

Factors Influencing the Mental Health of White-Collar Construction Workers in Developing Economies: Analytical Study during the COVID-19 Pandemic in India

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Abstract: This study focuses on an important issue of the mental health of white-collar construction workers, a concern that has grown more serious following the COVID-19 pandemic. Therefore, the purpose of this study is to investigate the factors that influenced the mental health of the white-collar construction workers during the COVID-19 scenario. Based on the review of extant literature, a survey questionnaire was developed and distributed online to Indian professional construction workers, 206 responses were received, and a data set was prepared for further analysis. The data set was analyzed using exploratory factor analysis, and second-order confirmatory factor analysis and distinct stressors were identified. The most critical were lack of upskilling challenges (SFL = 0.85) and workplace-related issues (SFL = 0.85), followed by financial constraints (SFL = 0.76) and family-related problems (SFL = 0.44), both having a moderate impact. The results of the study were used to design a stress management matrix that recommends practical strategies to minimize work-related stress. By aligning with the UN Sustainable Development Goals, this research contributes to enhancing worker wellbeing and enhanced productivity of construction workers. DOI: [10.1061/JCEMD4.COENG-14015](https://doi.org/10.1061/JCEMD4.COENG-14015). © 2024 American Society of Civil Engineers.

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Introduction

Psychological stress amongst construction workers arises from factors such as workload, lack of training, and poor communication among workers and their supervisors (Alsharef et al. 2023). Additional elements such as inadequate room for innovation, lower wages, ambiguity in job requirements, long working hours, tight schedules, and unfavorable working conditions further enhance the impact of these stressors, cause severe mental distress, and influence psychological safety (Chen et al. 2017; Olanrewaju et al. 2017; Enshassi et al. 2018; Liang et al. 2021). According to Edmondson (1999) psychological safety is “a belief that one

will not be punished or humiliated for speaking up with ideas, questions, concerns, or mistakes.” Therefore it can be stated that the mental health of workers is associated with the phenomenon of psychological safety influencing their overall occupational wellbeing.

Stress in construction workers is a result of psychological or physical factors (Batson et al. 2022; Ibrahim et al. 2023). The statistics published by chartered institute of building (CIOB) state that around 79,000 construction workers suffer from poor mental health (Rees-Evans 2020). The media has paid increasing attention to mental health and wellbeing in recent years, which raised public and corporate awareness. However, the decision-making process is still impacted by this issue across the construction sector, from the boardroom to the construction site. From the Rees-Evans (2020) CIOB report it was identified that poor communication (70.45% of respondents considered it stressful), unrealistic deadlines (71.26% of respondents considered it stressful), too much work (71.26% of respondents considered it stressful), and time pressure (73.33% of respondents considered it stressful) were the main factors that caused stress amongst construction workers. And it can be argued that the stress, anxiety, depression, fatigue, and irritability in construction workers that affect their productivity are a result of the aforementioned factors. Additionally, stress was reported as the most prevalent mental health condition experienced during study of more than 2,000 professionals in the construction business with almost 97% of the respondents reporting the issues (Rees-Evans 2020).

The lockdown that was imposed due to the COVID-19 crisis during the years of 2020–2021 was one of the worst phases for the construction industry globally, since construction work was stopped due to lockdowns and the resulting joblessness negatively impacted the mental health of white-collar construction workers

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Table 1. Past studies on mental stress and mental health problems of construction workers

Researchers	Year published	Main topics/themes
Kotera et al. (2020); Carvajal-Arango et al. (2021); Dennerlein et al. (2021); Pirzadeh and Lingard (2021); Sommovigo et al. (2021); Liang et al. (2022c); Singh and Ramdeo (2023)	2020–2021	Mental health and wellbeing of construction workers, prevalence of mental health problems, factors associated with mental health problems, interventions for improving mental health and wellbeing
He et al. (2019); Janusonyte et al. (2019); Kotera et al. (2019); Xing et al. (2019)	2019	Experiences and perceptions of mental stress among construction workers, factors that contribute to mental stress, consequences of mental stress
Jebelli et al. (2018a, b); Maqsoom et al. (2018); Yuan et al. (2018)	2018	Mental stress in construction workers, impact of mental stress on performance, factors that contribute to mental stress
Martin et al. (2016); Chen et al. (2017); Sunindijo and Kamardeen (2017)	2016–2017	Psychosocial factors and mental health in the construction industry, prevalence of mental health problems, risk factors for mental health problems, interventions for improving mental health
Dollard et al. (2014); Lorente et al. (2014); Niedhammer et al. (2015)	2014–2015	Mental health and wellbeing of construction workers in China, prevalence of mental health problems, risk factors for mental health problems, interventions for improving mental health

during the COVID crisis. Additionally, the transformation in work practices, e.g., the introduction of fourth-generation technologies such as drones for work monitoring, the use of building information modeling (BIM), and the use of remote working (billing and planning professionals), escalated the scenario specifically in developing countries. Thus, it can be argued that in the lockdown, joblessness escalated the work-related stresses. These stresses were mainly a result of heavy workloads, strict deadlines, an excessive amount of pressure or responsibility, and upskilling requirements. Some of the past studies that have focused on mental health and stress among the construction workers are shown in Table 1.

From the Table 1 it can be stated that past researchers also found that construction workers are at higher risk for mental stress, including depression, anxiety, and other mental health problems, particularly when they experience high levels of job strain, which is characterized by high demand and low control at work (He et al. 2019; Horváthová et al. 2023).

The COVID-19 pandemic intensified the impact risks on construction workers, as it introduced additional stressors such as health and safety concerns, job insecurity, changes to work environments and routines, and financial stress (Frimpong et al. 2022b; Guerin et al. 2022). It is therefore important for construction workers to have access to resources and support to manage stress and promote mental wellbeing amid the COVID-19 crisis. Therefore, the aim of the study was to identify and understand the influence of various COVID-19 introduced challenges on the mental health of construction workers. According to Jacobsen et al. (2013), during the post-pandemic era 16% of white-collar construction workers suffered from the mental distress. Additionally, Fisher et al. (2020) also mentioned that around 21% of white-collar construction workers in Australia reported anxiety and mental distress during the COVID-19 pandemic. Furthermore, in the case of developing countries King and Lamontagne (2021) have stated that white-collar construction workers are at a high level of suicidal risk due to severe mental health challenges arising out of their professional and personal environment. Therefore, the study explores the perspective of Indian white-collar construction workers on the factors that influenced their mental health. Moreover, the scope of this study is limited to psychological stress only, and physical stressors that induce stress have not been considered in the present study. The purpose behind doing so was to understand the emotional stressors and their

impact on the mental health of white-collared construction workers. Physical stressors were not considered to specifically understand the influence of emotional stressors on the mental health and occupational wellbeing of white-collar workers in the construction industry.

While researchers have explored safety from the physical and psychological aspects, this study contributes to the body of knowledge in two ways. First, it adds to the concept of psychological safety within the construction industry, by understanding the impact of stressors on mental health. And by doing so, the study contributes to the body of knowledge by developing strategies to improve the mental health of white-collar construction workers that would manifest better economic growth and enhance psychological safety through increased employee wellbeing. Therefore, the study also contributes toward the following UN sustainable development goals:

- SDG 3: Good Health and Wellbeing.
- SDG 8: Decent Work and Economic Growth.
- SDG 9: Industry, Innovation, and Infrastructure.

Additionally, this investigation into the factors affecting the mental health of white-collar construction workers in developing economies adds to the discourse on occupational wellbeing. It offers a perspective that highlights the significance of mental health under professional demands, including remote work and digitalization in the construction. The findings provide strategies for the organizations in developing countries to support white-collar workers. The purpose of this is to foster an environment conducive to mental wellbeing for white-collar workers, since the white-collar construction worker plays an important role in organizational decision making and project management. Such an environment would contribute goals of SDG 3 by ensuring employee wellbeing but also contribute to SDG 8 and SDG 9 by enhancing economic growth through a mentally stable and innovative workforce within the industry.

