



Research Paper

Self-critical thinking mediates the relationship between perfectionism and perceived stress in undergraduate students: A longitudinal study

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ABSTRACT

The present study examined the concurrent and longitudinal relationships between multidimensional perfectionism, perceived stress, and self-critical thinking in a sample of UK university students. Specifically, to determine whether self-critical thinking at baseline mediated the longitudinal relationship between baseline perfectionism and future stress at follow-up. At baseline, N=220 students completed measures of multidimensional perfectionism, perceived stress, and self-critical thinking, whereas N=84 completed the same measures at follow-up. Socially prescribed, and self-oriented perfectionism were related to increased stress, self-hatred, and self-inadequacy at baseline. Longitudinal analysis revealed that baseline self-oriented and socially prescribed perfectionism were significantly related to increased reports of stress and self-critical thinking fifteen weeks later at follow-up. More crucially, multiple mediation analysis found self-hatred and inadequacy at baseline mediated the longitudinal relationship between baseline perfectionism and perceived stress at follow-up. Perfectionistic and self-critical thinking appears to accentuate the experience of perceived stress in the university student population. Student-based interventions to reduce self-critical thinking may prove beneficial in preventing the onset of perceived stress.

1. Introduction

The transition to university level study typically involves significant academic and psychosocial challenges leaving university students particularly vulnerable to psychological distress (Holdaway et al., 2018; Taylor et al., 2013). The experience of stress entails a cognitive and emotional burden elicited in the face of particularly adverse or challenging situations which are perceived to or exceed their ability to cope, involving heightened autonomic nervous system and hypothalamic-pituitary-adrenocortical (HPA) activity (Ulrich-Lai and Herman, 2009). Acute physiological and psychological effects of stress include gastrointestinal discomfort, headaches, and cognitive impairments (e.g., poor memory and concentration; Waghachacare et al., 2013). Whereas prolonged stress appears to put individuals at risk of diabetes, cardiovascular disease, fatigue, depression, sleep disturbance and suicidal ideation (American Institute for Stress, 2014; Akram et al., 2020; Gardani et al., 2021; Iob and Steptoe, 2019; Nyberg et al., 2014).

University candidates face numerous situations that are likely to be perceived as stressful. Indeed, university level study comes with greater expectations of academic quality and capability within a less structured learning environment which emphasise independent learning (Cleary et al., 2011). Moreover, recurrent social and collegial activities that form part of the university lifestyle, in the absence of parental oversight, typically involve increased alcohol consumption, possible substance use and sexual relationships (Cleary et al., 2011). In the UK, increasingly higher costs of living and increased tuition fees leave many students exposed to financial difficulties, debt, and self-management of a limited budget, may prove especially difficult (O'Neil et al., 2018). Indeed, over the past decade the experience of psychiatric difficulties appears to be continually rising among UK university students, with a fivefold increase in the number of students choosing to divulge their mental health difficulties to an institutional support service (Thorley, 2017). Despite this, institutional wellbeing services often fail to meet the increased demand for help and support (Motier et al., 2018; O'Neil et al., 2018). As such,

Abbreviations: T1, Baseline data collection; T2, Follow-up data collection; MPS-HF, Multidimensional Perfectionism Scale; PSS-4, Perceived Stress Scale; FSCRS, The Forms of Self-Criticizing/Attacking & Self-Reassuring Scale; PMMA, Parallel Multiple Mediation Analysis; SPP, Socially Prescribed Perfectionism; SOP, Self-Oriented Perfectionism; OOP, Other-Oriented Perfectionism.

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the identification of potential modifiable predictors of stress in this population remains a vital means of refining the identification process for those at-risk, whilst offering novel insight into treatment targets (Mortier et al., 2018; O'Neil et al., 2018).

