Original Article

Relationship of Psychosocial Work Factors and Health-Related Quality of Life in Male Automotive Assembly Workers in Malaysia

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Abstract: The present study investigates the relationship between psychosocial work factors and health-related quality of life (HRQOL) in male automotive assembly plant workers in Malaysia. Materials and Methods: A total of 728 male workers were recruited in March–July 2005 from 2 major automotive assembly plants in Selangor and Pahang. In this cross-sectional study, information on socio-demography, psychosocial work factors using the 97-item Job Content Questionnaire (JCQ) and an abbreviated 26-item version of the World Health Organization Quality of Life-Brief Version (WHOQOL-BREF) questionnaire containing 4 domains (physical health, psychological, social relationship, and environment) was self-administered to all workers involved. Results and Conclusion: The prevalence of reported good or very good overall HRQOL and general health was 64.9% and 53.7%, respectively. Multiple linear regression analysis indicated that created skill was positively associated with physical health and psychological domains; whilst, skill discretion was positively associated with social relationship and environment domains. Social support was positively associated with physical health and environment domains; whilst, co-worker support was positively associated with psychological and social relationship domains. Job insecurity and hazardous condition were negatively associated with all domains, whilst psychological job demands was negatively associated with the environment domain of HRQOL.

Key words: Psychosocial work factors, Job Content Questionnaire (JCQ), World Health Organization Quality of Life-Brief Version (WHOQOL-BREF), Health-Related Quality Of Life (HRQOL), Automotive assembly workers

Introduction

Psychosocial work factors have been shown to be influential in the management of stress in workers. Among the psychosocial work factors, decision latitude and psychological job demand are also used to explain the Job Demand-Control (JDC) model of job stress—the most frequently quoted occupational stress model with various adverse health outcomes[1–4]. According to the JDC model, job stress mainly results from the interaction of two factors: high psychological job demand ('high job demand') and low decision latitude ('low job control'). This model is also referred to as the job strain model[3] which may predict adverse health effects of stressed workers. In the job strain model, jobs were classified into four categories. The highest level of strain would be found in *high-strain jobs* where the job demand was excessive and could not be moderated by the workers. This might occur, for example, when bureaucratic

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rules rigidly limit workers' responses[5]. A high level of psychological job demand combined with a high level of decision latitude would be found in *active jobs* that will result in "desirable stress" outcome of increased motivation and learning opportunity. Lower levels of strain would be found in *low-strain jobs* where the demand is low but control is high. Intermediary levels of strain could be expected in *passive jobs* (low job demand and low job control)[5]. An extension of this model—the iso-strain or Job-Demand-Control-Support (JDCS) model—posits that the most hazardous job occurs when high job strain is combined with low levels of social support[4–6].

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 production[7]. *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.

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 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 stress[8]. Previous studies have shown that job stress was a significant problem in automotive assembly line workers[9–13]. Karasek[9] highlighted high strain work (high demand and low control) among machine-paced operative assemblers. Lottridge[13] 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).

There is an increasing need to emphasize health-related quality of life (HRQOL) in workplaces[14–16]. The World Health Organization (WHO) defines quality of life as the individual's perception of his/her position in life in the context of the culture and value systems in which he/she lives and in relation to his/her goals, expectations, standards and concerns. It is a broad ranging concept that is influenced, in a complex way, by the person's physical health, psychological state, social relationships, and the environment[17]. The WHO developed a questionnaire to measure HRQOL based on this definition[18]. Although quality of life measures were developed mainly to reflect the consequences of health problems, losses in the sense of wellbeing may conceivably precede, follow, or be independent of the disease[14].

To date, studies investigating the relationship between psychosocial work factors and HRQOL are increasing[14, 15, 19–21]. Those studies found that psychosocial work factors in terms of job demand, job control, social support, effort-reward imbalance, job strain (defined as high job demand and low job control,) and iso-strain (job strain and low social support) are significantly associated with HRQOL. Despite that, insufficient attention has been given to the relationship of other psychosocial factors such as job insecurity, physical exertion, hazardous condition and toxic exposures on HRQOL. Hence, the purpose of the present study is to examine the relationship between psychosocial work factors and the 4 domains of HRQOL (physical health, psychological, social relationship and environment) of automotive assembly workers in Malaysia.

