WORKPLACE STRESS IN THE CONSTRUCTION INDUSTRY: AN EXPLANATORY MODEL

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The construction industry is noted for high levels of occupational stress, particularly among professional workers. Using data from 676 architects, civil engineers, quantity surveyors, and project and construction managers responding to an on-line survey in South Africa, an integrated conceptual model of occupational stress is proposed. Structural equation modeling is used to test the model iteratively. The results of the final model indicate that: psychological, physiological and sociological strain effects are the terminal consequences of occupational stress; organizational climate is largely determined by gender and job demand, control and support; age, gender, control and organizational climate are predictors of discrimination; psychological distress is predicted by age, job demand and control factors, and organizational climate; sociological stress is determined by age, job demands, discrimination and psychological distress; and age, and sociological and psychological stress effects manifest themselves as predictors of physiological stress effects. Construction employers should regularly review workload allocations, empower employees, foster a supportive work environment, conduct stress appraisals, and hold stress management workshops.

Keywords: construction professionals, predictive modeling, workplace stress.

INTRODUCTION

The U.S. National Institute for Occupational Health and Safety defines workplace stress as *"the harmful physical and emotional responses that occur when the requirements of the job do not match the capabilities, resources, or needs of the worker."* Occupational stress is associated with low productivity, high absenteeism and poor job performance (McShane and Von Glinow, 2005). Construction is a high-risk industry for work-related stress (Love *et al*. 2010), characterized by long work hours (Van Wanrooy and Wilson, 2006) and interpersonal and inter-role conflicts (Loosemore and Galea, 2008). Recent research has explored occupational stress experienced by construction professionals in South Africa, focusing on the relationship between occupational stress and job demand, control and support factors; the effects of occupational stress; the coping mechanisms adopted by professionals in an attempt to militate the effects of stress; and the role of harassment and discrimination as work-related stressors. Data from 676 respondents to an on-line

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survey of architects, engineers, quantity surveyors, and project and construction managers are used to investigate occupational stress phenomena. Earlier papers, based on this dataset, have reported on the comparative levels of self-assessed job stress and job demand, control and support (JDC/S) factors; the comparative relationship between job stress and harassment and discrimination at work; stress, strain effects and coping mechanisms; and predictive regression modeling of stress as a function of JDC/S factors (see Bowen *et al*., 2013). This paper, drawing together the disparate *foci* of the earlier papers, reports the application of structural equation modeling to posit an integrated model of occupational stress among construction professionals.

BACKGROUND TO THE STUDY

Job demands are quantifiable features of work, including time pressures and workload, while job control is defined by Karasek (1979: 290) as ''*the extent to which employees have the potential to control their tasks and conduct throughout the working day*". More recent adaptations of Karasek's JDC model of occupational stress have incorporated workplace support as a resource that, together with control, can mitigate the extent to which job demands induce harmful effects in workers (Schaufeli and Bakker, 2004). The Job Demands-Control-Support (JDC-S) theory of occupational stress (Shaufeli and Baker, 2004) thus states that jobs that are high in demands, low in control and low in workplace social support are experienced as the most stressful and produce the most damaging health impacts.

Work generally takes place within organisations and these differ in the attitudes and behaviours they elicit in people (Sharma, 2013). Organisational climate can be described in terms of the values of a particular set of characteristics (or attributes) of the organization (French *et al*., 1985). Thompson *et al*. (1996) found that stress and strain conditions were significantly less favourable in organisations with a negative organizational climate (characterised by employee perceptions of high compliance expectations, lower individual recognition and supervision, and lower employee autonomy) compared to organisations that were not so characterised. Such negativity can manifest in discrimination and harassment.

Discrimination in the workplace includes sexist or racist 'put downs' and unfair treatment by employers, supervisors or co-workers (Caplan *et al*., 2009). Discrimination at work is more serious than general 'daily hassles' because it threatens a person's goals and sense of value as a person (Landry and Mercurio, 2009), and impacts negatively on job satisfaction (Ensher *et al*., 2001) and mental health (Hoobler *et al*., 2010). Harassment can be sexual or ethnic or based on points of difference between people, such as language, religion or sexual preference (Schneider *et al*., 2000). Both discrimination and harassment are significant workplace stressors. All work stressors lead to strain effects.

