Impact of Worker Demographics and Shift Rotation on Work Stress Factors in Manufacturing

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ABSTRACT

Work Stress is a barrier towards productivity and efficiency in manufacturing sector. Various factors of stress interact with the demographics such as age, education, experience, marital status and smoking habits of workers. Different workers exhibit different reactions towards work stress. To enhance productivity, manufacturing industry is utilizing night shift. However, night shift work is against the natural tendency of humans. The impact of rotating shift in context of work-stress of the workers is an area of concern. To understand the impact of demographics and shift rotation on work-stress of the workers, a quantitative study was undertaken in a medium sized automotive organization. The case organization was explored through a survey questionnaire administered to both day and night shift workers and analysed through Non parametric Spearman correlation and Mann Whitney U Test. The study highlights the need for effective reward and gratification scheme (Young Worker Avg 3.12 – Old Worker Avg 3.82), taking care of old age workers (Muscle Pain Old Avg 4.47 – Young Avg 3.84), reducing the smoking habit (Depression Smoking Avg 3.79 – Non Smoking Avg 3.12) (Fatigue Smoking Avg 3.92 – Non Smoking Avg 3.06), fostering social community and teamwork. Night shift may enhance production but should not be accepted as an ideal solution. The downsides and ill effects of the unnatural night shift work in the form of work stress are identified and should be reduced by management.

Keywords: Stress management; demographics; shift rotation; manufacturing; productivity

INTRODUCTION

Stress is a physical or emotional reaction in response to any demand (Selye 1956). The opportunities/ constraints/ demands of work place under uncertainty increases burden on attainment or resolution of work-related outcomes in an organization (Schuler 1980). The demands of increased production, efficiency and quality, along with the learning of modern techniques and technologies is placing burden on employees (Benson & Dundis, 2003). These pressures are further compounded by the adoption of shift rotation system (Härmä et al. 1998). The demographics, personality, attitudes and approach of some workers can make manufacturing labor work stressful for them (Afza et al. 2011). The use of shift rotation is an interesting aspect to study as a source of work stress (French & Caplan 1972). Manufacturing work in Pakistan as well as in the world is generally repetitive involving simple tasks performed in an industrial infrastructure. The improvement in reducing repetitive and infrequent work has been focused upon in factories and office through an ergonomic approach (Holtermann et al. 2018; Kibria & Rafiquzzaman 2019). Workers experience work stress due to the nature of the job that includes several aspects like job design, long working hours (Bakker & Demerouti 2017), shift rotation, as well as their personal attributes (Tahghighi et al. 2017) and health ailments (Herr et al. 2018; Lunde et al. 2020) combined in a dynamic aspect. The focus of this study is to understand the stress faced by workers due to their work environment, demographics and shift rotation. The work environment has different work design characteristics such as organizational, social, technological, physical and task factors (Das 1999). The study is relevant to develop unique strategies to address the work stress of workers. An exploratory case study has been performed on a medium sized automotive industry in Pakistan. The work stress factors like organizational, physical, psychological and social factors found in the literature are examined and the research questions developed are; What are the differences in the workers work stress factors and impact across groups differentiated in terms of age, education, experience, marital status, smoking and shift rotation?

LITERATURE REVIEW

The blue-collar workers have to absorb pressure produced due to their different life roles, the workplace demands, domestic issues (Hsiao & Mor Barak, 2014) and economic conditions in this modern life (Mucci et al. 2016). Stress occurs in response to overcome these pressures. Stress in a manufacturing organization is becoming an important concern and is a wide inclusive phenomenon, with a vast scope for exploration. Briefly, stress is physical or emotional reaction in response to any demand (Selye 1956).

Work Stress is a condition where work related elements correlate with the worker's personal characteristics to change mental or physiological conditions with the end goal that the individual is compelled to act differently from regular routine work (French & Caplan, 1972). Stress is normally used about negative environmental components or stressors (e.g., work over-burden, poor working conditions, poor leadership, poor health and safety conditions etc.) related to a specific work. Individuals living in third world countries perceive more pressure because of weak economic conditions at the job as well as in society (Bauer, 1981). The development of new technologies is also increasing work stress (Smith & Carayon, 1995). As industry is growing day by day, the pressure is also increasing to meet the targets, demands and goals of production. As a result, industry is expecting more work from their workers but in return workers are facing difficulties in fulfilling the commitments of their professional and personal life. Workplace stress has turned into a global concern, which happens in different job level structures and various working environments (Seňová & Antošová, 2014). The person on job has fear of unemployment, forcing him/her to bear all new challenges and adverse conditions through workplace stress (Savery & Luks, 2000). Difficult job circumstances and poor incentives act against the will of the worker, and can create a mental load. On the other hand, favorable and positive conditions build consistency and effectiveness in work (Mucci et al. 2016). A temporary stress which increases the capabilities of worker enough to meet targets is called Eustress, which is a positive impression. Contrarily the distress, a negative stress pulls out the pessimistic behavior of the employee and creates an obstructive environment (Seyle 1974).

It is necessary to review the level of stress in the job and design work gratification to enhance performance level of employees (Areekkuzhiyil 2014). In workplace, the nature of stress and response to handle the stress are different in every culture (Afza et al. 2011). The impact of worker demographics and shift rotation on work stress is also an area to explore for identification of stress factors and their association with each other. Demographic studies have been carried out in varying scenarios (Alexandru-Mihai & Adina-Ionela 2020).

The relationship of stress with age, experience and qualification may be different and hence is an area to be investigated (Afza et al. 2011; Finkelstein et al. 2007). Personality, gender, age, academic qualification, place of employment (rural/urban), organizational sector (private/government/semi-government), nature of job (Afza et al. 2011), work load, and smoking habit (French & Caplan 1972) of worker are factors which can be related to high or low level of workplace stress. Education also plays a vital role for the worker perceiving stress. Workers who are educated or come from educated families are generally more optimistic and in a better position to handle stress. They can handle unexpected situation and can use resources more effectively as compared to uneducated one (Finkelstein et al. 2007).

With excessive production demands and increase in number of workers, the organizations developed the shift system. Extra shift can be defined as extending working hours beyond the regular working time. The working time may include morning shift, evening shift and night shift. Organizations may have their own rotational schedule for workers (Yeom et al. 2017). The example of automobile industry shows that the world has become a 24-hour society, eliciting the need for flexible shift operating hours. Shift duty is related to risk factors for health and well-being (Hurrell Jr & Colligan 1987). This interference has a negative impact on work performance (errors and accidents), social relations like (difficulties in family relations, care of children and social contacts) and health aspects such as sleeping disorders, chronic fatigue, psychological problems and cardiovascular diseases (Lee et al. 2017; Yeom et al. 2017). Shift work is strongly correlated with physical health of the workers (Lee et al. 2017).