Materials and Methods

Study design

A cross-sectional study of the relationship between psychosocial work factors and HRQOL of workers was conducted from March 2005 till July 2005 in two major representative automotive assembly plants located in Pahang and Selangor, Malaysia. This study is part of the Occupational Stress Intervention Study in Petroleum and Automobile Assembly Plants: Developing and Evaluating Stress Management Program at Workplaces (OSIS) for a period of three consecutive years beginning from July 2003.

Recruitment of study subjects

The automotive assembly industry was selected to represent high income generating industries in Malaysia. 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). 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). Sampling method used for this study was universal sampling. 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 and exclusion criteria were developed before recruiting the subjects. 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 work factors and HRQOL.

In this study, 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 the workers' 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 in the study. After excluding 39 female workers, the final total study subjects were 728 male workers.

Sample size

The estimation of sample size was performed using the single proportion formula[22] with 95% confidence interval. Sample size calculation was based on the 50% prevalence of self-reported on good or very good health status among Taiwanese male workers using the World Health Organization Quality of Life-Brief Version (WHOQOL-BREF) questionnaire[18]. We set the precision at 4% and the minimum calculated sample size was 601. After considering a 20% non-response, the final sample size was 721.

Research protocol

The study protocol was reviewed and approved by the Research and Ethics Committee, School of Medical Sciences, Universiti Sains Malaysia, Kelantan Health Campus. The workers and employers were also given a written guarantee of confidentiality. Self-administration of the validated Malay version of the Job Content Questionnaire (JCQ)[23, 24] and WHOQOL-BREF[25] were used in this study.

Psychosocial work factors

A validated Malay version of the JCQ, derived from the recommended format with 97 items of the JCQ 1.5 (Revised 1996) including added scales and extensions of the original scales for the Framingham version[24], was used to measure 15 aspects of psychosocial work factors. In this study, created skill scale is defined by 3 items (learn new things, require creativity and develop own abilities); whilst, psychological job demand is defined by 5 items (excessive work, conflicting demands, insufficient time to work, work fast, and work hard). Decision latitude is defined as the sum of 2 subscales: skill discretion, measured by 5 items (keep learning new things, job requires creativity, job requires high skill level, can develop own abilities, and repetitious), and decision authority, measured by 3 items (have freedom to make decisions, choose how to perform work, and have a lot of say on the job). Decision latitude is the primary measure of the concept of control and is defined as the combination of job decision-making authority and use of skills on the job. Social support is the sum of 2 subscales: support from co-workers, measured by 4 items (co-workers competent, co-workers interested in me, friendly co-workers, and co-workers helpful) and support from supervisor, measured by 4 items (supervisor shows concern, supervisor pays attention, supervisor is helpful, and supervisor is a good organizer). Physical exertion is measured by a single item only (much physical effort); whilst, job insecurity is measured by 3 items (steady work, job security, and future layoff). Hazardous condition is defined by 5 items (exposure to things dangerously stored/placed, dirty or badly maintained areas, dangerous tools, machinery and equipment, exposure to fire, burns, or shocks and dangerous work method), and toxic exposures is defined by 3 items (dangerous chemical exposures, air pollution exposures from dusts, smoke, gas, fumes, fibers or other things and risk of catching disease). Total psychological stressors is the sum of the psychological job demand scale and job insecurity scale. Meanwhile, total physical hazard is the sum of hazardous condition and toxic exposures scales; whilst, total physical stressors is the sum of the physical exertion and total physical hazards scales.

