

Mental health and psychological wellbeing in the early stages of doctoral study: A systematic review

Patricia C. Jackman^{1*}, Lisa Jacobs^{1,2}, Rebecca M. Hawkins¹, & Kelly Sisson³

1. School of Sport and Exercise Science, University of Lincoln, Lincoln, UK

2. School of Computer Science, University of Lincoln, Lincoln, UK

3. Lincoln Academy of Learning and Teaching, University of Lincoln, Lincoln, UK

ORCID ID:

Patricia C. Jackman	0000-0002-5756-4494
Lisa Jacobs	0000-0002-0074-6940
Rebecca M. Hawkins	0000-0002-5816-8186
Kelly Sisson	0000-0002-6190-5730

*Correspondence concerning this article should be addressed to Patricia C. Jackman, School of Sport and Exercise Science, University of Lincoln, Lincoln, LN6 7TS, UK. Email: pjackman@lincoln.ac.uk

Funding

This project has been funded by the Student Mental Health Research network (SMaRteN). SMaRteN is funded by UK Research and Innovation and their support is gratefully acknowledged (Grant reference: ES/S00324X/1). Any views expressed here are those of the project investigators and do not necessarily represent the views of the SMaRteN network or UKRI.

Abstract

As concerns about poor mental health and psychological wellbeing (wellbeing) in doctoral students grow, the early stage of doctoral study could be a prime opportunity for early intervention and prevention strategies. To inform the development of such strategies, it is important and timely to understand what is known about doctoral student mental health and wellbeing in the early stages. The aim of this systematic mixed studies review was to synthesise published research on mental health and wellbeing in early-stage doctoral students (ESDS). After conducting electronic searches on 10 databases and manual searches, 26 studies matching the eligibility criteria were identified. Thematic synthesis revealed there is limited evidence regarding the prevalence of mental health and wellbeing concerns, and the effects of the transition to doctoral study on mental health and wellbeing. More promisingly, the synthesis generated understanding of factors related to mental health and wellbeing in ESDS. Finally, a single mental health and/or wellbeing intervention in ESDS was identified. The review underscores the need for more high-quality research to allow more robust conclusions to be drawn about mental health and wellbeing in ESDS.

Keywords: PhD; higher education; postgraduate; stress; university; supervision.

Word Count: 8,397 words (excluding abstract)

Introduction

Concerns about mental health and psychological wellbeing (wellbeing) in doctoral students have grown in recent years after the emergence of worrying evidence about the prevalence of mental distress in doctoral students (Metcalf et al., 2018). For instance, Levecque et al. (2017) found that 51% of doctoral students ($n = 3659$) in Belgium were categorised as experiencing psychological distress, with the relative risk (RR) of psychological distress in doctoral students was found to be considerably greater than: highly educated employees ($n = 592$; $RR = 2.02$); highly educated adults in the general population ($n = 769$; $RR = 1.99$); and higher education students ($n = 769$; $RR = 1.53$). Likewise, Evans et al. (2018) reported that graduate students ($n = 2,279$; 90% doctoral students) in the USA were six times more likely to experience anxiety and depression compared to the general population, while one-quarter of UK doctoral students ($n = 431$) reported poor wellbeing (Byrom et al., 2020). These figures are extremely concerning as poor mental health and wellbeing in doctoral students has been identified as a contributing factor to doctoral student attrition (e.g., Hunter & Devine, 2016; Maher et al., 2020), the rates of which are consistently estimated at 30-50% (Golde, 2005; Levecque et al., 2017).

Against this backdrop of worrying figures surrounding the prevalence of poor mental health and wellbeing in doctoral students, it is vital that institutions and policymakers across the higher education sector take action to address these issues. The early stage of doctoral study could offer a prime opportunity to address calls for interventions that seek to prevent the onset of poor mental health and wellbeing in doctoral students (Metcalf et al., 2018). Definitions of the early stage of doctoral study vary across the doctoral education literature, which reflects the substantial heterogeneity in the length and design of doctoral programs internationally. For example, some scholars have categorised the early stage as the initial phase of a doctoral program (e.g., 'initiating' - Levecque et al., 2017; 'coursework' - Sverdlik

et al., 2020), whereas others have defined early-stage doctoral study as the first year (e.g., Cornwall et al., 2019). Irrespective of how the early stage of doctoral study is defined, all doctoral students will experience a transition at the commencement of their studies. This transition to doctoral study can be a challenging time (Pifer & Baker, 2016), as students may experience a range of changes, such as adjustments in their relationships, physical communities, and social communities (Cornwall et al., 2019), the need to move towards a more independent way of working (Turner & McAlpine, 2011), and a shift in their identity (Creely & Laletas, 2020).

In light of calls for interventions that focus on prevention and early intervention to reduce poor mental health and wellbeing in doctoral students (Metcalf et al., 2018), a systematic review of empirical evidence on mental health and wellbeing in early-stage doctoral students (ESDS) is important and timely for several reasons. First, systematic reviews on doctoral student mental health (Hazell et al., 2020 – final search April 2018) and wellbeing (Sverdlik et al., 2018) have been previously published, but neither of these reviews examined specific stages of the doctoral journey. Given that some of the challenges faced by doctoral students in the early stages differ from those at later stages, a systematic review that focuses specifically on ESDS could generate specific insights into current understanding of mental health and wellbeing during this stage. Second, by synthesising evidence on mental health and wellbeing in ESDS, this could help to inform the development of more robust, evidence-based interventions that enable institutions to reduce the onset of poor mental health and wellbeing in doctoral students. In turn, the findings could help institutions to take steps towards answering calls for preventative and early intervention approaches to improve doctoral student mental health and wellbeing (Metcalf et al., 2018). Finally, a systematic review of the literature on mental health and wellbeing in ESDS could help to identify gaps for future research that could advance understanding in the area.

This study aimed to systematically review, synthesise, and appraise research that has examined mental health and wellbeing in ESDS. Four specific research questions were formulated:

- i. What is the prevalence of mental health or wellbeing issues in ESDS?
- ii. What impact does transitioning into doctoral study have on mental health and wellbeing in ESDS?
- iii. What factors are related to mental health and wellbeing in ESDS?
- iv. What are the effects of interventions targeting mental health and wellbeing in ESDS?

Method

Review Protocol

A systematic mixed studies review employing the data-based convergent synthesis design (Hong et al., 2017) was adopted to ensure that the full breadth of methodologies (i.e., quantitative, qualitative, mixed method) and evidence was obtained. The review protocol was registered with PROSPERO (CRD42020193600) and followed reporting guidelines for: preferred reporting items for systematic reviews and meta-analyses (Appendix 1; Moher et al., 2009), and enhancing transparency in reporting the synthesis of qualitative research (Appendix 2; Tong et al., 2012).

Eligibility Criteria

To be included in the review, studies needed to: (i) be conducted with samples of ESDS; (ii) measure at least one mental health or wellbeing outcome in the early-stage of doctoral study; (iii) contain original, empirical data; and (iv) be peer-reviewed journal articles in the English language. The early stage was defined as the first year or first stage of a full-time doctoral program, or (ii) the first two years or first stage of a part-time doctoral program. Quantitative, qualitative, and mixed method studies were eligible for inclusion. Studies were

excluded if they combined multiple student groups (e.g., Masters, doctoral students at later stages) and did not present data for ESDS separately.

Information Sources and Search Strategy

Searches for relevant articles were conducted on 10 electronic databases: Academic Search Complete; British Education Index; CINAHL Complete; Education Source; ERIC; MEDLINE; APA PsycArticles; APA PsycInfo; PubMed; and Scopus. Databases were searched twice (July-November 2020), with the final searches conducted on November 1st, 2020. The search string consisted of two blocks of Boolean terms (Table 1). Both blocks were searched in the title, abstract, and keyword fields (see Appendix 3 for full search strings). Manual searches were also undertaken by examining the reference lists and forward citations (Google Scholar) of included studies. All records were exported to Endnote X9 reference management software. Duplicates were removed through the automatic de-duplication feature and manual screening.

Study Selection

The identified articles were screened at each stage by the first and fourth authors independently. Initially, the authors checked the titles and abstracts for eligibility, before meeting to discuss the outcomes and resolve any differences. After assessing the eligibility of the remaining full texts independently, both authors met to discuss the results of this screening process, resolve discrepancies, and agree reasons for excluding studies. The level of agreement was almost perfect between the reviewers at the title and abstract ($\kappa = .83$), and full text ($\kappa = .90$) screening stages.

Data Extraction

The following contextual information was extracted by the first and second authors independently: author(s); publication year; sample characteristics; country; discipline;

programme type; study design; and measure of mental health or wellbeing. All contextual information was cross-checked by both authors and consensual agreement was reached.

Data Synthesis

Data in the included studies were synthesised following the 3-stage guidelines for thematic synthesis (Thomas & Harden, 2008). Although multiple quantitative studies examined similar outcomes, a meta-analysis was not conducted due to the heterogeneity of sample sizes, outcomes, and measures employed. To facilitate the thematic synthesis process, all included studies were imported verbatim into NVivo 12. Initially, each study was read twice by the first author to increase familiarity. Next, line-by-line coding of all data (author interpretations, participant quotes, statistical data) in the results or findings was undertaken by the first author to identify relevant data. Following guidelines for convergent synthesis designs (Pluye & Hong, 2014), all quantitative data were transformed into codes (e.g., the code *anxiety* captured quantitative findings on this concept) via the process of ‘qualitising’ (Pope et al., 2007), thus permitting codes from all included quantitative, qualitative, and mixed method studies to be integrated. Through this process, it became clear that there was a lack of evidence for addressing research question 1. Rather than imposing our *a priori* framework, we temporarily set aside our research questions and agreed that a modified, inductively-generated framework would be more appropriate (see Thomas & Harden, 2008), and, therefore, capable of offering more comprehensive understanding of what is known about mental health and wellbeing in ESDS. After the initial coding, similar codes were combined by the first author to generate descriptive themes, with this stage involving the translation of concepts from one study to another (Thomas & Harden, 2008). At this point, a critical peer debrief took place between all authors to challenge the first author’s interpretations. After finalising the codes and descriptive themes, these were combined to establish analytical themes, which were then compared to the original review questions.

Quality Appraisal

The mixed methods appraisal tool (MMAT; Hong et al., 2019) was selected to appraise study quality as it includes criteria for quantitative, qualitative, and mixed method studies. The updated MMAT, which has been used previously in higher education research (e.g., Stretton et al., 2018), includes criteria for five specific study categories (qualitative, quantitative randomised controlled trials, quantitative non-randomised, quantitative descriptive, and mixed methods), with “yes”, “no”, or “can’t tell” used as responses for each criterion. An overall score was not calculated as this is not advised (Hong et al., 2019). Study quality was assessed independently by the first and third authors against the appropriate criteria for each study (i.e., mixed methods criteria were used for mixed methods studies). A substantial level of agreement was evidenced by the interrater reliability coefficient ($\kappa = .72$). Discussions took place between the reviewers in the event of discrepancies until final consensus was agreed.

Results

After screening the 2,784 articles returned by electronic and manual searches (see Figure 1), data from 26 papers satisfied the eligibility criteria and were initially included in the review (see Table 2), although one paper was omitted from the synthesis due to quality concerns (see *Quality Appraisal*). The most common reason for excluding papers was the absence of data on ESDS. Additionally, some data from 17 studies included in the review were omitted due to not meeting the eligibility criteria (see Appendix 4 for details). Most studies employed qualitative methods ($k = 12$), with the remainder using quantitative designs ($k = 8$) or mixed methods ($k = 6$).

Contextual Information

A total of 2,575 ESDS were included, with eligible sample sizes ranging from 1-817 participants. Only 14 studies included information on gender for ESDS, with females

accounting for 69.18% of these participants ($n = 146$). Samples from two papers (Barry et al., 2018, 2019) were classified as an independent sample as the later article by Barry and colleagues (2019) included participants from the earlier article (2018). Most samples ($k = 16$) were located at a single institution, with samples drawn primarily from the USA ($k = 12$). The remainder were based in China ($k = 4$), Australia ($k = 2$), New Zealand ($k = 2$), Belgium ($k = 1$), France ($k = 1$), Iran ($k = 1$), and Taiwan ($k = 1$). One study included a multi-national sample (Sverdlik & Hall, 2020), although the locations of the ESDS were not reported. The samples were enrolled on research ($k = 10$) and taught ($k = 8$) doctoral programs, with one sample including research and taught programs (Rogers-Shaw & Carr-Chellman, 2018). Program type was not specified in six samples.

[INSERT FIGURE 1 HERE]

[INSERT TABLE 2 HERE]

Quality Appraisal

At least one quality concern was identified with more than half of studies in the review (see Appendix 5 for additional information) based on the MMAT criteria (Hong et al., 2019). The majority of concerns were identified with mixed method studies, as most did not adequately: explain the rationale for a mixed method design (criterion 1); integrate the quantitative and qualitative study components (criterion 2) or the outputs from these phases (criterion 3); or address divergences or inconsistencies in the results (criterion 4). Most mixed methods studies did, however, satisfy criterion 5, whereby the studies were deemed to meet the quality criteria for the respective quantitative and qualitative traditions. One study (Hill, 1981) failed to achieve “yes” on any criterion and, therefore, the findings from this study were not included in the synthesis due to quality concerns. Although the MMAT offered some indication of the quality of the included studies, it did not account for some methodological issues deemed relevant to the review. Specifically, 96% of samples included

in the final synthesis ($k = 24$) recruited participants from one country, while participants were drawn from one discipline area or institution in two-thirds of included samples. Furthermore, four studies sampled just one participant. Thus, findings reported in some primary studies may be specific to a certain geographic location, discipline, and/or participant, which we recognise in the synthesis.

Synthesis

The synthesis produced four analytical themes drawn from 16 descriptive themes (see Appendix 6 for additional detail). The analytical themes are presented in the following sections, with descriptive themes italicised in text. Concerns with the quality of evidence are stated throughout.

Ratings of Mental Health and Wellbeing

Ratings of mental health and wellbeing were drawn mainly from cross-sectional studies in single countries and usually at single institutions. While first year students ($n = 119$) in China reported high *stress* (Liu & Abliz, 2019), limited information was provided on how the specific items in the adapted questionnaire were developed, thus raising validity concerns. Based on recommended cut off scores for the stress subscale of the Depression, Anxiety, and Stress Scale (Lovibond & Lovibond, 1995), the levels of *stress* reported by small samples of first year doctoral students at single institutions in Australia ($n = 20$ = Barry et al., 2018) and France ($n = 32$ ¹ – Marais et al., 2018) was classified as ‘normal’ and ‘mild’, respectively, with the ESDS reporting lower *stress* versus those at later stages in both studies. The only multi-national study on *stress* in a large sample of ESDS ($n = 817$) used a cross-sectional design and found significant differences between students in the coursework, comprehensive examination, and dissertation phases, with lower *stress* in students in the earlier coursework stage (Sverdlik & Hall, 2020). However, differences in the coursework

¹ The mean score (15.25) was obtained by contacting the corresponding author.

versus the comprehensive examination and dissertation stages were only small ($d = 0.26$) and negligible ($d = 0.12$), respectively. Indeed, compared to norms for the Perceived Stress Scale (PSS; Cohen, 1994), which ranges from 0-40, mean *stress* values reported by Sverdlik and Hall ($M = 31.73$ - 2020) and in small samples of ESDS ($n \leq 56$) in Australia ($M = 21.4$ - Barry et al., 2018) and the USA ($M = 18.8$ - Kizhakkeveetil et al., 2017; $M = 28.62$ - Rico & Bunge, 2020) were above the general populations norm ($n = 2332$, $M = 13.06^2$). *Anxiety* was generally within the normal range (Barry et al., 2018) or low (Liu & Abliz, 2019), but was mild-severe in 42.2% of students ($n = 71$) at a Chinese medical institution (Liu et al., 2019). Mild-severe *depression* was also found in 47.9% of students at this institution (Liu et al., 2019), although ratings for *depression* in a small sample of ESDS ($n = 20$) in Australia were normal (Barry et al., 2018). Therefore, findings reported by Liu et al. (2019) should be interpreted with caution. The final two descriptive themes were drawn from single studies, thus suggesting a lack of evidence. Moderate *spiritual wellbeing*, which was operationally defined as a combination of existential and religious wellbeing, was found in Iranian medicine, dentistry, and pharmaceuticals students ($n = 90$; Ziapour et al., 2017). Finally, doctoral students in the “initiating” phase in Belgium ($n = 789$) appeared to be at slightly greater risk of *mental health problems* than those at later stages, but significant differences were only evident versus the middle comprehensive examination phase (Levecque et al., 2017). That said, the sample as a whole was at significantly greater risk of psychological distress and psychological disorders than highly educated adults and higher education students (Levecque et al., 2017). Overall, it is difficult to draw firm conclusions about ratings of mental health and wellbeing in ESDS more generally based on the volume of current

² This figure was calculated by obtaining a weighted average from mean scores reported by Cohen (1994) for males ($M = 12.1$, $SD = 5.9$) and females ($M = 13.7$, $SD = 6.6$).

evidence and the substantial heterogeneity in measures, sample sizes, outcomes assessed, and geographic locations.

Impact of Transition to Doctoral Study on Mental Health and Wellbeing

No quantitative studies examined longitudinal changes in mental health and wellbeing due to the transition to doctoral study. Findings were drawn from one qualitative study that sampled a group of seven women on a nursing doctoral program at a single US institution more than three decades ago (Van Dongen, 1988). Van Dongen (1988) reported that commencing doctoral study increased *stress*, which manifested into *depression* and *anxiety* for some. It should be noted, however, that no example quotes supporting these assertions were presented. Further, other reasons that raise doubts with the quality of this evidence include the small, homogenous sample, and use of a self-interview. Overall, longitudinal studies on the impact of transition to doctoral study are needed as no robust conclusions can be drawn about this at present.