Stress is indirectly related with the economic growth of any organization (Steiber & Pichler 2015). Work Stress is a dynamic factor which is impacted by a number of factors. These factors usually pertain to physiological, psychological, social and behavioral aspects (Burman & Goswami 2018). Some of the work stress factors mentioned in literature review are as follows. The factor of job insecurity (Areekkuzhiyil, 2014 & Demerouti et al. 2001) arises and reduction in wages may also happen which ultimately leads to job dissatisfaction (Mucci et al. 2016 & Tabatabaeiet al. 2011). If regular traceability and feedback (Demerouti et al. 2001) does not exist in organization stress is enhanced. Lack of autonomy and independence of taking decisions are also causes of work stress. Various studies have shown that conflict or ambiguity (Areekkuzhiyil 2014; Ashill, Rod, Thirkell, & Carruthers 2009) in the role of worker is allied with low job satisfaction. Another factor is unrealistic deadline (Demerouti et al. 2001). Incorporation of support from management and positive assistance from co-workers can have a positive impact on worker's performance (Hsiao & Mor Barak 2014). The support and trust of leader correlates with lower stress levels and this behavior may provide motivation to the workers. Deficiency of constructive communication and excessive bureaucratic behavior is stressful in professional life (Dewe et al. 2010). Social support along with understanding supervisors also plays a role in influencing stress (Hsiao & Mor Barak 2014; Sharpley et al. 1997). There is positive relationship between

the fatigue and occupational stress if the worker is doing repetitive work (Lerman et al. 2012). When the organization is going to upgrade and change its machinery the required restructuring exerts pressure of learning new methods and thus accelerates the stress element. New procedures, technologies, and short deadlines all affect the workers mental wellbeing (Smith & Carayon 1995). Lean production practices places outcome impacts on employees (Mehta & Shah, 2005; Khalili et al. 2017). The extent of knowledge will decide the adaptive behaviour towards new technology. Flexibility in the work design has been proposed to be an alleviator of work stress (Rastogi et al. 2018). A model has been proposed in Figure 1, which includes the relationship between job resources and job demand. It has been found that greater job demand and poor job resources cause exhaustion and disengagement (Demerouti et al. 2001) which ultimately cause burnout and stress in workers.

The literature on work stress has identified stressors which reduce productivity and efficiency in the manufacturing industry. These were identified as the variables of interest, used in the cumulative evaluation of the work stress. Studies are now focusing on not only understanding the work stress factors but rather the impact of other variables such as demographics, culture (Farooquiea & Mohapatrab 2009), occupation (Calzavara, Battini, Bogataj, Sgarbossa, & Zennaro 2020; Hakanen et al. 2019; Idrees et al. 2017; La Torre et al. 2018), shift rotation (Brown et al. 2020; Jehan et al. 2017 & Ritonja et al. 2019).
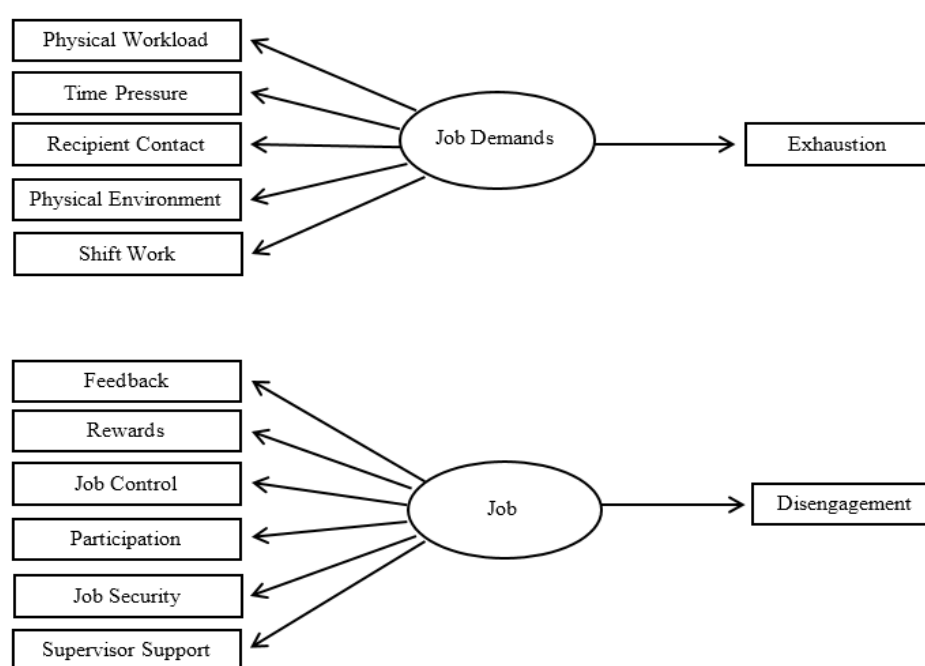

FIGURE 1. The job demands-resources model of burnout (Demerouti et al. 2001)

RESEARCH METHODOLOGY

The research design of the study was based on correlation in complement with case study method (Tabatabaei et al. 2011). The research was exploratory and quantitative in nature. Research was done on various stress causing factors developed because of work design. An attempt was made to accumulate these factors for manufacturing work. The data was collected on the perception of workers at a medium sized automotive manufacturing organization in Pakistan. A case study fabrication and welding unit comprising of 180 workers in each shift was examined. The workers worked in 8 hours shifts. Data of 100 individuals was collected from manufacturing workers, 50 from shift of day and night. The workers were rotated in the shifts after every 14 days and a relaxation leave of one day was provided within shifts. The unit was a part of a manufacturing automotive concern with generally modern machinery and assembly mechanism. The shifts were managed through groups of workers supervised by Senior Supervisors. These supervisors report to the management and carry out the management plans to meet aims and objectives. Independent design sample was undertaken, which means that the case workers in each group of shift workers were different. However, the organization under investigation remained the same.

The independent and dependent variables were identified and listed in Table 1. Survey Questions were prepared keeping in view the factors shortlisted from the literature. The factors included physical, psychological, social, organizational and task related issues. All these five factors were examined and contained a total of 20 items. The questionnaire had the ability to gauge the perception of work stress of manufacturing workers based on Likert scale (Gray-Stanley & Muramatsu 2011; Kumar 2019; Pflanz & Ogle 2006). The options included were 1-Strongly Disagree, 2-Disagree, 3-Neutral, 4-Agree and 5-Strongly Agree.

The data was gathered through survey and the results were analysed through statistical methods such as non-

parametric Spearman Correlation and Mann Whitney U Test (Kumar, 2019). The descriptive statistics (mean, frequency and standard deviation etc.) of the variables were calculated and the bar graphs were plotted to compare the value of means across the groups of independent variables (Demographics and Shift Rotation) for the dependent variables (Nebojša et al. 2020). The Spearman Correlation was carried out to find positive and negative correlation across all variables of the study. It was used to complement the second test called the Mann Whitney U Test. The Mann Whitney U Test tests the hypothesis of null difference across selected groups. The alternative hypothesis is the presence of significant difference across groups in the selected variable. The results were considered to be significant at confidence interval or below (Field 2013). The hypotheses developed were as follows; What are the differences in the workers work stress factors and impact across groups differentiated in terms of age, education, experience, marital status, smoking and shift rotation? Previous studies based on this methodology have been conducted for impact of muscle skeletal disorders across factors of work stress in Iranian

nurses (Barzideh et al. 2014), time management of students for academic performance (Razali et al. 2018), relation between industry 4.0 and organizational culture (Mohelska & Sokolova, 2018). The hypotheses proposed were tested by the Mann Whitney U Test for non-parametric data (Field & Miles 2010).

Non parametric tests were conducted since the analysis of data collected exhibited nonexistence of normality across variables. The KS Test of normality was conducted which generated test statistics having significance levels P < 0.01 indicating absence of normal data. Thus, non parametric tests such as Spearman Correlation and Mann Whitney Test were the preferred choice. To check the validity and reliability of the questionnaire a pilot study was conducted on a group comprising of 16 workers (Connelly 2008). Reliability of the questionnaire was tested by computing Cronbach Alpha value (Bonett & Wright 2015). The value of Cronbach Alpha was obtained as 0.722, a value above the acceptable range of 0.700 (Field 2013). The reliability of the final data set was also observed to be above the acceptable limit.