Theoretical Background

In the aftermath of the COVID-19 pandemic, specifically the time just after lifting of lockdowns, construction workers ranging from project managers to laborers faced family-related issues, workplace-related problems, lack of upskilling, and financial concerns specifically

in developing countries, e.g., Africa, South Asia, and Southeast Asia. Each of the intersections intersects with factors that influence worker mental health resulting in distress. In this context Edmondson and Bransby (2023) and Bransby et al. (2023) have advocated that considering work as a learning opportunity can manifest a psychologically safe environment. This directly links with the psychological challenges being faced by construction workers. For example, a learning-oriented work environment addresses workplace-related problems by encouraging open communication about safety concerns or procedural inefficiencies. Similarly, a culture open to mistakes might mitigate challenges related to upskilling by fostering an atmosphere conducive to continuous learning.

Construction workers are a vital part of the global economy, but they often face unique challenges in maintaining a healthy work–life balance (International Labour Organisation 2022). In India, according to a report by International Labour Organisation (2022) around 71% of construction workers reported working long hours, with 37% working more than 48 h per week. This schedule can lead physical and mental fatigue, as well as result in difficulties to manage family-related responsibilities.

Moreover, construction workers face additional stressors due the work environment, e.g., exposure to hazardous materials (Jebelli et al. 2018a), physical dangers on the job site (Janusonyte et al. 2019), and limited access to medical facilities in developing countries (Farashaei et al. 2022). These issues severely influence the mental health of professional construction. Furthermore Alsharef et al. (2023) and Frimpong et al. (2022a) also have observed that construction workers have higher rates of depression and anxiety compared to other occupations during COVID-19. Therefore, it is essential to focus on the wellbeing of construction workers, both in India and across the globe. This includes measures such as implementing fair labor practices (International Labour Organisation 2022), providing access to healthcare and mental health resources (Horváthová et al. 2023), and promoting work–life balance through policies such as paid time off and flexible scheduling (Jebelli et al. 2018b). In the context of the COVID-19 pandemic, many factors contribute to psychological stress among construction workers. And as a result, the white-collar construction workers primarily have the following concerns:

- **Health and safety concerns:** The pandemic has increased construction workers' concerns about their own health and safety, as well as the health and safety of their loved ones (Sherratt and Aboagye-Nimo 2022; Ajslev and Nimb 2022; Zhang et al. 2023).
- **Job insecurity:** The economic impact of the pandemic has resulted in uncertainty about job security and future employment prospects for construction workers due to technological transitions (Frimpong et al. 2022b; Liang et al. 2022c, d).
- **Changes to work environment and routines:** The pandemic has required construction workers to adapt to new protocols and procedures, such as wearing personal protective equipment (wearing mask and gloves) or practicing social distancing. It was stressful as the workers specifically in developing countries were not acclimated to that (Vignoli et al. 2021; Chong et al. 2022; Karnena et al. 2022).
- **Financial stress:** The pandemic may have caused financial strains for construction workers, such as lost income or increased expenses (Sommovigo et al. 2021; Sun et al. 2022; Ajslev and Nimb 2022).

While the above-mentioned factors were the primary concern of the workers that resulted in mental distress, their root causes are associated with the systemic challenges the white-collar workers face in professional and personal lives, for example:

- **Family-Related Challenges:** Health and safety concerns in the workplace are closely linked to the welfare of workers' families (Saurin 2021; Batson et al. 2022). Anxiety because of illness not only affects the individual workers but also raises concerns about their ability to safeguard the health of family members, thereby impacting their mental health (McCausland 2023).
- **Workplace-Related Problems:** The necessity to adjust to new work protocols and routines demonstrates the difficulties associated with changes in the workplace (Duan et al. 2023). These challenges go beyond mere physical adjustments and can lead to significant psychological strain as workers strive to maintain productivity amidst changing industry norms (Alsharef et al. 2023; Bransby et al. 2023).
- **Financial Issues:** Financial stress demonstrates the broader economic issues that white-collar construction workers face (Bransby et al. 2023; Duan et al. 2023). Short-term financial difficulties indicate financial instability, which negatively impacts the mental health and wellbeing of workers and their families (Liang et al. 2022a; Liu et al. 2023).
- **Lack of Upskilling:** The transformation of the construction industry, particularly with the integration of Industry 4.0 and digitalization, requires continuous skill development (Wang et al. 2022; Zhou et al. 2022). The stress associated with the need for upskilling is not just about learning new technologies; it also relates to job security and the potential for career advancement or obsolescence (Liang et al. 2022a; Duan et al. 2023).

It can be argued that the mental health of white-collared construction workers is affected by family-related challenges, workplace-related problems, lack of upskilling, and financial issues. For example, the economic repercussions of the pandemic create job insecurity, which in turn affects the family-related challenges faced by construction workers (Choudhari 2020). New protocols in the work environment resulted in change of routine leading to workplace-related problems (Liang et al. 2022a). Financial stress during this period aligns with the broader category of financial issues, implicating concerns such as lost income (Singh and Ramdeo 2023). The digital transformation in the sector necessitates a focus on the lack of upskilling as a stressor, given the need for workers to adapt (US Bureau of Labour Statistics 2021). Therefore, to measure the influence of these challenges on the mental health of construction workers the theoretical lens of stress and coping theory (Folkman and Lazarus 1985) and social cognitive theory (Bandura 2002) was found suitable. Stress and coping theory offers a structured approach to understanding how individuals manage stress, providing a useful framework for investigating both family-related and workplace-related challenges among construction workers. Social cognitive theory, on the other hand, focuses on the relationship between individual beliefs, actions, and the surrounding environment, which makes it useful for examining issues such as lack of upskilling and financial difficulties. In the next section these lenses are discussed in detail.

Theoretical Lens

The study integrates two complementary theories to explore the mental health of construction workers. Initially, the Folkman and Lazarus (1985) transactional model of stress and coping (psychological stress and coping theory) suggests that stress arises when perceived demands outweigh one's resources. Cognitive appraisal, the mental process of evaluating one's resourcefulness, plays an important role (Folkman 1984). In the construction context, cognitive appraisals frequently revolve around workplace safety and family responsibilities (Choudhari 2020; Bautista-Bernal et al. 2021). Further refining this perspective, stress and

coping theory categorizes coping mechanisms into problem-focused and emotion-focused strategies (Folkman 1984; Folkman and Lazarus 1985). An example is a construction worker enhancing safety measures to manage workplace stress, thereby positively affecting mental health (McCausland 2023). Alternatively, seeking social support can be viewed as an emotion-focused strategy to handle family-related stress (Bransby et al. 2023; McCausland 2023).

Moving from coping mechanisms to behavioral influences, social cognitive theory by Bandura (2002) increases the scope of study to investigate the interaction between personal factors, behavior, and environment on the mental health of construction workers. This theory highlights the dynamic relationship between behavior, environment, and personal factors, unified by the principle of triadic reciprocity (Zhou et al. 2022). Its main elements, e.g., self-efficacy and outcome expectations, become an important aspect in the context of mental health and psychological safety (Zhou et al. 2022; Liu et al. 2023). In the construction sector, self-efficacy refers to a worker's belief in their ability to learn new skills (Zhou et al. 2022). Outcome expectations could be the anticipated benefits, either financial or job-related, of such upskilling (Liu et al. 2023). These elements provide a lens to examine the impact of lack of upskilling and financial difficulties on stress levels. In the following sections the factors that result in the challenges that affect a construction worker's mental health are discussed.

Discourse on Factors Contributing to Challenges Affecting Mental Health

In the previous section, primary challenges influencing the mental health of construction workers, e.g., family-related challenges, workplace-related problems, financial issues, and lack of upskilling, were identified. In this section, using psychological stress and coping theory and social cognitive theory, the factors that resulted in these challenges are discussed in detail.

