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An Investigation Into the Wellbeing and Loneliness of PGR Students and the Effectiveness of Institutional Support Strategies

Jennifer Stead[1] | Louise Gracia[2] | Elena Riva[3]

[1]City St. George's University of London, London, UK | [2]Warwick Business School, Coventry, UK | [3]Institute for Advanced Teaching and Learning, University of Warwick, Coventry, UK

Correspondence: Jennifer Stead (jennifer.stead@citystgeorges.ac.uk)

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ABSTRACT

There is a well-recognised mental health and wellbeing crisis among the undergraduate population in UK higher education. However, the wellbeing of postgraduate research students (PGRs) and the effectiveness of university strategies in supporting PGR wellbeing are much less understood. Early research shows that PGRs' wellbeing is impacted by their loneliness. These initial studies are limited; however, primarily considering loneliness using qualitative approaches and treating it as a unidimensional phenomenon. Our study addresses these limitations, using a quantitative approach to investigate the impact of loneliness (as a multidimensional phenomenon) on PGR wellbeing and the effectiveness of institutional strategies to support PGR wellbeing. We conduct regression analyses on the wellbeing of PGRs, focusing on components of loneliness and stress as predictors. Analysis demonstrates that social loneliness and stress separately predict lower PGR wellbeing. Further analysis reveals that PGRs who experience both social loneliness and stress have additional declines in their wellbeing. Results also suggest that typical strategies used by universities to support students are ineffective within the PGR community. Findings improve understanding of the nature of PGR wellbeing and loneliness, providing a platform for further work to improve PGR support and wellbeing.

1 | Introduction

The wellbeing of postgraduate researchers (PGRs) has become an increasingly urgent issue in academia, particularly in the context of a growing global mental health crisis in higher education (Carter et al. 2017; Hughes et al. 2018; Lewis and Stiebahl 2024; Storrie et al. 2010). Studies consistently report rising psychological distress among both students and academic staff worldwide, alongside a growing demand for mental health and wellbeing services across higher education institutions (Bennett et al. 2024; Hill et al. 2024; Oswalt et al. 2020). This crisis has garnered significant media attention (Bewick and Stallman 2018; Coughlan 2019; Gil 2015; Weale 2019) and has led to increased interest in student mental health and wellbeing from both academics and government organisations (Office for Students 2018; UK Research Innovation and King's College London 2019). PGRs play a pivotal role in driving innovation and maintaining the academic research ecosystem (Davis 2009; O'Grady and Beam 2011). However, they are in a particularly vulnerable stage of their careers, where personal, academic, and systemic pressures converge, often compromising their mental health and overall wellbeing (Wellcome Trust 2020; Hazell et al. 2020; Riva et al. 2024). Studies on PGR populations reveal high levels of psychological distress and mental health issues (Allen et al. 2022; Casey et al. 2023; Evans et al. 2018), with recent research indicating that approximately 40% of PGRs

experience moderate to severe depression and anxiety symptoms (Hazell et al. 2021; Milicev et al. 2021).

Within this context, emerging studies highlight loneliness as a significant contributor to students' wellbeing (Ellard et al. 2023; Brett et al. 2023), with implications for both mental and physical health, including increased risks of premature mortality (Ernst et al. 2022). These findings underscore the urgent need for effective interventions to support students. While much of the research has focused on the experiences of undergraduate and taught postgraduate students, this paper aims to explore the predictors of PGR wellbeing, specifically examining the nature and impact of loneliness and evaluating the effectiveness of existing university strategies in supporting PGR wellbeing.

2 | Literature on PGR Wellbeing, Loneliness and Support

Subjective wellbeing (SWB) is a multifaceted concept reflecting an individual's cognitive judgements about how life is going, their emotional state, and judgements about psychological functioning (OECD 2013). Loneliness, as a key component of SWB, is understood as a negative feeling arising from a lack of meaningful contacts with others (Berg et al. 1981) or a deficient network of social relations (Perlman and Peplau 1981). Theories of loneliness construct it as multidimensional, including Weiss' (1973) early typology of social and emotional loneliness, which subsequent studies (including those of DiTommaso and Spinner (1997)) have evidenced as distinct experiences. Loneliness, despite being a key predictor of wellbeing, remains a significant yet frequently overlooked issue among doctoral and early-career researchers. Cross-national studies demonstrate that, as a population, university students are at particular risk of loneliness (Bonsaksen et al. 2022). Further studies (WONKE 2019) reveal over 15% of students grapple with daily loneliness, with higher rates observed among Black, Asian and Minority Ethnic students, those with disabilities, commuting students, and international students (Wawera and McCamley 2020). Loneliness has been studied for its profound impact on university students, linking it to heightened anxiety, stress, and depression (Diehl et al. 2018; Mann et al. 2022; Richardson et al. 2017). It has also been associated with maladaptive coping mechanisms, sleep disturbances, reduced life satisfaction, and suicidal ideation (Kurina et al. 2011; Zhang et al. 2018). Beyond these effects, loneliness negatively impacts cognitive health and alters brain functionality, with chronic loneliness shaping the nature and likelihood of social interactions (Lim et al. 2020). Research on loneliness among university students as a general population has delved into its correlations with various factors, including cultural background (Bauer and Rokach 2004), gender (Beutel et al. 2017), social media use (Yang 2016), internet usage (Bozoglan et al. 2013) and smartphone habits (Bian and Leung 2015). Other studies have explored its relationship with attachment styles (İlhan 2012), mental distress (McIntyre et al. 2018) and academic achievement (Stoliker and Lafreniere 2015).

