

Self-perceived Depression, Anxiety, Stress and Their Relationships with Psychosocial Job Factors in Male Automotive Assembly Workers

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Abstract: Depression, anxiety and stress have been recognized as important mental outcome measures in stressful working settings. The present study explores the prevalence of self-perceived depression, anxiety and stress; and their relationships with psychosocial job factors. A cross-sectional study involving 728 male automotive assembly workers was conducted in two major automotive assembly plants in Malaysia using the validated Malay versions of the Depression Anxiety Stress Scales (DASS) and Job Content Questionnaire (JCQ). Based on the DASS cut-off of ≥ 78 percentile scores, the prevalence of self-perceived depression, anxiety and stress was 35.4%, 47.2% and 31.1%, respectively. Four (0.5%), 29 (4.0%) and 2 (0.3%) workers, respectively, reported extremely severe self-perceived depression, anxiety and stress. Multiple linear regression analyses, controlling for age, education, salary, duration of work and marital status, revealed that psychological job demand, job insecurity and hazardous condition were positively associated with DASS-Depression, DASS-Anxiety and DASS-Stress; supervisor support was inversely associated with DASS-Depression and DASS-Stress. We suggest that reducing psychological job demand, job insecurity and hazardous condition factors may improve the self-perceived depression, anxiety and stress in male automotive assembly workers. Supervisor support is protective for self-perceived depression and stress.

Key words: Self-perceived Depression, Anxiety, Stress, Psychosocial Job Factors, Depression Anxiety Stress Scales, Job Content Questionnaire, Automotive Assembly Workers

Background

An assembly line in the automotive assembly plant is usually configured as three successive shops in which the body part is constructed (Body Shop), painted (Paint Shop), and then assembled with other components into a

complete vehicle (Assembly Shop). An automotive assembly-line work is often performed in a workplace environment with physical problems, such as noise, vibrations and dangerous machines that can be important stress factors among workers. The feeling that supervisors do not care about creating a good work environment is another important factor of stress. Furthermore, technical development in assembly-line work, especially in large

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companies, has often resulted in more complicated tasks for the workers who may have difficulty in over-viewing all the steps in production; this can easily build up a fear of the unknown and, consequently, more stress¹).

Previous studies have established that job stress is a major occupational health problem in many sectors of industries and automotive assembly industry workers are one of the several occupational groups who report disproportionately high levels of job stress^{1, 2}). Studies have shown that job stress was a significant problem in automotive assembly line workers²⁻⁶). Karasek³) highlighted high strain work (high demand and low control) among machine-paced operative assemblers. Lottridge⁶) reported that assembly line workers in the automotive industry exemplify optimized jobs: the industry dictates the right way to do the job (low job control); parts are supplied as fast as they can process them (high job demand); and they are isolated in their work (lack of social support). Heaney and colleagues⁷) indicated that high job insecurity acts as a chronic stressor whose effects become more potent as the time of exposure increases in automotive workers.

Due to rapid development and strong track record for economic growth and stability, the automotive industry has become one of the important contributors to the manufacturing sector in Malaysia. In 2004, Malaysia was the largest producer of passenger cars in the Association of Southeast Asian Nations (ASEAN), accounting for 24.4% of the total ASEAN motor vehicle production. For commercial vehicles, Malaysia was the third largest producer, accounting for 11.0% of the total ASEAN production⁸). *Perusahaan Otomobil Nasional* (Proton) was the first government-linked company that was accorded flagship status followed by *Perusahaan Otomobil Kedua* (Perodua). A number of privately-owned automotive companies have also succeeded in penetrating the domestic market for motor-vehicles. Thus, the demand for highly skilled workforce has created a sort of competition between rival automotive companies in order to meet both local and international demands.

Depression, anxiety and stress have been recognized as important mental health outcomes in stressful working setting⁹⁻¹¹). There are increasing studies exploring the relationship between psychosocial job factors and depression, anxiety and stress¹²⁻¹⁸). Among the psychosocial job factors, three dimensions of the Job Demand-Control-Support (JDCS)¹²) model of job stress—psychological job demand, job control and social support—are being widely used in this relationship. However, insufficient attention has been given to other psychosocial job factors such as job insecurity, physical exertion, hazardous condition and toxic exposures. In Malaysia, no study has documented the prevalence of self-perceived depression, anxiety and stress and their relationships with psychosocial

job factors in automotive assembly workers. This is a serious omission because the automotive industry is a key player in the manufacturing sector, a high income generating industry and a government-linked company in Malaysia. Therefore, the aims of this study are to determine the prevalence of self-perceived depression, anxiety and stress; and their association with the psychosocial job factors in male automotive assembly line workers in Malaysia.

