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Research paper

Prevalence and predictors of mental health outcomes in UK doctors and final year medical students during the COVID-19 pandemic

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ABSTRACT

Background: The mental health of doctors is an ongoing concern, both prior to and during the COVID-19 pandemic. This study aimed to: i) assess the prevalence of symptoms of depression, anxiety, PTSD, and burnout in UK doctors and final year medical students during the pandemic, and ii) analyse the hypothesised relationships between psychological flexibility, intolerance of uncertainty and resilience with these mental health outcomes.

Methods: A cross-sectional online study of UK-based doctors and final year medical students was conducted between 27/09/2020 and 31/01/2021. Outcomes were measured using the PHQ9, GAD7, PCL-5, and aMBI. Independent variables included the CompACT-SF, IUS-12, and CD-RISC-10. Descriptive statistics, between-group analyses, and multiple regression were performed.

Results: Prevalence of anxiety symptoms was 26.3%, depression 21.9%, PTSD 11.8%, and burnout 10.8%. Psychological flexibility negatively predicted all outcomes, apart from low personal achievement. Intolerance of uncertainty positively predicted anxiety and PTSD scores. Resilience negatively predicted scores on burnout subscales.

Limitations: Cross-sectional design and non-probability sampling method means that assumptions about causality cannot be made and may have implications for bias and generalisability of results.

Conclusion: Doctors and medical students in the UK reported high levels of mental health symptoms during the pandemic, between September 2020 and January 2021. All three independent variables explained significant variance in mental health outcomes. Psychological flexibility was the most consistent predictor, over and above sociodemographic variables and other psychological predictors. These findings have implications for interventions to improve retention of our essential medical workforce, and for providing support at future times of national crisis.

1. Introduction

The global high prevalence of depression, anxiety and burnout has been documented in systematic reviews and meta-analyses focussing on doctors (Mata et al., 2016; Rotenstein et al., 2018), and medical students (Rotenstein et al., 2016; Hope and Henderson, 2014; Puthran et al., 2016; Erschens et al., 2019). Since the beginning of the pandemic, there have been concerns regarding the potential psychological impact on this already at-risk population. This has led to studies being conducted across the world, spanning a wide range of medical specialities and geographical locations.

In the UK, a recent British Medical Association survey (BMA, 2021) of over 5000 doctors found that half were planning to work fewer hours after the pandemic, a quarter reported being more likely to take a career break, and just over a fifth were considering leaving the NHS altogether. According to the survey, the number of UK doctors considering early retirement in April 2021 was 32%, compared with 14% in June 2020. In response to these concerns, the BMA (2021) called for immediate measures to address the health, safety, and mental wellbeing of doctors in the UK.

Given that the UK and the rest of the world will be dealing with the residual effects of COVID-19 for many years to come, it is vital that both the physical and psychological needs of doctors are supported. While there are a number of external and organisational factors that can affect doctors' wellbeing, it is important to quantify the prevalence of distress and understand the individual factors that may reduce or increase

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vulnerability to emotional sequalae. To date, a small number of UK-based studies have focussed on the mental health of doctors in specific specialities during the pandemic (Shah et al., 2020; Greenberg et al., 2021; Roberts et al., 2021). A limitation of these studies is the focus on specific specialities, which can limit generalisability of findings. Further, these studies do not address the potential underlying mechanisms of psychological distress. The current study therefore focusses on three psychological processes as hypothesised underlying mechanisms contributing to mental health outcomes for doctors across a wide range of specialities during the pandemic:

Psychological flexibility is associated with reduced risk of a wide range of psychopathology (Gloster et al., 2020; Kashdan and Rottenberg, 2010; Masuda et al., 2011; Tyndall et al., 2020) and may act as a mediator and/or moderator in the relationship between stressful life events and a range of mental health outcomes (Palm and Follette, 2011; White et al., 2013; Bryan et al., 2015; Gloster et al., 2017; Fonseca et al., 2020; Kashdan et al., 2020). Studies focussing specifically on doctors (Solms et al., 2019; Wood et al., 2020; Jokić-Begić et al., 2020; Buck et al., 2019) found higher psychological flexibility was associated with lower burnout and psychological distress. While recent studies in the general population found higher levels of psychological flexibility were inversely related to anxiety, depression, and distress during the pandemic (Kroska et al., 2020; Dawson and Golijani-Moghaddam, 2020; McCracken et al., 2021).

Intolerance of uncertainty is associated with higher psychological distress in doctors and medical students (Strout et al., 2018; Hancock and Mattick, 2020). Based on the findings from their systematic review, Hancock and Mattick (2020) proposed a conceptual model, with IoU suggested as a key feature in the pathway to burnout and mental health problems in medical students.

Resilience has been found to be higher in some physicians, compared with the general population (West et al., 2020), although burnout symptoms were substantial among even the most resilient doctors in this study. An inverse relationship between resilience and burnout symptoms has been found in various medical populations, including medical students (Nituica et al., 2021) and family doctors (Buck et al., 2019).

Psychological flexibility, IoU and resilience may therefore be relevant in understanding and predicting mental health outcomes in doctors. Increasing understanding of these psychological processes, and their relationship to mental health, may help to shape future interventions and support for doctors. The current study is the first to assess the role of these three variables within the UK medical population during the pandemic.