1. Skill Discretion = [Q3 + Q5 + Q7 + Q11 + (5–Q4)] × 2
2. Created Skill = [Q3 + Q5 + Q11]
3. Decision Authority = [Q6 + Q10 + (5–Q8)] × 4
4. Decision Latitude = Skill Discretion + Decision Authority
5. Psychological Job Demand = [(Q19 + Q20) 3 + (15–(Q22 + Q23 + Q26)) 2]
6. Job Insecurity = [Q33 + Q36 + (5–Q34)]
7. Total Psychological Stressors = z-scored addition of Psychological Job Demand + Job Insecurity
8. Co-worker Support = [Q53 + Q54 + Q56 + Q58]
9. Supervisor Support = [Q48 + Q49 + Q51 + Q52]
10. Social Support = Coworker Support + Supervisor Support
11. Physical Exertion = Q21
12. Hazardous Conditions = [Q41 + Q42 + Q44 + Q45 + Q47]
13. Toxic Exposures = [Q39 + Q40 + Q43]
14. Total Physical Hazards = z-scored addition of Hazardous Condition + Toxic Exposures
15. Total Physical Stressors = z-scored addition of Physical Exertion + Total Physical Hazards

Fig. 1. Formulae for job content instrument scale construction.

All items 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 measured were computed using the formulae for job content instrument scale construction provided in the JCQ and User Guide as shown in Fig. 1[24]. Previous pilot study among 50 male automotive workers in Kelantan found that all 14 scales of the JCQ demonstrated acceptable Cronbach's alpha coefficients (Cronbach's α). The Cronbach's α for the 14 scales of 'created skill', 'skill discretion', 'decision authority', 'decision latitude', 'psychological job demand', 'job insecurity', 'co-worker support', 'supervisor support', 'social support', 'hazardous condition', 'toxic exposures', 'total psychological stressors', 'total physical hazards' and 'total physical stressors' were 0.67, 0.71, 0.70, 0.74, 0.61, 0.31, 0.64, 0.81, 0.79, 0.86, 0.88, 0.37, 0.92, and 0.91, respectively. The 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 namely decision latitude, psychological job demand and social support that found 3 meaningful factors that could explain the 3 theoretical dimensions of Karasek's demand-control-social support model[26].

Health-Related Quality of Life (HRQOL)

The validated Malay version of the WHOQOL-BREF is a 26-item version of the 100-item World Health Organization Quality of Life (WHOQOL-100) that was developed to provide a short form of HRQOL assessment concerned with the meaning of different aspects of life to the respondents and how satisfactory or problematic their experiences were. It is a self-reported questionnaire that contains 24 items and each item represents 1 facet of HRQOL and 2 'benchmark' items for an individual's overall perception of HRQOL and his/her general health. The facets are defined as those aspects of life that are considered to have contributed to a person's quality of life. The 24 facets were conceptually assigned to measure an individual's perception of HRQOL in each of the four domains—physical health (7 items), psychological (6 items), social relationship (3 items) and environment (8 items)[17]. These facets were scored on a Likert scale of 1 to 5 (1=Very poor, 2=Poor, 3=Neither poor nor good, 4=Good, and 5=Very good; 1=Very dissatisfied, 2=Dissatisfied, 3=Neither satisfied nor dissatisfied, 4=Satisfied, and 5=Very satisfied; 1=Not at all, 2=A little, 3=A moderate amount, 4=Very much and 5=An extreme amount; =Not at all, 2=A little, 3=Moderately, 4=Mostly, 5=Completely; 1=Not at all, 2=A little, 3=A moderate amount, 4=Very much and 5=Extremely; or 1=Never, 2=Seldom, 3=Quite often, 4=Very often and 5=Always). The scores for some facets were reversed to allow for comparisons with other facets[16]. The raw score of items within each domain was used to calculate the domain score by summing up the scores of the corresponding items in each domain. The domain score was then converted to a transformed score (range 4 to 20) to enable comparisons to be made between domains composed of unequal number of items. Domain scores were scaled in the positive direction, i.e. a higher score denotes a higher HRQOL[17, 25].

