Metacognitions, worry and attentional control in predicting OSCE performance test anxiety

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OBJECTIVES This study investigated the applicability of the self-regulatory executive functioning (S-REF) model to performance test anxiety (PTA) in objective structured clinical examinations (OSCEs). Specifically, it examined the relative contributions of metacognitive beliefs, trait worry and attentional control to PTA.

METHODS A cross-sectional design was used. Immediately prior to their formative Communication for Clinical Practice OSCE, 240 Year 1 medical students completed the following self-report questionnaires: the Metacognitions Questionnaire-30 (MCQ-30); the Penn State Worry Questionnaire (PSWQ); the Attentional Control Scale (ACS), and the Performance Test Anxiety questionnaire (PTA).

RESULTS Univariate analysis indicated that female students scored significantly more highly than male students on the MCQ-30 subscale for negative beliefs about the uncontrollability and danger of worry, the MCQ-30 subscale for cognitive confidence and the PSWQ subscale for trait worry. Partial correlations (controlling for gender) showed that metacognitions, worry and attentional control were significantly correlated with PTA. Multiple regression analyses showed that worry and negative beliefs about the uncontrollability and danger of worry were independent predictors of PTA in both male and female students, whereas attention focus was an independent predictor only in male students.

CONCLUSIONS The findings support predictions derived from the S-REF model that metacognitive beliefs, trait worry and attentional control processes underlie the onset and maintenance of PTA.

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INTRODUCTION

The objective structured clinical examination (OSCE) is an integral component of assessment in medical education.[1] The Communication for Clinical Practice (CCP) OSCE requires students to demonstrate a variety of clinical tasks, including consultations, within a specified timeframe, whilst being observed by an examiner. Levels of anxiety associated with OSCEs have been reported as higher than those for other forms of test assessment, such as unseen written examinations.[2–4] Test anxiety is defined as 'feelings of tension and apprehension, worrisome thoughts and the activation of the autonomic nervous system when an individual faces evaluative achievement-demanding situations'.[5] Test anxiety is not classified as a separate diagnostic category in DSM-IV (Diagnostic and Statistical Manual of Mental Disorders, 4th edn);[6] however, it is frequently reported as a presenting feature of social phobia and has recently been considered for inclusion in DSM-V as a specific phobia, situational type.[6,7] A recent epidemiological survey in young adults showed that 'fear of test taking' is the most frequently reported social fear in both non-clinical (28%) and diagnosed social phobic (75%) individuals.[8] Estimates for functionally impairing levels of test anxiety range between 15% and 20%.[9–13] Reviews have shown a general negative relationship between test anxiety and a number of test performance measures, such as school-leaving examinations, higher education assessments, aptitude tests, and cognitive tests of memory and problem solving.[9,10,14]

In 2003, a meta-analysis was conducted on 56 randomised controlled treatment studies on test anxiety reduction programmes.[15] Several treatment approaches were included in the meta-analysis, including cognitive, behavioural and skills training or some combination of these. A moderate overall mean effect size ($d = 0.65$) was reported for the post-test comparison of control and treatment groups. No single approach showed clear superiority over another.[15]

The information processing paradigm is the main conceptual framework for research into test anxiety.[16–18] One recent approach offering a new perspective on understanding test anxiety is the self-regulatory executive functioning (S-REF) model.[19,20] This model proposes that emotional disorders, including test anxiety, show a dysfunctional pattern of self-monitoring and self-regulation related to the control of cognition and cognitive processes and that is guided by metacognitive beliefs.[19–21] These attempts at self-regulation lead to a distinctive dysfunctional response pattern, termed 'cognitive attentional syndrome' (CAS), which is hypothesised to be central to a wide range of emotional problems.[21] This syndrome is characterised by perseverative thinking (worry and rumination), threat monitoring (self-focused attention on signs of anxiety and scanning of the environment for threat) and maladaptive coping behaviours (including thought control strategies, such as suppression).[19,20] In test anxiety, the CAS would be characterised by excessive worry about making mistakes and failing, ruminating about past failures, heightened threat monitoring (e.g. noticing failures in memory and anxiety symptoms), and maladaptive coping (e.g. attempting to suppress negative thoughts about failing). The S-REF model proposes that each component of CAS is guided by metacognitive beliefs. For example, a student may hold a negative metacognitive belief about worry (e.g. that worry is uncontrollable), which may lead to a perseverative engagement with worry.