The global COVID-19 pandemic in 2020 intensified challenges surrounding isolation and loneliness for students worldwide. Campus closures, the shift to remote learning, and the cancellation of social events significantly limited opportunities for socialising. Many students were confined to their accommodations or family homes, reducing chances to build connections through shared interests and activities. During the initial lockdowns, young people and students in the UK and US reported heightened loneliness and psychological distress compared to the general population (McGinty et al. 2020), with a notable increase in mental health symptoms (Tang et al. 2022). In the UK, individuals aged 18–24 years were nearly three times as likely as those aged 65–74 years to report experiencing loneliness 'more often than normal' during lockdown (Royal Society for Public Health 2020). Similar findings from Italy (Giusti et al. 2021) and the UK (Di Malta et al. 2022) during the pandemic revealed a concerning decline in the mental wellbeing of distance learners, tied to decreased emotional intimacy, heightened loneliness, and lower self-reported academic performance. Further expanding on this, Limone, Tota and Messina (2022) conducted a comprehensive review of 32 studies involving 81,395 participants across multiple countries, including China, Turkey, Poland, Saudi Arabia, France and India. Their findings highlight a significant increase in feelings of loneliness among university students during both the COVID-19 pandemic and the Russia–Ukraine conflict, identifying loneliness as a key predictor of stress and anxiety. Even more troubling are the findings of Labrague et al. (2021), which underscore the strong associations between loneliness and a range of negative outcomes, including stress, depression, anxiety, suicide, and physical health conditions such as heart issues, heightened inflammation, and impaired immunity.

Loneliness, despite being a key predictor of student wellbeing, remains a significant yet frequently overlooked issue among PGRs. Studies in this area are beginning to highlight the widespread issue of loneliness particularly among doctoral and early-career researchers (Moran et al. 2020), underscoring the need for targeted research and policy interventions. The Wellcome Trust's (2020) report on research culture found that doctoral and early-career researchers frequently experience high levels of isolation, often prioritising work over personal relationships and relocating away from support networks, which exacerbates loneliness. One PhD student shared, 'I have felt the most isolated I ever have in my life in this PhD'. The competitive and solitary nature of academic work, combined with limited support for mental health and restricted avenues for raising concerns, further contribute to these feelings. The survey revealed that 70% of junior researchers viewed a career in academia as inherently isolating. Patil et al. (2016) identified PGRs as particularly vulnerable to loneliness due to their hybrid roles as both students and staff, balancing research and teaching responsibilities. These dual roles can complicate social connections, leaving PGR students feeling isolated. Cantor (2020) further outlined key contributors to PGR loneliness, including physical isolation, challenges inherent to the PhD process, and difficulties with interpersonal relationships, especially the supervisory relationship. Additionally, individual differences such as personal characteristics (Das 2024), self-discipline, motivation, and imposter syndrome were identified as factors exacerbating feelings of isolation. Similarly, Janta et al. (2014) documented the global prevalence of loneliness among doctoral students, analysing online forums where students shared experiences of isolation. One participant described being '100% alone day and night'. While some were satisfied with their academic progress, others linked the lack of social connection to loneliness and, in some cases, depression.

Linked to loneliness, stress is a common theme in the PGR literature and often measured as an indicator of poor wellbeing (see Schmidt and Hansson (2018)). In one report, PGR focus groups normalised stress as an intrinsic and expected part of the PhD experience (Metcalfe et al. 2018). However, research shows that PGRs score significantly higher on perceived stress than the general population (Allen et al. 2021), and a recent systematic review found that high levels of stress in PGRs are associated with burnout, lower levels of wellbeing, and negative mental health impacts such as depression (Cho and Hayter 2020). Anttila et al. (2015) found that over half of PGRs had contemplated quitting their PhD at some point during the doctoral journey, with many citing stress as a determining factor.

Stress and loneliness can also be interrelated issues, as stress and loneliness have a bidirectional relationship (Laustsen et al. 2024), suggesting that increased loneliness also increases stress and vice versa. While there is relatively little research showing the interplay of these variables in the PGR population, a recent study on medical students found that perceived stress mediated the relationship between loneliness and academic burnout (Malakcioglu 2024). The bidirectional relationship between stress and loneliness could suggest that a possible route to lower stress for PGRs would be to reduce loneliness. As many universities already offer social activities in their institutional support for students, this could be a possible solution for reducing both stress and loneliness in PGRs.

In terms of institutional support for student wellbeing, most universities offer a range of support activities, mostly targeted at taught students. The range of offerings arises from evidence that participating in certain activities is beneficial in supporting students' SWB. For example, several studies have found that participating in yoga reduces stress (Park et al. 2021; Pascoe et al. 2017; Pascoe and Bauer 2015), improves psychological wellbeing (Gaiswinkler and Unterrainer 2016; Tulloch et al. 2018), and can help individuals reduce loneliness by building friendships (Cheshire et al. 2022; Ross et al. 2014). Yoga and meditation have been shown to reduce stress and improve wellbeing in medical students prior to exams (Prasad et al. 2016). Other physical activities are also linked to improvements in students' wellbeing, for example, a study of law students found that participating in a running group reduced psychological distress (Skead and Rogers 2016). Further research also links aerobic exercise to reductions in perceived stress (von Haaren et al. 2015), and social walking groups with a decrease in social isolation (Shellito and Velasco Roldan 2019). A recent systematic review found that physical activity interventions were effective at reducing depression, anxiety and psychological distress across a variety of adult populations (Singh et al. 2023).

Non-exercise related activities are similarly found to improve student SWB. Research with undergraduates shows that spending time with therapy dogs lowers stress and increases happiness (Ward-Griffin et al. 2018). A similar study found that time with therapy dogs also significantly decreases stress and improves mood (Spruin et al. 2021). Mindfulness meditation and training, frequently offered at universities as a wellbeing support activity, have been shown to reduce stress and symptoms of depression and anxiety (Roeser et al. 2013), and have also been associated with reductions in loneliness and increased social contact (Duncan and Weissenburger 2003; Lindsay et al. 2019). A report commissioned by the UK government found activities involving socialisation, exercise, mindfulness, learning a new skill or altruism as all associated with improved mental health and wellbeing (Marks et al. 2008). However, most support initiatives and research studies primarily focus on the needs of taught undergraduate and postgraduate students (Ellard et al. 2023). Given the significant differences in the circumstances and environments of research programmes, findings on how to support the wellbeing and loneliness of undergraduate and taught postgraduate populations may not be directly applicable to PGRs. As previously mentioned, there is limited investigation into the wellbeing of PGRs compared to their taught counterparts, and this is true particularly regarding the effectiveness of strategies designed to support them (Metcalfe et al. 2018; Watson and Turnpenny 2022). The limited research on PGRs' wellbeing, loneliness, and support initiatives also tends to be predominantly qualitative (Bireda 2015; Janson et al. 2004; Metcalfe et al. 2018), focusing on subjective experiences. Notable exceptions include a small study by Marais et al. (2018), which tested an eight-week positive psychology intervention on ten PhD students, with an additional thirteen as a control group. While the experimental group showed reduced anxiety, no significant improvements were found in stress, depression or overall well-being. Few studies quantitatively assess the effectiveness of interventions on PGRs' SWB, and those that do rarely address loneliness as a critical factor.

