessed with the Trauma Memory Questionnaire (Halligan *et al.* 2003) and Intrusion Qualities Questionnaire (Michael *et al.* 2005). Trauma appraisals were assessed with an updated version of the Posttraumatic Cognitions Inventory (Foa *et al.* 1997), Perceived Negative Responses of Others (Dunmore *et al.* 1999), and Interpretations of PTSD Symptoms Inventory (Dunmore *et al.* 1999). Social support was measured by the Crisis Support Scale (Joseph, 1999). Maintaining behaviours and cognitive strategies were assessed with the Safety Behaviour Questionnaire (Dunmore *et al.* 1999) and Response to Intrusions Questionnaire (Clohessy & Ehlers, 1999; Murray *et al.* 2002).

The additional paranoia process measures were not tied to the trauma event but assessed affective processes, anomalous experiences and reasoning. The affective measures were: the Penn State Worry Questionnaire (Meyer *et al.* 1990); Catastrophizing Interview (Vasey & Borkovec, 1992); Interpersonal Sensitivity Measure (Boyce & Parker, 1989); Brief Core Schema Scales – other scales (Fowler *et al.* 2006); and the Depression Anxiety Stress Scales (Lovibond & Lovibond, 1995). Factors related to anomalous experiences were assessed with the Cardiff Anomalous Perceptions Scale (Bell *et al.* 2006), Insomnia Severity Index (Bastien *et al.* 2001) and Maudsley Addiction Profile (Marsden *et al.* 1998). Reasoning style was assessed with the Cognitive Flexibility Scale (Martin & Rubin, 1995). The socio-economic classification of the participants was carried out using the occupationally based National Statistics Socio-economic Classification analytic classes (Office for National Statistics, 2005).

Statistical analysis

All analyses were carried out with Stata version 11 (StataCorp LP, USA). The first stage of the analysis was a description of the levels of paranoia and PTSD in the participant group. The second stage explored patterns of correlation between paranoia and PTSD items using an exploratory factor analysis to look for evidence of structure in the correlation matrix and, in particular, evaluate whether paranoia and PTSD are distinct experiences (at this stage it would not have been appropriate to use a confirmatory analysis). The exploratory factor analysis (based on an initial extraction of principal components) was carried on all of the paranoia and PTSD items. Examination of the initial eigenvalues (through the use of a scree plot)

was used to determine the number of factors for subsequent rotation using promax and varimax algorithms. In order to aid our decisions concerning the complexity of the resulting factor structure, these analyses were supplemented with maximum-likelihood factor analysis runs (assuming multivariate normality), assessing goodness of fit using the Bayesian information criterion (BIC). The possibilities being examined included a single-factor solution (all paranoia and PTSD items apparently being indicators of a single concept), a two (or possibly more)-factor solution but with no obviously explicable pattern of loadings on these factors, and, again, a two (or possibly more)-factor solution with loadings being consistent with prior expectations that the paranoia items, on the whole, indicate levels of one concept (paranoia) and PTSD items indicate another (PTSD). A further question then related to whether the two concepts are orthogonal (independent or uncorrelated) or non-orthogonal (correlated).

The third stage of the analysis examined the separate prediction of paranoia and PTSD at the 6-month follow-up using a series of simple univariate linear regressions. The fourth stage of the analysis examined the differential prediction of paranoia and PTSD. For this fourth stage, both the paranoia and PTSD scores at the 6-month follow-up were first standardized to have a standard deviation equal to 1. They were then analysed using a random-effects model (using Stata's `XTREG` command) incorporating both responses in the model (as in a repeated-measures analysis), distinguished by a new variable labelled 'type', with type equal to 0 for paranoia and equal to 1 for PTSD. The aim of the analysis was to provide a test of the putative predictor variable by type interaction (and the reason for the prior standardization was to give the two responses a common measurement scale, ruling out the scale of measurement as an explanation of the differential prediction, as tested by the interaction).