Factors Related to Mental Health and Wellbeing

Findings in this section were drawn entirely from qualitative data. In total, 10 of the 14 studies contributing to this analytic theme sampled less than 10 participants, while the same proportion of these studies recruited samples at a single institution. Most studies were conducted in the USA ($k = 8$), with the remainder undertaken in Australia ($k = 2$), China ($k = 2$), and New Zealand ($k = 2$). Given the programmatic and cultural differences between these locations, it is possible that some findings could be specific to the contexts in which they were studied. Of the 35 codes generated in the synthesis for this analytic theme (Table 3), 12 were drawn from single papers, while a further 75% of the 12 codes generated from two studies included at least one study with a sample ranging from 1-10 participants. Therefore, based on the lack of evidence for a high proportion of codes generated, many findings should be treated with caution. To aid interpretation, descriptive themes within this analytic theme

are presented in two sections: (i) factors positively related to mental health and wellbeing, and (ii) factors negatively related to mental health and wellbeing.

[INSERT TABLE 3 HERE]

Factors Negatively Related to Mental Health and Wellbeing. Myriad *concerns about being a doctoral student* were associated with poorer mental health and wellbeing. ESDS expressed unhelpful feelings of self-doubt and uncertainty. The early stage involved uncertainty for many, as reflected by the finding that 59.21% of students at a New Zealand university ($n = 152$) identified uncertainty as a stressor in their first year (Cornwall et al., 2019). Self-doubt during the early stage was synonymous with evaluative concerns, which intensified anxiety: “I felt a great deal of apprehension in my quality of work. I was nervous and felt a lot of self-doubt in the quality of my work” (Wei et al., 2019, p. 162). A specific concern for ESDS in the USA who transitioned from professional roles into doctoral study was the shift in their lifestyle or identity, which was inversely associated with mental health and wellbeing (Backmon, 1998; Bean et al., 2004; Van Dongen, 1988), although the relatively small sample sizes in these studies should be noted.

Downturns in mental health and wellbeing were attributed to *doctoral study processes*. A consistent finding was that impending assessments and deadlines were detrimental (Cornwall et al., 2019; Van Dongen, 1988; Yap et al., 2012). Furthermore, the process of producing and submitting written work also appeared to elicit stress and anxiety in the early stages, with most (74%) students in a sample of ESDS at a New Zealand university ($n = 80$) reporting intensification of these outcomes when submitting work to their supervisor for the first time (Wei et al., 2019). Thus, these findings suggest that time-based goals and milestones were a common factor related to poor mental health and wellbeing.

A range of *personal circumstances* were negatively associated with mental health and wellbeing. Problems with achieving a good work-life balance were attributed to doctoral

1 study, as the demands reduced the time dedicated to other activities (Cornwall et al., 2019;
2 Van Dongen, 1988). Although specific concerns, such as finances, were evident across
3 domestic and international students, some issues were magnified amongst international
4 students, who cited stressors such as language barriers, concerns about family members in
5 their native country, and the challenges with settling into a new culture (Cornwall et al.,
6 2019). While several personal circumstances associated with poorer mental health and
7 wellbeing were identified, evidence contributing to codes within this theme were drawn from
8 only four studies, including some that displayed quality concerns, thus suggesting the need
9 for further research.

10 The final descriptive theme, *scholarly community issues*, was only based on findings
11 in two studies (Benjamin et al., 2017; Cornwall et al., 2019), with some codes only drawn
12 from one study, thus suggesting the findings should be interpreted tentatively. Supervisory
13 changes and poor supervision (Cornwall et al., 2019), and poor interpersonal relations with
14 supervisors were problematic (Benjamin et al., 2017). While interviews with 29 biomedical
15 students by Benjamin et al. (2017) highlighted the potential detrimental impact of
16 departmental issues and poor peer relationships, these findings were limited to one study.

17 **Factors Positively Related to Mental Health and Wellbeing.** The importance of
18 *scholarly community support* for mental health and wellbeing in ESDS was evident. The
19 primary support providers were supervisors, with supportive relationships crucial for
20 navigating early challenges. For instance, one student detailed how emotional support from
21 their supervisor helped them manage a shift in their identity: “She's been very approachable
22 when I would get a little stressed, you know, in the beginning I had some separation anxiety
23 from being a seventh-grade teacher and how did I get here and things were really strange”
24 (Bean et al., 2004, p. 375). Likewise, the value of developing strong connections and
25 obtaining support from peers was evident: “The first semester it was rough, [but] my lab was

1 awesome and very supportive, giving me advice. If I had any questions they helped me out a
2 lot” (Benjamin et al., 2017, p. 204). Thus, the value of multi-faceted support was highlighted,
3 albeit across a small number of studies.

4 While focusing on *self-care and lifestyle* were perceived as helpful for maintaining
5 and improving mental health and wellbeing, only one of the five studies contributing to this
6 descriptive theme sampled more than eight participants (Benjamin et al., 2017), and two only
7 sampled one participant (Creely & Laletas, 2020; Espiritu & Smith, 2020). Exercise was the
8 most prominently reported strategy, with reductions in stress and anxiety associated with
9 participation in activities such as yoga, walking/jogging, biking, and swimming (e.g.,
10 Benjamin et al., 2017). Although beneficial for their health, physical exercise also served a
11 dual function by providing ESDS with a chance to distance themselves from their doctoral
12 work and get time for themselves (Espiritu & Smith, 2020; Rogers-Shaw & Carr-Chellman,
13 2018). While some studies alluded to the benefits of coping techniques (Benjamin et al.,
14 2017; Creely & Laletas, 2020) and doctoral students with caring responsibilities in small-
15 scale studies highlighted the importance of time management (Espiritu & Smith, 2020;
16 Rogers-Shaw & Carr-Chellman, 2018), these findings were limited to a small number of
17 studies and more robust evidence of their efficacy is needed.

18 Finally, ESDS emphasised the importance of their wider *support networks*, although
19 the adequacy and quality of evidence suggests further research is needed. Caring
20 relationships with family and friends promoted wellbeing (Benjamin et al., 2017; Espiritu &
21 Smith, 2020), while emotional support from family and friends was, according to a sample of
22 seven nursing students, helpful for managing stress (Van Dongen, 1988).

23 ***Interventions Targeting Mental Health and Wellbeing***

24 One study examined the effects of an intervention on mental health and wellbeing in
25 doctoral students (Barry et al., 2019). Compared to a control group ($n = 12$), Barry et al.

(2019) reported no significant differences in anxiety, stress, or depression in five doctoral students after an 8-week guided mindfulness intervention. Based on the lack of evidence contributing to this analytical theme, further research is warranted.

Discussion

This systematic mixed studies review aimed to identify, synthesise, and appraise published research on mental health and wellbeing in ESDS. While the number of eligible studies was relatively small, 76.92% of these studies were published in the 5-year period prior to the review. Therefore, the review provides a relatively contemporary perspective of evidence on mental health and wellbeing in ESDS. Although this trend could be viewed as an indicator of “growth”, we suggest that the recent expansion of literature more likely reflects the increased efforts by researchers to explore differences in mental health and wellbeing in doctoral students at various stages, rather than analysing doctoral students at all stages as a homogenous group, which itself contributed to a high proportion of studies that contained potentially relevant data being excluded from the review.

Findings in Context

Although the review set out to address four research questions in relation to mental health and wellbeing in ESDS, the synthesis revealed a substantive lack of evidence to address most questions. First, there was insufficient evidence to draw conclusions about the prevalence of poor mental health and wellbeing in ESDS, with the study by Liu et al. (2019) in Chinese doctoral students offering the only insight into the prevalence of mental health or wellbeing concerns. Second, no longitudinal studies examining mental health and wellbeing over time in ESDS were identified. The only evidence suggesting that the transition to doctoral study can be detrimental for mental health and wellbeing was a qualitative study in seven nursing doctoral students in the USA over 30 years ago (Van Dongen, 1988), which had quality concerns. Thus, without quantifiable, longitudinal evidence, no conclusions about

1 the effects of transition on mental health and wellbeing in ESDS can be drawn at present.
2 Third, only evidence for one published intervention trialled in ESDS was found (Barry et al.,
3 2019). This is a noteworthy finding given that the early stages of doctoral study could offer a
4 prime opportunity for universities to deliver interventions that seek to protect mental health
5 and wellbeing in doctoral students.

6 Although there was insufficient evidence to draw conclusions about the prevalence of
7 mental health and wellbeing concerns in ESDS, descriptive ratings from multiple studies give
8 some cause for concern. A salient finding was that reported stress levels were above general
9 population norms (Cohen, 1994) in several studies, but due to the geographical uniformity of
10 the findings, it is possible that the findings might not apply to all ESDS. Sverdlik and Hall
11 (2020) reported that the comprehensive examination and dissertation stages were
12 significantly more stressful than the earlier coursework stage. While it plausible to suggest
13 that the later stages of doctoral degrees are associated with heightened stress, the
14 generalisability of these conclusions may be somewhat limited by the categories used to
15 distinguish doctoral students. The coursework stage was defined as a period involving
16 assigned classes, while the comprehensive examination or qualifying exam (e.g., literature
17 review), which the authors defined as the “first major unstructured program requirement”
18 (Sverdlik & Hall, 2020, p. 114), constituted the middle phase. These criteria, however, might
19 not reflect the nature of doctoral study at different stages in all countries. For example, many
20 Doctor of Philosophy (PhD) programs in the UK and Australia do not involve structured
21 coursework and are often entirely research-based. Thus, ESDS would usually undertake tasks
22 such as literature reviewing, writing, and data collection alongside completing a formal
23 assessment (e.g., confirmation of studies) within the first year of enrolment, which would
24 appear to align more readily with the comprehensive examination or qualifying exam phase

adopted by Sverdlik and Hall (2020). Thus, findings reported by Sverdlik and Hall (2020) in the coursework phase may not be reflective of the experience of all ESDS internationally.

The initial phase of doctoral study presents new challenges to students and an important contribution of this review was the identification of a range of factors that are positively and negatively associated with mental health and wellbeing during this period, albeit the findings are not without limitations. The lack of cross-study evidence for a high proportion of codes highlights the need for further studies to generate more robust conclusions. Furthermore, as the findings were synthesised entirely from qualitative data, additional studies are needed to investigate the identified associations quantitatively using designs that allow cause-effect relationships to be examined. Notwithstanding these issues, several factors associated with mental health and wellbeing were synthesised from multiple studies. Although the nature of doctoral education programs will differ depending on the program type and discipline, there was consistent evidence that processes involved in doctoral study were inversely associated with mental health and wellbeing in ESDS. Furthermore, during the early stages, feelings of uncertainty and self-doubt were detrimental. Perhaps unsurprisingly, the synthesis provided cross-study evidence of the importance of social support from supervisors and peers, as well as positive relationships with friends and family, for protecting mental health and wellbeing in ESDS. More generally, isolation has been identified as a risk factor for poor mental health in doctoral students (Hazell et al., 2020). Although further quantitative research is required to elucidate the relationships identified in this review in more detail, it is clear that social support could be crucial to protecting mental health and wellbeing in ESDS.

Methodological Critique

Although findings in this review were synthesised from a respectable number of ESDS, several methodological limitations are evident in this literature. First, the

1 generalisability of the review findings are limited by a significant lack of diversity as the
2 evidence was drawn primarily from single-nation studies and single institutions, especially
3 those based in the USA. This finding is important given the substantial differences in course
4 requirements between doctoral education programs internationally, which may result in
5 contrasting experiences for ESDS. Therefore, further research is needed internationally on
6 mental health and wellbeing in ESDS, particularly in developing countries and outside the
7 USA.

8 A second methodological limitation of this literature centres on the ESDS sample size
9 in many included studies. Almost two-thirds (62.37%) of participants in the review were
10 drawn from two large, cross-sectional questionnaire studies (Levecque et al., 2017; Sverdlik
11 & Hall, 2020). While statistical-probabilistic generalisability is not a goal of qualitative
12 inquiry, most qualitative studies recruited very small samples. Indeed, apart from two studies
13 that employed qualitative surveys in New Zealand (Cornwall et al., 2019; Wei et al., 2019)
14 and a photo-elicitation interview study in biomedical students in the USA (Benjamin et al.,
15 2017), the remaining nine qualitative studies together sampled 29 participants, with most ($n =$
16 7) recruiting students from a single discipline and institution. Although synthesising multiple
17 studies in a systematic review can provide a more comprehensive overview of evidence, it is
18 conceivable that findings emanating from these studies may be specific to that context (e.g.,
19 country, institution, discipline, participant).

20 Another noteworthy issue identified by this review was the substantial heterogeneity
21 in psychometric inventories used to assess mental health and wellbeing. In total, five different
22 indicators of mental health and wellbeing were assessed in quantitative studies, comprising
23 stress ($k = 7$), anxiety ($k = 6$), depression ($k = 4$), mental health problems ($n = 1$), and
24 wellbeing ($k = 1$). While there was cross-study evidence for anxiety, stress, and depression,
25 the measurement tools used varied. For instance, anxiety was assessed using five different

measures in six studies (Barry et al., 2018, 2019; Ho, 2016; Liu et al., 2019; Liu & Abliz, 2019; Yap et al., 2012), while three measures were used in studies that examined depression (Barry et al., 2018, 2019; Liu et al., 2019; Sverdlik & Hall, 2020). Stress was assessed using the PSS in most studies (Barry et al., 2018, 2019; Kizhakkeveetil et al., 2017; Rico & Bunge, 2020; Sverdlik & Hall, 2020). Kizhakkeveetil et al. (2017) also assessed sources of stress based on a measure designed for undergraduate students (Blackmore et al., 2005), and although the findings did not contribute to the synthesis due to the absence of data specific to ESDS, this raises concerns with the validity of findings in the original study. Furthermore, although the adapted measure used by Liu and Abliz (2019) was subjected to principal component analysis, the lack of information provided on the development of scale items raises doubts about its validity. Overall, the review highlights the need for better measurement of mental health and wellbeing in this literature in future.

Implications for Practice and Policy

While the review demonstrates a clear need for further research on mental health and wellbeing in ESDS, we suggest that there is sufficient evidence to posit that several review findings could inform practice and policy. Several studies highlighted the importance of social support from supervisors for ESDS. Theoretically, social support could aid ESDS by promoting positive experiences and reducing the likelihood of negative experiences, and/or could help to buffer stress by preventing a stress response to potentially stressful events that occur (e.g., doctoral study processes), or facilitating a re-appraisal of events that have been appraised as stressful (Cohen & Wills, 1985). Thus, initiatives that educate supervisors on building supportive relationships and raise awareness of the importance of the supervisory relationship for mental health and wellbeing in ESDS could be valuable. Furthermore, institutions should ensure that supervisors have sufficient time to support doctoral students. From an institutional perspective, it could be beneficial to review current doctoral study

processes and identify how ESDS – and doctoral students more generally - can be better supported to manage these challenges. Furthermore, there is a need to consider how institutional policy and culture can be shaped to promote better mental health and wellbeing in doctoral students. At an individual level, ESDS' mental health and wellbeing could also benefit from self-care practices and the importance of engaging in self-care – and the long-term benefits of this for doctoral success – should be emphasised in the early stages.

Strengths and Limitations of the Review

As the first systematic review of mental health and wellbeing in ESDS, there are several strengths in this review. We applied a strict definition of an ESDS, which increases the findings' internal validity. The review was systematic and transparent, with several strategies employed to enhance trustworthiness (e.g., following a pre-registered protocol and involving multiple authors in screening, data extraction, quality checks, and synthesis). Despite these strengths, several limitations should be noted. The review could be susceptible to publication and language bias as only peer-reviewed articles in the English language were included. However, research suggests that non-English and unpublished literature can have a limited impact on review findings (Schmucker et al., 2017). Due to the small number of studies in the review, we were unable to examine whether specific findings were related to contextual factors or perform more advanced statistical analyses. Finally, data for relevant participants were excluded due to not meeting the inclusion criteria (i.e., combining ESDS with other doctoral students in analyses), although this could not be circumvented because of how the original studies were reported.

Future Research Directions

This review highlights several avenues for future research on mental health and wellbeing in ESDS. First, longitudinal research that examines the effects of transition into doctoral study on mental health and wellbeing is needed. Second, as the challenges of

doctoral study vary across years (Pifer & Baker, 2016), it is conceivable that the risk factors for poor mental health and wellbeing could differ depending on program stage. Therefore, future studies on mental health and wellbeing should consider program stage in their analyses. Finally, based on our findings, any attempts to address calls for early intervention and prevention strategies to improve mental health and wellbeing in doctoral students (e.g., Metcalfe et al., 2018) should adopt a multi-faceted approach that targets individual and contextual factors contributing to mental health and wellbeing in ESDS. Based on evidence in this review, the implementation of these multifaceted interventions could be crucial to setting the stage for better mental health and wellbeing in doctoral students. Although these areas are highlighted as potential directions for future research, all findings in this review could benefit from further, high-quality studies that aim to address more complex research questions and use more rigorous methods to generate increased understanding.

Conclusions

This review provides some evidence that concerns raised with doctoral student mental health and wellbeing in published literature (Evans et al., 2016; Hazell et al., 2020) and across the higher education sector (Metcalfe et al., 2018) may be evident even in the early stages of doctoral study. Present findings suggest it is vital that higher education institutions, support services, and supervisors recognise the crucial role they can play in efforts to mitigate poor mental health and wellbeing in ESDS. Initiatives that promote the provision of social support from supervisors, especially when doctoral students approach key milestones, could be particularly valuable. Furthermore, doctoral students should be aware of the importance of engaging in self-care practices to protect their mental health and wellbeing from the start of their doctoral journey. Overall, a dual focus on the surrounding environment and individual factors will promote better mental health and wellbeing in doctoral students.