Family-Related Challenges

From the lens of the stress and coping theory, various factors contribute to the mental wellbeing of construction workers, particularly in India. Reports from the National Institute of Mental Health and Neurosciences (2020) and Indian Council of Medical Research (2021) have highlighted the role of family-related issues in increasing anxiety levels among these workers during the COVID-19 pandemic and post lifting of lockdowns (Horváthová et al. 2023; Singh and Ramdeo 2023; Zhang et al. 2023). A substantial 60% of construction workers reported experiencing high stress, a phenomenon also noted in earlier studies (Sun et al. 2022). In accordance with stress and coping theory, social distancing measures enforced during the pandemic serve as environmental stressors, and increased feelings of isolation among workers lead to suicidal thoughts (Zhang et al. 2023). Economic difficulties, accentuated by low earnings and the responsibility of providing for large families, emerge as significant stressors requiring coping mechanisms (Singh and Ramdeo 2023).

Moreover, domestic violence has been recognized as an acute stressor negatively impacting mental health specifically among female construction workers, requiring immediate coping strategies (Indian Council of Medical Research 2021). The increased risk of suicide among the construction worker, especially for those in supervisory work due to job loss, loss of a close family member, etc., demonstrates the severity of these stressors (National Institute of Mental Health and Neurosciences 2020; Indian Council of

Medical Research 2021). While some workers find resilience and improved mental health through strengthened family bonds during crises, the absence of adequate medical services and the added responsibility of caring for ill family members serve as additional stressors that warrant coping strategies (Pirzadeh and Lingard 2021). The presence of these stressors necessitates professional intervention for effective coping, as suggested by stress and coping theory. Thus, the following can be hypothesized:

H0: There is no significant impact of 'family-related challenges' on the mental health of construction workers.

H1: There is a significant impact of 'family-related challenges' on the mental health of construction workers.

Workplace-Related Problems

The COVID-19 pandemic has significantly disrupted the construction industry, resulting in stressors that directly influenced the mental wellbeing of workers. These stressors are best understood through the framework of stress and coping theory. Initial challenges arose from government restrictions mandating remote work, a problematic adjustment for an industry reliant on on-site activities (Choudhari 2020; Denny-Smith et al. 2021). Consequently, there was a 20% increase in work backlog due to site closure and an average extension of working hours by 10% (Liang et al. 2022d). These operational changes have led to financial repercussions, including difficulties in employee appraisals and a 30% decline in company cash flows (Indian Council of Medical Research 2021; Zhang et al. 2023).

In addition to these challenges, the COVID crisis has also caused several mental health issues among construction workers. For instance, 70% of workers reported increased levels of stress and (Liang et al. 2022a). This increased stress has also escalated workplace conflicts by 15%, as observed by Ibrahim et al. (2023). The absence of a legal framework in this largely unregulated sector enhanced the magnitude of these issues, contributing to a 10% decline in overall productivity (Liang et al. 2022b). Additional concerns around site sanitization and locations in COVID-affected areas have compounded these stressors (Ibrahim et al. 2023). Therefore, the following can be hypothesized:

H0: There is no significant impact of 'workplace-related problems' on the mental health of construction workers.

H2: There is a significant impact of 'workplace-related problems' on the mental health of construction workers.

Challenges Due to Lack of Upskilling

Examining the lack of upskilling among construction workers through social cognitive theory provided insights into its impact on mental health, especially during the COVID-19 pandemic. Financial challenges have made it difficult for workers to access specialized training (Denny-Smith et al. 2021). This financial constraint limits workers' ability to adapt to new technologies, affecting their confidence and skill set (Liang et al. 2022a). Moreover, employers have not sufficiently informed workers about opportunities for professional development (Singh and Ramdeo 2023).

The limitations in upskilling have implications beyond economic concerns; they also affect workers' mental wellbeing. Workers who find it difficult to adapt to new technologies may experience low self-esteem and feelings of inadequacy (Liang et al. 2022a). This emotional strain can lead to increased stress and anxiety and, in some instances, contribute to depression (Liang et al. 2022c). Thus, improving access to upskilling opportunities could benefit not just

the career prospects of construction workers but also their mental health. Therefore, following hypothesis can be developed:

H0: There is no significant impact of ‘lack of upskilling’ on the mental health of construction workers.

H3: There is a significant impact of ‘lack of upskilling’ on the mental health of construction workers.

Financial Issues

From the lens of social cognitive theory, the financial challenges faced by construction workers, particularly during the COVID-19 pandemic, have become a noteworthy point of inquiry. These challenges have immediate and long-term effects on both the physical and mental wellbeing of workers (Sahoo and Ashwani 2020; Pirzadeh and Lingard 2021). Job loss and delayed payments have caused financial instability, adding to the overall stress workers experience (Sahoo and Ashwani 2020). Additional anxiety stems from the risk of contracting the virus on job sites, which can incur extra expenses (Liang et al. 2022c).

Moreover, the construction sector has been severely impacted by the pandemic, with more than 70% of firms reporting a decline in business (Sahoo and Ashwani 2020). This trend is not unique to India; similar patterns of financial hardship among construction workers have been observed globally (Babar 2020; US Bureau of Labour Statistics 2021). Therefore, there is a pressing need for employers and policymakers to focus on the financial wellbeing of construction workers as a matter of priority. Hence the following can be hypothesized:

H0: There is no significant impact of ‘financial issues’ on the mental health of construction workers.

H4: There is a significant impact of ‘financial issues’ on the mental health of construction workers.

Concept Derived

The mental health of construction workers is an element that influences the psychological safety as the latter ensures the overall wellbeing of the construction workers (Edmondson and Bransby 2023). The conceptual framework derived (see Fig. 1) demonstrates that mental health is influenced by several challenges, such as family-related issues, problems in the workplace, the challenge of upskilling, and financial difficulties. Stress and coping theory helps us understand how family and workplace challenges contribute to mental stress (Sahoo and Ashwani 2020; Ibrahim et al. 2023).

At the same time, social cognitive theory offers insights into how difficulties in upskilling can affect a worker’s confidence and mental wellbeing (Liang et al. 2022a). Financial issues, another key factor, add to the stress and uncertainty that impact mental health. As for the perspective of the construction workers, financial issues such as delayed salaries, job loss, or mounting debt create a sense of uncertainty and stress, influencing their mental wellbeing (Sahoo and Ashwani 2020).

Furthermore, contextualizing the concept of psychological safety provides an additional lens in understanding how various challenges affect not only mental health but also broader aspects of psychological wellbeing. This will increase the study’s contribution toward feelings of safety in the workplace, the comfort level in raising concerns, and freedom from fear of criticism.

Research Methodology

The aim of the study was to identify and understand the influence of various COVID-19 introduced challenges on the mental health of construction workers. To achieve this goal, an extensive review of recent literature was conducted, and a survey instrument was developed. The Likert scale items used in the survey instrument are