With that in mind, specific aspects of multidimensional perfectionism and negative self-appraisal are frequently evidenced to be associated with increased reports of perceived stress amongst university students in several countries including the US (Chang, 2006; Chang and Rand, 2000; Dunkley et al., 2003), Australia (Schweitzer and Hamilton, 2002), Canada (Flett et al., 2016) and France (Saleh et al., 2017), alongside UK dental students (Collin et al., 2020) and Chinese and Indian international students studying in the US (Rice et al., 2012).

1.1. The relationship between perfectionism and stress in the student population

Perfectionism refers to the tendency to set excessively high standards for oneself and to engage in overly critical self-evaluations (Frost et al., 1990; Hewitt et al., 1991). The experience of perfectionism plays a crucial predisposing and perpetuating role in relation to many psychiatric disorders including anxiety, depression, insomnia, and stress (Akram et al., 2015; Bardone-Cone et al., 2007; Egan et al., 2011; Johann et al., 2022; Hewitt et al., 1991). According to cognitive models of perfectionism, intrusive thoughts (e.g., perfectionistic, self-critical and/or procrastinatory), worry (e.g., hopelessness, negative future outlooks), and rumination (e.g., past mistakes and failures, anger-related, work-related) related to perfectionistic strivings may serve to increase psychological distress in perfectionistic students (Aprin-Cribble and Cribble, 2007; Flaxman et al., 2012; Flett et al., 2012; 2016; 2018; O'Conner et al., 2004). Here, worry and rumination may perpetuate an inherent yet unrealistic need to be perfect in all aspects of student life to offset feelings of self-doubt, shame, perceived humiliation, and unworthiness (Flett, 2018). Ultimately, this line of thought serves to elicit psychophysiological stress, which feeds back to accentuate worry and rumination in a cyclical manner (Flett et al., 2016; 2018).

Despite being prevalent in the student population, variation between studies limits conclusions regarding which specific perfectionistic subscales are related to stress. Rice and colleagues (2012) found perceived stress to be related to increased levels of the discrepancy subscale (inadequate attainment of personal performance expectations) of the Almost Perfect Scale-Revised (Slaney et al., 2002) when examining international students attending college in the US. Combining both the standards and discrepancy subscales of the short form Almost Perfect Scale (Rice, 2014), Collin and colleagues (2020) clustered UK dental students into groups experiencing maladaptive perfectionism, adaptive perfectionism, and non-perfectionist controls. Here, those experiencing maladaptive perfectionism reported increased levels of perceived stress relative to controls and adaptive perfectionists (Collin et al., 2020). Several studies (Chang, 2006; Chang and Rand, 2000; Flett et al., 2016) have used Hewitt and colleagues (1991) conceptualisation of perfectionism, comprised of three dimensions: unrealistic personal standards (self-oriented perfectionism); unrealistic expectations of others (other oriented perfectionism); and the idea that others expect unrealistically high standards for oneself (socially prescribed perfectionism). Here, socially prescribed perfectionism appears consistently related to increased stress amongst university students (Cang, 2006; Chang and Rand, 2000; Flett et al., 2016). However, it remains unclear whether these relationships are direct or mediated by other psychological factors.

1.2. The role of self-critical thinking

The experience of self-criticism (Gilbert et al., 2004) is comprised of three domains: self-inadequacy (i.e., perceived failure but a desire to improve oneself); self-hatred (i.e., desire to remove undesired aspects of the self); and self-reassurance (i.e., ability to be self-validating,

supportive, compassionate). With that in mind, perfectionistic tendencies in the student population are often associated with the experience of negatively oriented self-appraisal, manifesting in the form of self-criticism (Gilbert et al., 2006; James et al., 2015; Stoeber et al., 2008). In a sample of undergraduate students, socially prescribed perfectionism has been significantly related to increased self-hatred, self-inadequacy and reduced self-reassurance, whereas other oriented perfectionism has been associated with greater reassurance (Gilbert et al., 2006). Moreover, perfectionistic strivings emerged to be strongly associated with increased reports of self-criticism in UK students (Stoeber et al., 2008). Like perfectionism, the experience of stress appears to be related to increased reports of self-criticism in the student population (James et al., 2015; Kotera et al., 2021). In Czech university students, perceived stress appears to be positively related to self-hate and self-inadequacy, yet negatively related to self-reassurance (Kotera et al., 2021). When examining predictors of stress in US college students, Saleh and colleagues (2017) demonstrated a substantially high prevalence of low self-esteem (57.6%) which predicted an increased experience of stress.