This paper contributes to these gaps in the literature by exploring predictors of PGRs wellbeing (including the nature and influence of loneliness on this) and the effectiveness of existing university strategies to support PGR SWB. We present quantitative data evaluating the effectiveness of a range of support initiatives on PGR wellbeing and loneliness and investigate the influence of different components of loneliness as predictors of poorer wellbeing. Our study adds to the research on PGR isolation by investigating loneliness in a new way. Specifically, we investigate PGR stress and loneliness (as a multi-dimensional phenomenon) using a quantitative approach. We utilise a measure for loneliness, broken down into social loneliness and emotional loneliness subcomponents, to identify underlying sources of loneliness. This approach allows us to investigate stress and loneliness as predictors of wellbeing, controlling for common PGR demographics. Findings are useful in enhancing understanding of the nature of PGR loneliness, supporting the PGR experience and in shaping more effective PGR support provision.

Based on the literature, we expect to find that participation in a support activity reduces loneliness in PGRs, and that there will be negative associations between PGR stress, loneliness and wellbeing.

H1. *Regular participation in a support activity will reduce loneliness for PGRs.*

H2. *Loneliness and stress will be negatively associated with PGR wellbeing.*

3 | Methods

3.1 | Support Activities

The research team identified a range of institutional student support activities (identified within the literature discussed earlier as beneficial) for use within the project. These included guided mindfulness, gardening, social walking group, knitting, yoga, volunteering, aerobics, running group, time with support dogs, art class, online guided meditation, online gratitude diary and an interactive seminar series focusing on normalising academic failure. Each activity ran for nine weeks in the autumn term and six weeks in the spring term.

3.2 | Recruitment and Procedure

The project was advertised to PGRs attending a large UK Russell Group university. Participants volunteered to take part in the study and were entered into prize draws as a thank you for participating.

Participants accessed the study through a project website where they gave informed consent and took part in online questionnaires. Participants were assigned a project ID number, allowing us to track participants longitudinally and anonymously. Questionnaires included measures for wellbeing, loneliness, and demographic information, and invited participants to take part in a support activity. Interested participants indicated preferences for their first, second, and third choices of available activities and were later assigned to an activity via email.

Attendance was recorded for each activity, with regular attendance being defined as attending at least half of the total sessions offered. At the end of the term, participants were sent an email with the follow-up survey, containing the same measures as the baseline and some additional open-ended questions regarding their activity experience.

3.3 | Sample

Two hundred and four participants took part in at least one survey. Data from participants in the October and January waves were combined to investigate the impact of loneliness and other predictors on the wellbeing of PGRs. Twenty-two participants did not complete the survey and were removed from the analysis. Some participants did not answer a few of the demographic questions (ten did not answer year of PhD and thirteen did not answer ethnicity); to use this data in our analysis, we replaced the missing data with the mean for the group. The final sample for the cross-sectional analyses consisted of one hundred and eighty-two participants.

To test our hypotheses on support activities, we needed observations from two time points—before and after the intervention—for each participant. Therefore, only data where participants completed both the initial and follow-up questionnaires were used for the longitudinal analyses. The final sample for the longitudinal analyses consisted of fifty participants in the autumn term and twenty-seven participants in the spring term.

3.4 | Measures

Tables 1 and 2 contain descriptive statistics and reliability for all measures. Table 1 focuses on the cross-sectional samples, and Table 2 on the longitudinal samples.

3.4.1 | Main Variables

SWB was measured as life satisfaction and flourishing. Life satisfaction measures an individual's cognitive judgements about how their life is going (Diener et al. 1985), while flourishing measures a variety of wellbeing indicators such as meaning in life, self-esteem, and good relationships with others (Diener et al. 2009). Life satisfaction was measured with the Satisfaction with Life scale (Diener et al. 1985) and flourishing was measured with the 8-item Flourishing scale

TABLE 1 | Descriptive statistics for all variables used in regressions.

	n	*M*	SD	Min	Max	*α*
Main variables						
Life satisfaction	182	22.1	6.1	5	35	0.85
Flourishing	182	40.8	7.1	11	56	0.84
Social loneliness	182	2.7	1.9	0	5	0.81
Emotional loneliness	182	3.3	2.0	0	6	0.77
Perceived stress	182	19.9	7.1	2	38	0.88
Demographic variables						
Age	182	28.0	6.3	22	58	
Male	182	0.3	0.5	0	1	
Married	182	0.3	0.5	0	1	
Year of PhD	182	2.2	1.2	1	5	
UK student	182	0.5	0.5	0	1	
EU student	182	0.2	0.4	0	1	
International student	182	0.3	0.4	0	1	
Self-funded	182	0.2	0.4	0	1	
Social hours/week	182	12.5	13.8	0	70	
Income comfortability	182	3.1	0.8	1	4	
Disabled	182	0.3	0.5	0	1	
October 2018	182	0.6	0.5	0	1	

Note: Income comfortability has been reversed: high scores reflect that the individual is comfortable with their present income, low scores represent that the individual is struggling with their current income. October 2018 is a binary variable where 0 indicates that the participant took the survey in January 2019 and 1 indicates that the participant took the survey in October 2018. *α* represents the Cronbach's alpha for the study sample.

TABLE 2 | Descriptive statistics for all variables used in ANCOVAs.