TABLE 1. List of independent and dependent variables

INDEPENDENT VARIABLES	Age	Education	Experience	Marital Status	Shift Rotation	Smoking Habit
DEPENDENT VARIABLES	Physical Factors	Task Factors	Empowerment Factors	Organizational Factors	Social Factors	
	Muscle pain	Deadline	Ambiguity	Job Rotation	Social support	
	Job Demand	Complexity	Self Esteem	Reward	Communication	
	Fatigue	Monotony	Decisions	Supervision	Teamwork	
	Depression	Change	Turnover	Health and Safety Environment (HSE)		
	Mental Load					

TABLE 2. Descriptive statistics of dependent variables

Factors		Mean (μ)	S.D (σ)	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
Physical / Psychological Factors	Muscle Pain	4.01	1.26	8%	9%	3%	34%	46%
	Job Demand	3.65	1.16	5.05%	16.16%	12.12%	42.42%	24.24%
	Fatigue	3.55	1.33	7.14%	22.45%	10.20%	28.57%	31.63%
	Depression	3.54	1.24	7%	20%	8%	42%	23%
	Mental Load	3.61	1.31	9%	15%	13%	32%	31%
Task Factors	Time Pressure	3.90	1.17	7%	8%	7%	44%	34%
	Complexity	3.72	1.02	5.05%	8.08%	15.15%	53.54%	18.18%
	Monotony	3.34	1.25	10.1%	20.2%	11.11%	42.42%	16.16%
	Change	3.80	0.94	2%	11%	11%	57%)	19%
Empowerment Factors	Ambiguity	3.99	1.14	6%	7%	8%	40%	39%
	Self Esteem	3.46	1.26	11%	15%	9%	47%	18%
	Decision	3.49	1.24	4.04%	25.25%	14.14%	30.30%	26.26%
	Turn Over	3.41	1.26	11%	15%	14%	42%	18%

... continued

Social Factors	Communication	4.03	0.63	0%	1%	15%	64%	20%
	Team Work	4.32	0.76	1%	2%	6%	46%	45%
	Social Support	3.93	1.07	6.06%	6.06%	6.06%	52.53%	29.29%
Organizational Factors	Multi Skilling	3.97	1.04	5%	5%	10%	48%	32%
	Reward	3.30	1.25	12%	17%	14%	43%	14%
	Supervision	3.94	0.94	2%	7%	14%	49%	28%
	HSE	3.98	0.91	2 (2)	5 (5%)	15 (15%)	49 (49%)	29 (29%)

TABLE 3. Correlations of demographics with physical / psychological factors

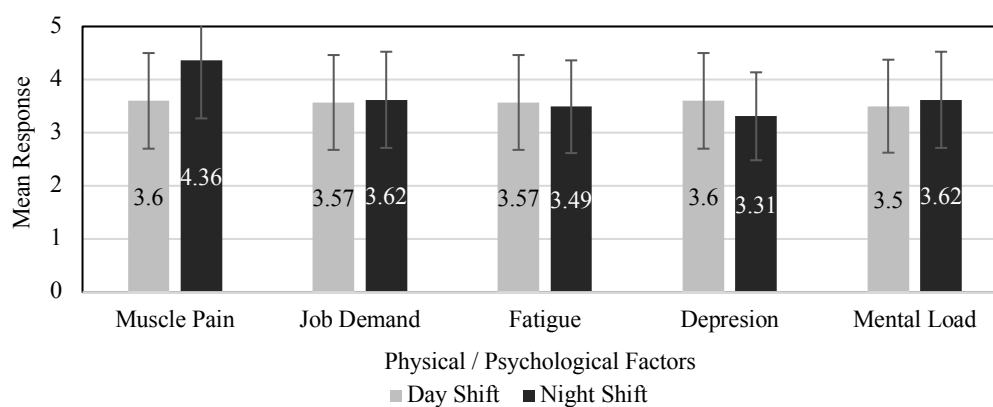|	Age	Education	Experience	Marital Status	Muscle Pain	Job Demand	Fatigue	Depression	Mental Load
Age	1.000								
Education	-.038	1.000							
Experience	.872**	-.014	1.000						
Status	-.338**	-.112	-.347**	1.000					
Muscle Pain	.220*	-.092	.254*	-.099	1.000				
Job Demand	.095	-.048	-.015	-.102	.120	1.000			
Fatigue	-.024	.075	-.032	.015	.142	.427**	1.000		
Depression	-.012	.085	-.042	-.003	.012	.410**	.493**	1.000	
Mental Load	.090	.017	.059	.084	.238*	.440**	.586**	.398**	1.000

FIGURE 2. Effect of shift rotation on physical / psychological factors

TABLE 4. Correlations of shift/smoking habit with physical / psychological factors

	Shift Rotation	Smoking	Muscle Pain	Job Demand	Fatigue	Depression	Mental Load
Shift Rotation	1.000						
Smoking	.397**	1.000					
Muscle Pain	-.346**	-.118	1.000				
Job Demand	-.027	.019	.120	1.000			
Fatigue	.049	.318**	.142	.427**	1.000		
Depression	.114	.244*	.012	.410**	.493**	1.000	
Mental Load	-.042	.146	.238*	.440**	.586**	.398**	1.000

RESULTS AND DISCUSSION

The descriptive statistics of all the variables was calculated in the first phase of result formation. The variables were grouped under five broad areas. These areas were physical/psychological, task, organizational, empowerment and social in nature; each broad area was further divided into sub factors. The data of workers mean and standard deviations of sub factors have been listed in Table 2.

PHYSICAL/PSYCHOLOGICAL FACTORS OF WORK STRESS

The correlations between demographics of workers and physical/psychological work stress factors are given in Table 3. The Spearman correlation test used for non-parametric data was carried out to find the relationships between the variables (Field 2013 & Kazmi et al. 2008). There is no relationship of age with education; however, as the workers age increases the experience of the worker increases. The elderly workers tend to be married. The research shows that as workers age the tendency to have higher muscular pain is significantly high. Elderly workers tire more easily and are prone to physical pain due to their work. The job demand, fatigue, mental load and depression are factors which are independent of age and are prevalent across workers of all ages. Education levels are uncorrelated with physical and psychological work stress factors. There are high correlations between job demand and other physical/psychological work stress factors. There is an indication of prevalence of fatigue, depression and mental load due to the work demand.

The Mann Whitney U Test gives the significant results for the difference across old and young workers to be the variable of muscle pain. It is inferred that the old (experienced) and young (inexperienced) workers have different levels of muscular pain. There is no difference found in the values of physical/psychological factors across the married and unmarried group of workers. The comparison of the means of the two groups of day shift and night shift workers to the physical/psychological factors has been shown in Figure. 2 through numerical values on top of each bar. There is a difference in the muscular pain felt by the workers in each shift and a moderate difference in the depression levels. The correlations between shift rotation and physical/psychological factors are given in Figure. 6. As shift rotation changes, the tendency to smoke also changes; it implies that workers in night shift tend to adopt the smoking habit.