In the first application of the metacognitive model to test anxiety, Spada *et al.*[22] examined the role of metacognitive beliefs (using the Metacognitions Questionnaire-30 [MCQ-30][23]) and attentional control (using the Attentional Control Scale [ACS][24]) in 142 undergraduates, 3 weeks before their end-of-year examinations. A hierarchical multiple regression analysis showed that negative beliefs about the uncontrollability and danger of worry and ACS attention focusing were independent predictors of state anxiety. However, this study[22] used a general measure of state anxiety (the State-Trait Anxiety Invetory-S[25]) and obtained its measurements 3 weeks prior to end-of-year examinations. We aimed to extend the findings of Spada *et al.*[22] by specifically measuring test anxiety by: (i) using a validated measure of performance test anxiety (PTA) rather than a general measure of state anxiety, and (ii) administering the questionnaires immediately before the commencement of examinations instead of 3 weeks prior to examinations. In addition, we aimed to examine the independent contribution of trait worry to PTA. Perseverative worry is a central characteristic of CAS and is assumed to be a key component in the S-REF formulation of test anxiety.[22,26,27] Lastly, we aimed to control for the potential confounding influence of gender, as females report higher levels of both test anxiety and trait worry than males.[8,27–29]

In summary, the main aim of the present study is to examine the roles of metacognitive beliefs, trait worry and attentional control in PTA. Based on the S-REF model, the primary hypotheses are: (i) metacognitions (negative beliefs about the uncontrollability and danger of worry, cognitive confidence and need to control thoughts) and trait worry will be positively correlated with PTA; (ii) attentional control will be negatively correlated with PTA, and (iii) metacognitions, trait worry and attentional control will independently predict PTA.

METHODS

Participants and procedure

A total of 240 Year 1 medical students (77% response rate) took part in the study on the day of a formative CCP OSCE. Women accounted for 54% of the sample. The mean ± standard deviation (SD) age of participants was 19.6 ± 2.6 years (range: 18–35 years). Domestic students (UK resident students) accounted for 89% of the sample; the remainder were EU or international students.

Measures

Criterion measure: Performance Test Anxiety

The Performance Test Anxiety questionnaire (PTA) is derived from the Three-Factor Anxiety Inventory (TFAI),[13] a 25-item state measure that assesses performance anxiety. In the TFAI, Factor 1 assesses worry and self-focused attention, Factor 2 assesses autonomic hyperactivity and somatic tension, and Factor 3 concerns perceived regulatory control. As the focus of the present study is primarily about performance anxiety, the summed scores from Factors 1 and 2 only are used to provide a specific overall measure of PTA. Respondents indicated how they were thinking and feeling 'right now' (using a 5-point scale on which 1 = totally disagree and 5 = totally agree) in response to the items. High PTA scores indicate high levels of performance anxiety. The factor scales have good psychometric properties.[13,30]

Predictor measures: MCQ-30

The MCQ-30, a 30-item self-report measure, assesses five dimensions of metacognitive beliefs: (i) positive beliefs about worry (e.g. 'Worry helps me cope'); (ii) negative beliefs about worry including concerns about its uncontrollability and danger (e.g. 'When I start worrying, I cannot stop'); (iii) cognitive confidence beliefs (e.g. 'I have a poor memory'); (iv) beliefs about need to control thoughts (e.g. 'Not being able to control my thoughts is a sign of weakness'), and (v) cognitive self-consciousness (e.g. 'I pay close attention to the way my mind works').[23]