Occupational stress exhibits strain effects in physiological, cognitive, emotional and behavioural ways (Blaug *et al*., 2007). Physiological strain effects include sleep disturbances, headaches, gastrointestinal upsets, increased ill-health, and loss of libido. Psychological effects may be emotional (e.g., anxiety, depression); intellectual (e.g., loss of concentration, lack of motivation); or behavioural (e.g., substance misuse, absenteeism, poor motivation). The sociological effects of occupational stress may include marital discord, withdrawal, and the inability to manage one's personal life. These are adaptive behavioural responses to stress.

Adaptive behaviours for coping with occupational stress include taking physical exercise, engaging in hobbies, socialising with family and friends, engaging in various

forms of entertainment, and seeking support from supervisors, co-workers and others. Maladaptive (or escapist) coping behaviours include the consumption of nicotine, alcohol and other (recreational) narcotics (see Moisan *et al.,* 1999). Research also suggests significant differences between the coping mechanisms utilised by men and women (Gianakos, 2002).

Few research findings explore the symptomatic relationship between the psychological, physiological and sociological effects of stress and JDC/S factors, organisational climate, harassment and discrimination at work, and the coping response mechanisms they adopt. This study attempts to address that shortcoming by proposing an integrated occupational stress model for construction professionals, and testing it mathematically using survey data.

RESEARCH METHOD AND QUESTIONNAIRE DESIGN

Primary data collection

An on-line questionnaire survey was administered to registered architects, civil engineers, quantity surveyors, and project and construction managers in South Africa. The item catalogue included: demographic details; self-assessed levels of occupational stress; a range of job demand, control and support issues; organisational climate; experiences of workplace harassment and discrimination; responses to psychological, physiological, and domestic/social (sociological) strain effects; and coping mechanisms. The catalogue of questions drew on the work of Haynes and Love (2004), Leung *et al*. (2005), Lingard and Francis (2009) and Love *et al*. (2010). The same questionnaire was used for all participating professional groups, and tested through a pilot study. Participants self-selected themselves by accessing the survey on-line at a given URL. Compulsory professional registration provided acceptable proxies for the populations of each profession. However, as the sample is self-selecting, care is needed in generalising findings. The responses (676) represent 7% of the total professional population. They comprise 269 architects, 168 engineers, 179 quantity surveyors, and 60 project and construction managers. Since many in the latter group hold dual registration in another discipline, their representation in the response sample is actually likely to be higher. The overall response rate is not considered unusual for web-based surveys of this nature.

Data validity and factor variables

Given the self-reporting survey measurement method adopted, the findings may have the potential risk of common method variance and the validity of data may be questioned. However, it should be noted that the question response Likert scales were adopted from survey designs reported in the extensive stress management and construction literature. The response sample size militates against data validity concerns, as do the significance values for the correlations between variables. The Cronbach's alpha for each variable summation scale (reported below) ranges from 0.69 to 0.89, indicating good to excellent scale reliability (see Table 1). The original dataset was subjected to missing value analysis involving the detection of anomalies. Eighteen anomalous cases were identified. Thereafter, listwise deletion was applied to the remaining 658 cases, resulting in 405 cases without anomalies or missing data. The remaining dataset is adequate for modeling purposes.

Demographic characteristics

Age is measured in seven discrete categories: under 25; 25-29; 30-34; 35-39; 40-44; 45-50; and over 50 years. Ethnicity data is captured in terms of the following

classifications: African; 'Coloured' (mixed race); Indian (Asian); and 'White'. However, the first three groups are combined as 'Black' in the statistical analysis and modeling, to improve cell count sizes.

Workplace stress

Participants are asked to assess their own perceived occupational stress (OS) levels on a 1 – 10 scale, ranging from 1 = minimum (*'feeling little or no stress'*) to 10 = maximum (*'highly stressed'*). No intermediate scale intervals are defined.

Job-related factors

Questions relating to *job demands* ask how frequently respondents experience working to tight deadlines (D1); how often they work long hours (D2); if they feel that they have inadequate time to balance work and family responsibilities (D3); and if they have to work harder than others to 'prove' themselves (D4). Each item uses a 5-point frequency response scale (1= '*most of the time*'; 2= '*frequently*'; 3= '*sometimes*'; 4= '*seldom*'; and 5= '*never*'). Item D4 permits the additional option of 6= '*not applicable*', to cater for sole practitioners and other instances in which this condition would not apply. In addition, participants are asked to indicate the number of hours worked per week (D5) on a scale with seven 5-hour intervals ranging from: 1= '*31-35 hours*', to 7= '*exceeding 60 hours*'. Exact items are shown in Table 1. Responses to each of the five demand factors were first examined as individual indicators of workplace demands of the job. Thereafter, a *job demand scale* was computed by summing all item responses in the direction of greater job demand. All demand factors, except hours worked per week, were reverse coded for this purpose. Scale scores thus represent the sum total of the endorsed items (range 5-27; with 27 representing the highest level of job demand). The job demand scale score is internally consistent (α = 0.63). The internal consistency was improved by the removal of variable D4 (need to 'prove' oneself) (α = 0.75), resulting in the scale score range 4-22. Similarly, factor scales were also computed for the other job-related factors: job control; job support; organizational climate; harassment; discrimination; drug usage; psychological symptoms; physiological symptoms; and sociological symptoms (see Table 1).