	October—Year 1 Autumn Term 1						December—Year 1 Autumn Term				
Variable	***n***	***M***	**SD**	**Min**	**Max**	***α***	***M***	**SD**	**Min**	**Max**	***α***
Social loneliness	50	2.58	1.92	0	5	0.88	2.36	2.02	0	5	0.91
Emotional loneliness	50	3.34	1.95	0	6	0.83	2.70	1.98	0	6	0.81
Demographic variables											
Age	49	26.00	4.20	22	44						
Male	48	0.30	0.5	0	1						
Married	47	0.30	0.5	0	1						
	January—Year 1 Spring Term						**April—Year 1 Spring Term**				
Variable	***n***	***M***	**SD**	**Min**	**Max**	***α***	***M***	**SD**	**Min**	**Max**	***α***
Social loneliness	27	2.63	1.88	0	5	0.82	2.11	1.76	0	5	0.76
Emotional loneliness	27	3.00	2.11	0	6	0.81	2.48	1.99	0	6	0.76
Demographic variables											
Age	27	26.04	3.04	22	34						
Male	26	0.19	0.40	0	1						
Married	24	0.29	0.46	0	1						

Note: Demographic variables used as controls in ANCOVAs. *α* represents the Cronbach's alpha for the study sample.

(Diener et al. 2009). Higher scores on both scales indicate better wellbeing. Despite being developed some time ago, the Satisfaction with Life scale by Diener remains the 'dominant measure of life satisfaction since its inception more than 30 years ago' (Margolis et al. 2019). Similarly, the widely utilised and validated 8-item Flourishing Scale (Sumi 2014; Silva and Caetano 2013; Carmona-Halty et al. 2022) exhibits robust psychometric properties (Hone et al. 2014).

Loneliness was measured using the 11-item Loneliness Scale (De Jong-Gierveld and Van Tilburg 1999). Items are on a 4-point scale, scored bimodally (0-0–1-1), and are summed, creating a scale from 0 (not lonely) to 11 (severely lonely). The loneliness scale can be used as a unidimensional construct measuring overall loneliness or broken down into two subscales: social loneliness and emotional loneliness. The social loneliness subscale measures whether individuals feel they have enough friends (scores range from 0 to 5) and the emotional loneliness subscale measures whether individuals feel they have enough social support (i.e. close friends whom they can emotionally connect with, scores range from 0 to 6). Lower scores indicate less loneliness. Respondents who score three or higher on the unidimensional scale are considered to be lonely (De Jong-Gierveld and Van Tilburg 1999).

We explored PGR loneliness by employing a quantitative loneliness measure, delineating it into the subscales of social and emotional loneliness to offer insight into its origins. As discussed earlier, previous research on PGR loneliness predominantly relies on qualitative methods. However, our more comprehensive analysis enhances comprehension around the intricacies of PGR loneliness, thereby offering a broader framework for devising effective support mechanisms for postgraduate researchers. Moreover, we selected the De Jong Gierveld short scale because it is a reliable and valid measurement instrument for overall, emotional and social loneliness, as demonstrated in large multi-national studies, with participants of different genders and ages (De Jong Gierveld and Van Tilburg 2010; Grygiel et al. 2019). The six-item scale is also suitable for large surveys (De Jong Gierveld and Van Tilburg 2010) such as ours. Additionally, the scale has been used by recent studies to evaluate loneliness among international higher education students in the UK (Wawera and McCamley 2020) and university students in Germany (Diehl et al. 2018). Perceived stress was measured using the 10-item Perceived Stress scale (Cohen 1994), which asks participants to indicate the frequency of particular feelings during the past month, with higher scores indicating higher perceived stress. We utilised this scale as it is well-accepted and demonstrated within the literature on stress as robust (Roberti et al. 2006; Baik et al. 2019).

3.4.2 | Demographic Variables

Previous research on SWB establishes relationships between wellbeing and a variety of socio-demographic variables such as age, gender, marital status, disability status, and income comfortability (e.g. Deeming 2013; Vera-Villarroel et al. 2012). We also measured academic department, hours of social time per week, employment status (in addition to studies), year of PhD, mode of study (full/part-time), funding status (funded/self-funded) and fee status (UK/EU/International). All demographic variables are controlled for in the regressions; gender, age, and marital status are controlled for in the ANCOVAs.

3.4.3 | Open-Ended Questions

At the end of the follow-up surveys, participants were asked if they had attended an activity. If they had not (or signed up but attended less than half of the sessions), they were prompted with the question: 'Can you briefly describe why you did not participate in an activity?' Participants who attended at least half of their activity sessions were asked whether the activity met their expectations and prompted with follow-up question: 'Why/Why not'.

Ethical approval for this project was obtained by the University's Humanities and Social Sciences Research Ethics Committee (Ethical Application Reference: 120/17-18 AM01).

3.5 | Analysis

To investigate whether participants experienced a change in loneliness after participating in the support activities, we ran 2×2 mixed design ANCOVAs with the two subscales of loneliness as dependent variables. Activity participation was entered as a between-subjects variable with two groups: (1) participants who attended at least half of the weeks of an activity, and (2) participants who attended less than half of the weeks of an activity or who chose not to participate in an activity.

To explore the impact of loneliness and other predictors of wellbeing in PGRs, we ran OLS regression models to predict life satisfaction and flourishing.

Analyses for the ANCOVAs were conducted in SPSS v28, and analyses for the regressions were conducted in R statistical software (R Core Team 2015).

To further our understanding of why participants did or did not attend activities, we analysed the open-ended questions using content analysis.

4 | Results

4.1 | Descriptive Statistics for Study Samples

4.1.1 | Surveys and Cross-Sectional Samples

The final cross-sectional sample is biased towards female participants from the Science, Engineering and Medicine faculty. Participants were primarily university/grant-funded and attending full-time (4% were part-time).

4.1.2 | Activities and Longitudinal Samples

The longitudinal samples have the same demographic biases as the cross-sectional sample. To control for potential confounds, we ran independent between-subjects t-tests to look for differences in loneliness between participants who signed up for support activities and those who did not and found no significant differences between groups.