Respondents indicated how much they 'generally agreed' with each statement (1 = do not agree; 2 = agree slightly; 3 = moderately agree; 4 = agree very much). Higher scores indicate more dysfunctional metacognitive beliefs. The subscales have good psychometric properties.[21,31]

Predictor measures: ACS

The ACS, a trait measure, assesses an individual's beliefs about his or her ability to voluntarily focus and switch attention.[24,32] The most recent version has 19 items that refer to two factors: (i) attention focusing (e.g. 'My concentration is good even if there is music in the room around me'), and (ii) attention shifting ('It is easy for me to read or write while I'm also talking on the phone').[32] Items are answered using a 4-point response scale (1 = almost never, 4 = always). Higher scores indicate greater belief in the individual's ability to control attention. Higher ACS scores positively correlate with greater resistance to interference in Stroop spatial conflict tasks and an increased ability to disengage from threat stimuli in anxious individuals.[24] The scale has good psychometric properties.[24,32]

Predictor measures: Penn State Worry Questionnaire

The Penn State Worry Questionnaire (PSWQ) is a 16-item self-report measure of trait worry.[27] Respondents indicate their 'typical' responses to its statements using a 5-point scale (1 = not typical of me, 5 = very typical of me). Higher scores indicate a greater tendency to worry. The PSWQ has been shown to have good internal consistency in clinical and non-clinical samples and good test–retest reliability.[27]

Analysis

All variables were examined to assess whether they were suitable for parametric analyses and for the presence of gender differences. Partial correlations (controlling for gender) were conducted to examine inter-correlations and correlations between predictor variables and PTA. Variables found to be statistically correlated with PTA were included as predictor variables in multiple regression analyses. The main hypotheses of the study were tested using two

multiple regression analyses, one for male and one for female students, in which the criterion variable, PTA, was regressed on predictor variables. All analyses were conducted using SPSS Statistics for Windows Version 19.0 (IBM Corp., Armonk, NY, USA).

RESULTS

Univariate analyses showed that the criterion variable (PTA) and the eight predictor variables were normally distributed with no significant outliers. Table 1 shows statistically significant and non-significant differences between male and female students. Female students reported higher scores than male students on three variables: MCQ-30 negative beliefs about the uncontrollability and danger of worry ($t[238] = -3.64$, $p < 0.001$); MCQ-30 cognitive confidence beliefs ($t[238] = -3.93$, $p < 0.001$), and PSWQ worry ($t[238] = -5.36$, $p < 0.001$).

Partial correlations (controlling for gender) were conducted. Table 2 shows that six of the eight predictor variables were significantly correlated with PTA (range: − 0.27 to 0.61); the two exceptions were MCQ-30 positive beliefs about worry and ACS attention shift. MCQ-30 negative beliefs about the uncontrollability and danger of worry, MCQ-30 cognitive confidence beliefs, MCQ-30 need to control thoughts beliefs, MCQ-30 cognitive self-consciousness beliefs and PSWQ worry were all positively correlated with PTA. ACS attention focus was negatively correlated with PTA (i.e. higher attention focus control was associated with lower PTA). Only variables that were significantly correlated with PTA were retained for subsequent regression analyses.

The six statistically significant variables correlated with PTA were retained for inclusion in multiple regression analyses. The six predictor variables (MCQ-30 negative beliefs about the uncontrollability and danger of worry, MCQ-30 cognitive confidence beliefs, MCQ-30 need to control thoughts beliefs, MCQ-30 cognitive self-consciousness beliefs, PSWQ worry and ACS attention focus) were entered in a single block in each regression analysis. Preliminary analysis of regression diagnostics indicated a single outlier in data for both female and male students (i.e. a case with a standardised residual of > 3 SD). To assess for the potential influence of the single case outliers, analyses were computed both with and without the outlier for the female and male samples. The overall R^2 improved for the female sample with the outlier removed, increasing R^2 from 0.40 to 0.45; however, the overall R^2 for the male sample remained unchanged. Based on this analysis, the outlier for the female sample was removed, reducing the sample to $n = 128$, and the outlier for the male sample was retained ($n = 111$). In these final analyses tolerance values were computed to test for multi-collinearity.