Table 1: Job-related category factors

Factor	Alpha	Sub-variables (survey questionnaire catalogue items)
Job Stress (OS)	-	-
Job Demands (Range 4-22)	0.751 (with D4 removed)	Need to work to tight deadlines (D1) (*reversed*)
		Need to work long hours (D2) (*reversed*)
		Inadequate time to balance work and family responsibilities (D3) (*reversed*)
		Need to work harder to 'prove' oneself (D4) (*reversed*)
		[Subsequently removed]
		Typical hours worked (per week) (D5)
Job Control (Range 4-20)	0.796	Control over work-place tasks (C1) (*reversed*)
		Control over pace of work (C2) (*reversed*)
		Control over work environment (C3) (*reversed*)
		Imbalance exists between work-place responsibilities and authority (C4)

Job support (Range 4-20)	0.779	*Manager support:* (a) Manager makes life easier (S1) (*reversed*) (b) Manager helps in difficult situations (S2) (*reversed*) *Colleague support:* (a) Colleagues make life easier (S3) (*reversed*) (b) Colleagues help in difficult situations (S4) (*reversed*)
Organisation (Range 7-35)	0.703 (with OG3 removed)	Honestly say what I think and get things off my chest (OG1) (*reversed*)
		Argue frequently with line managers, colleagues or clients (OG2) Kept busy and occupied by job demands (OG3) (*reversed*)
		[Subsequently removed]
		Given opportunities to improve or perfect skills (OG4) (*reversed*)
		Fairly compensated for the work done and hours worked (OG5) (*reversed*)
		Certainty regarding job stability in the industry over the next few years (OG6) (*reversed*)
		Certainty regarding job promotion opportunities in the construction industry (OG7) (*reversed*)
		Confidence in ability to secure a new job (if lost job) within a short period of time (OG8) (*reversed*)
Harassment (H1 – H16) (Range 0-16)	0.749	Perceived *harassment* of a sexual nature, or based on language, race, religion, gender and / or sexual preference – by line manager or colleagues: H1 H2 H3 H4 H5 H6 H7 H8 H9 H10 H11 H12 H13 H14 H15 H16 (*all reversed*)
Discrimination (DS1 – DS20) (Range 0-20)	0.715	Perceived *discrimination* in terms of salary or job security, based on language, race, religion, gender and / or sexual preference: DS1 DS2 DS3 DS4 DS5 DS6 DS7 DS8 DS9 DS10 DS11 DS12 DS13 DS14 DS15 DS16 DS17 DS18 DS19 DS20 (*all reversed*)
Drug usage (Range 3-18)	0.698 (with SU4 removed)	Extent of consuming alcoholic drinks (SU1) (*reversed*)
		Units of alcohol consumed per week (SU2) Number of cigarettes smoked per day (SU3) Use of illegal substances over the last 12 months (SU4) (*reversed*)
		[Subsequently removed]
Psychological symptoms (in the last 12 months) (Range 8-40)	0.851	Felt tense at work due to job-related issues (PS1) (*reversed*)
		Felt angry at work due to job-related issues (PS2) (*reversed*)
		Felt unhappy and / or depressed at work due to job-related issues (PS3) (*reversed*)
		Felt satisfied with the way a task is performed (PS4) Felt depressed about circumstances at work (PS5) (*reversed*)
		Lost self-confidence (PS6) (*reversed*)
		Felt you played a useful part in projects in which you were involved (PS7)
		Received adequate acknowledgement or appreciation for good work (PS8)
Physiological symptoms (in the last 12 months) (Range 6-30)	0.796	Experienced changes / disturbances to usual sleeping habits / patterns (PH1) (*reversed*)
		Felt (unexplained) symptoms of nausea or stomach disorders (PH2) (*reversed*)
		Experienced headaches (PH3) (*reversed*)
		Found it difficult to concentrate for a long period of time (PH4) (*reversed*)
		Communication with colleagues frustrates you or leaves you with feelings of being misunderstood (PH5) (*reversed*)
		Difficulty in relaxing after hours (PH6) (*reversed*)
Sociological symptoms (Range 3-15)	0.892	Stress at works puts a strain on family life (SE1) (*reversed*)
		Stress at work puts a strain on social activities (SE2) (*reversed*)
		Stress at work puts a strain on social relationships (SE3) (*reversed*)