Material and Methods

Study design

In 2005, a cross-sectional study was conducted in two major automotive assembly plants in Selangor and Pahang, Malaysia. This study was part of a national research project entitled “Occupational Stress Intervention Study in Petrochemical and Automotive Assembly Plants: Developing and Evaluating a Stress Management Program at Workplaces” (OSIS) under the research program “Quality of Work Life — National Occupational Risk Management Study and National Injury Prevention” (NORMS) funded by the Ministry of Science, Technology and Innovation (MOSTI), Malaysia under its 8th Malaysia Plan.

Recruitment of study subjects

The reference population consists of those workers in the paint shops and body shops in automotive assembly line plants in Malaysia. The source population included workers in an automotive assembly line plant in Selangor (plant A) and Pahang (plant B). These two automotive assembly plants were selected to represent a key player in the manufacturing sector, a high income generating industry and a government-linked company in Malaysia. The study population was 1,100 workers for both plants, where 800 workers in plant A (500 workers in the paint shop and 300 workers in the body shop) and 300 workers in plant B (200 workers in the paint shop and 100 workers in the body shop). Universal sampling was used in this study. Permission to carry out the study was obtained from the Manager of Environmental Health and Safety Department and Human Resource Department in each plant. Inclusion criteria included male workers who were working in the paint shop and body shop and at least one year of working experience. The exclusion criterion was a diagnosis of any psychiatric illness by the respective medical referees in each plant. This exclusive criterion was chosen to remove the influence of psychiatric illnesses on the association between psychosocial job factors and self-perceived depression, anxiety and stress.

Workers were met at their worksite during working hours. The supervisors were asked to send their workers

during rest hour to the room set aside for data collection. Recruitment of workers was done through the list of workers provided by the supervisors with written informed consents before participation. Before the workers were self-administered with the questionnaires, medical check ups were given as an appreciation for their cooperation. Trained research officers checked the returned questionnaires onsite to assure completeness. A total of 767 (response rate 69.72%) study subjects (521 workers in plant A and 246 workers in plant B) were recruited into the study. After excluding 39 female workers, the final total study subjects were 728 male workers.

Sample size

Sample size was estimated using the single proportion formula with 95% confidence interval¹⁹⁾. Sample size calculation was based on the 22.3% prevalence of stress among dental healthcare workers in Malaysia using the DASS²⁰⁾. We set the precision at 4% and the calculated sample size was 417. After considering a 20% non-response, the final sample size was 500.

Research instruments

Depression Anxiety Stress Scales (DASS) Questionnaire

A validated Malay version of the Depression Anxiety Stress Scales (DASS) questionnaire was used to measure the negative emotional states of self-perceived depression, anxiety and stress. The DASS consists of 14-item self-report in each three scales (DASS-Depression scale, DASS-Anxiety scale and DASS-Stress scale). The DASS-Depression scale assesses dysphoria, hopelessness, devaluation of life, self-deprecation, lack of interest/involvement, anhedonia, and inertia. The DASS-Anxiety scale assesses autonomic arousal, skeletal muscle effects, situational anxiety, and subjective experience of anxious affect. The DASS-Stress scale is sensitive to levels of chronic non-specific arousal. It assesses difficulty relaxing, nervous arousal, and being easily upset/agitated, irritable/over reactive, and impatient. Subjects were asked to use a 4-point severity/frequency scale (0=Did not apply to me at all, 1=Applied to me to some degree, or some of the time, 2=Applied to me a considerable degree, or a

good part of the time, and 3=Applied to me very much, or most of the time) to rate the extent to which they have experienced each state over the past week. Scores for the DASS-Depression, DASS-Anxiety and DASS-Stress were calculated by summing the scores for the relevant items and converting them into percentile scores²¹⁾.

There were two procedures to determine the cut-off values to classify individuals into the 5 levels of severity rating of core symptoms of depression, anxiety and stress (1=Normal, 2=Mild, 3=Moderate, 4=Severe, and 5=Extremely severe) provided by the DASS manual²¹⁾ (Table 1). Firstly, scores for the DASS-Depression, DASS-Anxiety and DASS-Stress were calculated by summing the scores for the relevant items and converting these into percentile scores. Based on the cut-off percentiles, workers scoring less than 78 percentiles were considered normal; 78 to 87 percentiles as mild; 85 to 95 percentiles as moderate; 95–98 percentiles as severe; and 98–100 percentiles as extremely severe. Secondly, the raw scores for each subscale (DASS-Depression, DASS-Anxiety and DASS-Stress) were summed and converted into Z scores. Based on the Z scores, workers scoring less than 0.5 were considered normal; 0.5 to 1.0, mild depression, anxiety or stress; 1.0 to 2.0, moderate depression, anxiety or stress; 2.0–3.0, severe depression, anxiety or stress; and more than 3.0, extremely severe depression, anxiety or stress²¹⁾. We used the first procedure in classifying the severity of self-perceived depression, anxiety and stress.

