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Assessing the well-being of PhD scholars: a scoping review

Naheed Mahsood[1], Usman Mahboob[2*], Muhammad Asim[3] and Neelofar Shaheen[4]

Abstract

Background Gaining insight into the well-being of PhD scholars is essential for cultivating a nurturing academic environment that boosts their efficiency and adds to the overall excellence of higher education. Our scoping review aimed to comprehensively map and analyse the current body of literature on the well-being of PhD scholars, identify important themes and gaps, and offer valuable insights for future studies and interventions to improve the overall well-being of PhD scholars.

Methods We conducted a scoping review using the Preferred Reporting Items for Systematic Review and Meta-Analysis–Scoping Review extension as per the Joanna Briggs Institute Protocol guidelines. A systematic search was performed across search engines and databases, including Medline, Embase, PsycINFO, CINAHL Ultimate, and Web of Science. The data were retrieved from inception to May 2024. All identified records were gathered and imported into the Covidence Software for screening, removing duplication, and final selection by the review team. The socio-ecological framework was used as a theoretical framework to analyse the data thematically.

Results The search across five databases resulted in the identification of 3,391 records, supplemented by an additional 25 records from Google Scholar as grey literature. Following the application of the eligibility criteria and thorough deliberation by the review team, 63 records were included in the review. Inductive thematic analysis systematically identified a conceptual framework encompassing the description of PhD scholars' well-being. The results revealed a comprehensive understanding of the concept of the well-being of PhD scholars, identifying themes at the individual, interpersonal, institutional, community, and policy levels.

Conclusion The scoping review highlighted the complex, diverse, and multifaceted nature of PhD scholars' well-being, emphasising the need for comprehensive and tailored interventions at the individual, interpersonal, institutional, community, and policy levels to enhance their overall well-being.

Keywords PhD Scholars, Well-being, Mental Health, Academic Environment, Scoping Review, Socio-ecological Framework

*Correspondence:
Usman Mahboob
usman.mahboob@kmu.edu.pk
Full list of author information is available at the end of the article

Background

A large increase in doctoral education enrolment in medical universities in developed and developing nations has resulted from the widespread growth of higher education [1]. PhD academics are vital to knowledge and innovation, but there is a lack of information on the precise elements that affect their well-being. PhD scholars often experience stress, anxiety, and issues in new academic settings, which hinders their academic growth [2]. Well-being is a multidimensional and multifaceted phenomenon described as "the individual's experience of his or her health" [3]. The well-being of PhD scholars has been a significant concern in recent years because it may influence their research and teaching productivity, thus affecting higher education quality. Given the intellectual and emotional toll of a PhD, it is essential to understand the intricacies of the PhD students'well-being. Concerns regarding the well-being of PhD researchers have escalated following documentation of facts on the attrition rate among PhD scholars [4]. PhD scholars are often stressed by publications, frequent assessments, workload, paper deadlines, financial concerns, scholarly activities, future uncertainties, and relationship issues with supervisors [5]. The well-being of this educational group affects the academic quality and sustainability of the education system in the short and long terms [6]. A previous study found that 56% of PhD scholars consider quitting due to stress, anxiety, exhaustion, and lack of interest [7]. Most evidence comes from Europe, the USA, and Canada, omitting the perspectives of developing countries [8]. PhD scholars in developing countries may face distinct obstacles owing to limited resources, infrastructure, and support, which can harm their well-being. Comprehending and addressing these difficulties are essential for retaining, progressing, and optimising PhD scholars and protecting their education and research investments. In a systematic review, it is recommended that doctoral student well-being be multidimensional and not limited to a particular setting or role, and should be conducted more comprehensively [6]. Despite the vital role of PhD scholars in promoting knowledge and innovation within their fields, there is a dearth of understanding of the factors that impact their well-being, particularly in developing countries [9]. By assessing the well-being of PhD scholars, policymakers can identify areas for improvement and develop policies to facilitate the journey of PhD scholars. Our scoping review aims to explore how the concept of the well-being of PhD scholars in medical and allied health sciences is mapped in the literature and identify methodologies and theoretical frameworks used to describe this concept. Moreover, this review focuses on the medical and allied health sciences because of the specific challenges faced in these fields, such as heightened stress levels and burnout, which result from the rigorous nature of their combined academic and clinical duties.

Methods

We employed a scoping review methodology intended to map broad research areas, offer a comprehensive qualitative exploration of concepts, and synthesise various types of evidence [10]. The research sought to identify key themes, assessment methods, and conceptual understanding of PhD scholars'well-being. Consequently, a scoping review employing an inductive and iterative approach was deemed the most appropriate methodology, ensuring methodological rigor and alignment with the study objectives. We utilised the Population, Concept, and Context (PCC) framework to explore how the well-being of PhD scholars has been defined and assessed in the literature. We developed a scoping review protocol following the Preferred Reporting Items for Systematic Review and Meta-Analysis- Protocol (PRISMA-P) checklist [11] and subsequently preregistered it on the Open Science Framework (OSF) (https://osf.io/smvyj/). During a preliminary search of PROSPERO, MEDLINE, Cochrane Database of Systematic Reviews, and JBI Database of Systematic Review and Implementation Reports, we could not locate any published or ongoing scoping or systematic reviews on this subject.

To conduct a comprehensive and systematic scoping review, we implemented the protocol established by the Joanna Briggs Institute(JBI) [12]. Additionally, the PRISMA-ScR checklist [13] was used to ensure transparent and systematic reporting. The review team developed a systematic search strategy by identifying keywords and selecting appropriate databases for the literature search. The research commenced with a systematic search of the following databases: Medline (Ovid), Embase (Ovid), PsycINFO (Ovid), CINAHL Ultimate (EBSCO), and Web of Science. Subsequently, Google Scholar was used to identify grey literature.

Defining and aligning the research questions and objectives

We followed the PCC format to generate research questions for our scoping review, which represent the Population, Concept, and Context [14]. Explicitly stating objectives, interventions, or phenomena of interest is necessary for a scoping review [12] (Table 1).

The research questions guiding the scoping review were derived from this structure. Therefore, our scoping review research questions are as follows.

- How is the concept of well-being in PhD scholars defined and described in the literature?

Table 1 The PCC format for formulating the research question

P	**Population**: PhD scholars enrolled in different medical and allied health science subjects
C	**Concept:** The well-being of PhD scholars is interpreted as a multidimensional and multifaceted phenomenon, and well-being is generally described in the literature as "the individual's experience of his or her health"
C	**Context:** Context encompasses the circumstances under which the study will take place, including the scholastic, cultural, and societal milieu, institutional rules, support structures, and any distinctive characteristics that potentially impact the well-being of PhD scholars

- What methodologies have been used to explore well-being in PhD scholars in the medical and allied health sciences?
- What theoretical frameworks have been considered when discussing well-being in PhD scholars?

These research questions prompted the formulation of the following objectives:

- To explore the concept of well-being in PhD scholars in literature
- To identify methodologies used to explore the concept of well-being among PhD scholars.
- To evaluate the theoretical framework used to discuss the concept of well-being among PhD scholars.

Developing and aligning the inclusion criteria with the objectives and questions

Due to the extensive nature of subject matter, we reviewed the English-language literature irrespective of time frame. The team examined all pertinent literature that"explicitly"or"implicitly"addressed"well-being"of PhD scholars in medical and allied health sciences.

Inclusion & exclusion criteria

The literature included English-language peer-reviewed papers, original full-text research articles, and literature reviews. The team analysed all pertinent literature that indirectly or directly addressed the"well-being of PhD scholars". The explicit illustration of well-being was defined as encompassing concrete and quantifiable elements, while the implicit elucidation was regarded as subjective and individual features contributing to overall satisfaction and fulfilment of PhD researchers. Both viewpoints were crucial for comprehending well-being in the doctorate academic environment.

Articles focusing on well-being in general other than PhD scholars or doctoral students, conference papers and abstracts, and articles without full text following contact with the corresponding authors were excluded from the scoping review. Records discussing the concept of well-being in PhD scholars from disciplines/specialities other than medical and allied health sciences were also excluded from the review. To ensure a uniform level of quality and rigour among the included studies, dissertations or theses that had not been published as articles, symposiums, or books were not considered.

Searching for evidence

The research question was divided into three concepts: assessing, well-being, and PhD scholars, to enhance the search strategy and conduct a comprehensive literature search. Keywords for each concept were systematically identified. Search queries were created for each notion utilising the Boolean operator"OR"to ensure a comprehensive scope for the enquiry. We used an iterative search approach combining several keywords with the Boolean operator"AND"to obtain pertinent results. We used the OVID interface for EMBASE, which employs Emtree terms and the"Exp"function to expand all the relevant terms. For CINAHL, we utilised EBSCO for CINAHL Headings, whereas Web of Science relies on keyword searches without a controlled vocabulary. By incorporating these different databases and search methods, we aimed to comprehensively capture the relevant literature. The search was conducted without any specified time constraints to obtain a comprehensive picture of the evolution, trends, and full scope of research, eliminating biases and including all relevant papers. We increased the search sensitivity by incorporating a field tag and truncation into the search queries.

A grey literature search was conducted to ensure that all viewpoints and perspectives on the topic were considered and no relevant information was overlooked. Historically, grey literature has been difficult to document, and cataloguing has been a challenge [15]. Therefore, a systematic grey literature search approach was adopted. The search of article titles focusing on the first 200 to 300 results has been recommended if grey literature is used in systematic reviews [16].

After a thorough assessment, considering the review's objectives and having detailed discussions with co-authors and our institute's librarian, the final search

query combined all individual search queries. The details of the concepts, key terms, and final search queries for each database are provided in an additional file (Annexure A). A Peer Review of Electronic Search Strategies Checklist [17] was verified by a certified and professional librarian.

Selecting the evidence

All identified records were gathered and imported into the reference management software EndNote 20 and then imported into the Covidence Software for screening and removing duplications. Two review team members, NM and MA, independently examined the titles and abstracts of all collated records for the eligibility criteria. Any conflicts between reviewers at any stage of the screening process were resolved by consensus. If the two reviewers could not reach a consensus, the other two reviewers, UM and NS, were consulted to finalise the list of records. After the initial screening, the selected records were extracted for full-text screening based on the inclusion criteria. The PRISMA flow diagram (Fig. 1) shows the systematic selection process of the studies and reasons for excluding the records.

Extracting the evidence

A data extraction sheet was developed in Microsoft Excel to extract data from the included records. It was finalised following a thorough deliberation process that involved all authors in achieving a unanimous agreement. Three reviewers (NM, MA, and NS) retrieved data from five studies to pilot the extraction tool and ensure consistency. The data extraction sheet was then subjected to iterative modifications. The changes included supplementary columns to streamline the data extraction process relating to an implicit or explicit description of the concept of the well-being of PhD Scholars. The data extraction sheet contained information on the items in terms of title, author, year of publication, journal, country/countries of origin, aim/objective of study, theoretical frameworks used to describe the well-being of PhD Scholars, study design, sample size, data collection tools, data analysis techniques, conclusion/key findings, and explanation of the well-being of PhD Scholars as an implicit or explicit concept. The lead investigator (NM) charted the data for all included items and finalised the data analysis strategy after the group consensus meeting. The co-authors (UM, MA, and NS) checked the data for accuracy and inclusiveness.