1.1. Study aims

The aims of this study were to 1) provide an estimate of the prevalence of symptoms of depression, anxiety, PTSD and burnout in UK-based doctors and final year medical students during the pandemic, and 2) explore the hypothesised relationships between psychological flexibility, IoU, and resilience with mental health outcomes.

Hypotheses:

1. Psychological flexibility and resilience will be negatively associated with symptoms of depression, anxiety, PTSD and burnout.
2. Intolerance of uncertainty will be positively associated with symptoms of depression, anxiety, PTSD and burnout.
3. Psychological flexibility, intolerance of uncertainty and resilience will predict continuous mental health outcomes, over and above sociodemographic control variables.

2. Methods

2.1. Procedure and participants

The online survey was open from 27/09/2020 to 31/01/2021 to all grades of medical doctors across the UK. Final year medical students were also invited to participate, given the decision to expedite provisional registration for this cohort as part of the pandemic response (Atherton et al., 2020). Informed consent was obtained from all participants at the beginning of the survey. The survey included demographic information, mental health outcome measures, and measures of predictor variables. The study was approved by the Cardiff University School of Psychology Ethics Committee.

2.2. Sample and recruitment

For regression analysis, a minimum sample size of 146 was calculated (Tabachnick and Fidell, 2013). Non-probability sampling methods were used. All UK medical and foundation schools were contacted via email to invite them to promote the study. The study was also promoted via social media and by sharing the study with friends, family and acquaintances. Participants were offered the opportunity to enter a prize draw for the chance to win a £100 high street voucher.

2.3. Measures

2.3.1. Sociodemographic information

Baseline self-reported sociodemographic data were collected for sex, age range, ethnicity, career grade, early registration, geographical location, speciality, frequency of contact with COVID-19 patients, pre-existing mental health condition, clinically vulnerable status (self or close relative/same household), experience of an adverse COVID-related event, experience of an adverse non-COVID-related event (past 12 months).

2.3.2. Dependant variables

The Patient Health Questionnaire-9 Item (PHQ-9; Kroenke et al., 2001) was used to measure symptoms of depression. Recommended severity thresholds are mild 5–9, moderate 10–14, moderately severe 15–19, and severe 20+. Cut-off threshold is ≥10. In the current study $\alpha = 0.86$.

The Generalised Anxiety Disorder Scale-7 Item (GAD-7; Spitzer et al., 2006) was used to measure symptoms of anxiety. Recommended severity thresholds are mild 5–9, moderate 10–14, and severe 15+. Cut-off threshold is ≥10. In the current study $\alpha = 0.90$.

The PTSD Checklist for DSM-5 (PCL-5; Weathers et al., 2013) was used to measure symptoms of post-traumatic stress disorder (PTSD). A cut-off of 31 was adopted, in line with initial research. In the current study, $\alpha = 0.94$.

The Abbreviated Maslach Burnout Inventory (aMBI) was used to measure burnout. The measure consists of three subscales that assess the subdomains of emotional exhaustion (EE;), depersonalisation (DP), and low personal accomplishment (LPA). Scores on the aMBI are pro-rated, as described in Colville et al. (2017). Subscale cut-offs are based on recommended cut-offs for the full MBI (Maslach et al., 1996). Scoring above or below the specified cut-off for all three subscales is considered necessary for burnout (Maslach and Leiter, 2021). Research indicates that the aMBI is a valid and reliable substitute for the full MBI (Riley et al., 2018). In the current study, internal consistency was broadly acceptable (EE $\alpha = 0.73$, DP $\alpha = 0.69$, LPA $\alpha = 0.61$).

2.3.3. Independent variables

The Comprehensive assessment of Acceptance and Commitment Therapy processes-Short Form (ComPACT-SF; Morris, 2019) was used to measure psychological flexibility. The CompACT-SF is an abbreviated version of the full CompACT (Francis et al., 2016), and assesses the six core psychological flexibility processes. Initial research indicates that the CompACT-SF is a valid and reliable substitute for the full CompACT (Morris, 2019). In the current study $\alpha = 0.77$.

The Intolerance of Uncertainty Scale–12 item (IUS-12; Carleton et al., 2007) is a 12-item self-report measure of IoU. In the current study

α = 0.90.

The Conor Davidson Resilience Scale 10-item (CD-RISC-10; Campbell-Sills and Stein, 2007) was used to measure psychological resilience. CD-RISC-10 is an abbreviated version of the full CD-RISC (Connor & Davidson, 2003) and is considered a valid and reliable substitute. In the current study α = 0.88.

2.4. Data collection and analysis

Data were collected anonymously using Qualtrics secure online survey platform. Data analysis was conducted using IBM SPSS statistical software v.25.0 (IBM Corp). As some of the scores for the measurement scales were not normally distributed, medians (Md) and interquartile ranges (IQRs) are reported. Frequency data, such as the total number of positive cases, are presented as absolute values (n,%). Spearmans Rho analysis was conducted to explore associations between independent variables (IVs) and dependant variables (DVs). Nonparametric Mann-Whitney U and Kruskal-Wallis tests were performed to compare median mental health scores among groups.