The validation study among automotive workers found that the scale demonstrated good Cronbach's alpha and good concurrent validity²²⁾. The results indicated that the Cronbach's alpha coefficients were acceptable for DASS-Depression (0.81), DASS-Anxiety (0.85) and DASS-Stress (0.85). Exploratory factor analysis showed three meaningful common factors that could explain the three theoretical dimensions or constructs of the DASS.

Job Content Questionnaire (JCQ)

The Job Content Questionnaire (JCQ) is widely used to measure social and psychological characteristics of jobs²³⁾. The questionnaire was designed to emphasize the

Table 1. General guidelines for the DASS severity ratings

Severity Ratings	Z Score	Percentile	DASS-Depression	DASS-Anxiety	DASS-Stress
1. Normal	<0.5	0–78	0–9	0–7	0–14
2. Mild	0.5–1.0	78–87	10–13	8–9	15–18
3. Moderate	1.0–2.0	87–95	14–20	10–14	19–25
4. Severe	2.0–3.0	95–98	21–27	15–19	26–33
5. Extremely Severe	>3.0	98–100	28+	20+	34+

Lovibond and Lovibond²¹⁾.

objective nature of the work, not the reactions of the respondents³). In this study, the psychological job demand scale consists of 5 items (work fast, work hard, excessive work, not enough time and conflicting demands). Decision latitude is a 9-item scale comprising of 2 subscales—skill discretion (6 items: learn new things, repetitive work, requires creativity, high skill level, task variety and develop own abilities) and decision authority (3 items: allows own decision, little decision freedom and lots of say)²³). The social support scale is composed of two subscales: supervisor support (4 items: supervisor is concerned, supervisor pay attention, helpful supervisor and supervisor good organizer) and co-workers support (4 items: co-worker competent, co-worker interest in me, friendly co-worker and co-worker helpful). Toxic exposures (3 items: exposure to dangerous chemicals, exposure to air pollution and risk of catching disease), physical exertion (1 item: lots of physical effort), hazardous conditions (5 items: exposure to things placed dangerously, dirty or badly maintained areas, dangerous tools, exposure to fire and dangerous work methods) and job insecurity (3 items: how steady the work, not good job security and will lose present job) scales were also included in the study. Thus, 11 scales (psychological job demand, decision latitude, social support, toxic exposure, physical exertion, hazardous condition, job insecurity, skill discretion, decision authority, supervisor support and co-worker support) were explored in this study.

Items in the JCQ were scored on a Likert scale of 1 to 4 (1=Strongly disagree, 2=Disagree, 3=Agree and 4=Strongly agree; or 1=Often, 2=Sometimes, 3=Rarely and 4=Never). All variables were analysed using the formulae for the JCQ scale construction provided in the Job Content Questionnaire and User Guide (Appendix 1)²³. Previous pilot study among 50 male automotive workers in Kelantan²⁴) found that all the scales of the Malay version of the JCQ demonstrated acceptable Cronbach's alpha coefficients (Cronbach's α). The Cronbach's α for 11 scales—"skill discretion", "decision authority", "decision latitude", "psychological job demand", "job insecurity", "co-worker support", "supervisor support", "social support", "hazardous condition" and "toxic exposures"—were 0.71, 0.70, 0.74, 0.61, 0.31, 0.64, 0.81, 0.79, 0.86 and 0.88, respectively. Physical exertion scale was not included in the reliability analysis because it only has one item. Meanwhile, the exploratory factor analysis in the previous pilot study was only performed on three scales—decision latitude, psychological job demand and social support—that could explain the 3 theoretical dimensions of Karasek's JDCA model. Information on demographic factors such as age, years of education, marital status, working duration and salary were also included.