Evidence analysis and presentation

To identify the categories and themes that characterised the concept of well-being among PhD scholars, we implemented a qualitative inductive thematic analysis [18] as we required a comprehensive description

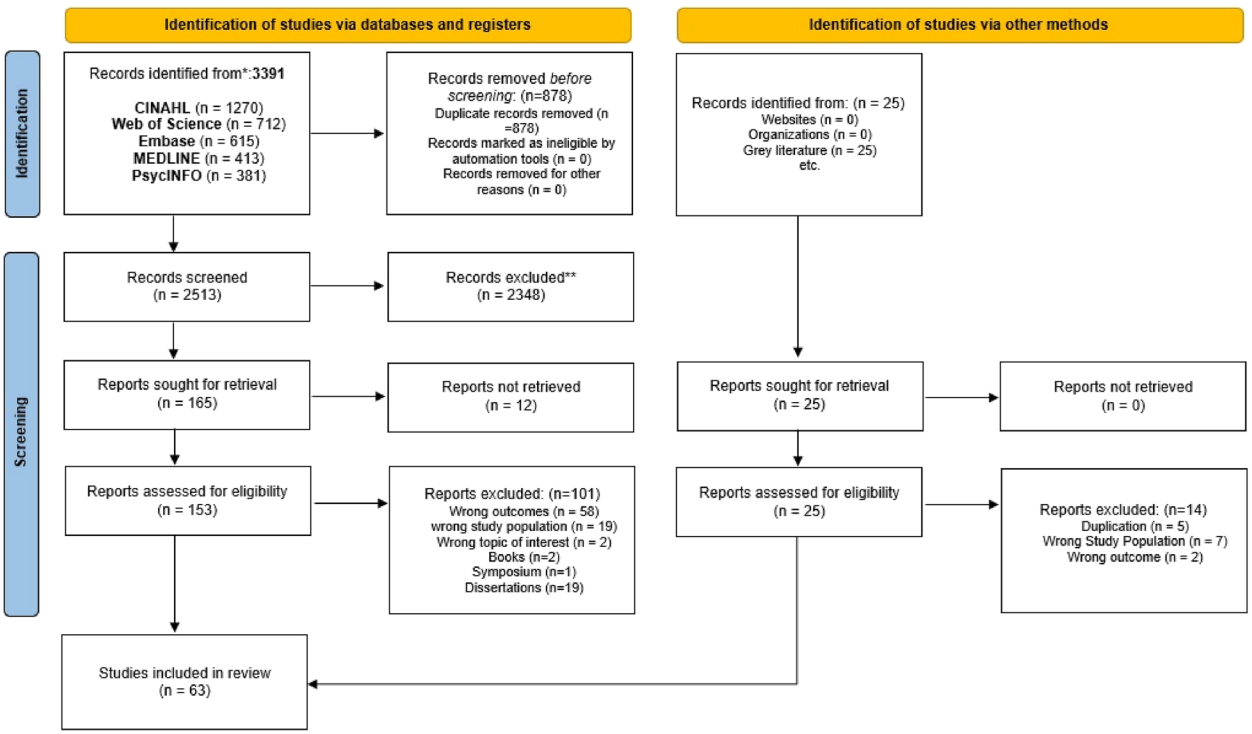

Fig. 1 The PRISMA flow diagram

of the extracted data that was not associated with the researchers'preconceived notions or analytical frameworks. The review team conducted regular meetings to deliberate on their initial thoughts and rationale behind the merits of the extracted evidence, which facilitated the development of themes and categories. The key findings from the data extraction process are summarised in Table 2, and the detailed data extraction sheet is attached as an annexure for comprehensive reference (Annexure B).

Result

The search of five databases yielded 3391 records. We identified an additional 25 records from Google Scholar as grey literature. Covidence identified 853 duplicate records, and 25 duplicate records were identified manually. 63 records met the eligibility criteria after a systematic screening and selection process following the PRISM-ScR flow diagram and logical exclusion, as illustrated in Fig. 1.

A substantial number of articles (30 articles, 47.6%) were published in the 2010 s [3, 6, 8, 9, 22–25, 29, 31, 36, 40, 43, 45, 46, 48, 49, 57, 58, 60, 63, 65, 67, 69, 70, 72–74, 76, 79] while a slightly higher number (33 articles, 52.4%) were published in the 2010 s [19–21, 26–28, 30, 32–35, 37–39, 42, 44, 47, 51–53, 56, 61, 62, 66, 68, 71, 75, 77, 78, 80–83]. In high-income countries, 51 studies (80.9%) were conducted [3, 6, 8, 9, 19–21, 23–33, 35–40, 42, 43, 46–49, 52, 53, 56–58, 60, 61, 66–68, 70–78, 80, 83], which accounted for the plurality of the studies, seven studies (11.1%) were conducted in upper-middle-income countries [22, 45, 62, 63, 65, 79, 82], while two studies (3.2%) were in lower-middle-income countries [51, 69]. Studies from low-income countries have not yet been conducted. Furthermore, three studies (4.8%) were conducted in multiple regions [34, 44, 81]. The World [84] country classifications by income level were used to categorize countries into high, upper-middle, lower-middle, and low-income categories [84].

The selected articles employed a variety of study designs. The predominant design utilized in the study was cross-sectional/survey (34 articles,53.9%) [3, 19, 21, 22, 25–28, 30, 32–36, 38–40, 43–46, 49, 65, 66, 68, 71, 72, 74, 76, 78–82]. The other designs that were included in the study were correlational studies (two articles, 3.2%) [69, 77], longitudinal studies (three articles, 4.8%) [29, 61, 83], reviews (six articles, 9.5%) [6, 8, 9, 48, 62, 67], qualitative studies (seven articles, 11.1%) [20, 31, 42, 56, 63, 70, 73], mixed method studies (eight articles, 12.7%) [23, 24, 37, 47, 51, 57, 60, 75], intervention studies (one article, 1.6%) [52], pilot studies (one article, 1.6%) [53], and one-group ex post facto design (one article, 1.6%) [58]. Aside from the six reviews, the sample sizes exhibited significant variation. Out of the total number of studies, 15 (26.3%) had less than 100 participants [20, 22–24, 27, 31, 51, 52, 56, 63, 70, 73, 75, 79, 80], while 18 studies (31.6%) had a participant range between 101 and 500 [19, 25, 26, 28, 29, 38, 42, 45, 47, 53, 58, 65, 69, 72, 74, 78, 81, 83]. Ten studies (17.5%) included a participant range of 501 to 1000 [3, 33, 46, 49, 57, 61, 68, 76, 77, 82]. Six studies (10.6%) had a participant range of 1001 to 2000 [21, 30, 35–37, 60]. Additionally, five studies, accounting for 8.8% of the total, had a participant range of 2001 to 5000 [32, 39, 40, 66, 71]. Of all the studies, only three (5.3%) had a participant count of over 5000 [34, 43, 44], with the most significant sample size being 6812 [44].

Surveys and questionnaires comprised the primary methods of data collection (42 articles, 66.7%) [3, 19, 21, 22, 25–30, 32–36, 38–40, 43–46, 49, 52, 53, 58, 61, 65, 66, 68, 69, 71, 72, 74, 76–83]. Interviews and focus groups were implemented in seven studies (11.1%) [20, 31, 42, 56, 63, 70, 73], whereas eight studies (12.7%) implemented multiple methodologies of data collection [23, 24, 37, 47, 51, 57, 60, 75]. Furthermore, databases were used for data acquisition in six review articles (9.5%) [6, 8, 9, 48, 62, 67]. The bulk of the studies (50 papers, 79.4%) employed specialized instruments, scales, or questionnaires to gather data [3, 19, 21–30, 32–40, 43–47, 49, 51–53, 57, 58, 60, 61, 65, 66, 68, 69, 71, 72, 74–83]. Except for the six reviews and seven qualitative investigations, most studies (45 articles, 90.0%) utilized valid and reliable tools [3, 19, 21–30, 32, 33, 35–40, 43–47, 49, 52, 53, 57, 58, 60, 61, 65, 66, 68, 69, 71, 72, 74, 76, 77, 79, 81–83]. Of the total number of studies, only five (10.0%) did not provide information on the validity and reliability of the instrument or questionnaire utilised [34, 51, 75, 78, 80].

In 40 articles (65.1%), theoretical frameworks were employed to describe the well-being of PhD scholars [3, 6, 9, 19, 20, 23–25, 29, 32, 34, 35, 38–40, 42, 44–46, 48, 49, 52, 56–58, 60–63, 65, 66, 70, 73–79, 83]. These studies employed diverse theoretical frameworks, demonstrating the multifaceted nature of well-being among PhD scholars. The frameworks encompassed a variety of psychological theories, including the Six-Factor Model of Psychological well-being [34] and Self-Determination Theory [42], as well as stress and burnout models such as the Perfectionism and Stress Model [19] and the Conservation of Resources Theory [29]. The Broaden-and-Build Theory of Emotions [6] and Diener's Tripartite Model of Subjective Well-Being [9] examined emotional experiences and overall life satisfaction. Theoretical models addressing stress and coping mechanisms were also prevalent. The Transactional Theory of Stress and Emotions [32], the Conservation of Resources Theory [6], and the Effort-Reward Imbalance Model [61] as the frameworks

Table 2 Data extraction sheet

Article	Theoretical frameworks used to describe the well-being of PhD Scholars	Study Design	Sample Size	Data Collection Tools	Data Analysis Techniques	Explanation of the well-being of PhD Scholars as an implicit or explicit concept	Themes of well-being
Richardson et al. [19]	Perfectionism and Stress Model Multidimensional Perfectionism and Burnout Model	Cross-sectional	119	Discrepancy subscale of the Almost Perfect Scale-Revised Self-Compassion Scale Depression subscale of the Inventory of Depression and Anxiety Symptoms- Version 2 Personal Burnout subscale of the Copenhagen Burnout Inventory	Descriptive and regression analysis	The well-being of PhD scholars is implicitly addressed through the lens of self-critical perfectionism, self-compassion, depression, and burnout among doctoral trainees in psychology	Self-critical perfectionism Self-compassion Depression Burnout
Maha Al Makhamreh [20]	The theoretical frameworks describe the well-being of PhD scholars as an individual's quality of life, happiness, satisfaction with life, and mental and physical health	Qualitative Interpretive phenomenology	12	In-depth interviews	Thematic analysis	The well-being of PhD scholars is implicitly addressed through the impact of mentorship experiences on motivation, satisfaction, stress, and supportive relationships in doctoral supervision	Positive relationships in doctoral supervision for promoting resilience and the overall well-being of PhD scholars
Juan Antonio Amador-Campos [21]	The theoretical framework underlying the study is not explicitly mentioned	Cross-sectional	1265	Research Self-Efficacy and Thesis-Related Work Questionnaire Mentoring and Thesis Supervision Process Questionnaire	Pearson's correlation Cronbach's alpha coefficient, principal component analysis	The article implicitly addresses the well-being of PhD scholars through the importance of mentoring, supervision, research self-efficacy, and academic performance	Research self-efficacy Mentoring and supervision Emotional health Discrimination Academic performance
Saman Azizi [22]	Nil	cross-sectional	80	Persian homesickness questionnaire Sarason's test anxiety questionnaire	Descriptive analysis Pearson correlation	Through homesickness and test anxiety, PhD scholars'mental health and academic adjustment are implicitly addressed	Homesickness Test anxiety Social support Mental adjustment

Table 2 (continued)