Hierarchical multiple regression was performed to assess the ability of the three key independent variables of psychological flexibility (COMPACT-SF), intolerance of uncertainty (IUS-12), and resilience (CD-RISC-10) to predict continuous scores on mental health measures. Nine control variables (frequency of contact with COVID patients; sex; ethnicity; pre-existing mental health conditions; early registration; adverse COVID-related event; adverse non-COVID-related event <12 months; clinically vulnerable group- self; clinically vulnerable group-close other) were entered at step-one, and the additional three psychological predictor variables were included in the model at step-two. Control variables were coded as dichotomous categorical variables, apart from career grade and age range (multiple categorical) and frequency of contact with COVID patients (continuous). All three primary IVs were continuous.

There was no evidence of multicollinearity, and residual and scatter plots indicated assumptions of normality, linearity and homoscedasticity were all broadly met (Hair et al., 1998; Pallant, 2016) for all outcomes, apart from the PCL-5 and depersonalisation scales. A square root transformation was applied to the data for these two scales before conducting multiple regression analyses, given the increased sensitivity to normality, linearity and homoscedasticity for multiple regression. A *p*-value of <0.05 was considered significant, and all tests were 2-tailed.

3. Results

3.1. Demographic characteristics

Three-hundred-and-forty-six participants completed the core set of questionnaires. Due to the recruitment strategy used, an accurate response rate was not calculable. Final year medical students comprised nearly a quarter of the sample, 46.2% were foundation doctors (F1, F2), 30% were middle or senior grade doctors. A majority of participants were female, under thirty, and white. Pre-existing mental health condition(s) were reported by over a fifth of respondents, while 71.2% reported their frequency of contact with COVID-19 patients as either 'sometimes', 'often' or 'all the time'. Full details of respondent demographics can be found in Table 1.

3.2. Prevalence of mental health symptoms

The proportions of participants scoring above cut-off were 26.3% for anxiety, 21.9% for depression, 11.8% for PTSD, 56.8% for emotional exhaustion,36.4% for depersonalisation, 27.2% for low personal achievement, and 10.8% for burnout. Median (IQR) scores were 6.0 (3.0–10.0) for the GAD7, 5.0 (2.0–9.0) for the PHQ9, 8.0 (2.0–19.0) for the PCL-5, 30.00 (18.00–39.00) for emotional exhaustion, 6.67 (1.67–11.67) for depersonalisation, and 37.33 (32.00–42.67) for low personal achievement. Supplementary Tables 1 and 2 provide a full breakdown by sociodemographic variables, and severity thresholds.

The prevalence of suicidal thoughts was assessed by question nine on the PHQ9 *"Thoughts that you would be better off dead, or of hurting yourself in some way"*. Overall prevalence was 7.3%. Those who reported a pre-

Table 1
Characteristics of participants.

Characteristic	Total (*N* = 346[a], 100%)	Characteristic	Total (N = 346, 100%)
Sex	*N* = 336	Non-COVID adverse life event	*N* = 342
Female	252, 75.0	Agree or strongly agree	96, 27.9
Male	84, 25.0	Disagree, strongly disagree, neutral	246, 71.5
Age	*N* = 339	COVID-related adverse life event	*N* = 341
18–24	109, 32.2	Agree or strongly agree	52, 15.1
25–29	133, 39.2	Disagree, strongly disagree, neutral	290, 84.3
30–34	54, 15.9	Clinically vulnerable group (self)	N = 341
35–39	20, 5.9	Yes	29, 8.4
40–44	12, 3.5	No	312, 90.7
45+	11, 3.2	Clinically vulnerable group (relative)	N = 339
Career grade	N = 346	Yes	105, 31.0
Final year medical student	82, 23.7	No	234, 69.0
Foundation Year 1	87, 25.1	Pre-existing mental health diagnosis	*N* = 332
Foundation Year 2	73, 21.1	Yes	70, 21.7
Junior Middle Grade	29, 8.4	No	262, 78.9
Senior Middle Grade	43, 12.4	Clinical contact with COVID-19 patients	*N* = 344
Consultant or GP	32, 9.2	Not at all	45, 13.1
Early provisional/full registration	N = 346	Rarely	54, 15.7
Yes	75, 21.7	Sometimes	75, 21.8
In progress	4, 1.2	Often	105, 30.5
No/not applicable	267, 77.2	All the time	65, 18.9
Geographical working location	*N* = 334	Current speciality	*N* = 331
South East	30, 9.0	General Internal Medicine	72, 22.4
East of England	17, 5.1	Surgery	54, 16.3
East Midlands	34, 10.2	General Practice (GP)	39, 11.8
West Midlands	43, 12.9	Psychiatry	27, 8.2
North West and North East	47, 14.1	Emergency Medicine	26, 7.9
Yorkshire and the Humber	55, 16.5	Paediatrics	17, 5.1
South West	33, 9.9	Intensive Care	11, 3.3
Scotland	32, 9.6	Anaesthesia	10, 3.0
Wales	43, 12.9	Other speciality and/or student rotation	77, 23.3
Ethnicity	*N* = 335	Previous speciality during pandemic[b]	*N* = 331
White/White British	262, 78.2	General Internal Medicine	74, 18.2
South Asian/South Asian British	37, 11.0	Surgery	41, 12.4
Mixed/multiple ethnic background	12, 3.6	Intensive Care	34, 10.3
East Asian/East Asian British	11, 3.3	Emergency Medicine	29, 8.8
Black/Black British	2, 0.6	General Practice (GP)	28, 8.4
Any other ethnic background	11, 3.3	Other[c]	58, 17.5

[a] Sample N for each demographic category may vary due to missing demographic information for some respondents.
[b] Percentages do not total 100 as multiple responses enabled.
[c] <20 per speciality, including: psychiatry, acute, COVID wards, infectious diseases, paediatrics, palliative care.

existing mental health condition had the highest rate of suicidal thoughts at 24.3%. Further breakdown is provided in Supplementary Table 3.