Results

Demographic details

As would be expected for a physical assault group, there were more male participants than female (79 men and 27 women), and the mean age was relatively young (mean age=34.4, s.d.=11.6 years). The ethnicities were white ($n=55$), black Caribbean ($n=14$), black African ($n=15$), black other ($n=5$), and other ($n=17$). Most people were single ($n=81$), but a minority were married ($n=19$) or divorced/separated ($n=6$). The educational qualifications obtained were: none ($n=11$), GCSE ($n=23$), AS/A-level ($n=9$), diploma/foundation degree ($n=23$), degree ($n=26$), postgraduate diploma ($n=11$), and doctorate ($n=3$). Employment statuses

were: full time ($n=47$), part time ($n=11$), unemployed for less than 1 year ($n=18$), unemployed for more than 1 year ($n=15$), retired ($n=1$), homemaker ($n=1$), and student ($n=13$). The distribution of the group across socio-economic categories was: large employers and higher managerial occupations ($n=3$), higher professional occupations ($n=9$), lower managerial and professional occupations ($n=15$), intermediate occupations ($n=10$), small employers and own account workers ($n=11$), lower supervisory and technical occupations ($n=6$), semi-routine occupations ($n=10$), routine occupations ($n=12$), never worked and long-term unemployed ($n=15$), and students ($n=13$).

Presence of PTSD

Mean scores on the PTSD measures at each time point are displayed in Table 2. At baseline there was a high correlation between the total scores for the self-report (PDS) and interviewer-rated (PSSI) PTSD assessments ($r=0.89$, $p<0.001$). Similarly these two measures correlated highly at the final follow-up ($r=0.85$, $p<0.001$). Both PTSD measures at baseline correlated highly with the measure of PTSD symptoms in virtual reality (PSS: $r=0.64$, $p<0.001$; PDS: $r=0.64$, $p<0.001$). Over the 6 months there were significant reductions in self-reported and interviewer-rated PTSD symptoms (PSSI total score: $t_{92}=5.76$, $p<0.001$; PTDS total score: $t_{93}=2.48$, $p=0.015$). At baseline, 35 (33%) people met diagnostic criteria from the SCID interviewer assessment. At the 6-month assessment, 15 (16.0%) met interviewer-rated SCID diagnostic criteria. Over the course of the study, six participants received a psychological intervention and one participant received a pharmacological intervention for PTSD. There was no baseline difference in PTSD scores for the 12 people who provided no 6-month follow-up data compared with the rest of the sample ($p=0.148$).

Presence of paranoia

Mean scores on the main paranoia measures are displayed in Table 2. All the paranoia measures were significantly correlated. For example, GPTS – part A ideas of reference correlated highly with GPTS – part B ideas of persecution ($r=0.82$, $p<0.001$), and the PANSS rating of suspiciousness correlated with the GPTS total score ($r=0.66$, $p<0.001$). Those individuals who reported paranoid thinking in virtual reality using the SSPS reported higher scores on the paranoia scales. For example, they reported higher GPTS – part A ideas of reference scores ($t_{79.5}=-3.94$, $p<0.001$), and higher GPTS – part B persecutory ideas scores ($t_{77.4}=-4.05$, $p<0.001$).

At the severe end of paranoia, on the PANSS suspiciousness item at baseline, 12 people (11%) were rated

Table 2. PTSD and paranoia scores

Measure	Baseline		3-month follow-up		6-month-follow-up	
	<i>n</i>	Mean (s.d.)	<i>n</i>	Mean (s.d.)	<i>n</i>	Mean (s.d.)
PTSD						
PSSI total	106	13.61 (10.39)	–	–	93	8.61 (9.50)
PDS total	106	16.59 (11.59)	82	16.40 (13.01)	94	13.66 (12.41)
PDS re-experiencing	106	4.92 (3.81)	82	4.56 (4.12)	94	3.78 (3.97)
PDS avoidance	106	5.77 (4.93)	82	6.12 (5.35)	94	5.03 (5.18)
PDS arousal	106	5.89 (4.42)	82	5.72 (4.71)	94	4.85 (4.41)
Paranoia						
GPTS total	106	58.18 (30.01)	84	61.32 (29.18)	94	56.73 (27.93)
GPTS – part A ideas of reference	106	29.26 (13.68)	84	30.75 (13.37)	94	28.88 (13.42)
GPTS – part B persecutory ideas	106	28.92 (17.75)	84	30.57 (17.22)	94	27.85 (15.30)
PANSS positive	106	8.73 (2.70)	–	–	93	8.28 (2.12)
PANSS suspiciousness	106	1.77 (1.12)	–	–	93	1.75 (1.07)