The workers in the night shift are prone to more muscular pain as compared to workers in the day shift. The levels of fatigue, depression, mental load and job demand does not vary across the two shifts. Workers who are subjected to higher fatigue levels are inclined towards smoking. There is a significant moderate relationship between smoking and depression; workers who are depressed take up the smoking habit shown in Table 4. The non-parametric Mann Whitney U test was carried out to find the difference between the two groups of night shift and day shift across the physical/psychological factors. The test indicated significant result for muscle pain, hence it is inferred that the muscle pain felt across the two groups of day shift and night shift workers is different from each other. There is no difference across the other variables of physical/psychological factors across shift rotation. Also, the smokers and non-smokers groups of workers have different levels of fatigue and depression levels, as indicated by test statistics.

TABLE 5. Correlations of demographics with task factors

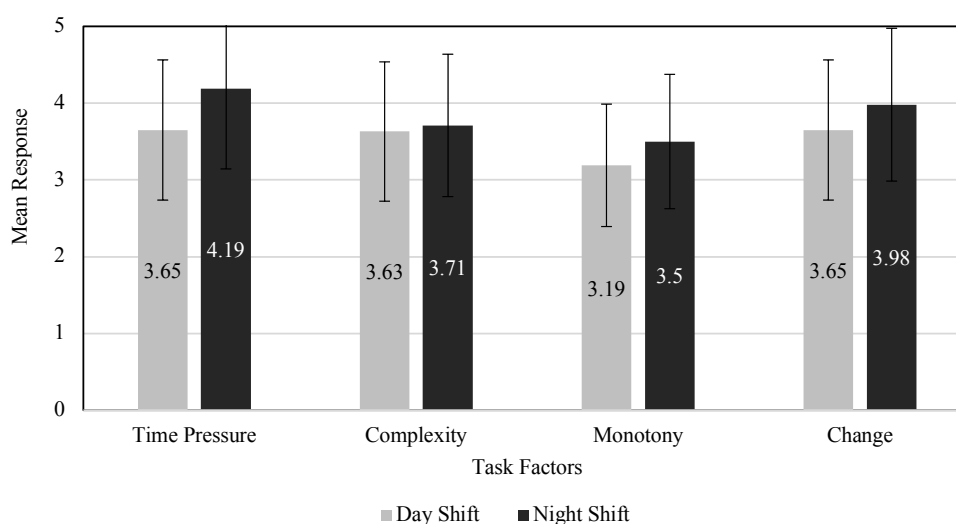|	Age	Education	Experience	Marital Status	Time Pressure	Complexity	Monotony
Age	1.000						
Education	-.038	1.000					
Experience	.872**	-.014	1.000				
Marital Status	-.338**	-.112	-.347**	1.000			
Time Pressure	.088	.122	.065	.081	1.000		
Complexity	.030	.067	-.039	-.216*	.154	1.000	
Monotony	.030	-.044	-.037	.025	.181	.374**	1.000

FIGURE 3. Effect of shift rotation on task factors

TABLE 6. Correlations of shift/smoking habit with task factors

	Shift Rotation	Smoking	Time Pressure	Complexity	Monotony	Change
Shift Rotation	1.000					
Smoking	.397**	1.000				
Time Pressure	-.293**	-.106	1.000			
Complexity	-.086	-.071	.154	1.000		
Monotony	-.151	-.055	.181	.374**	1.000	
Change	-.191	-.143	.168	.294**	.374**	1.000

.TASK FACTORS OF WORK STRESS

The correlation between demographics of workers and task work stress factors are listed in Table 5. The Spearman Correlation test used for non-parametric data. There is a significant relationship between marital status and complexity of work. Unmarried workers believe the complexity of work is high as compared to married workers. The Mann Whitney U Test for non-parametric data indicates that there is no difference across the worker groups based on age and experience for task factors. However, the results infer a significant relationship for complexity across the married / unmarried groups of workers. The comparison between the means of the two groups of shift workers across the task factors has been presented in Figure 3. There is a difference in the pressure of work pace felt by the workers in the shifts, however the correlation is not significant. A moderate difference is visible in the monotony and change levels.

There is a significant correlation between smoking and shift rotation as presented in Table 6; it implies that workers in night shift tend to adopt smoking habits. The relationship between shift rotation and time pressure is significant which implies that workers perceive time pressure to a greater extent in the day shift. The factor of complexity has a significant relationship with the factors of monotony and change implying that when workers perceive their tasks to be simple, they are inclined towards monotony and are willing to adopt changes.

The non-parametric Mann Whitney U test was carried out to find the difference between night shift and day shift groups across the task factors. This test indicates a significant result for time pressure, which infers that the time pressure in manufacturing work is different across shifts. There is no difference found between smoking groups across all dependent variables of task factors.

TABLE 7. Correlations of demographics with empowerment factors

	Age	Education	Experience	Marital Status	Ambiguity	Self Esteem	Decision	Turnover
Age	1.000							
Education	-.038	1.000						
Experience	.872**	-.014	1.000					
Marital Status	-.338**	-.112	-.347**	1.000				
Ambiguity	-.006	.082	.018	-.086	1.000			
Self Esteem	.019	.024	.004	-.114	.235*	1.000		
Decision	.118	-.140	.039	-.022	.059	.362**	1.000	
Turnover	.018	.001	-.083	-.076	.141	.469**	.249*	1.000
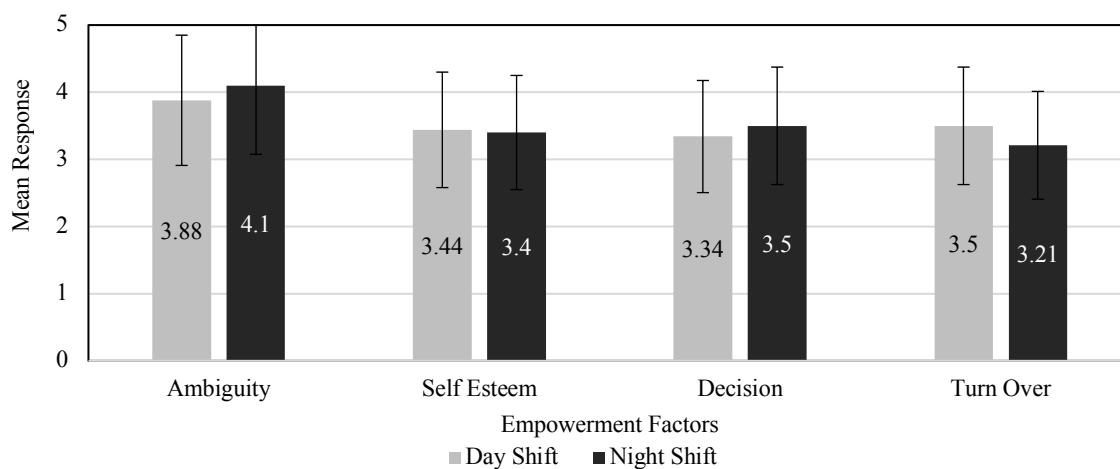
FIGURE 4. Effect of shift rotation on empowerment factors

TABLE 8. Correlations of shift/smoking habit with empowerment factors

	Shift Rotation	Smoking	Ambiguity	Self Esteem	Decision	Turnover
Shift Rotation	1.000					
Smoking	.397**	1.000				
Ambiguity	-.066	.194	1.000			
Self Esteem	.018	.126	.235*	1.000		
Decision	-.073	-.111	.059	.362**	1.000	
Turnover	.137	.122	.141	.469**	.249*	1.000

EMPOWERMENT FACTORS OF WORK STRESS

Table 7 presents the correlations between demographics of workers and empowerment work stress factors. There is a moderate significant correlation between ambiguity and self-esteem. Those workers who had a clear direction hold themselves well and believe that management values them. The factors of decision latitude and turnover intent are significantly and positively correlated with self-esteem. Decision latitude is related to turnover intent significantly. The Mann Whitney U test does not indicate any significant result across empowerment factors across age, experience and marital status groups. The comparison of the day shift and night shift to the empowerment factors has been shown in Figure 4. There is a moderate difference in the ambiguity and turnover intent felt by the workers among the shifts.

