PREVALENCE OF BURNOUT AMONG RESEARCH STUDENTS IN SCIENCE AND TECHNOLOGY INSTITUTIONS IN THIRUVANANTHAPURAM

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DECLARATION

I hereby declare that this dissertation titled – "Prevalence of Burnout among research students in Science and technology institutions in Thiruvananthapuram" is a Bonafede record of my original research. It has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published and unpublished work of others has been duly acknowledged in the text.

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CERTIFICATE

Certified that the dissertation titled - “Prevalence of Burnout among research students in Science and technology institutions in Thiruvananthapuram” is a record of the research work undertaken by Dr Aswathy B I, in partial fulfilment of the requirements for the award of the degree of Master of Public Health under my guidance and supervision.

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GLOSSARY OF ABBREVIATIONS

PhD	Doctor of Philosophy
ICD	International Classification of Diseases
WHO	World Health Organization
COR	Theory of Conservation of Resources,
MBI	Maslach Burnout Inventory
BM	Burnout Measure
CBI	Copenhagen Burnout Inventory
OLBI	Oldenburg Burnout Inventory
BAT	Burnout assessment tool
BDI	Beck Depression Inventory
HAM-D	Hamilton Rating Scale for Depression
PHQ	Patient Health Questionnaire
GAD	Generalized Anxiety Disorder
PSS	Perceived Stress Scale
HADS	Hospital Anxiety and Depression Scale
DASS	Depression, Anxiety, Stress Scale
HICs	High-income countries
SCTIMST	Sree Chitra Tirunal Institute for Medical Sciences and Technology
NCESS	National Centre for Earth Science Studies
IIST	Indian Institute of Space Science and Technology
IISER	Indian Institute of Science Education and Research
CET	College of Engineering Thiruvananthapuram
COA	College Of Agriculture
RCC	Regional Cancer Centre

CSIR- NIIST	Council of Scientific & Industrial Research - National Institute for Interdisciplinary Science and Technology
KUHS	Kerala University of Health Sciences
PI	Principal Investigator
ODK	Open Data Kit
ID	Identity Document
SPSS	Statistical Package for the Social Sciences
OBC	Other backward classes
SC	Scheduled Class
ST	Scheduled Tribe
CUSAT	Cochin University of Science and Technology
KU	University of Kerala
AcSIR	Academy of Scientific & Innovative Research
APJAKTU	Dr. A.P.J. Abdul Kalam Technical University
IEC	Institutional Ethics Committee

ABSTRACT

Background: PhD (Doctor of Philosophy) is widely regarded as the highest level of formal education that an individual can obtain. Research is a very methodical, organised, well-planned, and problem-solving activity where researcher is constantly in a state of turmoil, stress, and pressure. Stress-related diseases are a growing concern in the academic workplace, particularly among young researchers. The researcher's health, particularly their emotional and psychological health, has an impact on the results of their research. The present study assessed the prevalence of burnout among research students and the factors associated with burnout among research students.

Methods: A cross sectional survey was conducted among 298 PhD students from 7 science and technology institutions in Thiruvananthapuram, Kerala. Data was collected using a self-administered questionnaire which had questions from the Oldenburg Burnout Inventory (OLBI), the Patient Health Questionnaire-9 (PHQ-9), the General Anxiety Disorder-7 (GAD-7) and Perceived Stress Scale 4 (PSS-4) scales. The Chi square test was used to test the associations. The data were analyzed with the aid of IBM SPSS Statistics 25 for Windows.

Result: The mean age of the participants was 30 years (25 - 45). There were 298 participants of which 68.5 percent were females. A total of 75 percent of the participants (74 percent females and 26 percent males) had moderate-high levels of burnout, among them 22 percent (31 percent females and 20.5 percent males) had high burnout. Depression (21.5 percent), anxiety (16 percent) and stress (37.6 percent) were also high among the participants and have a significant positive association with the burnout.

Conclusion: A great proportion of the study participants had moderate to high levels of burnout. Comprehensive support systems, foster mentorship programs, promotion of work-life balance, enhancement of communication and collaboration, increase in awareness and education, reformation of academic culture and expectations and supporting institutional policies and resources can go a long way to tackle the issue. Further longitudinal studies to assess the burnout among PhD as well as other research institution should be carried to get an insight into the prevailing problem of burnout.

CHAPTER 1

INTRODUCTION AND LITERATURE REVIEW

1.1 Background:

A PhD (Doctor of Philosophy) is widely regarded as the highest level of education that an individual can obtain. It is a difficult process that has been linked to high levels of stress, pressure, and loneliness. Stress-related diseases are a growing concern in the academic workplace, particularly among young researchers (Evans et al., 2018; Tikkanen et al., 2021a). Although some stress is beneficial for personal and professional development (Pappa et al., 2020) chronic stress can lead to mental health issues such as burnout.

Although conducting research projects is not for everyone, it does require a high level of competence, enthusiasm, and a passion for learning as well as persistent efforts and resource management that is both wise and well-considered (Levecque et al., 2017). A researcher is constantly in a state of turmoil, stress, and other unwanted psychological fears due to their constant searching and problem-finding, exploring, and explaining. A researcher might occasionally feel hopeless and depressed. A situation like this may disrupt his or her routine, making him or her ill or uneasy. A researcher with a healthy mental makeup can easily cope with incoming stress and depression and manage himself. The researcher's health, particularly their emotional and psychological health, has an impact on the results of their research (Levecque et al., 2017). Research is a very methodical, organised, well-planned, and problem-solving activity, and it is likely to produce results that will address issues that affect the local community, society, country, economy, environment, and humanity. PhD students generally experience more academic stress and show more symptoms of depressive disorders, particularly when writing their

theses, preparing for publication, and defending their thesis. In conclusion, we can say that a PhD student's mental health is extremely important and should never be neglected as it could lead to resource waste and even personal harm to the student (Levecque et al., 2017).

1.2 Literature review

1.2.1 Definition of burnout

Herbert Freudenberger, a psychiatrist, and Christina Maslach, a social psychologist, were two of the first researchers to look into the phenomena of burnout (Nápoles, 2022). The psychologist Herbert Freudenberger coined the word ‘burnout’ in a clinical sense in 1974, describing it as particularly relevant to caring professions. More than four decades later, burnout is still viewed as affecting only individuals in emotionally demanding professional careers (Samra, 2018).

Burnout has been defined as a reaction to chronic emotional stress that includes three components: emotional and/or physical exhaustion, decreased job productivity, and over depersonalization (Perlman and Hartman, 1982). Burnout as a social problem was defined by both practitioners and social commentators long before it became a focus of research study (Nápoles, 2022). Maslach described burnout as ‘a prolonged response to chronic emotional and interpersonal stressors on the job, and is defined by the three dimensions of exhaustion, cynicism, and inefficiency’ (Maslach et al., 2001).

According to Schaufeli et al. (2009), the pattern of events in which interest in burnout seems to have grown is associated to the economic growth of the nations concerned. Burnout has sparked the attention of researchers in these nations as their economies

continue to expand (Nápoles, 2022). Burnout is not listed in the fifth edition of the Diagnostic and Statistical Manual of Mental illnesses, the standard categorization of mental illnesses used in the United States, as of 2019. The World Health Organisation, on the other hand, has categorised burnout in its International Classification of Diseases, ICD-10 (1994). Thus, burnout is recognised as a medical diagnostic in certain countries (for example, Sweden and the Netherlands), but only as a psychological diagnosis in the United States (Nápoles, 2022).

In the 11th Revision of the International Classification of Diseases, burnout is classified as an occupational phenomenon (WHO factsheet: burnout, 2019). It is not considered a medical condition. ICD-11 defines burn-out as: 'Burn-out is a syndrome conceptualized as resulting from chronic workplace stress that has not been successfully managed. It is characterized by three dimensions: feelings of energy depletion or exhaustion; increased mental distance from one's job, or feelings of negativism or cynicism related to one's job; and reduced professional efficacy.'

1.2.2 Symptoms and characteristics of burnout

Burnout is characterised by three qualitative dimensions: exhaustion, cynicism, and a lack of professional efficacy. Exhaustion is a broad term that describes feelings of overstrain, tiredness, or fatigue caused by long-term involvement in an overly demanding work situation. Cynicism reflects an indifferent and distant attitude toward work, as well as disengagement and lack of enthusiasm for it. Professional efficacy is defined as feelings of competence, success, and accomplishment in one's work, all of which diminish as burnout develops (Ahola et al., 2006).

There are three major areas of symptoms that are considered burnout signs (Depression:

What Is Burnout?, 2020):

- Exhaustion: Affected people feel depleted and emotionally spent, unable to cope, tired and depressed, and lacking in energy. Pain and gastrointestinal (stomach or bowel) issues are examples of physical symptoms.
- Alienation from (work-related) activities: Burnout patients perceive their occupations to be more demanding and irritating. They may become cynical about their working circumstances and co-workers. At the same time, people may become emotionally detached from their profession and become numb to it.
- Reduced performance: Burnout mostly impacts daily responsibilities at work, at home, or when caring for family members. People who are burnt out are dissatisfied with their jobs, find it difficult to focus, feel listless, and lack creativity.

Burnout is a continual process produced by a continuing, typically low-level loss of resources, according to S. E. Hobfoll's COR-Theory of Conservation of Resources, which focuses on four resources (that is objects, conditions, personal characteristics, and energy). A chronic threat to valued resources, according to the Conservation of Resources hypothesis, leads to burnout, and these resources may also be linked to work performance. Burnout may be characterised as a spiral of resource loss that has its dynamic at the intersection of work stress and inadequate coping. Those who suffer from burnout either see their resources threatened with loss, lose them, or fail to appropriately obtain new resources following a substantial resource commitment (Nowacka et al., 2018).

1.2.3 Factors leading to Burnout

The burnout process emerges from the interplay of the work environment and human

characteristics. The causes of burnout can be divided into three groups (Nápoles, 2022):

- Individual factors (low self-esteem, insecurity, dependency, a sense of external control, low self-efficacy);
- Interpersonal factors (regular contact with people in difficult situations, focusing on the traumatic experience of others); and
- Organisational factors (poor management system, low status of employment in social hierarchy, human resource scarcity, little pay for effort, poor working circumstances, interpersonal difficulties, rivalry, lack of trust, violence).

Researchers have addressed both psychological and organizational aspects that contribute to burnout. On one end of the range, there are characteristics of people that make them prone to burnout. (Maslach et al., 2001) (Nápoles, 2022). Others say that the cause of burnout is external, with organisational and management systems having a bigger part in why a person feels burned out. Maslach (1982a) identified personal traits such as motivations, needs, values, self-esteem, and emotional expressiveness and control, implying that these internal qualities determined how someone dealt with external sources of emotional stress and helped to explain why Person A experienced burnout in a specific job setting but not Person B (Nápoles, 2022).

Also referring to personal characteristics, burnout was thought to be more frequent in those who had Type A personality and behavioural traits. People with Type B personalities, on the other hand, were more relaxed and handled stress better. Similarly, Maslach et al. (2001) discovered that those with low levels of hardiness (for example, participation in everyday activities, a sense of control over events, and openness to change) had greater levels of burnout. People with an external locus of control were more likely to experience burnout than those with an internal locus of control (Nápoles, 2022).

The widely held belief is that certain aspects of work and organisation contribute to employee burnout. Longer and harder working hours, as well as less job recognition were identified as potential factors. Job burnout was further exacerbated by poor management and organization. If the agency's goals were unclear, staff roles were unclear, bureaucratic hassles predominated, or communication between management and employees was unclear and unsupportive, the employee found it especially difficult to provide good service, treatment, instruction, or care to recipients. Excessive loads, tight regulations, and inefficient leadership were also cited as issues (Nápoles, 2022).

A model was developed to study how companies lead to employee burnout, stating that burnout is an issue of the social context in which individuals work rather than the person. Burnout was more frequent when there was a mismatch between the nature of the job and the character of the person executing the job. This discrepancy might be seen in six different ways. (Nápoles, 2022):

- Work overload (work that is more intensive, takes more time, is more difficult, and creates exhaustion as a result of the overload)
- A lack of control (where workers do not believe they have the authority to make decisions or influence the procedures that affect their job),
- Insufficient reward (when staff member does not feel welcomed or do not experience genuine enjoyment);
- Breakdown in community (when workers lose a pleasant relationship with their coworkers),
- Absence of fairness (for example, disparities in workload, income, or respect);
- Conflicting values (when the value expectations of the job do not align with the

employee's own principles).

Among the factors responsible for developing a burnout syndrome, an important role is also played by socio-demographic factors. The most common ones include: age, work experience, sex, marital status, parental status, education, workplace, managerial position, and additional employment (Nowacka et al., 2018). Burnout was also related to education, socioeconomic status, and work experience among women. Women with a low basic education, a blue-collar job, and at least 17 years of experience in the same profession had higher burnout scores. Burnout was associated with marital status in men. Men who were single, divorced, or widowed had higher burnout scores (Ahola et al., 2006).

Gender had a significant univariate effect on exhaustion and cynicism. Men scored higher on cynicism, while women scored higher on exhaustion. Age had a significant univariate effect on exhaustion, cynicism, and lack of professional efficacy (Ahola et al., 2006). Burnout was slightly higher among women who had not completed comprehensive schooling compared to those who had. Burnout was significantly affected by socioeconomic status, work experience, working-time arrangement, and the number of weekly working hours. Marital status had a significant multivariate effect on male burnout (Ahola et al., 2006).

Women with burnout had a higher rate of impaired awakening, lower job control, a higher proportion of unpaid work, and worked more ‘with people’ than men. Men with burnout had a smaller social network and worked more overtime than women. In comparison to the general population, patients with burnout had a higher rate of unemployment, a more limited social network, and higher work demands. Women with burnout reported less emotional support, a more sedentary work environment, high job strain, and worked ‘with

people’ to a greater extent than women in the general population (Stenlund et al., 2007).

1.2.4 Consequences of burnout

Burnout results in a number of negative consequences for both the individuals who suffer from it and the organizations where these professionals' function. These implications are initially psychological in nature, but as time passes, they translate into negative impacts on workers' physical/biological health and habits, which will have unfavourable organizational consequences (Edú-Valsania et al., 2022).

- Psychological Consequences: The psychological changes caused by the burnout syndrome at work occur on both cognitive and emotional levels. Various studies have linked this condition to issues with focus and memory, trouble making decisions, decreased coping capability, anxiety, sadness, unhappiness with life, poor self-esteem, sleeplessness, irritability, and increased alcohol and nicotine intake. Other researchers have found that this condition may enhance the risk of suicide (Edú-Valsania et al., 2022).
- Health Consequences: Several studies conclude that employees with higher levels of burnout are more likely to suffer from a variety of physical health problems, including musculoskeletal pain, gastric changes, cardiovascular disorders, headaches, increased vulnerability to infections, insomnia, and chronic fatigue. Burnout has also been shown to severely raise blood cortisol levels, making it a separate risk factor for type 2 diabetes. Now, the way these symptoms express themselves is not the same in every person, nor do they all have to occur at the same time (Edú-Valsania et al., 2022).
- Behavioural Consequences: Besides physical and psychological health issues, burnout is closely associated with job dissatisfaction, poor organizational commitment,

increased absenteeism, turnover intention, and performance drops. Some employees with burnout syndrome, on the other hand, may be justified in leaving their jobs; nevertheless, others choose to continue working. This may result in work presenteeism (when people attend to work but do not fully complete their tasks owing to health difficulties). Furthermore, burnout can lead to aberrant and counterproductive conduct in personnel, hostility among colleagues and towards consumers, alcohol and psychotropic drug use, misuse of company assets, and even theft (Edú-Valsania et al., 2022).

However, the nature and progression of these specific repercussions (psychological, physical, and behavioural) differ in each situation. In this sense, and while it is not always simple to distinguish between them, four degrees of burnout syndrome have been identified (Edú-Valsania et al., 2022):

- Mild: people affected have mild, unspecific bodily symptoms (headaches, back pain, low back pain), fatigue, and become less operational.
- Moderate: insomnia, attention, and concentration problems develop. Detachment, irritability, cynicism, fatigue, boredom, and a growing lack of motivation occur at this level, leaving the individual exhausted with emotions of frustration, incompetence, guilt, and low self-esteem.
- Severe: increasing absenteeism, task aversion, and depersonalization, as well as abuse of psychotropic drugs and alcohol.
- Extreme: extreme behaviour such as solitude, aggression, existential crises, chronic depression, and suicidal ideation.

- Organizational Consequences: Individually, the negative effects of burnout translate into low motivation and performance, which can spread throughout the work unit and

the organization, resulting in a decline in service quality. Employees suffering from burnout also have an impact on the rest of the organization, producing more disputes or interrupting work activities, lowering productivity and prolonging production timelines. As a result, according to the emotional contagion theory, burnout can generate a ‘contagion effect,’ resulting in a negative working environment. This condition is also known to cause large economic losses due to absenteeism, inefficiency, and counterproductive behaviours. (Edú-Valsania et al., 2022).

1.2.5 Interventions to manage burnout

Given the negative consequences of burnout, it is critical to discover practical remedies and review preventative measures. Researchers have proposed ways to prevent burnout and general stress in three major categories: in-school settings, out-of-school settings, and mentoring/induction programmes. By changing one's workplace conditions or emotional responses to stress, one might reduce it. Alternatively, there may be challenges that may be alleviated by improving work-life balance. Mentoring and induction programs received the most attention in the research literature when it comes to best practices for burnout prevention (Nápoles, 2022).