DATA ANALYSIS

Bivariate correlations

Significant correlational relationships were found between perceived occupational stress (OS) and psychological strain effect (r=0.670, p<0.001), physiological strain effect (r=0.671, p<0.001) and sociological strain effect (r=0.714, p<0.001) (results not depicted here). Given the strength of these relationships, the three strain effect conditions are adopted as concurrent or surrogate indicator measures of stress. The relationship between factors was explored using Pearson's correlation coefficients (not shown here). The findings show that the three strain effect conditions are significantly (either positively or negatively) correlated with gender, age, work experience, job demands and job control, organisational climate, and harassment and discrimination (but not with ethnicity or job support). These patterns of correlations support more detailed analysis, first using multiple regression to model physiological, phsychological and sociological strain effects, respectively.

Multivariate analysis

For the multiple regression modeling, preliminary analyses were conducted to ensure no violation of the assumptions of normality, linearity, multicollinearity, and hetroscedasticity. A multiple regression was performed to examine the determinants of *physiological strain* in occupational stress, using the same set of independent variables (not shown here). The overall model is significant (F=14.911, p<0.001), explaining 29.4% of the variance in the physiological strain effects of stress. In this case, age (p<0.050), job demands (p<0.001) and organisational climate (p<0.001) are found to be significant independent determinants of physiological strain effects of occupational stress. Similarly, to determine the *psychological strain* effects of stress, a multiple regression was conducted with age, ethnicity, experience, job demands, job control, job support, organisational climate, harassment and discrimination at work, and substance usage being entered as independent variables (not shown here). The overall model is significant (F=36.687, p<0.001), explaining 50.7% of the variance in psychological strain effects. However, only age (p<0.050), job demands (p<0.001), job control (p<0.001), and organisational climate (p<0.001) are found to be significant independent determinants of psychological strain effects of occupational stress. Finally, to determine the *sociological strain* effects of stress, a multiple regression was performed using the same set of independent variables. The overall model is significant (F=25.225, p<0.001), explaining 41.4% of the variance in the sociological strain effects of stress. For this model, age (p<0.050), job demands (p<0.001), organisational climate (p<0.001), and discrimination at work (p<0.001) are found to be significant independent determinants of sociological strain effects of occupational stress (not shown here).

A four-part *conceptual model*, based on the literature review and the statistical analysis, is posited. Firstly, demographic (age, ethnicity, gender and experience) and workplace (job demand, control and support) factors are seen as predictors of the organisational culture, itself comprising harassment, discrimination, and the organisational climate. Secondly, the strain effects (psychological, physiological and sociological) experienced by construction professional participants are seen as being determined by the organisational culture; itself determined by demographic and workplace factors as noted above. In turn, the extent of use of alcohol and tobacco (substance use) is seen to be predicted by the three strain effects. In essence, in the conceptual model, substance use is posited as a terminal outcome of occupational stress. This model provides the starting point for structural equation modeling.

Structural equation modeling

Structural equation modeling (SEM), using Amos 22.0 for Windows, was used to delineate two structural equation models. Nine fit indices were applied to determine the degree of fit of the structural equation models. The development of the final SEM model occurs in three iterations: conceptual model; Model 1; and Model 2 (final model). Only the final model is discussed here. The fit indices of the various models are shown in Table 2. The final model is depicted in Figure 1.

A path diagram (not depicted here) was compiled to represent the conceptual model. The fit indices (Table 2) show that the ethnicity and harassment factors violate the normality assumption and are thus omitted from subsequent modeling. In line with the conceptual model, Model 1 (not shown here) models the stress-related determinants of substance use. The pathways from the three strain effect factors to substance use are *not* significant, and substance use is thus omitted for Model 2. Model 2 (the final model) models the determinants of strain effects, and displays the following fit statistics: χ^2 = 42.189 with *df*=24 and a χ^2/df ratio of 1.758 (below the recommended threshold of 2.00); GFI=0.982; AGFI=0.949; CFI=0.991; IFI=0.991; REMSEA=0.043 (all well within accepted tolerances); and Hoelter=349, which exceeds the 200 cases recommended threshold. An assessment of normality test reveals no transgressions. Model 2 is considered well-fitted to the data.