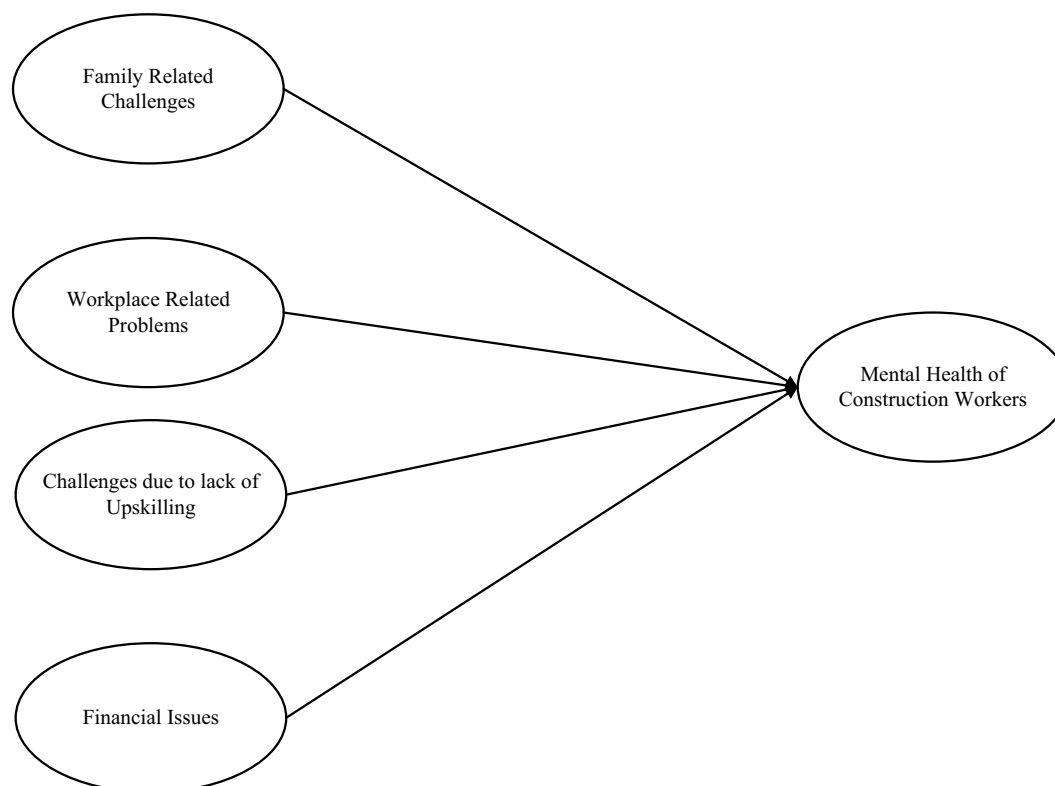


Fig. 1. Factors influencing mental health of construction workers.

shown in Table 2 and were used to understand the perspective of the professional construction worker (herein also referred to as construction workers). The participants of the study were selected with the help of the Institution of Engineers India Uttar Pradesh chapter, the association of construction worker suppliers and Architect associations. A random sampling approach was used, and the survey was administered online and was distributed to the respondent with the help of emails and text messages. In the Indian scenario, though the construction labor workers faced job losses due to site-closures, blue collared workers found employment within the agriculture sector as it was harvesting season when the lockdown was lifted, and they were also secure via several government social security schemes. Also because of the low level of digital literacy and limited understanding of English it was decided that the labor workers should be represented by their suppliers who are graduates and understand English. Therefore, as part of this study the perspectives of various stakeholders, including sole proprietors (e.g., suppliers of labor workers), engineers at various levels of hierarchy, and architects were

explored. Additionally, the reason for choosing the engineers and architects was due to project closure in building construction; many of these faced job losses and had no other option for survival, as observed by National Institute of Mental Health and Neurosciences (2020). The methodological approach for this study is mentioned in Fig. 2. To capture the perspectives of respondents, a survey was conducted that included two sections: demographic information about the respondents in section A, and the importance of identified factors measured on a Likert scale from 1 (not important) to 5 (very important) in section B.

Since the Likert scale item in this study was developed for the extant, a positivist (logical empiricism) worldview was adopted. It emphasizes the development of latent constructs through a review of existing literature and the subsequent testing of these constructs using statistical tools to assess reliability and validity. Following recommendations of Levine (2005), a two-stage methodology was employed. In the first stage, a questionnaire was tested for reliability and validity using the Cronbach alpha test [$\alpha \geq 0.6$

Table 2. Factors identified for the latent constructs

Latent variable	Variable code	Measurable item/factors	References
Family-related issues (FR)	FR1	Absence of family support or caretaker	Choudhari (2020); Denny-Smith et al. (2021); Liang et al. (2022a)
	FR2	Social isolation due to social distancing	
	FR3	Too many dependents	
	FR4	Positive and negative interactions with the family members	
	FR5	Physical and emotional domestic violence	
	FR6	Suicidal thoughts and feelings due to loss of job or a close relative	
	FR7	Increased feeling of closeness	
	FR8	Lack of availability of proper medical facilities	
	FR9	Inability to take care of family or friends due to prolonged illness	
	FR10	Worry about children's education	
Workplace-related problems (WPP)	WPP1	Difficulty in adjusting to virtual work	Sahoo and Ashwani (2020); Pirzadeh and Lingard (2021); Liang et al. (2022c); Singh and Ramdeo (2023)
	WPP2	Lack of effective legal framework to safeguard the interest of unorganized sector	
	WPP3	Longer working hours post lifting of COVID induced lockdowns	
	WPP4	Workplace conflict	
	WPP5	Lack of appraisal	
	WPP6	Location constraints	
	WPP7	Improper sanitization of workplace	
	WPP8	COVID infected coworkers	
	WPP9	Burnout effect leading to disengagement from work	
	WPP10	Lack of contingency plans for critical roles	
Challenges due to lack of upskilling (CUS)	CUS1	Difficulty in coping with the rapid technological advancement	Choudhari (2020); Dennerlein et al. (2021); Denny-Smith et al. (2021); Frimpong et al. (2022a)
	CUS2	Lack of incentives for upskilling	
	CUS3	Cost of upskilling	
	CUS4	Lack of availability of specialized trainers	
	CUS5	Limited knowledge of accreditation available	
	CUS6	Limited learning and development opportunities provided by the employer	
Financial issues (FI)	FI1	Daily wages workers (less savings)	Denny-Smith et al. (2021); Liang et al. (2022c); Sun et al. (2022); Ibrahim et al. (2023); Singh and Ramdeo (2023)
	FI2	Less return on investment	
	FI3	Lack of liquidity (availability of cash)	
	FI4	High out-of-pocket expenses	
	FI5	Bad debts/credits (inability to pay up loans)	
	FI6	Delayed salary payments	
	FI7	Limited earning options	
	FI8	Lack of financial security due to shortfall in employer–employee exchange	

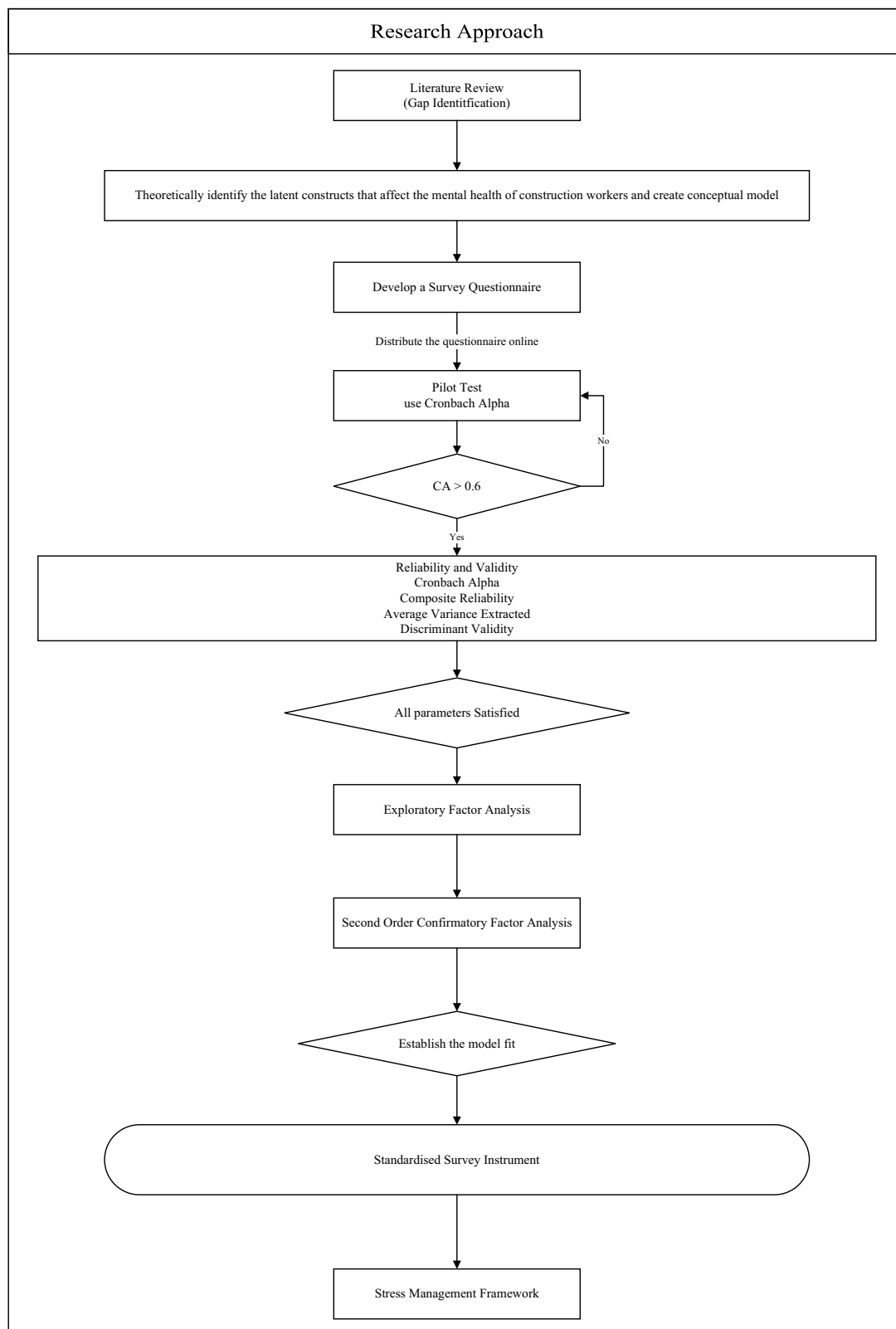


Fig. 2. Research methodology.

