

Cold working room temperature increased moderate/severe qualitative work stressor risk in Air Traffic Controllers

Dewi Astuti,^{1,2} Bastaman Basuki,¹ Herman Mulijadi³

¹Department of Community Medicine, Faculty of Medicine, Universitas Indonesia

²Indonesian Civil Aviation Institute, Ministry of Transportation, Indonesia

³Aviation and Aerospace Health Institute, Indonesia

Abstrak

Latar belakang: Pemandu lalu lintas udara (PLLU) kemungkinan lebih besar terkena stresor kerja kualitatif. Tujuan penelitian untuk mengidentifikasi beberapa faktor yang berkaitan dengan stresor kerja kualitatif moderat (SBKL) sedang di antara PLLU di Bandar Udara Internasional Soekarno-Hatta.

Metode: Studi potong lintang dilakukan pada bulan November 2008 dengan subjek PLLU aktif bekerja minimal 6 bulan. Penelitian menggunakan kuesioner standar survei diagnostik stres dan kuesioner stresor rumah tangga. Kuesioner diisi oleh subjek.

Hasil: Subjek berumur 27-55 tahun terdiri dari 122 PLLU dengan SBKL sedang/berat dan serta 13 (9,6%) PLLU dengan SBKL rendah. Model menunjukkan bahwa mereka yang merasa dibandingkan dengan yang tidak merasa suhu ruangan terlalu dingin mempunyai 11-lipat risiko SBKL sedang/berat [rasio odds suaian (ORa) = 10,63: 95% interval kepercayaan (CI) = 1,79-65,59]. Dibandingkan dengan subjek tanpa stresor ketaksaan peran, mereka yang mempunyai stresor ketaksaan peran sedang/berat berisiko 8,2-lipat SBKL sedang/berat (ORa = 8,23: 95% CI = 1,13-59,90). Di samping itu, mereka yang mempunyai stresor tanggung jawab sedang/berat mendapatkan dibandingkan dengan tanpa stresor ini 6,6-kali berisiko SBKL sedang/berat (ORa = 6,64: 95% CI = 1,13-38,85). Selanjutnya mereka yang mempunyai dibandingkan dengan yang tanpa stresor pengembangan karir sedang/berat mempunyai 3,7-kali risiko SBKL sedang/berat (ORa = 3,67: 95% CI = 0,88-15,35; P = 0,075).

Kesimpulan: Subjek LLU yang merasa suhu ruangan terlalu dingin, stresor ketaksaan peran, tanggung jawab personal dan pengembangan karir sedang/berat mengalami peningkatan risiko SBKL sedang/berat. (*Health Science Indones 2011;2:58-65*)

Kata kunci: suhu dingin, stresor beban kerja kualitatif, pemandu lalu lintas udara

Abstract

Back ground: Air traffic controllers (ATCs) have a high level of responsibility which may lead to qualitative work load stressor (QLWS). This study identified several risk factors related to moderate qualitative work load stressor among the ATCs.

Methods: This cross-sectional study was conducted in November 2008 at Soekarno-Hatta International Airport. Subjects consisted of active ATCs with a minimum of six months total working tenure. The study used standard diagnostic as well as home stressor questionnaire surveys. All questionnaires were filled in by the participants.

Results: Subjects were aged 27–55 years, consisted of 112 ATCs who had moderate and 13 (9.6%) ATCs who had slight QLWS. Those who felt than did not feel the working room temperature was not too cold had 11-fold moderate/severe QLWS [adjusted odds ratio (ORa) = 10.63: 95% confidence interval (CI) = 1.79-65.59]. Those who had than did not have moderate/severe role ambiguity stressor had 8.2-fold risk of moderate/severe QLWS (ORa = 8.23: 95% CI = 1.13-59.90). Those who had than did not have moderate/severe personal responsibility stressor had 6.6-fold risk for moderate/severe QLWS (ORa = 6.64: 95% CI = 1.13-38.85). In terms of the career development stressor, those who had it than did not have it had a 3.7-fold risk for moderate/severe QLWS (ORa = 3.67: 95% CI = 0.88-15.35; P = 0.075).