In-class solutions have often focused on becoming more prepared and involved with the job environment. Better time management was suggested by Hylton (1989), who saw it as a stress-relieving strategy. These included reviewing objectives, preparing ahead of time, and prioritizing (Hylton, 1989). Engagement is believed to be the exact opposite of burnout. As a result, the burnout process begins with the wearing down of engagement. Engagement is described by energy, involvement, and efficacy, which are the polar opposites of the three burnout qualities (Freudenberger and Richelson, 1980). Job crafting is a single best strategy for increasing engagement. Job crafting, is ‘the self-

initiated changes that employees make in their own job demands and job resources to attain and/or optimize their personal (work) goals' (Tims et al., 2012). Another strategy to boost job happiness is to build and sustain pleasant, high-quality interpersonal relationships (Nápoles, 2022).

A lot of recommendations for preventing burnout focused on striking a better balance between work and extracurricular activities. Researchers typically advise rest, exercise, avoiding long hours or overtime, minimising job overload, and emphasising other aspects of life. Setting suitable boundaries is another key approach (Freudenberger and Richelson, 1980) (Maslach, 1982). Setting personal standards and creating time for oneself and others was beneficial to participants, especially with the aid from supportive people. Although work-life balance was commonly mentioned, achieving it proved to be a more challenging task (Nápoles, 2022).

Previous research on the content, intensity, form, assessment, and time point of follow-up of interventions to reduce physician and nurse burnout has been published. There was individual-focused therapy, structural or organisational interventions, and combination approaches. Control of emotion was a key psychological factor associated with burnout. Self-regulation or control of emotion practices such as mindfulness was used to reduce doctor burnout. Individual-focused therapy included self-care lectures, stress management techniques, and communication skills training. Therapy, yoga, massage, mindfulness, and meditation have all been mentioned. Among the structural or organizational treatments were workload or schedule rotation, stress management training, group face-to-face delivery, teamwork/transitions, debriefing sessions, and a focus group (Zhang et al., 2020).

1.2.6 Burnout in connection with depression, anxiety, and stress

Depression (also known as depressive disorder) is a popular mental disorder. It is characterized by a long duration of depression or lack of pleasure or interest in activities. It is distinguished by persistent sadness and a loss of interest or pleasure in previously rewarding or pleasurable activities. It can also interfere with sleep and appetite. Tiredness and lack of concentration are common symptoms. Depression is a leading cause of disability worldwide, contributing significantly to the global disease burden. Depression's effects can be long-lasting or recurring, and they can have a significant impact on a person's ability to function and live a fulfilling life.

There are several risk factors for depression, including biological (genetic, chronic illnesses, terminal illness), psychological, social (familial, relationships, violence, disasters), cultural (religion, caste, beliefs, attitudes), and economic variables. The use of alcohol and drugs could aggravate the disease. It is classified as mild, moderate, or severe according on the quantity and severity of symptoms. There are effective therapy alternatives available (WHO factsheet: Depression, 2023). Depression affects an estimated 3.8 percent of the population, including 5 percent of adults (4% of males and 6% of women) and 5.7 percent of individuals over the age of 60. Depression affects around 280 million individuals worldwide. Women are around 50 percent more likely than males to suffer from depression. (WHO factsheet: Depressive disorder (depression), 2023).

Certain symptoms associated with burnout can also be found in depression. These include extreme exhaustion, feeling down, and reduced performance. Because the symptoms are similar, some persons may be labelled with burnout when they are actually suffering from depression. As a result, it is critical not to (self-) diagnose burnout too fast. This might

result in the improper treatment: For example, recommending someone suffering from depression to take a long vacation or time off from work. People who are ‘only’ tired from work can recuperate if they follow this guidance. People suffering from depression, on the other hand, may make matters worse since the type of assistance they require is entirely different, such as psychological counselling or medicine (Depression: What Is Burnout?, 2020).

However, certain aspects of burnout are quite particular. For example, in burnout, the majority of the issues are work-related. Negative thoughts and feelings of depression affect many aspects of life, not just work. Other common manifestations of depression include low self-esteem, hopelessness, and suicidal tendencies (thinking about killing yourself). These are not considered typical burnout symptoms. People who are burnt out do not usually suffer from depression. However, burnout may raise the risk of depression (Depression: What Is Burnout?, 2020). Additionally, it appears that one key distinction between burnout and depression is that one is context-free and ubiquitous, whereas the other is associated to a job and appears to be situation-specific (Maslach et al., 2001).

Anxiety is another factor to be linked to burnout, but it has received less attention than depression. Anxiety disorders are marked by excessive fear and worry, as well as associated behavioral problems. The symptoms are severe enough to cause substantial discomfort or difficulty in functioning. There are several types of anxiety disorders, including generalized anxiety disorder (excessive worry), panic disorder (panic attacks), social anxiety disorder (excessive fear and worry in social situations), separation anxiety disorder (excessive fear or anxiety about separation from those individuals with whom the person has a deep emotional bond), and others. There are effective psychological treatments available, and medication may be taken depending on age and severity. Anxiety disorders affected 301 million individuals in 2019, including 58 million children

and adolescents (WHO factsheet: Mental disorders, 2022).

Anxiety is a common psychological condition that serves as a protective factor in potentially dangerous situations. Prolonged anxiety, on the other hand, may cause psychological distress that interferes with an individual's daily functioning. According to some, work stress may be a risk factor for anxiety symptoms (Sun et al., 2012). In Vassilopoulos (2012)'s study, for example, individuals who reported high levels of social anxiety also reported high levels of burnout. Furthermore, job expectations, extrinsic effort, and over-commitment were linked to higher levels of anxiety. Similarly, emotional fatigue and cynicism were positively connected to anxiety symptoms, but professional effectiveness was negatively related to anxiety symptoms. That is, the more emotionally exhausted, cynical, and ineffective a person feels about his or her profession, the more nervous he or she will be (Koutsimani et al., 2019).

Stress can be described as a condition of psychological strain or distress generated by exposure to challenging or demanding situations known as stressors. Stress is a normal human response that motivates us to face problems and risks in our lives. To some extent, everyone endures stress. The way we respond to stress, on the other hand, has a significant impact on our general well-being (WHO factsheet: Stress, 2023). Stress makes it difficult to relax and can cause a variety of feelings such as anxiety and irritation. We may find it difficult to focus when we are worried. We may have headaches or other physical discomfort, an unsettled stomach, or difficulty sleeping. We may find ourselves losing our appetites or eating more than normal. Chronic stress can exacerbate pre-existing health issues and increase our consumption of alcohol, cigarettes, and other drugs. Stressful events can also induce or worsen mental health issues, most notably anxiety and depression, which need medical attention. When we have a mental health problem, it is often because our stress symptoms have become persistent and have begun

to interfere with our everyday functioning, particularly at work or school (WHO factsheet: Stress, 2023).

1.2.7 Tools to asses Burnout

Burnout assessment tools are valuable instruments designed to measure and evaluate levels of burnout experienced by individuals. Several validated tools have been developed to assess burnout, each focusing on different aspects of the phenomenon. Some widely recognized instruments include the Maslach Burnout Inventory (MBI), Burnout Measure (BM), Copenhagen Burnout Inventory (CBI), Oldenburg Burnout Inventory (OLBI) and Burnout assessment tool (BAT). These assessments utilize questionnaires to measure various dimensions of burnout and provide individuals and organizations with valuable data to address burnout effectively.

The Maslach Burnout Inventory (MBI)

The Maslach Burnout Inventory (MBI) is considered the gold standard of burnout assessment instruments. MBI (is by far the most extensively used instrument for measuring burnout, appearing in over 90 percent of journal publications and dissertations (Schaufeli et al., 2009). The MBI is divided into three scales: emotional weariness (9 items), depersonalization (5 items), and personal accomplishment (8 items). The scale goes from 0 (‘never’) to 6 (‘every day’). Burnout is defined by extreme exhaustion and depersonalization, as well as a lack of personal accomplishment.

The MBI's psychometric quality is supported by a substantial amount of research, notably in the human services professions. Except in certain depersonalization scale samples, internal consistency (Cronbach's Y) is often significantly above 0.70. Furthermore, the

validity of the MBI's three-factor structure is proven utilising cross-sectional and longitudinal designs, as well as across occupational domains such as healthcare, academia, and manufacturing. Furthermore, the three-factor model was shown to be consistent across occupations and countries (Bria et al., 2014).

Burnout Measure (BM)

The Burnout Measure is the second most used instrument, appearing in approximately 5 percent of all burnout studies. It comprises of 21 tasks that are scored to determine a person's level of physical, emotional, and mental exhaustion. The 21-items are exhaustion (6 items), demoralisation (10 items), and loss of motive (5 items) (Schaufeli and Enzmann, 1998a). BM-items were graded on a 7-point scale, with 1 being ‘never’ and 7 being ‘always.’

Oldenburg Burnout Inventory (OLBI)

The OLBI consists of items that are framed positively and negatively to assess the two core dimensions of burnout: exhaustion and disengagement (from work). It was originally developed and validated among various German occupational groups, the United States and Greece have all confirmed the OLBI's factorial validity (Demerouti, 2012). The OLBI consists of 16 favourably and negatively constructed items that are designed to assess the two aspects of burnout. The exhaustion subscale's eight items are broad and correspond to general emotions of emptiness, overwork, a strong need for relaxation, and a state of physical fatigue. The Disengagement subscale's eight items deal with disconnecting oneself from the object and content of the job at hand, as well as negative, cynical attitudes and behaviour towards one's work in general. A 4-point answer style is utilized for both subscales (1 = strongly disagree, 4 = strongly agree) (Demerouti, 2012).

A total OLBI score can be reached by summing the two sub-totals.

OLBI is not limited to human services; it may be used to assess burnout in all employees, regardless of occupation. (Reis et al., 2015). The psychometric properties of Tamil OLBI were inspected with the help of Confirmatory Factor Analysis, Internal Consistency and Reliability and Construct Validity. This study proposes that Tamil OLBI is a strong instrument for the estimation of burnout in different occupational contexts (Subburaj and Vijayadurai, 2016). The diversity of working groups (ranging from blue to white collar workers) where OLBI was already used, presenting in general good values of internal consistency, makes OLBI a reliable instrument to use in different labour contexts (Reis et al., 2021).

Copenhagen Burnout Inventory (CBI)

The Copenhagen Burnout Inventory (Kristensen et al., 2005) was developed to measure burnout in a variety of contexts. Personal burnout, client-related burnout, and work-related burnout are three sub-dimensions of the 19-item CBI. The questionnaire's three sections were developed to be used in diverse domains. Fatigue and exhaustion are at the core of burnout, according to the CBI. The methodological features of the CBI measures were evaluated in a sample of human service personnel using the PUMA research (Project on Burnout, Motivation, and Job Satisfaction). The authors found that the findings indicate that the CBI instrument has extremely good reliability and validity. They also stated that it is available in a variety of languages in a number of nations (Kristensen et al., 2005).

Burnout assessment tool (BAT)

The Burnout Assessment Tool (BAT) is a new burnout measure developed by Schaufeli

et al. to replace the Maslach Burnout Inventory (MBI). A 23-item version and a shorter 12-item version exist. The BAT measures four burnout dimensions: Exhaustion, Mental Distance, Cognitive Impairment, and Emotional Impairment (Shoman et al., 2021).

1.2.8 Tools for Depression, Anxiety and Stress

Assessing depression, anxiety, and stress is an important step in understanding and managing these mental health conditions. Several tools have been developed to help professionals and researchers evaluate the severity and impact of these disorders. Here is an introduction to the commonly used tools for assessing depression, anxiety and stress:

Beck Depression Inventory (BDI):

The BDI is a is a 21-item, self-reported rating inventory that measures characteristic attitudes and symptoms of depression (Beck, et al., 1961). It measures various aspects of depression, including mood, pessimism, guilt, and suicidal thoughts.

Hamilton Rating Scale for Depression (HAM-D)

The HAM-D is a clinician-administered scale that evaluates the severity of depressive symptoms. It consists of 17 items covering areas such as mood, insomnia, anxiety, and weight loss. The scale has shown a sensitivity of 86.4 percent and a specificity of 92.2 percent (Hamilton, 1960).

Patient Health Questionnaire (PHQ-9)

The PHQ-9 is a self-report tool used to assess depression. It consists of nine items that evaluate the frequency and severity of depressive symptoms over the past two weeks. PHQ-9 is a new tool for making criteria-based diagnoses of depressive and other common

mental disorders in primary care. The PHQ depression scale (also known as the PHQ-9) is half the length of many other depression measures, has comparable sensitivity and specificity, and contains the actual 9 criteria used to diagnose DSM-IV depressive disorders. The PHQ-9 is the 9-item depression module from the full PHQ. The PHQ-9 score as a severity measure can range from 0 to 27, because each of the 9 items can be scored from 0 (not at all) to 3 (nearly every day). Major depression is diagnosed when 5 or more of the 9 depressive symptom criteria are present for at least ‘more than half the days’ in the previous 2 weeks, with one of the symptoms being depressed mood or anhedonia. Other depression is diagnosed when two, three, or four depressive symptoms have been present for ‘more than half the days’ in the previous two weeks, with one of the symptoms being depressed mood or anhedonia (Kroenke et al., 2001).

The PHQ's diagnostic validity was established in two studies involving 3,000 patients in eight primary care clinics and 3,000 patients in seven obstetrics-gynaecology clinics. PHQ-9 scores more than 10 exhibited a sensitivity of 88 percent and a specificity of 88 percent for Key Depressive Disorder. The tool's reliability and validity have shown that it has good psychometric qualities. The PHQ-9 has been shown to have good internal consistency. Cronbach stats of .86 and .89 were obtained in a study including two separate patient populations. A mental health practitioner conducted 580 structured radio interviews to determine the validity of the criteria. According to the findings of these interviews, those who scored high (10) on the PHQ-9 were 7 to 13.6 times more likely to be diagnosed with depression by a mental health professional. Individuals who scored low (<=4) on the PHQ-9 had a less than 1 in 25 chances of experiencing depression. (Kroenke et al., 2001).

Generalized Anxiety Disorder 7-item Scale (GAD-7)

The GAD-7 (Spitzer et al., 2006) is a self-report measure designed to assess the severity of generalized anxiety disorder. It consists of seven items that evaluate the frequency and severity of anxiety symptoms. A score of 10 or greater on the GAD-7 represents a reasonable cut point for identifying cases of GAD. Construct validity was demonstrated by the fact that increasing scores on the GAD-7 scale were strongly associated with multiple domains of functional impairment.

Perceived Stress Scale (PSS)- 4

The PSS (Cohen et al., 1983) is a self-report tool used to measure the degree to which individuals perceive their lives as stressful. It consists of 4 items that assess the frequency and intensity of stress experienced in the past month. Higer the score, higher the chance of experiencing stress.

Hospital Anxiety and Depression Scale (HADS)

The HADS is a self-reported measure used to assess anxiety and depression in medical settings. The HADS (Zigmond and Snaith, 1983) is a 14-item scale developed to assess anxiety and depression symptoms in medical patients, with a focus on minimizing the influence of physical sickness on the overall score. The depression items are primarily concerned with the anhedonic symptoms of depression. The severity of each item is graded on a 4-point scale. The HADS generates two scales, one for anxiety (HADS-A) and one for depression (HADS-D), to distinguish between the two states. Scores of 11 or above on any scale indicate a solid case (Zigmond and Snaith, 1983).

Depression, Anxiety, Stress Scale – 21 (DASS 21)

The Depression Anxiety Stress Scales 21 (DASS-21) is a short form of Lovibond and Lovibond's (1995) 42-item self-report measure of depression, anxiety, and stress (DASS) (Henry and Crawford, 2005). The DASS-21 is a well-established instrument for measuring depression, anxiety, and stress with good reliability and validity reported from Hispanic American, British, Australian and Asian adults (Oei et al., 2013). Five studies have used factor analysis to test the construct validity of the full length DASS, with two of these also assessing the DASS-21. The DASS-21 is a self-reported questionnaire consisting of 21 items, 7 items per subscale: depression, anxiety, and stress. Recommended cut-off scores for conventional severity labels (normal, moderate, severe) are as follows. Scores on the DASS-21 will need to be multiplied by two to calculate the final score.

Table 1.1. Recommended cut-off scores for DASS 21 scale

Categories	Depression	Anxiety	Stress
Normal	0-9	0-7	0-14
Mild	10-13	8-9	15-18
Moderate	14-20	10-14	19-25
Severe	21-27	15-19	26-33
Extremely Severe	28+	20+	34+

1.2.9 PhD program

A Doctor of Philosophy programme, commonly known as a PhD programme, is the highest level of academic degree one may pursue in a certain field of study. It is a

research-oriented programme that aims to provide students with the information, skills, and competence needed to undertake original research and make major contributions to their subject (Yorke and Longden, 2008)

A PhD program's structure usually comprises several major components:

- Coursework: PhD programs often begin with a period of coursework to give students with a firm foundation in their field of study. These courses may address advanced themes, research procedures, and theoretical frameworks pertinent to the field of study (Walker et al., 2009).
- Comprehensive exams: PhD candidates are often expected to pass comprehensive tests after finishing courses to demonstrate their knowledge of the area. These tests examine their knowledge as well as their ability to critically evaluate existing research and theoretical frameworks (Golde, 2005).
- Research Proposal: After passing the comprehensive examinations, students commonly write a research proposal explaining their desired research study. Before the student may begin their study, this proposal must be evaluated and approved by a faculty committee (Phillips and Pugh, 2000).
- Research and Dissertation: At the heart of a PhD programme is original research conducted under the supervision of a faculty adviser. PhD students do research in their chosen topic, gather and analyse data, and deliver new knowledge to the field. The study concludes with a written dissertation, which is a lengthy document that details the research methods, findings, and conclusions (Murray, 2002).
- Defence and Examination: After finishing the dissertation, students defend their work in front of a faculty committee. A presentation is usually followed by a question-and-answer session in which committee members assess the student's understanding of the

study and its implications. The PhD degree is awarded after a successful defence (Bair and Haworth, 1999).