The Malay version was shown to have good discriminant validity, construct validity, internal consistency and test-retest reliability[27]. Hasanah *et al*.[27] reported that 4 scales of WHOQOL-BREF have shown satisfactory Cronbach's alpha

values. The alpha coefficients for physical health, psychological, social relationships and environment scales were 0.80, 0.64, 0.65 and 0.73, respectively. The exploratory factor analysis result was also in agreement with the four domains of HRQOL.

Statistical analysis

The data were analyzed using the SPSS version 12.0.1[28]. Means and standard deviations were calculated for continuous variables; frequencies and percentages for categorical variables. To determine the association of psychosocial work factors with each domain of HRQOL (physical health, psychological, social-relationship and environment), four multiple linear regression models were analyzed using the following steps. Firstly, data exploration and simple linear regression analysis were done for all socio-demographic and psychosocial work factor variables as independent variables and each of the four domains of HRQOL 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 level (p value) 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. In addition, possible interactions between independent variables were tested by including interaction terms in the model. If the term was significant, the interaction between the variables was considered. Finally, linear regression assumptions such as linearity and equal variance were checked by using residual plots including residual versus predicted values. Normality of residuals was checked by histogram. As the age variable was considered to be an influencing factor for the study outcome, the variable was added to the final model to control its possible confounding effect. Results were considered statistically significant if $p<0.05$.

Results

Table 1 shows the socio-demographic factors of 728 Malaysian male automotive assembly workers. The average age of the worker was 27 (5.9) yr. The mean education level was 10.9 (1.4) yr. The mean duration of work and salary were 6.1 (4.4) yr and Ringgit Malaysia 1281.6 (911.5), respectively. We found that 64.9% and 53.7% of workers reported good or very good self-evaluation of their HRQOL and general health status, respectively.

Tables 2 and 3 show the mean scores of the 4 domains of HRQOL and 15 psychosocial work factors. The mean scores range from 13.6 (1.9) for the environment domain to 14.8 (2.5) for the social relationship domain, thus suggesting a more positive perception of HRQOL by the workers.

Tables 4–7 show the association between psychosocial work factors and the 4 domains of HRQOL: physical health, psychological, social relationship, and environment. Multiple regression analyses, controlling for age, revealed that created skill was positively associated with the physical health (p=0.004) and psychological (p=0.003) domain whilst skill discretion was positively associated with the social relationship (p<0.001) and environment (p<0.001) domain. Social support was positively associated with the physical health (p<0.001) and environment (p<0.001) domain whilst co-worker support was positively associated with the psychological (p<0.001) and social relationship (p<0.001) domain. Psychological job demand was negatively associated with the environment (p=0.013) domain whilst job insecurity was negatively associated with the physical health (p<0.001), psychological (p<0.001), social relationship (p<0.001) and environment (p<0.001) domain. Hazardous conditions were negatively associated with the physical health (p<0.001), psychological (p=0.016), social relationship (p<0.001) and environment (p<0.001) domain. In addition, duration of work was positively associated with the social relationship (p=0.015) and environment (p=0.005) domain; marital status was positively associated with the social relationship domain (p=0.009).

Discussion

Nowadays, the HRQOL has become increasingly recognized as an important outcome measure in diverse healthy populations including workers in various work environments[14, 15, 19, 21]. The present study found that 64.9% of Malaysian male automotive assembly workers reported good or very good overall quality of life. This means that a high proportion of automotive assembly workers perceived the Malaysian quality of life related to health as being highly acceptable. The national trend of the quality of working life has become a great concern to the Malaysian government so much so that working life factors have become a component of the Malaysian Quality of Life Annual Report. In 2004, the Malaysian Quality of Life Annual Report reported that the period 1990 to 2002 recorded an overall improvement in the quality of working life as shown by an increase of 20 points based on the Working Life Index (WLI). The WLI was computed based on the unemployment rate,