4.2 | The Effect of Support Activities on PGR Loneliness (See Table 2)

To test whether support activities alleviated social or emotional loneliness, participants were grouped by whether they participated in half of the activity sessions (Autumn: n Activities = 28, n Control = 22; Spring: n Activities = 12, n Control = 15). In the autumn term, we found no significant differences in social loneliness for participants who took part in the support activities compared to those who did not. There were significant differences in emotional loneliness across time $F(\text{df } 1, 37) = 5.36$, $p = 0.026$, $\eta^2 = 0.13$ (small effect) and between groups $F(\text{df } 1, 37) = 7.68$, $p = 0.009$, $\eta^2 = 0.17$ (small effect). Examination of the estimated marginal means revealed that in September, the activity group and the control group had similar levels of emotional loneliness ($M_{\text{control}} = 3.34$, $\text{SE}_{\text{control}} = 0.43$, $M_{\text{activities}} = 3.35$, $\text{SE}_{\text{activities}} = 0.42$). At the end of term (December), the control group reported being less emotionally lonely than at the start of term ($M_{\text{control}} = 1.96$, $\text{SE}_{\text{control}} = 0.43$); however, the activity group reported similar levels of emotional loneliness as they did at the start of term ($M_{\text{activities}} = 3.23$, $\text{SE}_{\text{activities}} = 0.42$), see Figure 1. This rejects H1, as the activities provided did not improve the social or emotional loneliness of participating PGRs.

In the spring term, we found no significant differences in emotional or social loneliness for participants who engaged with the support activities compared to those who did not.

4.3 | Predictors of PGR Wellbeing

For the wellbeing regressions, we found significant negative associations between social loneliness and life satisfaction ($B = -1.07$, $\text{SE} = 0.25$, $p < 0.001$, Table 3, column 1), and social loneliness and flourishing ($B = -1.30$, $\text{SE} = 0.30$, $p < 0.001$, Table 3, column 3), suggesting participants who reported higher social loneliness also reported lower wellbeing. There were also significant negative relationships between both types of wellbeing and perceived stress (life satisfaction: $B = -0.29$, $\text{SE} = 0.06$, $p < 0.001$, Table 3,

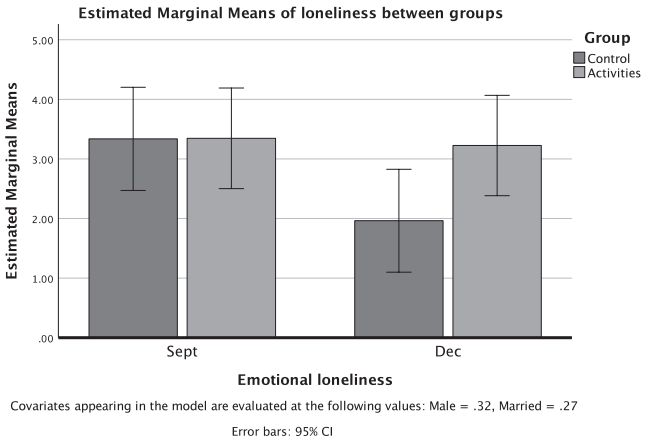

FIGURE 1 | Estimated marginal means for emotional loneliness, displaying a change in loneliness for the control group, but not for the activities group. Covariates appearing in the model are evaluated at the following values: male = 0.3171, marrried = 0.268. Error bars: 95% CI.

TABLE 3 | Wellbeing regression models.

	Life satisfaction		Flourishing	
Dependent variable	**(1)**	**(2)**	**(3)**	**(4)**
Age	−0.12 (0.07)	−0.12 (0.07)	0.02 (0.08)	0.02 (0.08)
Male	−2.04* (0.79)	−2.05** (0.77)	−0.78 (0.95)	−0.78 (0.92)
Married	0.21 (0.79)	0.38 (0.77)	−1.50 (0.95)	−1.29 (0.92)
Year of PhD	−0.29 (0.31)	−0.23 (0.30)	−0.59 (0.37)	−0.51 (0.36)
SEM faculty	0.14 (1.24)	0.21 (1.20)	−0.45 (1.49)	−0.37 (1.45)
Social Science faculty	0.12 (1.35)	−0.31 (1.31)	2.61 (1.62)	2.09 (1.58)
EU student	−0.64 (0.93)	−0.40 (0.91)	−2.36* (1.12)	−2.08 (1.09)
International student	−0.47 (1.02)	−0.27 (0.99)	−1.28 (1.23)	−1.04 (1.19)
Self-funded	−0.48 (0.99)	−0.27 (0.97)	−2.11 (1.19)	−1.85 (1.16)
Social hours/week	0.001 (0.03)	0.01 (0.03)	−0.03 (0.03)	−0.02 (0.03)
Employed in addition to studies	1.17 (0.73)	1.45* (0.71)	0.81 (0.88)	1.14 (0.86)
Income comfortability	1.57** (0.47)	1.51** (0.46)	0.44 (0.57)	0.36 (0.55)
Disabled	−2.19** (0.80)	−2.07** (0.78)	−0.67 (0.96)	−0.52 (0.93)
October 2018	−0.98 (0.75)	−0.79 (0.73)	−0.40 (0.91)	−0.17 (0.88)
Socially lonely	−1.07*** (0.25)	0.74 (0.59)	−1.30*** (0.30)	0.87 (0.71)
Emotionally lonely	−0.09 (0.25)	−0.15 (0.24)	0.02 (0.30)	−0.05 (0.29)
Perceived stress	−0.29*** (0.06)	−0.05 (0.09)	−0.41*** (0.07)	−0.12 (0.11)
Stress × Socially lonely		−0.09*** (0.03)		−0.11*** (0.03)
Constant	31.66*** (3.67)	26.89*** (3.82)	54.02*** (4.41)	48.32*** (4.59)
Observations	182	182	182	182
Adjusted R^2	0.42	0.46	0.39	0.42
Residual Std. Error	4.66 (df = 164)	4.52 (df = 163)	5.60 (df = 164)	5.43 (df = 163)
F Statistic	8.81*** (df = 17; 164)	9.50*** (df = 18; 163)	7.67*** (df = 17; 164)	8.35*** (df = 18; 163)

Note: Faculty variables are in comparison to the Arts Faculty. Fee status variables are in comparison to UK students. High scores on income comfortability reflect that the individual is comfortable with their present income; low scores represent that the individual is struggling with their current income. October 2018 is a binary variable where 1 represents participants who took the survey in October 2018 and 0 represents participants who took the survey in January 2019.
*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.

column 1; flourishing: $B = -0.41$ SE = 0.07, $p < 0.001$, Table 3, column 3), suggesting that PGRs who report higher levels of perceived stress also report lower levels of wellbeing. These findings support H2, which predicted that loneliness and stress would be negatively associated with PGR wellbeing.