Self-critical thinking is known to predict the onset of future psychological distress, including symptoms of anxiety, depression, and stress (Verplanken et al., 2007, 2012). Moreover, whilst self-critical thinking may contextually emerge as a by-product of perfectionistic symptoms (e.g., intrusive thoughts, rumination), a series of comprehensive and longitudinal outcomes evidenced self-criticism to be independent of ruminative thinking (Verplanken et al., 2007). Against this background, the associations between dimensions of multidimensional perfectionism and stress may be mediated by self-critical thinking. To that end, based on Frost's (1990) conceptualization of multidimensional perfectionism, James and colleagues (2015) found the cross-sectional association between maladaptive perfectionism and psychological distress in British students to be mediated by self-criticism (James et al., 2015).

1.3. The present study

Studies examining the relationship between perfectionism, stress and self-critical thinking remain sparse, and largely encompass a cross-sectional design. Whilst self-criticism is known to mediate the relationship between perfectionism and general psychological distress (James et al., 2015), the authors utilised a singular dimension of both perfectionism and self-critical thinking. Therefore, the present study examined the concurrent and acute prospective associations between multidimensional perfectionism, perceived stress, and self-critical thinking over the course of fifteen weeks. Specifically, to determine: the extent to which significant relationships between perfectionism and perceived stress were mediated by facets of self-critical thinking at baseline; whether self-critical thinking at baseline mediated the longitudinal relationship between baseline perfectionism and future stress at follow-up. Considering previous outcomes (Cang, 2006; Chang and Rand, 2000; Flett et al., 2016), we expect self-oriented and socially prescribed perfectionism to be related to increased reports of perceived stress and self-critical thinking at each time-point. Furthermore, in line with James and colleagues (2015), it was expected that reports of self-related perfectionism would be associated with increased stress at follow-up, and this relationship would be mediated by self-critical thinking.

2. Method

2.1. Sample and procedure

In accordance with the British Psychological Society's Code of Human Research Ethics and the host institution's Research Ethics Policy, the study protocol was approved by the University's Research Ethics Committee. Online informed consent was provided by all participants

prior to data collection. The study was completed in the year of 2018. Undergraduate students were recruited using an online research participation system and university-wide email circulation. While only undergraduate students were permitted to take part in the study, no age cut offs were imposed. Students accessed the web-based survey via Qualtrics, which was live for a period of 3 weeks at baseline (T1). Following, participants were invited to complete the same questionnaire after an interval of 15 weeks (T2). Incomplete entries were discarded. Considering to the ethical right to withdraw from the survey at any time, only complete cases were analysed. Possible duplicate responses were examined based on matching IP addresses, where none were found. At baseline, N=220 respondents (68.2% female; mean age = 19.41 ± 2.86, range = 17 – 47yrs) provided complete data for the variables of interest (i.e., multidimensional perfectionism, perceived stress, self-critical thinking) were entered into the final analysis. Eighty-four of these participants successfully completed the same measures at follow-up (T2) (66.7% female; mean age = 19.89 ± 3.92, range = 18 – 47yrs). A series of independent t-tests were conducted to determine whether those participants who completed the study differed from those who did not for the included measures. No significant differences were reported (all p's > .05; see Table 1).

Sample size was determined a-priori and calculated using G*Power (Faul et al., 2014) which determined the minimum required sample size for bivariate correlations was 192 to capture Pearson's r effect size = 0.20 (α = 0.05) with >80% power. The required sample size at T2 to conduct t-tests, correlational, and mediation analyses (N > 67) was determined using the same programme (Cohen's d effect size 0.35, power 0.80, α = 0.05; f effect size 0.20, power 0.80, α = 0.05). Based on a priori power analysis, the sample size at both timepoints were sufficient to detect moderate effects (Cohen, 1988) in the subsequent analysis. Previous experience utilizing similar research methods informed the decision to make the survey accessible for 3 weeks at both time-points to achieve the desired sample size at T2, after attrition. As such, this resulted in a slightly larger required sample size than was previously determined.