Article	Theoretical frameworks used to describe the well-being of PhD Scholars	Study Design	Sample Size	Data Collection Tools	Data Analysis Techniques	Explanation of the well-being of PhD Scholars as an implicit or explicit concept	Themes of well-being
Barry, K. M [23]	The Pyhältö typology was used to identify PhD candidates'hurdles as domain-specific expertise and personal or external issues	mixed method	81	Survey instruments, including the Depression Anxiety Stress Scale and the Perceived Stress Scale (PSS) Open-ended questions for Qualitative data	One-way ANOVA Abductive analysis of qualitative data	The study implicitly addresses PhD scholars'well-being by assessing psychological distress indicators and identifying doctoral obstacles	Psychological distress Candidature-related challenges Balancing responsibilities Expertise development
Alan Burkard [24]	The study explored graduates'positive and negative dissertation experiences using consensual qualitative research (CQR)	mixed-method design	25 doctoral graduates	Advisory Working Alliance Inventory-Student version Attitudes Toward Research Scale Self-efficacy in research measure–short form	Consensual qualitative data analysis techniques Descriptive statistics, correlations, t-tests	The paper implicitly addresses PhD scholars'well-being by examining how positive and negative dissertation experiences affect emotional and professional progress	Emotional well-being Professional growth Supportive relationships Negative consequences Difficult relationships
Shannon B. Myers [25]	The mindfulness framework used in the article is based on the concept of mindfulness practice, which involves meditation or other mindfulness activities	cross-sectional design	488 (58% enrolled in PhD program)	Sleep Hygiene Index Godin Leisure Time Exercise Questionnaire, Multidimensional Scale of Perceived Social Support, Emotion Regulation Questionnaire, Philadelphia Mindfulness Scale, Perceived Stress Scale	Hierarchical multiple regression Specific predictor variable analysis:	The study implicitly addresses the well-being of PhD scholars by highlighting the importance of self-care practices in managing stress levels	Self-care practices Stress management
Byrom Natassia [26]	Nil	cross-sectional design	431	Short Warwick-Edinburgh Mental Well-being Scale Perceived Fraudulence Scale Multidimensional Scale of Perceived Social Support Perceived Stress Scale 5. Achievement orientation scale, self-depreciation scale	Descriptive analysis Multiple regression analysis	The well-being of PhD scholars is implicitly addressed through supervisory support, career confidence, and self-depreciation, which influence mental health outcomes	Supervisory support Career confidence Self-depreciation Family support General health Sleep quality Achievement orientation

Table 2 (continued)

Article	Theoretical frameworks used to describe the well-being of PhD Scholars	Study Design	Sample Size	Data Collection Tools	Data Analysis Techniques	Explanation of the well-being of PhD Scholars as an implicit or explicit concept	Themes of well-being
Eleonora Cilli [27]	Nil	observational cross-sectional study	134	Depression Anxiety Stress Scales 21 Difficulties in Emotion Regulation Scale- 20 Short Grit Scale (Grit-S)14	Descriptive statistics. One-way analysis of variance Multivariate analysis of variance	The study implicitly addresses PhD scholars'well-being by identifying higher emotional discomfort and the need for personalized support services, emphasizing the relevance of mental health in academia	Emotional distress Difficulties in emotion regulation Networking activities Support services for early career researchers Perseverance
C. Corvino [28]	Nil	cross-sectional	120	adapted version of the Italian National Anti-Corruption Authority (ANAC) questionnaire	Analysis, Levene's tests ANCOVAs (Analysis of Covariance)	The study implicitly addresses the well-being of PhD scholars by analysing organizational factors highlighting the significance of well-being in academia for gender equality	Gender equality Perceptions of health and safety at work Career development Job autonomy
Mikaël De Clercq [29]	The study utilized the Conservation of Resources Theory, the Social Support Theory, and the self-determination theory to understand the well-being of PhD scholars	longitudinal three-wave design	446	Supervisor support scale Academic peers support scale Relatives support scale Positive emotions scale Perceived progress scale Intention to persist scale	linear hierarchical regressions ANOVAs	The study implicitly addresses the well-being of PhD scholars through emotions, progress, and persistence, emphasizing the role of social support in enhancing their well-being	Supervisor support Social support/peer support Intention to persist

Table 2 (continued)

Article	Theoretical frameworks used to describe the well-being of PhD Scholars	Study Design	Sample Size	Data Collection Tools	Data Analysis Techniques	Explanation of the well-being of PhD Scholars as an implicit or explicit concept	Themes of well-being
Francisco J. Estupiñá [30]	Nil	cross-sectional	1,018	General Health Questionnaire- 12, Patient Health Questionnaire-4, Beck's Depression Inventory, second edition, Satisfaction with Life Scale, Difficulties in Emotion Regulation Scale-Short Form, Work-Family Conflict Questionnaire, and Satisfaction with the Thesis Supervisor Scale	Descriptive statistics Binary logistic regression Student's t-tests and chi-square tests	The article implicitly addresses the well-being of PhD scholars by identifying factors influencing mental health and emphasizing the importance of emotional regulation and social support for their overall well-being	Emotional regulation Social support Life satisfaction Career aspirations Self-care skills
Julia M. Farquhar [31]	Nil	Qualitative research design	8 MD-PhD students and 8 faculty advisors	focus group discussions	Thematic analysis	The article implicitly addresses the well-being of PhD scholars through discussions on individual paths to resilience and faculty strategies for enhancing resilience	Resilience Coping strategies Institution-wide social support
Samira Feizi [32]	Lazarus and Folkman's transactional theory of stress and emotions Núñez-Regueiro's stress process model of school dropout	cross-sectional design	2486	Perceived Stress Scale Mental Health Continuum Short Form 4-tem scale for intention to quit 5-item questionnaire for program satisfaction	Pearson correlation coefficients Structural Equation Modelling (SEM)	The article implicitly addresses the well-being of PhD scholars by examining the impact of perceived stress on emotional, social, and psychological well-being, as well as program satisfaction and intention to quit	Perceived stress Emotional, Social, and Psychological Well-Being Program Satisfaction Intention to quit

Table 2 (continued)

Article	Theoretical frameworks used to describe the well-being of PhD Scholars	Study Design	Sample Size	Data Collection Tools	Data Analysis Techniques	Explanation of the well-being of PhD Scholars as an implicit or explicit concept	Themes of well-being
Julian Friedrich [33]	Nil	cross-sectional	589	Perceived Health Questionnaire, Generalized Anxiety Disorder Scale, Perceived Stress Scale, Job Satisfaction Scale, Job Insecurity Scale, and Institutional and Systemic Stressors Scales	Correlation analysis Linear regression	The article implicitly emphasizes the well-being of PhD scholars by discussing stressors, mental health issues, and the necessity for support services	Mental health issues Support services Supportive academic Environment Personalized well-being interventions Job satisfaction
S.M. González-Betancor [34]	The six-factor model of psychological well-being was used as a theoretical framework to understand the context of doctoral studies	Survey	6320	Nature PhD Survey 2019	Binomial logistic regression models	The article implicitly considers the well-being of PhD scholars by analysing mental health factors affecting study interruption, highlighting the need for a supportive environment	Anxiety and depression Social support Autonomy Resilience Conflict resolution skills
Dr. Cassie M. Hazell [35]	The Integrated Motivational-Volitional (IMV)	Survey	1263	Suicide Behaviour Questionnaire-Revised (SBQ-R) SBQ-R had excellent internal consistency	Descriptive analysis for quantitative data and thematic analysis for qualitative data	The article implicitly addresses the well-being of PhD scholars by examining suicidality and mental health challenges, emphasizing the need for universities to respond to these risks for scholars	Suicidality and risk factors Impact of PhD studies on well-being Protective factors against suicidality Importance of work-life balance Support systems
Kim Jesper Herrmann [36]	Nil	cross-sectional	1,780	Quality of PhD Program Questionnaire (QPPQ)	EFA, CFA Correlation coefficients One-way ANOVA	The well-being of PhD scholars was implicitly addressed in the study through the development of scales related to psychological aspects of the PhD experiences	Psychological well-being Integration within research environments Satisfaction and productivity Social support

Table 2 (continued)

Article	Theoretical frameworks used to describe the well-being of PhD Scholars	Study Design	Sample Size	Data Collection Tools	Data Analysis Techniques	Explanation of the well-being of PhD Scholars as an implicit or explicit concept	Themes of well-being
A. Holbrook [37]	Nil	mixed methods	pilot phase 333 National survey 733	Doctoral Wellbeing Questionnaire (IDWQ)	Principal Components Analysis Factor Structure Analysis Cronbach's alpha	The article implicitly addresses the well-being of PhD scholars by emphasizing factors such as'Personal Research Confidence'and'Work-Life Balance	Social-collegial Personal research confidence Work-life balance Relationship with supervisor Researcher identity
Patricia C. Jackman [38]	The theoretical framework of social support Social identification theory	cross-sectional	200	Social Provisions Scale Inventory for Socially Supportive Behaviour Short Form Warwick Edinburgh Mental Wellbeing Scale Kessler- 6	internal consistency, descriptive and inferential statistics	The well-being of PhD scholars is implicitly addressed by examining social support and social identification's impact on mental well-being and psychological distress	Social support Social identification with peers Supervisors and the academic community Mental well-being Psychological distress
Daniel R. Jones-White [39]	The conceptual framework from occupational health research suggests that organizational and individual factors influence doctoral students'mental health	Cross-sectional	2,582	Patient Health Questionnaire- 2	Descriptive Statistics Confirmatory Factor Analysis Regression Analysis Control Variables	The well-being of PhD scholars is implicitly addressed by focusing on factors affecting anxiety and depression symptoms in PhD students, emphasizing the need for supportive environments to improve mental health	Environmental conditions Mental health support Stigma reduction Program climate Positive faculty interaction Perceptions of equitable treatment Academic performance Work-life balance
B. Juniper [40]	A framework known as Impact Analysis (IA) assesses the well-being of PhD scholars, focusing on various domains	survey	2500	IDIs with 57 PhD students. Of these,34 attended three focus groups The instrument developed in this study demonstrated $\alpha = 0.78$ to 0.91	Internal reliability analysis, ANOVA, and Fisher's LSD test	The well-being of PhD scholars is implicitly addressed through various domains indicating the multifaceted nature of well-being	Development Facilities Home & health Research Social Supervisor University

Table 2 (continued)

Article	Theoretical frameworks used to describe the well-being of PhD Scholars	Study Design	Sample Size	Data Collection Tools	Data Analysis Techniques	Explanation of the well-being of PhD Scholars as an implicit or explicit concept	Themes of well-being
Arthur Richard Kitching [41]	Nil	Cross-sectional	25	a qualitative written questionnaire and a formal quantitative survey	descriptive statistics	The article indirectly addresses the well-being of PhD scholars by acknowledging personal challenges like work-life balance and family responsibilities	Work-life balance Managing family and personal responsibilities Personal funding concerns Navigating supervisory relationships
Rashmi A. Kusurkar [42]	The study utilized the Self-Determination Theory (SDT) as a theoretical framework to understand the factors influencing the well-being of PhD students in medicine	Qualitative inquiry	386	Qualitative data was collected using a Qualtrics electronic survey with open-text field questions	content analysis of narrative data	The study implicitly addresses the well-being of PhD scholars by highlighting factors like support, autonomy, and relationships that influence their satisfaction and energy levels	Supportive supervision and open communication Autonomy in work Recognition of the value of work Relationships and relatedness with coworkers, Collaboration, and teamwork opportunities
Katia Levecque [43]	Nil	cross-sectional	5,353	General Health Questionnaire (GHQ)	Percentages and risk ratios Confirmatory factor analyses Logistic regression Odds ratios	The article implicitly addresses the well-being of PhD scholars by investigating factors like work-family interface and supervisor leadership styles as predictors of mental health among PhD students	Mental health problems Work-family interface Job demands Job control Supervisor leadership styles

Table 2 (continued)

