

The Influence of Ergonomic and Psychosocial Risk Factors on the Stress of Computer Operators in an Office

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Abstract

The objective of this research is to study (1) the levels of stress, risk factors of ergonomics and psychosocial factors. The researcher also studies (2) the relationships among the risk factors of ergonomics, the psychosocial factors and the stress among computer operators in an office, (3) predictive equation for the stress among computer operators in an office with the risk factors of ergonomics and the psychosocial factors as predictors. The sample consisted of 325 operators on computers at the Headquarters of Airports of Thailand Public Company Limited. The research tool was a quadripartite questionnaire. The research revealed the findings that 1) the computer operators at the Headquarters of Airports of Thailand Public Company Limited evinced stress at a low level; 81.90 percent of the computer operators in the office who were not satisfied with the ergonomic risk assessment with the Rapid Office Strain Assessment (ROSA) method and the psychosocial risk factors at a moderate level. 2) The ergonomic and the psychosocial risk factors were found to be positively correlated with the stress of the operators on computers in an office at the statistically significant level of .01 with correlation coefficient at .25 and .44 respectively. 3) The researcher determined that the ergonomic risk factor of ROSA section A (chair), ROSA section B (monitor and telephone) and the psychosocial risk factor of job demands, social interactions and interaction between work and private life were predictive of the stress of the operators on computers in an office at 50.40 percent at the statistically significant level of .01. The ergonomic risk factor of ROSA section A (chair) regressively exerted effects on the stress at the highest level.

Keywords: Risk Factors, Ergonomic Factors, Psychosocial Factors, Stress, Computer

Background and Significance of Problem

According to the survey on the prevalence in the past 12 months on the occurrence of symptoms of bone and muscle systems of totaling 1,185 operators in the offices of workplaces located in Bangkok area, 63% of the operators in the offices were found to have the symptoms of bone and muscle systems possibly resulted from working. The parts of the body found to have high prevalence of disease occurrence were on the neck and shoulders for 42% followed by on the lower part of the back at the waist for 34, and on the upper part of the back for 28% (Janwantanakul, Pensri, Jiamjarasrangsi, & Sinsongsook, 2008: 436). This was correspondent with the results of studies in foreign countries revealing that 38% of the operators in the offices had the symptom of neck and shoulder pain (Heuval, Blatter, & Bongers, 2006: 585). These symptoms were ergonomics occurring from the interaction between human and machines inappropriately to the competence of the operators. This caused the stress and injuries from work. Moreover, the psychosocial risk factors also led to the stress in working. This was the result from the interaction among the factors in working, working environment, emotion, and mind affecting the physiological change causing people to be exhausted, fed up with the work, desperate, and hopeless. When people were desperate, they would have stress in working. This was correspondent with the study of Nielsen,

Rugulies, Smith-Hansen, Christensen, and Kristensen (2006: 187) studying the data from 52 offices in Denmark on the sample group of 1,919 persons. The research results revealed that the causes of illness and absence from work were physical demand, power in decision making, lack of skills in the operation, social support from the colleagues or the supervisors and the ability in the prediction. These psychosocial risk factors were the causes of stress and the work absence from illness for 29%. Therefore, the researcher was interested in studying the influence of ergonomic and psychosocial risk factors on the stress of computer operators in the offices to be used as the guidelines in improving the environment and gestures in working and promoting the psychosocial risk factors to reduce the stress in working of the employees.

Literature Review

The concept and theory of Selye (1976) stated that when the persons had stress, the body would respond in 3 stages. The 1st stage was the caution or warning period. It was the stage that the body was prepared to encounter the attack of the things causing the stress. It led to the 2nd stage, the stage of resistance. It was the stage that the body was adapted to the stress in order to maintain the balancing state of the body. If the body could not resist, it led to the 3rd stage; the stage of desperation. If the stress was severe and lasted for a long time, the body could not maintain the balancing state. The body systems would be impaired in the functions causing the body to fatigue and deteriorate. The body would become tired, exhausted leading to the diseases and death. Moreover, Lazarus and Folkman (1984) stated about stress that it was the result of the interaction between persons and environment. When the imbalance occurred, the persons would respond emotionally.