References

- Backmon, I.R. (1998). Doctoral accounting candidates: A profile of demographics and perceptions. *Equity & Excellence*, 31(3), 26-36.
<https://doi.org/10.1080/1066568980310305>
- Barry, K.M., Woods, M., Martin, A., Stirling, C., & Warnecke, E. (2019). A randomized controlled trial of the effects of mindfulness practice on doctoral candidate psychological status. *Journal of American College Health*, 67(4), 299-307.
<https://doi.org/10.1080/07448481.2018.1515760>
- Barry, K.M., Woods, M., Warnecke, E., Stirling, C., & Martin, A. (2018). Psychological health of doctoral candidates, study-related challenges and perceived performance. *Higher Education Research & Development*, 37(3), 468-483.
<https://doi.org/10.1080/07294360.2018.1425979>
- Bean, T.W., Readence, J.E., Barone, D.M., & Sylvester, T. (2004). An interpretive study of doctoral mentoring in literacy. *Mentoring and Tutoring*, 12(3), 371-381.
<https://doi.org/10.1080/030910042000275963>
- Benjamin, S., Williams, J., & Maher, M.A. (2017). Focusing the lens to share the story: Using photographs and interviews to explore doctoral students' sense of well-being. *International Journal of Doctoral Studies*, 12, 197-217.
- Blackmore, A. M., Tucker, B., & Jones., S. (2005). Development of the Undergraduate Sources of Stress Questionnaire. *International Journal of Therapy and Rehabilitation*, 12(3), 99-103. <https://doi.org/10.12968/ijtr.2005.12.3.19553>
- Byrom, N.C., Dinu, L., Kirkman, A., & Hughes, G. (2020). Predicting stress and mental wellbeing among doctoral researchers. *Journal of Mental Health*.
<https://doi.org/10.1080/09638237.2020.1818196>

- 1 Cohen, S., & Wills, T.A. (1985). Stress, social support, and the buffering hypothesis.
2 *Psychological Bulletin*, 98(2), 310–357. <https://doi.org/10.1037/0033-2909.98.2.310>
- 3 Cornwall, J., Mayland, E.C, van der Meer, J., Spronken-Smith, R.A., Tustin, C., & Blyth, P.
4 (2019). Stressors in early-stage doctoral students. *Studies in Continuing Education*,
5 41(3), 363-380. <https://doi.org/10.1080/0158037X.2018.1534821>
- 6 Creely, E., & Laletas, S. (2020). Transitions, transformations and finding success. A
7 phenomenological analysis of the experiences of a doctoral student in early
8 candidature. *Higher Education Research & Development*, 39(3), 439-453.
9 <https://doi.org/10.1080/07294360.2019.1680957>
- 10 Espiritu, E. W., and T. M. Smith. (2021). Health, wellness, and well-Being of a non-
11 traditional occupational therapy student: A case study. *Occupational Therapy in*
12 *Mental Health*, 37(1), 87-103. <https://doi.org/10.1080/0164212X.2020.1832942>
- 13 Evans, T.M., Bira, L., Beltran Gastelum, J., Weiss, L.T., & Vanderford, N.L. (2018).
14 Evidence for a mental health crisis in graduate education. *Nature Biotechnology*, 36,
15 282-284. <https://doi.org/10.1038/nbt.4089>
- 16 Fung, A.S.K., Southcott, J., & Sin, F. (2017). Exploring mature-aged students’ motives for
17 doctoral study and their challenges: A cross border research collaboration.
18 *International Journal of Doctoral Studies*, 12, 175-195.
- 19 Gardner, S.A., Salto, L., Riggs, M.L., Casiano, C.A., & De Leon, M. (2018). Supporting the
20 writing productivity of biomedical graduate students: An integrated, structured
21 writing intervention. *CBE – Life Sciences Education*, 7(3), 45.
22 <https://doi.org/10.1187/cbe.16-12-0350>
- 23 Golde, C.M. (2005). The role of the department and discipline in doctoral student attrition:
24 Lessons from four departments. *The Journal of Higher Education*, 76, 669-700.
25 <https://doi.org/10.1353/jhe.2005.0039>

- 1 Hazell, C.M., Chapman, L., Valeix, S.F., Roberts, P., Nevin, J.E., & Berry, C. (2020).
2 Understanding the mental health of doctoral researchers: a mixed methods systematic
3 review with meta-analysis and meta-synthesis. *Systematic Reviews*, 9, 197.
4 <https://doi.org/10.1186/s13643-020-01443-1>
- 5 Hill, C.E., Charles, D., & Red, K.G. (1981). A longitudinal analysis of changes in counseling
6 skills during doctoral training in counselling psychology. *Journal of Counselling*
7 *Psychology*, 28(5), 428-436. <https://doi.org/10.1037/0022-0167.28.5.428>
- 8 Ho, M. (2016). Exploring writing anxiety and self-efficacy among EFL graduate students in
9 Taiwan. *Higher Education Studies*, 6(1), 24-39.
10 <http://dx.doi.org/10.5539/hes.v6n1p24>
- 11 Hong, Q. N., Pluye, P., Fàbregues, S., Bartlett, G., Boardman, F., Cargo, M., Dagenais, P.,
12 Gagnon, M-P., Griffiths, F., Nicolau, B., O’Cathain, A., Rousseau, M-C., & Vedel, I.
13 (2019). Improving the content validity of the mixed methods appraisal tool: a
14 modified e-Delphi study. *Journal of Clinical Epidemiology*, 111, 49-59.
15 <https://doi.org/10.1016/j.jclinepi.2019.03.008>
- 16 Hong, Q.N., Pluye, P., Bujold, M., & Wassef, M. (2017). Convergent and sequential
17 synthesis designs: implications for conducting and reporting systematic reviews of
18 qualitative and quantitative evidence. *Systematic Reviews*, 6, 61.
19 <https://doi.org/10.1186/s13643-017-0454-2>
- 20 Hunter, K., & Devine, K. (2016). Doctoral students’ emotional exhaustion and intentions to
21 leave academia. *International Journal of Doctoral Studies*, 11, 35–61
- 22 Kizhakkeveetil, A., Vosko, A.M., Brash, M., & Philips, M.A. (2017). Perceived stress and
23 fatigue among students in a doctor of chiropractic training program. *Journal of*
24 *Chiropractic Education*, 31(1), 8-13. <http://dx.doi.org/10.7899/JCE-15-27>

- 1 Levecque, K., Anseel, F., De Beuckelaer, A., Van der Heyden, J., & Gisle, L. (2017). Work
2 organization and mental health problems in PhD students. *Research Policy*, 46(4),
3 868-879. <https://doi.org/10.1016/j.respol.2017.02.008>
- 4 Liu, C., Wang, L., Qi, R., Wang, W., Jia, S., Shang, D., Shao, Y., Yu, M., Zhu, X., Yan, S.,
5 Chang, Q., & Zhao, Y. (2019). Prevalence and associated factors of depression and
6 anxiety among doctoral students: the mediating effect of mentoring relationships on
7 the association between research self-efficacy and depression/anxiety. *Psychology*
8 *Research and Behavior Management*, 21(12), 195-208.
9 <https://doi.org/10.2147/prbm.S195131>
- 10 Liu, M., & Abliz, A. (2019). Anxiety and sources of anxiety in Chinese doctoral students.
11 *Journal of Higher Education and Science*, 9(3), 640-650.
12 <https://doi.org/10.5961/jhes.2019.361>
- 13 Lovibond, S.H. & Lovibond, P.F. (1995). *Manual for the Depression Anxiety & Stress Scales*
14 (2nd Ed.). Psychology Foundation.
- 15 Maher, M.A., Wofford, A.M., Roksa, J., & Feldon, D.F. (2020). Exploring early exits:
16 Doctoral attrition in the biomedical sciences. *Journal of College Student Retention:*
17 *Research, Theory & Practice*, 22(2), 205-226.
18 <https://doi.org/10.1177%2F1521025117736871>
- 19 Marais, G.A.B., Shakaland, R., Haag, P., Fiault, R., & Juniper, B. (2018). A survey and a
20 positive psychology intervention on French PhD student well-being. *International*
21 *Journal of Doctoral Studies*, 13, 109-138. <https://doi.org/10.28945/3948>
- 22 Martinez, E., Ordu, C., Della Sala, M.R., & McFarlane, A. (2013). Striving to obtain a
23 school-work-life balance: The full-time doctoral student. *International Journal of*
24 *Doctoral Studies*, 8, 39-59.

- 1 Metcalfe, J., Wilson, S., & Levecque, K. (2018). Exploring wellbeing and mental health and
2 associated support services for postgraduate researchers. *Vitae*.
3 <https://re.ukri.org/documents/2018/mental-health-report/>
- 4 Moher, D., Liberati, A., Tetzlaff, J., Altman, D.G., & PRISMA Group. (2009). Preferred
5 reporting items for systematic reviews and meta-analyses: The PRISMA statement.
6 *PLoS Medicine*, 6(7), e1000097. <https://doi.org/10.1371/journal.pmed.1000097>
- 7 Pifer, M.J., & Baker, V.L. (2016). Stage-based challenges and strategies for support in
8 doctoral education: A practical guide for students, faculty members, and program
9 administrators. *International Journal of Doctoral Studies*, 11, 15-34.
- 10 Pluye, P., & Hong, Q.N. (2014). Combining the power of stories and the power of numbers:
11 Mixed methods research and mixed studies reviews. *Annual Review of Public Health*,
12 35, 29-45. <https://dx.doi.org/10.1146/annurev-publhealth-032013-182440>.
- 13 Pope, C., Mays, N., & Popay, J. (2007). *Synthesizing qualitative and quantitative health*
14 *evidence: A guide to methods*. McGraw-Hill.
- 15 Rico, Y., & Bunge, E. L. (2021). Stress and burnout in psychology doctoral
16 students. *Psychology, Health & Medicine*, 26(2), 177-183.
17 <https://doi.org/10.1080/13548506.2020.1842471>
- 18 Rogers-Shaw, C., & Carr-Chellman, D. (2018). Developing care and socio-emotional
19 learning in first year doctoral students: Building capacity for success. *International*
20 *Journal of Doctoral Studies*, 13, 233-252.
- 21 Schmucker, C.M., Blumle, A., Schell, L.K., Schwarzer, G., Oeller, P., Cabrera, L., von Elm,
22 E., Briel, M., & Meerpohl, J.J. (2017). Systematic review finds that study data not
23 published in full text articles have unclear impact on meta-analyses results in medical
24 research. *PLoS One*, 12(4), e0176210. <https://doi.org/10.1371/journal.pone.0176210>

- 1 Stretton, T., Cochrane, T., & Naraya, V. (2018). Exploring mobile mixed reality in healthcare
2 higher education: A systematic review. *Research in Learning Technology*, 26, 2131.
3 <http://dx.doi.org/10.25304/rlt.v26.2131>
- 4 Sverdlik, A., & Hall, N.C. (2020). Not just a phase: Exploring the role of program stage on
5 well-being and motivation in doctoral students. *Journal of Adult and Continuing*
6 *Education*, 26(1), 97-124. <http://dx.doi.org/10.1177/1477971419842887>
- 7 Thomas, J., & Harden, A. (2008). Methods for the thematic synthesis of qualitative research
8 in systematic reviews. *BMC Medical Research Methodology*, 8, 45.
9 <https://doi.org/10.1186/1471-2288-8-45>
- 10 Tong, A., Flemming, K., McInnes, E., Oliver, S., & Craig, J. (2012). Enhancing transparency
11 in reporting the synthesis of qualitative research: ENTREQ. *BMC Medical Research*
12 *Methodology*, 12, 181. <https://doi.org/10.1186/1471-2288-12-181>
- 13 Turner, G., & McAlpine, L. (2011). Doctoral experience as researcher preparation: activities,
14 passion, status. *International Journal for Researcher Development*, 2(1), 46-60.
15 <https://doi.org/10.1108/17597511111178014>
- 16 Van Dongen, C.J. (1988). The life experience of the first-year doctoral student. *Nurse*
17 *Educator*, 13(5), 19-24.
- 18 Wang, X., Wang, C., & J. Wang. (2019). Towards the contributing factors for stress
19 confronting Chinese PhD students. *International Journal of Qualitative Studies on*
20 *Health and Well-being*, 14(1), 1598722.
21 <https://doi.org/10.1080/17482631.2019.1598722>
- 22 Wei, J., Carter, S., & Laurs, D. (2019). Handling the loss of innocence: first-time exchange of
23 writing and feedback in doctoral supervision. *Higher Education Research &*
24 *Development*, 38(1), 157-169. <https://doi.org/10.1080/07294360.2018.1541074>

- 1 Yap, K., Bearman, M., Thomas, N., & Hay, M. (2012). Clinical psychology students’
2 experiences of a pilot objective structured clinical examination. *Australian*
3 *Psychologist*, 47, 165–173. <http://dx.doi.org/10.1111/j.1742-9544.2012.00078.x>
- 4 Ziapour, A., Khatony, A., Jafari, F., & Kianipour, N. (2017). Prediction of the dimensions of
5 the spiritual well-being of students at Kermanshah University of Medical Sciences,
6 Iran: The roles of demographic variables. *Journal of Clinical and Diagnostic*
7 *Research*, 11(7), 5-9. <https://doi.org/10.7860/JCDR/2017/25114.10314>
- 8

Dr Patricia Jackman is a Lecturer in Sport and Exercise Psychology at the University of Lincoln, UK. Her research interests in higher education include mental health, psychological wellbeing, and social support in doctoral students.

Lisa Jacobs is a Research Assistant and PhD student at the University of Lincoln. Her research interests in higher education include mental health and wellbeing, the learning experiences of undergraduates and postgraduates with dyslexia, and how students can engage in peer support to support each other academically and with their well-being.

Rebecca Hawkins is a Lecturer in Sport and Exercise Psychology and PhD researcher at the University of Lincoln, UK. Her research typically investigates potential strategies for promoting positive physical activity behaviours and optimising experiences during exercise. This research additionally explores variables related to psychological wellbeing and has recently extended to examining such factors in doctoral students.

Dr Kelly Sisson is a Senior Lecturer in the Lincoln Academy of Learning and Teaching at the University of Lincoln, UK. Her research interests in higher education include mental health and psychological wellbeing in doctoral students.

1 **Appendix 1: Preferred Reporting Items for Systematic Reviews and Meta-Analyses Statement (PRISMA) checklist**

2 **Table 1**

3 *Preferred Reporting Items for Systematic Reviews and Meta-Analyses Statement (PRISMA) checklist applied to the study*

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	Title page
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	Title page
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	3
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	4
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	4
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	4

Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	5, Table 1, Appendix 3
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	5
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	5-6
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	6
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	7
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	6-7
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	6-7
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	n/a
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	n/a
RESULTS			

Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	7, Figure 1, Appendix 4
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	7-8, Table 2
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	8
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	n/a
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	9-14
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	n/a
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	n/a
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	14-19
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	19-20
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	11
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	Title page

Appendix 2: Synthesis checklist

Table 1

Enhancing Transparency in Reporting the Synthesis of Qualitative Research (ENTREQ) checklist

#	Item	Description	Reported on page #
1	Aim	State the research question the synthesis addresses.	4
2	Synthesis methodology	Identify the synthesis methodology or theoretical framework which underpins the synthesis, and describe the rationale for choice of methodology (e.g., meta-ethnography, thematic synthesis, critical interpretive synthesis, grounded theory synthesis, realist synthesis, meta-aggregation, meta-study, framework synthesis).	4, 6
3	Approach to searching	Indicate whether the search was pre-planned (comprehensive search strategies to seek all available studies) or iterative (to seek all available concepts until they theoretical saturation is achieved).	5
4	Inclusion criteria	Specify the inclusion/exclusion criteria (e.g., in terms of population, language, year limits, type of publication, study type).	4
5	Data sources	Describe the information sources used (e.g., electronic databases [MEDLINE, EMBASE, CINAHL, psycINFO, Econlit], grey literature databases [digital thesis, policy reports], relevant organisational websites, experts, information specialists, generic web searches [Google Scholar] hand searching, reference lists) and when the searches conducted; provide the rationale for using the data sources.	5
6	Electronic search strategy	Describe the literature search (e.g., provide electronic search strategies with population terms, clinical or health topic terms, experiential or social phenomena related terms, filters for qualitative research, and search limits).	7, Table 1, Appendix 3
7	Study screening methods	Describe the process of study screening and sifting (e.g., title, abstract and full text review, number of independent reviewers who screened studies).	5
8	Study characteristics	Present the characteristics of the included studies (e.g., year of publication, country, population, number of participants, data collection, methodology, analysis, research questions).	7-8, Table 2
9	Study selection results	Identify the number of studies screened and provide reasons for study exclusion (e.g., for comprehensive searching, provide numbers of studies screened and reasons for exclusion indicated in a figure/flowchart; for iterative searching describe reasons for study exclusion and inclusion based on modifications to the research question and/or contribution to theory development).	7, Figure 1, Appendix 4

10	Rationale for appraisal	Describe the rationale and approach used to appraise the included studies or selected findings (e.g., assessment of conduct [validity and robustness], assessment of reporting [transparency], assessment of content and utility of the findings).	7
11	Appraisal items	State the tools, frameworks and criteria used to appraise the studies or selected findings (e.g., Existing tools: CASP, QARI, COREQ, Mays and Pope [2000]; reviewer developed tools; describe the domains assessed: research team, study design, data analysis and interpretations, reporting).	7
12	Appraisal process	Indicate whether the appraisal was conducted independently by more than one reviewer and if consensus was required.	7
13	Appraisal results	Present results of the quality assessment and indicate which articles, if any, were weighted/excluded based on the assessment and give the rationale.	9, Table 1, Appendix 6
14	Data extraction	Indicate which sections of the primary studies were analysed and how were the data extracted from the primary studies? (e.g., all text under the headings “results /conclusions” were extracted electronically and entered into a computer software).	5-6
15	Software	State the computer software used, if any.	6
16	Number of reviewers	Identify who was involved in coding and analysis.	6
17	Coding	Describe the process for coding of data (e.g., line by line coding to search for concepts)	6
18	Study comparison	Describe how were comparisons made within and across studies (e.g., subsequent studies were coded into pre-existing concepts, and new concepts were created when deemed necessary).	6
19	Derivation of themes	Explain whether the process of deriving the themes or constructs was inductive or deductive.	6
20	Quotations	Provide quotations from the primary studies to illustrate themes/constructs, and identify whether the quotations were participant quotations or the author’s interpretation.	9-15, Table 3, Appendix 5
21	Synthesis output	Present rich, compelling and useful results that go beyond a summary of the primary studies (e.g., new interpretation, models of evidence, conceptual models, analytical framework, development of a new theory or construct).	9-15, Table 3, Appendix 5, Figure 2

1

2

3

[illegible]

										"depressi*" OR "stress" OR "distress" OR "wellbeing" OR "well-being" OR "anxiety")))
3	S1 AND S2	S1 AND S2	S1 AND S2	S1 AND S2	S1 AND S2	S1 AND S2	S1 AND S2	S1 AND S2	#1 AND #2	#1 AND #2
4	S3 Limit	S3 Limit	S3 Limit	S3 Limit	S3 Limit	S3 Limit	S3 Limit	S3 Limit	S3 Limit	AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (SRCTYPE , "j"))
	Limiters - Scholarly (Peer Reviewed) Journals; Academic journals	Limiters - Academic Journals	Limiters - Academic Journals	Limiters - Scholarly (Peer Reviewed) Journals,	Limiters - Source type: academic journals	Limiters – English language	Source type: academic journals	Limiters – Source type: peer reviewed; academic journals	English	245 titles
	Narrow by Language: - English		Narrow by Language: - English	Narrow by Language: - English	Narrow by Language: - English		Narrow by Language: - English			
	432 titles	50 titles	192 titles		174 titles	232 titles	69 titles		402 titles	656 titles

Appendix 4: Details on reasons for exclusion of papers and data at full text screening stage.

