



Exploring stressor-performance dynamics of construction workers: A VAR-based longitudinal study with five case studies

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ABSTRACT

Despite growing attention to stressor-performance relationships in the construction industry, the dynamic, time-sensitive interplay of this relationship remains underexplored. This study adopted an idiographic approach to examine how stressor-performance interactions evolve over time within individual construction workers. Daily diary data from five participants over an eight-week period were collected following an approved ethical regime. By concentrating on intensive measures with a small number of workers, this study uncovers within-person stressor-performance dynamics that are obscured in traditional nomothetic analyses. Granger-causality analysis revealed no significant predictive effects of stressors on job performance or vice versa for Participants 2, 4 and 5. However, it revealed significant predictive effects of stressors on job performance in Participant 3; significant predictive effects of job performance on stressors in Participant 1 and Participant 3—indicating participant-specific dynamics. Impulse response function analysis highlighted the time-sensitive nature of these dynamics: for Participant 1, improved job performance initially reduced stressor levels, with effects peaking on the second day before gradually dissipating. Variance decomposition analysis revealed various endogenous and/or exogenous contributions of stressors and job performance. The overall stressor and career development stressor from Participant 1, and role management stressor from Participant 3, were primarily explained by their own past values. Participant 3's organisational style stressor was explained by its own past values for the first 4 days, and thereafter by job performance. By identifying how these dynamics unfold at the intra-individual level, the study underscores the importance of tailored stressor-monitoring and performance-support strategies and presents thirteen propositions for future research.

1. Introduction

Stress, defined as a state of worry or psychological tension under challenging conditions (World Health Organisation, 2023), has been a pervasive issue in contemporary workplace. Stressors, in contrast, refer to the specific conditions or events that elicit such psychological responses. Extensive evidence shows that elevated stress levels undermine workers' well-being and hinder organisational productivity (AXA, 2023). Within this broader context, construction stands out as one of the most vulnerable industries due to its complex, high-pressure working environments. Construction workers frequently operate under hazardous site conditions, compressed schedules, and irregular working hours, making them particularly susceptible to chronic stress. International organisations, such as the International Labour Organization (ILO, 2022), have repeatedly emphasised the heightened psychosocial risks faced by construction workers, highlighting the sector's

disproportionate exposure to work-related stressors. National-level data from the UK and China further illustrate the severity of this issue among construction workers: the UK construction workforce reports the highest suicide rate of any sector, with 26% reporting suicidal thoughts (CIOB, 2020), while in China approximately 15% of construction workers suffer from moderate to severe stress—nearly double the rate observed in the general population (Wang et al., 2020; Zhang et al., 2023). Such alarming statistics raise broader concerns about how persistent exposure to stressors may impair construction workers' ability to perform safely and effectively, thereby negatively affecting their job performance and project outcomes (Ye et al., 2022). Therefore, understanding how various stressors interact with job performance in construction workers is essential for informing targeted occupational safety and health (OSH) interventions, strengthening accident-prevention strategies, and supporting the sustainable well-being and productivity of construction workforces.

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Despite growing scholarly attention to the types and consequences of stressors in the construction industry (Lingard and Turner, 2015; Leung et al., 2016a), the temporal dynamics of the stressor-performance relationship remain underexplored. Most existing studies rely on cross-sectional data, capturing stressors and job performance at a single point in time or based on retrospective accounts. These designs have yielded valuable insights by categorising various stressors in the construction industry, such as challenge-hindrance stressors framework (Lepine et al., 2005), and also by identifying impacting pathways within stressor-performance such as stress levels and individual resilience (Chen et al., 2017). However, **they only offer a static snapshot of such relationships, lacking the capacity to capture how these relationships evolve over time.** Stressors are not static; rather, they are dynamic, accumulative, and responsive to changes in the work environment. Their effects on job performance can be immediate, delayed, or cyclical, depending on prior exposures, coping capacity, and contextual variability (Rosenfield et al., 2013; Ford et al., 2014). Without a temporal lens, it is challenging to identify whether stressors exert short-term or lagged effects on construction workers' performance. This limitation extends beyond a methodological scope; it also constrains the theoretical understanding of how performance deteriorates or recovers in response to changing stressor levels. Consequently, it limits the practical applicability of existing findings for occupational safety and health (OSH) in the construction industry, where timely recognition of stressor increases and performance declines is essential for effective accident prevention.

Longitudinal research designs offer critical advantages for addressing these gaps. By tracking variables over time, such design allows researchers to examine within-person changes, identify potential time-lagged causal effects, and control for unobserved confounding variables such as individual differences (Dormann and Griffin, 2015). In high-stress environments like construction industry, where daily workloads, team dynamics, and site conditions vary significantly, such temporal granularity is essential to understanding not only whether stressors affect construction workers' job performance, but when and how they do so. Moreover, uncovering the temporal interplay between stressors and job performance has direct practical implications. It can inform the timing of targeted interventions and facilitate the development of monitoring systems that aim at sustaining both construction workers' well-being and project outcomes. Yet, few studies in construction management research have systematically investigated these dynamics longitudinally, leaving a significant knowledge gap in both theoretical understanding and empirical evidence.

Addressing this gap requires methodological approaches that can capture the inherently person-specific nature of stressor-performance dynamics. Research on humans is commonly organised around two methodological traditions: nomothetic and idiographic approaches (Beltz et al., 2016). Nomothetic approaches seek to identify generalisable patterns across populations, often relying on aggregated data and between-person comparisons. Although they provide valuable insights into broad trends, these approaches often obscure the heterogeneous intra-individual processes through which stressors interact with performance. In contrast, idiographic approaches focus on intensive modelling on intra-individual temporal variabilities within specific entity (Beltz et al., 2016; Piccirillo and Rodebaugh, 2019). The idiographic approach is particularly well suited for this study where individual construction workers may experience stressors differently depending on their roles, coping strategies, and site conditions. By concentrating on intensive, repeated measures with a small number of construction workers, this study uncovers within-person stressor-performance dynamics that might be obscured in traditional nomothetic analyses, thereby complementing population-level insights in traditional nomothetic analyses.

Building on this idiographic perspective, **this study investigates the longitudinal, individual-level mechanisms underlying the dynamic relationship between stressors and job performance in**

construction workers. By employing a Vector Auto Regressive (VAR) modelling approach, the study captures causal relationships, feedback loops, and potential time-lagged effects of stressor-performance interactions within each individual. Specifically, the following research questions are addressed in this paper: (1) what are the causal relationships between stressors and job performance in construction workers over time? (2) how do stressors and job performance dynamically interact on a temporal scale? (3) what is the relative significance and temporal variability of (i) different stressors in shaping performance outcomes (ii) performance outcomes in shaping different stressors? By answering these questions, this study contributes to advancing academic understanding of the longitudinal stressor-performance dynamics in the construction industry and provides empirical evidence for improving construction workers' well-being and productivity through time-sensitive management strategies.

2. Literature review

2.1. Stressors of construction workers

Stressors are conditions or events that trigger psychological stress (Alqahtani et al., 2022). In the construction industry, stressors are typically grouped into three broad domains: task stressors, organisational stressors, and personal stressors (Leung et al., 2010a), which have been consistently applied to characterise the stressors of construction labour in diverse project environments. Within this overarching structure, this study refines and operationalises six specific stressor types namely work itself, family-work conflict, career development, organisational style, interpersonal relationships, and role management (Lv et al., 2017). These six types of stressors represent a systematic operationalisation and refinement of the three broader domains while capturing the distinct job characteristics of frontline construction labour. Their use therefore enables a more fine-grained and contextually grounded examination of stressor-performance dynamics among construction workers.