Regarding the concept on ergonomics, Singleton (1972) stated that ergonomics was the technology of designing the works on the basis of biology. This was the study on the 2 principles; Anatomy, Physiology and Psychology, with the objectives in adjusting the working conditions to suit the operators in order to create the efficiency, safety, and comfort in working. This study was interested in studying the ergonomic risk factors from the gesture of using computer and arrangement of computer station improperly leading to the stress among computer operators. The ergonomic risk factors were assessed by using the method of ROSA (Rapid Office Strain Assessment) developed by Sonne and Andrews (2012). The assessment is classified into 3 groups; 1) ROSA section A (chair), 2) ROSA section B (monitor and telephone), and 3) ROSA section C (mouse and keyboard). The results of assessment were in the range of scores from 1-10 points. More points meant more risks. The criteria of assessment were that from 5 points and over means not passing the criteria. The working station must be improved in order to mitigate the risks to pass the criteria.

The concept about the psychosocial risk factors were the factors resulted from the interaction among the factors in the environment work, emotions, and mind. Lindstrom et al. (2000) studied the elements of psychosocial risk factors and conducted the handbook called General Nordic Questionnaire for psychological and social factors at work or QPSNordic in 1994 to be used in the assessment of physical, social, and working condition risk factors of the organization with the purposes in preventing and improving the work place and for the research consisting of 9 areas; 1) job demands, 2) role expectations, 3) control at work, 4) social interactions, 5) leadership, 6) organizational culture and climate, 7) interaction between work and private life, 8) group work, 9) work motives.

Research Methodology

This research was the causal relationship research with the objectives 1) to study the relationship between the ergonomic and psychological risk factors and the stress of computer

operators in an office, and 2) to study the prediction of stress of computer operators in an office with the ergonomic and psychological risk factors as the predictors. The sample group used in this research consisted of 325 operators working on desktop computer arranged on the desks in the office at the Headquarters of Airports of Thailand Public Company Limited. The sample group was selected by proportional stratified random sampling. The research tool was a quadripartite questionnaire as follows:

- 1) Questionnaire on general data
- 2) Stress test made by the researcher from the ideas of Selye (1976) and Lazarus and Folkman (1984). Some items were improved from the stress measurement form of Department of Mental Health (2003; 2012)
- 3) Ergonomic risk assessment form by using the method of ROSA to assess the gestures in working on computers and at the work station developed by Sonne and Andrews (2012). The researcher applies this assessment form to be adjusted to become the form for assessing the sample group. The sample group could be used in the ergonomic risk assessment.
- 4) Psychosocial risk test which was improved from General Nordic questionnaire for psychological and social factors at work of Lindstrom et al. (2000). The researcher asked the expert to verify the content validity of the Stress test, the Ergonomic risk assessment form by using the method of ROSA, and the Psychosocial risk test. The obtained scores would be used for finding the Index of Item-Objective Congruence (IOC). The questions with IOC from .5 or over represented the content validity which was applicable. The results of verification revealed that the 3 questionnaires had IOC between .60-1.00. After that, the questionnaires were used on other sample group working on computers in the office consisting of 50 operators. The obtained data in each questionnaire was used for item analysis from discrimination power by using the Corrected Item-Total Correlation. If the value was .20 or over, it would represent that the questions had the discrimination power in moderate level except for the Ergonomic risk assessment form which should not be verified on the discrimination power as it was the assessment on the real working state, analysis on the reliability of the Stress test, and the Psychosocial risk test using the method of Cronbach's alpha coefficient. The test retest method with the value of .80 or over would be used as the instrument in the data collection. The results of quality check of the instruments were as shown in Table 1.

Table 1 Number of items, content validity, discrimination power and reliability of the tests

Tests	Number of items	IOC	Discrimination power (r_{xy})	Reliability
1. Stress test	37	.60-1	.327-.884	.965
2. ROSA	8 (35 sub-items)	.60-1	-	.960
3. Psychosocial risk test	62	.60-1	.203-.872	.971

Using techniques of descriptive statistic, the research analyzed the data collected in term of frequency, percentage, mean, standard deviation, and the hypothesis was tested using the Pearson's product moment correlation coefficient and multiple regression analysis were also employed by the researcher.