2.2. Measures

Hewitt and Flett's Multidimensional Perfectionism Scale short form (MPS-HF, 1991) was used to assess participant levels of perfectionism. This 15-item measure dimensions of perfectionism – self-oriented (SOP: 5 items, e.g., "One of my goals is to be perfect in everything I do"), other-oriented (OOP: 5 items, e.g., "Everything that others do must be of top-notch quality"), and socially prescribed (SPP: 5 items, e.g., "The better I do, the better I am expected to do"). For each item, respondents were instructed to indicate on a 7-point Likert scale ranging from 1 (*Strongly agree*) to 7 (*Strongly disagree*). The individual dimensions of the MPS have been shown to have good internal consistency, the Cronbach's α for

Table 1

Mean scores ± standard deviations for measures of perfectionism, perceived stress, and self-perception at baseline and follow-up.

	Baseline (n = 220) M ± SD	Follow-up (n = 84) M ± SD	t	Sig.
Self oriented perfectionism	23.16 ± 7.48	23.29 ± 7.70	0.134	.893
Other oriented perfectionism	17.57 ± 5.97	18.35 ± 6.80	0.979	.328
Socially prescribed perfectionism	20.66 ± 6.34	22.27 ± 7.03	1.920	.056
Perceived stress	7.81 ± 3.13	7.48 ± 3.02	0.830	.407
Inadequate self	20.82 ± 8.97	19.48 ± 8.88	1.168	.244
Hated self	5.17 ± 5.43	5.06 ± 5.75	0.155	.977
Reassured self	17.69 ± 7.07	17.44 ± 7.28	0.273	.785

Note:

*Sig at <.01, **<.01, ***<.001

the current sample were self-oriented (.86), other-oriented (.73), and socially prescribed (.71).

Perceived stress was assessed using the Perceived Stress Scale (PSS-4; Cohen et al., 1983). The PSS-4 is designed to measure the degree to which respondents find their lives unpredictable, uncontrollable, and overloading as these three items have been repeatedly found to be central components of the experience of stress. For each item, respondents were instructed to indicate on a 6-point Likert scale ranging from 0 (*Never*) to 5 (*Very often*). The PSS-4 has been shown to have high internal consistency, the Cronbach's α for the current sample was .76.

The Forms of Self-Criticizing/Attacking & Self-Reassuring Scale (FSCRS; Gilbert et al., 2004) was used to examine self-criticism. The FSCRS is a 22-item measure that has been designed to measure inadequate self ("I am easily disappointed with myself"), hated self ("I have a sense of disgust with myself"), and reassured self ("I find it easy to forgive myself"). For each item, respondents were instructed to indicate on a 5-point Likert scale ranging from 0 (*Not at all like me*) to 4 (*Extremely like me*). The Cronbach's α for the current sample were inadequate self (.91), hated self (.88), and reassured self (.89).

2.3. Statistical analyses

Normality of the data was initially assessed by histograms. In addition, a series of Shapiro-Wilks tests were also conducted for each variable at both time points to confirm a normal distribution (all p's were > .05). Pearson's bivariate correlations examined concurrent and longitudinal associations between the subscales of the PSS-4, MPS-HF, and the FSCRS at baseline and follow-up. A series of t-tests compared mean variable scores between baseline and follow-up. This was followed by a series of parallel multiple mediation analysis with a single predictor, two mediators, and single outcome variable. Following James et al. (2015), this was to determine whether emerging relationships between perfectionism and perceived stress were mediated by self-hatred and self-inadequacy. When conducting PMMA, no mediator is modelled as influencing another mediator in the model and allowing for the estimation of a simultaneous test of both mediators, while accounting for shared variance between them. All statistical analyses were performed using Jamovi version 1.6.23 (The Jamovi Project, 2019). Significance was considered at the p < 0.05 level (two-tailed).