Article	Theoretical frameworks used to describe the well-being of PhD Scholars	Study Design	Sample Size	Data Collection Tools	Data Analysis Techniques	Explanation of the well-being of PhD Scholars as an implicit or explicit concept	Themes of well-being
Chuanyi Wang [44]	The fit theory from organization theory is used to analyse how doctorate students'training environment, academic profession, organizational culture, and financial support affect their mental health	Survey	6,812	Questionnaire from the 2019 Nature Global Doctoral	Principal Factor Method Probit Model Likelihood Ratio Test Logit Model Ordinary Least Squares Model	The well-being of PhD scholars is implicitly addressed through factors such as training environment fit, academic profession fit, organizational culture fit, and financial support fit, contributing to the overall well-being of doctoral students	Training environment fit Academic profession fit Organizational culture fit Financial support fit Institutional Policies and Support Financial support policies
Chunli Liu [45]	Theoretical model of research self-efficacy and mentoring relationships to understand the well-being of PhD scholars, focusing on depression and anxiety	cross-sectional study	325	Patient Health Questionnaire 9 Generalized Anxiety Disorder 7 Research Self-Efficacy Scale Advisory Working Alliance Inventory-student version	Correlations Hierarchical regression analysis T-tests Mediation analysis	The article implicitly addressed the well-being of PhD scholars by examining factors such as mental health outcomes, social support, and academic challenges	Mental health outcomes Social support Academic challenges Research self-efficacy Mentoring relationships
Kirsti Lonka [46]	The general framework of the person-environment fit model Three-class model	Survey	669	Writing Process Questionnaire MED NORD Questionnaire Perceptions of the Learning Environment Scale	Latent Profile ANOVA CFA	The well-being of PhD scholars is implicitly addressed through its association with writing profiles, epistemic beliefs, and academic outcomes	Writing profiles Epistemic beliefs Learning environment
Nasser Lubega [47]	Nil	mixed-methods approach	126 in survey 37 interviewed	Patient Health Questionnaire- 8) Generalized Anxiety Disorder 7-item scale) General Life Satisfaction Fixed Form B Scale Interview Guide	Inferential Statistics Correlation Regression Factor Analysis Thematic analysis	The well-being of PhD scholars is implicitly addressed through the exploration of how experiences of irreproducibility can impact the mental health of graduate students	Mental health impact of Irreproducibility Coping strategies Self-efficacy Support systems Stress and pressure Life satisfaction Research environment

Table 2 (continued)

Article	Theoretical frameworks used to describe the well-being of PhD Scholars	Study Design	Sample Size	Data Collection Tools	Data Analysis Techniques	Explanation of the well-being of PhD Scholars as an implicit or explicit concept	Themes of well-being
Sylvia Anne Mackie [48]	Theories of organizational and workplace behaviour Social-ecological theory	scoping review	26 articles	The following Databases have been searched Academic Search Complete, Education Resources Information Centre (ERIC), PsycINFO (EBSCO), PubMed, and Web of Science	Thematic analysis	The well-being of PhD scholars is implicitly addressed through discussions on mental health challenges in the doctoral environment and the need for tailored interventions	Environmental factors impacting mental health Tailored interventions for mental health support Designing and validating assessment Tools for well-being
Randall M. Moate [49]	3-class model (i.e., adaptive perfectionists, non-perfectionists and maladaptive perfectionists	cross-sectional	528	Almost Perfect Scale-Revised Perceived Stress Scale Satisfaction with Life Scale Scale of Positive and Negative Experiences	Bivariate correlations Latent Profile Analysis Descriptive statistics	The well-being of PhD scholars is implicitly addressed through perfectionism's impact on perceived stress, life satisfaction, and emotional experiences	Perfectionism Adaptive perfectionism Maladaptive Perfectionism Emotional well-being
Alex Molassiotis [50]	Nil	cross-sectional survey	76 coordinators and 193 doctoral students	Two self-designed questionnaires focusing on PhD program coordinators and doctoral students	Descriptive Analysis Content Analysis	The article indirectly addresses the well-being of PhD scholars by acknowledging challenges like time management and language barriers while highlighting satisfaction with supervision quality and training programs	Challenges faced during doctoral studies Satisfaction with supervision quality Training programs and academic support Facilities and resources provided by universities Overall study experiences and satisfaction
Adaobi U. Mosanya [51]	Nil	mixed-methods study	47 in an online survey 8 in-depth interviews	a validated questionnaire that was modified to suit the Nigerian context for Phase I Interview topic guide for Phase 2	Descriptive statistics Thematic analysis	The study indirectly considers the well-being of PhD scholars through factors influencing timely completion, highlighting the role of supervisor support and departmental assistance	Mental and emotional challenges due to delays in program completion Supervisor support and departmental assistance

Table 2 (continued)

Article	Theoretical frameworks used to describe the well-being of PhD Scholars	Study Design	Sample Size	Data Collection Tools	Data Analysis Techniques	Explanation of the well-being of PhD Scholars as an implicit or explicit concept	Themes of well-being
Fryni Panayidou [52]	The study utilized a working definition of'well-being'influenced by the PhD role and university-based interventions,	Intervention study	six PhD support groups with 12 participants in each group	Warwick-Edinburgh Mental Well-being Scale open-ended questions	Descriptive statistics Thematic analysis for qualitative responses	The article implicitly addresses the well-being of PhD scholars through pre- and post-intervention mental well-being assessments using the WEMWBS scale, aiming to enhance their overall doctoral experience	Confidence in completing the PhD program within the institutional timeframe Decreased feelings of isolation and anxiety Increased satisfaction with life and work-life balance Peer support Improved mental health outcomes and reduced risks of depression or psychological distress
Daria Pizuńska [53]	Nil	Pilot study	270	The General Health Questionnaire- 28 Resiliency Assessment Scale- 25	Analysis of Covariance	The study essentially examines PhD scholars'well-being by comparing their psychological health and psychosomatic symptoms to those who ended their studies at the master's level	Psychological well-being Prevalence of psychosomatic symptoms Mental health outcomes Gender differences in mental well-being
Cesar FCR [54]	Nil	cross-sectional	503	The Brazilian version of the WHOQOL-BREF	Descriptive statistics, Internal consistency analysis, CFA Bivariate and multivariable analyses	The article implicitly addresses the well-being of PhD scholars by examining stress, anxiety, and difficulty in balancing personal and academic responsibilities	Anxiety and depression Relationship with supervisors Quality of life assessment

Table 2 (continued)

Article	Theoretical frameworks used to describe the well-being of PhD Scholars	Study Design	Sample Size	Data Collection Tools	Data Analysis Techniques	Explanation of the well-being of PhD Scholars as an implicit or explicit concept	Themes of well-being
Manuela Schmidt [55]	Leader-member exchange theoretical perspective, Self-determination theory, Higgins's regulatory focus theory, Job demands-resources theoretical model, Conservation of resources theory, Social-ecological model, Broaden-and-build theory of emotions	Systematic literature review	17 studies	Web of Science (all databases), ERIC, PsycINFO, and Education Research Complete	Qualitative Analysis Techniques: Descriptive methods ANOVA Correlation analysis Regression analysis	The article implicitly explores the multifaceted nature of well-being among doctoral students, highlighting the need for a holistic approach to addressing their challenges and enhancing their overall academic experience	Physical well-being Mental well-being Social well-being Emotional well-being Academic well-being Professional well-being Personal identity and self-concept Spatial and temporal experiences of well-being
Hannah Scott [9]	Carol Ryff's Six-Factor Model Diener's Tripartite Model of Subjective Well-Being: Self-Determination Theory PERMA Model	Systematic literature review	19 articles	PsycINFO, ProQuest, and SCOPUS databases	Systematic review	The article implicitly addresses the well-being of PhD scholars by highlighting the importance of valid and reliable measures to assess mental health and stress symptoms in this student group	Depression & anxiety Stress Psychological distress Self-determined motivation Life satisfaction Domain-specific satisfaction Intrinsic and extrinsic motivation Social support Autonomy
David C. Stanley Jr. [56]	The study used Critical Race Theory and the Phenomenological Variant of Ecological Systems Theory to analyse PhD Scholars'sociocultural elements	Qualitative phenomenological approach	5	A semi-structured interview	reflexive thematic analysis	The well-being of PhD scholars is implicitly addressed in the study through the exploration of protective factors that support resilience and success among Black male doctoral students	Community of support (family, mentors, peers, faculty) Awareness (educational, self-awareness, contextual awareness) Societal expectations

Table 2 (continued)

Article	Theoretical frameworks used to describe the well-being of PhD Scholars	Study Design	Sample Size	Data Collection Tools	Data Analysis Techniques	Explanation of the well-being of PhD Scholars as an implicit or explicit concept	Themes of well-being
Jenni Stubb [57]	The broaden-and-build theory of emotions is used in the article to understand the relationship between doctoral students'perceived meaning of their thesis work	mixed methods	669	A survey consisting of Likert-type statements, Modified MED NORD questionnaire	Qualitative analysis, Descriptive analysis, Inferential statistics, Interrater reliability assessment	The article examines PhD scholars'implicit and explicit well-being, emphasizing the relevance of understanding how thesis labour affects stress and study engagement	Stress, exhaustion, and anxiety Lack of interest Study engagement Perceived meaning of thesis work Personal growth Career advancement
Brett A. Swords [58]	The study applied the conservation of resources theory to examine predictors of burnout among psychology doctoral trainees	one-group ex post facto design	203	Shirom-Melamed Burnout Measure Supervisory Working Alliance Inventory–Trainee Relationship Conflict Scale Financial Strain Scale	Correlation analysis Proxy comparative data analysis	The well-being of PhD scholars is implicitly addressed through the supervisory working alliance and burnout among clinical psychology doctoral students	Burnout Supervisory working alliance Financial strain, Relationship conflict Gender and ethnic diversity
Zahide Tepeli Temiz [59]	The study utilized attachment theory and the relational screening model to explore the relationship between attachment styles, life satisfaction, and psychological resilience	Descriptive cross-sectional study	15 PhD scholars out of 425 sample	Experiences in Close Relationships Scale II Satisfaction with Life Scale Resilience Scale for Adults	Student's t-test ANOVA, Chi-square test Correlation analysis Multiple regression analysis	The study implicitly addresses the well-being of PhD scholars by examining attachment styles, life satisfaction, and psychological resilience among university students,	Attachment styles Life satisfaction Psychological resilience Satisfaction with life Academic achievement Social factors Future expectations

Table 2 (continued)

Article	Theoretical frameworks used to describe the well-being of PhD Scholars	Study Design	Sample Size	Data Collection Tools	Data Analysis Techniques	Explanation of the well-being of PhD Scholars as an implicit or explicit concept	Themes of well-being
Nicolas Van der Linden [60]	The study on doctoral persistence utilized Self-Determination Theory (SDT) as the theoretical framework to understand the factors influencing the well-being and persistence of PhD scholars	mixed-method design	1458	Self-report scales of Doctorate-related Need Support and Need Satisfaction, Autonomy dimension of the need support scale, Structure dimension of the need support scale, Competence dimension of the need satisfaction scale, Autonomy dimension of the need satisfaction scale, Relatedness dimension of the need satisfaction scale, Behavioural engagement scale, Cognitive engagement scale, Emotional engagement scale, Doctoral persistence intentions scale	Exploratory Factor Analysis, Confirmatory Factor Analysis, Logistic Regression Analysis, Correlation Analysis, Comparison of Correlations, and Test–Retest Correlations	The well-being of PhD scholars is implicitly addressed in the study through the assessment of factors such as need support and need satisfaction, which are linked to doctoral persistence and dropout rates	Need support Need satisfaction Doctoral engagement Reflecting active involvement in doctoral activities Doctoral persistence intentions Dropout intentions Supervisor support Intrinsic motivation Competence satisfaction
Melanie Vilser [61]	The study utilizes the Effort-Reward Imbalance (ERI) model to explore the relationship between work stress and well-being in PhD students	longitudinal design	705	Effort-Reward Imbalance scale, Work engagement (UWES-9) scale, Perceived stress (PSS- 4) scale, Resilience scale	CFA, Multiple Regression Analyses, Mediation, and Moderated Mediation Analyses	The study implicitly addresses the well-being of PhD scholars by examining factors like perceived stress, work engagement, and resilience	Perceived stress Work engagement Resilience Effort-reward imbalance Overcommitment
Yanyan Wang [62]	Attribution theory The three-factor model	Scoping review	30 articles	Databases used in the scoping review are Springer, Google Scholar, Web of Science, PubMed, and JSTOR	Descriptive Analysis	The scoping review implicitly emphasizes the well-being of PhD scholars by discussing mental health challenges and the Impostor Phenomenon	Mental health challenges Academic stress Impostor phenomenon