Task stressors refer to pressures arising directly from the nature of construction work and the roles workers are expected to perform. Within this category, the stressors of **work itself** and **role management** are most salient. The physical intensity, extended working hours, tight deadlines, and safety risks of construction work constitute the primary components of the "work itself" stressor. Such conditions often lead to elevated levels of fatigue and injury (Leung et al., 2010a; Zhang et al., 2023). In parallel, role management stressors, such as unclear responsibilities, conflicting instructions, and frequent task changes, are aggravated by complex subcontracting chains and transient construction workforce arrangements. Both policy analyses and empirical studies in Europe highlight communication breakdowns and ambiguous instructions as recurring contributors to safety incidents among construction workers (European Agency for Safety and Health, 2025).

Organisational stressors emerge from the broader work environment, including managerial practices, reward structures, and opportunities for growth. These are reflected in this study through the stressors of **organisational style** and **career development**. Poor organisational coordination, lack of transparency, or ineffective communication systems fall under organisational style stressors and have been shown to significantly undermine construction workers' morale and perceived support across diverse contexts (Greiner et al., 2022; Lingard and Turner, 2017). Additionally, career development stressors arise when construction workers perceive few opportunities for promotion, skill enhancement, or job security. Construction projects often rely on temporary contracts or informal labour structures, resulting in feelings of stagnation and uncertainty among construction workers (Leung et al., 2012).

Personal stressors relate to the individual's life circumstances and social relationships, both within and beyond the workplace. In this category, **family-work conflict** and **interpersonal relationships** are of

primary concern. Construction workers often experience challenges in balancing job responsibilities with family obligations, particularly due to long working hours, project-based deployments, and unpredictable schedules. These pressures can lead to emotional exhaustion and even suicides (Milner et al., 2019). Additionally, the team-based nature of construction projects necessitates effective social interaction among construction workers. Poor interpersonal relationships, which are characterised by conflict, mistrust, or lack of collaboration, can reduce overall job performance (Leung et al., 2017; European Agency for Safety and Health, 2025). As highlighted by the Job Demand-Control-Support (JDCS) model, strong social networks can mitigate stress and enhance resilience (Theorell, 1992), underscoring the importance of interpersonal support among construction workers on site.

2.2. Synchronous and lagged effects of stressors

Stressors influence individuals both immediately (synchronous effects) and over time (lagged effects). Studies reveal that synchronous effects of stressors are immediate and can intensify over time. For example, in a 13-year longitudinal study, job stressors, particularly job demands, exhibited synchronous and gradually escalating effects on mental health (Milner et al., 2016). While the Conservation of Resources (COR) theory posits that material, social and personal resources are acquired and protected by individuals in order to cope with stressors, prolonged exposure to stressors depletes these resources, exacerbating stress (Hobfoll, 1989).

Lagged effects of stressors, by contrast, manifest after varying time delays. Dormann and Zapf (2002) found that social and job stressors could take at least two years to impact mental health. However, subsequent studies challenge this timeline, identifying lag periods ranging from six months for job insecurity's effects on back pain (Lau and Knardahl, 2008) to as long as 12 years (Brage et al., 2007). Furthermore, individual differences exist in the lagged effects of stressors such as perceived loneliness and the availability of leisure time (Kang et al., 2024; Qian et al., 2014).

2.3. Job performance of construction workers

In construction activities, job performance encompasses how workers fulfil their responsibilities in alignment with the overarching project objectives. The construction industry, known for its labour-intensive operations, demands the involvement of workers from various disciplines. Labour costs typically account for 30% to 50% of the total expenditure of a construction project (Jarkas and Bitar, 2012), underscoring the pivotal role of workforce performance in project success. Effective job performance by construction workers can reduce project duration and costs by up to 20% (Ireland, 2004).

Existing research on job performance has distinguished between task performance and contextual performance, both of which have been applied in construction worker populations internationally (Gao et al., 2020; Zhang, 2021). **Task performance** refers to the execution of the core work responsibilities, such as maintaining necessary productivity and adhering to safety protocols. Typical measurement items may include completing tasks efficiently and minimising errors during operations. Furthermore, **contextual performance** captures psychological activities and motivational behaviours that are integral to project execution. Typical measurement items include cooperating with other construction workers and volunteering for additional duties. Such behaviours are essential in construction projects, where effective coordination significantly influences safety outcomes and project outcomes (Okoye and Okolie, 2017).

2.4. The relationship between stressors and job performance

Numerous studies have explored the relationship between stressors and job performance, identifying significant associations (Leung et al.,

2010b; Abdalla et al., 2024). For instance, emotional stressors are linked to higher occupational injury rates among construction workers, which in turn affect individual performance and project outcomes (Leung et al., 2010b). While earlier research predominantly emphasised the negative effects of stressors on job performance, more recent findings suggest a comprehensive and nuanced perspective on stressors. Challenge stressors, such as workload and time pressure, have been shown to positively influence job performance, whereas hindrance stressors, including role ambiguity and role conflict, have detrimental effects (Lepine et al., 2005). Regarding the shape of this relationship, early studies assumed a linear correlation between stressor levels and job performance by using linear regression models (Leung et al., 2011); however, subsequent research challenged this assumption by revealing an inverted U-shaped pattern in stressor-performance relationship, where moderate stressor levels could enhance job performance, while both insufficient and excessive stressor levels impair job performance (Leung et al., 2016b; Zhang et al., 2016).

2.5. Summary of literature review

Existing research has identified a variety of stressors experienced by construction workers and has established diverse links between stressors and job performance. However, most studies rely on cross-sectional data, which capture stressors and performance at a single point in time, often reflecting retrospective accounts (e.g., Leung et al., 2017; Alqahtani et al., 2022; Ye et al., 2022). This approach provides valuable snapshots of stressor-performance relationships among construction workers but presents several limitations: (1) it cannot determine whether the relationship between stressors and job performance is synchronous or lagged; (2) it overlooks potential feedback effects, where job performance may influence subsequent stressors; (3) it treats stressors and job performance as singular, independent variables without accounting for the effects of their past values; and (4) it frequently disregards confounding factors, such as individual resilience, which can skew the measurement of stressors and their impacts. To address these limitations, a longitudinal design was employed in this study by using a VAR model at the individual participant level, with detailed methodologies provided in the next section. The conceptual framework of this study is illustrated in Fig. 1.

3. Methodology

3.1. Data collection

A case study design was adopted in this study to enable an in-depth investigation of the temporal evolution of stressor-performance dynamics in construction workers. This methodological approach is particularly appropriate for exploring complex within-person dynamics over time—patterns that are often obscured in large-sample, cross-sectional studies (Pan et al., 2019). The primary aim of this study is to explore how stressor-performance interactions evolve at the individual level. Such aim leads to theoretical exploration, rather than statistical generalisation. As such, **five participants (cases) were purposively selected to capture variations in daily experiences over an eight-week study period**. The five person-specific models in this study are consistent with idiographic research (as discussed in Introduction section) where each participant contributes a statistically analysable time series data (Kuehn et al., 2024; Rodebaugh et al., 2020; Conroy et al., 2020), which places greater emphasis on temporal depth than on sample size. In parallel, the eight-week study period was selected to strike a balance between participant fatigue and data stability, providing sufficient temporal depth for modelling lagged and autoregressive effects. The eight-week study period was adopted by other studies on assessing psychological stressors, such as Kinoshita et al. (2024).