No significant difference was found between groups of shift rotation and smoking with the empowerment factor in Table 8. Workers who are having low self-esteem tend to have ambiguity about their role at work. Workers with low self-esteem also tend to believe to have limited decision making and tendency to leave the job.

TABLE 9. Correlations of demographics with social factors

	Age	Education	Experience	Marital Status	Communication	Team Work	Social Support
Age	1.000						
Education	-.038	1.000					
Experience	.872**	-.014	1.000				
Marital Status	-.338**	-.112	-.347**	1.000			
Communication	.012	-.006	-.030	-.114	1.000		
Team Work	-.100	.114	-.012	-.004	.111	1.000	
Social Support	.067	.125	-.044	-.038	-.091	.042	1.000
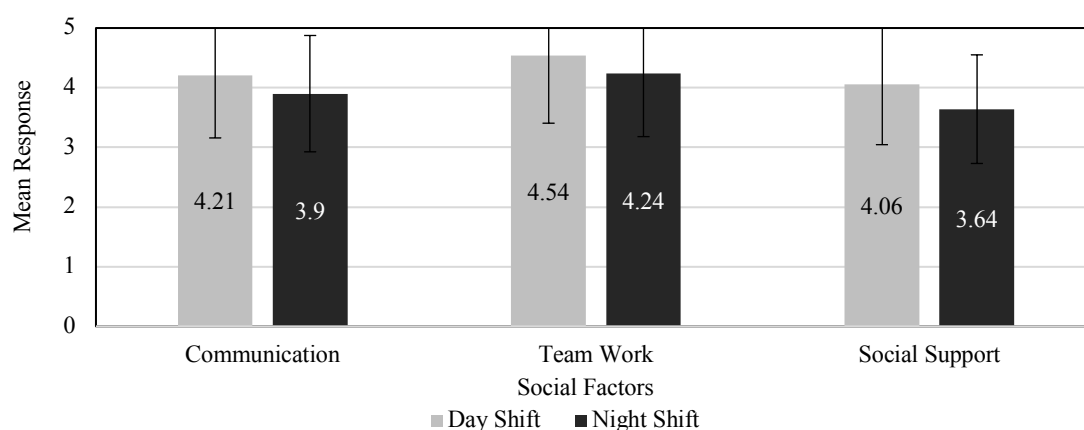
FIGURE 5. Effect of shift rotation on social factors

TABLE 10. Correlations of shift/smoking habit with social factors

	Shift Rotation	Smoking	Communication	Team Work	Social Support
Shift Rotation	1.000				
Smoking	.397**	1.000			
Communication	.265*	.012	1.000		
Team Work	.246*	.075	.111	1.000	
Social Support	.081	.072	-.091	.042	1.000

SOCIAL FACTORS OF WORK STRESS

Table 9 gives the correlations between demographics of the workers and social work stress factors. The Spearman correlation test used for non-parametric data was carried out to find the relationships between the variables. Evidently there is no significant relationship between communication, teamwork and social support factors. Although the workers have high scores to the individual factors but non-significant relationships show that more work is needed in development of these social factors.

The Mann Whitney U test indicated no significant result for differences across social factors for age, experience and marital status groups. The comparison of the means of day and night shifts to the social factors has been presented in Figure 5. For the three variables, namely communication, teamwork and support levels, a difference in each shift is apparent. The Mann Whitney U Test results indicate that the teamwork and communication is better during the day shift as compared to the night shift. However, there is no difference in social factors across the smoking and non-smoking workers as shown in Table 10.

ORGANIZATIONAL FACTORS OF WORK STRESS

The correlations between demographics of workers and social work stress factors are placed in Table 11. There is a significant correlation between age and reward; it implies that as age increases the perception about the reward offered improves. The relationship between marital status and reward indicates a difference in perception of married and unmarried workers. Workers who exhibit a positive attitude towards job rotation also believe that adequate reward is being given. The supervision is considered to be adequate and fostering the principles and practices of Health & Safety. The relationship between supervision and HSE policy is also positively significant. Mann Whitney U test indicated different perception towards reward for old and young workers. There is no significant difference for groups of experience however married and unmarried workers

perceive reward differently. The comparison based on means of day and night shifts workers to organizational factors has been presented in Figure 6. It is inferred that there is a difference in the multi-skilling, reward, supervision and HSE policy perceived by the workers in the shifts. The workers in the day shift are more comfortable to learn new skills. The perception of HSE policy is decidedly different for the day shift and night shift. Job rotation is associated with reward and supervision. Supervision is positively related with the HSE policy. The Mann Whitney U test indicates significant result for job rotation and HSE policy across shifts groups.

TABLE 11. Correlations of demographics with organizational factors

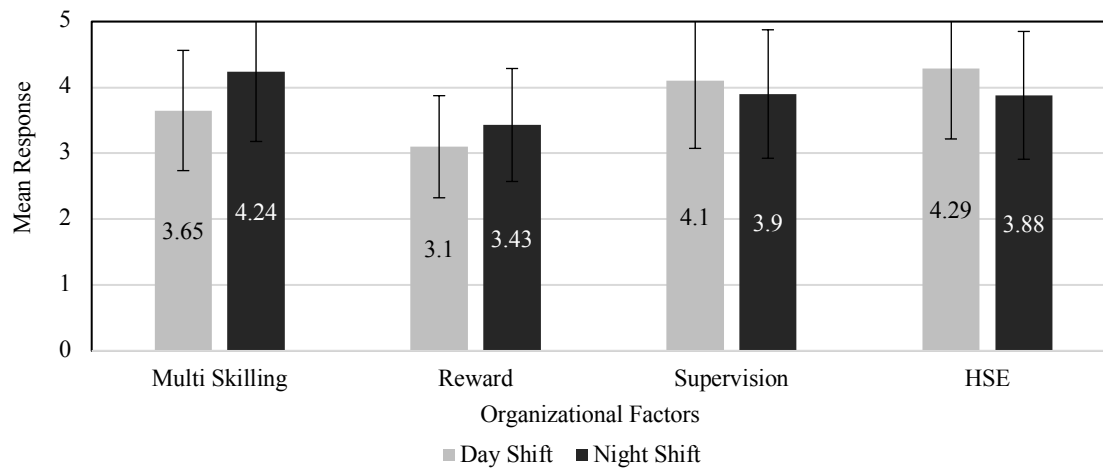|	Age	Education	Experience	Marital Status	Job Rotation	Reward	Supervision	HSE
Age	1.000							
Education	-.038	1.000						
Experience	.872**	-.014	1.000					
Marital Status	-.338**	-.112	-.347**	1.000				
Job Rotation	-.061	-.143	-.130	.009	1.000			
Reward	.207*	.108	.188	-.221*	.282**	1.000		
Supervision	-.030	.070	-.071	.103	-.198*	.087	1.000	
HSE	.022	.077	.070	-.042	-.134	.123	.304**	1.000

FIGURE 6. Effect of shift rotation on organizational factors

TABLE 12. Correlations of shift/smoking habit with organizational factors

		Shift Rotation	Smoking	Job Rotation	Reward	Supervision	HSE Policy
Spearman's rho (ρ)	Shift Rotation	1.000					
	Smoking	.397**	1.000				
	Job Rotation	-.242*	-.096	1.000			
	Reward	-.118	-.078	.282**	1.000		
	Supervision	.180	-.068	-.198*	.087	1.000	
	HSE Policy	.263*	.146	-.134	.123	.304**	1.000

WORKER DEMOGRAPHICS AND WORK STRESS FACTORS

The correlation of independent variables with dependent variables gives insight into the work stress phenomenon. The elderly workers are muscle pain due to their manual work as indicated in Figure 7. The numeric values on top of each bar indicate the mean levels in each age group. These workers face health issues and management needs to focus on the well-being of elder workers. Since fatigue levels and muscular pain also have an association with depression and mental health, these health aspects are also affected.