Table 1. Socio-demographic factors of 728 male automotive assembly workers

	Mean	SD	No.	%
1. Age (yr)	27.3	5.9		
2. Marital Status				
Single			427	58.7
Married			301	41.3
3. Education (yr)	10.9	1.4		
4. Salary (Ringgit Malaysia)	1,281.6	911.5		
5. Duration of work (yr)	6.1	4.4		
6. Shift work				
Yes			391	53.7
No			337	46.3
7. Overtime				
Yes			668	91.8
No			60	8.2
8. Self-evaluation of general QOL[1]				
Very bad			6	0.8
Bad			7	1.0
Fair			243	33.4
Good			403	55.4
Very good			69	9.5
9. Self-evaluation of general health				
Very bad			10	1.4
Bad			59	8.1
Fair			268	36.8
Good			335	46.0
Very good			56	7.7

[1]QOL=health-related quality of life.

number of trade disputes per thousand workers, number of man-days lost due to industrial actions and industrial accident rate[29].

The study also found that 53.7% of the Malaysian male automotive assembly workers felt good or very good in terms of overall general health as compared to 50.0% of Taiwanese workers[18]. The slight difference in the reported prevalence above could be due to the following factors. Firstly, expectations of what constitute good or very good general health between the Malaysian and Taiwanese workers may differ due to differences in cultural beliefs and value systems—Malaysian workers seemingly more contented with their state of health as compared to their Taiwanese counterparts. To clarify this difference, further research using socio-anthropological methodologies is necessary. Secondly, rapid industrialization in Malaysia and Taiwan over the past 20 yr has resulted in many changes in the workplace and may have considerable influence on the quality of life of Malaysian and Taiwanese workers[18]. It is hypothesized that the new technologies and work processes must have different impacts on the quality of life of Malaysian and Taiwanese workers. For example, a survey of 18,120 workers conducted by Taiwan's Council of Labor in 1998 revealed that 57% of workers were dissatisfied with conditions in the workplace. The major complaint of all workers was exposure to workplace hazards such as noise, dust and temperature. About 20% reported to have fallen in the workplace, and 29% reported to have sustained cuts or abrasions[30]. Further research into the impact of new labor policies and practices on Malaysian and Taiwanese workers is necessary. Thirdly, the types of workers in the Taiwanese study[18] were derived from various occupations and include both male and female workers, while the Malaysian findings were only concerned with male automotive workers. Thus, it would be desirable to have comparable study populations before we could arrive at any definitive conclusion. Fourthly, the Taiwanese study utilized the structured questionnaire interview approach whereas the present study utilized the self-administration approach using similar questionnaire (WHOQOL-BREF), thereby introducing possible subject bias. Finally, the sample size was relatively small in the present study as compared to those in the Taiwanese study, suggesting a possible bias in the representativeness of automotive assembly worker populations in the present study. A more representative

Table 2. Summary statistics of the four domains of the HRQOL in 728 male automotive assembly workers

HRQOL	Mean[a, b]	SD	Min. Score	Max. Score
1. Physical health	14.8	2.0	8.6	20.0
a. Pain and discomfort (3)	3.8	0.8	1.0	5.0
b. Dependence on medical treatment (4)	3.9	0.9	2.0	5.0
c. Energy and fatigue (10)	3.7	0.9	1.0	5.0
d. Mobility (15)	3.8	0.8	1.0	5.0
e. Sleep and rest (16)	3.4	0.9	1.0	5.0
f. Activities of daily living (17)	3.6	0.8	1.0	5.0
g. Working capacity (18)	3.7	0.7	1.0	5.0
2. Psychological	13.7	1.8	6.7	20.0
a. Positive feelings (5)	3.4	0.7	1.0	5.0
b. Spirituality, religion and personal beliefs (6)	3.6	0.8	1.0	5.0
c. Thinking, learning, memory and concentration (7)	3.4	0.7	1.0	5.0
d. Body image (11)	4.0	1.0	1.0	5.0
e. Self-esteem (19)	4.0	0.8	1.0	5.0
f. Negative feelings (26)	2.2	0.9	1.0	5.0
3. Social relationships	14.8	2.5	5.3	20.0
a. Personal relations (20)	3.8	0.8	1.0	5.0
b. Sex (21)	3.7	0.9	1.0	5.0
c. Practical social support (22)	3.6	0.7	1.0	5.0
4. Environment	13.6	1.9	7.0	19.5
a. Physical safety and security (8)	3.3	0.7	1.0	5.0
b. Physical environment (9)	3.3	0.7	1.0	5.0
c. Financial resources (12)	3.2	0.8	1.0	5.0
d. Information and skills (13)	3.3	0.7	1.0	5.0
e. Recreation and leisure (14)	2.9	0.9	1.0	5.0
f. Home environment (23)	3.7	0.8	1.0	5.0
g. Access to health and social care (24)	3.8	0.7	1.0	5.0
h. Transport (25)	3.8	0.8	1.0	5.0