In line with the study's analytic focus on within-person dynamics, neither **individual-level nor external confounding variables** were

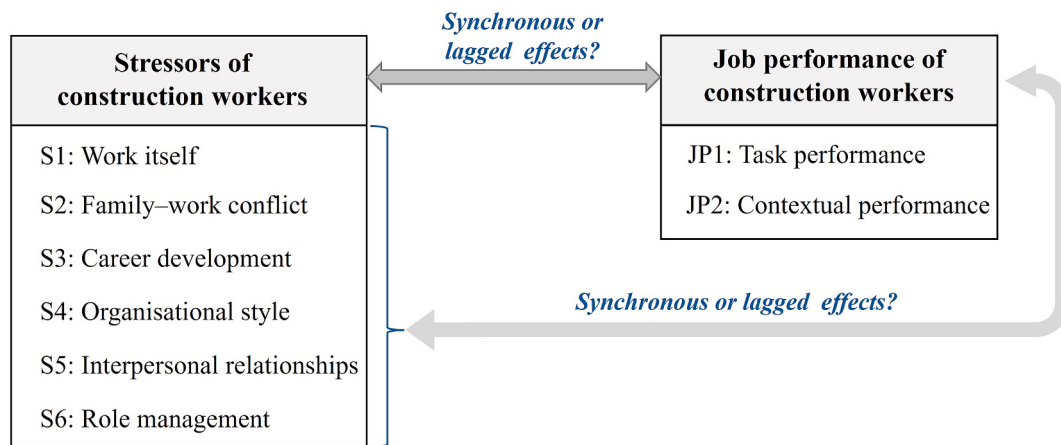


Fig. 1. Conceptual framework.

explicitly controlled. Individual-level confounders such as personality traits were assumed to be relatively stable within individuals over the eight-week period and thus unlikely to affect time-series relationships. Similarly, external factors such as economic conditions or project complexity were not treated as confounders, as they are considered constant within individual cases.

Each participant self-reported their daily stressor experiences and job performance through a structured questionnaire, with regular reminders sent to ensure timely and consistent responses. Given the reliance on self-reported data, efforts were made to mitigate potential biases such as social desirability and mood fluctuations. These efforts included: 1) anonymity was guaranteed; 2) participants were assured that their responses would be used exclusively for research purposes; 3) questions were neutrally worded and standardised; and 4) all participants received clear instructions to enhance clarity and accuracy in response.

All five participants were full-time construction workers employed by different companies, including three males and two females, aged between 25 and 47 years. Demographic information for the participants is shown in Table 1. As noted in the Data Availability Statement, the raw data of the five participants can be accessed via Du and Tutesigensi (2024).

3.2. Research instrument

The research instrument consisted of a questionnaire divided into three sections. The first section introduced the purpose of the data collection and addressed ethical considerations. The second section collected demographic information, including gender, age, job title, and years of experience. Demographic information was collected only once at the outset of the survey rather than on a daily basis. The third section included two scales measuring daily stressors and job performance ranging from 100 to 500, as detailed in Table 2. A score of 100 represented strong disagreement, 300 indicated uncertainty, and 500 represented strong agreement. For example, a participant might report a job performance score of 350 on one day and 370 the next, enabling us to capture small variations in self-assessment that would be difficult to detect in a traditional 1 to 5 scale. Using a wide continuous response

Table 1
Demographic information of participants.

Participants	Age	Job title	Years of experience
Participant 1	45	Concrete Worker	17
Participant 2	36	Concrete Worker	10
Participant 3	36	Bricklayer	14
Participant 4	47	Steel fixer	10
Participant 5	25	Cost Engineer	3

range enhances measurement sensitivity by reducing discretisation error, which is the information loss that occurs when responses are forced into a small number of categories (i.e., traditional 5 or 7 point Likert scales) (Kemper et al., 2020). This approach enables the detection of fine-grained within-person fluctuations that are central to analysing daily changes in stressor exposure and performance levels.

Considering that all participants were native Chinese construction workers with limited English proficiency, all items were translated to their native language. To address potential cultural or linguistic biases, Brislin's (1970) back-translation procedure was applied in this study, a standard method to ensure semantic and conceptual equivalence.

Stressors were measured using an 18-item scale developed and validated by Lv et al. (2017), which includes six dimensions: work itself, family-work, career development, organisational style, interpersonal relationship, and role management. We modified the items to focus on specific workday. A sample item is: "I was worried about safety during working today."

Job performance was assessed using a scale developed and validated by Zhang (2021), based on Borman and Motowidlo (1993) model. This scale evaluates two dimensions of job performance: task performance and contextual performance. We modified the items to focus on specific workday. A sample item is: "I completed my tasks efficiently and within the time limit today."

Prior to the formal questionnaire distribution, a pilot questionnaire was distributed to three Chinese construction workers for feedback. Based on their input, the questionnaire was revised for clarity. Specifically, the definition of stressor was explained in an easily understandable way, and redundant sections (such as the information sheet and informed consent form) were presented only on the first day of data collection.

3.3. Data analysis

To examine the temporal interactions between stressors and job performance in construction workers, this study employed the Vector Auto Regressive (VAR) model. The VAR model is particularly well-suited for analysing multivariate time-series data, as it treats all variables as endogenous and enables the identification of dynamic, reciprocal, and time-lagged effects (Hayakawa, 2016; Haslbeck et al., 2021). Compared to alternative longitudinal approaches, such as linear mixed-effects models or cross-lagged panel models, VAR is more flexible in capturing feedback loops and evolving relationships over time (Hamaker et al., 2015). Such functions of VAR are particularly effective in capturing longitudinally dynamic interactions between stressors and job performance in construction workers, as stressors may not only affect performance but also be shaped by performance fluctuations over time.

Table 2
Details of chosen scales.

Variables	Dimensions	Number of items	Cronbach's alpha		Supporting literature
Stressors (S)	Work itself (S1)	4	0.791	0.731	Lv et al. (2017)
	Family-work (S2)	3	0.727		
	Career development (S3)	2	0.843		
	Organisational style (S4)	3	0.695		
	Interpersonal relationship (S5)	3	0.675		
	Role management (S6)	3	0.698		
Job performance (JP)	Task performance (JP1)	3	0.702	0.715	Zhang (2021)
	Contextual performance (JP2)	3	0.717		

Prior to analysis, all raw time series data, ranging from 100 to 500, were rescaled to a common range of 1–5 (with two decimal places) to facilitate consistency and comparability with other studies. As time continuity is essential in time-series analysis, particular attention was paid to maintaining the integrity of the dataset. For Participant 1, two days of missing data (days 16 and 17) due to a holiday were excluded, so the analysis for Participant 1 was based on observations from day 18 onward.

The VAR model was applied separately to each of the five participants to explore individual-level variability in the dynamic relationship between stressors and job performance. Two models were developed for each participant in the VAR analysis. Model 1 included overall stressor and job performance, while Model 2 included six dimensions of stressors and job performance. This approach enabled both a macro-level and dimension-specific understanding of how different types of stressors influence, and are influenced by, job performance across time.

Data analysis in the VAR model was conducted using EViews software, employing three techniques: Granger causality test, impulse response function analysis, and variance decomposition. These techniques were used to address specific research objectives, as shown in Fig. 2. Granger causality identifies the directional predictive relationships between stressors and performance; impulse response function analysis traces how a temporary shock to one variable affects others over subsequent days; and variance decomposition quantifies the relative

contribution of one variable to others. Together, these techniques facilitated a comprehensive exploration of the longitudinal stressor-performance relationship in construction workers.