Table 2 (continued)

Article	Theoretical frameworks used to describe the well-being of PhD Scholars	Study Design	Sample Size	Data Collection Tools	Data Analysis Techniques	Explanation of the well-being of PhD Scholars as an implicit or explicit concept	Themes of well-being
Xueyu Wang [63]	The study utilized the Grounded Theory proposed by Strauss and Corbin as the theoretical framework to explain stress in PhD students	Qualitative research design	10	in-depth interviews	Thematic analysis	The study implicitly emphasizes the well-being of PhD scholars by examining stress factors among Chinese students and advocating for support systems	Graduation-related stress Job prospects Relationships Support systems Stressors
Feng Zhang [64]	Graduate Socialization Theory	longitudinal study	336	Research Experience Self-Rating Survey, Mental Well-being Questionnaire, Sense of Belonging Scale, Certainty of choice, Academic development and satisfaction, Graduate Advising Survey for Doctoral Students (GASDS)	logistic regression analysis, scale reliability analysis	The article explores the well-being of PhD scholars through an analysis of mental health profiles and socialization variables	Mental health profiles Socialization variables Support mechanisms Sense of belonging Mentoring
Arash Ziapour [65]	The study utilized the theoretical framework of spiritual well-being,	Descriptive cross-sectional study	346	Spiritual well-being scale	Descriptive statistics Inferential statistics	The article implicitly explores the well-being of PhD scholars through the assessment of spiritual well-being among university students	Spiritual well-being Religious well-being Existential well-being
Junjun Chen [66]	Self-Determination Theory (SDT) Postgraduate Research Experience Survey (PRES) framework	cross-sectional	2578	Postgraduate Research, Experience Survey, Motivation for PhD Studies Scale, Centre for Epidemiological Studies Depression Scale, Burnout Inventory, Illness Symptoms	Confirmatory Factor Analysis Descriptive Statistics	The article implicitly addresses the well-being of PhD scholars by examining factors like motivation and the research environment	Depression Burnout Illness symptoms Motivation Research environment

Table 2 (continued)

Article	Theoretical frameworks used to describe the well-being of PhD Scholars	Study Design	Sample Size	Data Collection Tools	Data Analysis Techniques	Explanation of the well-being of PhD Scholars as an implicit or explicit concept	Themes of well-being
Douglas E. Colman [67]	Nil	Systematic review and Meta-analysis	17 articles	PsycINFO database	Calculating effect sizes and conducting moderator analyses	The article implicitly highlights the well-being of PhD scholars through the positive effects of self-care practices on psychological distress and life satisfaction	Self-compassion Psychological distress Life satisfaction Academic performance Stress reduction Self-care practices
Erica Szkody [68]	Nil	Survey	912	Patient Health Questionnaire-9 Generalized Anxiety Disorder-7	Descriptive statistics, regression analysis, and correlation analysis	The article implicitly addresses PhD scholars'well-being by highlighting the impact of financial stress on mental health among clinical psychology doctoral students	Financial stress Mental health outcomes Access to healthcare services Delayed life events due to financial concerns Financial support and transparency in graduate programs
Aleena M. Sunny [69]	Nil	Correlational research design	400	- Depression, Anxiety, and Stress Scale (DASS- 21) - Flourishing Scale	descriptive statistics, Pearson correlation, t-test, and ANOVA	The article implicitly emphasizes the crucial role of supportive family environments and positive relationships with parents and friends in promoting the psychological well-being of PhD scholars	Psychological distress (depression, anxiety, stress) Supportive family environment Positive relationships with parents and friends Emotional strength Perseverance Passion for long-term goals
Claire Aitchison [70]	The article draws on the concept of emotional labour to examine the emotional dimensions of women doctoral students'experiences	Qualitative research design	18	interviews, online surveys, focus groups, research journals, and previously coded data	Thematic analysis	The article implicitly addresses the well-being of PhD scholars by exploring the emotional challenges and coping strategies of women doctoral students	Emotional challenges Coping strategies Balancing writing and Family relationships Resilience building

Table 2 (continued)

Article	Theoretical frameworks used to describe the well-being of PhD Scholars	Study Design	Sample Size	Data Collection Tools	Data Analysis Techniques	Explanation of the well-being of PhD Scholars as an implicit or explicit concept	Themes of well-being
Paul Barreira [71]	Nil	Survey	4,866	Centre for Epidemiologic Studies Depression Scale-Revised) Patient Health Questionnaire- 9 Generalized Anxiety Disorder- 7 Perceived Stress Scale Social Isolation Scale	Descriptive Statistics Inferential Statistics Factor Analysis Qualitative Analysis	The article implicitly addresses the well-being of PhD scholars through tailored mental health initiatives emphasizing a supportive learning environment for overall student well-being	Mental health initiatives tailored to department-specific needs Collaborative approach involving students and faculty Supportive learning environment Evaluation and follow-up for sustained well-being outcomes
Solveig Cornér [72]	Nil	Survey	248	Supervisory support scale Researcher-community support scale	Multiple Regression Analysis, Factor Analysis, and Reliability Analysis	The study implicitly addresses the well-being of PhD scholars by linking supervision quality and frequency to burnout experiences	Supervision quality and frequency Support from multiple supervisors Integration into the research community Sense of equality within the research community Burnout
Agnieszka M. Lech [73]	The study utilized Interpretative Phenomenological Analysis (IPA) to explore the well-being of PhD scholars who received coaching sessions	Qualitative study	6	open semi-structured interview	Interpretative Phenomenological Analysis	The well-being of PhD scholars is implicitly addressed in the study through the enhancement of self-awareness and support offered by coaching sessions	Motivation Self-confidence Resourcefulness Support Self-awareness
J. Peltonen [74]	The study utilized a person-centred approach and the impact of social support profiles on well-being, burnout, and completion rates among PhD scholars	cross-sectional	402	Supervisory Support Scale Researcher Community Support Scale Experienced Burnout Scale	Exploratory Factor Analysis, Confirmatory Factor Analysis Latent Profile Analysis	The well-being of PhD scholars is implicitly addressed in the study through the examination of social support profiles and their impact on burnout and satisfaction with supervision	Social support from supervisors and the researcher community Burnout Satisfaction with supervision Intentions to quit

Table 2 (continued)

Article	Theoretical frameworks used to describe the well-being of PhD Scholars	Study Design	Sample Size	Data Collection Tools	Data Analysis Techniques	Explanation of the well-being of PhD Scholars as an implicit or explicit concept	Themes of well-being
Luis P. Prieto [75]	The study utilized a design-based research (DBR) approach to develop interventions focusing on progress for doctoral students'well-being	mixed method	56	Pre-workshop questionnaires: Satisfaction with progress Doctoral burnout questionnaire CPC- 12 instrument Post-workshop questionnaire: Assessment of psychological capital and different aspects of the workshop	Descriptive statistics Exploratory data analysis Thematic analysis	The well-being of PhD scholars is implicitly addressed throughout the article through the focus on interventions aimed at enhancing emotional well-being and preventing dropout	Emotional well-being Psychological capital Burnout Dropout ideation Progress Mental health practices Perception biases and taboos Positive emotional resources
Kirsi Pyhältö [3]	The study utilized the scholarly community's theoretical framework and supervision practices to explore the well-being of PhD scholars	Survey	669	Modified items from the MED NORD	Qualitative Content Analysis and Statistical Analyses	The well-being of PhD scholars is implicitly addressed by analysing their challenges and the link between well-being and study continuation	Perceived problems in doctoral studies Relationship between well-being and study engagement Scholarly community as a factor influencing well-being Supervision practices Lack of interest
E. van Rooij [76]	The study utilized self-determination theory, specifically basic need theory, to investigate the factors influencing the well-being of PhD scholars	Survey	839	Autonomy Support Scale Academic Support Scale High Expectations Scale Relationship Quality Scale Academic Relationships Scale Social Relationships Scale Sense of Belonging Scale Freedom Scale Workload Scale	Descriptive Statistics Regression Analysis Correlation Analysis Factor Analysis	The study indirectly considers the well-being of PhD scholars through factors like workload, supervision quality, and autonomy in research projects	Workload Supervision Quality Autonomy in research projects Sense of belonging Mental health: stress, exhaustion, and anxiety

Table 2 (continued)

Article	Theoretical frameworks used to describe the well-being of PhD Scholars	Study Design	Sample Size	Data Collection Tools	Data Analysis Techniques	Explanation of the well-being of PhD Scholars as an implicit or explicit concept	Themes of well-being
Anna Sverdlik [8]	Nil	Literature Review	163 articles	ERIC, PsycINFO, Scopus, and Web of Science	Content and thematic analysis	The article implicitly discusses factors like self-efficacy, academic identity, supervision, personal/social lives, and financial support that influence the well-being of PhD scholars	Supervision Departmental support and resources Self-efficacy and motivation Balancing academic demands with personal and social responsibilities
Wayne Usher [77]	The study utilized Bronfenbrenner's socio-ecological framework and Bourdieu's social reproduction theory as theoretical lenses to examine the well-being of PhD scholars	Correlational research design	532	1. Participant Profiling (Personal) (Community) (Home/University)	Descriptive Statistics Correlation Analysis Inferential Statistics Factor Analysis	The article implicitly discusses how age, gender, and social involvement affect PhD academics'well-being, emphasizing the importance of mental health for academic performance	Factors promoting a PhD scholar's well-being: age, gender, nationality, financial status, years of PhD study, attendance at postgraduate student events
Juita-Elena (Wie) Yusuf [78]	The study utilized social cognitive, structuration, and border theories to explore work-life balance and well-being issues among graduate students	cross-sectional	343 (34.9% were doctoral students)	Quality of Life Scale Physical Health Scale Mental Health Scale Work-Life Balance Scale Program Climate Scale Sense of Belonging Scale Sources of Stress Scale Sources of Support Scale	One-way ANOVA Pairwise correlation Principal factor analysis	The article implicitly addresses the well-being of PhD scholars by highlighting their mental health challenges and quality of life	Quality of life Physical health Mental health Work-life balance Sources of stress Sources of support Sense of belonging Program climate

explored how stressors and coping strategies impact PhD scholars'well-being.

The significance of social support and community in improving well-being has been emphasised through frameworks such as Social Support Theory [29], Social Identification Theory [38], and the academic community and supervisory practices framework [38]. These theories emphasise the significance of human interaction and the academic community in supporting PhD academics. The concept of self-determination theory (SDT) [6, 9, 29, 42, 60, 66, 76] has gained prominence as a consistent paradigm highlighting the importance of autonomy, competence, and relatedness in fostering well-being. Graduate Socialization Theory [83], the Postgraduate Research Experience Survey (PRES) framework [66], and the Impact Analysis (IA) methodological framework [40] were among the frameworks that were specific to the academic context. These frameworks comprehensively understand the distinctive obstacles and factors that influence well-being during the doctoral research process.

It is important to note that a substantial number of studies (23 articles, 34.9%) [8, 21, 22, 26–28, 30, 31, 33, 36, 37, 43, 47, 51, 53, 67–69, 71, 72, 80–82] did not explicitly specify the theoretical frameworks they employed, which suggests a potential lacuna in the theoretical foundation of some research in this field.

Most articles (59 articles, 93.6%) discussed the well-being of PhD scholars as an implicit concept. The concept of well-being was defined both explicitly and implicitly in only four articles (6.4%) [6, 8, 43, 57] (Table 3).

We utilised the socioecological framework as a conceptual framework to explore the concepts and factors influencing the well-being of PhD scholars (Fig. 2). The social-ecological systems framework offers a comprehensive approach to understanding sustainability and governance arrangements across diverse contexts, providing a valuable tool for diagnosing interactions and outcomes in complex social-ecological systems [85].