[a]: The higher mean scores of domains denoted a higher HRQOL (4–20).
[b]: The mean scores of facets of HRQOL (1 = very poor; 5 = very good).

sample of workers in Malaysia will be necessary in order to compare quality of life perceptions between Malaysian and Taiwanese workers.

The mean scores of the environment (13.6) and psychological domain (13.7) were found to be lower compared to the other 2 domains [physical health (14.8) and social relationship (14.8)]. We suggest that automotive workers have lower perceptions of their HRQOL in terms of their environment as explained by physical safety and security, physical environment, financial resources, information and skills, recreation and leisure, home environment, access to health and transport; and psychological wellbeing in terms of positive feelings, spirituality, religion and personal beliefs, thinking learning, memory and concentration, body image, self-esteem and negative feelings. These findings were consistent with those observed in Lithuanian university students[31)].

Studies investigating the relationship between psychosocial work factors and workers' HRQOL are increasing[14–16, 19, 21, 32)]. In the present study, we investigated the relationship between psychosocial work factors using the full set of the JCQ containing 15 scales and HRQOL using the 26-item WHOQOL-BREF. Important findings of this study revealed that job insecurity and hazardous conditions were positively and significantly associated with all 4 domains of HRQOL. We suggest that reducing job insecurity and hazardous conditions at workplaces might improve the perceived HRQOL in the context of physical health, psychological, social relationships and environment. Furthermore, our results also indicated that created skill, skill discretion, social support, co-worker support were significantly and positively associated with all 4 domains

Table 3. Summary statistics of 15 psychosocial work factors in 728 male automotive assembly workers

	Mean[a]	SD	Min. Score	Max. Score
Psychosocial work factors				
1. Skill discretion	35.0	4.0	14.0	48.0
2. Created skill	9.6	1.3	3.0	12.0
3. Decision authority	31.6	5.3	12.0	48.0
4. Decision latitude	66.6	7.8	34.0	92.0
5. Psychological job demand	32.0	3.8	22.0	46.0
6. Job insecurity	5.7	1.7	3.0	12.0
7. Total psychological stressor	17.1	4.1	9.0	49.0
8. Co-worker support	12.1	1.4	7.0	16.0
9. Supervisor support	15.4	1.9	4.0	20.0
10. Social support	27.5	2.7	15.0	36.0
11. Physical exertion	3.0	0.6	1.0	4.0
12. Hazardous condition	8.2	2.6	5.0	15.0
13. Toxic exposures	5.9	2.0	3.0	36.0
14. Total physical hazards	5.9	2.0	8.0	46.0
15. Total physical stressors	17.1	4.1	9.0	49.0

[a]: All variables were calculated using the formulae for job content instrument scale construction provided in the JCQ and User Guide[23].

of the HRQOL suggesting that automotive workers who were highly skilled and creative, and receiving strong supervisor and co-worker support have higher perceptions of all HRQOL domains. However, psychological job demand was inversely associated with the environment domain suggesting that higher psychological demand adversely affects the perception of HRQOL of workers.