4. Results

4.1. Preliminary tests

Three preliminary tests, namely unit root test, lag length selection and eigenvalue stability condition test, were conducted to determine the presence of lagged effects and ensure the suitability of the established VAR models (Nguyen, 2022; Ejenma et al., 2023). Only data and models that met these conditions were subsequently analysed using the Granger causality test, impulse response function analysis, and variance decomposition.

4.1.1. Unit root test

The stressors and job performance data in this study are time-series. To prevent pseudo-regression, stationarity tests were conducted on the variables before constructing the VAR model (Planas, 1997). The Augmented Dickey-Fuller (ADF) unit root test was employed in this study to assess the stationarity of each participant's data. For Participants 2, 3, and 5, all data were stationary at the original level. For Participant 1 and 4, non-stationary data were first differenced to remove

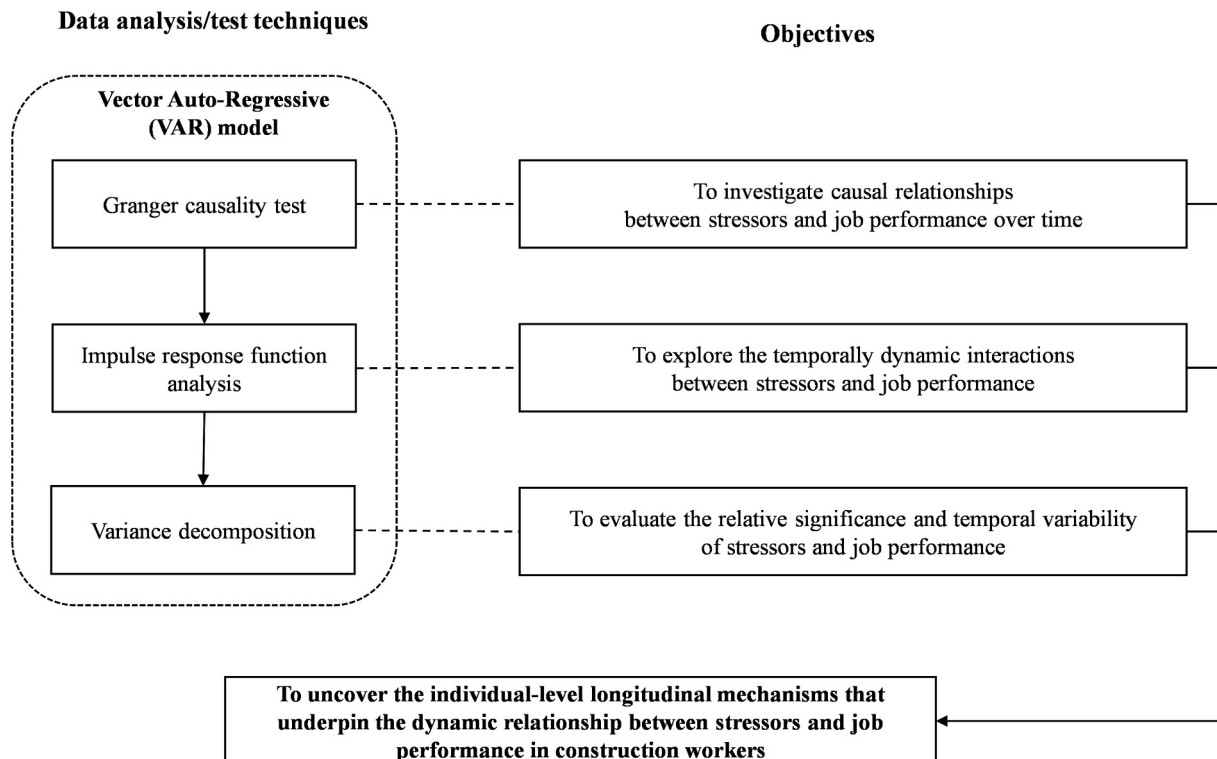


Fig. 2. Data analysis process.

trends, achieving stationarity at the 5% level (Hyndman and Athanassopoulos, 2021). These results confirmed the suitability of subsequent analyses for all participants.

4.1.2. Lag length selection

Once stationarity was confirmed, the optimal lag order for the VAR model was determined using five criteria: Likelihood Ratio Test (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), and Hannan-Quinn Information Criterion (HQ) (Woldemedhin et al., 2022). The optimal lag orders, indicated by the highest number of asterisks, are shown in Table 3.

For Participant 1, VAR (2) was optimal for Model 1, while VAR (1) was selected for Model 2. For Participant 2, the optimal lag order was 0, indicating contemporaneous relationships between stressors and job performance without lagged effects; as such, no further model was constructed since a zero-lag order undermines the purpose of the VAR model. For Participant 3, VAR (5) was optimal for Model 1 and VAR (4) for Model 2. For Participants 4 and 5, only Model 1 was considered meaningful, with VAR (4) and VAR (1) being optimal, respectively.

4.1.3. Eigenvalue stability condition test

Stability tests ensure that VAR models respond to external shocks and converge over time (Yang et al., 2019). The eigenvalue stability condition test confirmed the stability of the VAR models, as all autoregressive (AR) eigenvalues lay within the unit circle (see Fig. 3).

4.2. Granger causality test

The Granger causality test was employed to examine the causal relationships between stressors and job performance, focusing on the bidirectional nature of this relationship (Granger, 1988). Building upon the conceptual framework in section 2.5, Table 4 presents the detailed null hypotheses developed for our analysis. The null hypotheses for Model 1 and Model 2 were tested only for effective VAR models (lag greater than zero), specifically for Participant 1 and Participant 3 (both Models 1 and 2), and for Participants 4 and 5 (Model 1).

Table 5 illustrates six rejected null hypotheses. For Participant 1, Model 1 shows that job performance Granger-caused overall stressor levels ($p = 0.0158$), with performance data from the previous two days predicting current stressor levels. In Model 2, job performance was found to Granger-cause family-work stressor (S2) ($p = 0.0012$) and career development stressor (S3) ($p = 0.0066$), with these stressors being predicted by job performance from the previous day (lag of one day). For Participant 3, interpersonal relationship stressor (S5) Granger-caused job performance ($p = 0.0202$), with a 4-day lag, indicating that the job performance on a given day could be predicted from the interpersonal relationship stressor from four days before. Conversely, Participant 3's job performance Granger-caused organisational style stressor (S4) ($p = 0.0019$) and role management stressor (S6) ($p = 0.0173$), with a similar 4-day lag. These six findings form the basis for

subsequent impulse response function analysis and variance decomposition analysis.

4.3. Impulse response function analysis

Impulse response function analysis was employed to investigate how endogenous variables react to external shocks, such as a one-unit shock to one variable affecting others over time (Winarno et al., 2021). This approach provides insights into the dynamic interactions between stressors and job performance, highlighting how changes in one factor may influence others. To ensure meaningful predictive relationships, impulse response analysis was only conducted on variables with established Granger causality (see Fig. 4).