Table 1

References and reasons for excluded papers.

Reference	Reason(s) for exclusion	Additional information
Aalim, P. N., & Ambily, R. (2019). A descriptive study on mental stress, time-management & worklife-balance among Ph.D. scholars. <i>Indian Journal of Public Health Research & Development</i> , 10(7), 1308-1312. https://doi.org/10.37506/ijphrd.v10i7.6266	Not early-stage doctoral students	No information on candidate stage
Acker, S., & Haque, E. (2015). The struggle to make sense of doctoral study. <i>Higher Education Research & Development</i> , 34(2), 229-241. http://dx.doi.org/10.1080/07294360.2014.956699	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Aghaee, N., Jobe, W., Kaarunaratne, T., Smedberg, A., Hansson, H., & Tedre, M. (2016). Interaction gaps in PhD education and ICT as a way forward: Results from a study in Sweden. <i>International Review of Research in Open and Distributed Learning</i> , 17(3), 360-383. https://doi.org/10.19173/irrodl.v17i3.2220	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Al Makhamreh, M., & Stockley, D. (2019). Mentorship and wellbeing. <i>International Journal of Mentoring and Coaching in Education</i> , 9(1), 1-20. https://doi.org/10.1108/IJMCE-02-2019-0013	Not early-stage doctoral students	Data not specific to early stage. Data mixed for all doctoral candidates
Allen, H. K., Lilly, F., Green, K. M., Zanjani, F., Vincent, K. B., & Arria, A. M. (2020). Substance use and mental health problems among graduate students: Individual and program-level correlates. <i>Journal of American College Health</i> . Advance online publication. https://doi.org/10.1080/07448481.2020.1725020	Not early-stage doctoral students	No specification of candidate stage
Allen, T., Shockley, K., & Poteat, L. (2010). Protégé anxiety attachment and feedback in mentoring relationships. <i>Journal of Vocational Behavior</i> , 77(1), 73-80. https://doi.org/10.1016/j.jvb.2010.02.007	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Alvarez, M., Elexpuru, I., Castelló, M., Villardón-Gallego, L., & Yániz, C. (2017). The “why” and “what for” of research in Social Sciences: Early career researchers’ conceptions. <i>Electronic Journal of Research in Educational Psychology</i> , 15(3), 598-623. http://dx.doi.org/10.14204/ejrep.43.16098	Not early-stage doctoral students	Data mixed for all doctoral candidates.

Anderson, B. J., & Miezeitis, S. (1999). Stress and life satisfaction in mature female graduate students. <i>Initiatives</i> , 59(1), 33-43.	Not early-stage doctoral students	Data for doctoral students mixed with Masters students. No separation of doctoral students or information on year of study.
Angelopoulos, G., Levkovits, D., Pimienta, J., & Koren, J. (2019). Evidence for a mental health crisis in doctoral students. In D. Hernández-Leo, & J. Martínez-Moreno (Eds.), <i>META Research Conference MERE 2019 Proceedings</i> (pp. 120-128). Universitat Pompeu Fabra, Barcelona.	Not a journal article	Conference proceedings
Anttila, H., Lindblom-Ylänne, S., Lonka, K., & Pyhälto, K. (2015). The added value of a PhD in medicine – PhD students' perceptions of acquired competences. <i>International Journal of Higher Education</i> , 4(2), 172-180. http://dx.doi.org/10.5430/ijhe.v4n2p172	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Appel, M., & Dahlgren, L. (2003). Swedish doctoral students experiences on their journey towards a PhD: Obstacles and opportunities inside and outside the academic building. <i>Scandinavian Journal of Educational Research</i> , 47(1), 89-110. http://dx.doi.org/10.1080/0031383032000033380	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Ayala, E. E., & Almond, A. (2018). Self-care of women enrolled in health service psychology programs: A concept mapping approach. <i>Professional Psychology: Research and Practice</i> , 49(3), 177-184. http://dx.doi.org/10.1037/pro0000190	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Ayala, E. E., Ellis, M. V., Grudev, N., & Cole, J. (2017). Women in health service psychology programs: Stress, self-care, and quality of life. <i>Training and Education in Professional Psychology</i> , 11(1), 18-25. http://dx.doi.org/10.1037/tep0000141	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Azizi, S. (2016). Relationship between homesickness and test anxiety in non-native students of Shiraz university of medical sciences international branch and physiopathology course in 2013. <i>Global Journal of Health Science</i> , 8(7), 293-300. http://dx.doi.org/10.5539/gjhs.v8n7p293	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Bahrami, S., Rajaeepour, S., Rizi, H.A., Zahmatkesh, M., & Nematolahi, Z. (2011). The relationship between students' study habits, happiness and depression. <i>Iranian Journal of Nursing and Midwifery Research</i> , 16(3), 217–221.	Not early-stage doctoral students	Data for doctoral students mixed with Masters students. No separation of doctoral students or information on year of study.
Bazrafkan, L., Shokrpour, N., Yousefi, A., & Yamani, N. (2016). Management of stress and anxiety among PhD students during thesis writing: A qualitative study. <i>The Health Care Manager</i> , 35(3), 231-240. https://doi.org/10.1097/HCM.0000000000000120	Not early-stage doctoral students	No specification of candidate stage
Beasy, K., Emery, S., & Crawford, J. (2019). Drowning in the shallows: An Australian study of the PhD experience of wellbeing. <i>Teaching in Higher Education</i> , 1-17. Advance online publication. https://doi.org/10.1080/13562517.2019.1669014	Not early-stage doctoral students	Data for first year student could not be separated

Beasy, K., Emery, S., Dyer, L., Coleman, B., Garrad, B., Crawford, J., Swarts, K., & Jahangiri, S. (2020). Writing together to foster wellbeing: Doctoral writing groups as spaces of wellbeing. <i>Higher Education Research & Development</i> , 1-15. https://doi.org/10.1080/07294360.2020.1713732	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Begun, A., & Carter, J. (2017). Career implications of doctoral social work student debt loan. <i>Journal of Social Work Education</i> , 53(2), 161-173. http://dx.doi.org/10.1080/10437797.2016.1243500	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Bekki, J. M., Smith, M. L., Bernstein, B. L., & Harrison, C. (2013). Effects of an online personal resilience training program for women in STEM doctoral programs. <i>Journal of Women and Minorities in Science and Engineering</i> , 19(1), 17-35.	Not early-stage doctoral students	Candidates not in early stages
Bender, S., Rubel, D., & Dykeman, C. (2018). An interpretative phenomenological analysis of doctoral counselor education students' experience of receiving cybersupervision. <i>The Journal of Counselor Preparation and Supervision</i> , 11(1). Retrieved from https://repository.wcsu.edu/jcps/vol11/iss1/7	Not early-stage doctoral students	No specification of candidate stage
Berry, C., Valeix, S., Niven, J. E., Chapman, L., Roberts, P. E., & Hazell, C. M. (2020). Hanging in the balance: Conceptualising doctoral researcher mental health as a dynamic balance across key tensions characterising the PhD experience. <i>International Journal of Educational Research</i> , 102, 101575. https://doi.org/10.1016/j.ijer.2020.101575	Not early-stage doctoral students	On page 4, there is a reference to stress and anxiety from the beginning, but no separation of early staggers.
Bireda, A. D. (2015). Challenges to the doctoral journey: a case of female doctoral students from Ethiopia. <i>Open Praxis</i> , 7(4), 287-297. http://dx.doi.org/10.5944/openpraxis.7.4.243	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Blaney, J. M., Kang, J., Wofford, A., & Feldon, D. F. (2020). Mentoring relationships between doctoral students and postdocs in the lab sciences. <i>Studies in Graduate and Postdoctoral Education</i> , 11(3), 263-279. https://doi.org/10.1108/SGPE-08-2019-0071	Not early-stage doctoral students	Later stage - nothing specific to early stage
Bolliger, D. U., & Halupa, C. (2012). Student perceptions of satisfaction and anxiety in an online doctoral program. <i>Distance Education</i> , 33(1), 81-98. http://dx.doi.org/10.1080/01587919.2012.667961	Not early-stage doctoral students	No specification of candidate stage
Broc, G., Shankland, R., Martin-Krumm, C., Carter, S., & Bouteyre, E. (2020). Burnout académique en doctorat. Validation d'une échelle de burnout adaptée aux étudiants francophones en doctorat. <i>Annales Medico Psychologiques</i> , 178(5), 517-524. https://doi.org/10.1016/j.amp.2019.01.011	Not in the English language	French language

Brown, L., & Watson, P. Understanding the experiences of female doctoral students. <i>Journal of Further and Higher Education</i> , 34(3), 385-404. https://doi.org/10.1080/0309877X.2010.484056	Not early-stage doctoral students	No specification of candidate stage
Brown, P. (2013). Loneliness at the bench. Is the PhD experience as emotionally taxing as it is mentally challenging? <i>EMBO reports</i> , 14, 405-409. https://doi.org/10.1038/embor.2013.35	Not a journal article	Not empirical
Burrow, A. L., & Ong, A. D. (2010). Racial identity as a moderator of daily exposure and reactivity to racial discrimination. <i>Self and Identity</i> , 9, 383-402. https://doi.org/10.1080/15298860903192496	Not early-stage doctoral students	Data mixed for all doctoral candidates. Data for doctoral candidates mixed with graduates
Busari, A. (2011). Validation of student academic stress scale (SASS). <i>European Journal of Social Sciences</i> , 21(1), 94-105.	No full text available	Full text not retrieved. Searches undertaken at three institutions.
Byers, V. T., Smith, R. N., Hwang, E., Angrove, K. E., Chandler, J. I., Christian, S. H., Dickerson, S. H., McAlister-Shields, L., Houston, S., Thompson, S. P., Denham, M. A., & Onwuegbuzie, A. J. (2014). Survival strategies: Doctoral students' perceptions of challenges and coping methods. <i>International Journal of Doctoral Studies</i> , 9, 109-136.	Not early-stage doctoral students	2nd year students
Byrom, N. (2020). COVID-19 and the research community: The challenges of lockdown for early-career researchers. <i>eLife</i> , 9, e59634. https://doi.org/10.7554/eLife.59634	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Byrom, N. C., Dinu, L., Kirkman, A., & Hughes, G. (2020). Predicting stress and mental wellbeing among doctoral researchers. <i>Journal of Mental Health</i> , 1-9. https://doi.org/10.1080/09638237.2020.1818196	Not early-stage doctoral students	No specification of doctoral stage
Caesens, G., Stinghamer, F., & Luypaert, G. (2014). The impact of work engagement and workaholism on well-being: The role of work-related support. <i>Career Development International</i> , 19(7), 813-835. https://doi.org/10.1108/CDI-09-2013-0114	Not early-stage doctoral students	No specification of candidate stage
Caretta, M. A., Drozdowski, D., Jokinen, J. C & Falconer, E. (2017). "Who can play this game?" The lived experiences of doctoral candidates and early career women in the neoliberal university. <i>Journal of Geography in Higher Education</i> , 42(2), 261-275. https://doi.org/10.1080/03098265.2018.1434762	Not early-stage doctoral students	No specification of candidate stage and no relevant data to review for the early stage
Castelló, M., Iñesta, A., & Monereo, C. (2009). <i>Electronic Journal of Research in Educational Psychology</i> , 7(3), 1107-1130.	Not early-stage doctoral students	No specification of candidate stage

Clark, H. K., Murdock, N. L., & Koetting, K. (2009). Predicting burnout and career choice satisfaction in counseling psychology graduate students. <i>The Counseling Psychologist</i> , 37(4), 580-606. https://doi.org/10.1177/0011000008319985	Not early-stage doctoral students	No first years
Cohen, J. S., & Miller, L. J. (2009). Interpersonal mindfulness training for well-being: A pilot study with psychology graduate students. <i>Teachers College Record</i> , 111(12), 2760-2774.	Not early-stage doctoral students	Data for doctoral student mixed with Masters students.
Collins, J., & Brown, N. (2020). Where's the validation? Role of emotion work and validation for doctoral students. <i>Higher Education Research and Development</i> , 1-14. https://doi.org/10.1080/07294360.2020.1833315	No relevant data	No data on MH/PWB in year 1
Cornér, S., Löfström, E., & Pyhältö, K. (2017). The relationships between doctoral students' perceptions of supervision and burnout. <i>International Journal of Doctoral Studies</i> , 12, 91-106. Retrieved from http://www.informingscience.org/Publications/3754	Not early-stage doctoral students	Not early stage
Divaris, K., Polychronopoulou, A., Taoufik, K., Katsaros, C., & Eliades, T. (2012). Stress and burnout in postgraduate dental education. <i>European Journal of Dental Education</i> , 16, 35-42. https://doi.org/10.1111/j.1600-0579.2011.00715.x	Not early-stage doctoral students	No specification of candidate stage
Doutrich, D. (2001). Experiences of Japanese nurse scholars: insights for U.S faculty. <i>Journal of Nursing Education</i> , 40(5), 210-216.	Not early-stage doctoral students	Data for doctoral students mixed with Masters students. No separation of doctoral students or information on year of study.
Dunsmuir, S., Atkinson, C., Lang, J., & Wright, S. (2020). The value of practice simulations and objective structured professional assessments (OSPAs) for school psychology training: Participant perspectives. <i>International Journal of School & Educational Psychology</i> , 8(sup1), 177-186. https://doi.org/10.1080/21683603.2019.1605953	Not early-stage doctoral students	No separation of data for doctoral students or explication of part-time or full-time
Dunsmuir, S., Atkinson, C., Lang, J., Warhurst, A., & Wright, S. (2017). Objective structure professional assessments for trainee educational psychologists: An evaluation. <i>Educational Psychology in Practice</i> , 33(4), 418-434. https://doi.org/10.1080/02667363.2017.1352490	Not early-stage doctoral students	Second year candidates
Eisenbach, B. (2013). Finding a balance: a narrative inquiry into motherhood and the doctoral process. <i>The Qualitative Report</i> , 18(17), 1-13. Retrieved from https://nsuworks.nova.edu/tqr/vol18/iss17/2	Not early-stage doctoral students	No specification of candidate stage

El-Ghoroury, N. H., Galper, D. I., Sawaqdeh, A., & Bufka, L.F. (2012). Stress, coping, and barriers to wellness among psychology graduate students. <i>Training and Education in Professional Psychology</i> , 6(2), 122-134. https://doi.org/10.1037/a0028768	Not early-stage doctoral students	No information on candidate stage
Falk, L. L., Augustin, H., Torén, K., & Magnusson, M. (2019). Doctoral students' perceived working environment, obstacles and opportunities at a Swedish medical faculty: A qualitative study. <i>BMC Medical Education</i> , 19(250), 1-9, https://doi.org/10.1186/s12909-019-1684-x	Not early-stage doctoral students	No specification of candidate stage
Fatima, I., & Malik, S. (2019). Effects of supervisor support on depression symptoms in research students: Time management as moderator. <i>Journal of Behavioural Sciences</i> , 29(1), 1-12.	Not early-stage doctoral students	Data for doctoral students mixed with Masters and undergraduate students. No separation of doctoral students or information on year of study.
Fisher, A. J., Mendoza-Denton, R., Patt, C., Young, I., Eppig, A., Garrell, R. L., Rees, D. C., Nelson, T. W., & Richards, M. A. (2019). Structure and belonging: Pathways to success for underrepresented minority and women PhD students in STEM fields. <i>PLoS One</i> , 14(1), e0209279. https://doi.org/10.1371/journal.pone.0209279	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Fleming, L. M. Glass, J. A., Fujisaki, S., & Toner, S. L. (2010). Group process and learning: A grounded theory model of group supervision. <i>Training and Education in Professional Psychology</i> , 4(3), 194-203. https://doi.org/10.1037/a0018970	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Fomunyan, K. G. (2020). Theorising intercontinental PhD students' experiences: The case of students from Africa, and Asia. <i>International Journal of Higher Education</i> , 9(3), 232-239. https://doi.org/10.5430/ijhe.v9n3p232	Not early-stage doctoral students	No specification of doctoral stage
Gao, Y. (2019). Experiences of Chinese international doctoral students in Canada who withdrew: A narrative inquiry. <i>International Journal of Doctoral Studies</i> , 14, 259-276. https://doi.org/10.28945/4240	No relevant data	No relevant data here for early-stage participants
Gasman, M., Hirschfeld, A., & Vultaggio, J. (2008). "Difficult yet rewarding": The experience of African American graduate students in education at an ivy league institution. <i>Journal of Diversity in Higher Education</i> , 1(2), 126-138. https://doi.org/10.1037/1938-8926.1.2.126	Not early-stage doctoral students	Data for doctoral students mixed with Masters students. No separation of doctoral students or information on year of study.
Golden, L., Alamía, J., Baker, R., Chilson, S., Choucroun, P., Cook, K., de Vries-Kell, S., Marbach, C., & Peters, S. (2005). Doc Tales. <i>The Family Journal: Counseling and Therapy for Couples and Families</i> , 13(4), 487-490. https://doi.org/10.1177/1066480705278727	Not empirical	Narrative pieces, but do not refer to any methods.