We found that job insecurity, as assessed by steady work, job security, and future layoff, was strongly associated with all domains of HRQOL after controlling for age. The strong relationship between job insecurity and health was shown in previous studies[33–35]. Cheng and colleagues[33] have shown that job insecurity was strongly associated with poor health, even after adjustment for age, job control, job demand, and workplace social support. Previous Whitehall II studies in British civil servants have also shown that self-reported job insecurity was strongly associated with poor self-rated health (p<0.005) and the two measures of minor psychiatric morbidity[34]. Despite that, the longitudinal study of 207 automobile manufacturing workers indicates that chronic

Table 4. Association of psychosocial work factors and physical health domain of HRQOL in 728 male automotive assembly workers

Variables	Multiple Linear Regression			
	Adj. b[a]	(95% CI)[b]	*t* stat.	*p*-value[c]
Psychosocial work factors				
Created skill	0.16	0.05, 0.26	2.861	0.004
Job insecurity	–0.27	–0.35, –0.18	–0.356	<0.001
Social support	0.10	0.06, 0.15	3.374	<0.001
Hazardous conditions	–0.20	–0.14, –0.91	–7.104	<0.001

[a]: Unstandardized regression coefficients for *adjusted beta* controlling for age; [b]: Confidence interval for *adjusted beta*; [c]: Significant (p<0.05).

Table 5. Association of psychosocial work factors and psychological domain of HRQOL in 728 male automotive assembly workers

Variables	Multiple Linear Regression			
	Adj. b[a]	(95% CI)[b]	*t* stat.	*p*-value[c]
Psychosocial work factors				
Created skill	0.15	0.05, 0.25	2.933	0.003
Job insecurity	–0.16	–0.23, –0.08	–4.091	<0.001
Co-worker support	0.21	0.11, 0.30	4.337	<0.001
Hazardous conditions	–0.06	–0.11, –0.01	–2.424	0.016

[a, b, c]: as per Table 4.

Table 6. Association of psychosocial work factors and social relationship domain of HRQOL in 728 male automotive assembly workers

Variables	Multiple Linear Regression			
	Adj. b[a]	(95% CI)[b]	*t* stat.	*p*-value[c]
Psychosocial work factors				
Skill discretion	0.08	0.03, 0.12	3.330	0.001
Job insecurity	–0.28	–0.38, –0.18	–5.535	<0.001
Co-worker support	3.34	0.21, 0.47	5.150	<0.001
Hazardous conditions	–0.12	–0.19, –0.05	–3.446	0.001
Socio-demographic factors				
Duration of work (yr)	0.07	0.00, 0.13	2.447	0.015
Marital status (1=married, 0=unmarried)	–0.61	–1.06, –0.151	–2.623	0.009

[a, b, c]: as per Table 4.

Table 7. Association of psychosocial work factors with environment domain of HRQOL in 728 male automotive assembly workers

Variables	Multiple Linear Regression			
	Adj. b[a]	(95% CI)[b]	*t* stat.	*p*-value[c]
Psychosocial work factors				
Skill discretion	0.07	0.04, 0.10	3.952	<0.001
Psychological job demand	–0.04	–0.08, –0.01	–2.480	0.013
Job insecurity	–0.27	–0.34, –0.19	–6.515	<0.001
Social support	0.10	0.04, 0.15	3.588	<0.001
Hazardous conditions	–0.13	–0.18, –0.08	–4.877	<0.001
Socio-demographic factor				
Duration of work (yr)	0.07	0.02, 0.12	2.829	0.005

[a, b, c]: as per Table 4.

job insecurity is predictive of changes over time in both job satisfaction and physical symptoms. Extended periods of job insecurity may decrease satisfaction and increase physical symptomatology, over and above the effects of job insecurity at any single point in time. It has been shown that high job insecurity acts as a chronic stressor, whose effects become more potent as the time of exposure increases in automotive workers[35].

Another important associated factor for all domains of HRQOL in automotive workers was hazardous conditions. We found that hazardous conditions were strongly and inversely associated with all domains of HRQOL of workers, implying that low of HRQOL scores was significantly associated with more experiences with exposures to store things dangerously, dirty of badly maintained areas, dangerous tools, machinery or equipment, fire, burns or shocks and dangerous work among workers. Kalimo and Mejman[36] have shown that exposure to chemicals or adverse physical conditions in the work environment and quite often, the existences of adverse working conditions leads to combined, and probably aggravate effects of the worker's health.