The duration of a PhD program varies depending on the institution, discipline, and individual circumstances. Generally, it takes between three to seven years to complete a PhD program. Factors that can affect the duration include the nature of the research, availability of funding, teaching or assistantship responsibilities, and the student's progress in meeting program requirements (Nerad and Evans, 2014).

1.2.10 Studies on Burnout among research students

University students have six times more prevalence of depressive disorders than the general population (Evans et al., 2018). Additionally, it is more common in early semesters compared to late semesters (Deb et al., 2016), and it is more common in post-graduate and research students than undergraduate students (Chen et al., 2013). They are at a greater risk of burnout, which has serious detrimental effects on their careers.

According to the 6,300-student global survey by Nature (Woolston, 2019), 36 percent of PhD students have sought treatment for depression or anxiety. The prevalence of depressive disorders among university students is between 33 and 41 percent in the US and Canada, between 6.1 and 34.2 percent in Europe, and between 4 and 79.2 percent in Asia. Depressive disorders were identified in studies from African universities to range from 16.2 to 67 percent (L. T. et al., 2022).

There have been discrepancies in recent studies on the prevalence of burnout. In high-income countries (HICs), such as Saudi Arabia, the frequency was found to be 30.5 percent among students enrolled in healthcare-related courses. In Uganda, the frequency was 54.5 percent in a comparable cohort. Such disparities in incidence rates have been

ascribed to differing levels of exposure to socioeconomic, political, health, and conflict-related stress factors (Kaggwa et al., 2021).

Only a few research have been done in studying the mental health of the PhD students in India. One such study is ‘A Study of Mental Health of PhD Students in Relation to Research Environment and Other Demographic Variables in Haryana State Universities’ (Hooda and Choudhary, 2021). 500 PhD students by using random sampling were studied using random sampling with a self-prepared questioner in the form of google form was used for data collection. The study's findings showed that gender and year of registration had a big impact on mental health. However, it also showed that the supervisor's gender, stream, or marital status had no real impact on their mental health. The study also revealed a strong, substantial association between the research environment and mental health.

Another study done in Kerala is ‘Prevalence and underlying factors of depressive disorders among PhD students: a mixed-method study in the Indian context’ (L. T. et al., 2022). The study aimed at estimating the prevalence of depressive disorders among PhD students and to analyze the underlying factors in the Indian context. They used a mixed-method approach involving survey and in-depth interviews. The study was conducted among 240 PhD students using multistage cluster sampling in two universities in Kerala, one in Kannur and one in Thiruvananthapuram. Data was collected using self-administered PHQ9 form. And in-depth interviews were conducted among 12 students using semi-structured interview guide. The prevalence of no/minimal, mild, moderate, moderately severe, and severe depressive disorders were 31.7, 41.7, 17.9, 6.7 and 2.1 percent respectively (L. T. et al., 2022). Students belonging to economically weaker section, having limited knowledge of local language, and earning less than INR 20,000/month were more likely to report moderate to severe depressive disorders. In

addition, thematic analyses of interviews found that financial hardship, disagreement between student-supervisor, compromised students' support services and an uncertain job market were the key factors affecting the mental health of students and inhibiting academic performance (L. T. et al., 2022).

Another study on the burn out and its correlates among interns and residents at Government Medical College, Thiruvananthapuram, Kerala, found the work-related burnout prevalence as 34.8 percent among postgraduates (Ratnakaran et al., 2016). There are no studies in my knowledge on the burnout among the research scholars' group in the Kerala and Indian context.

1.2.11 Factors affecting burnout in research students

Burnout is a common phenomenon experienced by research students, particularly those pursuing graduate studies. Burnout is a state of physical, mental, and emotional exhaustion caused by chronic stress. It can affect individuals in various fields, including research students. Several factors can contribute to burnout in research students.

- Workload and time pressure: Heavy workloads, long hours, and tight deadlines can all contribute to research student burnout. The pressure to generate results in a short period of time may be overwhelming and exhausting (Sonnentag and Fritz, 2015).
- Poor work-life balance: Finding it difficult to reconcile personal life, relationships, and leisure activities with the demands of research might raise the risk of burnout. Neglecting one's own well-being and leisure time can result in chronic stress and exhaustion (Demerouti et al., 2001).
- Perfectionism and high self-expectations: Research students frequently have high self-expectations and strive for excellence. These inclinations can lead to a lot of pressure,

self-criticism, and fear of failure, all of which contribute to burnout (Stoeber and Otto, 2006).

- A lack of support and mentoring: Research students who receive insufficient support from advisors and mentors are more likely to burn out. Isolation and stress can be exacerbated by a lack of supervision, communication problems, and a lack of emotional support (Sverdlik et al., 2018).
- Uncertainty in research objectives, project requirements, and performance expectations: Ambiguity in research goals, project requirements, and performance expectations can all lead to burnout. When research students are unclear about their duties and responsibilities, they may suffer stress and dissatisfaction (Morgeson and Humphrey, 2006).
- Lack of control and autonomy: Burnout can be exacerbated by a lack of decision-making power and control over research initiatives. When research students have limited control over their work procedures and project direction, they may get frustrated and disengaged (Deci and Ryan, 2000).

To prevent burnout, research students should prioritize self-care, seek support from peers and faculty, and set realistic goals and expectations. It is also essential to maintain a healthy work-life balance and to seek help if one is experiencing symptoms of burnout. It is worth noting that the factors contributing to burnout can vary among individuals and the interaction between these factors can also play a role. It is essential to recognize and address these factors to support the well-being and success of research students.

1.2.12 Gender roles

Gender roles are defined by the various expectations that people, groups, and societies

have of people based on their sex as well as by the values and beliefs that each society holds regarding gender. Gender roles are the result of interactions between individuals and their environments, and they provide cues to people about what type of behaviour is considered appropriate for which sex. Appropriate gender roles are set by a society's beliefs about sex differences (Blackstone, 2003).

Understanding the term ‘gender’ is essential for understanding the phrase ‘gender roles.’ Social terms like ‘gender’ and ‘sex’ are commonly used interchangeably. Gender and sex are two distinct concepts. Sex is a biological concept that is determined by an individual's primary sex characteristics. Gender, on the contrary, refers to the meanings, values, and characteristics that different sexes are associated with. Gender is referred to as a social construction because humans created the concept of gender socially (Blackstone, 2003).

The roles that men and women are expected to play based on their sex are known as gender roles. Women have traditionally been thought to be more nurturing than men in many Western societies. Thus, the traditional interpretation of the feminine gender role suggests that women should act in a nurturing manner. A woman could play the traditional feminine gender role by nurturing her family by working full-time within the home rather than working outside the home. Men, on the contrary, are assumed to be leaders by traditional gender roles. As a result, the traditional view of the masculine gender role suggests that men should be the heads of their households, providing financial support and making major family decisions. While these views continue to dominate in many areas of society, alternative perceptions on traditional gender roles are gaining traction in the twenty-first century (Blackstone, 2003).

Burnout is speculated to be more common in women, according to some theories (Maslach et al., 2001). Such speculations are risky for two reasons. First, work peers and

superiors may portray women as being more likely to burn out than men. According to research, people have a stereotype that women are more prone to stress, and thus burnout, than men. Even trained clinicians and physicians are susceptible to such assumptions, as they are more likely to diagnose female patients with depression and anxiety disorders than male patients. If managers believe that female employees are more likely to burn out than male employees, women may be passed over for challenging assignments and promotions (Purvanova and Muros, 2010) .

Second, by assuming that burnout is primarily a female experience, men may fail to receive adequate care or attention when they do experience burnout (Purvanova and Muros, 2010). The latter point is especially noteworthy when one considers that men and women may experience burnout in different ways. Men tend to score higher on depersonalization than women, while women tend to score higher on emotional exhaustion, in their qualitative review of the burnout literature. This is in line with gender role theory, which asserts that men are more likely to shut off and withdraw under stress (that is depersonalization) because they learn to conceal their emotions. In contrast, women should be more likely to express feelings of emotional and physical exhaustion (for example, emotional exhaustion) because they learn to display their emotions. Emotion-expressive behaviours, on the other hand, are associated with psychological distress in both the general public and trained professionals, whereas emotion-suppressive behaviours are associated with strength, masculinity, and psychological adjustment. This suggests that men's workplace burnout may go unnoticed. In short, presuming that women experience burnout at a higher rate than men could result in implicit or overt workplace discrimination against women and a failure to recognise men's burnout (Purvanova and Muros, 2010).

Women and men have very similar correlates of publication productivity and time to PhD completion, but there are some gender differences. In terms of publication output, discover that good supervision had a greater impact on men than on women; and getting married during the PhD reduced women's publication productivity while increasing men's (Fisher et al. 2020). According to their findings, becoming a parent while pursuing a PhD was a major reason why women took longer to complete their degrees. Findings indicate that having a female supervisor, attending an institution with gender policies, and pursuing the PhD in a department where sexual harassment by faculty was perceived to be uncommon were enabling factors for women to complete their doctoral studies on time (Purvanova and Muros, 2010).

1.2.12.1 Child care and financial responsibilities

Child care can be a significant financial burden during a PhD program, as it often requires expensive day-care or nanny services. Additionally, the time demands of a PhD program can make it difficult to balance child care responsibilities with academic work. There are several potential solutions to this challenge, depending on individual circumstances. Some PhD students may be eligible for funding or support from their university, such as through grants or fellowships that provide child care subsidies. Some universities also have on-campus child care facilities that offer reduced rates for students. Another option is to seek out community resources, such as low-cost day-care programs or subsidized child care services. Many cities and states offer financial assistance to low-income families for child care, and some non-profit organizations provide free or low-cost child care services (Navarro-Cruz et al., 2023).

Additionally, PhD students can consider adjusting their schedules or workload to better accommodate child care responsibilities. This may involve working part-time or taking on

fewer courses per semester. It can also be helpful to establish a support network of friends, family, or other caregivers who can assist with child care responsibilities when necessary. Ultimately, it is important for PhD students with children to prioritize self-care and seek out resources and support that can help them manage both their academic and parental responsibilities (Navarro-Cruz et al., 2023).

1.2.13 Science and technology institutions in Thiruvananthapuram, Kerala

According to Oxford, Science encompasses the systematic study of the structure and behavior of the physical and natural world through observation and experiment, and technology is the application of scientific knowledge for practical purposes. Various science and technology subjects include physical science, Chemical science, Biological science, Bioengineering, Engineering, Biomaterial science and technology, Applied Sciences & Technology, Health science, medical science, Mathematics, and statistics.

Various science and technology institutions were identified in Thiruvananthapuram of which 12 institutions were selected providing PhD program including SCTIMST (Sree Chitra Tirunal Institute for Medical Sciences and Technology), ; IIST (Indian Institute of Space Science and Technology), Valiamala; IISER (Indian Institute of Science Education and Research), Vithura; National Centre for Earth Science Studies, Aakkulam; CET (College of Engineering Thiruvananthapuram), RCC (Regional Cancer Centre), Rajiv Gandhi Centre for Biotechnology, Poojapura; College of Agriculture Vellayani; CSIR-National Institute for Interdisciplinary Science and Technology, Pappanamcode; Government Ayurveda College and research centre, Vanchiyoor; Digital University, Kerala; and University of Kerala, Karyavattom. Each institution has its own areas of specialization and contributes significantly to research, education, and technological advancements in the country.

1.3 Rationale for this study

There have been many studies on the mental health and well-being of various stakeholders in education, such as students, teachers, managers, administrators, and so on, and there is sufficient literature to guide a researcher in grasping the concept of mental health, possible causes, measures to reduce mental disorders, and so on. It is also true that there is a severe lack of research on the mental health of PhD students in their research environment. It is also worth noting that there is a severe lack of academic guidance and counselling at the university level in India, particularly at the research level. There is ample evidence that many research students face a variety of difficulties during their studies.

With sufficient well-proven evidence, the current paper aims to explore the concept of burnout and childcare responsibilities, financial responsibilities and research environment, as well as their possible co-relationship on different demographic variables. The findings of the studies could serve as the foundation for academic guidance and counselling services, as well as many newer future studies.

1.4 Objectives

The study aims to assess the prevalence of burn out among research students and explore how gender roles especially child care and financial burden influence burnout among research students.

The primary objective:

- To assess the prevalence of burnout among PhD students in science and technology institutions in Thiruvananthapuram

The secondary objectives:

- To study the relationship between gender roles (childcare responsibility and financial burden) and burnout among PhD students
- To explore the relationship between depression, anxiety and stress and burnout in PhD students

CHAPTER 2
METHODOLOGY

2.1 Study design

A quantitative cross-sectional survey to assess the prevalence of burnout among PhD students in science and technology institutions in Thiruvananthapuram, Kerala.

2.2 Study setting

The study was conducted in Thiruvananthapuram district. The number of science and technology institutions providing PhD programs in Thiruvananthapuram were identified to be 12, namely SCTIMST; IIST (Indian Institute of Space Science and Technology), Valiamala; IISER (Indian Institute of Science Education and Research), Vithura; National Centre for Earth Science Studies, Aakkulam; CET (College of Engineering Thiruvananthapuram), RCC (Regional Cancer Centre), Rajiv Gandhi Centre for Biotechnology, Poojapura; College of Agriculture Vellayani; CSIR-National Institute for Interdisciplinary Science and Technology, Pappanamcode; Government Ayurveda College and research centre, Vanchiyoor; Digital University Kerala; and Kerala university, Karyavattom. The request for permission to perform the study was denied by three institutions, while two institutions did not respond. As a result, I approached the remaining 7 institutions where the list of PhD scholars was compiled in order to set up the sample frame, and 305 online survey submissions were received.

2.3 Study Population

PhD students residing in Thiruvananthapuram district are the target population and the sampled population is the 12 science and technology institutions.

Inclusion criteria: full time PhD students in the age group of 25 to 45 years in 2nd year and above who consent for the study.

Exclusion criteria: students enrolled in part-time PhD mode and working elsewhere, enrolled in non-science disciplines such as history, the language arts, literature, philosophy, ethics, and religion, and art; and students unwilling to give consent.

2.4 Sample size estimation

Based on the study conducted in Government Medical College, Thiruvananthapuram, (Ratnakaran et al., 2016) the prevalence of burnout is expected to be 34.8 percent, with 5 percent absolute precision for the 95 percent confidence interval, the estimated sample size is 348, using the formula $n = \frac{z^2\ P(1-P)}{D^2}$, where z = 1.96 for alpha at 5 percent and two-sided, P = 34.8, and D = 0.05. The sample size was adjusted for population correction factor for the population size of 1500. Hence the size of 284 was estimated and further adjusted for an additional 20 percent of non-response, resulting in the final sample size of 341 which was rounded up to 350.

2.5 Sampling procedure

The number of science and technology institutions providing PhD programs in Thiruvananthapuram was identified to be 12. The recruitment was done by the principal investigator. The request for permission to perform the study was denied by three institutions, while two institutions did not respond. The study participants were selected from the remaining seven institutions after obtaining the list of PhD students from the respective institutions. The PI communicated with the participants in the list, and the consenting process took place via phone. When the list of PhD students was not obtained

from one institution, PI contacted PhD student representatives from that institution to identify and collect contact information of other participants.

2.6 Data collection process

The recruitment was done by the principal investigator. The request for permission to perform the study was denied by three institutions, while two institutions did not respond. The study participants were selected from the remaining seven institutions after obtaining the list of PhD students from the respective institutions. The PI communicated with the participants in the list, and the consenting process took place via phone. When the list of PhD students was not obtained from one institution, PI contacted PhD student representatives from that institution to identify and collected contacts information of other participants. In both scenarios, the PI communicated with the participants, and the consenting process took place over the phone. Given the time constraints of participants during working hours, and the fact that the tools for assessing burnout and depression are self-administered, the PI send them the link to the questionnaire tool in ODK via WhatsApp or email after obtaining their permission to participate. A participant could only proceed with the online survey after initial consent by choosing ‘Yes’ option. The link was activated for one entry by one person. The data was collected online mode.

2.7 Data collection instruments

A structured questionnaire schedule was developed in English. The information sheet was explained in detail to each of the participants by the principal investigator. After clarification of their concerns and queries they were asked to sign the consent form or was obtained over the phone. Then PI shared the link of the questionnaire survey in ODK

to the participant and their responses were recorded in the soft copy of the tool. The different section of the questionnaire schedule is as follows:

- Section 1: Survey details of the participant - This section covers the details regarding participant ID, name of the institution, to which university the institution is affiliated, duration of PhD program, year of joining PhD, study area and PhD time line.
- Section 2: Background details of participant - Age, sex, religion, caste, residence, if living with family, type of family and relationship status.
- Section 3: Details regarding childcare support - Details regarding childcare support was captured in this section. Questions were related to current pregnancy, availability of maternity leave, whether they had any child/children, number of children, if the child was born during the PhD program, who takes care of the child, any help with child caring, spouse's contribution to child caring and whether if affects their PhD work. The questions are framed separately for female and male participants.
- Section 4: Financial responsibilities - Questions in this section covered details regarding fellowship, the stipend, financial difficulties, financial dependencies, and any help received.
- Section 5: Working Environment - Details regarding the working environment was captured in this section. Family support, relationship with guide, availability of laptop, working space, any missed out opportunities, extra work burden, the challenges faced, stressors, coping mechanisms, sleep and balancing of work and personal lives.
- Section 6: Burnout - This section captures burnout using the OLdenburg Burnout Inventory (OLBI).
- Section 7: Depression, Anxiety and Stress - This section captures depression using the

Patient Health Questionnaire-9 (PHQ-9); anxiety using Generalised Anxiety Disorder Assessment (GAD-7); and Stress using Perceived Stress Scale (PSS-4).