González-Betancor, S. M., & Dorta-González, P. (2020). Risk of interruption of doctoral studies and mental health in PhD students. <i>Mathematics</i> , 8(10), 1695. https://doi.org/10.3390/math8101695	Not early-stage doctoral students	No specification of doctoral stage
Grady, R. K., La Touche, R., Oslawski-Lopez, J., Powers, A., & Simacek, K. (2014). Betwixt and between: The social position and stress experiences of graduate students. <i>Graduate Student Teaching Experiences</i> , 42(1), 5-16. https://doi.org/10.1177/0092055X13502182	Not early-stage doctoral students	Data for doctoral students mixed with Masters students. No separation of doctoral students or information on year of study.
Greeson, J. M., Toohey, M. J., & Pearce, M. J. (2015). An adapted, four-week mind-body skills group for medical students: Reducing stress, increasing mindfulness, and enhancing self-care. <i>Explore</i> , 11(3), 186-192. https://doi.org/10.1016/j.explore.2015.02.003	Not early-stage doctoral students	Data for doctoral students mixed with Masters students. No separation of doctoral students across different years of study.
Guidotti Breting, L. M., Towns, S. J., Butts, A. M., Brett, B. L., Leafer, E. B., & Whiteside, D. M. (2020). 2020 COVID-19 American academy of clinical neuropsychology (AACN) student affairs committee survey of neuropsychology trainees. <i>Clinical Neuropsychologist</i> , 34(7/8): 1284-1313. https://doi.org/10.1080/13854046.2020.1809712	Not early-stage doctoral students	No specification of doctoral stage
Haag, P., Shankland, R., Osin, E., Boujut, É., Cazalis, F., Bruno, A. -S., Vrignaud, P., & Gay, M. -C. (2017). Stress perc, u et santé physique des doctorants dans les universités françaises. <i>Pratiques Psychologiques</i> , 1-20. http://dx.doi.org/10.1016/j.prps.2017.04.005	Not in the English language	Not in English
Hadjioannou, X., Shelton, N. R., Fu, D., & Dhanarattigannon, J. (2007). The road to a doctoral degree: Co-travelers through a perilous passage. <i>College Student Journal</i> , 41(1), 160-177.	Not empirical	Not empirical. Not specific to early stage.
Havercamp, B. (1994). Using assessment in counseling supervision: Individual differences in self-monitoring. <i>Measurement and Evaluation in Counseling and Development</i> , 27(1), 316-24.	Not early-stage doctoral students	Later stage. Over 3 years of training.
Haynes, C., Bulosan, M., Citty, J., & Grant-Harris, M. (2012). My world is not my doctoral program...or is it? Female students' perceptions of well-being. <i>International Journal of Doctorial Studies</i> , 7, 1-17.	Not early-stage doctoral students	Second year candidates
Heaviside, H. J., Staff, H. R., & Donnan, K. J. (2017). Riding out the storm: The challenges faced and strategies used when balancing teaching commitments and a PhD. <i>Sport & Exercise Psychology Review</i> , 13(2), 32-38.	No relevant data	Not relevant. Focus on teaching.

Hish, A. J., Nagy, G. A., Fang, C. M., Kelley, L., Nicchitta, C. V., Dzirasa, K., & Rosenthal, M. Z. (2019). Applying the stress process model to stress-burnout and stress-depression relationships in biomedical doctoral students: A cross-sectional pilot study. <i>CBE-Life Sciences Education</i> , 18(ar51), 1-11. https://doi.org/10.1187/cbe.19-03-0060	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Hladchenko, M., & Westerheijden, D. F. (2018). The self-concept of Ukrainian doctoral students: Means-ends decoupling at the state level. <i>Higher Education Quarterly</i> , 1-16. https://doi.org/10.1111/hequ.12182	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Hockey, J. (1994). New territory: problems of adjusting to the first year of a social science PhD. <i>Studies in Higher Education</i> , 19(2), 177-190. https://doi.org/10.1080/03075079412331382027	Not original data	Not original data
Holahan, C. K. (1979). Stress experienced by women doctoral students, need for support, and occupational sex typing: An interactional view. <i>Sex Roles</i> , 5(4), 425-435. https://doi.org/10.1007/BF00287318	Not early-stage doctoral students	Unclear what stage of the doctoral programme
Hopwood, N., & Paulson, J. (2012). Bodies in narratives of doctoral students' learning and experience. <i>Studies in Higher Education</i> , 37(6), 667-681. https://doi.org/10.1080/03075079.2010.537320	Not early-stage doctoral students	No specification of candidate stage
Howell, S. L., & Coates, C. J. (1997). Utilizing narrative inquiry to evaluate a nursing doctorate program professional residency. <i>Journal of Professional Nursing</i> , 13(2), 110-123. https://doi.org/10.1016/S8755-7223(97)80011-7	Not early-stage doctoral students	No information on when the listed phases were situated within the programme
Hughes, C. (2011). Pleasure, change and values in doctoral pedagogy. <i>Studies in Higher Education</i> , 36(6), 621-635. https://doi.org/10.1080/03075079.2010.502569	Not early-stage doctoral student	Not original data. Third-year student.
Hunter, K. H., & Devine, K. (2016). Doctoral students' emotional exhaustion and Intentions to leave academia. <i>International Journal of Doctoral Studies</i> , 11, 35-61.	Not early-stage doctoral students	No specification of candidate stage. Data mixed between current and past doctoral students.
Illovsy, M. E. (1991). A comparison of the physical and mental health of doctoral level women scientists. <i>Journal of College Student Psychotherapy</i> , 5(3), 99-110. http://dx.doi.org/10.1300/J035v05n03_08	Not early-stage doctoral students	No specification of candidate stage
Infortuna, C., Gratteri, F., Benotakeia, A., Patel, S., Fleischman, A., Musscatello, R. R. A., Bruno, A., Zoccali, R. A., Chusid, E., Han, Z., & Battaglia, F. (2020). Exploring the gender difference and predictors of perceived stress among students enrolled in different medical programs: A cross-sectional study. <i>International Journal of Environmental Research and Public Health</i> , 17(18), 1-8. https://doi.org/10.3390/ijerph17186647	Not early-stage doctoral students	1st years mixed with 2nd years

Jacobsen, S. F., & O'Brien, M. E. (1992). Satisfying and stressful experiences of first-time federal grantees. <i>IMAGE: Journal of Nursing Scholarship</i> , 24(1), 45-49. https://doi.org/10.1111/j.1547-5069.1992.tb00698.x	Not early-stage doctoral students	No indication that participants are doctoral students.
Jiao, Q. G., Onwuegbuzie, A. J., & Waytowich, V. L. (2008). The relationship between citation errors and library anxiety: An empirical study of doctoral students in education. <i>Information Processing and Management</i> , 44, 948-956. https://doi.org/10.1016/j.ipm.2007.05.007	Not early-stage doctoral students	No specification of doctoral student stage
Juniper, B., Walsh, E., Richardson, A., & Morley, B. (2012). A new approach to evaluating the well-being of PhD research students. <i>Assessment & Evaluation in Higher Education</i> , 37(5), 563-576. http://dx.doi.org/10.1080/02602938.2011.555816	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Kaufman, J. A. (2006). Stress and social support among online doctoral psychology students. <i>Journal of College Student Psychotherapy</i> , 20(3), 79-88. http://dx.doi.org/10.1300/J035v20n03_07	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Kearns, H., Gardiner, M., & Marshall, K. (2008). Innovation in PhD completion: The hardy shall succeed (and be happy!). <i>Higher Education Research & Development</i> , 27(1), 77-89. https://doi.org/10.1080/07294360701658781	Not early-stage doctoral students	No specification of candidate stage, but appears to be later stage
Keengwe, J., & Wilsey, B. B. (2012). Online graduate students' perceptions of face-to-face classroom instruction. <i>International Journal of Information and Communication Technology Education</i> , 8(3), 45-54. https://doi.org/10.4018/jicte.2012070106	Not early-stage doctoral students	Participants more than a year into their programme. No specification of whether data pertained to the early stage.
Kenty, J. R. (2000). Stress management strategies for women doctoral students. <i>Nurse Educator</i> , 25(5), 251-254. https://doi.org/10.1097/00006223-200009000-00018 .	Not early-stage doctoral students	No specification of candidate stage or data relevant to early stage
Kian, A. A., Fathi, M., Moeen, Z., Rostami, B., Zein, S., Safavi, A., & Fakour, E. (2020). Relationship of tendency towards substance abuse with spiritual and psychological well-being in students of Zanjan university of medical sciences. <i>Health, Spirituality & Medical Ethics Journal</i> , 7(2), 59-67. http://dx.doi.org/10.29252/jhsme.7.2.59	Not early-stage doctoral students	Undergraduate and doctoral data mixed
Kim, M. (2019). Action research to overcome the stress caused by the combination of academic and work life of Korean early childhood education doctoral students. <i>World Journal of Education</i> , 9(5), 16-25. https://doi.org/10.5430/wje.v9n5p16	Not early-stage doctoral students	No specification of candidate stage
Kim, S. (2019). Experiences of Korean international students of masters and doctoral programs in the United States. <i>Asia Life Sciences</i> , 18(2), 797-808.	No full text available	No full text available
Klawonn, A., Kernan, D., & Lynskey, J. (2019). A 5-week seminar on the biopsychosocial-spiritual model of self-care improves anxiety, self-compassion,	Not early-stage doctoral students	No specification of candidate stage

mindfulness, depression, and stress in graduate healthcare students. <i>International Journal of Yoga Therapy</i> , 29, 81-89. https://doi.org/10.17761/D-18-2019-00026 .		
Klocko, B. A., Marshall, S. M., & Davidson, J. F. (2015). Developing practitioner-scholar doctoral candidates as critical writers. <i>Journal of Higher Education Theory and Practice</i> , 15(4), 21-31.	Not early-stage doctoral students	No specification of candidate stage
Kovach Clark, H., Murdock, N. L., & Koetting, K. (2009). Predicting burnout and career choice satisfaction in counseling psychology graduate students. <i>The Counseling Psychologist</i> , 37(4), 580-606. https://doi.org/10.1177/0011000008319985	Not early-stage doctoral students	No participants met our definition of early stage (no first years)
Kulikowski, K., Potoczek, A., Antipow, E., & Król, S. (2019). Demands, resources and study satisfaction among Polish PhD students. <i>Educational Sciences: Theory and Practice</i> , 19(4), 65-79. http://dx.doi.org/10.12738/estp.2019.4.005	Not early-stage doctoral students	Excluded first years
Lappalainen, P. (2018). Tracing pedagogical progression on the doctoral level: Review of instructional immediacy needs, behaviors and outcomes. <i>International Journal of Engineering Pedagogy</i> , 8(5), 58-73. https://doi.org/10.3991/ijep.v8i5.8668	Not early-stage doctoral students	No specification of candidate stage
Liu, L., & Haque, M. (2017). Age different in research course satisfaction in a blended Ed.D program: A moderated mediation model of the effects of internet self-efficacy and statistics anxiety. <i>Online Journal of Distance Learning Administration</i> , 20(2), 1 - 17.	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Liu, X., Xiao, S., Luo, D., Zhang, J., Qin, L., & Yin, X. (2020). Graduate students' emotional disorders and associated negative life events: A cross-sectional study from Changsha, China." <i>Risk Management and Healthcare Policy</i> , 13, 1391-1401. http://doi.org/10.2147/RMHP.S236011	Not early-stage doctoral students	Doctoral students mixed with masters
Lonka, K., Chow, A., Keskinen, J., Hakkarainen, K., Sandström, N., & Pyhältö, K. (2014). How to measure PhD students' conception of academic writing? <i>Journal of Writing Research</i> , 5(3), 245-269. https://doi.org/10.17239/jowr-2014.05.03.1	Not early-stage doctoral students	Data mixed for all doctoral candidates. No specification of candidate stage
Lonka, K., Ketonen, E., Vekkaila, J., Lara, M. C., & Pyhältö, K. (2019). Doctoral students' writing profiles and their relations to well-being and perceptions of the academic environment. <i>Higher Education</i> , 77(4), 587-602. https://doi.org/10.1007/s10734-018-0290-x	Not early-stage doctoral students	Data mixed for all doctoral candidates. No specification of candidate stage
Marchand, T. (2017). Action learning in postgraduate research training. <i>Action Learning: Research and Practice</i> , 14(1), 83-95. https://doi.org/10.1080/14767333.2017.1282637	Not early-stage doctoral students	"students at more advanced stages"
Marshall, S., Klocko, B., & Davidson, J. (2017). Dissertation completion: No longer higher education's invisible problem. <i>Journal of Educational Research and Practice</i> , 7(1), 74-90. https://doi.org/10.5590/JERAP.2017.07.1.06	Not early-stage doctoral students	Focus on later stages

McAlpine, L., Skakni, I., & Pyhältö, K. (2020). PhD experience (and progress) is more than work: Life-work relations and reducing exhaustion (and cynicism). <i>Studies in Higher Education</i> . Advance online publication. https://doi.org/10.1080/03075079.2020.1744128	Not early-stage doctoral students	Data mixed for all doctoral candidates. No specification of candidate stage
McGee, E., Griffith, D. M., & Houston, S. L. (2019). "I know I have to work twice as hard and hope that makes me good enough": Exploring the stress and strain of black doctoral students in engineering and computing. <i>Teachers College Record</i> , 121(6), 1-38. Retrieved from https://eric.ed.gov/?id=EJ1204371	Not early-stage doctoral students	Data mixed for all doctoral candidates. No relevant quotes from first-year students
Meetai, L. A., Singh, N. B., Sarma, T., & Mutum, K. (2019). Job uncertainty after Ph.D: A common concern for doctoral students of technical institutes of North East India. <i>Prabandhan: Indian Journal of Management</i> , 1-30. https://doi.org/10.17010/pijom/2019/v12i8/146411	Not early-stage doctoral students	No specification of candidate stage. Stress data mixed with motivation.
Meira, T.M Paiva, S. M., Antelo, O. M., Guimarães, K., Bastos, S. Q., & Tanaka, O. M. (2020). Perceived stress and quality of life among graduate dental faculty. <i>Journal of Dental Education</i> , 84(10), 1099-1107. https://doi.org/10.1002/jdd.12241	Not early-stage doctoral students	No separation of doctoral students or information on year of study.
Merç, A. (2016). Research anxiety among Turkish graduate ELT students. <i>Current Issues in Education</i> , 19(1), 1-15. Retrieved from http://cie.asu.edu/ojs/index.php/cieatasu/article/view/1539	Not early-stage doctoral students	Data mixed for all doctoral candidates. No specification of candidate stage
Miller, A. N., & Orsillo, S. M. (2020). Values, acceptance, and belongingness in graduate school: Perspectives from underrepresented minority students. <i>Journal of Contextual Behavioral Science</i> , 15, 197-206. https://doi.org/10.1016/j.jcbs.2020.01.002	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Moate, R. M., Gnlika, P. B., West, E. M., & Rice, K. G. (2019). Doctoral student perfectionism and emotional well-being. <i>Measurement and Evaluation in Counseling and Development</i> , 52(3), 145-155. https://doi.org/10.1080/07481756.2018.1547619	Not early-stage doctoral students	Data mixed for all doctoral candidates. No specification of candidate stage
Nagy, G. A., Fang, C. M., Hish, A. J., Kelly, L., Nicchitta, C. V., Dzirasa, K., & Rosenthal, M. Z. (2019). Burnout and mental health problems in biomedical doctoral students. <i>CBE – Life Sciences Education</i> , 18(ar27), 1-14. https://doi.org/10.1187/cbe.18-09-0198	Not early-stage doctoral students	No separation of doctoral students or information on year of study.
Nelson, N. G., Dell'Oliver, C., Kock, C., & Buckler, R. (2001). Stress, coping, and success among graduate students in clinical psychology. <i>Psychological Reports</i> , 88, 759-767. https://doi.org/10.2466/pr0.2001.88.3.759	Not early-stage doctoral students	Data for doctoral students mixed with Masters students. No separation of doctoral students or information on year of study.
Niclasse-Haenggi, C. (2018). Doctoral students' well-being – an imperative on the path to accomplishment. <i>VSH-Bulletin</i> , 3/4, 8-16.	Not early-stage doctoral students	No information on candidate stage
Nogueira-Martins, L. A., Fagnani Neto, R., Macedo, P. C. M., Cítero, V. A., & Mari, J. J. (2004). The mental health of graduate students at the Federal University of São	Not early-stage doctoral students	Only gives comparative data versus other years and no quantitative data