For Participant 1, in Model 1, the initial response of stressors was zero, indicating no immediate significant changes following an increase in job performance. Subsequently, stressors exhibited a sharp decline, reaching below -0.2 , demonstrating that improved job performance significantly reduced stressor levels. However, this decline was followed by a rapid rebound in the second period, nearly returning to baseline. In Model 2, the responses of family-work stressor (S2) and career development stressor (S3) to job performance mirrored the overall stressor's response. However, the initial response of these stressors was not zero, suggesting that Participant 1's family-work stressors and career development stressors decreased on the same day as the job performance got one-unit positive shock.

For Participant 3, a positive shock to job performance triggered alternating effects on organisational style stressor (S4) and role management stressor (S6), with this effect diminishing over time, but the wide confidence intervals encompassing zero precluded definitive conclusions. However, an increase in interpersonal relationship stressor (S5) enhanced job performance by 0.055 units during the first period, suggesting that changes in interpersonal relationship stressors impact job performance within the same day.

4.4. Variance decomposition

Variance decomposition analysis assessed the contribution of unit shocks to endogenous variables (Woldemedhin et al., 2022), evaluating the relative significance of factors influencing stressors and job performance. To ensure the significance of this analysis, it was only conducted on variables with established Granger causality (see Fig. 5).

For Participant 1, the overall stressor (S) is predominantly explained by its own past values, with job performance (JP) contributing marginally to its variation. This suggests that, for P1, changes in the overall stressor are largely endogenous, with job performance exerting limited explanatory influence over time. However, in Model 2, changes in the family-work stressor (S2) are largely exogenous, with job performance exerting large explanatory influence (approximately 80%) over time. In contrast, a more balanced explanation of variance from endogenous and exogenous factors (approximately 40%) is observed in

Table 3
Lag order selection criteria.

	Model	Lag	LogL	LR	FPE	AIC	SC	HQ
P1	1	2	-22.4776	14.3834*	0.0351*	2.3198*	2.7956*	2.4653*
	2	1	-55.7831	74.2774*	7.76e-06*	7.9845	10.6489	8.7990
P2	1	0	-47.7922	NA*	0.0441*	2.5535*	2.6388*	2.5841*
	2	0	-257.5758	NA*	0.0004*	12.0262*	12.3100*	12.1314*
P3	1	5	74.0759	12.40338*	0.000229*	-2.740836*	-1.7928	-2.403518*
	2	4	252.5977	59.1167	2.04e-09*	-2.361793*	6.0369	0.716676*
P4	1	4	-4.4216	11.29589*	0.010684*	1.121080*	1.8811	1.3959
	2	0	-168.9109	NA	8.43e-06*	8.1819	8.468608*	8.287629*
P5	1	1	-34.1976	24.96511*	0.030131*	2.172844*	2.434074*	2.264940*
	2	0	-212.8218	NA	6.50e-05*	10.2243	10.51098*	10.33000*

Note: * indicates lag order selected by the criterion; NA: means Not Applicable; P1 means Participant 1; P2 means Participant 2; P3 means Participant 3; P4 means Participant 4; P5 means Participant 5.

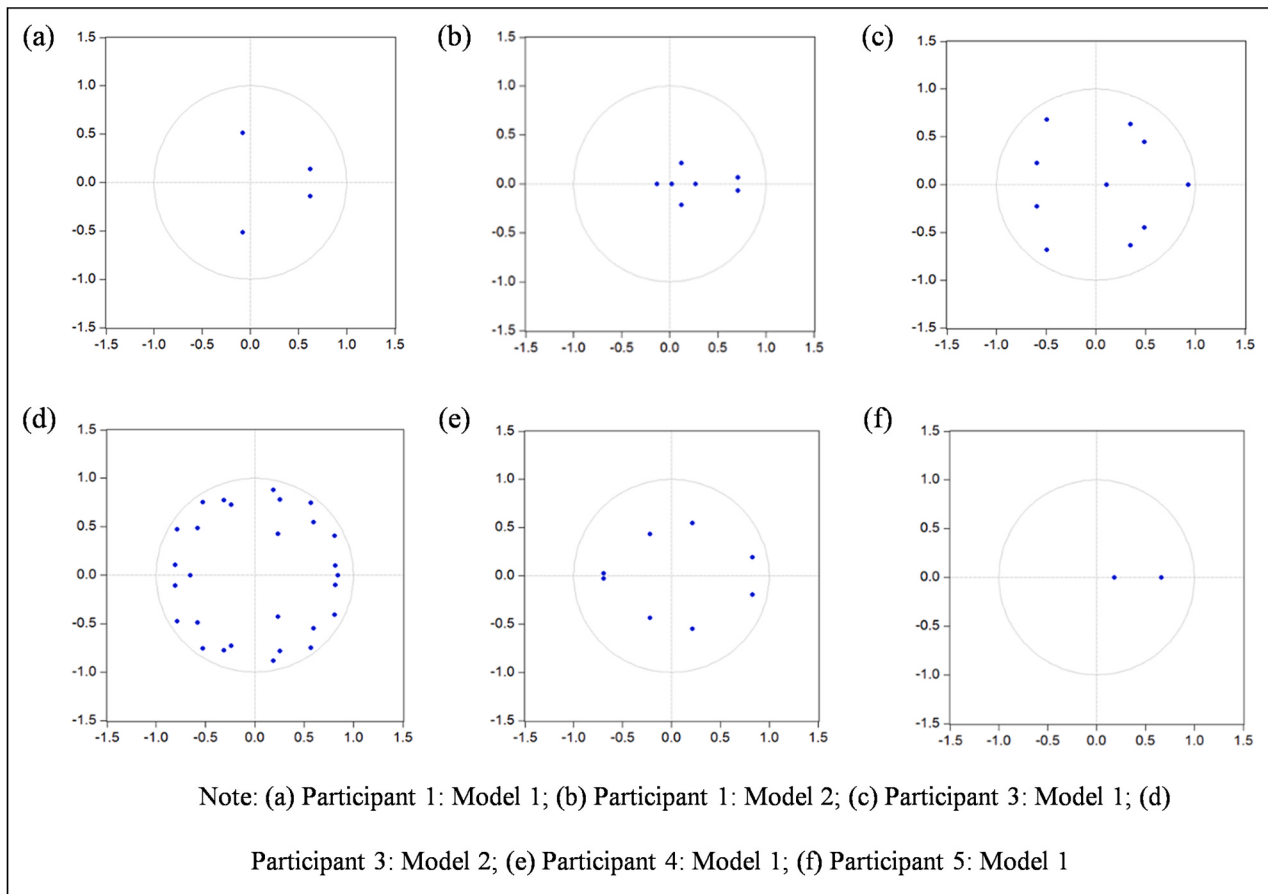


Fig. 3. Results of eigenvalue stability condition test.

Table 4
Null hypotheses in Granger causality test.

	Null Hypothesis
Model 1	H1: JP does not Granger Cause S H2: S does not Granger Cause JP
Model 2	H3: JP does not Granger Cause S1 H4: S1 does not Granger Cause JP H5: JP does not Granger Cause S2 H6: S2 does not Granger Cause JP H7: JP does not Granger Cause S3 H8: S3 does not Granger Cause JP H9: JP does not Granger Cause S4 H10: S4 does not Granger Cause JP H11: JP does not Granger Cause S5 H12: S5 does not Granger Cause JP H13: JP does not Granger Cause S6 H14: S6 does not Granger Cause JP

Table 5
Variables with Granger causality.