The group of workers who smoke reported higher fatigue levels at work. The workers who are smoking have health issues and tire more quickly at their work as indicated in Figure 8. The mean values across each group are exhibited on top of each bar. The depression levels of works were gauged by trying to find tension levels at the end of the day. It is interesting to observe that smoking workers exhibit higher levels of depression. These findings give support to the no smoking campaign, which can be launched at work places.

The aged worker tends to be satisfied with the reward offered for their work. The satisfaction and contentment levels towards reward tend to be acceptable. Older workers after spending their life in manufacturing work tend to find it acceptable and suitable for them. It is recommended that the satisfaction and contentment of elder workers be utilized to maintain a permanent and long-term workforce. Married workers can be motivated to work through incentive schemes and bonus as shown in Figure 9. These workers tend to be driven by the needs of their families. The empowerment and social factors are not correlated to demographics of the workers.

<div align="center">SHIFT ROTATION AND WORK STRESS FACTORS</div>

The results indicate that in night shift most workers are in a hurry to complete their tasks. This may be due to poor supervision, numeral quota system or the need to take some time off in that shift. Results indicate that night shift workers suffer from more muscular pain than the morning shift workers. There is direct relationship between sleep deprivation and muscle pain (Muecke, 2005). Workers who are working in night shift could not sleep well and should be given rest properly.
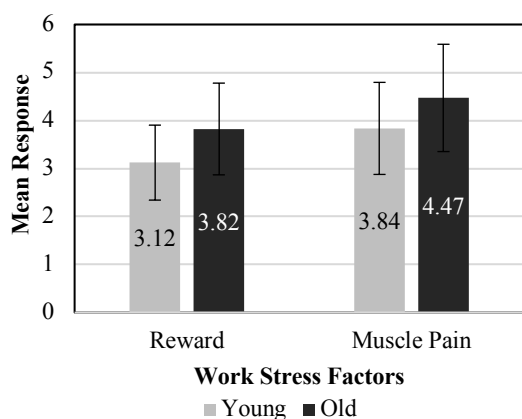
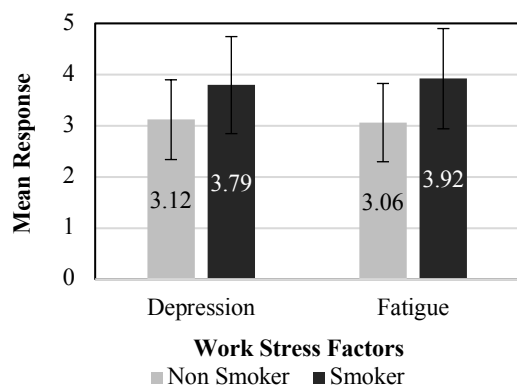FIGURE 7. Significant effect of age on work stress factor

FIGURE 8. Significant effect of smoking on work stress factor

In night shift, the workers' perception towards HSE policy is poor as compared to the morning shift. This shows that the lax attitude of management exists on HSE policy in night shift. There are some clear indications that management practices for night shift are not equivalent to day shift standards. In day shift there is better communication between workers as compared to night shift workers. In night shift the tendency of sleepiness, tiredness and odd timings results in poor communication. The natural human clock is not programmed for active communication at night time. The results indicate that the workers feel better cohesion as a team in the day shift as compared to the night shift. With little communication at night, each worker was in a rush to complete tasks besides feeling muscular pain, tiredness and sleepiness. As a natural tendency, all such factors lead towards poor team work and productivity. The night shift is detrimental to the health and work of the workers. The model of shift rotation and work stress has been developed based on the findings of this research and shown in Figure 10.
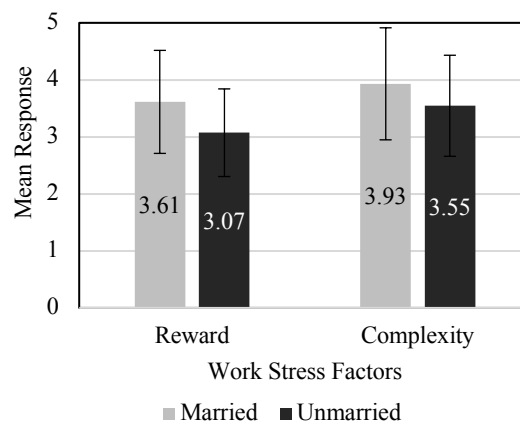
FIGURE 9. Significant effect of marital status on work stress factor
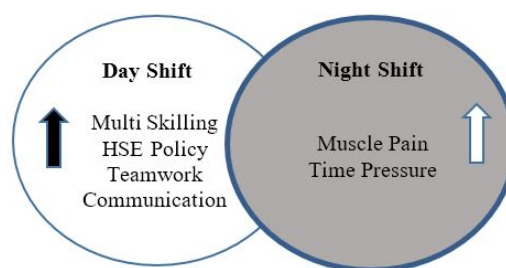
FIGURE 10. Significant effect of shift rotation on work stress factor

<div align="center">CONCLUSION</div>

The reward given to the worker if perceived well can result in reduction in stress. The reward can be termed as the pill which reduces the ill effects of stress. Elderly workers who

have committed to a long-term career in manufacturing work are more responsive towards their work, accept the job task and respond to management. The perception of low reward is a cause of stress enhancement at the job especially for young workers. At the young age, worker is not mature and he/she may become depressed from the situation. This can be reduced by giving them appreciation in their work, counselling and sometimes gifts as token of appreciation. The management of manufacturing industry needs to apply a well-planned incentive scheme, bonus, and gratification, reward program which encourages good performers and reduces stress in workers.