3.3. Group differences in mental health symptoms

Analysis of median scores on the GAD-7 (anxiety) and PHQ-9 (depression) revealed significant group differences, with higher scores in females vs males, in those reporting pre-existing mental health conditions vs those without, in those reporting a significant non-COVID-related adverse event in the past twelve months vs those who had not, and in those reporting a significant COVID-related adverse event vs those who had not for both measures. For the PCL-5 (PTSD) the same group differences were found, with the exception of sex, which was not significant.

For median emotional exhaustion (EE) there were significantly higher median scores for females vs males. There were also significant differences across career grades. F2s and senior grades recorded the same median scores, higher than the other groups. Post hoc Mann Whitney U analysis, with Bonferroni corrections applied ($p = .017$), confirmed a significant difference between F2s and final year medical students (U = 2130.500, z = −2.996, $p = .003$, $r = -0.24$), close to significance with middle grades (U = 2031.00, z = −2.367, $p = .018$, $r = 0.19656866$), but no significant difference when compared with F1s (U = 3.103.500, z = −0.247, $p = .805$, $r = 0.02$). Senior grades were significantly different when compared with final year medical students (U = 896.500, z = −2.551, $p = .011$, $r = -0.24$), but not with F1s (U = 1258.500, z = −0.803, $p = .422$, $r = -0.07$), or middle grades (U = 844.00, z = −2.176, $p = .030$, $r = -0.21$).

Analysis of median depersonalisation (DP) scores revealed significant differences across career grades. F2s recorded a higher median score other groups. Post hoc analysis with Bonferroni corrections ($p = .0125$) confirmed a significant difference between F2s compared with final year medical students (U = 1959.0, z = −3.522, $p = .000$, $r = -0.28$), but no significant difference when compared with F1s (U = 2612.500, z = −1.697, $p = .090$, $r = 0.13$), senior grades (U = 1074.00, z = −0.551, $p = .581$, $r = -0.05$), or middle grades (U = 2036.00, z = −2.235, $p = .025$, $r = 0.19$).

For median scores on low personal achievement (LPA), none of the sub-group were statistically significantly different.

Supplementary Tables 2–7 present full statistics for all group comparisons.

3.4. Associations between primary IVs and mental health outcomes

Spearmans rho correlation analysis revealed all primary IVs were statistically significantly associated with all mental health outcomes. Further details, including effect sizes, are presented in Table 2.

3.5. Predictors of continuous scores

For the anxiety model, the control variables entered at step-one explained 7.3% of the variance in symptoms. At step-two, the total variance explained by the model as a whole was 38.2%, F (12,312) =16.10, $p \leq 0.0005$. The three primary IVs explained an additional 31% of the variance in anxiety. In the final model, only psychological flexibility and IoU were statistically significant.

For the depression model, the variables entered at step-one explained 15.1% of the variance in symptoms. At step-two, the total variance explained by the model as a whole was 43%, F (12, 312) =19.606, $p \leq 0.0005$. The three primary IVs explained an additional 28% of the variance in anxiety. In the final model, only psychological flexibility and adverse non-COVID life event were statistically significant.

For the PTSD model, the variables entered at step-one explained 13.3% of the variance in symptoms. At step-two, the total variance explained by the model as a whole was 45.5%, F (12, 312) =21.75, $p \leq 0.0005$. The three primary IVs explained an additional 32.2% of the variance in PTSD symptoms. In the final model, statistically significant step-one variables were: COVID-related adverse life event and frequency of contact with COVID patients; significant step-two variables were psychological flexibility and IoU.

For the emotional exhaustion model, the variables entered at step-one explained 7.9% of the variance in symptoms. At step-two, the total variance explained by the model as a whole was 31.7%, F (12, 312) =12.069, $p \leq 0.0005$. The three primary IVs explained an additional 23.8% of the variance in symptoms. In the final model, statistically significant step-one variables were: sex, early registration, close relative/same household with a clinically vulnerable group; significant step-two variables were psychological flexibility and resilience.

For the depersonalisation model, the variables entered at step-one explained 5.1% of the variance in symptoms. At step-two, the total variance explained by the model as a whole was 13.3%, F (12, 312) =3.981, $p \leq 0.0005$. The three primary IVs explained an additional 8.2% of the variance in symptoms. In the final model, statistically significant step-one variables were: adverse COVID life event and frequency of contact with COVID patients. The only significant step-two variable was psychological flexibility.

For the low personal achievement model, the variables entered at step-one explained 1.6% of the variance in symptoms. At step-two, the total variance explained by the model as a whole was 18.7%, F (12, 312) =5.997, $p \leq 0.0005$. The three primary IVs explained an additional 17.2% of the variance in symptoms. In the final model, the only statistically significant variable was resilience.

Tables 3–5 present full details of multiple regression analyses.

Table 2
Spearman's Rho correlations.