2.8 Data entry and analysis

The information was recorded by the participants in the softcopy using the data entry platform prepared in ODK, and later converted to Microsoft Excel. The data were analysed with the aid of IBM SPSS Statistics-25 for Windows. The proportion of PhD students with depression, anxiety, stress, and burnout was estimated. Further analysis was carried out to determine how the characteristics of childcaring responsibilities, financial responsibilities and working environment are associated with burnout. Chi-square test or Fischer's exact test, was used to test the associations.

2.9 Ethical concerns

The Institutional Ethics Committee of Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram, Kerala had reviewed the study and gave clearance to conduct the study (SCT/IEC/2006/MARCH/2023). Before moving to each institution, permission was obtained from dean/principal of respective institution. Participation in the study was completely voluntary. The interview was conducted only after obtaining verbal consent from the participants. The participant's identity and personal information were kept confidential.

CHAPTER 3
RESULTS

The study subjects were obtained from the seven selected Science and Technology institutions in Thiruvananthapuram, Kerala, after obtaining the list of PhD students from the respective institutions. From a sample frame of around 600 PhD students, a total of 298 participants responded. The background details of the study participants, information on child-care and financial responsibilities, working environment, depression, anxiety, stress, and the characteristics associated with burnout are described in different sections in this chapter.

3.1. Background details of the study participants

The sociodemographic, details regarding PhD program and the list of institutions are described in this section (Tables 3.1 to 3.3). The highest proportion of the study participants, 35.2 percent (104), were from University of Kerala, Karyavattom Campus

Table 3.1. List of institutions and sample size

Name of the science and technology institution	Frequency (n =298)
Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST)	51 (17.1)
National Centre for Earth Science Studies (NCESS)	17 (5.7)
College of Engineering, Trivandrum (CET)	17 (5.7)
College Of Agriculture (COA)	44 (14.8)
CSIR - National Institute for Interdisciplinary Science and Technology (CSIR-NIIST)	64 (21.5)
University Of Kerala / Kerala University of Health Sciences (KUHS)	105 (35.2)

and the least with 1 student was from Government Ayurveda College and Research centre, Thiruvananthapuram. (Table 3.1)

Table 3.2. Socio-demographic characteristics of the population.

Variable	Categories	Frequency (%) (n = 298)
Age	< 30 yrs.	198 (66.4)
	>= 31 yrs.	100 (33.6)
Sex	Female	204 (68.5)
	Male	94 (31.5)
Religion	Hindu	189 (63.4)
	Muslim	27 (9.1)
	Christian	45 (15.1)
	Sikh	1 (0.3)
	Atheist	1 (0.3)
	Do not wish to disclose	35 (11.7)
Caste	General category	127 (42.6)
	OBC (Other backward classes)	116 (38.9)
	SC (Scheduled Class)	20 (6.7)
	ST (Scheduled Tribe)	1 (0.3)
	Do not wish to disclose	34 (11.4)
Residence	Home	133 (44.6)
	Quarters/ hostel by the institute	85 (28.5)
	Paying guest/ hostel outside	80 (26.8)
Living with family	Yes	155 (52)
Family description	Nuclear	101 (65.2)
(n = 155)	Extended	48 (31)
	Joint	5 (3.2)
	Do not wish to disclose	1 (0.6)
Relationship status	Single	153 (51.3)
	Married	144 (48.3)
	Separated	1 (0.3)

Table 3.3. Details regarding PhD program

Variable	Categories	Frequency (%) (n = 298)
PhD degree provision	Respective institution	267 (89.6)
	Other universities (CUSAT, KU, AcSIR, APJAKTU)	31 (10.4)
PhD year	<= 3 years	151 (50.7)
	> 3 years	147 (49.3)
Field of Study	Physical Science	46 (15.4)
	Chemical science	26 (8.7)
	Biological science	115 (38.6)
	Bioengineering/Engineering	31 (10.4)
	Biomaterial science and technology	20 (6.7)
	Applied Sciences & Technology	29 (9.7)
	Health science	9 (3)
	Medical science	1 (0.3)
	Mathematics/ statistics	10 (3.4)
	Demography	4 (1.3)
	Psychology	6 (2)
PhD timeline	Attending / just completed course work	34 (11.4)
	Preparing or during the process of comprehensive exam/ just completed exam	14 (4.7)
	Preparing proposal for/ submitted/ obtained IEC clearance	3 (1)
	Data collection/ lab experiments and observations - going on/ just completed	141 (47.3)
	Data analysis	27 (9.1)
	Writing the thesis	34 (11.4)
	Pre-submission phase	24 (8.1)
	Submission - about to submit / just submitted	9 (3)
	Public defence - waiting / done	12 (4)

The total number of participants in the study were 298. The mean age of the participants was 30 years, with a standard deviation of 3.2 (range 25 – 45 years). Females constituted 68.5 percent of the study participants. Majority of the participants (63.4%) were Hindus and 42.6 percent belonged to general category. Half the number, 144 (48.3%) participants were married among which 77 (53.5%) got married during PhD course. Almost 45 percent (133) of the participants resided at their own homes. More than half of the participants, 155 (52%) are living with their family of which one-third (101) of them are residing in a nuclear family (Table 3.2).

About 90 percent (267) participants will be awarded their PhD degree by their respective institutions. Nearly half (50.7%) of them were in 3rd year or less. Largest proportion of the participants (38.6%) pursue their PhD in biological science. The greater percentage of the study subjects that is 47.3 percent are in the phase of data collection (Table 3.3).

3.2. Child caring responsibilities

This section describes the childcare responsibilities of a PhD student. The marital status, parental status, number of children, age of children, requirement of break/ time-off for childcare are described in Table 3.4.

Out of the 144 married participants, 63 (43.7%) females and 14 (9.7%) males were married during the PhD program. 25 percent of females (53) and males (24) have at least one child. 18 percent of the participants have only one child and 8 percent have two or more children. 14 percent of the participants have at least one child born during PhD program. 12 percent of females and males have child/ children under 3 years of age. 15 percent (45) of individuals stated that they required a break/ time-off for carrying out their child care responsibilities among which 64.4 percent (29) pointed out that the break/ time-off taken for child care affected their PhD work (83% females) (Table 3.4).

Table 3.4. Common childcare responsibilities among non-single PhD participants

Variable	Category	Females (n = 204)	Males (n = 94)	Total (n = 298)
Married during PhD studies	Yes	63 (30.8)	14 (14.8)	77 (25.8)
Do you have child/children	Yes	53 (25.9)	24 (25.5)	77 (25.8)
Number of children	One	40 (19.6)	13 (13.8)	53 (17.7)
	Two/ three	13 (6.7)	11 (11.7)	24 (8)
Were the child/ children born during PhD	Child one, two or both	30 (14.7)	11 (11.7)	41 (13.7)
	Born before PhD	23 (11.2)	0	23 (7.7)
Do you have a child less than 36 months old	Yes	24 (11.7)	11 (11.7)	35 (11.7)
Needed a break or time off from PhD work for child care	Yes	30 (14.6)	15 (15.9)	45 (15.1)
Did the time off affect your PhD work	Yes	24 (11.7)	5 (5.3)	29 (9.7)

The sex-aggregated information on the child care responsibilities of females and males are given separately in tables 3.5 to 3.6. The current pregnancy state, the provision of maternity/ paternity leave, parental status, number of children, spouse support and availing services of extra-caregivers are compared in both the tables.

There are five (4.6%) currently pregnant women of which three polled that they would receive maternity leave for this pregnancy. Whereas, none of the males reported their wife as currently pregnant. At least one kid is present in the lives of 53 percent of the women and 24 percent of the men. Seven men and seventeen females have babies under six months old.

Table 3.5. Details regarding childcare responsibilities among non-single females

Variable	Categories	Non-single females (n = 108)
Currently pregnant	Yes	5 (4.6)
Will get maternity leave (n = 5)	Yes	3 (60)
Have Children	Yes	53 (49.1)
No of Children (n = 53)	1 (n = 53)	40 (75.5)
	< 6 months	4 (7.5)
	6 months – 3 yrs.	17 (32.1)
	> 3 yrs.	32 (60.4)
	2 (n = 13)	10 (18.9)
	< 6 months	2 (15.4)
	6 months – 3 yrs.	2 (15.4)
	> 3 yrs.	9 (69.2)
	3 (n = 3)	3 (5.7)
	> 3 yrs.	3 (100)
Children born during PhD program (n = 53)	Child 1	25 (47.2)
	Child 2	2 (3.8)
	Both	3 (5.7)
Maternity leave	Child 1 (Yes) (n = 30)	16 (57.1)
	Child 2 (Yes) (n = 5)	2 (40)
Have breast-feeding child at present	Yes (n = 53)	17 (32.1)
Able to breast feed at regular intervals	Yes (n = 17)	12 (70.6)
How breast feeding is managed (n=17)	Direct breast feeding	6 (35.3)
	Giving mixed feeds (both direct and pumped breast milk)	4 (23.5)
	Semi solid/ solid food	7 (41.2)
Spouse support in childcare (n=53)	Yes	41 (77.4)
	No, he lives elsewhere	10 (18.9)

Variable	Categories	Non-single females (n = 108)
Receive adequate spouse support (n=41)	Yes	38 (92.7)
Have external support in child care (n=53)	Yes	41 (77.4)
Extra care-giver type (n= 41)	Paid	9 (22)
	Unpaid	32 (78)
Extra care giver duration (n =9)	Full-time	3 (33.3)
	Part- time	6 (66.7)
Able to care for child when sick	Always	25 (23.1)
	Sometimes	25 (23.1)
	Rarely	3 (2.7)

(41) who responded to the survey said yes, and 93 percent among them (38) said that the assistance was adequate. Among the fathers, 92 percent (22) stated that they support their spouse in childcare responsibilities among which only 6 percent (17) declared that they adequately support their spouse. Among the mothers (53), 41 mothers (77%) required external child care-givers of which one-third (3) opted for fulltime-paid and three-quarters (6) opted for parttime-paid-external child care-givers. Among the fathers (16) who required external child care-givers, 29 percent fathers opted for fulltime-paid (2) and 71 percent fathers opted for parttime-paid-external child care-givers (5). Only 23 percent of the mothers and 37 percent of the fathers could always take care their child/children when they were sick.

3.3. Financial responsibilities among the participants

Of the total participants, 221 (74.2%) are fellowship holders of which 69 percent were females (152). The fellowship stipend was above Rs. 30,000 for 42 percent (68.8%

Table 3.6. Details regarding childcare responsibilities among non-single males

Variable	Categories	Males (n = 38)
Spouse currently pregnant	No	38 (100)
Have Children (n = 38)	Yes	24 (63.2)
No of Children (n = 38)	1 (n = 24)	13 (54.2)
	< 6 months	1 (4.3)
	6 months – 3 yrs.	8 (34.8)
	> 3 yrs.	14 (60.9)
	2 (n = 10)	10 (41.7)
	< 6 months	2 (20)
	6 months – 3 yrs.	1 (10)
	> 3 yrs.	7 (70)
	3 (n = 1)	1 ((4.2)
	> 3 yrs.	1 (100)
Children born during PhD program (n = 53)	Child 1	6 (25)
	Child 2	1 (4.2)
	Both	4 (16.7)
Paternity leave	Child 1 (Yes) (n = 10)	4 (40)
	Child 2 (Yes) (n = 5)	3 (60)
Have breast-feeding child at present	Yes (n = 24)	7 (29.2)
Mother available to breast feed at regular intervals	Yes (n = 7)	7 (100)
Support your spouse with childcare (n=24)	Yes	22 (91.7)
	No, they live elsewhere	2 (8.3)
Adequately help spouse with childcare (n=22)	Yes	17 (5.7)
Have external support in child care (n=24)	Yes	16 (66.7)
Extra care-giver type (n= 16)	Paid	7 (43.8)
	Unpaid	9 (56.3)
Extra care giver duration (n =7)	Full-time	2 (28.6)
	Part- time	5 (71.4)
Able to care for child when sick (n=24)	Always	9 (37.5)
	Sometimes	14 (58.3)
	Rarely	1 (4.2)

females and 31.2% males) of the participants. Only 7.4 percent females (15) and 26.6 percent of males (25) support themselves with an alternate source of income. Among the non-single participants 85.4 percent (123) have an employed spouse of which 89.7 percent are females (96) and 71.1 percent are males (27) (Table 3.7).

Participants who have their parents or other family members financially dependent on them consists of 72 (62.1%) females and 44 (37.9%) males. More than half (51.3%) of the study subjects (153) contributed less than 25 percent of their fellowship money to cover house hold expenses and 191 (64.1%) participants voted that their stipend is not sufficient to cover their monthly expenses. Among the participants who worry about their finances 86.6 percent worry some/ all the time. While 134 (68.7%) females and 61 (31.3%) males have had a financial emergency during PhD course, 243 participants (84.3% females and 75.5% males) voted that they can depend on their parents/ family members/ friends to help them out in case of financial emergency (Table 3.7).

3.4. Working environment among the participants

This section describes the working environment of a PhD student. The various perceptions pertaining to the institution, PhD program, family support, relationship with guide, missed out opportunities and balancing professional and personal lives are described in Table 3.8.

The number of participants who aspired their respective institutions and respective PhD programs were 211 (72.1% females and 68.1% males) and 253 (83.8% females and 87.2% males) respectively. More than half of the study subjects (62.4%) had the freedom to pursue and learn about the topics they wanted. 293 (98.3%) participants stated that they have complete or partial support from their family; 28 (9.4%) participants described their relationship with their guide as hostile whereas 46 (15.4%) did not wish to disclose the

relationship with their guide.

Table 3.7. Financial responsibilities among the participants

Variable	Categories	Female n=204 (%)	Male n= 94 (%)	Total n = 298 (%)
Fellowship holder	Yes	152 (74.5)	69 (73.4)	221 (74.2)
Fellowship Stipend	<10,000	12 (5.9)	3 (3.2)	15 (5)
	10,000 – 30,000	54 (26.5)	27 (28.7)	81 (27.2)
	>30,000	86 (42.2)	39 (41.5)	125 (41.9)
Alternate source of income	Yes	15 (7.4)	25 (26.6)	40 (13.4)
Spouse employment*	Yes	96 (89.7)	27 (71.1)	123 (85.4)
Financial dependence of parents or other family	Yes	72 (35.3)	44 (46.8)	116 (38.9)
Contribution to cover Household expenses	< 25%	121 (59.3)	32 (34)	153 (51.3)
	25 – 50%	46 (22.5)	20 (21.3)	66 (22.1)
	50 – 75%	18 (8.8)	13 (13.8)	31 (10.4)
	>75 %	19 (9.3)	29 (30.9)	48 (16.1)
Stipend sufficient to cover expenses	Yes	75 (36.8)	32 (34)	107 (35.9)
Worry about finances	All the time	76 (37.3)	28 (29.8)	104 (34.9)
	Some of the time	102 (50)	52 (55.3)	154 (51.7)
	Rarely	22 (10.8)	10 (10.6)	32 (10.7)
	Never	4 (2)	4 (4.3)	8 (2.7)
Ever had a financial emergency	Yes	134 (65.7)	61 (64.9)	195 (65.4)
Receive financial support in an emergency	Yes	172 (84.3)	71 (75.5)	243 (81.5)

*Only for non-single participants

Table 3.8. Perceptions in the Working Environment

Variable	Categories	Females n=204 (%)	Males n=94 (%)	Total n=298 (%)
Institution I aspired to join	Yes	147 (72.1)	64 (68.1)	211 (70.8)
PhD program I aspired to join	Yes	171 (83.8)	82 (87.2)	253 (84.9)
Freedom to pursue and learn	Yes	124 (60.8)	62 (66)	186 (62.4)
	Partially	66 (32.4)	28 (29.8)	94 (31.5)
Family support	Complete support	170 (83.3)	70 (74.5)	240 (80.5)
	Partial support	33 (16.2)	20 (21.3)	53 (17.8)
	No support	1 (0.5)	4 (4.3)	5 (1.7)
Relationship with guide	Friendly	151 (74)	73 (77.7)	224 (75.2)
	Hostile	22 (10.8)	6 (6.4)	28 (9.4)
	Do not wish to disclose	31 (15.2)	15 (16)	46 (15.4)
Missed out on opportunities (such as attending conferences or workshops, presenting papers, or receiving funding) because of being a woman or man	Yes	51 (25)	18 (19.1)	69 (23.2)
Had to work on any other research projects/ administrative works in addition to PhD research	Yes	132 (64.7)	70 (74.5)	202 (67.8)
Felt the need to spend more time for work because of being a woman or man	Yes	54 (26.5)	27 (28.7)	81 (27.2)
Unable to take credit/ ownership of study	Yes	36 (17.6)	17 (18.1)	53 (17.8)
Able to balance professional and personal lives	Never	104 (51)	53 (56.4)	157 (52.7)
	Rarely	100 (49)	41 (43.6)	141 (47.3)

Over half of the participated PhD students (67.8%) polled that they had to work on other research projects/ administrative works in addition to their PhD research (as a help to their mentor or for others). Approximately one quarter (23.2%) of the participants (25% females and 19.1% of males) have missed out on opportunities (such as attending conferences or workshops, presenting papers, or receiving funding) because of being a woman or man. Participants who had to work on any other research projects or administrative works in addition to their PhD research (as a help to their mentor or for others) were 202 (67.8%) in number (64.7% females and 74.5% males). 17.8 percent (53) of the PhD students were unable to take credit/ ownership of study of which 67.9 percent are females. Nearly half (52.7%) of the PhD scholars were unable to balance their

Table 3.9. Facilities in the working environment

Variable	Categories	Females n=204 (%)	Males n=94 (%)	Total n=298 (%)
Spend majority of research time	Lab/ office/ desktop	128 (62.7)	56 (59.6)	184 (61.7)
	Field	3 (1.5)	3 (3.2)	6 (2)
	Both	20 (9.8)	13 (13.8)	33 (11.1)
	Changes as per requirement	53 (26)	22 (23.4)	75 (25.2)
Own computer/ laptop	Own	189 (92.6)	78 (83)	267 (89.6)
	Institute support	5 (2.5)	6 (6.4)	11 (3.7)
	Both	8 (3.9)	10 (10.6)	18 (6)
	Others (guide's computer/ brother's laptop)	2 (1)	-	2 (0.7)
Own working space	Yes	134 (65.7)	68 (72.3)	202 (67.8)
Average No. of hours of sleep	< 6 hrs	117 (57.4)	52 (55.3)	169 (56.7)
	> 6 hrs	87 (42.6)	42 (44.7)	129 (43.3)
Do you get Adequate sleep	Yes	102 (50)	51 (54.3)	153 (51.3)

professional and personal lives (51% females and 56.4% males) (Table 3.8).