Research Results

The operators on computers at the Headquarters of Airports of Thailand Public Company Limited had the stress in the low level. According to the Ergonomic risk assessment, most of the risks did not pass the criteria (ROSA score = 5-10) for 81.90% with the ergonomic risk mean of 6.02 points and the psychosocial risk factors were in the moderate level. When considering

each aspect, the psychosocial risk factors were in the moderate level in 3 aspects and were in the low level in 6 aspects. The aspect with the most mean was the job demand ($\bar{x} = 3.10$) followed by the work control ($\bar{x} = 2.64$). The aspect with the least mean was the group working ($\bar{x} = 2.34$).

The ergonomic risk factors were positively related to the entire stress, physical stress, and mental stress of the operators on computers in an office at the statistically significant level of .01 with correlation coefficient (r_{xy}) of .25, .22, and .24 respectively. When considering each aspect, the ergonomic risk factors ROSA section A (chair) was found to be related to the stress most followed by ROSA section B (monitor and telephone) and the least was ROSA section C (mouse and keyboard) with correlation coefficient of .63, .36, and .31 respectively. The details were as shown in Table 2.

The psychosocial risk factors were positively related to the entire stress, physical stress, and mental stress of the operators on computers in an office at the statistically significant level of .01 with correlation coefficient of .44, .50, and .33 respectively. When considering each aspect, the aspect found to have the most relation was the expectation on the roles followed by the job demand, organizational culture and atmosphere. The least was working in group with correlation coefficient of .35, .34, .33, and .18, respectively. The details were as shown in Table 2.

According to the multicollinearity, the relations between 75 pairs of independent variables to be analyzed the multiple regression were found to be from .03 -.68. Therefore, there was no multicollinearity among the independent variables. Tabachnick and Fidell (2001: 82-83) stated that the multicollinearity occurred from the correlation coefficient between each pair of independent variables of .90 and over. Consequently, the results of analysis on the relationship between the variables followed the statistically preliminary accordance of the multiple regression analysis. The details were as shown in Table 2.

Table 2 Correlation coefficient between ergonomic risk factor, psychosocial risk factor and the stress of computer operators in an office

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. ROSA section A (chair)	-																
2. ROSA section B (monitor and telephone)	.24**	-															
3. ROSA section C (mouse and keyboard)	.22**	.36**	-														
4. ROSA Score	.23**	.40**	.47**	-													
5. job demands (JD)	.19**	.21**	.28**	.21**	-												
6. role expectations (RE)	.24**	.28**	.18**	.21**	.38**	-											
7. control at work (CW)	.21**	.17**	.12**	.11**	.22**	.40**	-										
8. social interactions (SI)	.04	.22**	.21**	.14**	.31**	.41**	.24**	-									
9. leadership (LD)	.17**	.23**	.20**	.10	.23**	.42**	.35**	.60**	-								
10. organizational culture and climate (CC)	.27**	.11*	.15**	.19**	.36**	.56**	.19**	.52**	.46**	-							
11. interaction between work and private life (WL)	.14*	.12*	.18**	.03	.38**	.31**	.29**	.35**	.32**	.28**	-						
12. group work (GW)	.12*	.21**	.21**	.17**	.24**	.37**	.26**	.62**	.68**	.39**	.30**	-					
13. work motives (WM)	.28**	.16**	.13*	.20**	.14*	.48**	.46**	.36**	.51**	.35**	.23**	.51**	-				
14. psychosocial risk factor (PS)	.28**	.29**	.12**	.23**	.54**	.72**	.54**	.75**	.79**	.70**	.53**	.71**	.67**	-			
15. physiological stress (S_1)	.52**	.33**	.32**	.22**	.30**	.26**	.21**	.18**	.20**	.22**	.27**	.07	.22**	.33**	-		
16. psychological stress (S_2)	.67**	.35**	.26**	.24**	.34**	.41**	.28**	.29**	.35**	.40**	.28**	.28**	.33**	.50**	.77**	-	
17. Stress (ST)	.63**	.36**	.31**	.25**	.34**	.35**	.26**	.25**	.29**	.33**	.29**	.18**	.29**	.44**	.94**	.94**	-

** $p < .01$, * $p < .05$

The ergonomic risk factors of ROSA section A (chair), ROSA section B (monitor and telephone), the psychosocial risk factors in job demands, social interactions, and interaction between work and private life could be joined to predict the stress of the operators on computers in an office for 50.4% with correlation coefficient of .01. The risk factor regressively influenced the stress of the operators on computers in an office most was the ergonomic risk factors of ROSA section A (chair) followed by ROSA section B (monitor and telephone), the psychosocial risk factors in job demands, social interactions, and interaction between work and private life with regressive coefficient of $(\beta) = .55, .16, .13, .11$, and $.11$, respectively at the statistically significant level of $.01$ and $.05$. The variables used in predicting the stress of the operators on computers in an office as follows:

Predictive equation
$$Y_{ST} = .051 + .20X_{ROSA_A}^{**} + .06X_{ROSA_B}^{**} + .12X_{JD}^{**} + .11X_{SI}^{*} + .09X_{WL}^{*}$$

Standard score equation
$$Z_{ST} = .55Z_{ROSA_A}^{**} + .16Z_{ROSA_B}^{**} + .13Z_{JD}^{**} + .11Z_{SI}^{*} + .11Z_{WL}^{*}$$

Research results as shown in Table 3.

Table 3 Regression analysis of predictive equation for the stress among computer operators in an office with the risk factors of ergonomics and the psychosocial factors as predictors

Predictors	<i>b</i>	Std. Error	β	<i>t</i>	Sig.	collinearity statistic	
						tolerance	VIF
1. ROSA section A (chair)	.20	.02	.55	13.23**	.00	.91	1.09
2. ROSA section B (monitor and telephone)	.06	.02	.16	3.91**	.00	.79	1.26
3. job demands (JD)	.12	.04	.13	2.85**	.00	.88	1.13
4. social interactions (SI)	.11	.04	.11	2.54*	.01	.81	1.22
5. interaction between work and private life (WL)	.09	.04	.11	2.43*	.01	.78	1.27

a = .051, *R* = .710, *R*² = .504, Adjusted *R*² = .497, *F* = 64.914, *p* value < .01

***p* < .01, **p* < .05

Conclusion and Discussions

The research results of the Influence of Ergonomic and Psychosocial Risk Factors on the Stress of Computer Operators in an Office had the issues which should be discussed following the research results as in the following hypotheses:

1st Hypothesis: The ergonomic risk factors had the relations to the stress of the operators on computers in an office

According to the research results, the ergonomic risk factors were found to have positive relations with the stress of the operators on computers in an office. This followed the hypothesis. This was possibly because the operators on computers did not arrange the work station properly following the ergonomic principles on the arrangement of computer monitor, chair, keyboard, mouse, telephone, and gestures in working repeatedly for several hours in each day causing the bone and muscle system to function heavily resulting in the accumulative tension and the employees would be fatigue, exhausted, depressed, bad-tempered without the happiness in working. These things were the symptoms of stress correspondent with the research of Yoshifumi, Premkumar, and Manzuma-Ndaaba (2017) studying the measurement of operation following the ergonomic principles from the viewpoint of stability in work, stress in work, and satisfaction in the automobile system industry. It was found that the ergonomic risk factors had positive relations with the stress in working with the correlation coefficient of .874. The chair for sitting in working was also related to the stress in working with the correlation coefficient of .05. Moreover, this was also related to the research of Kaisangthong (2008) studying the relations between the ergonomic factors and the stress of the operators on computers: Case study of a private organization. The research results revealed that the personnel selecting to use the ergonomic factors less correctly had the stress level higher than the personnel selecting to use the ergonomic factors most correctly. The ergonomic factors in chairs, gestures in working, and computer connecting devices had the relations with the stress of the operators on computers at the statistically significant level of .05.

2nd Hypothesis: The psychosocial risk factors had the relations to the stress of the operators on computers in an office

According to the research results, the psychosocial risk factors were found to have positive relations with the stress of the operators on computers in an office. This followed the hypothesis. This was possibly because the persons had to work under pressure with improper psychosocial environment such as the work load was so much that creating the imbalance in life, working to compete with the limited time, the unclear roles, the non-freedom in solving