	1	2	3	4	5	6	7	8	9	10
1. GAD7	–									
2. PHQ9	0.723**	–								
3. PCL-5	0.641**	0.718**	–							
4. aMBI EE	0.432**	0.414**	0.404**	–						
5. aMBI DP	0.124*	0.115*	0.150**	0.424**	–					
6. aMBI LPA	−0.109*	−0.109*	−0.037	−0.221**	−0.195**	–				
7. CompACT-SF	−0.589**	−0.638**	−0.621**	−0.437**	−0.235**	0.148**	–			
8. IUS-12	0.436**	0.347**	0.384**	0.309**	0.129*	−0.176**	−0.407**	–		
9. CD-RISC-10	−0.372**	−0.332**	−0.274**	−0.425**	−0.219**	0.407**	0.473**	−0.415**	–	
10. COVID Pt Contact	0.080	0.105	0.157**	0.107*	0.176**	0.057	−0.071	0.052	0.024	–

GAD7 = Generalised Anxiety Disorder −7 Item; PHQ9 = Patient Health Questionnaire- 9 Item; PCL-5 = PTSD checklist for DSM-5; aMBI = abbreviated Maslach Burnout Inventory; EE = emotional exhaustion scale; DP = depersonalisation scale; LPA = low personal achievement scale; CompACT-SF = Comprehensive assessment of Acceptance and Commitment Therapy processes - short form; IUS-12 = Intolerance of Uncertainty Scale – 12 Item; CD-RISC-10 = Connor Davidson Resilience Scale-10 Item; COVID pt. Contact = frequency of contact with COVID-19 patients.

* $p \leq 0.05$.

** $p \leq 0.01$.

Table 3
Hierarchical multiple regression: predictors of anxiety (GAD7) and depression (PHQ9) symptoms.

	Anxiety								Depression							
	Step 1 (control variables)				Step 2				Step 1 (control variables)				Step 2			
	B	*SE B*	*β*	*p*	B	SE B	*β*	*p*	B	*SE B*	*β*	*p*	B	SE B	*β*	*p*
Early registration	0.980	0.697	0.077	0.161	0.974	0.577	0.077	0.092	0.572	0.659	0.045	0.387	0.610	0.547	0.049	0.266
Ethnicity	−0.073	0.693	−0.006	0.916	−0.880	0.576	−0.069	0.128	−0.316	0.655	−0.25	0.630	−0.817	0.547	−0.065	0.136
Vul. group (self)	0.433	1.025	0.023	0.673	−0.276	0.851	−0.015	0.745	0.834	0.969	0.045	0.390	0.008	0.808	0.000	0.992
Vul. group (rel.)	−0.204	0.623	−0.018	0.744	0.273	0.514	0.024	0.596	0.217	0.589	0.019	0.713	0.784	0.488	0.070	0.109
AE COVID	0.918	0.817	0.063	0.262	0.473	0.679	0.032	0.487	1.277	0.772	0.089	0.099	0.512	0.645	0.036	0.427
AE non-COVID	1.223	0.655	0.105	0.063	0.501	0.543	0.043	0.357	2.306	0.619	0.200	0.000**	1.554	0.516	0.135	0.003*
Pre mental health	1.832	0.725	0.143	0.012*	0.156	0.611	0.012	0.798	2.707	0.686	0.213	0.000**	1.083	0.580	0.085	0.063
Sex	1.438	0.665	0.119	0.031*	0.706	0.549	0.058	0.200	1.364	0.629	0.114	0.031*	0.810	0.521	0.068	0.121
COVID pt. contact	0.220	0.226	0.054	0.330	0.045	0.186	0.011	0.807	0.326	0.213	0.082	0.127	0.177	0.177	0.044	0.316
Psych flexibility	–	–	–	–	−0.256	0.036	−0.400	0.000**	–	–	–	–	−0.319	0.034	−0.505	0.000**
Resilience	–	–	–	–	−0.058	0.044	−0.071	0.186	–	–	–	–	−0.042	0.041	−0.052	0.316
IoU	–	–	–	–	0.135	0.029	0.243	0.000**	–	–	–	–	0.036	0.028	0.066	0.192
R^2	0.073				0.382				0.151				0.430			
R^2 Change	0.073				0.310				0.151				0.279			
F Change	2.740				52.143				6.228				50.867			
Sig F Change	0.004*				0.000**				0.000**				0.000**			

Vul. group = clinically vulnerable group; AE = adverse event; Pre mental health = pre-existing mental health condition; COVID pt. contact = frequency of contact with COVID-19 patients.
* $p \leq 0.05$.
** $p \leq 0.001$.

Table 4
Hierarchical multiple regression: predictors of PTSD (PCL-5) and depersonalisation (aMBI subscale) symptoms.