3. Results

Descriptive statistics and bivariate correlations for the dimensions of perfectionism, perceived stress, and self-criticism at baseline (T1) and follow-up (T2) are presented in Tables 1 and 2.

3.1. Baseline relationships

Concurrent analysis indicated that, at baseline, self-oriented perfectionism was positively correlated with other oriented (r = .45, p < .01) and socially prescribed perfectionism (r = .49, p < .01), perceived stress (r = .18, p < .01), and self-inadequacy (r = .32, p < .01) and self-hatred (r = .16, p < .05). Other oriented perfectionism was significantly positively correlated with socially prescribed perfectionism (r = .37, p < .01), whereas no significant relationships were observed with the remaining variables (all p's > .05). Socially prescribed perfectionism was significantly related to increased reports of stress (r = .34, p < .01), self-inadequacy (r = .40, p < .01) and self-hatred (r = .36, p < .01), and reduced self-assurance (r = -.26, p < .01). Finally, perceived stress was related to increased reports of self-hatred (r = .65, p < .01) and inadequacy (r = .62, p < .01) and reduced self-assurance (r = -.56, p < .01). Other than socially prescribed perfectionism at follow-up (Male = 18.96 ± 5.75, Female 23.40 ± 7.62: F = 137.91, p = .04), no sex differences were observed between the remaining variables at each time point (all p's > .05).

Table 2

Concurrent correlations between perfectionism, perceived stress, and self-perception at baseline and follow-up.

	1	2	3	4	5	6	7
1. Self oriented perfectionism	-	.48**	.63**	.23*	.36**	.20	-.05
2. Other oriented perfectionism	.45**	-	.44**	.09	.10	.01	.06
3. Socially prescribed perfectionism	.49**	.37**	-	.37**	.43**	.34**	-.21
4. Perceived stress	.18**	.11	.34**	-	.59**	.76**	-.71**
5. Inadequate self	.32**	.11	.40**	.62**	-	.71**	-.48**
6. Hated self	.16*	.06	.36**	.65**	.72**	-	-.67**
7. Reassured self	-.06	-.05	-.26**	-.56**	-.55**	-.65**	-

Note: Baseline (n = 220) correlations are displayed below the diagonal; follow-up (n = 84) correlations are displayed above the diagonal.

*Sig at <.01, **<.01

3.2. Baseline mediation

Using the MEDMOD plugin for Jamovi, we examined whether self-inadequacy and self-hatred mediated the relationship between SOP and SPP with perceived stress at baseline. Bootstrapping with 1000 bias-corrected and accelerate resamples and 95% confidence intervals were used, and the Sobel test (z) was used to indicate the hypothesized mediation effects. As demonstrated in Table 3, the results demonstrated no significant direct effects between perceived stress with SOP and SPP. However, significant indirect effects of SOP and SPP (respectively) with perceived stress via self-hate and inadequacy were evidenced.

3.3. Follow-up relationships

Concurrent analysis indicated that, at follow-up, self-oriented perfectionism was positively correlated with other oriented (r = .48, p < .01) and socially prescribed perfectionism (r = .63, p < .01), and perceived stress (r = .23, p < .05). Socially prescribed perfectionism was significantly related to other oriented perfectionism (r = .44, p < .01), increased reports of stress (r = .37, p < .01), self-inadequacy (r = .43, p < .01) and self-hatred (r = .34, p < .01). Finally, perceived stress was related to increased reports of self-hatred (r = .59, p < .01) and inadequacy (r = .76, p < .01) and reduced self-assurance (r = -.71, p < .01).