According to Karasek's job strain model, high job demand and low decision latitude need to occur simultaneously in order to produce psychological strain[4]. Lerner *et al.* (1994)[15] conducted a cross-sectional study in 1,319 male and female workers and found that job strain was significantly associated with five of the nine components of the Short-Form 36 Health Survey. Amick *et al.* (1998)[20] found that high strain work was significantly associated with lower vitality, mental health, higher pain and increased risks of both physical and emotional role limitations. Whereas, iso-strain work (defined as high strain and low work-related social support) increased the risks further.

Our study shows that psychological job demand (p=0.013) was significantly associated with the environment domain, but not for the decision latitude domain. This result suggests that low psychological job demand might increase the physical safety and security, physical environments, financial resources, information and skills, recreation and leisure, home

environment, access to health and social care and transport. In a previous study, the psychological job demands scale showed the greatest association with related health symptoms: workers having higher psychological job demands were more likely to report body pain, to get injured at the workplace, and to sleep less from Monday to Thursday[37]. Sundquist and Johansson[38] found that high job demand among male workers was also associated with all dependent variables with especially high risks (OR >4.3) of reduced vitality, lower social functioning, and impaired mental health, after adjusting for age and time in the general practice setting.

A significant association was noted between social support and the physical health domain (p<0.001) as well as the environment domain (p<0.001). Cheng *et al*.[21] reported that poor social support in American women workers was associated with their poor functional status such as reduced physical activities, role limitations due to physical health problems, increased bodily pain, decreased vitality, reduced social activities, and role limitations due to emotional problems, mental health and gradual intellectual decline.

The study also found that created skill was positively associated with the level of physical health domain (p=0.004) and psychological domain (p=0.003). Created skill is only a small component of the skill discretion scale[39]. Our study found that skill discretion was positively associated with the social relationship (p=0.001) and environment domain (p<0.001). Several demographic factors, such as duration of work was positively associated with the social relationship (p=0.015) and environment (p=0.005) domain; marital status was positively associated with the social relationship domain (p=0.009). Our findings suggest that these demographic factors should be taken into account in assessing the social relationships in automotive workers. Previous study[32] found that there was significant variability in the HRQOL scores according to age in assessing the HRQOL of workers in Greek hospitals. The oldest group in their sample (50 yr and over) generally reported a better health status compared to other age groups in the sample whilst the youngest participants (20–29 and 30–39 yr-olds) reported the worst HRQOL.

The primary limitation of our study was its cross-sectional design, which did not allow a causal relation between the psychosocial work factors and the domains of HRQOL. Since various instruments were used to measure the HRQOL—WHOQOL-BREF, Medical Outcomes Study Short-Form Health Survey 12 items (SF-12) and 36 items (SF-36) in previous studies—our findings could not be compared with many previous studies. The psychosocial work factors and the domains of the HRQOL were measured using self-reported questionnaires, thereby introducing subject bias into the study. However, our findings supported the findings from other prospective studies that strongly suggest that psychosocial work factors play a key role in the development of HRQOL of workers[14, 20, 21].

In conclusion, created skill was positively associated with the physical health and psychological domain, whilst skill discretion was positively associated with the social relationship and environment domain. Meanwhile, social support was positively associated with the physical health and environment domain, whilst co-worker support was positively associated with the psychological and social relationship domain. Our study also was found that job insecurity and hazardous conditions were negatively influenced by all four domains of HRQOL; however, psychological job demand was negatively influenced only on the environment domain of HRQOL. Therefore, establishing of contribution of job insecurity and hazardous conditions as an associated factor for quality of life awaits further study. Finally, these results suggested that each individual factor in the psychosocial work characteristics separately provides a better evaluation of the effect of psychosocial work characteristics on the quality of life in automotive workers.

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