The various factors in the working environment of the PhD students are summarized in Table 3.9. The highest proportion of the participants (61.7%) spend majority of their research time in lab/ office/ desktop. One-quarter of the participants (75) stated that the spending of time in each location changes as per requirement. 92.6 percent of females and

Table 3.10. Challenges, Stressors, and Coping mechanisms

Variable	Categories	Females (n=204)	Males (n=94)	Total (n=298)
Challenges faced	Delay in getting fellowship amount	119 (58.3)	61 (64.9)	180 (60.4)
	Irregular stipend	121 (59.3)	43 (45.7)	126 (42.3)
	Financial constraints	101 (49.5)	50 (53.2)	150 (50.7)
	Poor guide support	51 (25)	15 (16)	66 (22.1)
	Poor family support	6 (2.9)	8 (8.5)	14 (4.7)
	Poor family relations	12 (5.9)	12 (12.8)	24 (8.1)
	Family responsibilities	63 (30.9)	36 (38.3)	99 (33.2)
	Family members suffering from illness	32 (15.7)	18 (19.1)	50 (16.8)
	Lack of work environment at home	31 (15.2)	17 (18.1)	48 (16.1)
	Time constraints of 5 years	44 (21.6)	15 (16)	59 (19.8)
	Administrative delay in academic matters	97 (47.5)	44 (46.8)	141 (47.3)
	Unable to get publications	71 (34.8)	15 (16)	86 (28.9)
	Unable to meet PhD requirements	57 (27.9)	22 (23.4)	79 (26.5)
	Childcare responsibilities	32 (15.7)	6 (6.4)	38 (12.8)
	Others (Health issues, No challenges, Poor infrastructure, homesickness, hostile work environment, etc)	20 (9.8)	12 (12.8)	32 (10.7)

Variable	Categories	Females (n=204)	Males (n=94)	Total (n=298)
Stressors	Course subjects and exams	40 (19.6)	28 (29.8)	68 (22.8)
	Literature review	22 (10.8)	11 (11.7)	33 (11.1)
	Data collection/ lab work	77 (37.7)	24 (25.5)	101 (33.9)
	Presentations	42 (20.6)	13 (13.8)	55 (18.5)
	Analysis	54 (26.5)	14 (14.9)	68 (22.8)
	Paper writing	96 (47.1)	27 (28.7)	123 (41.3)
	Paper publication	106 (52)	27 (28.7)	133 (44.6)
	Field work	20 (9.8)	12 (12.8)	32 (10.7)
	Allocation of additional work aside from PhD work	68 (33.3)	36 (38.3)	104 (34.9)
	No job opportunity after PhD	-	1 (1.1)	1 (0.3)
	No stressors	2 (1)	6 (6.4)	8 (2.7)
Coping mechanisms	Going for a walk/run	82 (40.2)	37 (39.4)	119 (39.9)
	Exercise	33 (16.2)	31 (33)	64 (21.5)
	Meditation	22 (10.8)	8 (8.5)	30 (10.1)
	Music	123 (60.3)	46 (48.9)	169 (56.7)
	Watching movies/series	121 (59.3)	49 (52.1)	170 (57)
	Reading	34 (16.7)	12 (12.8)	46 (15.4)
	Sleeping	122 (59.8)	40 (42.6)	162 (54.4)
	Travelling	64 (31.4)	31 (33)	95 (31.9)
	Consume alcohol	-	7 (7.4)	7 (2.3)
	Smoking	-	7 (7.4)	7 (2.3)
	Prescribed medication	4 (2)	3 (3.2)	7 (2.3)
	Others (stress eating, dancing, art, spend time/conversation with family/friends, use social media, playing instruments, games)	18 (8.8)	4 (4.3)	22 (7.4)

83 percent of the males works using their own laptop meanwhile 32 % of the consists of 34.3 percent females and 27.7 percent males. More than half (56.7%) of the study subjects sleep less than 6 hours a day and 48.7% participants reported that they do not get

adequate sleep (Table 3.9).

The various challenges, stressors and coping mechanisms followed by the PhD students are summarized in Table 3.10. Major challenges faced by the PhD scholars are delay in participants do not own a working space (like a cabin with a table and chair) which getting fellowship amount, irregular stipend, financial constraints, administrative delay. Majority reported that paper writing, paper publication, and allocation of additional work aside from PhD work acted as the most common stressors. The most opted coping mechanisms included watching movies/series, listening to music, and sleeping.

3.5. Burnout, depression, anxiety, and stress

This section describes the prevalence of burnout, depression, anxiety and stress using Oldenburg Burnout Inventory (OLBI), Patient Health Questionnaire (PHQ-9), Generalized Anxiety Disorder – 7 (GAD-7) and Perceived Stress Scale 4 (PSS-4). Oldenburg Burnout Inventory was used to measure burnout among the study participants. First quartile value (38) and third quartile value (45) of the total OLBI score in the range of 16 – 64 was used to group the variable into 3 categories of low, moderate, and high burnout. Table 3.11 summarizes the OLBI individual variable frequencies.

Almost 75.2% (95% CI: 69.9% - 80%) of the respondents had moderate to high levels of burnout of which 21.8% had high levels. Figure 3.1. shows the levels of burnout among the participants and the domains of burnout namely disengagement and emotional exhaustion. The proportion of participants with moderate to high levels of disengagement was 83.2% (95% CI: 78.5% - 87.3%) while 75.2% (95% CI: 69.9% - 80%) showed moderate to high levels of exhaustion. Among the study participants 81.3% of the females and 61.7% of the males had moderate to high levels of burnout (Table 3.12).

Table 3.11. OLBI individual variable frequency

Variable	Strongly agree	Agree	Disagree	Strongly disagree
I always find new and interesting aspects in my work	70 (23.5)	174 (58.4)	44 (14.8)	10 (3.4)
There are days when I feel tired before I arrive at work	110 (36.9)	153 (51.3)	26 (8.7)	9 (9)
It happens more and more often that I talk about my work in a negative way	57 (19.1)	103 (34.5)	104 (34.9)	34 (11.4)
After work, I tend to need more time than in the past in order to relax and feel better	84 (28.2)	142 (47.7)	56 (18.8)	16 (5.4)
I can tolerate the pressure of my work very well	25 (8.4)	134 (45)	112 (37.6)	27 (9.1)
Lately, I tend to think less at work and do my job almost mechanically	27 (9.1)	136 (45.6)	110 (36.9)	25 (8.4)
I find my work to be a positive challenge	65 (21.8)	190 (63.8)	35 (11.7)	8 (2.7)
During my work, I often feel emotionally drained	82 (27.5)	131 (44)	68 (22.8)	17 (5.7)
Over time, one can become disconnected from this type of work	37 (12.4)	131 (44)	112 (37.6)	18 (6)
After working, I have enough energy for my leisure activities	21 (7)	91 (30.5)	146 (49)	40 (13.4)
Sometimes I feel sickened by my work tasks	48 (16.1)	156 (52.3)	77 (25.8)	17 (5.7)
After my work, I usually feel worn out and weary	60 (20.1)	138 (46.3)	84 (28.2)	16 (5.4)
This is the only type of work that I can imagine myself doing	25 (8.4)	92 (30.9)	130 (43.6)	51 (17.1)
Usually, I can manage the amount of my work well	28 (9.4)	197 (66.1)	63 (21.1)	10 (3.4)

Variable	Strongly agree	Agree	Disagree	Strongly disagree
I feel more and more engaged in my work	31 (10.4)	184 (61.7)	70 (23.5)	13 (4.4)
When I work, I usually feel energized	31 (10.4)	161 (54)	90 (30.2)	16 (5.6)

Table 3.12. Oldenburg Burnout Inventory scale distribution among subjects

Category	Females (n = 204)	Males (n = 94)	Total (n = 298)
Low burnout (17 - 37)	38 (18.6)	36 (38.3)	89 (29.9)
Moderate burnout (38 - 45)	113 (55.4)	46 (48.9)	144 (48.3)
High burnout (> 45)	53 (26)	12 (12.8)	65 (21.8)

Figure 3.1. Prevalence of burnout and sub-divisions

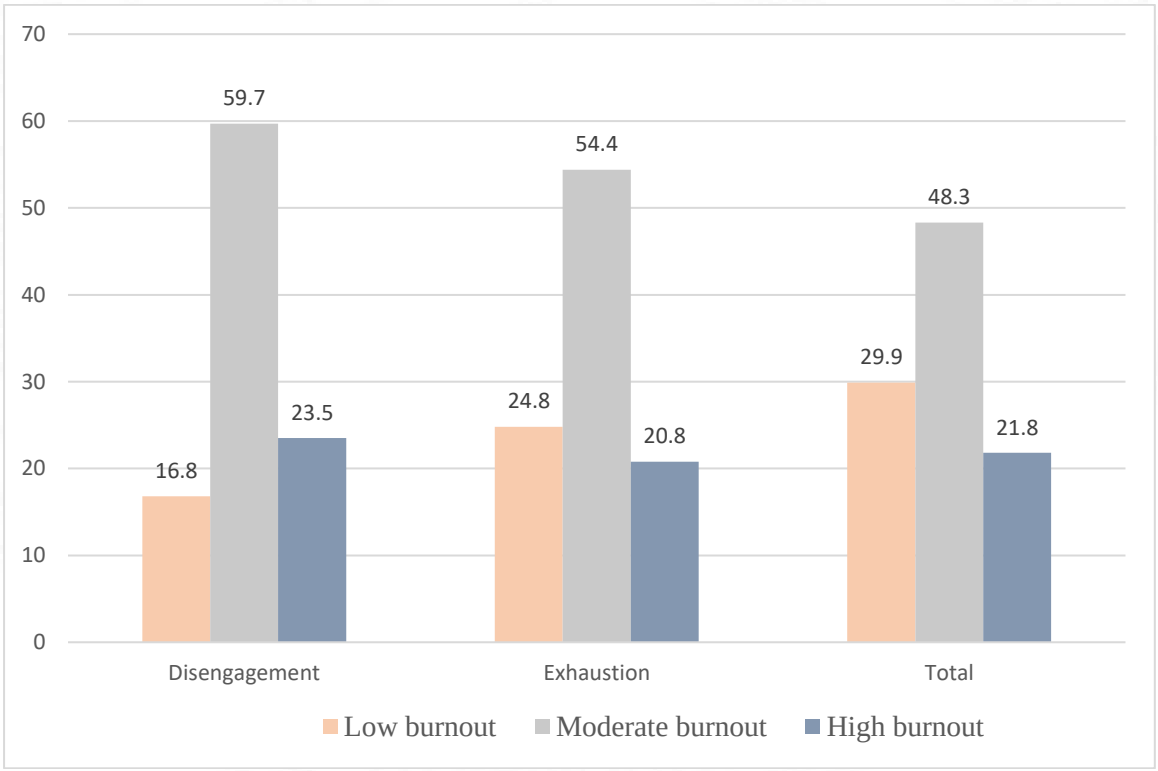

Table 3.13. Sex-disaggregated prevalence of Disengagement and Exhaustion

Burnout category	Sub-category	Females (n = 204)	Males (n = 94)	P-value	Total (n = 298)
Disengagement	Low	27 (13.2)	23 (24.5)	0.036	50 (16.8)
	Moderate	124 (60.8)	54 (57.4)		178 (59.7)
	High	53 (26)	17 (18.1)		70 (23.5)
Exhaustion	Low	40 (19.6)	34 (36.2)	< 0.001	74 (24.8)
	Moderate	109 (53.4)	53 (56.4)		162 (54.4)
	High	55 (27)	7 (7.4)		62 (20.8)

Public Health Questionnaire- 9 scale was used to measure depression. PHQ9 scale individual variable frequency is given in Table 3.14. In this study population of PhD students, 5.7 percent had no depression, 16.8 percent had minimal depression, 38.9 percent had mild depression, 17.1 percent had moderate depression, 13.1 percent had moderately severe depression, and 8.4 percent had severe depression (Table 3.15).

Table 3.14. Item-wise analysis of Patient Health Questionnaire (PHQ-9)

Variable	Not at all	Several days	More than half the days	Nearly every day
Little interest or pleasure in doing things	65 (21.8)	161 (54)	39 (13.1)	33 (11.1)
Feeling down, depressed, or hopeless	56 (18.8)	149 (50)	57 (19.1)	36 (12.1)
Trouble falling or staying asleep, or sleeping too much	85 (28.5)	128 (43)	49 (16.4)	36 (12.1)
Feeling tired or having little energy	37 (12.4)	171 (57.4)	50 (16.8)	40 (13.4)
Poor appetite or overeating	107 (35.9)	97 (32.6)	52 (17.4)	42 (14.1)

Variable	Not at all	Several days	More than half the days	Nearly every day
Feeling bad about yourself or that you are a failure or have let yourself or your family down	104 (34.9)	105 (35.2)	48 (16.1)	41 (13.8)
Trouble concentrating on things, such as reading the newspaper or watching television	100 (33.6)	115 (38.6)	44 (14.8)	39 (13.1)
Moving or speaking so slowly that other people could have noticed. Or the opposite - being so fidgety or restless that you have been moving around a lot more than usual	150 (50.3)	86 (28.9)	40 (13.4)	22 (7.4)
Thoughts that you would be better off dead, or of hurting yourself	175 (58.7)	73 (24.5)	28 (9.4)	22 (7.4)

Table 3.15. PHQ9 scale distribution among subjects

Category	Females (n = 204)	Males (n = 94)	Total (n = 298)
No depression (0)	8 (3.9)	9 (9.6)	17 (5.7)
Minimal depression (1 - 4)	35 (17.2)	15 (16)	50 (16.8)
Mild depression (5 - 9)	79 (38.7)	37 (39.4)	116 (38.9)
Moderate depression (10 - 14)	39 (19.1)	12 (12.8)	51 (17.1)
Moderately severe depression (15 - 19)	25 (12.3)	14 (14.9)	39 (13.1)
Severe depression (20 - 27)	18 (8.8)	7 (7.4)	25 (8.4)

Generalized Anxiety Disorder – 7 (GAD-7) was used to measure the level of anxiety among the participants. Table 3.16 summaries the prevalence of the GAD-7 scale individual variables. The sex disaggregated prevalence of anxiety is given in the table 3.17. The prevalence of minimal anxiety is 27.5 percent, mild anxiety is 41.6 percent,

moderate anxiety is 15.1 percent and severe anxiety is 15.8 percent. Females (35.2%) experience more moderate to severe anxiety than males (21.2%).

Table 3.16. GAD7 scale individual variable frequency

Variables	Not at all	Several days	More than half the days	Nearly every day
Feeling nervous, anxious, or on edge	68 (22.8)	153 (51.3)	46 (15.4)	31 (10.4)
Not being able to stop or control worrying	69 (23.2)	132 (44.3)	49 (16.4)	48 (16.1)
Worrying too much about different things	53 (17.8)	140 (47)	53 (17.8)	52 (17.4)
Trouble relaxing	85 (28.5)	136 (45.6)	42 (14.1)	35 (11.7)
Being so restless that it is hard to sit	109 (36.6)	119 (39.9)	39 (13.1)	31 (10.4)
Becoming easily annoyed or irritable	63 (21.1)	149 (50)	45 (15.1)	41 (13.8)
Feeling afraid, as if something awful might happen	104 (34.9)	119 (39.9)	36 (12.1)	39 (13.1)

Table 3.17. GAD7 scale distribution among subjects

Category	Females (n= 204)	Males (n=94)	Total
Minimal anxiety (0 - 4)	51 (25)	31 (33)	82 (27.5)
Mild anxiety (5 - 9)	81 (39.7)	43 (45.7)	124 (41.6)
Moderate anxiety (10 - 14)	34 (16.7)	11 (11.7)	45 (15.1)
Severe anxiety (15 - 21)	38 (18.6)	9 (9.6)	47 (15.8)

Perceived Stress Scale 4 (PSS-4) was used to measure stress among the study population. PSS4 scale individual variable frequencies are given in the table 3.18. More than half (60.7%) of the PhD students experience high stress levels, of which 61.3 percent are females (Table 3.19).