PTSD, Post-traumatic stress disorder; s.d., standard deviation, PSSI, PTSD Symptom Scale; PDS, Posttraumatic Diagnostic Scale; GPTS, Green *et al.* Paranoid Thoughts Scale; PANSS, Positive and Negative Symptom Scale.

as having moderate or moderate-severe suspiciousness. Using the PSYRATS at baseline, 13 people (12%) held suspicious beliefs with a level of conviction (above 50%) sufficient to be considered delusional. On the visual analogue scales at baseline almost everyone (95%) reported some suspicious thinking, 80% reported feeling more fearful of others than they should, while there was unsurprisingly more fear about men than women (see Supplementary Table S1). This is broadly consistent with the GPTS – part B where 68% of participants endorsed at least one of the persecutory ideation items. This endorsement rate of paranoid thinking is similar to that of a high-paranoia non-clinical sample and higher than the 49% reported for a general population sample (Freeman *et al.* 2010).

Over the 6 months there were no significant reductions in GPTS – part A (ideas of reference) or part B (persecutory thoughts) scores or PANSS total or suspiciousness scores ($p > 0.1$). There were, however, significant reductions in three out of four of the visual analogue scale scores: ‘I feel suspicious of other people’ ($t_{93} = 6.85$, $p < 0.001$); ‘I feel more fearful of other people than I should’ ($t_{93} = 4.04$, $p < 0.001$); ‘I fear fearful of all males’ ($t_{93} = 3.96$, $p < 0.001$); ‘I feel fearful of all females’ ($t_{93} = 1.69$, $p = 0.094$). There was no significant difference in baseline GPTS total scores between the 12 people who provided no final follow-up data and the rest of the participants ($p = 0.537$).

Relationship between paranoia and PTSD measures

There were moderate correlations between the main paranoia and PTSD measures (see Supplementary

Table S2). Of the 13 people reporting a delusion using the PSYRATS, 11 also received a PTSD diagnosis using the SCID. The baseline GPTS (32 items), PSSI (17 items), PDS (17 items), visual analogue scales (four items) and the single PANSS suspiciousness item were entered into a principal components analysis. The first four eigenvalues were 27.19, 7.13, 2.65 and 2.23, explaining 43, 11, 4 and 4% of the total variation, respectively. Investigation of the scree plot (not shown) clearly indicated the existence of two main dimensions (jointly explaining 54% of the total variation in the data). The BIC criteria obtained through use of maximum-likelihood factor analysis were 6749.4, 6058.2, 6044.7 and 6136.6 when extracting one, two, three or four factors, respectively. Here the best-fitting model is represented by the smallest BIC. Although the three-factor solution was the optimum, the two-factor solution was very close, and, in combination with examination of the above scree plot, we opted for the simpler two-factor solution. A varimax rotation of the first two principal components was then carried out for ease of interpretation [the two rotated factors here being constrained to be uncorrelated (i.e. independent/orthogonal), with the magnitude of factor loadings as close as possible to either 1 or 0]. Those items found to be loading on factor 1 (accounting for 32% of the original variation) were the GPTS items, the PANSS suspiciousness item, and the VAS scale ‘Since the assault I feel fearful of all females’. Those found to be loading on factor 2 (explaining 22% of the original variation) were the PSSI and PTDS items, and the VAS scales ‘Since the assault I feel suspicious of other people’, ‘Since

the assault I feel fearful of all males' and 'Since the assault I feel more fearful of other people than I should'. Rotation of the maximum-likelihood factors led to exactly the same conclusions. An identical pattern of loadings was found using a promax rotation (which relaxes the orthogonality/independence constraint – allowing the resulting factors to be correlated) – the variation explained by the two factors being 38% and 32%, respectively, but the correlation between the two promax-rotated factors being 0.53 (i.e. the contributions of the two factors should not be added – there being about 28% of the variation in one being explained by variability in the other). Therefore there were clear but correlated paranoia and PTSD factors, each comprising the main measures, respectively, but three out of four of the visual analogue scales did not load as expected.