Paulo: a preliminary report. <i>Brazilian Journal of Medical and Biological Research</i> , 37(10), 1519-1524. https://doi.org/10.1590/S0100-879X2004001000011		
Odaci, H. (2012). The role of computer self-efficacy, self-esteem, and subjective well-being in predicting research self-efficacy among postgraduate students. <i>The Asia-Pacific Education Researcher</i> , 22(4), 399-406. DOI 10.1007/s40299-012-0039-8	Not early-stage doctoral students	Data for doctoral students mixed with Masters students. No separation of doctoral students or information on year of study.
Ong, A. D., Fuller-Rowell, T., & Burrow, A. L. (2009). Racial discrimination and the stress process. <i>Journal of Personality and Social Psychology</i> , 96(6), 1259-1271. https://doi.org/10.1037/a0015335	Not early-stage doctoral students	Data mixed for all doctoral candidates. No specification of candidate stage
Pain, E. (2017). Ph.D students face significant health challenges. <i>Science</i> . https://doi.org/10.1126/science.caredit.a1700028	Not a journal article	Not a peer-reviewed journal article.
Pappa, S., Elomaa, M., & Perälä-Littunen. (2020). Sources of stress and scholarly identity: the case of international doctoral students of education in Finland. <i>Higher Education</i> , 80, 173-192. https://doi.org/10.1007/s10734-019-00473-6	Not early-stage doctoral students	No specification of candidate stage
Perepiczka, M., Chandler, N., & Becerra, M. (2011). Relationship between graduate students' statistics self-efficacy, statistics anxiety, attitude toward statistics, and social support. <i>The Professional Counselor</i> , 1(2), 99-108. https://doi.org/10.15241/mpa.1.2.99	Not early-stage doctoral students	Data for doctoral students mixed with Masters students. No separation of doctoral students or information on year of study.
Pervez, A., Brady, L. L., Mullane, K., Lo, K. D., Bennett, A. A., & Nelson, T. A. (2020). An empirical investigation of mental illness, impostor syndrome, and social support in management doctoral programs. <i>Journal of Management Education</i> . Advance online publication. https://doi.org/10.1177/1052562920953195	Not early-stage doctoral students	Data mixed for all years in analysis
Platt, J., & Schaefer, C. (1995). Clinical psychology students' subjective stress ratings during their doctoral training. <i>Psychological Reports</i> , 76, 994. https://doi.org/10.2466/pr0.1995.76.3.994	Not early-stage doctoral students	Data for doctoral students mixed with Masters students. No separation of doctoral students or information on year of study.
Prabawati, C. Y. (2020). Self-help strategies to reduce emotional distress among Indonesian doctoral students who studied abroad: A phenomenology study. <i>International Journal of Pharmaceutical Research</i> , 12(3), 1819-1825. https://doi.org/10.31838/ijpr/2020.12.03.254	No full text available	No full text
Pychyl, T. A., & Little, B. R. (1998). Dimensional specificity in the prediction of subjective well-being: Personal projects in pursuit of the PhD. <i>Social Indicators Research</i> , 45, 423-473. https://doi.org/10.1023/A:1006970504138	Not early-stage doctoral students	Data mixed for all doctoral candidates. No specification of candidate stage

Pyhältö, K., & Keskinen, J. (2012). Doctoral students' sense of relational agency in their scholarly communities. <i>International Journal of Higher Education</i> , 1(2), 136-149. http://dx.doi.org/10.5430/ijhe.v1n2p136	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Pyhältö, K., Toom, A., Stubb, J., & Lonka, K. (2012). Challenges of becoming a scholar: A study of doctoral students' problems and well-being. <i>International Scholarly Research Network</i> , 2012, 1-12. https://doi.org/10.5402/2012/934941	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Ramírez-Castañeda, V. (2020). Disadvantages in preparing and publishing scientific papers caused by the dominance of the English language in science: The case of Colombian researchers in biological sciences. <i>PLoS ONE</i> , 15(9), 1-15. https://doi.org/10.1371/journal.pone.0238372	Not early-stage doctoral students	No specification of doctoral stage
Razavi, S. A., Shahrabi, A., & Siamian, H. (2017). The relationship between research anxiety and self-efficacy. <i>Materia Socio-Medica</i> , 29(4), 247-250. https://doi.org/10.5455/msm.2017.29.247-250	Not early-stage doctoral students	Data for doctoral students mixed with Masters students. No separation of doctoral students or information on year of study.
Reilly, J., & Fitzpatrick, J. (2009). Perceived stress and sense of belonging in doctor of nursing practice students. <i>Journal of Professional Nursing</i> , 25(2), 81-86. https://doi.org/10.1016/j.profnurs.2008.10.002	Not early-stage doctoral students	Data mixed for all doctoral candidates. No specification of candidate stage
Rheineck, J. E., & Roland, C. B. (2008). The developmental mentoring relationship between academic women. <i>Adultspan</i> , 7(2), 80-93. https://doi.org/10.1002/j.2161-0029.2008.tb00048.x	No relevant data	No evidence on MH/PWB for the first years.
Richardson, C. M. E., Trust, W. T., & George, K. A. (2020). Trainee wellness: Self-critical perfectionism, self-compassion, depression, and burnout among doctoral trainees in psychology. <i>Counselling Psychology Quarterly</i> , 33(2), 187-198. https://doi.org/10.1080/09515070.2018.1509839	Not early-stage doctoral students	Data mixed for all years in analysis
Rocha-Singh, I. A. (1994). Perceived stress among graduate students: Development and validation of the graduate stress inventory. <i>Educational and Psychological Measurement</i> , 54(3), 714-727. https://doi.org/10.1177/0013164494054003018	Not early-stage doctoral students	Study 1 - graduate students. No separation of doctoral. / Study 3 Masters
Sato, T. (2016). Doctoral sojourn experiences of adapted physical education students from Asian countries. <i>Journal of International Students</i> , 6(2), 339-366.	Not early-stage doctoral students	Unclear what stage of the doctoral programme. Exclude if no information - no specification of stage
Schmidt, M., & Umans, T. (2014). Experiences of well-being among female doctoral student in Sweden. <i>International Journal of Qualitative Studies on Health and Well-being</i> , 9(1), 23059. https://doi.org/10.3402/qhw.v9.23059	Not early-stage doctoral students	One paragraph refers to the beginning

Schulte, L. (2005). The application-based doctoral comprehensive examination for educational administration programs. <i>AASA Journal of Scholarship and Practice</i> , 2(2), 25-29.	Not a journal article	Magazine
Shaukat, S., Siddiquah, A., Abiodullah, M., & Akbar, R. (2014). Postgraduate students' attitudes towards research. <i>Bulletin of Education and Research</i> , 36(1), 111-122.	Not early-stage doctoral students	No specification of doctoral student stage.
Shavers, M. C., & Moore, J. L. (2017). The perpetual outsider: Voices of black women pursuing doctoral degrees at predominantly white institutions. <i>Journal of Multicultural Counseling and Development</i> , 47, 211-226. https://doi.org/10.1002/jmcd.12154	No relevant data	No data relevant to participant group
Shavers, M. C., & Moore, J. L. (2014). Black female voices: Self-presentation strategies in doctoral programs at predominately white institutions. <i>Journal of College Student Development</i> , 55(4), 391-407. https://doi.org/10.1353/csd.2014.0040	No relevant data	Data does not explicitly make reference to MH/PWB.
Sorrel, M. A., Martínez-Huertas, J. A., & Arconada, M. (2020). It must have been burnout: prevalence and related factors among Spanish PhD Students. <i>Spanish Journal of Psychology</i> , 23(e29), 1-13. https://doi.org/10.1017/SJP.2020.31	Not early-stage doctoral students	No specification of doctoral stage
Stanley, P. (2014). Writing the PhD journey(s): An autoethnography of zine-writing, angst, embodiment, and backpacker travels. <i>Journal of Contemporary Ethnography</i> , 44(2), 143-168. https://doi.org/10.1177/0891241614528708	No relevant data	Nothing specific to the early stage
Stubb, J., Pyhältö, K., & Lonka, K. (2011). Balancing between inspiration and exhaustion: PhD students' experienced socio-psychological well-being. <i>Studies in Continuing Education</i> , 33(1), 33-50. https://doi.org/10.1080/0158037X.2010.515572	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Stubb, J., Pyhältö, K., & Lonka, K. (2012). The experienced meaning of working with a PhD thesis. <i>Scandinavian Journal of Educational Research</i> , 56(4), 439-456. http://dx.doi.org/10.1080/00313831.2011.599422	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Suinn, R. M. (1972). Removing emotional obstacles to learning and performance by visuo-motor behavior rehearsal. <i>Behavior Therapy</i> , 3(2), 308-310. https://doi.org/10.1016/S0005-7894(72)80096-0	Not early-stage doctoral students	Case report. Appears to be late stage.
Swords, B. A., & Ellis, M. V. (2017). Burnout and vigor among health service psychology doctoral students. <i>The Counseling Psychologist</i> , 45(8), 1141-1161. https://doi.org/10.1177/0011000017747548	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Temiz, Z. T., & Comert, I. T. (2018). The relationship between life satisfaction, attachment styles and psychological resilience in university students. <i>Dusunen Adam The Journal of Psychiatry and Neurological Sciences</i> , 31, 274-283. https://doi.org/10.5350/DAJPN2018310305	Not early-stage doctoral students	Data for doctoral students mixed with Masters and undergraduate students. No separation of doctoral students or information on year of study.

Tigranyan, S., Byington, D. R., Liupakorn, D., Hicks, A., Lombardi, S., Mathis, M., & Rodolfa, E. (2020). Factors related to the impostor phenomenon in psychology doctoral students. <i>Training and Education in Professional Psychology</i> . Advance online publication. http://dx.doi.org/10.1037/tep0000321	Not early-stage doctoral students	Data mixed for year 1-3 doctoral candidates.
Tijdink, J. K., Schipper, K., Bouter, L. M., Maclaine Pont, P., de Jonge, J., & Smulders, Y. M. (2016). How do scientists perceive the current publication culture? A qualitative focus group interview study among Dutch biomedical researchers. <i>BMJ Open</i> , 6, e008681. https://doi.org/10.1136/bmjopen-2015-008681	Not early-stage doctoral students	Data mixed with other non-doctoral candidates. No specific of doctoral stage.
Toews, J. A., Lockyer, J. M., Dobson, D. J. G., & Brownell, A. K. (1993). Stress among residents, medical students, and graduate science (MSc/PhD) students. <i>Academic Medicine</i> , 68(10 Suppl), S46-48. https://doi.org/10.1097/00001888-199310000-00042 .	Not early-stage doctoral students	Data for doctoral students mixed with Masters students. No separation of doctoral students or information on year of study.
Torres, L., Driscoll, M. W., & Burrow, A. L. (2010). Racial microaggressions and psychological functioning among highly achieving African-Americans: A mixed-methods approach. <i>Journal of Social and Clinical Psychology</i> , 29(10), 1074-1099. https://doi.org/10.1521/jscp.2010.29.10.1074	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Ulibarri, N., Cravens, A., Cornelius, M., Royalty, A., & Nabergoj, A. S. (2014). Research as design: Developing creative confidence in doctoral students through design thinking. <i>International Journal of Doctoral Studies</i> , 9, 249-270. Retrieved from http://ijds.org/Volume9/IJDSv9p249-270Ulibarri0676.pdf	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Ülkü-Steiner, B., Kurtz-Costes, B., & Kinlaw, C. R. (2000). Doctoral student experiences in gender-balanced and male-dominated graduate programs. <i>Journal of Educational Psychology</i> , 92(2), 296–307. https://doi.org/10.1037/0022-0663.92.2.296	Not early-stage doctoral students	Excluded first years
Vacek, K., Donohue, W. J., Gates, A., Shu-Ju Lee, A., & Simpson, S. (2019). Seeking balance within personal writing ecologies: A collaborative autoethnography of a doctoral student writing group. <i>Studies in Continuing Education</i> , 1-15. https://doi.org/10.1080/0158037X.2019.1703670	Not early-stage doctoral students	Participants in later stages
Valdez, R. (1982). First year doctoral students and stress. <i>College Student Journal</i> , 16(1), 30-37.	No relevant data	Proxy measure of stress.
Van Kampen, D. J. (2004). Development and validation of the multidimensional library anxiety scale. <i>College & Research Libraries</i> , 65(1), 28-34. https://doi.org/10.5860/crl.65.1.28	Not early-stage doctoral students	No specification of doctoral student stage
Virtanen, V., Taina, J., & Pyhältö, K. (2017). What disengages doctoral students in the biological and environmental sciences from their doctoral studies? <i>Studies in</i>	Not early-stage doctoral students	No first years and no specific data for that period

Continuing Education, 39(1), 71-86. http://dx.doi.org/10.1080/0158037X.2016.1250737		
Volkert, D., Candela, L., & Bernacki, M. (2018). Student motivation, stressors, and intent to leave nursing doctoral study: A national study using path analysis. <i>Nursing Education Today</i> , 61, 210-215. https://doi.org/10.1016/j.nedt.2017.11.033	Not early-stage doctoral students	Data mixed for all doctoral candidates.
Waaiker, C. J. F., Heyer, A., & Kuli, S. (2016). Effects of appointment types on the availability of research infrastructure, work pressure, stress, and career attitudes of PhD candidates of a Dutch university. <i>Research Evaluation</i> , 25(4), 349-357. https://doi.org/10.1093/reseval/rvw008	Not early-stage doctoral students	Data mixed for all doctoral candidates. Year of study not considered as between-subjects variable.
Wall, S. (2008). Of heads and hearts: Women in doctoral education at a Canadian university. <i>Women's Studies International Forum</i> , 31, 219-228. https://doi.org/10.1016/j.wsif.2008.04.007	No relevant data	Nothing specific on mental health or psychological wellbeing to the early stage
Wang, C., Chen, Y., & Wu, T. (2010). Self-guided bibliotherapy: A case study of a Taiwanese doctoral student. <i>The International Journal of the Humanities</i> , 8(1), 413-422. https://doi.org/10.18848/1447-9508/CGP/v08i01/42820	Not early-stage doctoral students	Unclear what stage of the doctoral programme
Weise, C., Aguayo-González, M., & Castelló, M. (2020). Significant events and the role of emotion along doctoral researcher personal trajectories. <i>Educational Research</i> , 62(3), 304-323. https://doi.org/10.1080/00131881.2020.1794924	Not original data	Not original data
White, E. (2017). The art of triage. <i>Science</i> , 357(6351), 618. https://doi.org/10.1126/science.357.6351.618	Not a journal article	Not a journal article
Williams, P. S., Mueller, M. K., Carroll, H. C., Cornwall, M. W., Denney, L. M., & Kroneberger, L. M. (2018). Patterns of academic burnout, emotional distress, and coping in physical therapy students. <i>The International Journal of Health, Wellness and Society</i> , 8(3), 31-46. http://doi.org/10.18848/2156-8960/CGP/v08i03/31-46	Not early-stage doctoral students	Data for Year 1 only compared with year 2
Williams, R. A., Hagerty, B. M., Murphy-Weinberg, J., & Wan, J. (1995). Symptoms of depression among female nursing students. <i>Archives of Psychiatric Nursing</i> , 9(5), 269-278.	Not early-stage doctoral students	Data for doctoral students mixed with Masters and undergraduate students. No separation of doctoral students or information on year of study.
Wright, T. (2006). Issues in brief counselling with postgraduate research students. <i>Counselling Psychology Quarterly</i> , 19(4), 357-372. https://doi.org/10.1080/09515070601043203	Not early-stage doctoral students	Nothing specific to the early stage
Yousaf, S. U., Usman, B., & Akram, M. (2016). Exploring the causes of stress and coping with it amongst doctoral level students: Highlighting the importance of	Not early-stage doctoral students	Unclear what stage of the doctoral programme

information collection and management. <i>Pakistan Journal of Information Management & Libraries</i> , 18(2), 19-39.		
Yusuf, J. E., Saitgalina, M., & Chapman, D. W. (2020). Work-life balance and well-being of graduate students. <i>Journal of Public Affairs Education</i> . Advance online publication. https://doi.org/10.1080/15236803.2020.1771990	Not early-stage doctoral students	No specification of doctoral stage
Zahniser, E., Rupert, P. A., & Dorociak, K. E. (2017). Self-care in clinical psychology graduate training. <i>Training and Education in Professional Psychology</i> , 11(4), 283-289. http://dx.doi.org/10.1037/tep0000172	Not early-stage doctoral students	Data mixed for all doctoral candidates.

Table 2

Paper details and reasons for excluding some data from studies included in the review.