According to the socio-ecological framework, the primary themes are as follows:

1. **Well-being of PhD scholars at the individual level** with subthemes of personal well-being, mental/psychological and emotional well-being, physical well-being, professional well-being, and scholarly well-being.
2. **Well-being of PhD scholars at the interpersonal level** with collegial and supervisor-related well-being subthemes.
3. **Well-being of PhD scholars at the institutional level** with academic and organizational well-being subthemes.
4. **Well-being of PhD scholars at the community level** with cultural and social well-being subthemes.
5. **Well-being of PhD scholars at the policy level** with a subtheme of strategy-driven well-being.

The socio-ecological framework was employed to develop themes at the individual, interpersonal, institutional, community, and policy levels, as illustrated in Fig. 3 and Table 4.

Theme 1: Well-being of PhD scholars at the individual Level

The well-being of PhD scholars at the individual level of the socioecological framework involves various subthemes, including personal, mental/psychological, emotional, physical, professional, and scholarly well-being, all of which significantly impact their experience in the PhD journey.

> **i. Personal well-being** centres on an individual's self-perception, ability to cope with challenges, and capacity for resilience. PhD scholars frequently face challenges related to self-critical perfectionism [19], self-depreciation [26] and self-confidence [73]. Nevertheless, difficulties can be alleviated through self-compassion [19], resilience [31, 34, 61, 70], and implementation of effective coping techniques [47, 70].

> *"Self-critical perfectionism is linked to depression and exhaustion, therefore, it's important to find ways to help doctorate students cope, such as self-compassion (76)."*

Self-care practices [25, 67] and personalised well-being interventions [33] are indispensable, along with awareness [56, 73], perseverance [27, 69], and passion for long-term goals [69].

Additionally, factors such as self-efficacy [8, 47], confidence [73], and self-determined motivation [9] are essential for successfully completing the PhD program within the institutional timeframe [52]. Personal characteristics, such as age, gender, and nationality, further influence well-being [77], attachment styles [79], perception biases, and taboos [75]. Financial strain substantially influences well-being [58], which encompasses delayed life events due to financial concerns [68]. Spiritual, religious, and existential well-being were also significant factors [65].

> *"When an academic-work-to-personal-life conflict exists, distress increases by 6% per point on the 0–10 scale. Distressed students also regretted choosing doctoral studies [30]."*

Table 3 Description of characteristics of included articles

Elements		n (%)
Decade	2000's	0 (0%)
	2010's	30 (47.6%)
	2020's	33 (52.4%)
Countries	High-income countries	51 (80.9%)
	Upper-middle-income	7 (11.1%)
	Lower-middle-income	2 (3.2%)
	Low-income	0 (0%)
	Multiple regions	3 (4.8%)
Study design	Cross-Sectional/Survey	34 (53.9%)
	Correlational	2 (3.2%)
	Longitudinal	3 (4.8%)
	Review	6 (9.5%)
	Qualitative	7 (11.1%)
	Mixed method	8 (12.7%)
	Intervention study	1 (1.6%)
	Pilot study	1 (1.6%)
	one-group ex post facto design	1 (1.6%)
Sample size (excluding 6 reviews)	< 100	15(26.3%)
	101–500	18(31.6%)
	501–1000	10(17.5%)
	1001–2000	6(10.6%)
	2001–5000	5(8.8%)
	> 5000 (maximum sample size 6812)	3(5.3%)
Methods of data collection	Survey & questionnaires	42 (66.7%)
	Interviews/focus groups	7 (11.1%)
	Multiple methods	8 (12.7%)
	Databases for articles (reviews)	6 (9.5%)
Tool/scales/questionnaire used	Yes	50(79.4%)
	No	13(20.6%)
The validity/reliability of the tool mentioned (excluding 6 reviews and 7 qualitative studies)	Yes	45 (90.0%)
	No	5 (10.0%)
Theoretical frameworks used to describe the well-being of PhD Scholars	Yes	40 (63.5%)
	No	23 (36.5%)
Explanation of the well-being of PhD Scholars as an implicit or explicit concept	Implicit	59 (93.6%)
	Explicit	4 (6.4%)

ii. Mental/psychological & emotional well-being: The mental health challenges that scholars encounter include anxiety & depression [3, 9, 34, 39, 45, 46, 52, 57, 68, 71, 76, 82], stress & burnout [9, 19, 23, 25, 26, 32, 33, 39, 42, 46, 47, 49, 52, 57, 61, 63, 67, 69, 71, 76, 78, 82], homesickness [22], and psychological distress [9, 23, 38, 52, 67, 69]. The impostor phenomenon exacerbates these problems [62], exhaustion [36, 46, 57, 76], and irreproducibility [47]. Environmental factors exacerbate mental and emotional challenges [48] and program delays [51], while mental health outcomes are influenced by gender differences [53].

"PhD students report more mental illness symptoms than highly educated people in the general population, highlighting the need for help and a major issue for institutions [34]."

It is essential to have support systems, such as mental health services [33] and interventions [71] that are specifically designed to improve well-being. These support systems boost mental health, reduce depression and psychological distress, and reduce isolation, anxiety, and tiredness [52].

Emotional well-being and regulation encompass the management of emotional distress [24, 27] and challenges

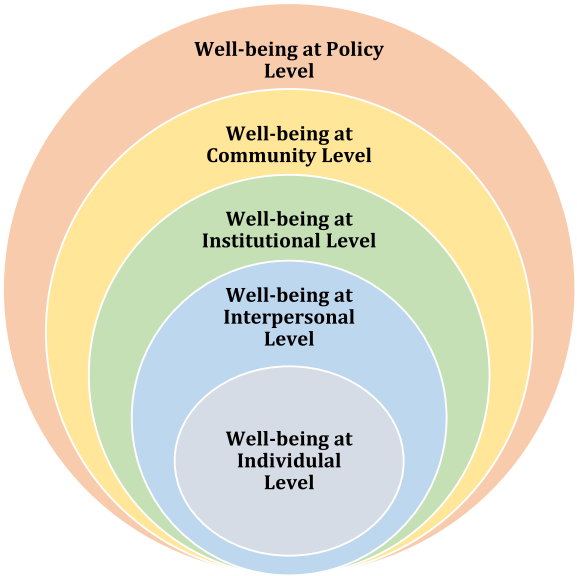

Fig. 2 Conceptual Framework of Well-Being of PhD Scholars

[70], including insecurity and loneliness [36]. The cultivation of positive emotional resources [75] and emotional strength [69] is indispensable for preserving one's overall health.

"Identifying, acknowledging, and managing emotions is essential for staying focused and achieving long-term goals [27]."

iii. Physical well-being encompasses the maintenance of general health [26], access to healthcare services [68], and quality of sleep [26]. It is imperative to prioritise physical health to support the academic and personal lives of PhD scholars as they frequently experience sleep issues and illness symptoms [66].

"Over half (59%) of respondents reported poor or very bad overall health, which may be aggravated by insufficient sleep, as those who neglect their physical health may encounter higher stress and mental health issues [26]."

iv. Professional well-being: The work environment and opportunities for professional development impact the well-being of PhD scholars. Scholars'perspectives on occupational health and safety, job autonomy, work engagement, and career advancement are indispensable [28]. Concerns about future employment prospects [63] and the pursuit of professional milestones are factors that affect well-being [68]. Additionally, job demands [43], career confidence [26], and the degree of job control [43] play a significant role in shaping scholars'professional well-being.

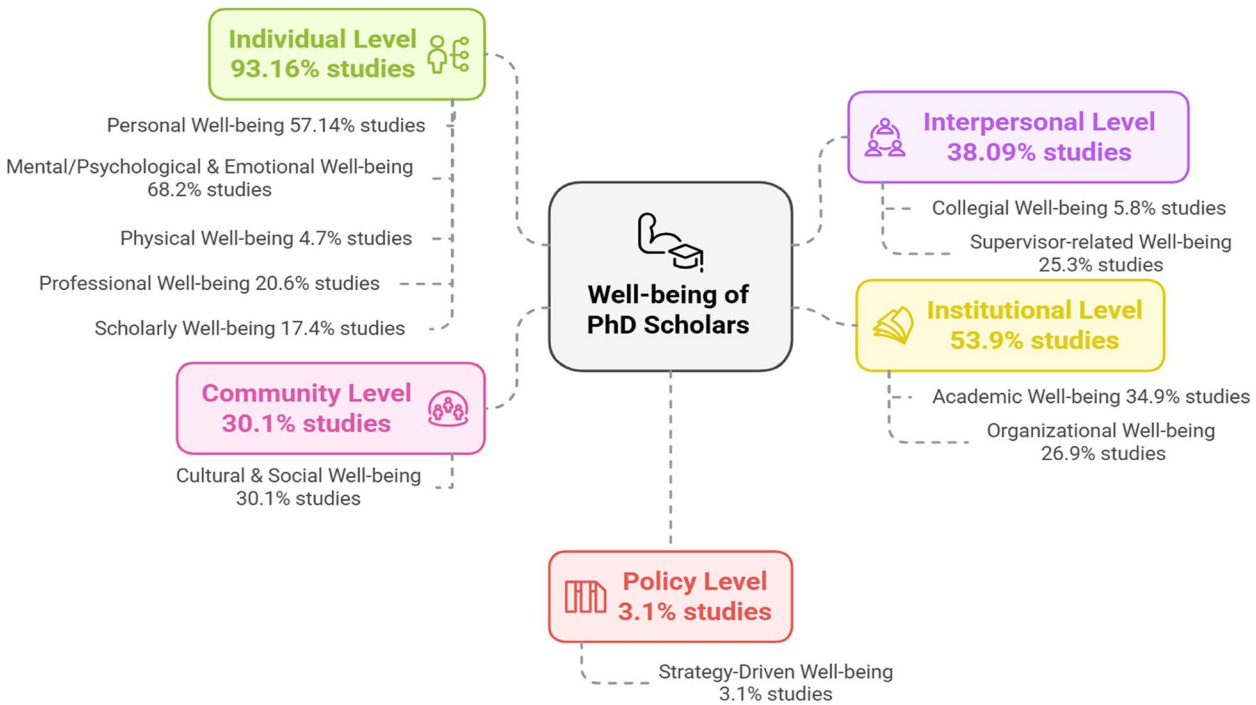

Fig. 3 Percentage and Distribution of Themes and Subthemes in the Included Studies