Predicting the persistence of paranoia and PTSD

The ability of the individual baseline variables to predict self-reported paranoia and PTSD at the final follow-up assessment is reported in Table 3. There is an extremely consistent pattern of the variables predicting both paranoia and PTSD. Of the 30 baseline variables, 25 significantly predicted both outcome measures. The predictor variables were then assessed again after controlling for the baseline score of the dependent variable (i.e. to assess variable prediction above initial symptom score) (see Supplementary Table S3). Of the variables, 13 predicted paranoia, and 10 predicted PTSD even after controlling for initial symptom levels.

Consistent with the variables predicting both paranoia and PTSD, there was little evidence of differential prediction. Only three out of 30 variables differed significantly in their effects on paranoia and PTSD ($p < 0.05$) (see Supplementary Table S4): perceived threat to life/physical integrity, characteristics of unwanted memories of the assault and baseline PTSD score. An increase at baseline in all three variables increased the likelihood of paranoia at follow-up but increased to an even greater degree the occurrence of PTSD.

Discussion

This is the first study to examine concurrently paranoia and PTSD in the months after a physical assault. While PTSD after an assault has previously been the focus of investigation, paranoia in reaction to the event has not. We considered it probable that a physical assault would skew judgements about others to the negative and hence provide an ideal testing ground for furthering the understanding of paranoid thinking. The

prevalence rates of PTSD at 1 month after the assault were consistent with other studies, as were the reductions over time (e.g. Halligan *et al.* 2003; Kleim & Ehlers, 2008). A new finding was the notably high level of paranoia, including simple self-reports of being overly suspicious. For three reasons it is likely that this level of mistrust is not simply explained by the assessments tapping thoughts about the real perpetrator of the assault: paranoia was equally visible in ideas of reference, which are less likely to be directly related to the assault event; the participants themselves identified exaggerated and generalized fears; and the assessments were validated against an experimental test of paranoid thinking. Though we expected high rates of suspicious thinking, we did not predict there to be so little decline in these thoughts over time. It is conceivable that some of the participants may already have been exhibiting high levels of paranoia before the assault (i.e. there was a selection bias, most likely in who is assaulted); alternatively, the results indicate that assaults have a significant lasting impact on trust. The visual analogue scales certainly indicate that many of the participants believed that the trauma raised their level of suspiciousness. If future studies replicate this finding then routine assessment of paranoia in clinical cases of PTSD may prove to be warranted.

The high prevalence of paranoia and PTSD symptoms in the group provided the opportunity to examine the predictive ability of contemporary psychological models for these problems, and participants were followed over 6 months to assess which variables predicted the course of the disorders. This is the strength of the research design. The results for PTSD replicate and extend previous studies that investigated a subset of these variables (Dunmore *et al.* 2001; Halligan *et al.* 2003; Kleim *et al.* 2007; Ehring *et al.* 2008). Cognitive factors related to the assault predicted the persistence of PTSD, consistent with the theoretical model of Ehlers & Clark (2000). Predictors of PTSD symptoms included a reliance on sensory impressions, mental defeat and a greater perceived threat at the time of trauma, suppression of trauma memories, rumination, safety behaviours, and ideas of the self as damaged or at risk after the assault. A failure to contextualize the trauma, negative appraisals of the event, the self and others, and cognitive and behavioural avoidance are plausible factors in maintaining a current sense of threat. Many of these cognitive variables predicted over and above the initial presence of PTSD symptoms.

The new result – and where perhaps there is the most surprise – is the extent to which the same factors predicted levels of paranoia over time. We predicted considerable overlap in the prediction of paranoia and

Table 3. Baseline predictors of 6-month follow-up scores (unadjusted results)