Table 3.18. PSS4 scale individual variable frequency

Variables	Never	Almost Never	Some times	Fairly Often	Very Often
In the last month, how often have you felt that you were unable to control the important things in your life?	42 (14.1)	31 (10.4)	144 (48.3)	37 (12.4)	44 (14.8)
In the last month, how often have you felt confident about your ability to handle your personal problems?	25 (8.4)	41 (13.8)	118 (39.6)	72 (24.2)	42 (14.1)
In the last month, how often have you felt that things were going your way?	38 (12.8)	54 (18.1)	125 (41.9)	58 (19.5)	23 (7.7)
In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	42 (14.1)	56 (18.8)	125 (41.9)	43 (14.4)	32 (10.7)

Table 3.19. PSS4 scale distribution among subjects

Category	Females (n= 204)	Males (n=94)	Frequency (%)
Low stress level (< 8)	79 (38.7)	38 (40.4)	117 (39.3)
High stress level (>= 8)	125 (61.3)	56 (59.6)	181 (60.7)

3.6. Association between Depression, Anxiety, Stress, and burnout.

The association between depression, anxiety, stress and burnout is demonstrated in Table 3.20. There was statistically significant association between depression and burnout, anxiety and burnout and stress and burnout. As the severity of depression, anxiety and stress increased, the prevalence of high burnout also increased.

Table 3.20. Relationship between Depression, Anxiety, stress, and burnout

		Burnout n (%)				
Variable	**Category**	**Low**	**Moderate**	**High**	**Total**	**p-value**
Depression	Minimal/ Mild	52 (31.3)	96 (57.8)	18 (10.8)	166	< 0.001
	Moderate	6 (11.8)	31 (60.8)	14 (27.5)	51	
	Moderately severe/ Severe	3 (4.7)	28 (43.8)	33 (51.6)	64	
Anxiety	Minimal anxiety	41 (50)	38 (46.3)	3 (3.7)	82	< 0.001
	Mild anxiety	24 (19.4)	79 (63.7)	21 (16.9)	124	
	Moderate anxiety	6 (13.3)	27 (60)	12 (26.7)	45	
	Severe anxiety	3 (6.4)	15 (31.9)	29 (61.7)	47	
Stress	Low	50 (42.7)	61 (52.1)	6 (5.1)	117	< 0.001
	High	24 (13.3)	98 (54.1)	59 (32.6)	181	

3.7. Factors associated with Burnout

3.7.1. Socio-demographic characteristics Vs Burnout

Table 3.21 represents the association between socio-demographic characteristics and Burnout. PhD students less than 30 years of age had higher prevalence of moderate to high burnout. Women were found to have higher prevalence of moderate to high burnout than males. Participants who were residing in their own homes had lower prevalence of high burnout than those residing in hostel or quarters. PhD scholars who are living with their family has a slightly slower prevalence of burnout than those who are not living with their family. There was no statistically significant difference in the prevalence of burnout among those in third year or less and above (Table 3.22).

Table 3.21. Association between various socio-demographic characteristics and Burnout

Variable	Category	Low	Moderate	High	Total	p-value
Age	< 30 yrs.	38 (19.2)	113 (57.1)	47 (23.7)	198	0.006
	>= 31 yrs.	36 (36)	46 (46)	18 (18)	100	
Sex	Female	38 (18.6)	113 (55.4)	53 (26)	204	<0.001
	Male	36 (38.3)	46 (48.9)	12 (12.8)	94	
Residence	Home	41 (30.8)	71 (53.4)	21 (15.8)	133	0.047
	Quarters/ hostel of institute	15 (17.6)	50 (58.8)	20 (23.5)	85	
	Paying guest/ hostel outside	18 (22.5)	38 (47.5)	24 (30)	80	
Living with Family	Yes	48 (31)	81 (52.3)	26 (16.8)	155	0.013
	No	26 (18.2)	78 (54.5)	39 (27.3)	143	

Table 3.22. Burnout frequencies according to year of the PhD program

Year of the PhD program	Low n (%)	Moderate n (%)	High n (%)	Total	p-value
<= 3 years	41 (27.2)	79 (52.3)	31 (20.5)	151	0.620
> 3 years	33 (22.4)	80 (54.4)	34 (23.1)	147	

3.7.2. Childcare responsibilities Vs Burnout

Association between childcare responsibilities among the PhD participants and burnout are described in Table 3.23. Those study participants who got married during the PhD program have higher prevalence of moderate to high burnout. PhD scholars with single child experience more burnout than those with higher order of children. Those participants who opted for time off from PhD program for child care have higher prevalence of burnout than those who did not opt for a time-off for child care.

Table 3.23. Association between childcare responsibilities and burnout.

Variable	Category	Low	Moderate	High	p-value
Married during PhD studies	Yes	15 (19.5)	42 (54.5)	20 (26)	0.027
	No	24 (35.8)	35 (52.2)	8 (11.9)	
Do you have child/ children	Yes	25 (32.5)	38 (49.4)	14 (18.2)	0.460
	No	16 (23.2)	39 (56.5)	14 (20.3)	
Number of children	one	13 (24.5)	27 (50.9)	13 (24.5)	0.028
	two/three	12 (50)	11 (45.8)	1 (4.2)	
Were the children born during PhD	Child one, two or both	9 (22)	23 (56.1)	9 (22)	0.185
	Born before PhD	10 (43.5)	10 (43.5)	3 (13)	
Do you have a child less than 36 months old	Yes	7 (20)	20 (57.1)	8 (22.9)	0.779
	No	67 (25.5)	139 (52.9)	57 (21.7)	
Needed a break or time off from PhD work for child care	Yes	8 (17.8)	28 (62.2)	9 (20)	0.004
	No	17 (53.1)	10 (31.3)	5 (15.6)	
Did the time off affect your PhD work	Yes	3 (10.3)	18 (62.1)	8 (27.6)	0.091
	No	5 (31.3)	10 (62.5)	1 (6.3)	

Table 3.24 demonstrates the sex-disaggregated data on the association between statistically significant child care responsibilities and burnout. Marriage during the PhD program has led to statistically significant difference in the prevalence of burnout among females where married women have higher prevalence. The difference in the prevalence of burnout among married and unmarried males is not statistically significant. The proportion of mothers who needed time-off from PhD work for child care had higher prevalence of burnout.

The associations of different child care responsibilities with burnout in females and males were done separately (Table 3.25 and 3.26). Presence of a breast-feeding child, spouse support and the need to take time-off for child-caring were found statistically significant.

94% of the mothers with breast-feeding baby experience moderate to high burnout.

Table 3.24**.** Sex-disaggregated data on the association between common child care responsibilities and burnout.

Variable	Category	Burnout				
		Total (n = 298)	**Females (n = 204)**	**p-value**	**Males (n = 94)**	**p-value**
Married during PhD studies	Yes	62 (20.8)	56 (27.4)	0.008	6 (6.3)	0.420
	No	43 (14.4)	30 (14.7)		13 (13.8)	
Number of children	one	40 (13.4)	31 (15.1)	0.155	9 (9.5)	0.408
	two/three	12 (4)	7 (2.3)		5 (5.3)	
Needed a break or time off from PhD work for child care	Yes	37 (12.4)	26 (8.7)	0.006	11 (11.7)	0.092
	No	15 (5)	12 (4)		3 (3.1)	

Nearly 81% of the mothers declared that support from their spouse in child caring caused them moderate to high burnout. The prevalence of burnout among the mothers who needed time off from PhD work for child care was 86.7 percent. Males who adequately help their spouse with child-care have moderate burnout where as those who does not adequately help have high burnout (Table 3.26).

Table 3.25. Association of child care responsibilities vs Burnout in Females

Variable	Category	Burnout (%)				
		Low	**Moderate**	**High**	**Total**	**p-value**
Have breast-feeding child at present	Yes	1 (5.9)	11 (64.7)	5 (29.4)	17	0.029
	No	14 (38.9)	17 (47.2)	5 (13.9)	36	
Spouse support in childcare	Yes	8 (19.5)	23 (56.1)	10 (24.4)	41	0.026
	No	7 (58.3)	5 (41.7)	0	12	
Time when break was needed	Yes	4 (13.3)	20 (66.7)	6 (20)	30	0.019
	No	11 (47.8)	8 (34.8)	4 (17.4)	23	

Table 3.26 - Association of child care responsibilities vs Burnout in Males

		Burnout (%)				
Variable	**Category**	**Low**	**Moderate**	**High**	**Total**	**p-value**
Adequately support spouse with childcare	Yes	8 (47.1)	9 (52.9)	0	17	0.006
	No	1 (20)	1 (20)	3 (60)	5	

3.7.3. Financial responsibilities Vs burnout

The association of various financial responsibilities with burnout are summarized in the table 3.27. The sex-disaggregated data of the same is described in table 3.28. PhD students without an alternate source of income reported higher prevalence of moderate-high burnout. The prevalence of moderate-high burnout decreases as the contribution to cover the household expenses increases. Moderate-high burnout was high in those who reported insufficient stipend to cover the monthly expenses. The participants who worry some or all the time about their finances have higher prevalence of moderate-high burnout. The burnout is low in those who never had any financial emergency.

There is statistically significant higher prevalence of burnout in females who do not have an alternate source of income but not in case of males. The negative association between burnout and the contribution to cover household expenses is statistically significant only in females. The males reported higher burnout in those who did not have sufficient stipend to cover household expenses. Males who worry about their finances all or some of the time, had statistically significant higher prevalence of burnout when compared to females. Both females and males have higher burnout prevalence in those who had a financial emergency during PhD program.

Table 3.27 – Association between financial responsibilities among the study participants and burnout

		Burnout (n = 298)				
Variable	**Category**	**Low**	**Moderate**	**High**	**Total**	**p-value**
Alternate source of income	Yes	19 (47.5)	17 (42.5)	4 (10)	40	**0.002**
	No	55 (21.3)	142 (55)	61 (23.6)	258	
Financial dependency of parents or other family members	Yes	35 (30.2)	51 (44)	30 (25.9)	116	0.034
	No	39 (21.4)	108 (59.3)	35 (19.2)	182	
Contribution to cover Household expenses	< 25%	27 (17.6)	91 (59.5)	35 (22.9)	153	0.020
	25 to 50%	16 (24.2)	32 (48.5)	18 (27.3)	66	
	50 to 75%	11 (35.5)	15 (48.4)	5 (16.1)	31	
	>75%	20 (41.7)	21 (43.8)	7 (14.6)	48	
Stipend sufficient to cover monthly expenses	Yes	37 (34.6)	50 (46.7)	20 (18.7)	107	0.014
	No	37 (19.4)	109 (57.1)	45 (23.6)	191	
Worry about finances in a month	All the time	22 (21.1)	52 (50)	30 (28.8)	104	0.004
	Some of the time	32 (20.8)	91 (59.1)	31 (20.1)	154	
	Rarely	15 (46.9)	14 (43.8)	3 (9.4)	32	
	Never	5 (62.5)	2 (25)	1 (12.5)	8	
Ever had a financial emergency	Yes	36 (18.5)	110 (56.4)	49 (25.1)	195	0.001
	No	38 (36.9)	49 (47.6)	16 (15.5)	103	

Table 3.28 – Sex-disaggregated data on the association between financial responsibilities among the study participants and burnout

Variable	Category	Total (n = 298)	Burnout			
			Females (n = 204)	p-value	Males (n = 94)	p-value
Alternate source of income	Yes	40 (13.4)	9 (4.4)	0.039	12 (12.7)	0.149
	No	258 (83.8)	157 (76.9)		46 (48.9)	
Financial dependency of parents or other family members	Yes	116 (38.9)	56 (27.4)	0.330	25 (26.5)	0.361
	No	182 (61)	110 (53.9)		33 (35.1)	
Contribution to cover Household expenses	< 25%	153 (51.3)	103 (50.4)	0.044	23 (24.4)	0.512
	25 to 50%	66 (22.1)	39 (19.1)		11 (11.7)	
	50 to 75%	31 (10.4)	12 (5.8)		8 (8.5)	
	>75%	48 (16.1)	12 (5.8)		16 (17)	
Stipend sufficient to cover monthly expenses	Yes	107 (35.9)	56 (27.4)	0.061	14 (14.8)	0.010
	No	191 (64)	110 (53.9)		44 (46.8)	
Worry about finances in a month	All the time	104 (34.8)	64 (31.3)	0.305	18 (19.1)	0.001
	Some of the time	154 (51.6)	84 (41.1)		38 (40.4)	
	Rarely	32 (10.7)	15 (7.3)		2 (2.1)	
	Never	8 (2.6)	4 (1.9)		0	
Ever had a financial emergency	Yes	195 (65.4)	117 (57.3)	0.003	42 (44.6)	0.053
	No	103 (34.5)	49 (24)		16 (17)	

3.7.4. Working environment vs Burnout

Various characteristics of the working environment such as the perceptions, facilities available, challenges, stressors, and coping mechanisms vs Burnout are given in the table 3.29, 3.30 and 3.31. Participants who reported their respective institution or program as

Table 3.29 – Association between perceptions in working environment vs Burnout

Variable	Category	Burnout (%) Low	Moderate	High	Total	p-value
Is this the aspired institution	Yes	58 (27.5)	120 (56.9)	33 (15.6)	211	<0.001
	No	16 (18.4)	39 (44.8)	32 (36.8)	87	
Is this the aspired PhD program	Yes	71 (28.1)	137 (54.2)	45 (17.8)	253	<0.001
	No	3 (6.7)	22 (48.9)	20 (44.4)	45	
Freedom to pursue and learn about the topics required	Yes	62 (33.3)	105 (56.5)	19 (10.2)	186	< 0.001
	Partially/ No	12 (10.7)	54 (48.2)	46 (41.1)	112	
Family support	Complete support	33 (45.2)	34 (46.6)	6 (8.2)	73	0.70
	Partial/ no support	3 (14.3)	12 (57.1)	6 (28.6)	21	
Relationship with guide	Friendly	69 (30.8)	124 (55.4)	31 (13.8)	224	< 0.001
	Hostile/ do not wish to disclose	5 (6.8)	35 (47.3)	34 (45.9)	74	
Had to work on any other research projects/ administrative works in addition to your PhD research	Yes	50 (24.8)	100(49.5)	52 (25.7)	202	0.045
	No	24 (25)	59 (61.5)	13 (13.5)	96	
Ever felt like you need to spend more time for work because you are a woman (or a man)	Yes	14 (17.3)	42 (51.9)	25 (30.9)	81	0.034
	No	60 (27.6)	117 (53.9)	40 (18.4)	217	

Variable	Category	Low	Moderate	High	Total	p-value
Unable to take credit or ownership of your study	Yes	6 (11.3)	24 (45.3)	23 (43.4)	53	< 0.001
	No	68 (27.8)	135 (55.1)	42 (17.1)	245	
Able to balance your professional and personal lives	Never	63 (40.1)	79 (50.3)	15 (9.6)	157	< 0.001
	Rarely	11 (7.8)	80 (56.7)	50 (35.5)	141	

their aspired choices, who has good family support, friendly relationship with their guide, able to manage professional and personal lives have lower prevalence of burnout. Owning a workspace and a laptop and getting adequate sleep have statistically significant positive association with burnout (Table 3.30).

Table 3.30 – Association between Facilities in the working environment

Variable	Category	Low	Moderate	High	Total	p-value
Own working space, such as a cabin with a chair and table	Yes	60 (29.7)	103 (51)	39 (19.3)	202	0.015
	No	14 (14.6)	56 (58.3)	26 (27.1)	96	
Average No. of hours of sleep per day	< 6 hrs	38 (22.5)	86 (50.9)	45 (26.6)	169	0.062
	> 6 hrs	36 (27.9)	73 (56.6)	20 (15.5)	129	
Adequate sleep	Yes	49 (32)	80 (52.3)	24 (15.7)	153	0.002
	No	25 (17.2)	79 (54.5)	41 (28.3)	145	

Association between the various challenges and burnout are described in the table 3.31. The challenges with statistically significant positive association with burnout include irregular stipend, financial constraints, poor guide support, lack of work environment at home, time constraints of 5 years, administrative delay in academic matters, unable to get publications and unable to meet PhD requirements.