	Model	Null Hypothesis	F-Statistic	Prob.	Conclusion
Participant 1	Model 1	H1: JP does not Granger Cause S	4.99333	0.0158*	Reject
	Model 2	H5: JP does not Granger Cause S2	13.1547	0.0012**	
Participant 3	Model 2	H7: JP does not Granger Cause S3	8.71764	0.0066**	
	Model 2	H12: S5 does not Granger Cause JP	3.37295	0.0202*	
	Model 2	H9: JP does not Granger Cause S4	5.40204	0.0019*	
	Model 2	H13: JP does not Granger Cause S6	3.4978	0.0173*	

Note: **Significant at the 0.01 level; *Significant at the 0.05 level.

career development stressor (S3). However, for P1, the relative contribution of these variables remains unchanged (the factor that contributed the most at the beginning continues to do so throughout).

For Participant 3, job performance is largely endogenous in the initial stages, with the interpersonal relationship stressor (S5) contributing an increasing share, stabilising around 18%. In contrast, the role management stressor (S6) shows its endogeneity in the first few days, but over time, there is a more balanced decomposition, with endogenous and exogenous factors each explaining around 30% of the variance. However, the variance decomposition for the organisational style stressor (S4) shows a shifting pattern: from initial endogeneity to final exogeneity. S4 explains most of its own variance in the first few days, but the contributions of job performance increased over S4 in the fourth

period, accounting for approximately 20% of the variation. This suggests that job performance gained explanatory power over S4 as time progressed. Notably, for P3, the relative contribution of these variables in organisational style stressor (S4) exhibits a shifting pattern over time, a pattern that contrasts with P1's results.

Interestingly, for Participant 1 in Model 2, the family-work stressor (S2) was initially explained by job performance (57%) and itself (35%), with their combined contribution totalling 92%. Over time, job performance's contribution stabilised at 78%, while the self-contribution of S2

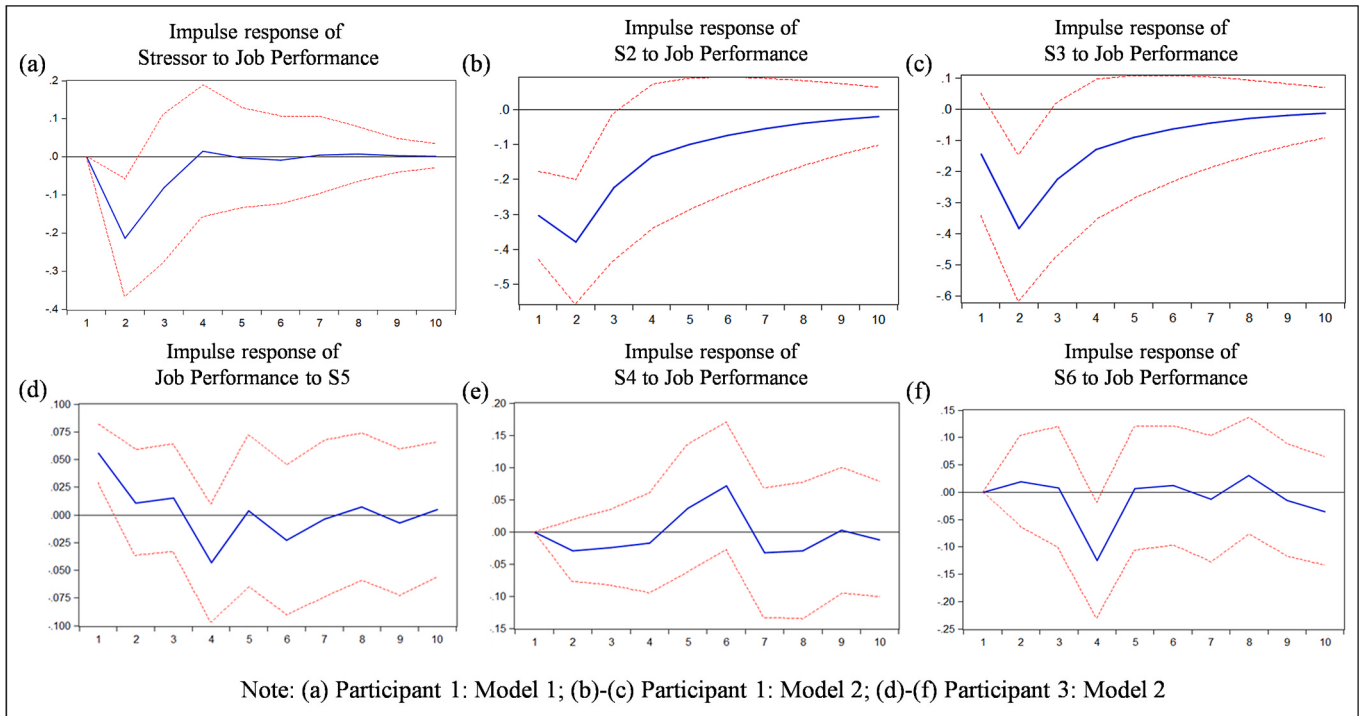


Fig. 4. Results of impulse response function analysis.

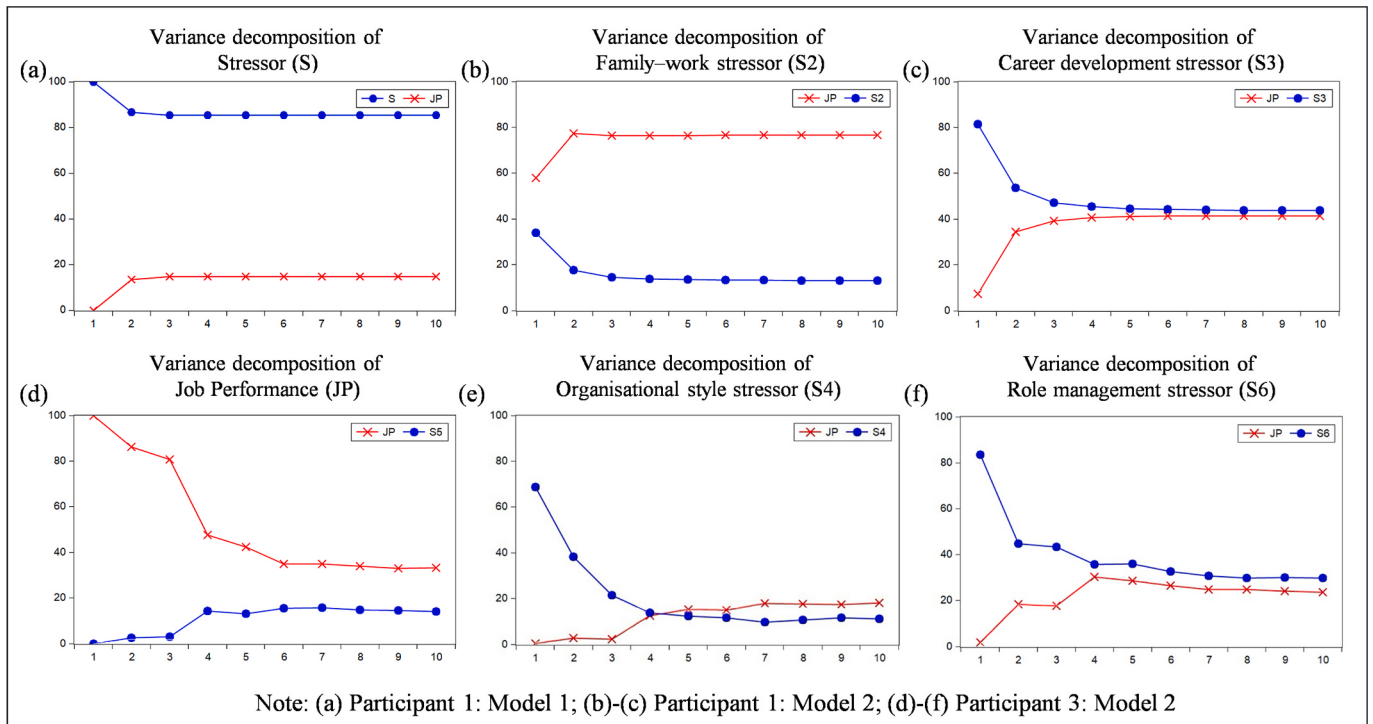


Fig. 5. Results of variance decomposition.

decreased to 11%, maintaining the overall contribution at 89%. A similar trend was observed for the career development stressor (S3), where the combined contribution of job performance and the stressor itself also remained stable at about 90%. In contrast, for Participant 3, the total contribution of job performance and stressors, such as the role management stressor (S6), showed more variability over time.