The stress of old workers can be reduced by assigning them tasks which require less muscular effort. The night shift also compounds the muscle pain and the management can think about avoiding older workers to work in night shift. Young workers can also be assigned as trainees under their supervision. All other variables such as social, task, and organizational factors remain unaffected by the age and experience of workers. In the case of different marital status, it is inferred that married workers are more committed and are willing to perform complex tasks. They show inclination to work hard to support their families. Unmarried and young workers perceive tasks to be complex and a source of stress. During the course of the lifetime raising family and providing for them makes the married workers satisfied with their salary and reward offered for their hard work. Young workers are a bit removed from reality and the ambitions are on the higher side. Age and marital status underscore the reality and the problems of sustenance in life in the workers. The research reveals that workers in night shift are more inclined towards smoking. As nicotine is considered to be a stress alleviator (Hall & Morrison, 1973), there is indirect inference that high stress causes workers to smoke more. Night shift and its management style damage the health and lifestyle of the worker which in turn impacts the organization negatively. The night shift is basically against the natural lifestyle of the workers. Poor HSE practices, communication, teamwork and muscle pain in night shift all indicate that there is a clear difference in the stress levels of day shift and night shift workers. It is inferred that night shift workers are rushed to complete tasks especially when quota system is there in which employees have to finish set numbers of units within shifts. The day workers are more comfortable in learning new technology, techniques or work steps as compared to night shift workers. Also, day shift workers are clearer about the requirement of higher management in regard to their work. The responses, work tasks, standards and role of worker are clearer for day shift as compared to that of night shift. The physical and psychological factors of stress are impacted most across groups of age of workers. Muscle pain and associated stress has to be managed for old workers. These workers are experienced having valuable insight into the organization work. It is a source of benefit if the position, job and work tasks of elder workers are arranged with special preference in terms of utilization in the factory. Married workers also give certain benefits to organization in terms of their responsibility, maturity and commitment. No single demographic group is better or solely advantageous for the factory rather it is the placement of the right person for the right job which is the ultimate goal.

RECOMMENDATIONS AND LIMITATIONS

The findings indicate that improvement steps need to be undertaken by higher management to reduce stress levels and improve productivity and efficiency of the manufacturing industry. The concept that night shift enhances productivity should be re-examined by keeping in view the shortcomings and viewpoints presented in this research. The demographics of the worker, shift work and culture contribute towards the creation of work stress in the factory. The old age workers exhibit reaction towards work stress. The factors associated with elder workers are the perception of reward for work and muscle pain. They handling of elder worker in the manufacturing factory can be different and innovative to reduce these ill effects. Workers who smoke are definitely experiencing higher level of stress. Already the workers perceive work stress, depression, fatigue and mental load due to the factory work. There is a clear indication that these variables are compounded by smoking habit. Married workers are more committed and perceive tasks as manageable and are willing to go the extra mile for the organization.

The aspects of difference between day shift and night shift are highlighted. The night shift is different from day shift in terms of teamwork, communication, HSE practices, work pacing and learning environment. The industry manager can have an idea about how to design work keeping in view the demographics and shift aspects in mind. This research provides insight for industrial managers on how to design work especially in shift situations for reduction in work stress and ultimately to enhance productivity. To optimize night shift work, further work could be undertaken on a larger, more diverse, different culture and industrial samples. Studies can be conducted to investigate stress levels for modern techniques and automation in manufacturing. The question on how the new era's work design, involving automation, internet, computer integrated manufacturing and lean manufacturing would impact the stress levels of manufacturing worker, is an area to be explored.

The study is basically exploratory and correlated in nature. A more diverse data sample extending across multiple organizations can be gathered to give results which are more generalized and give better model fit of the whole population of Work stress across manufacturing industry. The study is conducted in developing country perspective and results may differ in developed countries. Only basic shifts two weeks apart were considered while shift work may be more complex with slow and fast rotating shifts, scheduling of shift duty etc. The study can be further enhanced by studying the interaction between the various stress factors through structure equation modelling. The overall work

stress and means to alleviate this stress can vary from the demographics and shift work factors. A comprehensive study can be conducted to present a complete picture.

DECLARATION OF COMPETING INTEREST

None

REFERENCES

Afza, T., Mujtaba, B., & Habib, N. 2011. Stress perceptions of working adult Pakistanis and Americans. *International Journal of Business and Social Science* 2(5): 32-40.

Alexandru-Mihai, B., & Adina-lonela, S. 2020. Financial spending behavior patterns based on education, gender and age. *Studies in Business & Economics* 15(2).

Areekkuzhiyil, S. 2014. Factors influencing the organizational stress among teachers working in higher education sector in Kerala: *An Empirical Analysis. Online Submission.*

Ashill, N. J., Rod, M., Thirkell, P., & Carruthers, J. 2009. Job resourcefulness, symptoms of burnout and service recovery performance: an examination of call centre frontline employees. *Journal of Services Marketing* 23(5): 338-350.

Bakker, A. B., & Demerouti, E. 2017. Job demands–resources theory: taking stock and looking forward. *Journal of Occupational Health Psychology* 22(3): 273.

Barzideh, M., Choobineh, A., & Tabatabaee, H. 2014. Job stress dimensions and their relationship to musculoskeletal disorders in Iranian nurses. *Work* 47(4): 423-429.

Bauer, P. T. 1981. *Equality, the Third World, and Economic Delusion*. Harvard University Press.

Benson, S. G., & Dundis, S. P. 2003. Understanding and motivating health care employees: integrating Maslow's hierarchy of needs, training and technology. *Journal of Nursing Management* 11(5): 315-320.

Bonett, D. G., & Wright, T. A. 2015. Cronbach's alpha reliability: Interval estimation, hypothesis testing, and sample size planning. *Journal of Organizational Behavior* 36(1): 3-15.

Brown, J. P., Martin, D., Nagaria, Z., Verceles, A. C., Jobe, S. L., & Wickwire, E. M. 2020. Mental health consequences of shift work: an updated review. *Current Psychiatry Reports* 22(2): 1-7.

Burman, R., & Goswami, T. G. 2018. A systematic literature review of work stress. *International Journal of Management Studies* 5(3-9): 112-132.

Calzavara, M., Battini, D., Bogataj, D., Sgarbossa, F., & Zennaro, I. 2020. Ageing workforce management in manufacturing systems: state of the art and future research agenda. *International Journal of Production Research* 58(3): 729-747.

Connelly, L. M. 2008. Pilot studies. *Medsurg Nursing* 17(6): 411.

Das, B. 1999. Development of a comprehensive industrial work design model. *Human Factors and Ergonomics in Manufacturing & Service Industries* 9(4): 393-411.

Demerouti, E., Bakker, A. B., Nachreiner, F., & Schaufeli, W. B. 200). The job demands-resources model of burnout. *Journal of Applied Psychology* 86(3): 499.

Dewe, P. J., O'Driscoll, M. P., & Cooper, C. L. 2010. *Coping with Work Stress: A Review and Critique*. John Wiley & Sons.

Farooquiea, J. A., & Mohapatrab, A. B. 2009. Japanese manufacturing techniques and practices: an Indian perspective. *Jordan Journal of Mechanical and Industrial Engineering* 3(3).

Field, A. 2013. *Discovering Statistics using IBM SPSS Statistics*. Sage.

Field, A., & Miles, J. 2010. Discovering statistics using SAS:(and sex and drugs and rock'n'roll): *Sage*.

Finkelstein, D. M., Kubzansky, L. D., Capitman, J., & Goodman, E. 2007. Socioeconomic differences in adolescent stress: the role of psychological resources. *Journal of Adolescent Health* 40(2): 127-134.

French, J. R., & Caplan, R. D. 1972. Organizational stress and individual strain. *The Failure of Success* 30: 66.

Gray-Stanley, J. A., & Muramatsu, N. 2011. Work stress, burnout, and social and personal resources among direct care workers. *Research in Developmental Disabilities* 32(3): 1065-1074.

Hakanen, J. J., Ropponen, A., Schaufeli, W. B., & De Witte, H. 2019. Who is engaged at work? A large-scale study in 30 European countries. *Journal of Occupational and Environmental Medicine* 61(5): 373-381.