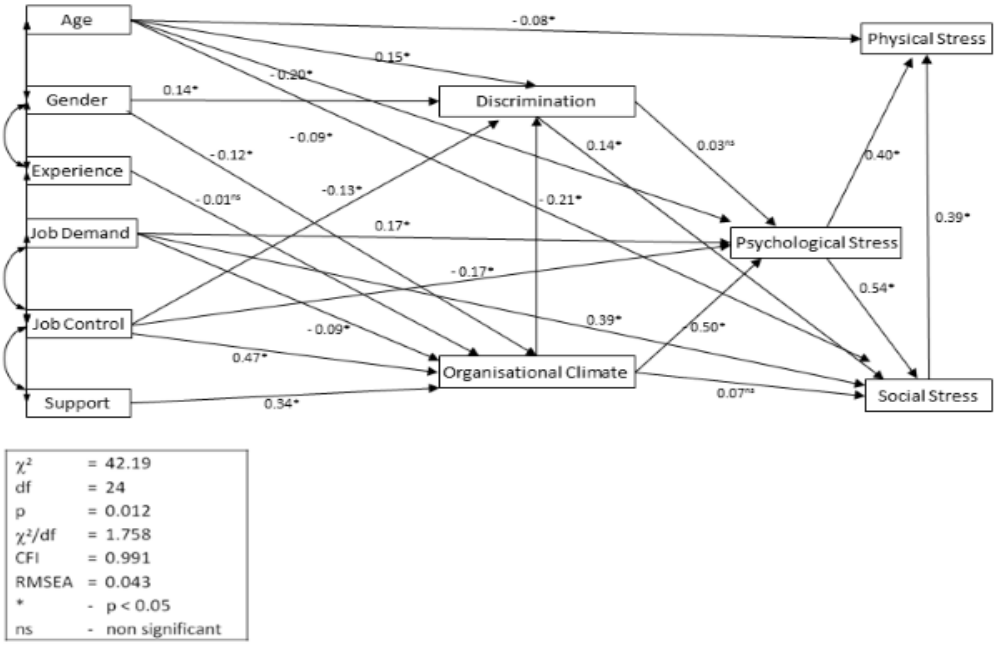

Figure 1: Modeling determinants of strain effects – Model 2 (Final)

Table 2: Fit indices of the occupational stress structural equation models

Model	χ^2	*df*	*p*	χ^2/df	GFI	AGFI	CFI	IFI	REMSEA	Hoelter
Conceptual Model	120.000	56	0.000	2.143	0.960	0.924	0.971	0.971	0.053	251
Model 1	53.48	32	0.010	1.671	0.978	0.947	0.989	0.990	0.041	349
Model 2 (Final)	42.19	24	0.012	1.758	0.982	0.949	0.991	0.991	0.043	349

Note: χ^2 = Chi-square; *df*=degrees of freedom; GFI=goodness-of-fit index; AGFI=adjusted goodness-of-fit index; CFI=comparative fit index; IFI=incremental fit index; REMSEA=root mean square residual; and Hoelter=critical *N* (CN) index.

DISCUSSION

Several significant predictive pathways are identified in the SEM (see Figure 1). Firstly, gender is significant in predicting perceptions of organisational climate (b=-0.122, p<0.010) and discrimination at work (b=0.135, p<0.010). Female construction professionals are more likely than males to experience a less supportive organisational climate and more discrimination at work. Subsequent field research interviews, conducted to address the absence of female construction managers in the original survey response, support this finding, particularly for female professionals working on construction sites, where reported issues include the provision, adequacy and cleanliness of female toilet amenities, and less willingness on the part of male artisans to accept instructions from a female supervisor. These findings align with those of Bowen *et al.* (2008) in respect of quantity surveyors.

Job demand (b=-0.090, p<0.050), control (b=0.471, p<0.010) and job support (b =0.340, p<0.010) factors are predictive of perceptions of organisational climate. Construction professionals who experience lower levels of demands, and higher levels of control and support are more likely to experience a better organisational climate. Long hours and tight deadlines are considered endemic job demands in the construction industry, but must be operationally justified if their magnifying effect on employees' physiological strain is to be mitigated. Greater flexibility in job allocation processes; improving staff supervision; and encouraging more collegial support will not only yield efficiency dividends but will also lead to a better organizational climate. Blaug *et al.* (2007) argue the positive effect of primary organizational measures to prevent occupational stress; improving the organizational climate is one way to implement them.