Table 1 Scores on the study variables by gender

	Female students (*n* = 129)	**Male students (*n* = 111)**		
Variables	**Mean ± SD**	**Mean ± SD**	***t*-test**	**p-value***
MCQ-30: Positive beliefs	12.40 ± 4.42	12.01 ± 4.20	− 0.67	NS
MCQ-30: Negative beliefs	13.08 ± 4.67	11.00 ± 4.22	− 3.64	0.001
MCQ-30: Cognitive confidence	11.60 ± 4.40	9.55 ± 3.44	− 3.93	0.001
MCQ-30: Need to control thoughts	10.71 ± 3.50	11.63 ± 3.53	2.02	NS
MCQ-30: Self-consciousness	14.10 ± 3.90	14.93 ± 4.04	1.63	NS
PSWQ: Worry	53.70 ± 12.64	44.80 ± 13.00	− 5.36	0.001
ACS: Attention focus	22.70 ± 4.36	22.68 ± 4.38	− 0.00	NS
ACS: Attention shift	26.10 ± 4.00	26.80 ± 3.63	1.39	NS
PTA: Performance test anxiety	61.88 ± 12.94	57.60 ± 12.40	− 2.61	NS

* Adjusted for Bonferroni correction
SD = standard deviation; NS = not significant; MCQ-30 = Metacognitions Questionnaire-30; PSWQ = Penn State Worry Questionnaire; ACS = Attentional Control Scale; PTA = Performance Test Anxiety questionnaire

Values ranged between 0.36 and 0.85 for male students and between 0.33 and 0.79 for female students (tolerance values of < 0.2 are viewed as potentially problematic), indicating no multicollinearity issues.[33]

Table 3 shows the results of the multiple regressions for female and male students. For female students, the overall model had an $R^2 = 0.45$ (adjusted $R^2 = 0.42$; $F[6, 121] = 16.29$, $p < 0.001$), accounting for 45% of the variance in PTA scores. Two variables made independent contributions to predicting PTA: PSWQ worry ($\beta = 0.38$, $t[127] = 3.40$, $p < 0.001$) and MCQ-30 negative beliefs about worry ($\beta = 0.27$, $t[127] = 2.28$, $p < 0.024$).In males, the overall model had an $R^2 = 0.50$ (adjusted $R^2 = 0.47$; $F[6, 104] = 17.30$, $p < 0.001$), accounting for 50% of the variance in PTA scores. Three variables made independent contributions to predicting PTA: PSWQ worry ($\beta = 0.38$, $t[110] = 3.70$, $p < 0.001$); MCQ-30 negative beliefs about the uncontrollability and danger of worry ($\beta = 0.25$, $t[110] = 2.10$, $p < 0.037$), and ACS attention focus ($\beta = 0.18$, $t[110] = -2.40$, $p < 0.018$).

Table 2 Partial correlations (controlling for gender) among the study variables (study sample: *n* = 240)

Variables	1	2	3	4	5	6	7	8	9
MCQ-30: Positive beliefs	–	0.20	0.20	0.30*	0.31*	0.32*	– 0.09	– 0.00	0.15
MCQ-30: Negative beliefs		–	0.36*	0.49*	0.47*	0.76*	– 0.30*	– 0.20	0.61*
MCQ-30: Cognitive confidence			–	0.27*	0.25*	0.27*	– 0.35*	– 0.33*	0.28*
MCQ-30: Need to control thoughts				–	0.59*	0.36*	– 0.17	– 0.01	0.33*
MCQ-30: Self-consciousness					–	0.37*	– 0.13	0.09	0.29*
PSWQ: Worry						–	– 0.29*	– 0.17	0.61*
ACS: Attention focus							–	0.50*	– 0.27*
ACS: Attention shift								–	– 0.14
PTA: Performance test anxiety									–