There were also relationships between the wellbeing measures and some demographic variables. For life satisfaction, these included gender ($B = -2.04$, SE = 0.79, $p < 0.05$, Table 3, column 1), income comfortability ($B = 1.57$, SE = 0.47, $p < 0.001$, Table 3, column 1), and disability ($B = -2.19$, SE = 0.80, $p < 0.01$, Table 3, column 1). For flourishing, there was a significant association for one of the dummy variables for fee status (EU student, $B = -2.36$, SE = 1.12, $p < 0.05$, Table 3, column 3) suggesting UK students reported higher levels of wellbeing than students from the EU.

As stress and loneliness have both been previously reported as negative components of the PGR experience, we conducted an exploratory moderation to investigate whether social loneliness moderated the relationship between perceived stress and wellbeing. We chose to look at social loneliness as a moderator as opposed to both types of loneliness, as creating opportunities for PGRs to make friends is something within the control of universities. Our results revealed that for both measures of wellbeing, social loneliness strengthened the negative relationship between perceived stress and wellbeing (life satisfaction: $B = -0.09$, SE = 0.03, $p < 0.001$, Table 3, column 4; flourishing: $B = -0.11$, SE = 0.03, $p < 0.001$, Table 3, column 4). See Figures 2 and 3. Adding the moderations to the regression models significantly improved the fit of the model to the data (life satisfaction: $F(1, 163) = 11.47$, $p < 0.001$; flourishing: $F(1,163) = 11.59$, $p < 0.001$). The final models explained 46%

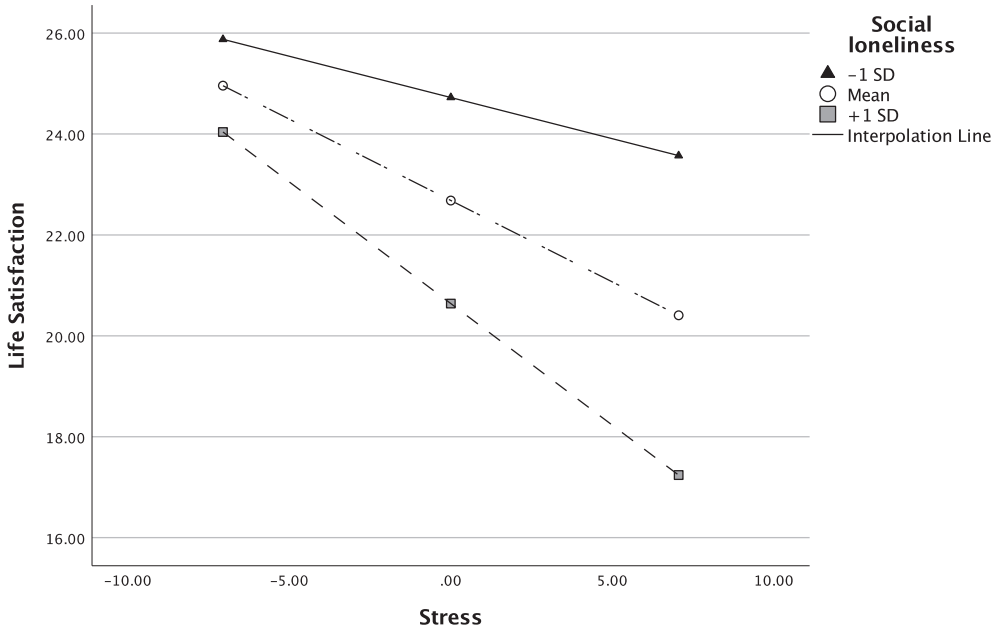

FIGURE 2 | Social loneliness strengthens the negative relationship between stress and life satisfaction. Variables centred in the figure.

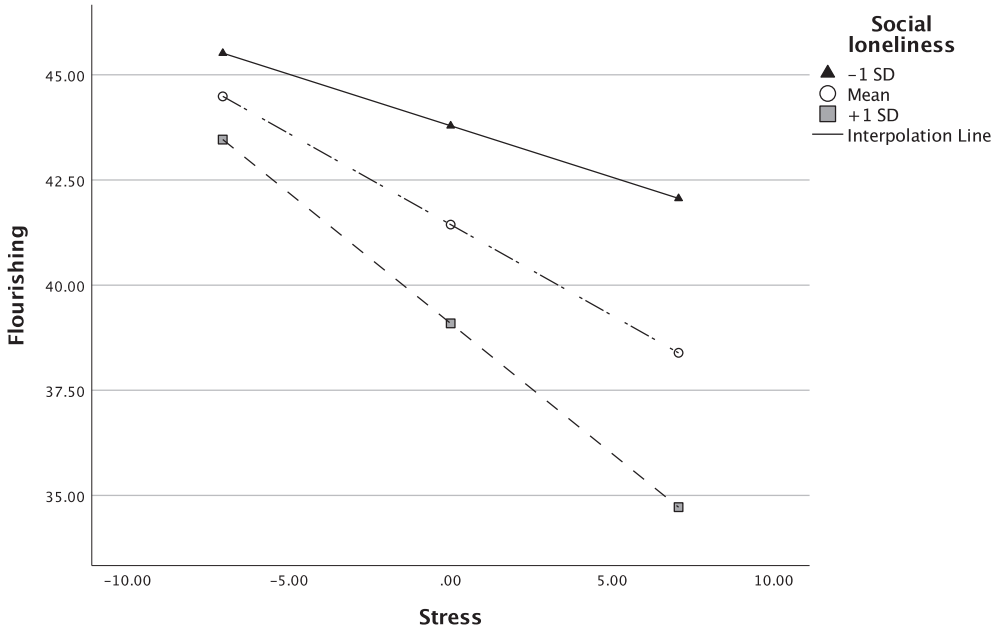

FIGURE 3 | Social loneliness strengthens the negative relationship between stress and flourishing. Variables centred in the figure.

of the variance in life satisfaction and 42% of the variance in flourishing.