3.4. Longitudinal relationships

Baseline levels of SOP were significantly associated with increased reports of perceived stress (r = .22, p < .01), self-hatred (r = .29, p < .01) and inadequacy (r = .24, p < .01) at follow-up. Baseline OOP was not related to future stress or deficits in self-perception (all p's >.05). However, baseline SPP was significantly related to greater reports of perceived stress (r = .48, p < .01), self-hatred (r = .46, p < .01) and inadequacy (r = .48, p < .01), and reduced self-reassurance (r = -.34, p < .10). Perceived stress at baseline was related to an increase in future SPP (r = .38, p < .01), stress (r = .65, p < .01), self-hatred (r = .55, p <

Table 3

Baseline examination of the mediating effect of self-hatred and inadequacy, with self-oriented and socially prescribed perfectionism as independent variables (IV) and perceived stress as dependent (DV).

IV	Mediator	Z: Total effect (c path)	Z: Direct effect (c' path)	Total indirect effect		β	P
				Point est.	95% CI		
[A] SOP	Hated self	2.08	0.28	.03	.01, .06	.08	.038*
	Inadequate self	2.96		.04	.02, .07	.10	.003**
	Total	2.72		.08	-.04, .05	.18	.007**
[B] SPP	Hated self	4.04	1.51	.01	.02, .13	.02	.783
	Inadequate self	3.10		.08	.05, .12	.17	.001***
	Total	5.42		.06	.02, .09	.12	.002**
				.17	.11, .23	.34	.001***
				.04	-.01, .09	.09	.131

Note: P, Sobel test; Mediation model, 1000 bootstrap BCa samples.

* Sig at < .05, ** < .01, ***<.001

.01) and inadequacy (r = .63, p < .01), and reduced self-reassurance (r = -.60, p < .10). Interestingly, self-hatred and inadequacy at baseline were related to future stress (r = .69, r = .57 respectively, both at p < .01) and increased levels of SOP (r = .22, p < .05; r = .38, p < .01 respectively) and SPP (r = .29, r = .40 respectively, both at p < .01) at follow-up. Interestingly, greater reports of self-reassurance at baseline emerged to be a protective factor against future stress (r = -.62, p < .01), self-hatred (r = -.52, p < .01) and inadequacy (r = -.650, p < .01), and SPP (r = .86, p < .01).

3.5. Longitudinal mediation

Like baseline analysis, the MEDMOD plugin for Jamovi was used to examine whether self-inadequacy and self-hatred at baseline mediated the longitudinal relationship between baseline SOP and SPP and future stress at follow-up. Bootstrapping with 1000 bias-corrected and accelerate resamples and 95% confidence intervals were used, and the Sobel test (z) was used to indicate the hypothesized mediation effects. As demonstrated in Table 5, no significant effects of perfection were observed in relation to perceived stress. However, for both SOP and SPP, only self-hatred but not inadequacy was significantly related to the future experience of perceived stress.

4. Discussion

The current outcomes provide further evidence that the experience of multidimensional perfectionism amongst university students is related to greater reports of perceived stress and self-critical thinking (Dunkley et al., 2003; Gilbert et al., 2006; Low, 2020; Salaeh et al., 2017; Kotera et al., 2021; Yu et al., 2016). More specifically, socially prescribed, and self-oriented perfectionism were related to increased reports of perceived stress, self-hatred, and self-inadequacy at baseline. Furthermore, the relationships between self-oriented and socially prescribed perfectionism with perceived stress were mediated by self-hatred and inadequacy at baseline.