Research protocol

The research protocol was reviewed and approved by the Research and Ethics Committee, School of Medical Sciences, Universiti Sains Malaysia Health Campus, Kelantan, Malaysia. The workers and employers were also given a written guarantee of confidentiality. Data will be collected using the self-administration of the Malay version of the Job Content Questionnaire (JCQ^{24–26}) and the Depression Anxiety Stress Scales (DASS).²²

Statistical analysis

Data entry and analysis was done using the SPSS version 12.0.1²⁷). Means and standard deviations were calculated for continuous variables, and frequencies and percentages for categorical variables. To determine the relationship between psychosocial job factors with DASS-Depression, DASS-Anxiety and DASS-Stress, three multiple linear regression models were analyzed using the following steps. Firstly, data exploration and simple linear regression analysis were done for all socio-demographic factors including age, education, salary, duration of work and marital status and psychosocial job factors as independent variables and DASS-Depression, DASS-Anxiety and DASS-Stress as outcome variables. Secondly, three variable selection procedures such as stepwise, backward, and forward methods were performed one at a time. Variables selected by each procedure were, then, evaluated using their significant levels (p values) to include in the preliminary main effect model. In the third step, the possible multi-collinearity problem between independent variables was evaluated by obtaining the variance inflation factor (VIF). If the VIF was more than 10, serious multi-collinearity problem was considered. The collinearity diagnostic test results indicated that all VIF values for independent variables in the preliminary main effect model of the DASS-Depression, DASS-Anxiety and DASS-Stress were less than 10 (ranging from 1.02 to 1.08). In addition, all possible 2-way interactions between independent variables (supervisor support*psychological job demand, supervisor support*job insecurity, supervisor support*hazardous condition, psychological job demand*job insecurity and psychological job demand*hazardous condition) were tested by including the interaction terms as additional independent variables in the models. All interaction terms were not significant ($p>0.05$), suggesting that no interaction term should be added to our models. Finally, linear regression assumptions such as overall model linearity and equal variance were checked by using residual plots including residual versus predicted values whilst normality of residuals was checked by histogram. All these assumptions were met in our data. In addition, there is no relationship between

residuals and each numerical independent variable thus suggesting that all numerical independent variables are linear. Since our study is interested in determining significant associated psychosocial job factors that influence self-perceived depression, anxiety and stress, therefore, demographic factors such as age, education, salary, duration of work and marital status were added to the final model to control for their possible confounding effects. Results were considered statistically significant if $p < 0.05$.

Results

Descriptive statistics

Table 2 shows the demographic characteristics of 728 Malaysian male automotive assembly workers. The average age of the workers was 27.3 (SD 5.9) yr. The mean duration of work and salary were 6.1 (SD 4.4) yr and Ringgit Malaysia 1281.6 (SD 911.5), respectively. Table 3 shows the mean scores of 11 scales of the JCQ.

Psychosocial job factors and DASS-depression

Table 4 shows that the prevalence of self-perceived depression (mild to extremely severe) was 35.4%. Four automotive workers (0.5%) experienced extremely severe self-perceived depression whilst 254 (34.9%) experienced mild to severe self-perceived depression. Simple linear regression analysis shows that physical exertion, social support, co-worker support, supervisor support, psychological job demand, job insecurity and hazardous condition were significantly associated with the DASS-

Table 2. Demographic characteristics of 728 male automotive assembly plant workers

Demographic characteristics	Mean	SD	No.	%
1. Age (yr)	27.3	5.9		
2. Education (yr)	10.9	1.4		
3. Salary (Ringgit Malaysia)	1,281.6	911.5		
2. Duration of work (yr)	6.1	4.4		
4. Marital Status				
a. Single			427	58.7
b. Married			301	41.3

Depression. Multiple linear regression analysis, controlling for demographic factors such as age, education, salary, duration of work, marital status, reveals that the DASS-Depression was positively associated with psychological job demand, job insecurity and hazardous condition; and inversely associated with supervisor support (Table 5).

Psychosocial job factors and DASS-anxiety

Table 4 shows that the prevalence of self-perceived anxiety (mild to extremely severe) was 47.2%. Twenty nine automotive assembly workers (4.0%) experienced extremely severe self-perceived anxiety whilst 343 (43.2%) experienced mild to severe self-perceived anxiety. Simple linear regression analysis shows that toxic exposure, physical exertion, social support, co-worker support, supervisor support, psychological job demand, job insecurity and hazardous condition were significantly associated with the DASS-Anxiety. Multiple linear regression analysis, controlling for age, education, salary, duration of work, marital status, reveals that psychological job demand, job insecurity and hazardous condition were positively associated with the DASS-Anxiety (Table 6).