Author (year)	Reason(s) for exclusion	Additional information
Barry et al. (2018)	No relevant data	Qualitative data excluded as it was not relevant to the review (did not assess mental health or psychological wellbeing).
Barry et al. (2019)	Not early-stage doctoral students	Data for participants after first year excluded.
Bean et al. (2004)	Not early-stage doctoral students	Follow-up interview was not early stage.
Fung et al. (2017)	Not early-stage doctoral students	Non-pre-candidature students were not early stage.
Gardner et al. (2018)	Not early-stage doctoral students	Timepoint for the post-program data was unclear and appeared to be after the first year.
Hill et al. (1981)	Not early-stage doctoral students	Data for years 2 and 3 excluded due to not being early stage.
Ho (2016)	Not early-stage doctoral students	Masters and PhD students were not relevant to the review.
Kizhakkeveetil et al. (2016)	Not early-stage doctoral students	5 th and 8 th term students were not early stage.
Levecque et al. (2017)	Not early-stage doctoral students	Executing and finishing students excluded due to not being early stage.
Liu and Abliz (2019)	Not early-stage doctoral students	“Other-year” participants excluded due to not being early stage.
Liu et al. (2019)	Not early-stage doctoral students	Second, third, fourth year and above participants excluded due to not being early stage.
Marais et al. (2018)	Not early-stage doctoral students	Data for participants in Study 2 not separated by year.
Martinez et al. (2013)	Not early-stage doctoral students	Data for four participants were excluded due to being second year students and, therefore, not early stage.
Rico and Bunge (2020)	Not early-stage doctoral students	Data for years 3-7 were excluded due to not being early stage.
Sverdlik et al. (2020)	Not early-stage doctoral students	Data for those at the comprehensive examination and dissertation were excluded due to not being early stage.
Wang et al. (2019)	Not early-stage doctoral students	Data for participants 3-10 were excluded due to not being early stage.
Ziapour et al. (2017)	Not early-stage doctoral students	Data for terms 3-7 were excluded due to not being early stage.

Appendix 5: Extended synthesis

Table 1

Extended synthesis presenting analytical themes, descriptive themes, papers contributing to each describe themes, codes, and findings from studies contributing to codes

Analytical theme	Descriptive themes	Papers contributing to descriptive theme	Codes (italicised) and findings from studies contributing to codes (direct participant quotes are italicised within inverted commas)
Ratings of mental health and psychological wellbeing	Depression (3)	(Barry et al., 2018; Liu et al., 2019; Sverdlik & Hall, 2020)	<p><i>Depression</i></p> <p>Depression in the normal range using the Depression Anxiety Stress Scale (Barry et al., 2018)</p> <p>Depression in first years ($n = 71$) classified as none-minimal (52.1%), mild (28.2%), moderate (14.1%), moderately severe (2.8%), or severe (2.8%) (Liu et al., 2019)</p> <p>No significant differences in depression in ESDS versus other stages (Sverdlik & Hall, 2020)</p>
	Stress (9)	(Backmon et al., 1998; Barry et al., 2018; Gardner et al., 2018; Kizhakkeveetil et al., 2017; Liu & Abliz, 2019; Marais et al., 2018; Rico & Bunge, 2021; Rogers-Shaw & Carr-Chellman, 2018; Sverdlik & Hall, 2020)	<p><i>Stress</i></p> <p>Based on recommended cut off scores for the Depression Anxiety Stress Scale (Lovibond & Lovibond, 1995), stress was in the normal range for Australian doctoral candidates ($n = 20$ - Barry et al., 2018), but classified as “mild” in French doctoral students ($n = 32$ - Marais et al., 2018)¹, although stress was reported to be lower in both samples versus those in later years at the same institutions.</p> <p>Doctoral candidates reported above-normal (Cohen & Williamson, 1988) stress using the Perceived Stress Scale-10 (PSS-10; Barry et al., 2018; Kizhakkeveetil et al., 2017; Rico & Bunge, 2021)</p> <p>61% of doctoral students ($n = 47$) reported that the first year was more stressful (Backmon, 1998)</p> <p>High stress reported in Chinese doctoral students (Liu & Abliz, 2019)</p> <p>Stress apprehension in relation to writing was higher in early stage of doctoral study before a writing program (Gardner et al., 2018)</p> <p>Some of the same traits helped students handle stress. Stress is clearly part of being a doctoral student, and the participants were aware of its presence in their lives. They found various ways to handle stress. Pam stated, “<i>I would say on the stress Richter scale I’m way over where anyone should be.</i>” (Rogers-Shaw & Carr-Chellman, 2018, p. 244)</p>

			Moderate stress reported in early-stage doctoral students, which was significantly lower in those in the middle stage of their doctoral program, but not significantly differ from those at the later stage (Sverdlik & Hall, 2020)
	Anxiety (6)	(Barry et al., 2018; Gardner et al., 2018; Ho, 2015; Liu et al., 2019; Liu & Abliz, 2019)	<p><i>Anxiety</i></p> <p>Low anxiety (physical and mental) reported in Chinese doctoral students (Liu & Abliz, 2019)</p> <p>Anxiety in the normal range using the Depression Anxiety Stress Scale (Barry et al., 2018)</p> <p>Anxiety in first years ($n = 71$) at a medical institution classified as none (57.7%), mild (26.7%), moderate (11.3%), or severe (4.2%) (Liu et al., 2019)</p> <p>Moderate levels of overall writing, somatic, and cognitive anxiety reported in engineering doctoral students based on scale scores (Ho, 2015)</p> <p>Five of six participants also expressed writing apprehension during their interviews, noting that they entered the graduate program with unfavorable attitudes about writing as well as writing anxieties. (Gardner et al., 2018, p. 17)</p>
	Mental health problems (1)	(Levecque et al., 2017)	<p><i>Psychological distress</i></p> <p>Early-stage doctoral students in Belgium were at greater risk of psychological distress than those at later stages of study, but only significantly more than those in the middle stage (Levecque et al., 2017)</p> <p><i>Psychological disorders</i></p> <p>Early-stage doctoral students in Belgium were at greater risk of psychological disorders than those at later stages of study, but only significantly more than those in the middle stage (Levecque et al., 2017)</p>
	Wellbeing (1)	(Ziapour et al., 2017)	<p><i>Wellbeing</i></p> <p>Moderate overall, religious, existential, and spiritual wellbeing were moderate in doctoral students in medicine, dentistry and pharmaceuticals in Iran (Ziapour et al., 2017)</p>
Impact of transition into doctoral study on mental health and wellbeing	Anxiety (1)	(Van Dongen, 1988)	<p><i>Anxiety</i></p> <p>“Feelings of tension and anxiety definitely increased as the semester progressed” (Van Dongen, 1988, p. 22)</p>
	Depression (1)	(Van Dongen, 1988)	<p><i>Stress</i></p> <p>Behavioural indicators included feelings of depression, irritability, increased smoking, sleep disturbances, giggling, crying, and fatigue....Students dealt with increased feelings of stress” (Van Dongen, 1988, p. 22)</p>
	Stress (1)	(Van Dongen, 1988)	<p><i>Stress</i></p>

			<p>“Manifestations of <i>stress responses</i> were evident through a variety of physiological and behavioural symptoms. Behavioural indicators included feelings of depression, irritability, increased smoking, sleep disturbances, giggling, crying, and fatigue...Students dealt with increased feelings of stress” (Van Dongen, 1988, p. 22)</p> <p>Participants reported increased feelings of stress after starting full-time doctoral study (Van Dongen, 1988)</p>
Factors related to mental health and wellbeing – negative	Personal circumstances (4)	(Backmon et al., 1998; Cornwall et al., 2019; Gardner et al., 2018; Van Dongen, 1988)	<p><i>Financial worries</i></p> <p>38.16% of students, including both domestic and international students, reported concerns about the financial impact of doctoral study, even if a scholarship was available (Cornwall et al., 2019)</p> <p>Nursing doctoral students explained that doctoral study resulted in a decrease in income and the need to closely monitor expenditure (Van Dongen, 1988)</p> <p><i>Separation from Family</i></p> <p>Doctoral student reported difficulties with being away from family (Backmon et al., 1998; Cornwall et al., 2019), with some international students reporting concerns for the safety of their family in other countries (Cornwall et al., 2019)</p> <p>Doctoral nursing students reported a decline in the amount of time spent with their family (i.e., significant others) during doctoral study, while doctoral study was also reported by some to lead to more conflict in marital relationships (Van Dongen, 1988)</p> <p><i>Relationships with Family</i></p> <p>Maintaining a healthy relationship with family was difficult due to the lack of understanding of the PhD process among family members (Cornwall et al., 2019)</p> <p><i>Relocation</i></p> <p>Students, especially those from different cultures, found settling into their new communities stressful (Cornwall et al., 2019)</p> <p><i>The research proposition submission deadline [was stressful for me]: I thought the research proposition submission deadline, which is within 3 months from the PhD start date, was intended to be very strict and I was greatly worried about it because during the first few weeks of my study, I could not concentrate on my study due to a long process of settling in with my [family] in an unfurnished private flat. I am receiving the university’s full scholarship, and I was concerned that missing the deadline(s) could do serious harm to my scholarship status. (Cornwall et al., 2019, p. 368).</i></p> <p><i>The first semester it was rough, [but] my lab was awesome and very supportive, giving me advice. If I had any questions they helped me out a lot. [Interviewer: Why was it a rough semester?] I moved to a new state [and] getting used to the area. There was a lot to do, get my</i></p>

project going, write a grant. It was nice to have my cohort because we got along really well. (Participant 72, Black/American Indian/White male) (Benjamin et al., 2017, p. 204)

Language

Doctoral students who struggled with written and spoken English reported worries (Gardner et al., 2018)

Language barriers increased the sense of detachment from members of the scholarly community (Cornwall et al., 2019)

Work-life balance

32.89% of students reported work-life balance as problematic. Focusing on doctoral studies during holiday times reported as a stressor, while other reported that the absence of a social life was detrimental: *The feeling that I have no social life and that I would have to run behind my experiments for coming three years without getting any chance to explore New Zealand or make new friends [is stressful].* (Cornwall et al., 2019, p. 370)

Doctoral nursing students reported a decline in the amount of time dedicated to socialising with others, for example: *“my life used to be colorful and diverse like a calico quilt, but now as a doctoral students, it’s like a gray army blanket....still warm but definitely less colourful”* (Van Dongen, 1988, p. 22)

Participants reported a sense of guilt when not dedicating time to their doctoral work (Cornwall et al., 2019; Van Dongen, 1988), with personal demands impacting on the ability to meet deadlines (Cornwall et al., 2019)

Personal stressors

Personal and family stressors could overwhelm students, especially when combined with doctoral-related stressors (Van Dongen, 1988)

Major life stressors were reported as stressful (Cornwall et al., 2019)

Future employment worries only reported by 2.6% of students (Cornwall et al., 2019)

Concerns about being a doctoral student (8)	(Backmon, 1998; Bean et al., 2004; Cornwall et al., 2019; Creely & Laletos, 2020; Van Dongen, 1988; Wang et al., 2019; Wei et al., 2019; Yap et al., 2012)
---	--

Adjustment difficulties

Various comments from respondents mentioned the difficulty in adjusting from a practitioner or private industry lifestyle to an academic (Backmon, 1998)

“...in the beginning I had some separation anxiety from being a seventh-grade teacher and how did I get here and things were really strange. It was mostly just me dealing with that change.” (Bean et al., 2004)

Nursing PhD students reported a loss of status associated with the loss of their professional role as they transitioned into doctoral study, which they regarded themselves as novices and lacking in expertise (Van Dongen, 1988)

Doubts about ability

34.2% of participant responses contained references to doubt about ability (Cornwall et al., 2019)

A lack of confidence in experience or knowledge created stress for participants. This was generated by participants' expectations to complete specific aspects of their research ('*not feeling competent to do statistical analyses on my own*') and by their concern about others' (supervisors and other lab members) perceptions of their abilities ('*fear that my supervisor might not be satisfied with my work*'). This doubt was reflected in participants' concerns that their research may not 'make a significant contribution' to the academic community.

In terms of self-doubt and those little voices that sneak in there when you are not feeling 100% confident. Why are you doing this? Can you do this? Are you stupid to do this? (Creely & Laletos, 2020, pp. 445-446)

The remaining anxious-on-submission students in our survey ($n = 23/46$) felt worse after getting supervisory feedback. Why was that? One reason was that somehow the profusion of tracked changes and comments intensified their self-doubt. It seems that often students are unused to feedback calling for considerable revision ('*I felt quite gutted by ...the amount that needed to be reworked over...a very, very long time!*') and begin to doubt their ability to produce a thesis. One doctoral participant explained that '*I felt a great deal of apprehension in my quality of work. I was nervous and felt a lot of self-doubt in the quality of my work and start to critically pick apart the work that I did submit*'. (Wei et al., 2019)

High demands of doctoral study threatened self-identity, with participants expressing concerns as to whether they were performing well enough, their new position as novices, and how they lacked the status of doctoral faculty (Van Dongen, 1988)

Lack of experience and preparedness

I am not well-prepared for the PhD study, not recognizing that it is so hard to get articles published and complete the thesis, although I had full knowledge of the Doctorate Conferral requirements when I began the PhD program. (Wang et al., 2019, p. 8)

Lack of clinical and examination experience was identified as a factor that influenced anxiety and distress in clinical psychology students (Yap et al., 2012)

Uncertainty

Doctoral students reported that they were uncertain on the expected criteria for submitting writing to supervisors (Wei et al., 2019)

59.2% of students reported uncertainty about doctoral processes as a stressor, which included concerns about whether one was proceeding correctly, the lack of structure in their research, lack of clarity around expectations, the pressure to complete within a 3-year time period, and unpredictable future stressors (Cornwall et al., 2019)

		Nursing doctoral students reported uncertainty about whether they had made the right decision to return to study (Van Dongen, 1988)
Scholarly community issues (2)	(Benjamin et al., 2017; Cornwall et al., 2019)	<p><i>Departmental issues</i></p> <p>Departments that were unwelcoming, lacking in collaboration or camaraderie, and contained conflict were reported as stressful (Cornwall et al., 2019)</p> <p><i>Isolation from scholarly community</i></p> <p>Participants reported that not feeling connected to the scholarly community (e.g., university or departmental levels, due to distance) could be stressful, with some describing the experience as a “very lonely adventure” (Cornwall et al., 2019, p. 370). In addition, another stated: ‘<i>The feeling of isolation that is almost inherent to PhD study is sometimes stressful, especially since I am just starting the programme and the isolation isn’t necessarily always by choice, but rather because meeting other PhD students takes time.</i>’ (Cornwall et al., 2019, p. 370)</p> <p><i>Problems with peers</i></p> <p>Negative lab mates and peers were reported as detrimental to wellbeing (Benjamin et al., 2017)</p> <p><i>Supervisor issues</i></p> <p>26.97% of students reported engagement and effectiveness of supervision as stressors (Cornwall et al., 2019)</p> <p>Supervisor changes, conflict between supervisors, and poor supervisor ability increased stress: “<i>This totally floored me, and even though I am sure I will manage to find someone else, in my opinion he was the best qualified in my Dep[artment] for the job of supervising me and that is why I chose to work with him. It has unsettled me, and I don’t really feel as though I have the ‘head-space’ to be able to deal with it at the moment. I am unsure of the process to find a replacement, and I feel it is unfair to expect me to find out for myself - my supervisor should have briefed me fully on the next steps when he informed me he was leaving.</i>” (Cornwall et al., 2019, p. 372)</p> <p>Faculty advisors could have a negative impact on student wellbeing: Two participants described somewhat or outright negative relationships with their PI. In one case, a student (Participant 18, White female) stated, “<i>At the moment, I am a little intimidated by my supervisor [PI], and I think what I need to work on is approaching her and being more open with her about how I feel about the project.</i>” (Benjamin et al., 2017, p. 202)</p>
Doctoral study processes (8)	(Benjamin et al., 2017; Cornwall et al., 2019; Creely & Laletas, 2020; Gardner et al., 2018; Martinez et al., 2013; Van	<p><i>Assessments, deadlines, and time pressures</i></p> <p>Research-related delays (e.g., ethics, co-ordinating research activities) created the perception that time was being wasted, which elicited stress, while time pressures associated with finishing within a certain timeframe was the most common stressor reported in doctoral researchers (69.08%; Cornwall et al., 2019)</p>

Dongen, 1988; Wei et al., 2019; Yap et al., 2012)

Two-thirds of clinical psychology doctoral students ($n = 9$) reported high state anxiety prior to an examination, which decreased significantly afterwards. Doctoral psychology students taking an Objective Structured Clinical Examination reported that time pressures elicited anxiety (Yap et al., 2012)

Reaching deadlines reported to be constricting, which reduced overall sense of wellbeing and increased stress (Martinez et al., 2013)

Preparing the confirmation document was reported to be an “intense” period (Creely & Laletas, 2020), while submitting writing for the first time also created pressure that elicited negative emotions, including stress and anxiety (Wei et al., 2019)

Feelings of anxiety and stress increased as nursing doctoral students moved towards submission dates and examinations (Van Dongen, 1988)

Presentations were a source of stress, especially for students for whom English was a second language (Cornwall et al., 2019)

Workload and working arrangements

Nursing doctoral students reported working 17-hour non-stop, including managing family and student responsibilities (Van Dongen, 1988)

One doctoral candidate explained how mixing her doctoral studies and teaching commitments led to feelings of fatigue and tiredness: *The past 4 weeks have probably been the most hard and intense time in my PhD... coinciding with me finalizing and finishing off my confirmation document. I had done a lot of planning beforehand and a lot of my reading, research, organizing. But the actual writing process was very intense. Also took on some marking [of undergraduate student work within the university] which is all about timing. I also learnt a lot about time management and organization in the last four weeks.* (Creely & Laletas, 2020, p. 445)

35.52% of doctoral research students that anticipation of future workload associated with the PhD was stressful, while early activities in the PhD research process (e.g., planning, literature review, ethical approval) were identified as stressors (Cornwall et al., 2019)