(Lin et al. 2006)], composite reliability [$CR \geq 0.7$ (Chiu et al. 2006)], convergent validity [$AVE \geq 0.5$ (Wu et al. 2014)], and discriminant validity (Willis 2020). A Cronbach's alpha of 0.6 or higher indicates a moderate correlation between items within a scale, which is sufficient to proceed with further analysis in early

stages of research. A threshold of 0.7 for composite reliability indicates good level of consistency in the constructs measured by the items in the model. This value suggests that the items of a construct are reliably measuring the underlying theoretical concept. Lastly, an average variance extracted (AVE) value of 0.5 or above shows

that a majority of the variance captured by the construct is due to the variance of the indicator variables, confirming that the construct is well-measured by its indicators. This allowed for the determination of reliability and validity of the scale, providing a basis for further investigation on power and dependence constructs in a general contractor–subcontractor relationship. In the next step the validation of the questionnaire was performed using exploratory factor analysis (EFA), and second-order confirmatory factor analysis (a SEM tool for hypothesis testing) was employed following the recommendation of Chu (2008).

A pilot study with 30 highly experienced respondents was conducted to ensure the reliability of the survey. The data set was analyzed, and a Cronbach alpha value of 0.82 demonstrated the reliability of the questionnaire and internal consistency between the variables with exceeding the acceptable level of 0.6 as stated in Hair et al. (2019). Therefore, no changes were made to the questionnaire for the main study. For the main study the participants were selected using a random sampling approach, and to calculate the required minimum sample size G power software was used following the recommendations of Faul et al. (2007). The required minimum sample size of 200 was calculated using the G power software. The survey was distributed online using Google forms, and the link was sent to participants via email and social media, while maintaining anonymity by not collecting personal information such as names or contact details, and a participant information statement was provided and consent to participate in the study was asked at the beginning of the study.

This study was conducted in India because construction workers in India face many challenges that influence their mental health, such as long working hours, hazardous working conditions, and limited access to mental health resources. By analyzing the influence of these factors on the mental health of professional construction workers in India, strategies to improve their wellbeing and overall quality of life would be recommended.

Demographic Profile of Respondents

The survey was administered online using Google forms and Google docs as a repository for administration and collection of data. The participants were selected using a random sampling approach, and the survey questionnaire was sent to the 1,000 respondents using emails and text messages with the help of professional associations that participated in the study. A low response rate of 25% was observed as only 256 responses were received and 206 were found suitable for the data analysis. The demographic profile of the respondents is shown in Table 3.

Reliability and Validity of the Constructs

To ensure the validity and model fit of the survey and conceptual model developed for this study, a series of tests was conducted. The validity of the questionnaire was evaluated using Cronbach alpha, composite reliability, average variance extracted, and the Fornell–Larker criterion (Hair et al. 2019). The construct validity was assessed through an exploratory factor analysis (Hair et al. 2019). Additionally, second-order confirmatory factor analysis was applied to assess the model fit, and the importance of the constructs was determined by examining the factor loadings, which should be greater than 0.45 as recommended by Hair et al. (2017). To evaluate the fitness of the proposed model, various model fit indices were used, including the chi-square to degree of freedom ratio, goodness of fit index (GFI), adjusted goodness of fit index (AGFI), and comparative fit index (CFI) following the approach of Ogbeibu et al. (2018). Based on the Fornell and Larcker (1981) criterion that

Table 3. Demographic profile of the respondents

Demographic variable	Criteria	Frequency
Experience	0 years to less than 5	27
	5 years to less than 10	46
	10 years to less than 15	116
	15 years to less than 20	11
	20 years or more	6
	Total	206
Gender	Female	56
	Male	150
	Total	206
Job role	Architect	4
	Assistant Engineer	25
	Chief Engineer	32
	Executive Engineer	20
	Project Manager	18
	Quality Manager	1
	Quantity Surveyor	1
	Senior Management	9
	Site Engineer	31
	Sole Proprietor	65
	Total	206
Qualification	Bachelor's degree in civil engineering	61
	Diploma in Architect	2
	Diploma in Engineering	49
	Doctorate	2
	Graduate	75
	Master's Degree	17
	Total	206

Table 4. Reliability and validity of data set

	Cronbach alpha	Composite reliability	A.V. E	WPP	FR	FI	CUS
WPP	0.852	0.924	0.782	0.884			
FR	0.712	0.852	0.812	0.420	0.901		
FI	0.876	0.919	0.732	0.650	0.290	0.856	
CUS	0.798	0.886	0.757	0.720	0.320	0.660	0.870

Note: Bold values represent square root of AVE.

states “the square root of the average variance extracted by a construct must be greater than the correlation between the construct and any other construct,” the discriminant validity of the latent constructs was established. The results of reliability and validity are shown in Table 4.

Analysis and Results

Exploratory Factor Analysis

The reason for using an exploratory approach for questionnaire validation was to delve deeper into the factors that impact analytical project governance within construction projects (Hair et al. 2019). Moreover, the exploratory approach offered valuable insights into the views of construction professionals about factors influencing mental health of construction workers. This method enabled us to create a survey questionnaire that accurately reflects the opinions and experiences of professionals in the construction industry. By validating the questions through an exploratory approach, we ensured that the survey results would accurately capture the perspectives of the participants and provide significant insights into

the factors affecting analytical project governance in construction projects. The results of the exploratory factor analysis (EFA) are displayed in Tables 5 and 6. The factor analysis was performed using SPSS v 26 software.

From Table 6, the results of exploratory factor analysis (EFA), it was identified that out of the initial 35 measurable items, 21 items were grouped under four categories (cumulative total variance explained = 78.36%). This finding had supported the idea that during the COVID-19 pandemic the mental health of construction workers had been significantly impacted by family-related challenges, financial issues, work-related challenges, and challenges due to upskilling. Notably, the exclusion of items WPP1, WPP2, and WPP3 had suggested that construction workers had not faced significant difficulties adapting to longer virtual working hours. This might have been attributed to their prior experience working long hours and under time pressure resulting in these factors having less of an impact on their mental health.