Table 3. Means and standard deviations of the Karasek's Job Content Questionnaire scales

Psychosocial job factors	Mean	SD	Min Score	Max Score
1. Skill discretion	35.0	4.0	14.0	48.0
2. Decision authority	31.6	5.3	12.0	48.0
3. Toxic exposure	5.9	2.0	3.0	36.0
4. Physical exertion	3.0	0.6	1.0	4.0
5. Job control	66.6	7.8	34.0	92.0
6. Social support	27.5	2.7	15.0	36.0
7. Co-worker support	12.1	1.4	7.0	16.0
8. Supervisor support	15.4	1.9	4.0	20.0
9. Psychological job demand	32.0	3.8	22.0	46.0
10. Job insecurity	5.7	1.7	3.0	12.0
11. Hazardous condition	8.2	2.6	5.0	15.0

Table 4. Means and standard deviations for the DASS questionnaire subscales (N=728)

DASS Subscales	Mean	SD	Min-Max	Prevalence (%) in each DASS category ^a				
				Normal (0-78 ^a)	Mild (78-87)	Moderate (87-95)	Severe (95-98)	Extremely severe (98-100)
Depression	8.2	5.8	0-42	470(64.6)	141(19.4)	86(11.8)	27(3.7)	4(0.5)
Anxiety	8.3	5.6	0-42	385(52.9)	88(12.1)	154(21.2)	72(9.9)	29(4.0)
Stress	11.2	6.5	0-42	502(69.0)	115(15.8)	82(11.3)	27(3.7)	2(0.3)

^a Lovibond and Lovibond's (1995) percentile cut-offs corresponding to each DASS category²¹.

Table 5. Relationship between DASS-Depression and psychosocial job factors in 728 male automotive assembly workers

Psychosocial job factors	Simple Linear Regression					Multiple Linear Regression				
	Crude <i>b</i> ^a	95% CI ^b		<i>t</i> stat	<i>p</i> -value ^c	Adj <i>b</i> ^d	95% CI ^e		<i>t</i> stat	<i>p</i> -value
1. Skill discretion	-0.023	-0.13,	0.08	-0.423	0.673					
2. Decision authority	-0.035	-0.11,	0.05	-0.854	0.393					
3. Job control	-0.011	-0.15,	0.13	-0.153	0.879					
4. Toxic exposure	0.003	-0.67,	0.67	0.008	0.994					
5. Physical exertion	0.535	0.04,	0.18	2.930	0.003					
6. Social support	-0.508	-0.66,	-0.36	-6.642	<0.001					
7. Co-worker support	-0.574	-0.87,	-0.27	-3.752	<0.001					
8. Supervisor support	-0.723	0.94,	-0.51	-6.664	<0.001	-0.385	-0.59,	-0.18	-3.629	<0.001
9. Psychological job demand	0.282	0.17,	0.39	5.034	<0.001	0.166	0.06,	0.27	3.123	0.002
10. Job insecurity	1.132	0.90,	1.37	9.517	<0.001	0.839	0.61,	1.07	7.067	<0.001
11. Hazardous condition	0.674	0.52,	0.83	8.413	<0.001	0.444	0.29,	0.60	5.610	<0.001

^a Crude regression coefficient; ^b Confidence interval for crude regression coefficient; ^c Significant at $p \leq 0.05$; ^d Adjusted regression coefficient controlling for demographics factors such as age, education, marital status, salary and duration of work, ^e Confidence interval for adjusted regression coefficient.

Table 6. Relationship between DASS-Anxiety and psychosocial job factors in 728 male automotive assembly workers

Psychosocial job factors	Simple Linear Regression					Multiple Linear Regression				
	Crude <i>b</i> ^a	95% CI ^b		<i>t</i> stat	<i>p</i> -value ^c	Adj <i>b</i> ^d	95% CI ^e		<i>t</i> stat	<i>p</i> -value
1. Skill discretion	0.072	-0.03,	0.17	1.398	0.163					
2. Decision authority	0.015	-0.06,	0.09	0.379	0.705					
3. Job control	0.106	-0.03,	0.24	1.567	0.118					
4. Toxic exposure	0.606	0.41,	0.81	5.926	<0.001					
5. Physical exertion	0.836	0.20,	1.48	2.561	0.011					
6. Social support	-0.297	-0.44,	-0.15	-3.980	<0.001					
7. Co-worker support	-0.291	-0.58,	<0.01	-1.973	0.049					
8. Supervisor support	-0.446	-0.65,	-0.24	-4.218	<0.001					
9. Psychological job demand	0.259	0.15,	0.37	4.820	<0.001	0.174	0.07,	0.28	3.370	0.001
10. Job insecurity	0.829	0.60,	1.06	7.086	<0.001	0.592	0.37,	0.81	5.234	<0.001
11. Hazardous condition	0.727	0.58,	0.88	9.592	<0.001	0.569	0.42,	0.72	7.452	<0.001

^a, ^b, ^c, ^d, ^e : as per Table 5.