Age (b=0.148, p<0.010), organisational climate (b=-0.208, p<0.010), and control (b=-0.126, p<0.050) are predictive of discrimination at work. Older construction professionals, working in less supportive organisational climates, and experiencing lower levels of control at work, are more likely to experience greater discrimination than younger professionals working in supportive environments and enjoying higher levels of control. This suggests that the effectiveness of any stress 'conditioning' (i.e., where tolerance of the strain effects has gradually built up over time in the face of continuing exposure to workplace stressors) is likely to be of limited duration. This finding aligns with Gilbert (2010).

Psychological strain effects are predicted by age (b=-0.204, p<0.010), job demands (b=0.166, p<0.010), control (b=-0.170, p<0.010), and organisational climate (b=-0.497, p<0.010). Younger construction professionals, experiencing higher levels of job demands in less supportive organisational climates and having low levels of control, are more likely to report higher levels of psychological strain than their older counterparts. It may be hypothesized that the stress arising from a need to prove themselves, uncertainty about their place and 'fit' in the organisation and uncertainty about what they can reasonably expect by way of support from the organisation, may all lead to higher psychological strain outcomes for young construction professionals. Similar findings are reported by Leung *et al*. (2005).

Physiological strain effects are predicted by age (b=-0.076, p<0.050), psychological strain effects (b=0.404, p<0.010), and social / domestic strain effects (b=0.391, p<0.010). Younger professionals, experiencing higher levels of psychological and social strain, are more likely to suffer from physiological strain effects than older

professionals experiencing lower levels of psychological and social/domestic strain (see also Leung *et al*., 2005).

Social/domestic strain effects are predicted by age (b=-0.087, p<0.050), job demands (b=0.390, p<0.010), discrimination (b=0.138, p<0.010) and psychological effects of stress (b=0.538, p<0.010). Younger professionals, experiencing high levels of job demand, higher levels of discrimination at work, and more severe psychological effects of stress, are more likely to display social strain effects than older participants who have not experienced similar high job demands, lower levels of discrimination at work, and lower levels of psychological stress effects. Explanations may include the demands of families and young children (compared to the potentially quieter lives enjoyed by older 'empty nesters'); the social expectations of peer groups; the effects of 'conditioning' among older professionals or their greater experience with appropriate coping mechanisms. These findings support those of Lingard and Francis (2009).

This study offers some new and interesting findings. Firstly, it reaffirms the prominence of job demand and control factors as workplace stressors, together with job support as a mitigator. Secondly, it shows that age is an important factor in the strain effects of occupational stress among construction professionals. Thirdly, female professionals are likely to have more negative perceptions than males with respect to the organizational climate of the construction industry.

CONCLUSIONS

Data were gathered from construction professionals and a conceptual model of workplace stress posited. This model, comprising demographic factors, job demand, control and support factors, harassment and discrimination at work, organisational climate, and psychological, physiological and sociological strain effects, initially proposed substance use as the terminal consequence of job stress. Structural equation modeling was then used to test the conceptual model. The initial proposition was not supported and a different model formulated.

The results indicate that: (1) psychological, physiological and sociological strain effects are the terminal consequences of occupational stress, not substance use (2) employees' perceptions of organisational climate are largely determined by gender and job demand, control and support factors; (3) age, gender, and perceptions of job control and organisational climate are predictors of workplace discrimination; (4) psychological distress is predicted by age, perceptions of job demand and control factors, and perceptions of organisational climate; (5) sociological stress is determined by age, perceptions of job demands, and experiences of discrimination and psychological distress; and that (6) age, and sociological and psychological strain effects manifest themselves as predictors of physiological strain effects (the manifest symptoms). The complexities of organizational climate, and the ways in which it is perceived by employees, are likely to be highly nuanced. The organisational climate derives from how employees perceive their working environment, not from the experiences they bring to it. Employers should understand the effect that occupational stress has on their employees and implement strategies preferably aimed at prevention. These might include regular reviews of workload allocations, empowering employees, fostering a supportive work environment, conducting stress appraisals, conducting stress management workshops, and facilitating stress counseling where warranted. SEM has yielded valuable insights into the relationships between work stressors and their strain effects, the age and gender of construction professionals, and the strength of these associations. This is the contribution of the research.

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