Table 3.31 – Association of various challenges with burnout

		Burnout (%)				
Challenges	**Category**	**Low**	**Moderate**	**High**	**Total**	**p-value**
Irregular stipend	Yes	20 (15.9)	74 (58.7)	32 (25.4)	126	0.009
	No	54 (31.4)	85 (49.4)	33 (19.2)	172	
Financial constraints	Yes	24 (15.9)	88 (58.3)	39 (25.8)	151	0.001
	No	50 (34)	71 (48.3)	26 (17.7)	147	
Poor guide support.	Yes	5 (7.6)	26 (39.4)	35 (53)	66	< 0.001
	No	69 (29.7)	133 (57.3)	30 (12.9)	232	
Poor family relations	Yes	2 (8.3)	13 (54.2)	9 (37.5)	24	0.050
	No	72 (26.3)	146 (53.3)	56 (20.4)	274	
Lack of work	Yes	5 (10.4)	22 (45.8)	21 (43.8)	48	< 0.001
environment at home	No	69 (27.6)	137 (54.8)	44 (17.6)	250	
Time constraints of	Yes	4 (6.8)	34 (57.6)	21 (35.6)	59	< 0.001
5 years	No	70 (29.3)	125 (52.3)	44 (18.4)	239	
Administrative delay in	Yes	31 (22)	69 (48.9)	41 (29.1)	141	0.016
academic matters	No	43 (27.4)	90 (57.3)	24 (15.3)	157	
Unable to get	Yes	7 (8.1)	49 (57)	30 (34.9)	86	< 0.001
publications	No	67 (31.6)	110 (51.9)	35 (16.5)	212	
Unable to meet PhD	Yes	8 (10.1)	40 (50.6)	31 (39.2)	79	< 0.001
requirements	No	66 (30.1)	119 (54.3)	34 (15.5)	219	
Childcare	Yes	6 (15.8)	25 (65.8)	7 (18.4)	38	0.232
responsibilities	No	68 (26.2)	134 (51.5)	58 (22.3)	260	

CHAPTER 4
DISCUSSION AND CONCLUSION

4.1 Discussion

The major purpose of the study was to understand the prevalence of burnout among research students and study the association between childcare and financial responsibilities, depression, anxiety, stress, and burnout. Three-quarters of the study participants had moderate to high levels of burnout of which 21.8% had high burnout levels. Among the study participants 81.3% of the females and 61.7% of the males had moderate to high levels of burnout. Childcare and financial responsibilities, depression, anxiety, and stress are positively associated with burnout.

Nearly half of the participants were married of which 50 percent got married during their PhD program. A quarter of the participants have at least one child, with about 12 percent have child/ children below 36 months of age. Three-fourths of the participants are fellowship holders of which 69% are women. Around 87% of the responders worry about their finances some or all the time. Nearly 10% described their relationship with their guide as hostile whereas 15% did not wish to disclose it. About 53% of the PhD scholars reported that they were unable to balance their professional and personal lives. Only about 90% of the participants have their own computer/ laptop and only 68% have their own working space.

Considerable observations from the study are that burnout are higher in participants who are less than 30 years of age, females, married during PhD period, parents with single child, mothers with breastfeeding child, poor family support and hostile relationship with guide. The main observations from the study are discussed in this chapter.

The burnout scores were classified as high burnout (21.8% of the participants), moderate burnout (48.3% of the participants), and low burnout (29.9% of the participants). Figure 3.12

reveals that 20.8% of the respondents (n=62) were high in Exhaustion and 23.5% (n=70) were high in Disengagement. Our questionnaire included socio-demographic information as well as a burnout assessment using the OLdenburg Burnout Inventory (OLBI). Similar to the present study, the burnout scores were classified as high burnout (22.4% of the respondents), moderate burnout (51.7% of the respondents), and low burnout (25.9% of the respondents) in a cross-sectional study conducted on 116 Romanian psychiatric residents (Tipa et al., 2019). In addition, 23.3% of the respondents (n=27) were high in Exhaustion and 25% (n=29) were high in disengagement.

Although there is evidence that female PhD students suffer higher stress and exhaustion than men (McAlpine et al., 2022), male students are also more likely to report higher levels of exhaustion than their female peers. Devine and Hunter (2016), on the other hand, discovered that the gender of PhD students was not related to their feelings of exhaustion (Devine and Hunter, 2016). The contradictory findings show that gendered effect may be influenced by sociocultural or disciplinary practises (Tikkanen et al., 2021).

The depression scores were classified as no/ minimal (22.4%), mild (38.9%), moderate (17.1%), moderately severe (13.1%) and severe depressive disorders (8.4%). The PHQ9 questionnaire was used to assess depression in the study. This is comparable to the prevalence of depressive disorders conducted among 240 PhD students using multistage cluster sampling in two public universities of Kerala, India. About 31.7, 41.7, 17.9, 6.7 and 2.1% had no/minimal, mild, moderate, moderately severe, and severe depressive disorders, respectively (L. T. et al., 2022).

In the study, 65 PhD students (21.8%) suffered from high levels of burnout of which the majority of respondents were females (81.5%) with a mean age of 29.32 (±2.44). Tipa et al., 2019 study had similar findings where 22.4 percent residents suffered from high

levels of burnout of which 84.6% were females with a mean age of 27.35 (±3.81) (Tipa et al., 2019).

The bivariate analysis of survey results found that financial factors such as no alternate source of income, financial dependency of parents or other family members, contribution of less than 25 percent of their monthly income to cover house hold expenses, insufficient fund to cover monthly expenses and worrying about finances are important predictor of burnout (Table 3.7). Another issue that emerged in the interviews causing financial difficulties among students includes delays in receiving fellowships leading to financial constraints which may be addressed by administrative promptness at the university/funder level. These findings complement our findings, in which financial difficulty of students emerged as a key factor potentially triggering depressive disorders among students. These findings also back up prior research (L. T. et al., 2022) (Rawat et al., 2016).

Burnout was higher in females with no alternate source of income, contribution of less than 25 percent of their monthly income to cover house hold expenses, with history of financial emergency. Whereas burnout was higher in males with insufficient stipend to cover monthly expenses and worry about finances all or some of the time. There are not many literatures regarding sex-disaggregated information on how financial constraints leads to burnout.

Another significant element found in our study that contributed to depressive disorders was an unhealthy student-supervisor relationship, often resulting in disagreement, distrust, and conflict situations. The poor guiding relationship between supervisors and students has already been identified as a factor in depressive illnesses (L. T. et al., 2022) (Peluso et al., 2011). When asked about if the participants could balance their professional and personal lives, 100 percent of the PhD students polled never or rarely out

of the given 4 options accounting to the fact that none of the PhD scholars are able to make time for both their family/ friends as well as work.

The prevalence of burnout was slightly higher in those who did not own a working space such as a cabin with chair and table. Students who do not get adequate sleep had higher prevalence of burnout. There was statistically significant association between depression and burnout, anxiety and burnout and stress and burnout. As the severity of depression, anxiety and stress increased, the prevalence of high burnout also increased. Many studies have shown that there is a positive association between burnout and depression (Schaufeli and Enzmann, 1998b) (Koutsimani et al., 2019).

4.2. Limitation and strengths

The study planned to recruit participants from 12 selected science and technology institutions in Thiruvananthapuram, but 5 institutions refused to grant permission or did not respond. Hence sample frame was smaller and the sample may not be representative of the PhD population. Furthermore, the study relied on self-reported data. The information gathered on mental health comes from a student's viewpoint on how they felt over the two weeks before it.

There are only limited number of studies available with regard to burnout among PhD students and the factors associated with it. The responded institutions were major one with high number of PhD enrolments, Hence, this study helps to add knowledge to shorten this gap.

4.3. Recommendations

Based on the findings of the study on the prevalence of burnout among PhD students, the following recommendations can be made to address and mitigate this issue:

- Implement comprehensive support systems: Universities and academic institutions should establish and strengthen support systems specifically tailored to the needs of PhD students. This includes providing access to mental health services, counselling, and workshops on stress management, encouragement to seek help and resilience-building.
- Foster mentorship programs: Establishing mentorship programs that pair experienced faculty members with PhD students can provide valuable guidance, support, and encouragement. Mentors can assist students in setting realistic expectations, managing workloads, and navigating the challenges of academia. Regular check-ins and mentorship activities can help alleviate feelings of isolation and promote a sense of belonging.
- Promote work-life balance: Encourage a healthy work-life balance by promoting flexible working hours and setting realistic expectations for PhD students. Institutions should advocate for regular breaks, vacations, and time off to rejuvenate and recharge. Additionally, promoting hobbies, physical activity, and social connections outside of academic work can contribute to overall well-being and prevent burnout.
- Enhance communication and collaboration: Foster a collaborative and inclusive academic environment where PhD students can connect and engage with their peers and faculty members. Encouraging interdisciplinary collaboration, organizing seminars or conferences, and providing platforms for networking can create a sense of community and support among students.
- Increase awareness and education: Raise awareness about burnout, its signs, and its impact among both PhD students and faculty members. Conduct workshops and training sessions on stress management, time management, and self-care strategies. Promote discussions on mental health and well-being within academic departments to

reduce stigma and encourage proactive approaches towards preventing burnout.

- Reform academic culture and expectations: Evaluate and reassess the prevailing academic culture and expectations placed on PhD students. Encourage a shift from an overemphasis on productivity and perfectionism towards a more holistic approach that values well-being, personal growth, and skill development. This can involve reevaluating workloads, revising evaluation criteria, and promoting a healthier work environment.
- Support institutional policies and resources: Advocate for policies and resources that prioritize the well-being of PhD students. This includes ensuring adequate funding and stipends, provision of proper working space, reducing financial stressors, promotion of co-curricular activities (like arts and sports) and providing access to affordable healthcare and mental health services. Institutional commitment to addressing burnout is crucial for implementing sustainable changes.

Creating a supportive and nurturing environment that prioritizes mental health and well-being will not only benefit the individual students but also contribute to the overall success and advancement of the academic community.

4.4 Conclusion

In conclusion, this study offers insight on the high rate of burnout among PhD students. The statistics clearly show that burnout is a widespread problem that affects a considerable number of graduate students seeking doctorates. The study emphasises the complexities of burnout, including exhaustion and disengagement.

According to the findings, a variety of variables contribute to the high frequency of burnout among PhD students. A number of factors surfaced, including childcare and financial obligations, academic pressure, a lack of work-life balance, a hostile work

environment, and slow academic processing. The difficult nature of doctorate study, along with the pressure to satisfy stringent academic standards, can result in chronic stress and psychological distress, eventually leading to burnout.

Burnout among PhD students has far-reaching consequences. Burnout not only has a negative influence on an individual's well-being, but it also has a detrimental impact on their academic achievement, productivity, and job prospects. Furthermore, burnout might have long-term effects, such as the possibility of chronic health problems and decreased job satisfaction.

Given the grave nature of the situation, universities, academic institutions, and legislators must address the issue of PhD student burnout. This may be accomplished by putting in place comprehensive support systems and interventions focused at enhancing mental health and well-being. Providing a friendly and inclusive academic environment, adequate working space, mentoring programs, work-life balance promotion, and access to mental health services are all critical measures in reducing burnout and encouraging resilience among PhD students.

Last but not least, the outcomes of this study highlight the critical necessity for collaborative efforts to combat burnout among PhD students. We may aim for a healthier, more supportive academic culture that supports the success and well-being of future generations of researchers by recognizing the prevalence of burnout and implementing evidence-based solutions.

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Achutha Menon Centre for Health Science Studies (AMCHSS)

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Thiruvananthapuram -11

Information sheet

Study Title: Prevalence of Burnout among research students in Science and Technology Institutions in Thiruvananthapuram

I am Dr Aswathy B I, a final year MPH Student at AMCHSS, SCTIMST. As part of my MPH course, I am conducting a study titled 'Prevalence of Burnout among research students in Science and Technology Institutions in Thiruvananthapuram.'

Burnout is defined by the World Health Organization as a syndrome caused by chronic workplace stress that has not been successfully managed. It is characterized by three dimensions: feelings of energy depletion or exhaustion; feelings of negativism about one's job; and reduced professional efficacy.

University students have six times more prevalence of depressive disorders than the general population and is more common in post-graduate and research students than undergraduate students. There is ample evidence that many research students face a variety of challenges during their studies, resulting in chronic stress that can have an impact on both researchers and their social life.

The study needs to interview researchers like you for gathering information related to the topic. If you are willing to participate in my study, I would be asking you regarding your background details such as socio-demographic, family support, childcaring, financial responsibilities and working environment. Also, there will be questions to assess burnout, depression, anxiety, and stress. It can take around 15-20 minutes time for the interview or to fill up the questionnaire.

In this study, your participation is purely voluntary. You are free to take your own time to answer the questions and if you are not willing to answer any of the questions you can ask me to skip the question. You have the complete right to withdraw your participation from the study at any time during the interview.

Though there might not be any direct benefit for you from this study, the information you share will be useful to understand what percentage of research students are reporting burnout and how different factors contribute to burnout among researchers. It may help to suggest policy recommendations regarding the PhD program and its curriculum to enhance the student's psychological well-being. I assure you that all information you will be sharing with me will be highly confidential and only a summary of the information will be used for research and publication purposes.

For any clarification regarding the study, you can contact me and for any queries on the authentication of this study, you can get the Member Secretary, Institutional Review Board (IRB) of SCTIMST.

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Achutha Menon Centre for Health Science Studies (AMCHSS)
Sree Chitra Tirunal Institute for Medical Sciences & Technology (SCTIMST)
Thiruvananthapuram -11

Prevalence of Burnout among research students in Science and Technology Institutions in Thiruvananthapuram

Consent form

I---------- have read/ heard and understood all the information provided in the research information sheet. I understand that my participation in this study is entirely voluntary. By signing/ giving thumb impression, I confirm my voluntary participation in this study. I understand that I can withdraw my participation at any time during the interview without any explanation and I also understand that my identity and personal information will be kept confidential. I have been informed who should be contacted for further clarification.

I agree to take part in this study.

Name of the Participant:

Signature of the Participant:

Date:

Prevalence of Burnout among research students in Science and Technology Institutions in Thiruvananthapuram, Kerala

Questionnaire survey

I have read/heard and comprehended all the information on the research information page. I am aware that my participation in this study is completely voluntary. I confirm my voluntary involvement in this study by clicking the "yes" option. I understand that I can withdraw my participation in the questionnaire at any time without explanation, and that my identity and personal information will be kept private. I've been told who should be contacted for further clarification.	
Do you agree to take part in this study?	1. Yes 2. No

Section1: Survey Details

Q. No	***Survey Details***	
1.1	Participant ID: (Enter the ID number given to you)	__ /__ /__ (Institutional code/stream chosen/ student serial number)
1.2	Name of your Institution:	1. SCTIMST 2. IIST 3. IISER 4. NCESS 5. CET 6. RCC 7. RGCB 8. College of Agriculture 9. CSIR-NIIST 10. Government Ayurveda College and Research Centre 11. Kerala university

		12. Digital University Kerala
1.3	Will this institution provide the PhD degree on completion of your research?	1. Yes 2. No, my PhD is registered with another university (If no, please fill the next question)
1.4	Which university is this institution affiliated with?	
1.5	What is the maximation duration between registration and submission of PhD thesis (the total years to complete PhD) in your institution:	
1.6	Year of joining PhD:	
1.7	Title of your PhD thesis (optional):	
1.8	Which of the following is best suited to your field of study?	1. Physical Science 2. Chemical science 3. Biological science 4. Bioengineering/Engineering 5. Biomaterial science and technology 6. Applied Sciences & Technology 7. Health science 8. Medical science 9. Mathematics/ statistics 10. Others If Others, please specify
1.9	Which of the PhD timeline events best represents your most recent activity?	1. Registered within 3 months 2. Attending / just completed course work 3. Preparing or during the process of comprehensive exam/ just completed exam

		4. Preparing proposal for/ submitted/ obtained IEC clearance 5. Data collection/ lab experiments and observations - going on/ just completed 6. Data analysis 7. Writing the thesis 8. Pre-submission phase 9. Submission - about to submit / just submitted 10. Public defense - waiting / done

Section2: Background details of participant

Q. No.	***Background details of participant***	
2.0	Full name (optional)	
2.1	Age in completed years:	
2.2	Sex	1 Female 2 Male 3 Others If other, please specify
2.3	Religion	1 Hindu 2 Muslim 3 Christian 4 Others 5 Do not wish to disclose If other, please specify
2.4	Caste	1 General category 2 OBC (Other backward classes)

		3 SC (Scheduled Class) 4 ST (Scheduled Tribe) 5 Do not wish to disclose
2.5	Where do you reside?	1 Home 2 Quarters/ hostel by the institute 3 Paying guest/ hostel outside
2.6	Are you living with your family?	1 Yes 2 No
2.7	How would you describe your family? (If yes to the above question 2.6)	1 Nuclear 2 Extended 3 Joint 4 Others If others, please specify
2.8	Relationship status:	1 Single 2 Married 3 Separated 4 Divorced 5 Widowed 6 Others If others, please specify
2.9	Did you get married while pursuing your PhD?	1 Yes 2 No
2.10	Did you get divorced while pursuing your PhD?	1 Yes 2 No
2.11	Did you lose your loved one while pursuing your PhD?	1 Yes 2 No
Please make sure that you have correctly marked your response to the questions about sex (Qn. 2.2) and relationship status (Qn. 2.8).		
If the participant is single, Skip section 3 and go to section 4		

Section 3: Details regarding childcare support

Q. No.	**Section 3.1. Female participant**	
3.1.1	Are you currently pregnant?	1 Yes 2 No
3.1.2	Will you get maternity leave? (If yes to the above question (3.1.1))	1 Yes, paid leave 2 Yes, unpaid leave 3 No maternity leave, but will have to avail other available leave/ loss of pay.
3.1.3	Do you have child/children?	1 Yes 2 No
If no to above question (3.1.3), skip the remaining questions and go to Section 4		
3.1.4	If yes to the above question (3.1.3), please specify the number of children:	
3.1.5	Age of the child/ children:	Child 1: …… Child 2: …… Child 3: ……
3.1.6	Were the child/children born during your PhD period?	1 Yes, the first child 2 Yes, the second child 3 Yes, both children 4 No, the child/children born before I join for PhD Any other information please specify
3.1.7	Did you get maternity leave? (If the respondent had childbirth during the PhD period)	Child 1: 1 Yes, paid leave 2 Yes, unpaid leave 3 No maternity leave, but had to avail other available leave/loss of pay.