Psychosocial job factors and DASS-stress

Table 4 shows that the prevalence of self-perceived stress (mild to extremely severe) was 31.1%. Two (0.3%) automotive workers experienced extremely severe self-perceived stress whilst 226 (30.8%) experienced mild to severe self-perceived stress. Simple linear regression analysis shows that toxic exposure, social support, co-worker support, supervisor support, psychological job demand, job insecurity and hazardous condition were significantly associated with the DASS-Stress. Multiple linear regression analysis, controlling for age, education, salary, duration of work, marital status, reveals that psychological job demand, job insecurity and hazardous condition were positively associated with the DASS-Stress; however, supervisor support was inversely associated (Table 7).

Discussion

Prevalence of self-perceived depression, anxiety and stress

The DASS questionnaire was used to assess the severity levels of self-perceived depression, anxiety and stress. Using the DASS cut-off of ≥ 78 percentile scores by Lovibond and Lovibond²¹⁾, our study has shown that the DASS could identify 35.4%, 47.2% and 31.1% of Malaysian male automotive assembly workers who were perceived as being depressed, anxious and stressed, respectively. Four (0.5%) workers were classified as extremely severely depressed whilst 34.9% was classified as mild to severely depressed; 29 (4.0%) workers experienced extremely severe anxiety whilst 43.2% experienced mild to severe anxiety; and 2 (0.3%) workers experienced extremely severe stress whilst 30.8% experienced mild to

Table 7. Relationship between DASS-Stress and psychosocial job factors in 728 male automotive assembly workers

Psychosocial job factors	Simple Linear Regression					Multiple Linear Regression				
	Crude <i>b</i> ^a	95% CI ^b		<i>t</i> stat	<i>p</i> -value ^c	Adj <i>b</i> ^d	95% CI ^e		<i>t</i> stat	<i>p</i> -value
1. Skill discretion	0.036	-0.08,	0.16	0.591	0.555					
2. Decision authority	-0.031	-0.12,	0.06	-0.685	0.494					
3. Job control	0.058	-0.10,	0.22	0.727	0.467					
4. Toxic exposure	0.668	0.43,	0.91	4.983	<0.001					
5. Physical exertion	0.377	-0.38,	1.13	0.978	0.328					
6. Social support	-0.508	-0.68,	-0.34	-5.856	<0.001					
7. Co-worker support	-0.563	-0.90,	-0.22	-3.256	0.001					
8. Supervisor support	-0.730	-0.97,	-0.49	-5.925	<0.001	-0.350	-0.58,	-0.12	-2.931	0.003
9. Psychological job demand	0.371	0.25,	0.50	5.904	<0.001	0.225	0.11,	0.34	3.773	<0.001
10. Job insecurity	1.075	0.81,	1.34	7.867	<0.001	0.709	0.45,	0.97	5.312	<0.001
11. Hazardous condition	0.873	0.70,	1.05	9.802	<0.001	0.646	0.47,	0.82	7.260	<0.001

a, b, c, d, e, : as per Table 5.

Table 8. Means and standard deviations of the DASS subscales score of depression, anxiety and stress in the present and other studies

DASS Subscale	Automotive assembly workers in Malaysia (Present study)	Workers with mental health problems ³³⁾	General adults in UK ³⁰⁾	Non-clinical samples in Australia ³²⁾	Clinical samples in USA ²⁹⁾
Depression	8.2 (5.8)	20.6 (9.7)	5.6 (7.5)	6.3 (7.0)	10.7 (9.3)
Anxiety	8.3 (5.6)	14.0 (8.2)	3.6 (5.4)	4.7 (4.9)	10.9 (8.1)
Stress	11.2 (6.5)	21.2 (8.5)	9.3 (8.0)	10.1 (7.9)	21.1 (11.2)

severe perceived stress.