Additionally, exclusion of items CUS5 and CUS7 had implied that construction workers' stress levels were not significantly affected by a limited knowledge of accreditation or a lack of learning and development opportunities. This could be because

Table 5. Results of KMO and Bartlett's test for sampling adequacy

Parameters	Results
Kaiser–Meyer–Olkin measure of sampling adequacy	0.889
Bartlett's test of sphericity	
Approx. chi-square	2,090.953
df	190
Sig.	0.000

Table 6. Results of exploratory factor analysis

Factor	Variable code	1	2	3	4
Burnout effect leading to disengagement from work	WPP9	0.80			
Lack of contingency plans for critical roles	WPP10	0.80			
COVID infected coworkers	WPP8	0.79			
Improper sanitization of workplace	WPP7	0.75			
Lack of appraisal	WPP5	0.71			
Workplace conflict	WPP4	0.71			
Location constraints	WPP6	0.64			
Cost of upskilling	CUS3		0.78		
Difficulty in coping with the rapid technological advancement	CUS1		0.73		
Lack of availability of specialized trainers	CUS4		0.66		
Lack of incentives for upskilling	CUS2		0.65		
Limited learning and development opportunities provided by the employer	CUS6		0.62		
Daily wages workers (less savings)	FI1			0.76	
Less return on investment	FI2			0.72	
Lack of liquidity (availability of cash)	FI3			0.67	
High out-of-pocket expenses	FI4			0.67	
Positive and negative interactions with family members	FR4				0.75
Physical and emotional domestic violence	FR5				0.70
Inability to take care of family or friends due to prolonged illness	FR9				0.70
Social isolation due to social distancing	FR2				0.59
Too many dependents	FR3				0.53

of professional construction workers' familiarity with their jobs, while stress levels increased when the workers faced technological advancements, as indicated by item CUS1 (SFL = 0.73).

Furthermore, financial issues items related to bad debt (FI5), delayed salary payments (FI6), limited earning options (FI7), and lack of financial security (FI8) were excluded. This finding suggests these were not primary sources of stress for professional construction workers in the context of working on the construction site. Additionally, exclusion of items FR1, FR6, FR7, FR8, and FR10 shows that the absence of family support and concerns about children's education were not the main reasons that affect the mental health of professional construction workers as they plan contingencies for these. However, inclusion of item FR3 indicates that an increase in the number of dependents influences mental health. Lastly, exclusion of FR8 suggests that construction sites generally have adequate medical facilities.

Second-Order Confirmatory Factor Analysis

In this investigation, the limitations of conventional factor analysis were overcome by using second-order confirmatory factor analysis (SCFA), which is a structural equation modeling method. With SCFA, latent variables can be tested to establish the constructs identified from literature and demonstrate their relationship with hypothesized construct (Hair et al. 2017). The outcomes of this method provide a more comprehensive analysis of connections between the various elements and support the validity of the model. The use of SCFA allows detailed investigation of the underlying construct and its variables' underlying structures with the help of standard factor loading (SFL). Furthermore, to establish the model fit and validity of the construction a confirmatory factor analysis was also performed; see Fig. 3.

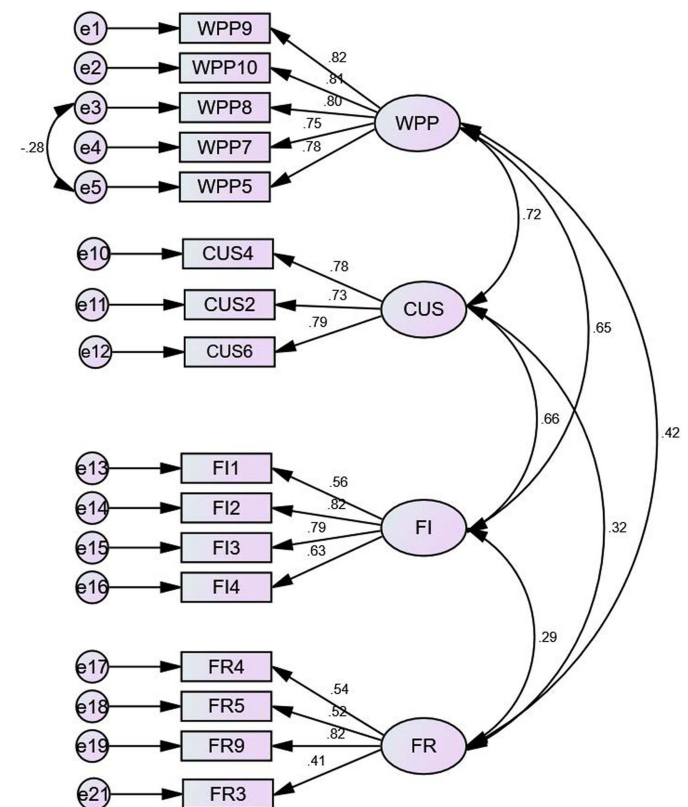


Fig. 3. Results of confirmatory factor analysis.

By employing SCFA a rigorous analysis of the conceptual model (see Fig. 4) was performed to establish its reliability and validity, which further establishes the questionnaire. The results of the analysis are presented in Table 7, which provides information on the model fit. The thresholds of model fit parameters (see Table 7) were adopted based on the recommendations of Hair et al. (2014).

Discussion

Psychological safety, as described by Newman et al. (2017) and Edmondson and Bransby (2023), is important for open interaction in work environments without fear of negative consequences. In the construction industry, lack of psychological safety is linked to mental health issues, made more challenging by the stressful and physically demanding nature of the work. The COVID-19 scenario has added to these workplace-related challenges, further limiting open communication, and reducing psychological safety. Family-related issues, made more difficult by the pandemic, also affect safety at work and work performance. The absence of opportunities for skill development and financial constraints, worsened by the pandemic's economic impact especially in the case of

developing economies, made the workers less willing to take risks, reducing psychological safety. Therefore, in line with the study's aim and using psychological stress and coping theory and social cognitive theory, it is hypothesized that workplace-related challenges, family-related issues, challenges due to lack of upskilling, and financial constraints influence the mental health of construction workers, especially during the COVID-19 scenario.

Second-order confirmatory factor analysis (SCFA) was used as a tool to measure the influence of these factors on the mental health of professional construction workers. It was observed that workplace-related problems, which had SFL of 0.86, strongly influenced mental health. The reason could be a lack of open communication channels, leading to stress and anxiety among workers. This highlights the importance of a psychologically safe work environment. Challenges due to lack of upskilling followed closely with an SFL of 0.84. For example, a worker who lacks the opportunity to learn new construction techniques might feel stagnant in their role, affecting their mental wellbeing. Financial issues, with an SFL of 0.76, also had a strong influence. This shows that professional construction workers are concerned about job security due to financial instability at the job increasing their stress levels. Family-related issues had a moderate influence, with an SFL of 0.43. The pandemic has increased family responsibilities for many, making it more challenging to maintain a work-life balance, which in turn affects mental health. Additionally, this influences psychological safety since it would result in absenteeism at the workplace due to lack of focus and increased stress levels.

Therefore, for organizations, these findings demonstrate that actions are needed to address the factors affecting workers' mental health and psychological safety. Improved communication methods can keep workers informed and reduce stress. Training programs in BIM can help workers adapt to the digital demands that have grown during the pandemic. Transparent pay structures can help ease financial stress, and flexible work hours can assist workers in managing family responsibilities. These actions are not just beneficial for the mental health of the workers but are also crucial for the overall health of the organization, especially in a pandemic-affected developing economies. In the following sections a detailed discussion on the factors underlying these constructs is presented.

Workplace-Related Problems

Research has consistently shown that workplace-related problems have been a primary cause of concern during the COVID pandemic (Denny-Smith et al. 2021; Singh and Ramdeo 2023). In line with these studies, from the SCFA it was identified that the burnout effect leading to disengagement from work (SFL = 0.82) was the most critical factor impacting construction workers' mental health. This was because construction workers experienced high stress levels due to uneven work schedules leading to severe exhaustion (Frimpong et al. 2022a; Alsharef et al. 2023). And since this burnout is a result of physical and psychological fatigue, it disconnects the worker from their duties, resulting in absenteeism (Ibrahim et al. 2023). It also makes them vulnerable to workplace hazards affecting their safety and productivity (Lee et al. 2020).