Self-oriented perfection involves a strong desire for the self to be

perfect whilst maintaining unrealistic expectations and intensive self-evaluation fixated on personal shortcomings (Hewitt and Flett, 1991). Whereas socially prescribed perfectionism, lacking the self-critical aspect, involves the notion that other people impose unrealistic and unobtainable demands and expectations on to them, where the self will not be satisfied unless these demands are met (Hewitt and Flett, 2002). Depending on the psychosocial context and nature of perfectionistic beliefs, the experience of stress in university students can manifest in various forms, such as an overwhelming burden to attain, and indeed maintain, incredibly high standards. In the current context, SOP to an extent may facilitate the drive to: consistently attain high grades; engage in outside learning, making the most of available support materials; and facilitating academic networking. However, extreme levels of SOP may be an overwhelming experience, particularly in academically struggling students. With that in mind, where the perfectionistic goal is unattainable, irrespective of ability, psychophysiological stress possibly accentuates. As such, SOP in university students may be adaptive and/or maladaptive depending on contextual factors. Competitively, the student experience of SPP can be considered more maladaptive in nature. Here, the perceived academic expectations of parents and academic tutors likely increases the experience of stress in students. Additionally, socially prescribed perfectionists possible strive to achieve perfectionism in social aspects of university life. Whilst a similar perception may stem from SOP (e.g., "I need to fit in"), SPP in the context of university life may theoretically be the most maladaptive dimension (Bieling et al., 1998). This perhaps make sense considering the perceived lack concerning control of others expectations, paired with a constant striving to sate and/or exceed these unattainable goals. Indeed, it is relevant to note the recent paradigm shift away from defining dimensions of perfectionism as adaptive or maladaptive. Rather, the experience of perfectionism should be considered within the context of the sample population and the severity of its presentation (Table 4).

The combined experience of perfectionistic thinking and prolonged stress accentuates additional dysfunctional cognitive (i.e., contextual worry and rumination) and behavioural (i.e., the active pursuit of unrealistic goals) mechanisms. Indeed, individuals pre-exposed to constant daily pressures (e.g., students) face greater vulnerability to psychological distress when negative life events occur (Hewitt and Flett, 2002). As such, perfectionistic thinking may act as a predisposing and precipitating factor in the context of stress and psychological distress in the university student population. Indeed, the desire to obtain high grades, maintain academic performance and personal standards in perfectionistic students may accentuate self-critical thinking, particularly in those who may be struggling to maintain the desired level of attainment (Collin et al., 2020).

Longitudinal analysis of the current data revealed that baseline self-oriented and socially prescribed perfectionism predicted increased reports of stress and self-critical thinking fifteen weeks later at follow-up. More crucially, self-hatred and inadequacy at baseline mediated the longitudinal relationship between baseline perfectionism and perceived stress at follow-up. Whilst perfectionism may amplify perceived stress, self-critical thinking may accentuate this relationship due to self-

defeating styles of cognitive appraisal (Hewitt and Flett, 2002). Together, this fuels a cycle of pre-existing self-critical thinking in the form of self-hatred and inadequacy. Here, self-inadequacy maintains the drive for unrealistic levels of perfection whilst self-hatred accentuates the desire to remove undesired aspects of the self (Gilbert et al., 2004). Underlying this cycle, cognitive processes including attentional (e.g., perseverative thoughts related to performance) and interpretive biases (e.g., more likely to perceive an event as a mistake, then attributed as a personal failure), worry, rumination, and deficits in cognitive appraisal (e.g., overgeneralizing negative outcomes to aspects of the self) culminate to increase the physiological and psychological presentation of stress in the student population (Macedo et al., 2014).

Student-based interventions to reduce self-critical thinking and maladaptive forms of perfectionism may prove beneficial in preventing the onset of perceived stress. Indeed, meta-analytic data found cognitive behavioural interventions for perfectionism to effectively improve the cognitive, but not trait, elements of perfectionism (Galloway et al., 2022). Moreover, a single group session of tailored psychodynamic psychotherapy evidenced substantial sustained improvements in both cognitive and trait elements of perfectionism (Hewitt et al., 2015). Likewise, psychological interventions involving compassionate mind training amongst individuals experiencing extreme levels of shame and self-critical thinking (Gilbert and Procter, 2006). Against this background, institutions should broaden their range of talking therapies to address maladaptive aspects of perfection and overly self-critical thinking in students. These may also be contextually tailored the student experience (i.e., academic attainment, psychosocial relationships), possibly attenuating the onset of future stress.