In this study, the severity rating of self-perceived depression, anxiety and stress levels was not assessed with the 'gold standard,' —a diagnostic psychiatric interview — but with the self-reported DASS questionnaire. The DASS questionnaire was developed to measure mental health problems for screening purposes and has been shown to be acceptably reliable and valid instrument to measure depression, anxiety and stress in normal and clinical samples^{21, 28–33)}. In terms of psychometric properties, using normal samples, Lovibond and Lovibond have shown that the DASS questionnaire possesses adequate convergent and discriminant validity²¹⁾. They found that the Beck Anxiety Inventory (BAI) and the DASS-Anxiety subscale was highly correlated ($r=0.81$), as was the Beck Depression Inventory (BDI) and DASS-Depression subscale ($r=0.74$). However, between construct correlations were substantially lower ($r=0.54$ for the DASS-Depression and BAI; $r=0.58$ for the DASS-Anxiety and BDI). Moreover, Antony *et al.*²⁸⁾ found a similar pattern of correlations in a clinical sample. The results of Nieuwenhuijsen *et al.*'s³³⁾ study suggested that the DASS questionnaire is a valid instrument for use in occupational health care. It can be helpful in ruling out anxiety disorder and depression in employees with mental health problems.

For most purposes, scores on the DASS questionnaire

may also be interpreted relative to the means and standard deviations of the full normative sample²¹⁾. Our study has shown that the mean DASS-Depression score was 8.2 (5.8), the mean DASS-Anxiety score was 8.3 (5.6) and the mean DASS-Stress score was 11.2 (6.5). These findings are slightly lower than those of the clinical samples taken from the Phobia and Anxiety Disorders Clinic in USA²⁹⁾ and workers with mental health problems in the Netherlands³³⁾; but higher than the general adult samples in the United Kingdom³⁰⁾ as well as student samples in Australia³²⁾ (Table 8).

The present study found that 31.1% workers reported self-perceived stress, thus suggesting that stress is relatively high in Malaysian male automotive assembly workers compared to findings by Rusli and colleagues²⁰⁾ in dental healthcare workers where the prevalence of self-perceived stress was 22.2%. Previous studies have shown that workers in automotive assembly plants reported high levels of job stress^{1–5)}. For instance, Karasek *et al.*'s³⁾ cross-sectional study highlighted high strain work (high demand and low control) in machine-paced operative assemblers. Hanse and Forsman's⁵⁾ case study in a workshop of a car manufacturer found that mental strain situations were identified in automotive workers working with truck-picking. Approximately 80% of the workers experienced low job control. However, Oleske and colleagues²⁾ found that 28.1% of 352 automotive workers in

two United States automotive plants reported continuous or frequent stress and revealed that high stress levels were associated with low back disorders disability over time.

Relationship between self-perceived depression, anxiety, stress and psychosocial job factors

The present study investigated the relationship between self-perceived depression, anxiety and stress and psychosocial job factors such as job insecurity, hazardous condition, toxic exposure, skill discretion and physical exertion in male automotive workers. We found that psychological job demand, job insecurity and hazardous condition were strongly associated with DASS-Depression, DASS-Anxiety and DASS-Stress after controlling for age, education, salary, duration of work, and marital status. Meanwhile, supervisor support was inversely associated with the DASS-Depression and DASS-Stress. However, job control was not significantly associated with any of the DASS subscales. Previous studies using cross-sectional and longitudinal designs have shown that automotive workers were exposed to high strain working condition, conceptualized as high psychological job demand, low job control and low social support, and significantly associated with negative depression and anxiety.

In a cross-sectional study, Kumlin *et al.*⁴⁾ have shown that psychological job demand was rated higher by Renault (French automotive industry) and Volvo (Swedish automotive industry) in married and divorced male workers compared to single workers. Whereas, Sanne *et al.*¹³⁾ have shown that job demand, job control and social support were independently associated with anxiety and depression. Wang and Patten¹⁷⁾ have shown that the Canadian male workers who reported high psychological job demand had a greater degree of elevation in their risk of major depression than women workers who were at the same stress level. Their study also found that workers who reported high decision authority, job insecurity, and lack of social support from co-workers and supervisors were more likely to experience major depression than those who reported low decision authority, job insecurity, and sufficient social support from co-workers and supervisors. There was no evidence that major depression was related to stress from lack of skill discretion and physical exertion. Meanwhile, in a longitudinal study, Plaisier *et al.*¹⁴⁾ reported that job demand predicted the incidence of depressive and anxiety disorders in both men and women workers, but not for job control and interaction between psychological job demand and job control.

We found that job insecurity, as assessed by steady work, job security, recent layoff, career possibilities and skills valuable, was strongly associated with the DASS-Depression, DASS-Anxiety and DASS-Stress. These findings were supported by previous longitudinal research

studies. For instance, Ferrie *et al.*³⁴⁾ have shown that subjective job insecurity was strongly related to self-rated health, minor psychiatric disorder and depression in the Whitehall II study among male and female London-based office staff. Meanwhile, a recent study to investigate the impact of psychosocial work characteristics in a 5-yr prospective study supported the findings that job insecurity predicted severe depressive symptoms (RR=2.04, 95% CI: 1.02, 4.07) among men³⁵⁾.