the problems in working, the bad relationship with the colleagues, the superiors lack of justice, the work was assigned not correspondent with the knowledge and competence of the inferiors, the too strict organizational culture and atmosphere, the discrimination, the organization paid the remuneration and welfares improperly resulting in the lack of motivation in working. These psychosocial risk factors caused the persons to have depress, fatigue, sadness, emotional tension, and mental health problems. These were all stress from working correspondent with Stavroula, Griffiths, and Cox (2003: 1) stating that the psychosocial risk factors had the relations with the stress in working. This stress in working was the response of persons possibly occurring when there was the expression on the job demand and pressure of the work features not matching the knowledge and competence of persons to cope with. The bad psychosocial environment resulted in the stress, physical, emotional, and mental fatigue. This was correspondent with the research of Prasarakkee (2007) studying the psychosocial risk factors and the stress from work of the traffic police in Chiang Mai. The research results revealed that the psychosocial risk factors had relations with the stress from work of the traffic police in Chiang Mai. Moreover, it was also correlative with the research of Nuchnontre (2013) studying the stress from work of personnel in the central agencies, court office. It was found that the factors resulting in the stress were the workplace environment, work progress, rewards, welfares, and job features.

3rd Hypothesis: The ergonomic and psychosocial risk factors could predict the stress of the operators on computers in an office

According to the research results, the ergonomic and psychosocial risk factors were found to predict the stress of the operators on computers in an office. This followed the hypothesis. The ergonomic risk factors regressively influenced the stress significantly were the ergonomic risk factors of ROSA A (chair) ROSA B (monitor and phone). The psychosocial risk factors regressively influenced the stress significantly were the job demand, social interactions, and interaction between work and private life. These factors could predict the stress of the operators on computers in an office for 50.4 at the statistically significant level of .01. This was possibly because the operators on computers did not arrange the work station properly following the ergonomic principles on the arrangement of chair, computer monitor, telephone, and gestures in working repeatedly for several hours in each day causing the muscles of shoulders, back, waist, tendon, and joints to be tense. The operators would become painful, discomfort, suffered, frustrated, unhappy in working leading to the stress in working. This was correspondent with the research of Zafir, Abdullah, and Senik (2013) studying the ergonomics and stress in working: Participation with Engineering and Social Science. It was found that ergonomics could predict the stress in working for 38.4%. This also agreed with the study of Cook, Burgess-Limerick, and Papalia (2004) stating that the chairs properly to work could reduce stress in working. Besides, this was also in accordance with the research of Yoshifumi et al. (2017) studying the measurement of operation following the ergonomic principles from the viewpoint of stability in work, stress in work, and satisfaction on the automobile system industry. It was found that the ergonomic factors could predict the stress in work for 86.2.

Furthermore, the psychosocial risk factors in the job demand, social interactions, and interaction between work and private life could predict the stress of the operators on computers in an office. This was possibly due to inadequate work requirements, such as excessive workload or work hours, the job features that were not consistent with ability and responsibility causing stress to the employees, too much workload in the responsibilities, having to work competing with time until lacking the rest, poor working relationship, conflict and harassment from colleagues resulting in the obstacles to work. The persons would become physically, emotionally, and mentally exhausted influencing the work stress. This agreed with the idea of Stavroula, Griffiths, & Cox (2003: 5) stating that there were the

problems on the relationship with the colleagues, the harassment, and the abuse from the colleagues leading to the stress in work and the imbalance of life, family, and work. This influenced the mental conditions of the employees. If there was the conflict between the family and private life, the persons would have stress. This was in accordance with the research of Bell, Rajendran, and Theiler (2012) finding that the stress and pressure in work had the relations with the imbalance in private life and career life. This was the main index indicating the stress of persons. Moreover, this was also correspondent with the research of Lappanopakorn, and Phasunon (2014) studying the factor affecting the stress of personnel of Phetchaburi Rajabhat University most was job features followed by the relationship with the others in working. The working factor was also found to influence the stress of personnel of Phetchaburi Rajabhat University with the R Square equaling to 80.1.

Recommendations

The research results had the recommendations possibly beneficial to the organizations in reducing the stress of the operators on computers in an office as follows:

- 1) The organizations should hold the workshop training on the operators on computers in an office to have knowledge and understanding on the correct sitting position to work correctly following the ergonomic principles.
- 2) The organizations should improve the computer working station to be correct following the ergonomic principles such as the arrangement of computer desk, chair, monitor level, keyboard, mouse arrangement, selection of wrist-resting equipment, designing of the place for storing documents, foot-resting, and the use of other equipment.
- 3) The organizations should have the good corporate governance considering proper psychosocial factors such as promoting working in team efficiently, balance between work and private life, creating motivation in working for the employees to facilitate the employees to be satisfied and happy in working.

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