Adjusting to the long hours in the lab elicited physical and mental stress (Cornwall et al., 2019)

The lack of structure in a research doctorate was also considered stressful (Cornwall et al., 2019)

There was a lot to do, get my project going, write a grant. It was nice to have my cohort because we got along really well. (Participant 72, Black/American Indian/White male) (Benjamin et al., 2017, p. 204)

Writing

Only 1.3% of students reported a pressure to publish (Cornwall et al., 2019)

			<p>Submitting work to a supervisor for the first time was a milestone that elicited stress and anxiety, with 74% of respondents indicating that negative emotions were heightened at this point: “Respondents felt ‘<i>anxious</i>’, ‘<i>uncertain</i>’, ‘<i>apprehensive</i>’, ‘<i>hesitating</i>’, ‘<i>nervous</i>’, ‘<i>pressured</i>’, ‘<i>scared</i>’, ‘<i>worried</i>’, ‘<i>vulnerable</i>’, and ‘<i>insecure</i>’. They found the experience ‘<i>intimidating</i>’, ‘<i>difficult</i>’, ‘<i>stressful</i>’, ‘<i>terrifying</i>’, and ‘<i>very nerve wrecking</i> [sic]’”. (Wei et al., 2019, p. 161)</p> <p>The writing process for the confirmation of studies document was reported to be very intense, bringing on feelings of fatigue (Creely & Laletos, 2020)</p> <p>Concerns about writing produced fear: “<i>The fear of writing ... was just blocking me from using the right words, the right grammar, and the punctuation. I was avoiding writing because of fear. I didn’t want to do it.</i>” (Gardner et al., 2018, p. 5)</p> <p><i>Concerns about evaluation and feedback</i></p> <p>Prior to commencing their degree, doctoral students reported worry and “psychological trauma” associated with writing due to previous experiences of writing feedback (Gardner et al., 2018)</p> <p>Self-esteem was lowered when participants received negative feedback from faculty (Van Dongen, 1988)</p> <p>Waiting for feedback after the first writing submission was characterised by anxiety, while 50% of students who reported anxiety upon submission ($n = 46$) reported that they felt worse after receiving supervisor feedback, and this could culminate in self-doubt and a loss of self-assurance (Wei et al., 2019).</p> <p>Concerns about being evaluated in doctoral psychology students taking an Objective Structured Clinical Examination elicited anxiety and distress; for example: “<i>This is stress about being judged...Traumatic, to be honest. It was good. Borderline too traumatic to be good</i>” (Yap et al., 2012, p. 169)</p>
Factors related to mental health and wellbeing – positive	Scholarly community support (4)	(Bean et al., 2004; Benjamin et al., 2017; Cornwall et al., 2019; Rogers-Shaw & Chellman-Carr, 2018)	<p><i>Supervisor support</i></p> <p>“<i>She’s been very approachable when I would get a little stressed, you know, in the beginning I had some separation anxiety from being a seventh-grade teacher and how did I get here and things were really strange. It was mostly just me dealing with that change. And she was always willing to sit and talk to me for a few minutes. Most of the time it was about what was going on with classes, and she just touched bases with me. We would email each other and, you know, if I had questions, she got back right away. Then we started about the professor role and how it was a different operating style, so she was helping me to learn how to negotiate that and survive it. So that helped quite a bit. I didn’t have the intimidation that she was a professor, and I was a student. I just feel very comfortable working with her.</i>” (Bean et al., 2004, p. 375)</p> <p>Supervisors could positively influence wellbeing in doctoral students (Benjamin et al., 2017), although this did not always alleviate stress (Fung et al., 2017)</p>

The caring relationships they developed with...faculty members reflected their self-awareness, illustrated reciprocal respect, provided recognition, and acknowledged achievement, confirming their suitability as doctoral students and contributing to their initial success. As our participants articulated, care and socio-emotional learning were key factors in their successful first year of doctoral study. (Rogers-Shaw & Chellman-Carr, 2018, p. 369)

Mentor support

One of the [two] women [in this photo] is me, and one is my mentor, a postdoc ... She has been really patient; she has shown me how to do everything ... She is just one of the best influences I have had since I joined this lab, which is what has helped me to overcome all of the difficulties (depression, being unfamiliar with microbiology, the frustration of science in general). She is the one who pushes me to be better and she educates me in this. (Participant 173, Latina female) (Benjamin et al., 2017, p. 204)

Peer support

Many students seemed to contribute their sense of well-being to positive relationships they had developed with their lab mates and other graduate student peers, usually those with whom they entered the program. These students became allies with whom to discuss issues and challenges. Representative statements included:

That [photo] is of my PI and lab mates. The photo was taken after lab ... they are all so supportive. The first semester it was rough, [but] my lab was awesome and very supportive, giving me advice. If I had any questions they helped me out a lot. [Interviewer: Why was it a rough semester?] I moved to a new state [and] getting used to the area. There was a lot to do, get my project going, write a grant. It was nice to have my cohort because we got along really well. (Participant 72, Black/American Indian/White male) (Benjamin et al., 2017, p. 204)

This stress was partially mitigated by positive interactions with students in similar positions. In particular, one participant found that meeting others just starting their PhD helped mitigate stress. (Cornwall et al., 2019, p. 369)

Departmental support

In contrast to the isolation felt by those who had not developed good departmental relationships, participants who experienced a strong departmental 'community' felt this '*informal support in the form of shoulders and ears makes life easier*' (Cornwall et al., 2019, p. 369)

Institutional support

The series of workshops provided by the university on how to approach the 'PhD Journey' were reported as helpful for reducing stress (Cornwall et al., 2019)

Relationships with wider	(Benjamin et al., 2017; Espiritu & Smith, 2021; Rogers-Shaw &
--------------------------	---

The caring relationships they developed with family, friends, and faculty members reflected their self-awareness, illustrated reciprocal respect, provided recognition, and acknowledged achievement, confirming their suitability as doctoral students and contributing to their initial

support network (4)	Chellman-Carr, 2018; Van Dongen, 1988)	<p>success. As our participants articulated, care and socio-emotional learning were key factors in their successful first year of doctoral study. (Rogers-Shaw & Chellman-Carr, 2018, p. 369)</p> <p>Emotional support from family and significant others helped doctoral students to manage stress (Van Dongen, 1988) and helped them to maintain a healthy mental status (Benjamin et al., 2017)</p> <p>With the assistance and support of loved ones, the PhD students interviewed were able to manage their stress and maintain a positive attitude. Although some of their family members did not live close, students still felt like they were able to communicate thanks to technological advances. PhD students used social media, such as Facebook, to overcome stressful times during their doctoral experiences. Supportive families encouraged students to embrace the tough times, and many students felt it was their obligation to stay in the fray, due to support from their family and significant others. These people assisted students to maintain a sense of well-being, serving as a refuge to students' daunting PhD pursuit. (Benjamin et al., 2017, p. 206)</p> <p>Spending time with family helped to maintain mental wellbeing (Espiritu & Smith, 2021).</p>
Self-care and lifestyle (5)	(Benjamin et al., 2017; Creely & Laletas, 2020; Espiritu & Smith, 2021; Rogers-Shaw & Carr-Chellman, 2018; Van Dongen, 1988)	<p><i>Entertainment activities</i></p> <p>“Many described participating in various activities to maintain their physical and mental health and reduce stress triggered by their doctoral student responsibilities and PI or lab mate personalities... Students also described relaxing by watching movies/television or playing games, either by themselves or with their family and friends: I’m not a huge gamer; it [playing video games] followed me from high school. It is a great way for me to unwind. I am introverted so I need to re-charge. It can be a mindless thing so it is a great way to take a break from thinking critically. It is a great way to un-clog for a bit. It isn’t a distraction that can be found in the lab or campus; only something I can do when I’m at home. (Participant 109, Black/White female; describing a photo of video gaming equipment)... Maintaining physical and mental health requires engaging in activities outside of one’s doctoral program. Doctoral learners noted how mindfulness, meditative exercises, and physical activities helped with their anxiety and reduced stress levels through activities like yoga, walking/jogging, biking, and swimming. Ultimately, these activities provided them with balance” (Benjamin et al., 2017, pp. 207-209).</p> <p><i>Exercise</i></p> <p>Coping strategies included exercise (Van Dongen, 1988)</p> <p>Doctoral learners noted how...physical activities helped with their anxiety and reduced stress levels through activities like yoga, walking/jogging, biking, and swimming. (Benjamin et al., 2017, p. 209)</p> <p>“I feel like having a kid makes you have to play and rest more than if I were all by myself. So I don’t get to do . . . I can’t do work all the time. I have to like run around at the park and read</p>

books. And so I have that built into my schedule, which is great.” (Rogers-Shaw & Carr-Chellman, 2018)

Throughout the interview and demonstrated during the participant observation, the participant provided examples where she participates in activities that serve multiple purposes, calling it “double duty.” Examples include doing yoga for physical exercise and time for herself. (Espiritu & Smith, 2021, p. 12)

Pets

Doctoral students reported that pets contributed to their well-being: “*Cats, they keep me calm and sane ... and it is just nice to have an animal who always loves you even when your life is crazy and stressed and you have eight things to do, so it’s really nice. They are my babies (Participant 60, White female, describing a photo of cats). This [photo of Gus, my dog – as shown in Figure 4] is really about life outside of the lab. I think a lot of us graduate students really forget about that but something that I think is very important for me is being able to not live in the lab. [So, do you see a lot of other people who do that?] Yeah, there are definitely some people who kind of throw everything else to the wind for a month at a time because they are working on something important and then they end up really burning out, and I have already seen some of that.* (Participant 69, White male)” (Benjamin et al., 2017, p. 206).

Nutrition

Coping strategies included nutrition (Van Dongen, 1988)

Sleep

Coping strategies included regular sleep (Van Dongen, 1988)

Reading

Coping strategies included reading books (Van Dongen, 1988)

Gardening

Gardening was reported to serve a functional purpose (maintenance) as well as enabling the participant to get time away from their PhD (Espiritu & Smith, 2021)

Mental techniques

Maintaining physical and mental health requires engaging in activities outside of one’s doctoral program. Doctoral learners noted how mindfulness, meditative exercises, and physical activities helped with their anxiety and reduced stress levels through activities like yoga, walking/jogging, biking, and swimming. (Benjamin et al., 2017, p. 209)

One doctoral student reported the use of mindfulness to cope with intensity of research (Creely & Laletas, 2020)

Organisation and time management

			<p>Cindy explained how she worked to meet her obligations:</p> <p>...his classes are every day, so Monday/Wednesday/Friday is one class. So those days I drop him off and I'll pick him up, cause his class is only from 9 to 10 a.m. And then I drop him off and go to work, so those days I cut down my work hours. Tuesdays and Thursdays he has class at 8 in the morning so I drop him off, go home, and get ready for work, and then he takes the bus to [Bustle], and we ride home together. If it's a day I have class, it depends. On Tuesdays I can drop him off then come back to campus for class and Wednesdays, he's already at home, so I just stay on campus the rest of the day. So we have a little system going on. (Rogers-Shaw & Carr-Chellman, 2018)</p> <p>A doctoral student reported that using multiple strategies for time management (e.g., structuring activities to fulfil multiple purposes, using a family schedule with flexibility), and getting the balance right between working and taking time off promoted better mental wellbeing (Espiritu & Smith, 2021).</p> <p><i>Managing pressure</i></p> <p>One doctoral student reported that giving herself permission not to be productive all the time helped to maintain a state of mental well-being: "...that it being okay and the part about it being beneficial is...crucial because sometimes...you just I reach a point where...everything is...fuzzy I just can do nothing good. ...it's almost better to step back to...take a breath and revisit the thing that you're writing or working on...even though I really want to submit it right now so it's off my plate Yeah, just...stopping and...giving it a day and then going back and revisiting it...when I stopped...having pressure on myself to be...so productive every minute, then I was...Okay, this is...doable." (Espiritu & Smith, 2021)</p> <p>Linda acknowledged the need to handle stress as she stated, "<i>I work well under pressure. So that's one trait that I have had to rely on.</i>" (Rogers-Shaw & Carr-Chellman, 2018, p. 245)</p>
Interventions mental health and wellbeing	Mindfulness	Mindfulness	An 8-week mindfulness intervention in doctoral students ($n = 5$) did not produce significant changes compared to a control group ($n = 12$) (Barry et al., 2019).
Note: 1. The mean score for the 1 st year sample was not reported by Marais et al. (2018), but was retrieved by contacting the author.			

Appendix 6: Quality appraisal

Table 1

Study quality based on the Mixed Methods Appraisal Tool (MMAT; Hong et al., 2019).

Author (year)	Category of study design	Clear RQ? (PQ1)	Does collected data allow RQ to be answered? (PQ2)	Q1	Q2	Q3	Q4	Q5	Reviewer comments
Bean et al. (2004)	Qualitative	N	CT	CT	CT	Y	Y	Y	No explicit statement of the RQ or study aim, which makes it difficult to answer PQ2.
Benjamin et al. (2017)	Qualitative	Y	Y	Y	Y	Y	Y	Y	Good use of different data capture tools.
Cornwall et al. (2019)	Qualitative	Y	Y	Y	Y	Y	Y	Y	Data captured enabled the RQ to be addressed. Appropriate analysis, interpretation, and reporting.
Creely and Laletas (2020)	Qualitative	Y	Y	Y	Y	Y	N	Y	Very small amount of data reported.
Espiritu and Smith (2021)	Qualitative	Y	Y	Y	Y	Y	Y	Y	Satisfies the criteria, but a small sample.
Fung et al. (2017)	Qualitative	Y	Y	Y	Y	Y	Y	Y	Quotes were short in places but fulfilled the criteria.
Gardner et al. (2018)	Qualitative	Y	Y	N	Y	Y	Y	Y	No rationale explicitly stated for mixed methods. Difficult to judge due to lack of information on the qualitative phase.
Martinez et al. (2013)	Qualitative	Y	Y	Y	Y	Y	Y	Y	Positive to see reference to philosophical positioning. Only one participant.
Rogers-Shaw and Carr-Chellman (2018)	Qualitative	Y	Y	Y	Y	Y	Y	Y	It should be noted, however, that some results were only presented in the discussion section.
Van Dongen (1988)	Qualitative	Y	Y	Y	CT	Y	N	Y	The amount of qualitative data was very sparse, with only very brief quotes used. In addition, it is unclear how the researcher self-administered the interview.

Wang et al. (2019)	Qualitative	Y	Y	Y	Y	Y	Y	Y	Y	It should be noted that the amount of qualitative data was very sparse, with only very brief quotes used.
Wei et al. (2019)	Qualitative	Y	Y	Y	Y	Y	Y	Y	Y	Good integration of different forms of qualitative data.
Kizhakkeveetil et al. (2017)	Quantitative descriptive	Y	Y	Y	Y	N	Y	Y	Y	One measure of stress was for undergraduates.
Levecque et al. (2017)	Quantitative descriptive	Y	Y	Y	Y	Y	CT	Y	Y	Large sample. Potential risk of response bias. Appropriate measures and analysis.
Liu et al. (2019)	Quantitative descriptive	Y	Y	Y	Y	Y	Y	Y	Y	Good size sample. Appropriate measures and analysis.
Marais et al. (2018)	Quantitative descriptive	Y	Y	Y	Y	CT	CT	Y	Y	Sample for the entire study is adequate. No information provided on strategies used to assess validity of questionnaires after translation. Potential risk of response bias.
Rico and Bunge (2021)	Quantitative descriptive	Y	Y	Y	Y	Y	Y	Y	Y	Large sample. Appropriate measures and analysis.
Sverdlik and Hall (2020)	Quantitative descriptive	Y	Y	Y	Y	Y	CT	Y	Y	Large sample. Appropriate measures and analysis. Potential for response bias.
Ziapour et al. (2017)	Quantitative descriptive	Y	Y	Y	Y	Y	Y	Y	Y	Good size sample. Appropriate measures and analysis given the research question.
Barry et al. (2019)	Quantitative randomized controlled trials	Y	Y	Y	Y	Y	Y	CT	Y	No specific information provided on adherence to the intervention by years. Small number of participants in the intervention group for first years.
Backmon (1998)	Mixed method	Y	Y	Y	N	Y	Y	CT	Y	Rationale for open-ended questions is limited but is noted. No explicit reference to dataset integration. No information on analysis of qualitative data. Lack of information on how the qualitative responses were analysed (“summarized” is the only detail).
Barry et al. (2018)	Mixed method	Y	Y	N	N	N	N	Y	Y	Limited rationale for MM. MM design involved equal status – findings were reported independently.
Hill et al. (1981)	Mixed method	Y	Y	N	N	N	N	CT	Y	Small sample. Lack of information on size of population sampled from. Datasets reported independently and not integrated.
Ho (2016)	Mixed method	Y	Y	N	N	N	N	Y	Y	Good sample size. Qualitative findings supported by raw data. However, no integration of datasets (results presented separately) and no explicit reference to why mixed methods were used.

Liu and Abliz (2019)	Mixed method	Y	Y	N	N	N	N	Y	Rationale for open-ended response not provided.
Yap et al. (2012)	Mixed method	Y	Y	N	N	N	N	Y	Very small sample. Datasets analysed and interpreted independently.

Notes: (1) study quality was assessed using the appropriate criteria in the mixed methods appraisal tool (MMAT; Hong et al., 2019), with responses categorised as: *yes* (Y; satisfy quality criterion); *no* (N; does not satisfy quality criterion); or *can't tell* (CT; cannot tell if quality criterion is satisfied); (2) abbreviations used as follows: MM = mixed method; RQ = research question; PQ = preliminary question.