Another important factor in influencing the DASS-Depression, DASS-Anxiety and DASS-Stress in automotive workers was hazardous condition. Kalimo and Mejman³⁶⁾ reported that exposure to chemicals or adverse physical conditions in the working environment and quite often, the existence of adverse working conditions leads to combine and probably aggravated effects on the workers health. We found that hazardous condition was strongly and positively associated with all DASS subscale, implying that high DASS-Depression, DASS-Anxiety and DASS-Stress were significantly associated with more experiences with the following: exposures to, storing things dangerously, dirty or badly maintained areas, dangerous tools, machinery or equipment, fire, burns or shocks and dangerous work among workers.

In our study, lack of supervisor support was significantly associated with the DASS-Depression and DASS-Stress. This finding was supported by previous longitudinal studies. For instance, Stansfeld *et al.*'s³⁷⁾ 5-yr follow-up study of 10,308 British civil servants sample in the Whitehall II longitudinal design found that participants who reported high levels of stress in psychological job demand and decision authority and lacking social support from co-workers and supervisors were at a higher risk of depressive symptoms³⁷⁾. Whereas, in a French GAZEL cohort study of 11,552 employees of an electricity and gas company, Niedhammer and colleagues³⁸⁾ found that the components of the JDCS—high psychological job demand, low job control, and low social support—predicted the onset of depression over a 12-month follow-up.

Study limitations

The cross-sectional design of our present study precludes any causal relationship between psychosocial job factors and self-perceived depression, anxiety and stress. However, findings from other studies using longitudinal designs, have suggested possible relationships between psychosocial job factors and depression, anxiety and stress^{7, 14, 35, 37–39)}. To investigate issues of causality, future research could use prospective designs to replace the subjective responses related to the work environment in individuals with and without depression, with more objective measures using a job exposure matrix⁴⁰⁾.

Another limitation of this study is that all of the study data were self-reported, which may have introduced bias. However, self-report is often the only feasible strategy to gather information concerning workers' working conditions²⁵). Since various instruments were used to measure the depression, anxiety and stress such as the Positive and Negative Affect Schedule (PANAS), Hospital Anxiety and Depression Scale (HADS), Beck Depression Inventory (BDI), Beck Anxiety Inventory (BAI) and other clinical diagnostic instruments in previous studies — our findings could not be compared with many previous studies.

Conclusions

Using similar instrument, our study has shown that the mean DASS-Depression, DASS-Anxiety and DASS-Stress score were slightly lower than those of the clinical samples taken from USA and workers in Netherlands, but higher than the general adult samples in the United Kingdom as well as student samples in Australia. The prevalence of self-perceived stress was relatively high in male automotive assembly workers compared to dental healthcare workers in Malaysia. It should be noted that in the present study, our interest is on the relationship between DASS subscales containing DASS-Depression, DASS-Anxiety, DASS-Stress and psychosocial job factors which not only solely used the three scales of Karasek's JDCS model, but also included the other job factors such as job insecurity, hazardous condition, toxic exposure, skill discretion and physical exertion. We conclude that supervisor support is protective for depression and stress. Psychological job demand, job insecurity and hazardous condition were suggested as important factors in automotive assembly workers; reducing these factors may improve the depression, anxiety and stress in these workers.

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Appendix

Formulae for the Job Content Questionnaire's scale construction

1. Skill discretion = $[Q3 + Q5 + Q7 + Q11 + (5 - Q4)] \times 2$
2. Decision authority = $[Q6 + Q10 + (5 - Q8)] \times 4$
3. Job control = Skill Discretion + Decision Authority
4. Toxic exposure = $[Q39 + Q40 + Q43]$
5. Physical exertion = $Q21$
6. Co-worker support = $[Q53 + Q54 + Q56 + Q58]$
7. Supervisor support = $[Q48 + Q49 + Q51 + Q52]$
8. Social support = Co-worker support + Supervisor support
9. Psychological job demand = $[(Q19 + Q20) \times 3 + (15 - (Q22 + Q23 + Q26)) \times 2]$
10. Job insecurity = $[Q33 + Q36 + (5 - Q34)]$
11. Hazardous condition = $[Q41 + Q42 + Q44 + Q45 + Q47]$