* Adjusted for Bonferroni correction
MCQ-30 = Metacognitions Questionnaire-30; PSWQ = Penn State Worry Questionnaire; ACS = Attentional Control Scale; PTA = Performance Test Anxiety questionnaire

Table 3 *Standardised β-coefficients and statistically significant predictors of performance test anxiety in female and male students*

	Female students (*n* = 129)			**Male students (*n* = 111)**		
Variables	*β*	***t*-test**	**p-value**	*β*	***t*-test**	**p-value**
MCQ-30: Negative beliefs	0.27	2.28	0.024	0.25	2.10	0.037
MCQ-30: Cognitive confidence	0.15	1.81	NS	0.06	0.82	NS
MCQ-30: Need to control thoughts	0.12	1.34	NS	0.03	0.38	NS
MCQ-30: Self-consciousness	– 0.08	– 0.90	NS	– 0.00	– 0.02	NS
PSWQ: Worry	0.38	3.40	0.001	0.38	3.7	0.001
ACS: Attention focus	0.13	1.73	NS	– 0.18	– 2.40	0.018

NS = not significant; MCQ-30 = Metacognitions Questionnaire-30; PSWQ = Penn State Worry Questionnaire; ACS = Attentional Control Scale

DISCUSSION

This study examined the roles of metacognitive beliefs, worry and attentional control in PTA whilst controlling for gender in Year 1 medical students taking a formative CCP OSCE. The results support the applicability of the S-REF model to PTA. Firstly, partial correlations (controlling for gender) indicated that PTA was significantly positively correlated with MCQ-30 negative beliefs about the uncontrollability and danger of worry, MCQ-30 cognitive confidence beliefs, MCQ-30 need to control thoughts beliefs, MCQ-30 cognitive self-consciousness beliefs and PSWQ, and that PTA was negatively correlated with ACS attention focus (i.e. higher attention focus was associated with lower PTA).

To test the main predictions derived from the S-REF model, and to consider gender differences, multiple regression analyses were conducted separately for female and male participants. For both genders, trait worry and metacognitive beliefs about the uncontrollability and danger of worry made independent contributions to PTA; however, attentional focus was a significant predictor of PTA only in male students. These findings represent a partial replication of those of Spada *et al.*,[22] who found that negative metacognitive beliefs about the uncontrollability and danger of worry and attention focus control predicted state anxiety. However, the current study extends these findings by showing trait worry also contributes to PTA.

Confidence in the findings is supported by the study's high response rate (77%) and near-equal gender distribution (54% female). In addition, the statistical controlling for the effect of gender enabled a more valid test of the key variables. The study was limited in its use of a cross-sectional design: not only does this confound issues of causality, but it also means that trait and state measures were both assessed on the day of the OSCE. This is a potential threat to internal validity because high levels of state anxiety may inflate scores on trait measures. However, the mean scores on the MCQ-30 and PSWQ were comparable with those reported in previous studies.[23,27] To offset these problems, future studies should use prospective designs that assess trait measures several weeks prior to examinations and assess state measures on the day of an examination. A second issue concerns the ACS attentional control measure. Based on standardised regression coefficients, the ACS showed a relatively small albeit significant association with PTA in male students, but not in female students. Attentional control is a key component in CAS, but the ACS is essentially a belief measure about attentional control. A behavioural assessment of attentional control would provide a better index of how well individuals can allocate their attention (see the attentional control capacity for emotion paradigm[34]).

The identification of these processes has implications for how PTA might be addressed within medical training. The findings suggest that psychological interventions for PTA should focus on reducing perseverative worry, modify negative metacognitive beliefs about the uncontrollability of worry, increase attention focus control and reduce maladaptive coping responses. It is envisaged that raising students' awareness of both the operation of CAS and their ability to employ metacognitive skills to enhance their self-regulation in preparing for tests and examinations will lead to a reduction in PTA in medical students.

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