5. Discussion

5.1. Lagged effects

The lag length for each participant reveals notable individual differences in the interaction between stressors and job performance over time. For Participants 1, 3, 4, and 5, the presence of lagged effects

suggests a delayed impact in stressors and performance. Such delayed responses reflect the nature of construction work, where tasks are often sequential and highly interdependent. In these settings, the consequences of stressors or performance in these participants only become evident after a period of continued exposure.

The differences in lag patterns of Participants 1, 3, 4, and 5 reflect variations in individual factors and external conditions. Previous research suggests that psychological resources, such as emotional stability, resilience, and locus of control, play a critical role in stressor-performance relationships (Milner et al., 2016; Nguyen et al., 2022; Oh et al., 2024). In construction environments characterised by tight deadlines and high safety risks, workers with poorer psychological resources and weaker coping strategies often struggle with emotional regulation, which gradually affects their timely adaptation to stressors. Conversely, workers with stronger coping mechanisms (e.g., problem-focused coping) can address stressors more quickly, preventing prolonged effects. External conditions, including workload and support systems, also influence these temporal dynamics. Construction workers frequently operate within hierarchical organisational structures and project-based teams, where supervisory practices and peer support can shape how stressors and performance are experienced and managed (Uçar and Kerse, 2022). For example, construction workers with access to organisational and social support are better equipped to manage stressors than those without such resources, thereby shortening the time required for negative stressors to influence performance.

In contrast, for Participant 2, the absence of lagged effects implies that stressor-performance relationship occurs within the same time frame (1 day) or beyond the temporal scope (8 weeks) of the VAR model. This limitation underscores the potential mismatch between the measurement intervals and the actual response cycles. For example, Participant 2 may experience lagged effects on an hourly basis, recovering within a day, which were not captured in this study. This aligns with the temporal misalignment perspective, which argues that mismatched measurement intervals can obscure lagged relationships (Beal et al., 2005). This discrepancy highlights the need for more tailored temporal measurements to accurately capture these dynamics among construction workers.

5.2. Granger causality between stressors and job performance

Regarding Granger causality from stressors to job performance, the overall stressor did not predict job performance. However, the interpersonal relationship stressor for Participant 3 did Granger-cause job performance. The finding of no Granger-causality from stressors to job performance diverges from most previous studies that report significant impacts of stressors on performance. For example, emotional stressors have been linked to increased occupational injuries (Leung et al., 2010b), which negatively affect project outcomes. The absence of correlation here highlights the complexity of this relationship, which is influenced by moderating factors such as mental resilience (Gao et al., 2024). Notably, the interpersonal relationship stressor emerged as a Granger-cause of Participant 3's job performance, underscoring its critical role in this participant's workplace dynamics (Siu et al., 2013; Zhou et al., 2024). Empirical studies indicate that bullying and harassment remain prevalent in construction settings and constitute a major source of interpersonal tensions (Roelofs et al., 2025). When such tensions remain unresolved, they not only undermine individual performance but also lead to broader team inefficiencies and conflicts.

In contrast, five of the six findings of Participant 1 and Participant 3 pointed to Granger-causality from job performance to overall stressor levels as well as specific stressors, including family-work conflict, career development concerns, organisational style, and role management. This pattern suggests that variations in performance can shape stressor levels—a perspective that has received very little attention in existing literature. This aligns with the transactional model of stress, proposed by Lazarus and Folkman (1987), emphasising the dynamic interplay

between individual behaviours and external conditions. Within construction activities, underperformance can trigger negative feedback and job insecurity, thereby exacerbating additional stressors.

Therefore, the individual-level relationship between stressors and job performance in construction workers is not strictly unidirectional. In a dynamic and evolving environment of construction work, these two factors interact with each other in a feedback loop, where job performance can both cause and result from stressors (Sonnetag and Frese, 2013). This interplay highlights the critical need for construction organisations to recognise and mitigate performance-induced stressors among construction workers who exhibit similar relationships as Participant 1 and Participant 3.

5.3. Time-sensitive nature of relationship between stressors and job performance

The impulse response analysis reveals the time-sensitive nature of stressor-performance dynamics in construction workers. For Participant 1, improved job performance initially reduced stressor levels, peaking on the second day before gradually dissipating. While this aligns with prior research on temporary stressor relief from workplace success (Lazarus and Folkman, 1987), it raises concerns about the sustainability of this effect in construction workers. According to the conservation of resources theory (Hobfoll, 1989), enhanced job performance replenish individual resources, alleviating stressors like family-work conflict and career development concerns. However, the diminishing impact suggests that these resources are insufficient to generate lasting psychological buffers in the demanding construction contexts, where daily uncertainties and shifting production targets rapidly consume regained resources.

Notably, a transient positive effect was observed for interpersonal relationship stressor of Participant 3, where an increase slightly enhanced job performance. This aligns with the challenge-hindrance stressor framework (Cavanaugh et al., 2000), suggesting that Participant 3 perceived interpersonal relationship stressors as challenge stressors. Such stressors stimulate intrinsic motivation to respond positively to adversity, leading to improved job performance (Liu et al., 2022). In collaborative construction tasks, interpersonal tensions may occasionally prompt workers to work harder in order to maintain work coordination or demonstrate competence to peers. However, the transient nature of this effect indicates that the benefits of challenge stressors are short-lived and might turn into a hindrance if the stressor persists or intensifies, highlighting the importance of critical rethinking on the sustainability of stressor's positive effects. These findings suggest that, for construction workers who exhibit relationships such as this shown by Participant 3, construction organisations could prioritise both timely conflict resolution and ongoing support mechanisms to prevent interpersonal tensions from evolving into persistent stressors that impair performance.

5.4. Endogenous and/or exogenous contributions of stressors and job performance

In the variance decomposition, **endogenous**, **exogenous**, or a **combination of endogenous and exogenous** contributions were observed in different variables.

Specifically, the overall stressor and career development stressors for Participant 1, as well as the role management stressors for Participant 3, were predominantly explained by their own past values in the first few days. This indicates that the variation in these stressors was largely **endogenous**, with minimal influence from job performance. Such endogeneity suggests that for construction workers like Participant 1 and Participant 3, stressors were driven by their internal stabilities (such as personal predispositions) or a rigid organisational culture, which shape how stressors persist over time (Oruh and Dibia, 2020; Gao et al., 2024).