	Paranoia: GPTS total at 6 months			PTSD: PDS total at 6 months		
	Coefficient	Standard coefficient (s.e.)	<i>p</i>	Coefficient	Standard coefficient (s.e.)	<i>p</i>
The assault						
Location						
Close or at home						
Far from home	-12.35	-0.21 (6.14)	0.047*	-5.03	-0.19 (2.74)	0.069
Relationship to attacker						
Stranger						
Known person	13.78	0.23 (5.99)	0.024*	6.38	0.24 (2.66)	0.018*
Person's rating of severity of injuries (0–10 scale)	3.72	0.32 (1.16)	0.002**	2.05	0.39 (0.50)	<0.001***
Ongoing physical problems from assault	17.84	0.32 (5.60)	0.002**	9.15	0.36 (2.44)	<0.001***
During trauma processing						
Perceived threat to life/physical integrity	4.16	0.35 (1.17)	0.001**	2.62	0.49 (0.48)	<0.001***
Negative emotion during trauma	1.13	0.30 (0.38)	0.004**	0.54	0.32 (0.17)	0.002**
Cognitive processing during the assault (data-driven processing, lack of self-referent processing and dissociation)	0.77	0.44 (0.17)	<0.001***	0.36	0.45 (0.07)	<0.001***
Mental defeat	2.24	0.51 (0.40)	<0.001***	1.09	0.56 (0.17)	<0.001***
Trauma memory						
Memory disorganization	0.81	0.13 (0.62)	0.196	0.31	0.12 (0.28)	0.269
Characteristics of unwanted memories	0.07	0.34 (0.02)	0.001**	0.04	0.50 (0.01)	<0.001***
Post-trauma responses						
Cognitive responses to trauma memories (suppression of trauma memories, rumination on trauma, numbing)	1.30	0.47 (0.25)	<0.001***	0.72	0.59 (0.10)	<0.001***
Safety behaviours	1.25	0.43 (0.27)	<0.001***	0.62	0.48 (0.12)	<0.001***
Negative thoughts about self (vulnerable self, permanent change, alienation)	0.91	0.56 (0.14)	<0.001***	0.53	0.72 (0.05)	<0.001***
Negative thoughts about others (overgeneralized danger)	1.78	0.48 (0.33)	<0.001***	0.88	0.54 (0.14)	<0.001***
Self-blame	2.08	0.42 (0.43)	<0.001***	0.98	0.48 (0.19)	<0.001***
Perceived negative responses of others	2.09	0.57 (0.32)	<0.001***	0.95	0.58 (0.14)	<0.001***
Perceived social support	-1.30	-0.33 (0.38)	0.001**	-0.71	-0.41 (0.16)	<0.001***
General psychological processing						
Worry (PSWQ)	0.78	0.39 (0.19)	<0.001***	0.33	0.37 (0.09)	<0.001***
Catastrophizing	0.98	0.14 (0.73)	0.182	0.10	0.03 (0.33)	0.754
Negative beliefs about others (BCSS)	1.95	0.46 (0.39)	<0.001***	0.73	0.39 (0.18)	<0.001***
Positive beliefs about others (BCSS)	-0.63	-0.13 (0.48)	0.197	-0.19	-0.09 (0.22)	0.385
Inter-personal sensitivity	1.97	0.42 (0.72)	0.007**	0.64	0.36 (0.32)	0.052
Cognitive flexibility	-1.43	-0.43 (0.31)	<0.001***	-0.55	-0.37 (0.14)	<0.001***
Anomalous experiences (CAPS)	2.14	0.50 (0.38)	<0.001***	0.79	0.42 (0.18)	<0.001***
Cannabis used in past month	7.52	0.13 (6.22)	0.230	2.49	0.09 (2.77)	0.372
Current psychological problems						
Anxiety	1.54	0.53 (0.26)	<0.001***	0.78	0.61 (0.11)	<0.001***
Depression	1.48	0.54 (0.24)	<0.001***	0.75	0.62 (0.10)	<0.001***
Insomnia	1.77	0.46 (0.36)	<0.001***	0.86	0.50 (0.16)	<0.001***
Paranoia (GPTS total)	0.66	0.71 (0.07)	<0.001***	0.25	0.59 (0.04)	<0.001***
PTSD (PDS total)	1.33	0.53 (0.22)	<0.001***	0.78	0.70 (0.08)	<0.001***

GPTS, Green *et al.* Paranoid Thoughts Scale; PTSD, post-traumatic stress disorder; PDS, Posttraumatic Diagnostic Scale; s.e., standard error; PSWQ, Penn State Worry Questionnaire; BCSS, Brief Core Schema Scale; CAPS, Cardiff Anomalous Perceptions Scale.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

PTSD since both concern perceptions of ongoing threat but also expected a degree of difference. Instead we showed that processing style in relation to the assault and its aftermath was similarly linked to the persistence of paranoia. The cognitive factors identified from PTSD work as resulting in maladaptive responses to trauma may provide a framework to assess negative events in relation to persecutory ideas. It is notable also that being attacked close to home, and by people known to the person, were associated with greater paranoia over time, indicating perhaps the more corrosive nature of attack in places and with people thought previously safe or trustworthy. The close links longitudinally between paranoia, anxiety, worry, depression and insomnia replicate findings in the general population (Freeman *et al.* 2012). Although by necessity there was considerable statistical testing in the prediction of levels of paranoia and PTSD, the pattern of findings was very clear.