From an organizational perspective, the lack of a contingency plan for essential roles (SFL = 0.81) and the presence of COVID-19 infected coworkers (SFL = 0.80) were major stressors. The fear of contracting COVID-19 from infected colleagues was a serious worry for construction workers in the case of construction sites that were in the COVID zones. These findings support the observations of Liang et al. (2022b), who emphasized the importance of employers implementing comprehensive safety measures and contingency plans to alleviate the mental strain on their

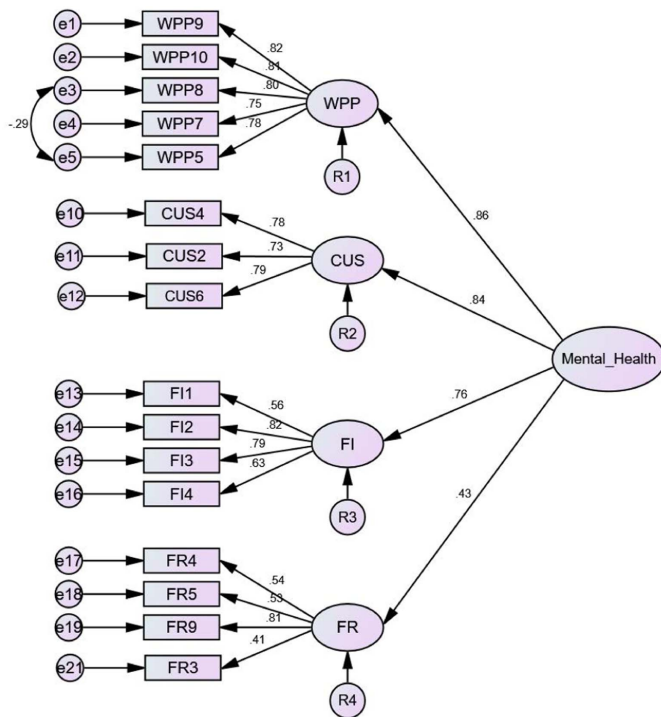


Fig. 4. Results of second-order confirmatory factor analysis.

Table 7. Model fit indices

Model fit indices	Estimate	Threshold	Interpretation
Chi-square/df	1.390	<3.0	Excellent
GFI	0.931	>0.90	Excellent
AGFI	0.902	>0.90	Excellent
NFI	0.910	>0.90	Excellent
TLI	0.966	>0.90	Excellent
CFI	0.974	>0.90	Excellent
RMSEA	0.043	<0.08	Excellent
RMR	0.056	<0.09	Excellent

staff. Moreover, the absence of a proper performance appraisal (SFL = 0.77) was another crucial factor contributing to workplace-related mental health issues. As construction work had transitioned to a more virtual setting, this shift creates an uncertainty about performance evaluation and recognition affects their productivity and mental health (Wang et al. 2022).

Finally, the SCFA identified inadequate sanitization of the workplace (SFL = 0.75) as a significant concern. The pandemic had amplified hygiene awareness and expectations (Wong et al. 2020; Singh and Ramdeo 2023), and construction workers were increasingly conscious of the actions taken by their employers to maintain a clean and safe work environment (Wong et al. 2020). Therefore, any failure to implement proper sanitation measures influences the mental health and psychological safety of construction workforces.

Challenges Due to Lack of Upskilling

The COVID-19 pandemic resulted in significant disruption in the construction industry, particularly in the adoption of new technologies due to the lack of upskilling (Lee et al. 2020; Karanikas and Hasan 2022). Primarily, the limited learning and development opportunities provided by employers have a CUS score of 0.792. The focus on immediate crisis management during the pandemic has made the organizations limit focus on long-term employee development (Choudhari 2020). This influences overall psychological safety, as employees may interpret this as a lack of investment in their skills, leading to increased anxiety and diminished mental wellbeing.

Second, the issue of a lack of specialized trainers (SFL = 0.778) demonstrates the necessity for technological skills, which are made vital because of the pandemic. Some of the technologies, e.g., BIM, have gained popularity, but in the case of developing countries there is a lack of training opportunities (Duan et al. 2023). Also, the cost of training is too high due to the lack of local trainers; thus this requirement is unmet due to the absence of specialized training (Singh and Ramdeo 2023). This gap contributes to reduced psychological safety, as professional construction workers feel less equipped to adapt to industry changes, thereby experiencing increased stress levels influencing mental health.

Lastly, the absence of incentives for upskilling obtains a CUS score of 0.73. As noted by Abreu Saurin (2021), professional construction workers desire skill development. However, without tangible incentives, employees are deterred from pursuing these advancements (Denny-Smith et al. 2021). The resulting skill gap adversely affects psychological safety, contributing to elevated stress levels and negative mental health outcomes (Liang et al. 2022a). This condition is made worse by the COVID-19 pandemic as resulting financial losses made construction organizations limit incentivization for such schemes (Pirzadeh and Lingard 2021).

Therefore, the limited availability of learning opportunities, lack of specialized trainers, and absence of upskilling incentives contribute to professional stagnation and reduced psychological safety. These factors during the COVID-19 pandemic resulted in increased stress and mental discomfort among the construction workers.

Financial Issues

The COVID scenario brought about significant changes to the construction industry, further exacerbating the financial stressors that workers faced. Less return on investment (0.82) emerged as a key financial issue in the SCFA. The pandemic-induced economic downturn led to decreased demand in the construction industry (Sommovigo et al. 2021), causing reduced earnings and limited

work opportunities for construction workers (Ibrahim et al. 2023). This instability undermined their ability to invest and save for the future, contributing to financial stress, which in turn negatively impacted their mental health (Liang et al. 2022c).

Lack of liquidity (0.79) was another financial stressor identified in the SCFA. Payment delays from clients and insufficient credit facilities became more common during the pandemic (Singh and Ramdeo 2023). This lack of liquidity prompted workers to seek high-interest loans, creating a debt cycle that was challenging to escape. The financial instability resulting from the pandemic has been associated with increased levels of stress and potential mental health issues (Kotera et al. 2020).

High out-of-pocket expenses (0.63) continued to burden construction workers in the COVID context. The increased costs of personal protective equipment and sanitation supplies added to the already high expenses (Singh and Ramdeo 2023). This financial strain, particularly for lower-wage workers, led to difficulties in managing their cash flows, further contributing to stress and negative impacts on mental health.

Finally, daily wage workers' limited savings (0.55) persisted as a financial challenge during the pandemic. The intermittent lockdowns and project cancellations led to periods of low demand and increased job insecurity for these workers (Sahoo and Ashwani 2020). With limited savings and restricted access to benefits such as health insurance or paid time off, daily wage workers faced heightened financial stress during the pandemic. This constant worry about financial security contributed to chronic stress and mental health issues (Zhang et al. 2023).

Therefore, the COVID scenario has further intensified the financial stressors experienced by construction workers. As the literature suggests, these financial issues have led to a range of mental health issues, including anxiety and depression (Karanikas and Hasan 2022). Struggling with financial challenges can also decrease job satisfaction and productivity (Denny-Smith et al. 2021) resulting in mental health issues amongst the construction workforce.

Family-Related Challenges

The COVID period has brought numerous challenges for construction workers, with family-related challenges being of particular significance. As observed from the SCFA, the inability to take care of family or friends due to prolonged illness (0.83) surfaced as a primary concern impacting workers' mental health. The increased stress of balancing work and caregiving responsibilities, particularly during a pandemic, can lead to heightened anxiety and depression (Singh and Ramdeo 2023).

Interactions with family members (0.54) also played a crucial role in workers' mental wellbeing. Positive interactions, providing emotional support and validation, could enhance mental health (Karanikas and Hasan 2022). Conversely, negative interactions, marked by conflict and criticism, could lead to increased anxiety and low self-esteem (Zhang et al. 2023).

Physical and emotional domestic violence (0.52) was another significant issue. The stress and fear associated with such violence can lead to severe mental health consequences, including depression, anxiety, and posttraumatic stress disorder (PTSD) (Wang et al. 2022). Therefore, support systems and resources for victims are crucial to help them escape the situation and receive necessary mental health treatment.

Having too many dependents (0.41) was another factor contributing to family-related stress for construction workers. The responsibility of supporting multiple dependents, be it young children or elderly parents, can create considerable financial and emotional strain (Choudhari 2020). This strain can lead to mental health

issues such as depression and anxiety, affecting their overall work performance and relationships.

Hence, family-related challenges, especially in the post-COVID period, have had a significant impact on the mental health of construction workers. These issues can lead to severe mental health consequences if not addressed effectively, ultimately affecting their productivity and overall quality of life.