4.3.1 | Open-Ended Responses

The content analysis revealed that participants who chose not to take part in activities or started an activity but did not attend for at least half of the weeks cited time constraints as an issue. Many felt they were too busy to attend an activity, or the timing of scheduled activities did not match their availability. Some participants also cited little desire to take part in activities, as they were involved in other activities off-campus or did not want to interact with undergraduates whom they felt they shared little in common with.

5 | Discussion

The purpose of this study was twofold: first, we sought to investigate the efficacy of typical support activities offered by universities in their ability to reduce loneliness in PGRs. Results across the wide range of activities explored show them not to be as beneficial for PGRs as predicted. Second, in seeking to understand this finding, our research explored aspects of the PGR experience, identifying predictors of PGR

wellbeing, including that social loneliness is negatively associated with both types of wellbeing. Our exploratory analysis reveals that social loneliness strengthens the negative relationship between perceived stress and wellbeing, suggesting that if PGRs are both stressed and socially lonely, they report even lower wellbeing. These results are of interest to universities seeking to improve PGR support strategies, support PGR wellbeing and enhance the PGR experience.

5.1 | Support Activities and Loneliness

Contrary to our predictions, institutional support activities offered did not have a significant impact on PGR loneliness. Findings reveal no difference in social loneliness between the activities and control groups across both the autumn and spring terms. This suggests that support activities routinely provided by universities were ineffective at reducing PGR loneliness. In the autumn term, the control group was significantly less emotionally lonely in December than in September. This might suggest that individuals in the control group who felt emotionally lonely at the start of term sought their own remedies, which were more effective than the activities offered to the experimental group. These findings are contrary to our hypotheses and to previous literature which suggests that activities such as meditation/mindfulness (Duncan and Weissenburger 2003; Lindsay et al. 2019), yoga (Purohit et al. 2016; Ross et al. 2014), spending time with support dogs (Banks and Banks 2002) and social walking clubs (Shellito and Velasco Roldan 2019) can reduce loneliness. However, much of the current literature available on loneliness focuses on the elderly population (as evidenced by the mean participant age in most loneliness studies such as the meta-analysis of Masi et al. (2011)). While there is some literature investigating loneliness in PGRs (Cantor 2020; Janta et al. 2014), to the best of our knowledge, little of this literature explores loneliness interventions. It is therefore possible that the needs of the PGR population in regard to loneliness are different, requiring distinct types of interventions. Research on the PGR experience is sparse, and more research is needed to identify what differentiates PGRs and why initiatives which work for other populations are not as beneficial for PGRs. One potential difference may stem from the academic culture around taking breaks from research tasks. There is some evidence that PGRs struggle to take breaks and feel guilty when not working, as evidenced by the X (formerly Twitter) hashtag #phdguilt and many blog posts (i.e. Agata (2017); Hill (2019); Marias (2015)). It is possible that this guilt could prevent PGRs from signing up for activities or weigh on their minds while taking part, counteracting the benefits of taking part in a social activity. The timing of activities may also play a role in this, as PGRs in our study expressed that activity times conflicted with their research duties. Feedback from the open-ended surveys indicated that the times these activities are offered may not always be possible or convenient for PGRs.

Another possible reason for the activities not being as effective as predicted may be that activities on university campuses are usually aimed at undergraduate students. It also means that most of the attendees of these activities tend to be undergraduates, with whom, according to the open-ended survey questions, the PGRs feel they have little in common Although PGRs are considered to be students in UK higher education, the PGR role is more aligned with that of academic staff. This may explain why our PGRs viewed engaging with undergraduate students as a deterrent to signing up for activities. A recent article highlights this conflict in the PGR identity (Livermore and Gallagher 2015). These combined factors suggest that it may be beneficial for universities to develop activities specifically for PGRs. Future research should consider using co-design to involve PGRs in the development of such activities, to ensure they are fit for purpose.

5.1.1 | Predictors of PGR Wellbeing

To build on the information about the PGR experience, the regression models explored the relationships between two types of wellbeing, different types of loneliness, and perceived stress. In our models, high-perceived stress is a strong predictor of both lower life satisfaction and lower flourishing. This finding is supported further by evidence from the general population that stress is related to lower wellbeing (Thoits 2010). Stress is also commonly cited as an intrinsic part of the PhD process (Corner et al. 2017; Schmidt and Umans 2014; Stubb et al. 2011). Additionally, our regression models reveal that social loneliness is associated with both lower life satisfaction and lower flourishing. This relationship is also unsurprising, as social connection is a well-known predictor of wellbeing (Kawachi and Berkman 2001). As previous literature on the PGR experience cites both loneliness (Brown 2013; Cantor 2020; Janta et al. 2014; Wawera and McCamley 2020) and stress (Cornwall et al. 2019; Schmidt and Hansson 2018; Stubb et al. 2011) as common experiences, we conducted a further exploratory moderation revealing that social loneliness significantly strengthened the negative relationship between perceived stress and both types of wellbeing. This moderation suggests that social loneliness exacerbates the relationship between high levels of stress and poor wellbeing in PGRs, meaning that PGRs who are both stressed and lonely have poorer wellbeing than PGRs who are also stressed but not lonely. As both stress and loneliness are common experiences on the PGR journey, it is important that universities develop support for PGR loneliness to mitigate the negative interaction between stress and loneliness on PGR wellbeing. A better understanding of the predictors of high perceived stress and social loneliness for PGRs may support universities in the development of more effective initiatives.