	PTSD (PCL-5)								Depersonalisation (aMBI)							
	Step 1 (control variables)				Step 2				Step 1 (control variables)				Step 2			
	B	*SE B*	*β*	*p*	B	SE B	*β*	*p*	B	*SE B*	*β*	*p*	B	SE B	*β*	*p*
Early registration	0.212	0.251	0.045	0.399	0.160	0.202	0.034	0.428	−0.043	0.205	−0.012	0.834	−0.004	0.198	−0.001	0.985
Ethnicity	0.068	0.250	0.014	0.786	−0.189	0.201	−0.040	0.350	0.098	0.204	0.027	0.631	0.031	0.198	0.008	0.876
Vul. group (self)	0.771	0.369	0.110	0.038*	0.375	0.297	0.054	0.208	0.124	0.301	0.023	0.552	0.043	0.293	0.008	0.884
Vul. group (rel.)	0.139	0.224	0.033	0.536	0.332	0.180	0.079	0.066	−0.022	0.183	−0.007	0.905	0.076	0.177	023	0.670
AE COVID	0.754	0.294	0.139	0.011*	0.495	0.237	0.091	0.038*	−0.458	0.240	−0.108	0.057	−0.575	0.234	−0.136	0.014*
AE non-COVID	0.508	0.236	0.117	0.032*	0.177	0.190	0.042	0.351	−0.119	0.192	−0.035	0.536	−0.214	0.187	−0.063	0.253
Pre mental health	0.841	0.261	0.176	0.001**	0.206	0.214	0.043	0.335	0.168	0.213	0.045	0.429	−0.088	0.210	−0.024	0.677
Sex	0.361	0.239	0.080	0.132	0.113	0.192	0.025	0.558	−0.278	0.195	−0.079	0.156	−0.359	0.189	−0.102	0.058
COVID pt. contact	0.207	0.081	0.137	0.011*	0.133	0.065	0.088	0.042*	0.229	0.066	0.2195	0.001**	0.212	0.064	0.180	0.001**
Psych flexibility	–	–	–	–	−0.127	0.013	−0.535	0.000**	–	–	–	–	−0.044	0.012	−0.236	0.000**
Resilience	–	–	–	–	0.017	0.015	0.057	0.262	–	–	–	–	−0.026	0.015	−0.109	0.088
IoU	–	–	–	–	0.038	0.010	0.183	0.000**	–	–	–	–	0.000	0.010	−0.001	0.987
R^2	0.133				0.455				0.051				0.133			
R^2 Change	0.133				0.322				0.051				0.082			
F Change	5.374				61.558				1.889				9.785			
Sig F Change	0.000**				0.000**				0.053				0.000**			

Vul. group = clinically vulnerable group; AE = adverse event; Pre mental health = pre-existing mental health condition; COVID pt. contact = frequency of contact with COVID-19 patients.
* $p \leq 0.05$.
** $p \leq 0.001$.

Table 5
Hierarchical multiple regression: predictors of emotional exhaustion and low personal achievement symptoms (aMBI subscales).

	Emotional Exhaustion (aMBI)								Low Personal Achievement (aMBI)							
	Step 1 (control variables)				Step 2				Step 1 (control variables)				Step 2			
	B	SE B	β	p	B	SE B	β	p	B	SE B	β	p	B	SE B	β	p
Early registration	3.072	1.738	0.097	0.078	3.756	1.516	0.118	0.014*	1.868	1.111	0.095	0.094	1.127	1.023	0.057	0.271
Ethnicity	1.245	1.728	0.039	0.472	−0.097	1.515	−0.003	0.949	−0.515	1.104	−0.026	0.642	0.049	1.021	0.003	0.962
Vul. group (self)	2.383	2.554	0.051	0.352	1.741	2.237	0.037	0.437	1.191	1.633	0.041	0.466	0.525	1.509	0.018	0.728
Vul. group (rel.)	1.444	1.551	0.051	0.353	2.709	1.351	0.096	0.046*	0.285	0.992	0.016	0.774	−0.219	0.911	−0.013	0.810
AE COVID	−1.594	2.035	−0.044	0.434	−2.714	1.786	−0.074	0.130	−0.333	1.301	−0.015	0.798	−0.262	1.204	−0.012	0.828
AE non-COVID	1.034	1.633	0.035	0.527	−0.093	1.429	−0.003	0.948	0.259	1.044	0.014	0.804	0.255	0.963	0.014	0.791
Pre mental health	2.425	1.807	0.075	0.181	−1.235	1.606	−0.038	0.442	0.398	1.155	0.020	0.731	1.768	1.083	0.089	0.104
Sex	6.384	1.657	0.211	0.000**	5.003	1.444	0.165	0.001*	0.250	1.059	0.013	0.814	0.812	0.974	0.043	0.405
COVID pt. contact	1.186	0.562	0.117	0.036*	0.957	0.489	0.094	0.051*	0.335	0.359	0.053	0.352	0.328	0.330	0.052	0.321
Psych flexibility	–	–	–	–	−0.469	0.095	−0.293	0.000**	–	–	–	–	0.006	0.064	0.006	0.930
Resilience	–	–	–	–	−0.506	0.115	−0.249	0.000**	–	–	–	–	0.507	0.077	0.404	0.000**
IoU	–	–	–	–	0.116	0.077	0.084	0.130	–	–	–	–	−0.035	0.052	−0.041	0.499
R^2	0.079				0.317				0.016				0.187			
R^2 Change	0.079				0.238				0.016				0.172			
F Change	3.005				36.236				0.552				21.999			
Sig F Change	0.002*				0.000**				0.836				0.000**			

Vul. group = clinically vulnerable group; AE = adverse event; Pre mental health = pre-existing mental health condition; COVID pt contact = frequency of contact with COVID-19 patient.
* $p \leq 0.05$.
** $p \leq 0.001$.