For Participant 3, job performance was initially explained by its past values but became more influenced by interpersonal relationship stressors from the fourth day onwards. Early performance stability observed in this construction worker may stem from the reinforced self-efficacy from prior performance successes, which can further enhance task performance (Miraglia et al., 2017). Moreover, the intensifying impact of interpersonal relationship stressors is consistent with research on the cumulative effects of stressors. In project-based environments where construction workers rely heavily on cooperation and communication, unresolved interpersonal frictions may gradually disrupt coordination processes, thereby exerting prolonged adverse effects on job performance (Li et al., 2024). In contrast, for Participant 1, family-work stressors were **exogenous**, primarily explained by job performance. This may stem from the nature of construction work, where construction workers usually work for long hours and their income structures are closely tied to productivity or project completion, which consequently marginalises their family responsibilities.

The variance decomposition findings for Participants 3 exhibit **switching between endogenous and exogeneous contributions** in some variables. Variance decomposition of Participant 3's organisation style stressor (S4) was dominated by endogenous contribution for the first four days, but thereafter the contribution was predominantly exogenous arising from job performance. According to the Conservation of Resources (COR) theory (Hobfoll, 1989), organisational stressors in construction industry such as extremely rigid systems and unhealthy cultures deplete the personal resources of Participant 3, thereby reshaping Participant 3's perceptions towards these stressors. As a result, this construction worker pivots to viewing satisfying performance as a strategic resource to buffer against or regain control over organisational stressors. This transition effectively establishes a resource-recovery loop. These findings suggest that, for construction workers who manifest this switching phenomenon as Participant 3, construction organisations should address organisational stressors by implementing personalised mental health programs and fostering supportive organisational cultures. Short-term interventions can focus on direct, proactive stressor management, while long-term strategies can be generated based on this worker's historical performance trends.

5.5. Propositions for future research

The findings of this study reveal that stressor-performance relationships in construction workers exhibit clear temporal dynamics, highlighting the value of adopting a longitudinal analytical perspective in construction settings. By tracking variables over time, this study was able to identify time-lagged interactions and feedback relationships between stressors and job performance in construction workers, which would not be observed in conventional cross-sectional analysis.

Arising from the findings from the five case studies, thirteen propositions alongside their corresponding source cases in this study are presented in Table 6. These propositions constitute the authors' contributions to the body of knowledge about existence of the respective relationships in proportions of construction worker populations. Future research is recommended to examine these propositions using generalisable methodologies across larger samples and diverse contexts (e.g., country, type of construction project and type of work).

6. Limitations and future research

The eight-week duration of this study presents both strengths and limitations. While it enabled the observation within certain time frame, it may not capture the long-term effects of stressors and job performance over a more extended period. Future studies should consider extending the observation period to better explore these longer-term dynamics. Moreover, some participants exhibited no Granger causality between stressors and job performance, potentially due to the presence of mediating variables, such as organisational support, which was beyond

Table 6
Propositions for future research.

Proposition	Source cases
1: Stressor–performance relationships among construction workers exhibit temporal dynamics with either lagged or immediate effects.	Participants 1, 2, 3, 4, and 5
2: In a substantial proportion of construction workers, overall stressor levels do not predict subsequent job performance.	Participants 1, 3, 4, and 5
3: In a substantial proportion of construction workers, interpersonal relationship stressors positively predict subsequent job performance.	Participants 1, 3, 4, and 5
4: In a substantial proportion of construction workers, job performance positively predicts subsequent overall stressor levels.	Participants 1, 3, 4, and 5
5: In a substantial proportion of construction workers, job performance predicts subsequent family-work stressors.	Participants 1, 3, 4, and 5
6: In a substantial proportion of construction workers, job performance predicts subsequent career development stressors.	Participants 1, 3, 4, and 5
7: In a substantial proportion of construction workers, job performance predicts subsequent organisational style stressors.	Participants 1, 3, 4, and 5
8: In a substantial proportion of construction workers, job performance predicts subsequent role management stressors.	Participants 1, 3, 4, and 5
9: In a substantial proportion of construction workers, overall stressor levels are primarily driven by their own past values.	Participants 1, 3, 4, and 5
10: In a substantial proportion of construction workers, career development stressors are primarily driven by their own past values.	Participants 1, 3, 4, and 5
11: In a substantial proportion of construction workers, role management stressors are primarily driven by their own past values.	Participants 1, 3, 4, and 5
12: In a substantial proportion of construction workers, family-work stressors are primarily influenced by job performance.	Participants 1, 3, 4, and 5
13: In a substantial proportion of construction workers, organisational style stressors shift from being endogenously-driven to being performance-driven over time.	Participants 1, 3, 4, and 5

the scope of this study. Future research could address this limitation by including such variables. Another limitation is the reliance on self-reported data, which can be subject to biases, including mood variability or social desirability, potentially distorting the accuracy of evaluations. To enhance reliability, future research should incorporate objective measures of job performance (e.g., productivity indicators) and complementary data sources (e.g., evaluations from supervisors).

7. Conclusions

This study examines the individual-level temporal dynamics of stressor-performance relationships within construction workers employing Vector Auto Regressive (VAR) models. By examining intra-individual patterns over an eight-week period, the study complements existing cross-sectional research by highlighting the dynamic and bidirectional nature of stressor-performance interactions.

The results reveal substantial heterogeneity across participants in both the direction and timing of stressor-performance interactions. **Lag length analysis** indicated that stressor-performance interactions often unfold with delay, with Participants 1, 3, 4, and 5 exhibiting notable lagged effects. **Granger causality analysis** revealed that, overall stressor did not predict job performance across all participants, while the interpersonal relationship stressor for Participant 3 was found to Granger-cause job performance. In contrast, for five out of six findings, Granger causality ran from job performance to stressors, suggesting that variations in performance can shape stressor levels, which is a perspective that has, hitherto, received very little attention in the stressor-performance literature. **Impulse response function analysis**

further highlighted the time-sensitive nature of these relationships. For Participant 1, an improvement in job performance temporarily reduced stressor levels, with the effect peaking on the second day before gradually dissipating. **Variance decomposition analysis** revealed various endogenous and/or exogenous contributions of stressors and job performance. The overall stressor and career development stressor from Participant 1, and role management stressor from Participant 3, were primarily explained by their own past values. Participant 3's organisational style stressor was explained by its own past values for the first 4 days, and thereafter by job performance.

Theoretically, this study advances the understanding of stressor-performance relationships in construction workers by demonstrating that these relationships are temporally evolving and vary from individual to individual. Notably, the study challenges the prevailing unidirectional perspective on this relationship by providing empirical evidence that job performance can also shape specific stressor levels at individual level, thereby underscoring the need for feedback-sensitive models in occupational stressor research within the construction industry. This study presents thirteen propositions for future research that will deepen our understanding of these relationships.

Methodologically, this study underscores the value of longitudinal analysis in stressor-performance research in construction industry settings. Such approach enables the detection of lagged causal pathways and feedback loops that would remain unobservable in traditional cross-sectional studies.

Practically, the findings offer valuable implications for construction management by underscoring the importance of personalised stressor monitoring and performance-based interventions tailored to temporal variations. A nuanced understanding of when and how stressors and job performance interact can inform the timing and design of targeted support mechanisms and monitoring systems for construction workers, ultimately enhancing construction workers' well-being and sustaining project efficiency.

CRediT authorship contribution statement

Yuting Du: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Apollo Tutesigensi:** Writing – review & editing, Supervision, Methodology, Formal analysis, Conceptualization.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The raw data associated with this paper can be accessed via [Du and Tutesigensi \(2024\)](#).

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