To the best of our knowledge, this research is one of the first to conduct quantitative research on PGR loneliness. It is also among the first to investigate PGR social and emotional loneliness. While the concept of loneliness is explored in the PGR literature, the focus is on the qualitative description of its experience, with little research on how to address it. Exceptions include research by Verlie et al. (2017) and Janson et al. (2004), who endeavour to build community and combat loneliness through frequent social contact with other PGRs and early career researchers. Some academic subjects may have an advantage in combating loneliness, as a previous study found that Chemistry PGRs were more satisfied with their research environment than Education PGRs due to the team-based nature of the subject

(Chiang 2003). This team-based approach may be especially useful to combat emotional loneliness, as lab-independent PGRs may be lacking opportunities to build deep connections which only form through frequent and repeated social contact. While the literature suggests that frequent social contact can combat PGR loneliness (Hastings et al. 2022), our study demonstrates that the activities commonly in place on university campuses are ineffective in reducing loneliness in PGRs.

5.2 | Designing Support Programs for PGR Loneliness and Wellbeing

Universities and researchers interested in developing support programmes for PGRs may be able to learn from our findings. Currently, support activities offered by universities tend to revolve around meeting the needs of undergraduate students. Our results suggest that activities tailored towards undergraduates are ineffective for PGRs, as activities may be offered at times that do not fit with their schedules and/or offer socialisation primarily with undergraduates, which PGRs do not desire. We found perceived stress to be a strong predictor of poor wellbeing in our sample. Perceived stress was also moderated by social loneliness, suggesting that if PGRs are suffering from high levels of stress, loneliness can exacerbate the issue, leading to even lower wellbeing. This knowledge, combined with our finding that PGRs felt they had little in common with undergraduate students, reinforces the importance of offering activities that are PGR exclusive. Prior research strengthens this argument, with multiple studies finding that peer support is important for PGR wellbeing (Schmidt and Umans 2014; Stubb et al. 2011). We recommend future support programmes are co-designed and co-produced with PGRs (Piper and Emmanuel 2019), to take account of their specific needs and, at the same time, offer an opportunity for fostering community among PGRs and staff. Activities should be PGR exclusive, encourage peer support, and may need to be offered at the School/Departmental level to ensure they take place at a time when PGRs are available.

5.3 | Limitations and Future Work

Our research may have self-selection bias as participants volunteered to take part. Our samples were biased towards white, female, full-time UK students from the sciences, which may affect the generalisability of our study across the broader PGR population. The disproportionately high number of female participants is a common issue in PGR wellbeing studies (Levecque et al. 2017; Marais et al. 2018). As these studies took place in the UK, it is possible the PGR experience differs in other countries, which may affect how variables are associated with SWB. Also, we did not find any significant differences in loneliness due to activity attendance. It is possible that participants were not exposed to the activities for enough time or frequency for the effects identified in previous studies to occur.

Future work can build and improve on our findings by investigating both short-term and long-term impacts on PGR wellbeing and loneliness (especially in regard to activity participation) using different methods such as experience sampling. Studies of this nature should test different exposure times and frequencies to activities to determine if there is a cut-off point for duration before such activities are beneficial. Additionally, future work could create a set of support activities specifically for PGRs, designed with PGR input to explore if this impacts participation, and should seek to test these variables on a representative sample. More work is needed to develop interventions to address both social and emotional loneliness in PGRs.

Finally, it is possible that the issues discussed above are not specific to PGRs but extend across academic staff, with evidence suggesting that loneliness is also an issue for academic staff (Jandrić 2022). A recent study points to a large spike in the number of university staff accessing mental health/wellbeing services on university campuses (Richardson 2019). This spike occurs just before the period when the student mental health crisis became apparent in 2017 (Shackle 2019). It is therefore possible that these are related issues, as there is evidence from research in other educational contexts which shows that teachers' job satisfaction and emotional exhaustion impact students' academic outcomes, school satisfaction, and perceptions of teacher support (Arens and Morin 2016; Dicke et al. 2020; Klusmann et al. 2016). These findings may replicate across the higher education context, suggesting that the wellbeing and emotional exhaustion of university academics impact university student/PGR academic outcomes, wellbeing, and perceptions of supervisor support. While some work is starting to emerge in this area, more is needed to investigate the loneliness, wellbeing, and perceived stress of university academics (Morrish 2019; O'Brien and Guiney 2019).

6 | Conclusions

This study addresses gaps in the literature around PGR wellbeing, loneliness, and support. It explores PGR SWB, looking specifically at the social and emotional subcomponents of loneliness and stress as quantitative predictors of PGRs' wellbeing. Additionally, it investigates the effectiveness of institutional support activities in reducing loneliness and promoting wellbeing within the PGR community.

Our results show that the wide range of typical institutional support activities we investigated, which have been found to improve loneliness in other student populations, was ineffective within the PGR community, delivering no improvements in the SWB of participating PGRs. Our findings identify social loneliness and stress as predictors of poorer wellbeing among PGRs, and that experiencing a combination of social loneliness and stress predicted further declines in PGR SWB.

Results are useful to universities looking to better understand the PGR experience, specifically around the nature of PGR wellbeing and loneliness. They also provide insight into how loneliness interacts with stress to create further declines in PGR wellbeing. These insights provide a platform for further work to build the literature on PGR wellbeing and to deliver improvements to institutional support strategies and initiatives within the PGR community to safeguard students' wellbeing. Future work could therefore usefully focus on identifying further barriers to wellbeing in the academy and seek to develop solutions to loneliness in the PGR experience.

Ethics Statement

Ethical approval for this study was obtained by the researchers, and was granted by the ethics board in the department of Behavioural Science at Warwick Business School.

Consent

All participants who volunteered to take part received a participant information sheet, gave informed consent for their participation and were debriefed after the study was complete.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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