		Child 2: 1 Yes, paid leave 2 Yes, unpaid leave 3 No maternity leave, but had to avail other available leave/loss of pay.
3.1.8	Do you have a breast-feeding child?	1 Yes 2 No
3.1.9	Are you able to breastfeed the baby at regular intervals? (If yes to the above question (3.1.8))	1 Yes 2 No
3.1.10	How do you manage feeding your baby at regular intervals?	1 Direct breast feeding 2 Feeding breast milk after collecting through breast pump 3 Giving mixed feeds (both direct and pumped breast milk) 4 Semi solid/ solid food 5 Others If others, specify
3.1.11	Does your spouse help with child care?	1 Yes 2 No 3 No, he lives elsewhere.
3.1.12	Do you think you get adequate help from your spouse on child care?	1 Yes 2 No
3.1.13	Is there anyone else (besides you and/or your spouse) who can help with child care? (paid/unpaid)	1 Yes 2 No If yes, please specify
3.1.14	If yes, please specify if the care taker is paid or unpaid:	1. Paid 2. Unpaid ((relatives/ neighbors/ friends))
3.1.15	If paid, are these extra care-givers part time	1 Full time

	or full time?	2 Part-time
3.1.16	When your child is sick, are you able to be with your child?	1 Always 2 Sometimes 3 Rarely
3.1.17	Were there times when you needed to take a break or take time off from PhD work for childcare?	1 Yes 2 No
3.1.18	If yes to the above question (3.1.16), did it affect your PhD work?	1 Yes 2 No
Q. No	**<u>Section 3.2: Male participant</u>**	
3.2.1	Is your wife currently pregnant	1 Yes 2 No
3.2.2	Will you get paternity leave? (If yes to the above question (3.2.1))	1 Yes, paid leave 2 Yes, unpaid leave 3 No paternity leave, but will have to avail other available leave/ loss of pay.
3.2.3	Will you take the leave? How long do you think it should be?	1 Yes 2 No ……..
3.2.4	Do you have child/ children?	1 Yes 2 No
If no to above question (3.2.4), skip the remaining questions and go to Section 4		
3.2.5	If yes to above question 3.2.4, please specify the number of children:	
3.2.6	Age of the child/ children:	Child 1: …… Child 2: …… Child 3: ……
3.2.7	Were the child/children born during your PhD period?	1 Yes, the first child 2 Yes, the second child 3 Yes, both children 4 No, the child/children were

		born before I joined PhD Any other information please specify
3.2.8	Did you get paternity leave? (If the respondent had the child during the PhD period)	Child 1: 1. Yes, paid leave 2. Yes, unpaid leave 3. No paternity leave, but had to avail other available leave/loss of pay. Child 2: 1. Yes, paid leave 2. Yes, unpaid leave 3. No paternity leave, but had to avail other available leave/loss of pay.
3.2.9	Did you take the leave? How much was eligible? How much leave did you avail?	1 Yes 2 No …… …….
3.2.10	Do you have a breast-feeding child?	1 Yes 2 No
3.2.11	Is the mother available with the child to breastfeed the baby at regular intervals? (If yes to the above question (3.2.10))	1 Yes 2 No
3.2.12	Do you help your spouse with childcare?	1 Yes 2 No 3
3.2.13	Do you think you adequately help your spouse with child care?	1 Yes 2 No
3.2.14	Is there anyone else (besides you and your spouse) who can help with child care?	1 Yes 2 No

3.2.15	If yes, please specify if the care taker is paid or unpaid:	1. Paid 2. Unpaid (relatives/ neighbors/ friends)
3.2.16	If paid, are these extra care-givers part time or full time?	1. Full time 2. Part-time
3.2.17	Who mainly takes care of the child/ children when they are sick?	1 Myself 2 Spouse 3 Family member 4 Helper 5 Others If others, please specify
3.2.18	Were there times when you needed to take a break or take time off for childcare?	1 Yes 2 No
3.2.19	If yes to the above question (3.2.17), did it affect your PhD work?	1 Yes 2 No

Section 4: Financial responsibilities

Q. No.	***Financial responsibilities***	
4.1	Are you a fellowship holder?	1 Yes 2 No
4.2	How much is your average fellowship stipend per month? (E.g., 21,000) (If yes to the above question (4.1))	
4.3	Do you have an alternate source of income?	1 Yes 2 No
4.4	If yes to above question (4.3), please specify: (optional)	
4.5	Is your spouse employed?	1 Yes 2 No
4.6	Are your parents or other family members financially dependent on you?	1 Yes 2 No

4.7	What percentage of your total household expenses are covered by your own earnings?	1 <25% 2 25 to 50% 3 50 to 75% 4 >75%
4.8	Is your stipend/income sufficient to cover your overall monthly expenses?	1 Yes 2 No
4.9	How often do you worry about your finances in a month?	1 All the time 2 Some of the time 3 Rarely 4 Never
4.10	Have you ever had a financial emergency while working on your PhD?	1 Yes 2 No If yes, please specify (optional) …….
4.11	Is there any one (your parents/family members /friends) to help you out in a financial emergency?	1 Yes 2 No If yes, please specify (optional)

Section 5: Working Environment

Q. No.	***Working Environment***	
5.1	Is this the institution to which you aspired to join?	1 Yes 2 No
5.2	Is this the PhD program to which you aspired to join?	1 Yes 2 No
5.3	Do you have the freedom to pursue and learn about the topics you want?	1 Yes 2 partially 3 No
5.4	Do you have the support of your family to pursue a PhD?	1 Complete support 2 Partial support

		3 No support
5.5	Where do you spend the majority of your research time? Specify how many hours do you spend working at each location.	1 Lab/office/desktop …… hours per day 2 Field …… hours per day 3 Both …… hours per day 4 Cannot specifically answer, it will change as per requirement
5.6	Do you own a computer or a laptop?	1 Yes, my own laptop 2 Yes, institute provides laptop/computer 3 Yes, both above 4 Others If others, please specify
5.7	Do you have your own working space, such as a cabin with a chair and table?	1 Yes 2 No
5.8	Which of the following best describes your relationship with your guide?	1 Friendly 2 Hostile (Unfriendly) 3 Do not wish to disclose
5.9	Have you ever felt like you missed out on opportunities (such as attending conferences or workshops, presenting papers, or receiving funding) because you are a woman (or man)?	1 Yes 2 No
5.10	Have you had to work on any other research projects/administrative works in addition to your PhD research (as a help to your mentor or for others)?	1 Yes 2 No
5.11	Have you ever felt like you need to spend more time for work because you are a woman (or a man)?	1. Yes 2. No
5.12	Do you feel that you are unable to take credit or ownership of your study due to some reasons?	1 Yes 2 No

	Can you specify the reason if you are willing to disclose it? (If the answer is yes)	…… …..
5.13	What are the challenges you face as a PhD scholar? (Multiple answers can be chosen) If others, please describe:	1 Delay in getting fellowship amount 2 Irregular stipend 3 Financial constraints 4 Poor guide support. 5 Poor family support 6 Poor family relations 7 Family responsibilities 8 Family members suffering from illness 9 Lack of work environment at home 10 Time constraints of 5 years 11 Administrative delay in academic matters 12 Unable to get publications 13 Unable to meet PhD requirements 14 Childcare responsibilities 15 Others ……
5.14	Which among the following stresses you out? (Multiple answers can be chosen)	1 Course subjects and exams 2 Literature review 3 Data collection/ lab work 4 Presentation 5 Analysis 6 Paper writing 7 Paper publication 8 Field work 9 Allocation of additional

	If others, please specify	work aside from PhD work 10 Others ……..
5.15	What coping mechanisms do you use when you are stressed? (Multiple answers can be chosen) If others, please specify	1 Going for a walk/run 2 Exercise 3 Meditation 4 Music 5 Watching movies/series 6 Reading 7 Sleeping 8 Travelling 9 Consume alcohol 10 Smoking 11 Prescribed medication 12 Others ……
5.16	On a typical day, how many hours do you sleep at night?	
5.17	Do you think you get adequate sleep?	1 Yes 2 No
5.18	Are you able to balance your professional and personal lives? (Make time for family/friends as well as work)	1 Never 2 Rarely 3 Sometimes 4 Often 5 Always

Section 6: Burnout

Now we are moving to last 2 sections. Burnout is defined by the World Health Organization as a chronic stress condition that develops gradually as a result of a prolonged stress environment. It's a challenging process associated with significant levels of stress, pressure, and loneliness. Stress-related disorders

are becoming a growing problem in academia, particularly among young academics.

The following questions are to assess the Burnout you may experience during your PhD program. This is a series of statements with which you may agree or disagree. Using the scale, please indicate the degree of your agreement by selecting that corresponds with each statement.

Q. No.	***Oldenburg Burnout Inventory***	***strongly agree***	***agree***	***disagree***	***strongly disagree***
6.1	I always find new and interesting aspects in my work	1	2	3	4
6.2	There are days when I feel tired before I arrive at work	1	2	3	4
6.3	It happens more and more often that I talk about my work in a negative way	1	2	3	4
6.4	After work, I tend to need more time than in the past in order to relax and feel better	1	2	3	4
6.5	I can tolerate the pressure of my work very well	1	2	3	4
6.6	Lately, I tend to think less at work and do my job almost mechanically	1	2	3	4
6.7	I find my work to be a positive challenge	1	2	3	4
6.8	During my work, I often feel emotionally drained	1	2	3	4
6.9	Over time, one can become disconnected from this type of work	1	2	3	4
6.10	After working, I have enough energy for my leisure activities	1	2	3	4
6.11	Sometimes I feel sickened by my work tasks	1	2	3	4

6.12	After my work, I usually feelworn out and weary (*worn out and weary means extremely tired or exhausted*)	1	2	3	4
6.13	This is the only type of work that I can imagine myself doing	1	2	3	4
6.14	Usually, I can manage the amount of my work well	1	2	3	4
6.15	I feel more and more engaged in my work	1	2	3	4
6.16	When I work, I usually feel energized	1	2	3	4

Section 7: Depression, Anxiety and Stress

This is the final section which is divided into three subsections. Each part focuses on a different mental health issue, such as depression, anxiety, or stress. The prevalence of depressive disorders among university students is believed to be six times greater than in the general population, with post-graduate/research students having a higher prevalence. Hence these areas are focused on.

7 A. PATIENT HEALTH QUESTIONNAIRE (PHQ-9)

The following questions are related to your mental health. Over the last 2 weeks, how often have you been bothered by any of the following problems?		Not at all	Several days	More than half the days	Nearly every day
A.1	Little interest or pleasure in doing things	0	1	2	3
A.2	Feeling down, depressed, or hopeless	0	1	2	3
A.3	Trouble falling or staying asleep, or sleeping too much	0	1	2	3
A.4	Feeling tired or having little energy	0	1	2	3
A.5	Poor appetite or overeating	0	1	2	3

A.6	Feeling bad about yourself or that you are a failure or have let yourself or your family down	0	1	2	3
A.7	Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
A.8	Moving or speaking so slowly that other people could have noticed. Or the opposite - being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
A.9	Thoughts that you would be better off dead, or of hurting yourself	0	1	2	3

7 B. GAD-7 Anxiety

The following questions are related to your anxiety. Over the last two weeks, how often have you been bothered by the following problems?		Not at all	Several days	More than half the days	Nearly every day
B.1	Feeling nervous, anxious, or on edge	0	1	2	3
B.2	Not being able to stop or control worrying	0	1	2	3
B.3	Worrying too much about different things	0	1	2	3
B.4	*Trouble relaxing*	0	1	2	3
B.5	Being so restless that it is hard to sit	0	1	2	3
B.6	Becoming easily annoyed or irritable	0	1	2	3
B.7	Feeling afraid, as if something awful might happen	0	1	2	3

7. C. Perceived Stress Scale 4 (PSS-4)

The following questions are related to your perceived stress. The questions in this scale ask you about your feelings and thoughts during THE LAST MONTH. In each case, please indicate your response by placing an "X" over the square representing HOW OFTEN you felt or thought a certain way.		Never	Almost Never	Some times	Fairly Often	Very Often
C.1	In the last month, how often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
C.2	In the last month, how often have you felt confident about your ability to handle your personal problems?	0	1	2	3	4
C.3	In the last month, how often have you felt that things were going your way?	0	1	2	3	4
C.4	In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

7. D.

D.1	Have you undergone any sessions/ courses/ treatment/ any services related to mental health in the past?	1. Yes 2. No
D.2	Did you seek any of the following services? (If yes to D.1.)	1. Smoking cessation 2. Deaddiction 3. Counselling therapy 4. Specialist care 5. Others

		If others, please specify……
D.3	Do you plan to seek any of the following service in the future? (If no to D.1.)	1. Smoking cessation 2. Deaddiction 3. Counselling therapy 4. Specialist care 5. Others 6. No services will be required If others, please specify…….
D.4	Kindly provide any additional critical information, if any, in regard to the above-mentioned mental health sections (optional):	

Thank you for your valuable time 😊

श्री चित्रा तिरुनाल आयुर्विज्ञान और प्रौद्योगिकी संस्थान, त्रिवेन्द्रम
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Institutional Ethics Committee

(IEC Regn No. ECR/189/Inst/KL/2013/RR-21)

SCT/IEC/2006/MARCH/2023

18.04.2023

Dr. Aswathy BI
MPH Student, AMCHSS
SCTIMST, Thiruvananthapuram

Dear Dr. Aswathy,

The Institutional Ethics Committee held on 18th March, 2023, reviewed and discussed your application to conduct the study titled "**PREVALENCE OF BURNOUT AMONG RESEARCH STUDENTS IN SCIENCE AND TECHNOLOGY INSTITUTIONS IN THIRUVANANTHAPURAM, KERALA** (IEC/2006)".

The following members of the Ethics Committee were present at the meeting held on 18th March, 2023.

SL. No.	Member Name	Highest Degree	Gender	Scientific /Non Scientific	Affiliation with Institution(s)
1.	Smt. Sathi Nair	MA (English Literature)	Female	Lay Person	No
2.	Dr. Pradeep S	MBBS, MD	Male	Basic Medical Scientist	No
3.	Dr. Christina George	MD Psychiatry	Female	Clinician	No
4.	Dr. P. Manickam	BSMS, MSc (Epid).,PhD	Male	Health Science Expert/ Social Scientist	No
5.	Adv. Priya Kaimal	LLM, MBL	Female	Legal Expert	No
6.	Dr. Biju Soman	MBBS,MD, DPH, MSc, DLSHTM	Male	Basic Medical Scientist	Yes
7.	Dr. Syam K	MBBS, MD, DM	Male	Clinician	Yes
8.	Dr. Srinivas G	PhD	Male	Basic Medical Scientist (Member Secretary)	Yes

The following documents were reviewed:

Original submission

1. Checklist Form
2. Covering letter addressed to the Chairman, IEC, SCTIMST dated 03.03.2023
3. Responses/Amendments made based on the Reviewer's comments
4. IEC Application Form
5. Research Proposal
6. Research Participant Information Sheet
7. Informed Consent
8. Questionnaire
9. CV of Principal Investigator and Guide
10. Declaration Form
11. SRC Recommendation letter

Revised submission

1. *Covering letter addressed to the Chairman, IEC, SCTIMST dated 04.04.2023*
2. *Copy of IEC Recommendation letter dated 03.04.2023*
3. *Checklist Form*
4. *IEC Application Form*
5. *Research Proposal*
6. *Information Sheet*
7. *Consent Form*
8. *Questionnaire survey*
9. *CV of Principal Investigator and Guide*
10. *Declaration Form*

IEC Decision

The IEC approved the conduct of the study in the present form.

Remarks:
The Institutional Ethics Committee expects to be informed about the progress of the study, any SAE occurring in the course of the study, any changes in the protocol and patient information/informed consent and asks to be provided a copy of the final report.

There was no member of the study team / Guide who participated in voting / decision making process. The ethics committee is organized and operated according to the requirements of Good Clinical Practice and the requirements of the Indian Council of Medical Research (ICMR).

Sincerely,

Dr. G. Srinivas
Member Secretary, IEC

MEMBER SECRETARY
INSTITUTIONAL ETHICS COMMITTEE (IEC)
SCTIMST, THIRUVANANTHAPURAM

SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES & TECHNOLOGY
INSTITUTIONAL ETHICS COMMITTEE (IEC) SCTIMST

Originality Report

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Sources included in the report

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Entire Document

ABSTRACT Background: PhD (Doctor of Philosophy) is widely regarded as the highest level of formal education that an individual can obtain. Research is a very methodical, organised, well-planned, and problem-solving activity where researcher is constantly in a state of turmoil, stress, and pressure. Stress-related diseases are a growing concern in the academic workplace, particularly among young researchers. The researcher's health, particularly their emotional and psychological health, has an impact on the results of their research. The present study assessed

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the prevalence of burnout among research students and the factors associated with burnout among research students. Methods: A cross sectional survey was conducted among 298 Ph.D. students from 7 science and technology institutions in Thiruvananthapuram, Kerala. Data was collected using a self-administered questionnaire which had questions from the Oldenburg Burnout Inventory (OLBI), the