Table 4 Themes, subthemes, and categories of Well-being of PhD Scholars

Themes	Subthemes	Categories and Axial Codes
1. Well-being of PhD Scholars at the Individual Level (59 out of 63 studies [93.16%])	**a. Personal well-being** (36 out of 63 studies [57.14%])	**Self-Perception, Coping, and Resilience** (25 out of 63 studies [39.6%]) •Self-critical perfectionism (76) •Self-compassion (76) •Self-depreciation (47) •Personal identity and self-concept (6) •Self-confidence (40) •Resilience (24, 38, 53, 67) •Coping Strategies (38, 60) •Adjustment (19) •Conflict resolution skills (53) •Intention to persist (23) •Intention to quit (42, 51) •Awareness (educational, self-awareness, contextual awareness) (40, 66) •Perseverance (43, 48) •Passion for long-term goals (43) •Self-care practices (22, 37) •Self-care skills (50) •Personalized well-being Interventions (52) •Self-determined motivation (9) •Self-Efficacy (8, 60) •Confidence in completing the PhD program within the institutional timeframe (63) •Perception biases and taboos (73) •Attachment styles (44) •Age, Gender, and Nationality (74)
		Life Satisfaction, Motivation, and Financial Well-being (17 out of 63 studies [26.9%]) •Balancing responsibilities (20) •Life satisfaction (9, 31, 37, 44, 50, 60) •Overcommitment (67) •Quality of life (65, 75) •Competence satisfaction (34) •Personal growth (32) •Intrinsic motivation (34) •Intrinsic and extrinsic motivation (9) •Lack of interest (3, 32) •Financial strain (33) •Delayed life Events due to financial concerns (71) •Personal funding concerns (57) •Future expectations (44) •Spiritual well-being (36) • Religious well-being(36) •Existential well-being (36)
	b. Mental/Psychological & Emotional well-being (43 out of 63 studies [68.2%])	**Mental Health Challenges and Impact** (36 out of 63 studies [57.1%]) •Anxiety & depression (3, 9, 28, 29, 32, 41, 53, 56, 63, 65, 71, 72) •Stress and burnout (9, 20, 22, 29, 31, 32, 35, 37, 41, 43, 47, 51, 52, 56, 58, 60, 63, 65, 67, 72, 75, 76) •Mental health issues (27, 52) •Mental health impact of irreproducibility (60) •Homesickness (19) •Exhaustion (25, 29, 32, 41) •Psychological distress (9, 20, 37, 43, 55, 63) •Suicidality and risk Factors (54) •Impostor phenomenon and its relationship to psychological well-being (68) •Mental health profiles (69) •Environmental factors impacting mental health (30) •Mental and emotional challenges due to delays in program completion (62) •Prevalence of psychosomatic symptoms (64) •Gender differences in mental well-being (64) •Mental health outcomes (28, 64, 71)
		Support Systems and Well-being Enhancement (9 out of 63 studies [14.2%]) •Support services for mental health (52) •Mental health practices (73) •Mental health initiatives tailored to department-specific needs (72) •Tailored interventions for mental health support (30) •Protective factors against suicidality (54) •Decreased feelings of isolation and anxiety (63) •Improved mental health outcomes and reduced risks of depression or psychological distress (63) •Stress reduction (37) •Reduction of burnout experience (39) •Psychological resilience (44)
		Emotional Well-being and Regulation (7 out of 63 studies [11.1%]) •Emotional distress (21, 48) •Emotional regulation (50) •Difficulties in emotion regulation (48, 50) •Emotional strength (43) •Emotional challenges (38) •Loneliness and insecurities (25) •Positive emotional resources (73) •Emotional strength (43) •Psychological capital (73) •Emotional challenges (38)
	c. Physical well-being (3 out of 63 studies [4.7%])	**Physical Health** (3 out of 63 studies [4.7%]) •General Health (47) •Sleep quality (47) •Illness symptoms (70) •Access to healthcare services (71)

Table 4 (continued)

Themes	Subthemes	Categories and Axial Codes
	d. Professional well-being (13 out of 63 studies [20.6%])	**Work Environment and Professional Growth** (8 out of 63 studies [12.6%]) •Perceptions of health and safety at work (49) •Autonomy in work (58) •Job autonomy (49) •Work engagement (67) •Professional growth (21) •Career development (49) •Career advancement (32) •Career aspirations (50) •Concerns about future employment (35) •Professional milestones (71)
		Job Satisfaction and Personal Fulfilment (6 out of 63 studies [9.5%]) •Increased satisfaction with life and work-life balance (63) •Job satisfaction (52) •Recognition of the value of work (58) •Work-family interface (27) •Importance of work-life balance (54) •Career confidence (47) •Job demands (27) •Job control (27) •Relationships and relatedness with co-workers (58)
	e. Scholarly well-being (11 out of 63 studies [17.4%])	**Integration and Identity in Research** (6 out of 63 studies [9.5%]) •Integration within research environments (25) •Researcher identity (77) •Integration into the research community (39) •Sense of equality within the research community (39) •Support from the researcher community (42) •Scholarly community as a factor influencing well-being (3) •Sense of belonging (41)
		Confidence and Autonomy in Research (8 out of 63 studies [12.6%]) •Research self-efficacy (25, 28, 46) •Personal research confidence (77) •Perceived meaning of thesis work (32) •Research environment (25, 60, 70) •Autonomy in research projects (41)
2. Well-being of PhD Scholars at the Interpersonal level (24 out of 63 studies (38.09%])	**a. Collegial well-being** (10 out of 63 studies (15.8%])	**Peer Support Systems and Networks** (10 out of 63 studies (15.8%]) •Peer support (23, 55, 63, 66) •Mentoring relationships (28, 38, 69) •Institution-wide social support (24) •Networking activities (48) •Social identification with peers, supervisors, and the academic community (55) •Social-Collegial (77)
	b. Supervisor-related well-being (16 out of 63 studies [25.3%])	**Supervisory Relationships and Support** (16 out of 63 studies [25.3%]) •Relationships with supervisor (65, 77) •Navigating supervisory relationships (57) •Supportive supervision and open communication (58) •Supervisor leadership styles (27) •Supervisory working alliance (33) •Supervision practices (3) •Supervisory support (23, 26, 34, 42, 47, 55, 62) •Satisfaction with supervision quality (61) •Supervisor support and departmental assistance impact on well-being (62) •Supervision quality and frequency (41) •Support from multiple supervisors (39)
3. Well-being of PhD Scholars at the Institutional level (34 out of 63 studies (53.9%])	**a. Academic well-being** (22 out of 63 studies [34.9%])	**Academic Performance and Engagement** (12 out of 63 studies [19.04%]) •Academic performance (37, 46, 56, 76) •Academic achievement (44) •Achievement orientation (47) •Academic milestones (71) •Doctoral engagement (34) •Study engagement (3, 32) •Program satisfaction (51) •Overall study experiences and satisfaction (61)
		Challenges, Stressors, and Support (13 out of 63 studies [20.6%]) • Impact of PhD studies on well-being (54) •Candidature-related challenges (20) •Role-related challenges (57) •Academic stress (68) •Academic challenges (28) •Perceived problems in doctoral Studies (3) •Challenges faced during doctoral studies (61) •Workload (41, 76) •Years of PhD study (74) •Expertise development (20) •Training programs and academic support (61) •Academic profession fit (59) •Attendance at postgraduate student events (74) •Writing profiles (29)

Table 4 (continued)

Themes	Subthemes	Categories and Axial Codes
	b. Organizational well-being (17 out of 63 studies [26.9%])	**Program Climate and Organizational Support** (17 out of 63 studies [26.9%]) •Program climate (56, 75) •Training environment fit (59) •Organizational culture fit (59) •Facilities and resources provided by universities (61) •Financial support and transparency in graduate programs (26, 40, 71) •Supportive academic environment (29, 52, 72) •Collaborative approach involving students and faculty (72) •Evaluation and follow-up for sustained well-being outcomes (72) •Departmental support (8, 62) •Support services for early career researchers (48) •Positive faculty interaction (56) •Gender equality (49) •Spatial and temporal experiences of well-being (6) •Effort-reward imbalance (67) •Collaboration and teamwork opportunities (58)
4. Well-being of PhD Scholars at the Community level(19 out of 63 studies [30.1%])	**Cultural and Social well-being** (19 out of 63 studies [30.1%])	**Family and Community Support** (15 out of 63 studies [23.8%]) •Family support (38, 43, 47, 66) •Community of support (66) •Supportive relationships (21, 45) •Support systems (35, 52, 54, 60) •Positive relationships with parents and friends (43) •Supportive family environment (43) •Sources of support (75) •Sense of belonging (41, 56, 69, 75) •Social factors (44) **Challenges and Balancing Responsibilities** (4 out of 63 studies [6.3%]) •Difficult relationships (21) •Relationship conflict (33) •Managing family and personal responsibilities (57) •Balancing writing and family relationships (38) **Cultural Diversity and Inclusion** (5 out of 63 studies [7.9%]) •Gender and ethnic diversity (33) •Perceptions of equitable treatment (56) •Experiences of discrimination (46) •Societal expectations (66) •Spiritual and religious well-being (36)
5. Well-being of PhD Scholars at the Policy level (2 out of 63 studies [3.1%])	**Strategy-Driven well-being** (2 out of 63 studies [3.1%])	**Governance and Financial Support** (2 out of 63 studies [3.1%]) •Higher Education Policies (35) •Institutional policies and support (59) •Institutional accountability (35) •Financial support policies (59) •Financial support fit (59)

"Feeling understood and supported by other group members reduced isolation and anxiety, improved life and work-life balance, and increased confidence in completing their PhD within the institutional deadline [52]."

v. Scholarly well-being*:* Integration and identity within research environments are essential components of scholarly well-being [36]. Key factors included a sense of belonging [76], support from the research community [74] and equality within the research community [72].

Personal research confidence [37] and the autonomy of PhD scholars in their research [76] are essential for academic achievement. Research self-efficacy [21, 36, 45] is a key factor that fuels motivation and determination. When scholars perceive their thesis work as meaningful, they exhibit higher levels of engagement [57]. The autonomy in research initiatives promotes independence and intellectual liberty [76].

"Formal and informal integration was substantially connected with a sense of belonging... it may indirectly affect quitting intention and contentment [76]."

Theme 2: Well-being of PhD scholars at the interpersonal level

The interpersonal well-being of doctoral candidates, encompassing collegial and supervisor-related aspects, is crucial to their overall academic performance and satisfaction throughout their scholarly pursuits.

i. Collegial well-being*:* The peer support offers professional and emotional support [29, 38, 52, 56]. This sense of community and belonging is further bolstered by institutional social support [31], which cultivates a supportive academic environment. Networking activities [27] and social identification with peers, supervisors, and the broader academic community are essential for a scholar's social-collegial

well-being [38], ensuring that they feel supported and integrated throughout their PhD voyage.

"Research shows that high social support and identity are substantially linked to mental well-being and psychological suffering in this population [38]."

ii. Supervisor-related well-being: The quality and dynamics of supervisory relationships are the primary focus of supervisor-related well-being [81]. It is imperative to effectively navigate these relationships to achieve academic success and personal fulfilment [80]. Open communication and supportive supervision are essential elements for cultivating productive and positive working relationships [42]. The quality and frequency of supervision significantly influence scholars'experiences [76], as well as the leadership styles [43] and supervision practices [3] of supervisors. Supervisory and departmental support have a substantial impact on scholars' well-being [51]. Additionally, having access to multiple supervisors can provide a more extensive support network, which can improve their overall satisfaction and success in academic endeavours [72].

"Supportive supervision with open communication has been recognized as the primary factor contributing to the well-being of PhD students [42]."

Theme 3: Well-being of PhD scholars at the institutional level

PhD scholars' institutional well-being, encompassing both academic and organizational well-being subthemes, significantly influences their overall satisfaction and achievement.

i. Academic well-being: Scholars' satisfaction with their programs is influenced by crucial characteristics, such as academic achievement [79], milestone completion [68], and doctoral engagement [60], all of which are related to academic performance and engagement.

PhD research projects are bound to involve challenges and difficulties that affect researchers' well-being [35]. Common obstacles include challenges connected to candidacy [23], roles [80], academic stress [62], perceived difficulty in doctoral studies [3], and workload [19, 76]. The duration of doctoral studies and the acquisition of expertise often present difficulties [23]. Overcoming these difficulties is essential and can be achieved through training programs and academic support [81].

"Poor academic preparation and support.... negatively affect academic development and mental health [62]."

ii. Organizational well-being: The well-being of an organisation is influenced by the programme's climate [39, 78] and the supportive academic environment offered by the institution [33, 46, 71]. It is crucial to have a positive program climate, strong alignment with the training environment, and alignment with the organisation's culture [44]. An inclusive academic environment is fostered by providing sufficient facilities, resources, and financial support, as well as promoting transparency in graduate programs [40, 68, 73]. Collaborative approaches involving students and faculty [71], supportive learning settings, and departmental assistance [8, 51] improve scholars' overall well-being.

"Doctoral students'mental health is significantly influenced by the organizational cultural fit they experience [44]."

Moreover, offering services to early career researchers [8, 51] and promoting positive interactions with faculty members [39] further augment this aspect. Both learning environment and resource management are critical factors.

Theme 4: Well-being of PhD scholars at the community Level

The well-being of PhD researchers is significantly impacted by cultural and social factors, including support from their families and communities and the presence of cultural diversity and inclusiveness.