Hall, G., & Morrison, C. F. 1973. New evidence for a relationship between tobacco smoking, nicotine dependence and stress. *Nature* 243(5404): 199-201.

Härmä, M., Barton, J., Costa, G., Greenwood, K., Knauth, P., Nachreiner, F., Akerstedt, T. 1998. New challenges for the organization of night and shiftwork.

Herr, R. M., Barrech, A., Riedel, N., Gündel, H., Angerer, P., & Li, J. 2018. Long-term effectiveness of stress management at work: Effects of the changes in perceived stress reactivity on mental health and sleep problems seven years later. *International Journal of Environmental Research and Public Health* 15(2): 255.

Holtermann, A., Mathiassen, S. E., & Straker, L. (2018). Promoting health and physical capacity during productive work: The Goldilocks Principle. *Scandinavian Journal of Work, Environment & Health* 45(1): 90-97.

Hsiao, H. Y., & Mor Barak, M. E. 2014. Job-related stress, social support, and work–family conflict among Mexican workers in a multinational company: A case study of a Korean-owned, US-branded former "sweatshop" in Mexico. *International Journal of Social Welfare* 23(3): 309-320.

Hurrell Jr, J. J., & Colligan, M. J. 1987. Machine pacing and shiftwork: Evidence for job stress. *Journal of Organizational Behavior Management* 8(2): 159-176.

Idrees, M. D., Hafeez, M., & Kim, J.-Y. 2017. Workers' age and the impact of psychological factors on the perception of safety at construction sites. *Sustainability*, 9(5): 745.

Jehan, S., Zizi, F., Pandi-Perumal, S. R., Myers, A. K., Auguste, E., Jean-Louis, G., & McFarlane, S. I. 2017. Shift work and sleep: medical implications and management. *Sleep Medicine and Disorders: International Journal* 1(2).

Kazmi, R., Amjad, S., & Khan, D. 2008. Occupational stress and its effect on job performance. A case study of medical house officers of district Abbottabad. *Journal Ayub Medical Collage Abbottabad* 20(3): 135-139.

Khalili, A., Ismail, M. Y., Karim, A., & Daud, M. R. C. 2017. Critical success factors for soft TQM and lean manufacturing linkage. *Jordan Journal of Mechanical & Industrial Engineering* 11(2).

Kibria, M., & Rafiquzzaman, M. 2019. Ergonomic computer workstation design for university teachers in Bangladesh. *Jordan Journal of Mechanical & Industrial Engineering* 13(2).

Kumar, R. 2019. *Research Methodology: A Step-By-Step Guide for Beginners*. Sage Publications Limited.

La Torre, G., Sestili, C., Mannocci, A., Sinopoli, A., De Paolis, M., De Francesco, S., Lojodice, B. (2018). Association between Work Related Stress and Health Related Quality of Life: The impact of socio-demographic variables. A cross sectional study in a region of central Italy. *International Journal of Environmental Research and Public Health* 15(1): 159.

Lee, A., Myung, S.-K., Cho, J. J., Jung, Y.-J., Yoon, J. L., & Kim, M. Y. 2017. Night shift work and risk of depression: Meta-analysis of observational studies. *Journal of Korean Medical Science* 32(7): 1091-1096.

Lerman, S. E., Eskin, E., Flower, D. J., George, E. C., Gerson, B., Hartenbaum, N., . . . Moore-Ede, M. 2012. Fatigue risk management in the workplace. *Journal of Occupational and Environmental Medicine* 54(2): 231-258.

Lunde, L.-K., Skare, O., Mamen, A., Sirnes, P. A., Aass, H. C., Ovstebo, R., Heglum, H. S. A. 2020. Cardiovascular health effects of shift work with long working hours and night shifts: Study protocol for a three-year prospective follow-up study on industrial workers. *International Journal of Environmental Research and Public Health* 17(2): 589.

Mehta, V., & Shah, H. 2005. Characteristics of a work organization from a lean perspective. *Engineering Management Journal* 17(2): 14-20.

Mohelska, H., & Sokolova, M. 2018. Management approaches for Industry 4.0–the organizational culture perspective. *Technological and Economic Development of Economy* 24(6): 2225-2240.

Mucci, N., Giorgi, G., Roncaioli, M., Perez, J. F., & Arcangeli, G. 2016. The correlation between stress and economic crisis: a systematic review. *Neuropsychiatric Disease and Treatment* 12: 983.

Muecke, S. 2005. Effects of rotating night shifts: literature review. *Journal of Advanced Nursing* 50(4): 433-439.

Nebojša, P., Marija, I., & Kristina, Č. 2020. Organizational culture and job satisfaction among university professors in the selected central and Eastern European countries. *Studies in Business and Economics* 15(3): 168-184.

Pflanz, S. E., & Ogle, A. D. 2006. Job stress, depression, work performance, and perceptions of supervisors in military personnel. *Military Medicine* 171(9): 861-865.

Rastogi, M., Rangnekar, S., & Rastogi, R. 2018. Enhancing quality of work life in India: the role of workplace flexibility. *Industrial and commercial Training*.

Razali, S., Rusiman, M., Gan, W., & Arbin, N. 2018. The impact of time management on students' academic achievement. *Journal of Physics: Conference Series*.

Ritonja, J., Aronson, K. J., Matthews, R. W., Boivin, D. B., & Kantermann, T. 2019. Working Time Society consensus statements: Individual differences in shift work tolerance and recommendations for research and practice. *Industrial Health* 57(2): 201-212.

Savery, L. K., & Luks, J. A. 2000. Organizational change: the Australian experience. *Journal of Management Development* 19(4): 309-317.

Schuler, R. S. 1980. Definition and conceptualization of stress in organizations. *Organizational Behavior and Human Performance* 25(2): 184-215.

Selye, H. 1956. *The Stress of Life*. Hans Selye. MD New York: McGraw-Hill Book Company, Inc.

Seňová, A., & Antošová, M. 2014. Work stress as a worldwide problem in present time. *Procedia-Social and Behavioral Sciences* 109: 312-316.

Seyle, H. 1974. *Handbook of Stress*. New York, The Free Press.

Sharpley, C. F., Bitsika, V., & Efremidis, B. 1997. Influence of gender, parental health, and perceived expertise of assistance upon stress, anxiety, and depression among parents of children with autism. *Journal of Intellectual and Developmental Disability* 22(1): 19-28.

Smith, M. J., & Carayon, P. 1995. New technology, automation, and work organization: stress problems and improved technology implementation strategies. *International Journal of Human Factors in Manufacturing* 5(1): 99-116.

Steiber, N., & Pichler, F. 2015. Trends in work stress and exhaustion in advanced economies. *Social Indicators Research* 121(1): 215-239.

Tabatabaei, S., Hosseinian, S., & Gharanjiki, B. 2011. General health, stress associated to the work and job satisfaction of Hormozgan Cement Factory employees in Iran. *Procedia-Social and Behavioral Sciences* 30: 1897-1901.

Tahghighi, M., Rees, C. S., Brown, J. A., Breen, L. J., & Hegney, D. 2017. What is the impact of shift work on the psychological functioning and resilience of nurses? An integrative review. *Journal of Advanced Nursing* 73(9): 2065-2083.

Yeom, J. H., Sim, C. S., Lee, J., Yun, S. H., Park, S. J., Yoo, C.-I., & Sung, J. H. 2017. Effect of shift work on hypertension: cross sectional study. *Annals of Occupational and Environmental Medicine* 29(1): 11.