Levels of paranoia and PTSD were moderately correlated, but the factor analyses indicated that paranoia and PTSD are distinct experiences. Each therefore needs to be explained. This led to our analysis of differential predictors. Even given our expected close connections between PTSD and paranoia, it was quite striking that only two cognitive variables related differently to the experiences. Indeed, given the multiple testing, the probability values obtained, and the absence of *a priori* prediction for the significant variables, we are probably simply observing type I error. Even initial paranoia scores did not differentially predict levels of later paranoia. Our judgement is that a larger sample size is needed to more rigorously evaluate the potential cognitive differences and hence test the two theoretical models specificity. However, there may also be measurement difficulties, especially for anomalous experiences where the theoretical import resides in the absence of clear conscious awareness, thus limiting self-report assessment. Nonetheless, we did not replicate two studies that showed that anomalous experiences are specific to paranoia, in that such anomalies differentially predicted paranoia from social anxiety (Freeman *et al.* 2005, 2008a). This might be explained by the current study investigating PTSD rather than social anxiety. In PTSD dissociation is common (e.g. Briere *et al.* 2005), and this includes a wide variety of anomalous perceptual experiences (e.g. Sierra *et al.* 2005). The central and clear finding is the near absence of detection of factors that differentiate paranoia and PTSD, which is in contrast to the clear pattern of results showing the cognitive variables predicting both experiences.

The study has a number of important limitations. Foremost, due to the study design, it cannot be determined that the assault led to an increase in paranoia.

It is likely that this could only be researched in a natural experiment. The visual analogue questions certainly indicated that the majority of the participants viewed the assault as raising their levels of suspiciousness, but this is a retrospective evaluation. In the current study it may have been helpful to have had an earlier assessment of symptom levels and cognitive processing, perhaps in the first few days after the assault. Corroboration of changes in the individuals' behaviours after the assault, particularly in trust, by those close to the person may have been revealing, and added to the variety of methods employed in the current study. The interpretation of the results is clearly strongest for the longitudinal element of the study. It is notable that the sample studied was a small proportion of those potentially eligible, indicating sampling bias. During the 12 months of the study we recorded the recruitment process in detail, and consider the low recruitment rate to be a reflection of the general difficulties of engaging people after a significant physical assault, which is clearly illustrated by many of the emergency department attendees giving incorrect contact details to the hospital. Nonetheless, the demographic profile of the group and the PTSD results closely mirror those found in past studies (e.g. Kleim *et al.* 2008), indicating that a typical sample is likely to have been recruited. It is also important to note that a recruitment of a greater number of participants would have enhanced the ability to detect differential predictors. A large number of statistical tests were carried out because this was the first test of the hypotheses and therefore we were most interested in individual scale results. Another valid approach, minimizing the statistical testing, would be to identify a smaller number of clusters of factors and examine their predictive ability. Nonetheless, the overall pattern of results is strikingly clear. A different but strong research design for future studies would be to manipulate the cognitive variables of interest and examine the impact on reactions to an assault (Kendler & Campbell, 2009). One way of initially looking at this approach, using existing datasets, would be to see whether psychological treatments for PTSD have also led to a lowering of levels of mistrust, as the results of the study would imply. The study has shown a close proximity between paranoia and PTSD but also left a significant question unanswered: what are the factors determining specifically paranoid rather than PTSD responses to a trauma (and vice versa)?

Supplementary material

For supplementary material accompanying this paper visit <http://dx.doi.org/10.1017/S003329171300038X>.

Acknowledgements

The study was funded by a Wellcome Trust fellowship awarded to D.F. Some of the clinical time of P.G. and E. K. during the study was funded by the Biomedical Research Centre for Mental Health at the Institute of Psychiatry, King's College London, and the South London and Maudsley NHS Foundation Trust.

Declaration of Interest

None.

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