Cultural and social well-being: PhD scholars' well-being is significantly influenced by the support they receive from their families and communities. Establishing supportive relationships with family and friends fosters a robust support system that offers both emotional and practical aid [20, 24]. To preserve one's well-being, it is crucial to have a favourable family environment and a feeling of inclusion in the community [39, 76, 78, 83]. Social elements, such as the presence of supportive networks and a community of support, play a role in the scholar's capacity to effectively manage the demands of their PhD programme [33, 35, 47, 63].

"Strong academic and local community links provided emotional support, reducing loneliness, according to students [39]."

PhD scholars frequently encounter obstacles and strive to balance their obligations [80]. Managing personal and family responsibilities can be difficult because of tensions induced by complex relationships and conflicts [24, 58]. Writing and academic work are frequently challenging for scholars to manage in conjunction with their familial obligations, which can harm their overall health [70].

PhD scholars'experiences and perceptions of equitable treatment are influenced by the gender and ethnic diversity of the academic environment [58]. Their well-being may be influenced by their experiences of discrimination [21] and societal expectations [56]. Furthermore, spiritual and religious well-being are critical components of cultural inclusion, as they offer scholars from various backgrounds a sense of purpose and community [65].

> *"Academic racism is obvious. There's more to it than individual experiences—a society that marginalizes voices makes it hard to feel accepted or respected [56]."*

Theme 5: Well-being of PhD scholars at the policy Level

PhD scholars'well-being at the policy level is heavily influenced by strategy-driven initiatives that focus on governance and financial support.

Strategy-driven well-being: Government and educational authorities'policies on higher education significantly influence the academic environment, affecting various aspects such as resource distribution and academic criteria [63]. Institutional policies and support mechanisms are equally important as they establish a structure in which scholars function [44]. These policies guarantee that institutions are held responsible for the well-being and achievements of their students.

> *"Policymakers disregard the fact that publishing papers is difficult, time-consuming, and possibly lethal. This requirement has been publicly denounced in academics [63]."*

PhD scholars frequently face substantial financial obligations, rendering financial support policies crucial. Scholars'capacity to pursue their studies without undue financial stress is substantially improved when financial support matches their needs [44].

Discussion

Our scoping review aimed to map the literature on the description of the well-being of PhD scholars across multiple socio-ecological levels. The results revealed a comprehensive understanding of the well-being of PhD scholars, identifying themes at the individual, interpersonal, institutional, community, and policy levels.

The well-being of PhD scholars at the individual level includes personal, mental/psychological, emotional, physical, professional, and scholarly well-being.

Our scoping review highlighted personal well-being as a complex interplay between individual traits and overall well-being. Recent research has highlighted that PhD scholars need resilience and coping strategies to manage their academic stress. Dimitra Kokotsaki revealed that resilience helps doctorate students cope with stressors and obstacles, suggesting that increased perceived resilience can improve functioning and guard against distress and low well-being [86]. Additionally, Megan E. Cowie discovered that self-critical perfectionism causes psychological suffering and burnout [87]. According to Fazal Ilahi, self-compassion can also protect PhD students from stress, anxiety, and depression, increasing their mental health and emotional well-being [88].

E Hwang found that financial stress delays life events and creates tension, which can hamper doctoral candidates'development [89]. The balance between inner and extrinsic motivation is also crucial for performance in doctorate studies. Financial pressures can reduce intrinsic drive, according to Sara Diogo, lowering PhD students'academic performance and well-being [90].

The results of our scoping review supported recently published research showing a significant occurrence of anxiety, depression, and stress among PhD students. Gabriela A. Nagy highlighted the alarming mental health crisis among PhD students, who reported higher levels of anxiety and depression compared to the general population [91]. Recent studies have emphasised the role of emotional regulation and resilience in overcoming these challenges. Stefania Velardo emphasized the need to develop emotional regulation skills and encourage students to monitor and seek help with their emotions, thereby addressing burnout [92]. Chloe Casey has advocated for mental health support networks, emphasizing the necessity for a comprehensive understanding and management of doctoral students'mental health [93]. These findings suggest that the implementation of enhanced mental health services can positively impact student achievement.

Physical well-being, including sleep and healthcare, is essential for overall health. Hannah K. Allen (2021) found that many PhD students have poor sleep quality, which increases stress and lowers academic performance [94].

Professional well-being was found to be significantly influenced by work environment and job satisfaction. Consistent with the conclusions of Juita-Elena (Wie) Yusuf, work-life balance is essential for the professional growth and well-being of PhD students, as it enhances mental and physical health and alleviates stress [78].

Recent studies, notably Alexandra Coso Strong, have demonstrated that autonomy and acknowledgement assist PhD students in overcoming challenges and enhancing intrinsic motivation [95].

The review focused on the integration of the research environment as well as the aspects of confidence and autonomy in accordance with the existing literature. Castelló found that doctoral students require a robust sense of community to succeed and persist in their studies. Conversely, a deficiency in research community integration may result in feelings of inadequacy and isolation [96]. Additionally, research self-efficacy and confidence are crucial for academic well-being. A study conducted by Raluca Livinți revealed that research confidence reduces stress levels and enhances research productivity and academic satisfaction [97].

At the interpersonal level, the well-being of PhD scholars is significantly influenced by support extended by colleagues and supervisors. Recent research has highlighted the critical role of social support in academic environments, affirming that peer support systems and networks are essential for the well-being of PhD scholars. Muhammad Sufyan conducted a study underscoring the critical importance of peer support in alleviating stress among PhD scholars, thereby enhancing their overall well-being [98].

The quality of supervisory interactions significantly impacts PhD scholars' well-being. Empirical evidence from Amjad Almusaed's study confirmed that proficient supervision is vital in the research talents, motivation, and general academic achievement of PhD students [99]. Empirical studies have demonstrated that supervisory leadership and communication influence the well-being of PhD students. A survey by Ivan Gruzdev highlighted the significant impact of supervision style on the happiness and propensity of PhD students to switch supervisors [100].

The well-being of PhD scholars at the institutional level comprises academic and organizational well-being. Karma Yangdon found that excessive academic workloads harm students'well-being and performance [101]. This emphasises the importance of enhancing support and achieving a better balance in academic institutions.

The program climate and organizational support were significant for well-being, which is consistent with the recent literature. McCray emphasized the significance of institutional support and program satisfaction, as institutional support for doctoral candidates boosts resilience and achievement [102]. According to Rodrigo Rosa, it is crucial for PhD academics to have a supportive academic atmosphere that encompasses gender equality and teamwork [103].

Family and community support play a crucial role at the community level, while cultural diversity and inclusiveness significantly impact academic experience. Managing personal, familial, and educational obligations remains a significant hurdle. Shweta Mishra found that family and community support reduces stress and improves well-being in PhD students, particularly those from underrepresented backgrounds, by providing essential encouragement and resources that help them navigate challenges in higher education [104]. As Owens found, managing responsibilities and adapting to cultural diversity is difficult. Owens stressed the need to promote cultural diversity among doctoral students to create an inclusive research environment and improve doctorate students'academic and personal growth [105].

The well-being of PhD scholars at the policy level includes governance and financial support. Policies must be based on the needs of PhD scholars to enhance their well-being. Research conducted by M. Nerad emphasized the need to implement comprehensive financial policies that support doctoral candidates to enhance their research experience and ensure timely completion [106]. An optimal academic environment is cultivated through open and transparent access to resources and well-defined financing methodologies that distribute research expenses and supervision funds. Current scholarly research has endorsed the adoption of government interventions to address the financial and academic challenges faced by PhD students. Jamil Salmi has underscored the need to advocate for equal opportunities in higher education to facilitate social integration and advance economic development. He emphasises the need to adopt targeted measures to support marginalised communities and enhance their access to educational opportunities [107].

Limitation

This scoping review aimed to evaluate the well-being of PhD scholars within the fields of medical and allied health sciences, which may limit the generalisability of the findings to PhD scholars in other disciplines. The absence of literature from diverse academic environments may have resulted in the omission of critical insights into the well-being of PhD researchers. The review was confined to English-language publications, potentially excluding pertinent studies published in other languages. To ensure consistency, focus, and quality, dissertations, theses, symposiums, and book chapters were excluded from the review. While this exclusion may have omitted certain data and perspectives, the emphasis was placed on peer-reviewed journal publications that undergo rigorous evaluation to provide evidence. Despite comprehensive search efforts, 12 full-text articles could not be retrieved because of access restrictions. Attempts were made to obtain these articles, including contacting the corresponding authors; however, these efforts were

unsuccessful, resulting in their exclusion and the potential omission of relevant insights regarding the well-being of PhD scholars.

Conclusions

Our scoping review provides a comprehensive framework addressing the well-being of PhD scholars at the individual, interpersonal, institutional, community, and policy levels. This broader perspective enables the formulation of effective and tailored interventions as well as a systematic understanding of the various factors influencing the well-being of PhD scholars. The descriptive details of the articles included in this scoping review offer comprehensive insight into the current state of research on the well-being of PhD scholars. The findings indicate that the majority of research studies have been conducted in high-income countries, highlighting the need for greater geographic diversity, particularly in lower-middle- and low-income countries. The predominant study design was cross-sectional surveys, emphasising the need for more in-depth qualitative, intervention-based, and longitudinal research to achieve a comprehensive understanding of the well-being of PhD scholars. Future research should also aim to establish and implement clear definitions of well-being and employ robust theoretical frameworks to guide future investigations.

Our scoping review uncovered the complex, diverse, and multifaceted nature of the well-being of PhD scholars at five different levels of the socio-ecological framework. Overall, this review emphasises the complexity of PhD researchers'well-being and the necessity of a holistic approach to address the diverse challenges they face across multiple levels of their academic journey.

Abbreviations

CINAHL	Cumulative Index to Nursing and Allied Health Literature
Embase	Excerpta Medica Database
JBI	Joanna Briggs Institute
MEDLINE	Medical Literature Analysis and Retrieval System Online.
OSF	Open Science Frameworks
PhD	Doctor of Philosophy
PRISMA-ScR	Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews
PROSPERO	International Prospective Register of Systematic Reviews
PsycINFO	Psychological Information Database

Supplementary Information

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Supplementary Material 1.

Supplementary Material 2.

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Authors' contributions

NM and UM developed the idea and planned the methodology for the study. NM and MA collaborated closely to refine the search terms, identify relevant databases, and ensure comprehensive coverage of the literature. Data screening and selection were completed using Covidence Software. NM and MA completed screening records (titles and abstracts); disagreements were resolved by consensus or in consultation with UM and NS. Full texts were retrieved for those records considered eligible and for each included study data were extracted and reviewed by NM and MA using a pre-designed data extraction form. The responsibility of creating the Data Charting Form fell upon the first author NM, who designed it after achieving consensus and scrutinizing it by all the co-authors.UM was responsible for supervising the overall design and NS contributed to the development of the data extraction form. All the authors reviewed the final draft and approved it.

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Data availability

The data and materials analyzed in this scoping review are publicly available and were sourced from peer-reviewed articles, databases, and grey literature. A detailed search history of all databases used in the review is submitted in the related files section of the journal's article submission portal. All the relevant sources and references are properly cited throughout the manuscript. No primary data were collected for this review.

Declarations

Ethics approval and consent to participate

This study was conducted after approval of the synopsis from the Advanced Studies and Research Board (ASRB), Khyber Medical University (KMU) Peshawar (No. DIR/KMU-AS&RB/AT/001996). The review did not involve human participants or primary data collection; therefore, consent to participate was not required.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

[1]Department of Medical Education, Khyber Girls Medical College, Peshawar, Pakistan. [2]Institute of Health Professions Education and Research, Khyber Medical University, Peshawar, Pakistan. [3]Institute of Public Health and Social Sciences, Khyber Medical University, Peshawar, Pakistan. [4]Department of Health Professions Education and Research, Peshawar Medical College, Riphah International University, Islamabad, Pakistan.

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