Contribution and Implication of the Study

Theoretical Contribution

The study contributes to the existing research by analyzing the influence of various stressors on the mental health of professional construction workers in the construction industry. Utilizing psychological stress and coping theory, as well as social cognitive theory, the research explores how workplace problems, skill development, financial stability, and family responsibilities influence the mental health of construction workers, particularly during the COVID-19 pandemic within the broader concept of psychological safety. It was observed that increased work due the COVID-19 lockdown delay and the presence of COVID infected workers resulted in a psychological fatigue. Therefore, it can be argued that absence of effective communication channels significantly contributes to stress and mental health issues among construction workers. This demonstrates a necessity to develop contingencies to facilitate open communication among the workers, thereby enhancing psychological safety.

Moreover, it was identified that limited opportunities for skill advancement lead to feelings of stagnation and stress among construction workers. This extends existing theories of psychological stress and coping theory to include the specific challenges faced by workers in this industry, especially during the pandemic. The study

shows that concerns about job security and financial instability are prominent stressors for construction workers. This adds to the understanding of the importance of financial wellbeing as a critical component of psychological safety within the unique context of the construction industry.

Additionally, it was found that the pandemic has added an additional layer of stress in balancing work and family life. This observation provides a more comprehensive view of the factors affecting mental health in the construction sector, adding to body of knowledge to include family dynamics as a significant element. By focusing on these specific latencies within the construction industry and the COVID-19 pandemic, the study offers insights that increase the importance of psychological safety within the construction sector.

Practical and Policy Implications

The research analyzed the influence of stressors on the mental health of construction workers during the COVID-19 pandemic. Among the identified stressors, burnout resulting from irregular work schedules emerged as a significant contributor to mental health deterioration. This finding demonstrates the necessity for organizations to reevaluate work scheduling and resource allocation considering the effects of pandemic. Moreover, the critical role of contingency planning for essential roles and workplace sanitation were also identified as critical stressors, highlighting the need for comprehensive organizational policies that are sensitive to the mental wellbeing of construction workers. Based on these findings, organizations are advised to integrate following preventive and responsive actions into their existing health and safety protocols to address the identified stressors and enhance psychological safety. A stress management matrix has been developed based on the specific findings; see Fig. 5.

Stressors	Preventive Action for Construction Professionals	Responsive Action for Construction Professionals	Psychological Safety Measures for Construction Professionals
Workplace-Related Challenges	- Site rotation, mandatory rest periods - Role redundancy planning, cross-training - Regular COVID-19 testing, vaccination campaigns. - Regular cleaning schedules, sanitation audits - Objective performance metrics, regular reviews	- On-site mental health resources, quick redeployment - Immediate task reassignment, external hiring - Temporary site closure, remote work arrangements - Immediate sanitation, halt work until resolved. - Immediate feedback sessions, short-term goals	- Anonymous safety reporting, monthly safety briefings - Encourage skill sharing, open forum discussions. - Health and wellness check-ins, isolation protocols - Sanitation quality feedback system - Peer recognition programs
Financial Issues	- Offer saving schemes (incentivised professional advisory) - Investment education programs - Cash advance options - Subsidized additional health insurance	- Emergency funds - Investment reallocation - Immediate cash provision - Medical claim facilitation	- Financial well-being webinars - Confidential financial advice - Emergency fund planning guides - Subsidized medical check-ups
Lack of Upskilling	- Contract with training agencies - Performance-linked upskilling incentives - Regular on-site training workshops	- Intensive training programs - Spot rewards for skill utilization - Immediate upskilling opportunities	- Skill development tracking - Collaboration with local educational institution for training for tool e.g., BIM, advanced construction technologies - Open feedback mechanisms - Incentivised professional development plans
Family-Related Challenges	- Work-from-home options - Crisis management training - Employee assistance programs - Dependent care benefits	- Family counselling - Legal assistance - Immediate medical care - Financial support for dependents	- Work-life balance discussions - Emotional well-being workshops - Crisis helplines - Family support networks

Fig. 5. Stress management matrix.

In the context of policy implications for organizations, the study recommends the incorporation of financial support mechanisms for professionals within employment contracts to mitigate financial stress, as it significantly impacts mental wellbeing. Additionally, the gap in skill development opportunities demonstrates a need for partnerships between construction firms and educational institutions to develop customized training programs for their workers as part of their learning and development strategies. These initiatives would upgrade workforce skills while addressing concerns related to job security making them more mentally relaxed thereby improving psychological safety. The recommended framework provides an approach to managing stressors specifically within the construction profession. It outlines potential impacts, preventive actions, responsive measures, and psychological safety protocols to guide both organizational policy and individual practice.

Conclusion

This study presents a comprehensive investigation into the intricate landscape of workplace stress in the construction industry, focusing on stressors that white-collar workers face, e.g., job burnout, financial struggles, and family-related challenges. In response to these multifaceted issues, the study emphasizes the necessity for proactive and responsive stress management strategies, with the goal of enhancing the overall wellbeing and productivity of construction workers. A notable outcome of this research is the development of a unique stress management matrix to guide industry practitioners in preventing and managing workplace stress specifically in the case of white-collar construction workers.

Another significant contribution of this study is toward the realization of three United Nations Sustainable Development Goals (SDGs). By exploring and providing strategies to mitigate the effect of stressors on the construction workforce, the study contributes with *SDG 3: Good Health and Wellbeing*, aiming to improve the mental health of construction workers. Furthermore, by advocating for improved working conditions and increased productivity it also contributes to *SDG 8: Decent Work and Economic Growth*. Lastly, through the creation of the stress management matrix, the study supports *SDG 9: Industry, Innovation, and Infrastructure*, fostering innovative practices to manage workplace stress within the construction industry.

The alignment of this study with these SDGs emphasizes the broader societal and economic implications of addressing mental health in the workplace. It reinforces the significance of prioritizing workers' wellbeing for sustainable economic growth, industry innovation, and the overall progress toward resilience, efficiency, and sustainability in the construction industry. The aspiration is that this research will stimulate further dialogue, inspire additional studies, and advocate for proactive action in the crucial area of mental health within the construction industry.

Limitation and Directions of Future Research

The study was conducted in India; therefore geographical boundaries were a major limitation of this study. And it is recommended to validate the results in other geographical locations, e.g., South America and Africa. Since a quantitative approach was adopted to understand the perspective of professional construction workers, a limitation exists in the form of qualitatively understanding the perspective of blue-collared construction workers, and future studies can explore this. The effectiveness of the stress management framework may vary depending on specific circumstances within individual construction sites or worker groups; this is another limitation, and the frameworks should be qualitatively validated.

Furthermore, another limitation was the exclusion of physical stressors to focus on the emotional factors. Stress management is a multifaceted aspect, but due to the aforementioned focus of the study understanding the relationship between physical and psychological stressors and understanding their combined influence on the mental health of construction workers is another limitation. It is therefore recommended that future studies should also consider physical factors and update the survey instrument and must carefully consider the perspectives of both white-collared and blue-collared construction workers. Another aspect that can be explored is how these physical factors result in emotional stresses, which can be investigated using a qualitative approach.

Lastly, the limited focus on the project characteristics as a stressor is another limitation of the study, and future studies should include this as a variable to update the questionnaire. In this context it can be recommended that future research should measure the influence of project characteristics indicators; e.g., complexities, duration, project size, etc., impact the mental health of construction workers. This limitation also demonstrates a need for updating the questionnaire based on a qualitative study to suit unique project characteristics. Additionally, a stress management matrix was proposed as an advice for practitioners. It is recommended that future research should assess the stress management matrix's applicability and effectiveness across diverse settings within the construction industry using a phenomenological case study approach.

Moreover, further case studies can focus on the investigating the impacts of these stressors and measure the success of the proposed strategies over time. As the construction industry continues to evolve rapidly, further exploration into how emerging technologies and industry trends impact workplace stress could prove beneficial and can also be explored. Also, future studies can consider using physical stressors such as the presence of hazardous materials onsite to explore the mental health of construction workers.

Data Availability Statement

All data, models, and code generated or used during the study appear in the published article.

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