4. Discussion

4.1. Summary of prevalence of mental health symptoms

This cross-sectional study provides an estimate of the prevalence of mental health symptoms among UK doctors and final year medical students during the COVID-19 pandemic. The prevalence of anxiety reported is similar to other recent UK-based studies of doctors during the pandemic (24.6%, Shah et al., 2020; 28%, Greenberg et al., 2021). It is also close to the 25.8% (95% CI 20.4–31.5%) global prevalence of anxiety among doctors, found in a meta-analysis covering the first year of the pandemic (Johns et al., 2022). The rate for depression falls between the 15.9% reported by Shah et al. (2020) for obstetrics and gynaecology doctors, and the 31% reported by Greenberg et al. (2021) for ICU doctors. It is also comparable with the estimated 20.5% (95% CI 16.0–25.3%) global prevalence among doctors during the pandemic (Johns et al., 2022). Symptoms of probable PTSD were significantly lower than the 32% reported by Greenberg et al. (2021), perhaps due to the emotive nature of ICU work. Burnout was considerably lower in this study, compared with previous reports, although rates on the subscales of emotional exhaustion and depersonalisation (i.e., unfeeling or impersonal response toward patients) were very high, indicating risk of future burnout.

Data from a longitudinal study of adults in the general population in England (Fancourt et al., 2021), conducted between March and August 2020, indicated higher levels of depression (26%) and anxiety (22%) during the early stages of the pandemic, followed by a rapid decline, potentially as people adapted to the situation. By week twenty, prevalence had dropped significantly to 16.3% for depression and 11.5% for anxiety; these figures are markedly different from the prevalence rates for doctors in the current study, however direct comparisons cannot be made given the difference in data collection timeframe.

4.2. Sociodemographic risk factors for poor mental health

In the current study, females were significantly more likely to have higher symptoms of anxiety, depression and emotional exhaustion, a finding that has been widely reported in the literature for doctors (Kinman and Teoh, 2018). Medics reporting a pre-existing mental health condition were also significantly more likely to have increased symptoms of anxiety, depression and PTSD. Nearly a quarter of medics in this category reported thoughts of suicide or self-harm within the previous two weeks, compared with 5.2% of doctors without a pre-existing mental health condition. The increased suicide risk among doctors has previously been highlighted (Ventriglio et al., 2020). F2s were statistically more likely to have higher symptoms of emotional exhaustion and depersonalisation compared with final year medial students, providing support for previous reports that burnout seems to peak at F2 (Taylor, 2020). Participants who had experienced a COVID-related adverse event were also more likely to have higher symptoms of depression, anxiety and PTSD, as were participants who had experienced a non-COVID-related adverse event within the previous twelve months. These results highlight some important at-risk groups, which may be useful for targeting future interventions. These findings also suggest a need for greater consideration and support to be given to the impact of recent adverse life experiences, both inside and outside of the workplace. Given the high rates observed across career grades, support should be targeted toward doctors at all career stages.

Frequency of contact with COVID patients and experience of a COVID-related adverse event were only significant in the multiple regression models as predictors of PTSD and depersonalisation. Interestingly, although experience of a COVID-related adverse event was *positively* associated in all other significant relationships, it was *negatively* associated with depersonalisation. A tentative hypothesis for this finding is that these experiences may lead to increased empathy toward patients, partially protecting them from feelings of depersonalisation

(cynicism). However, this hypothesis would need to be empirically tested before drawing this conclusion.

4.3. Psychological predictors of poor mental health

The current study found that psychological flexibility demonstrated incremental negative predictive validity for all mental health outcomes in multiple regression models, over and above sociodemographic variables. These results are consistent with recent findings from studies conducted with the general population during the pandemic (Dawson and Golijani-Moghaddam, 2020; Kroska et al., 2020; McCracken et al., 2021).

IoU and resilience were both significantly associated with all mental health outcomes in Spearmans correlational analyses. In regression analyses, IoU demonstrated positive incremental validity for symptoms of anxiety and PTSD. Resilience negatively predicted emotional exhaustion and low personal achievement scores. However, neither processes were able to predict outcomes as consistently or as strongly as psychological flexibility.

4.4. Conceptual similarities and differences

It is important to consider the potential overlap in the underlying constructs of the three primary IVs in this study, as well as the features that distinguish them. Psychological flexibility appears to be a much broader concept than IoU, but both incorporate the idea that distress arises from avoidance. While IoU is predominantly focussed on the avoidance of uncertainty, reduced psychological flexibility is associated with avoidance of a wider range of experiences. Further, resilience has been conceptualised as a contextual behavioral factor, or set of behaviours (Gentili et al., 2019), closely related to the behavioral aspects of psychological flexibility (i.e., ability to act in line with values in the presence of discomfort).

One hypothesis is that IoU and/or resilience may be subsumed under the broader concept of psychological flexibility. However, further research is needed to parse out these psychological concepts and explore which, if any, of their underlying constructs are convergent. Dismantling studies may help to clarify which factors are most amenable to change through therapeutic intervention. Another consideration is the potential overlap with other related concepts. For example, close parallels have been drawn between psychological flexibility and executive function (Cherry et al., 2021), a concept most closely associated with the field of neuropsychology and with its own extensive body of research. Indeed, some have suggested executive functioning is one of the 'building blocks' of psychological flexibility (Kashdan and Rottenberg, 2010). Executive function is the 'top-down' process of engaging in goal-directed behavior by overriding pre-potent responses; a feature that could be considered common to all three IVs in this study. However, executive function is similarly not a unitary concept and there has been much debate regarding its conceptual definition. Future research may benefit from adopting a transdisciplinary approach to studying these processes, which may help to bridge the conceptual gap (Poldrack et al., 2011), and in turn help to shape more effective interventions (Cherry et al., 2021; Kashdan et al., 2020).