4.1. Strengths and limitations

Whilst a longitudinal design was employed, the timeframe of fifteen weeks between baseline and follow up may be considered relatively short. Although three time points are typically used to examine mediation when employing a prospective design, this path was not currently perused when considering the high level of attrition at follow-up. Nevertheless, to the best of the authors knowledge, this is the first study to examine whether self-critical thinking mediates the relationship between Hewitt and colleagues (1991) conceptualisation of perfectionism and perceived stress in undergraduate students from a longitudinal perspective. Based on a priori power analysis, the sample size at both timepoints were sufficient to detect moderate effects (Cohen, 1988) in the present data. However, considering the sample size, particularly at follow-up, the possibility of a Type 1 error remains (Koopman et al., 2015). Moreover, as the present sample was mostly comprised of young adult females, further research using a more balanced sample should clarify the role of sex. As such, future research is needed, employing a larger sample size, and preferably, a longer period, to examine the parameters of the findings of the current work. Finally, it is relevant to note that the current data was collected prior to the Covid-19 pandemic, where research has reliably evidenced increased psychiatric difficulties in young adults and university students (Akram et al., 2022; O'Connor

Table 4
Longitudinal correlations between perfectionism, perceived stress, and self-perception at baseline and follow-up.

Baseline (T1)	Follow-up (T2)						
	1	2	3	4	5	6	7
1. Self oriented perfectionism	.80**	.38**	.50**	.22*	.29**	.24*	-.14
2. Other oriented perfectionism	.39**	.69**	.40**	.21	.14	.10	-.09
3. Socially prescribed perfectionism	.49**	.27*	.77**	.48**	.46**	.48**	-.34**
4. Perceived stress	.21	.10	.38**	.65**	.55**	.63**	-.60**
5. Inadequate self	.38**	.19	.40**	.57**	.80**	.68**	-.55**
6. Hated self	.22*	-.01	.29**	.69**	.65**	.90**	-.72**
7. Reassured self	-.04	.03	-.23*	-.62**	-.52**	-.60**	.86**

Note: Baseline (n = 220) correlations are displayed below the diagonal; follow-up (n = 84) correlations are displayed above the diagonal.

*Sig at <.01, **<.01

Table 5

Longitudinal examination of the mediating effect of baseline self-hatred and inadequacy, with self-oriented and socially prescribed perfectionism at baseline as independent variables (IV) and perceived stress at follow-up as the dependent (DV).

IV	Mediator	Z: Total effect (c path)	Z: Direct effect (c' path)	Total indirect effect		β	P
				Point est.	95% CI		
[A]							
SOP	Hated self	2.30	0.10	.06	.02, .12	.16	.022*
	Inadequate self	1.02		.02	-.01, .08	.06	.306
	Total	2.10		.09	.01, .17	.22	.038*
[B]							
SPP	Hated self	3.78	0.16	.11	.06, .18	.16	.010**
	Inadequate self	0.86		.02	-.03, .08	.06	.338
	Total	4.92		.21	.13, .29	.22	.001***
				.07	-.01, .15	.01	.092

Note: P, Sobel test; Mediation model, 1000 bootstrap BCa samples.

* Sig at < .05, ** < .01, *** < .001

et al., 2021; Robinson et al., 2022). Inherently, any further work should account for the situational role of the Covid-19 pandemic.

5. Conclusion

Overall, we further evidence that the experience of multidimensional perfectionism amongst university students appears to be concurrently and longitudinally related to greater reports of perceived stress and self-critical thinking. More crucially, self-hatred and inadequacy at baseline mediated the longitudinal relationship between baseline perfectionism and perceived stress at follow-up. Whilst self-critical thinking may provide a novel treatment target in the student population, the current outcomes should be considered as preliminary given the aforementioned limitations.

Data availability statement

Data will be made available on reasonable request.

Author contribution

The experiment was designed and conceived by JS. Data was collected by JS. Data was analysed by UA and JS. An initial version of the manuscript was written by UA. Following, input was sought from JS. All authors approved the final version of the manuscript.

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Declaration of Competing Interest

The authors report there are no competing interests to declare.

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