4.5. Implications and recommendations

The findings from the current study may be relevant to future iterations of conceptual models that seek to explain the pathway to mental health difficulties for medical students and doctors, such as the one proposed by Hancock and Mattick (2020). Within their model, IoU and resilience were identified as possible modifying or mediating variables; however, the current study suggests that psychological flexibility may be an even more salient variable in this pathway. In order to effectively address the question of mediating or moderating relationships, further longitudinal research is needed to adequately explore mechanisms of causality.

Psychological flexibility is a construct that is considered amenable to change. A meta-analysis (Levin et al., 2012) of lab-based component studies found evidence to support the usefulness and theoretical coherence of components of the psychological flexibility model. A recent review of meta-analyses for ACT (Gloster et al., 2020) found positive effects for a broad range of conditions. There is also emerging meta-analytic evidence for the use of specific approaches with doctors, such as mindfulness (Scheepers et al., 2020) ACT (Reeve et al., 2018) and CBT (Petrie et al., 2019), all approaches in which psychological flexibility is central. Indeed, it has been suggested that psychological flexibility is an integral mechanism of many therapeutic approaches, even when it is not the explicit aim (Kashdan and Rottenberg, 2010). Given that psychological flexibility is a transdiagnostic process, interventions could be universally targeted, as part of medical student induction and/or embedded within the ongoing curriculum. For example, there is preliminary evidence to suggest that even brief ACT-based interventions may be effective for NHS and non-NHS care staff (Waters et al., 2018; Reeve et al., 2021).

Finally, it is important to highlight the need for organisational sensitivity. Exclusive focus on individual responsibility can contribute to a culture of blame. Targeting individual factors, without wider structural changes, can feed into unhelpful narratives and stigma around "failure to cope" (Kinman and Teoh, 2018). However, it is equally important not to disregard the relevance of personal resources, such as those highlighted in this study. Involving doctors in the co-construction of interventions and support systems may help to enhance acceptability, feasibility, and engagement (Petrie et al., 2019). It is therefore imperative that interventions targeting the mental health and wellbeing of doctors are implemented at multiple levels, in partnership with doctors, and with appropriate consideration given to organisational, team and individual factors (Bakker and Demerouti, 2018; West et al., 2016; Petrie et al., 2019).

4.6. Limitations

This study has some important limitations. A cross-sectional survey-based design was adopted, which means that assumptions about causality cannot be made. Similarly, since a non-probability sampling method was used, a sampling frame could not be established, and it was not possible to calculate a response rate. More senior staff grades and male doctors were under-represented, and there were no participants from Northern Ireland. At-risk doctors may have been too busy or distressed to take part in the study or, alternatively, the study may have attracted a greater number of doctors with a history of mental health conditions, due to personal relevance and interest. Self-report measures can also introduce bias due to social desirability. Further, the data collection timeframe may have influenced results, given the variability in cases over this period and the potential implications this may have for reported distress. All of these factors may have implications for the risk of bias and generalisability of results. Finally, since 'gold standard' diagnostic interviews were not possible, the reported estimates may not reflect the true prevalence of mental health conditions within this population.

4.7. Strengths

There has been a wealth of research assessing the prevalence of mental health problems in healthcare workers during the pandemic and their associated sociodemographic risk factors. However, few studies have explored the hypothesised underlying psychological processes that may be modifying these outcomes. Further strengths of this study include the UK-wide coverage and sample size. In addition, the use of standardised and validated outcome measures offers more robust support to findings from larger-scale staff surveys (e.g., BMA, 2021) that predominantly utilise idiosyncratic measures to estimate prevalence of

mental health problems. Finally, while some studies have looked at the role of resilience and intolerance of uncertainty in doctors (Di Monte et al., 2020; Mosheva et al., 2020), to the author's knowledge, this is the only study to date to assess the role of psychological flexibility within this population during the pandemic. The strength of findings in relation to psychological flexibility suggests that this may be an important variable to target in future research; particularly in relation to models of wellbeing for this population, in which the potential moderating role of psychological flexibility has not yet been adequately explored through longitudinal research.

4.8. Conclusion

The findings from this study help to quantity the prevalence of distress experienced by doctors in the UK during the pandemic, which may help to plan and prepare for other times of national crisis. Furthermore, the risk factors and psychological predictors identified in this study may help to inform future support and interventions for doctors. Improving support systems should form a central role in our recovery plan as we emerge from the pandemic, and may ultimately improve the retention and wellbeing of the essential medical workforce in the years to come.

Conflict of Interest

None.

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CRediT authorship contribution statement

G. Johns: Conceptualization, Methodology, Formal analysis, Writing – original draft. **L. Waddington:** Conceptualization, Supervision. **V. Samuel:** Conceptualization, Supervision.

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Appendix A. Supplementary data

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