Conclusion: Those who felt the room temperature was too cold, moderate/severe role ambiguity, personal responsibility, as well as career development stressor were at increased risk for moderate/severe QLWS. (*Health Science Indones 2011;2:58-65*)

Key words: working room temperature, qualitative work stressor, air traffic controller

Corresponding author: Dewi Astuti
E-mail: dewi.astuti@rocketmail.com

Stressors and stress are main issues affecting the human factor in aviation. Stressors are the source of stresses. The effect of stress could produce psychological and physical reactions such as fear, anxiety, frustration, loss of motivation, decreased attention, slower reaction time, and decreased situational awareness.^{1,2} Air Traffic Controllers (ATCs) are required to work at optimal levels according to international standards, and there is intolerance for any error or mistake in order to guarantee perfect air traffic operation.³

It was believed the ATCs had excessive workload demands and a high level of responsibility. They also were at risk for experiencing work stress generated by their working environment or home stresses.^{4,5}

A previous report noted that there were 11 near misses at the Soekarno-Hatta International Airport in 2006, more than the standard maximum for near misses of 3 miss per year. The report also found positive correlation between work stressors and performance. Moderate-severe qualitative work load stressors would produce stress that would decrease performance. Hence, the medium-heavy qualitative work load stressors would increase operational error errors or mistakes.^[6]

This study aimed to identify work environment stressors and other risk factors related to the moderate qualitative workload among the ATCs.

METHODS

This cross-sectional study was conducted in November 2008. Subjects consisted of active ATCs at Soekarno-Hatta International Airport who had a minimum of six months total working tenure. Subjects were given information by researchers and filled in special questionnaires in their office or at home.

Demographic and behavioral factors questionnaires identified age, gender, marital status, number of children, education, smoking habits and sports.

Work characteristics questionnaires included information on job title, working unit, length of employment, experience in problem, stress management training, and second job/additional job. Working environment stressor questionnaires included information on lighting in the room, noise, working chair, configuration of the room, crowded working room, and other complaints.

Stressor questionnaires used standard diagnostics for identifying stress.⁷ Working stressor questionnaires

consisted of role conflict, ambiguity, quantitative workload, qualitative workload, career development, and personal responsibility.

Work stressors were determined by a diagnostic survey questionnaire which consisted of 6 stressor groups (quantitative workload, role ambiguity, personal responsibility, career development, role conflict and quantitative workload stressors). Moreover, each sub-group of stressors consisted of 5 questions and every question had a score from 1 to 7. One was the lowest and 7 were the highest score. The total score for each stressor ranged from 5 through 35. Furthermore, each stressor group was divided into 3 categories (low = 1-10; moderate = 11-23; severe = 24-35). More details are as follows:

Qualitative workload stressor was work variability that required technical and intellectual ability above a worker's abilities. It consisted of: job standard demands that were too high; assigned tasks that were sometimes too difficult/complicated; tasks that became more complex day to day; organization's expectations that exceeded my abilities and skills; and inadequate training or experience to accomplish my job.

Role ambiguity was the worker's feeling that he/she does not have enough information to do the job or does not understand the job sufficiently to fulfill the expectations of the role. It consisted of: my tasks and job description were not well defined; I did not clearly know to whom and who to report; I did not have authority in doing my obligations; I did not clearly understand what my goals are; and I did not understand my job role in the organization

Personal responsibility was being responsible for customers' safety. It consisted of: I was responsible for the development of other employees; I was responsible to guide and/or help my colleagues with their problems; I acted or made decisions that affected the safety and welfare of others; My responsibility was primarily about taking care of people rather than things; and I was responsible for my colleagues' careers/ futures.

Career development was potential stress aroused because of work uncertainty, over promotion and low promotion. It consisted of: I didn't have enough opportunities to advance in this organization; if I want to advance my position, I have to find another job in another unit; my career will suffer if I stay in this organization; I only had minimal opportunity to

develop and learn new knowledge and skill in this organization; and I feel stuck in my career.

Role conflict was conflict that was created because of a mismatch between role demands and personal needs. It consisted of: I was doing unnecessary tasks; I was caught between my supervisor and my staff; Formal line of command was not obeyed; I was doing work that was not being done by colleagues and was their responsibility; I received contradictory orders from one or more person(s).

Quantitative Workload Stressor related to limited time. It consisted of: I had to bring my work home every noon or weekend to stay on schedule; I spent too much time at unnecessary meetings and wasted my time; I was responsible for all kinds of jobs at the same time and almost uncontrollable; I really had more tasks than could be accomplished in one day; and I felt that I didn't have periodic time to rest.

Working room lighting, noise, working chair, working room space and configuration of one's work station were categorized based on the subjects' perceptions:

The Home Stress Checklist questionnaire included one's role in the family, home physical factors, home tension and privacy.⁸ Home stressors included household conditions that might increase or create stress. These were categorized into four groups consisting of role in home, physical home stressor, home tension, and privacy. To determine a score for role in the home subjects were asked "what is your role in your home: as the main source of family income, as a father/mother, as a husband/wife, as a financial support to other family members, as a payer, as a gardener, as a home decorator, as a household repairman. Each role identified was given the score of one. The total score was determined by adding roles and categories (low = less than 2; moderate = 3-5; severe =6-7).

Physical home stressor was a physical or home environment that could create stress. The question consisted of: neighborhood noise, small house, messy house, leaking and/or damage to part of one's house, dense neighborhood, flooded neighborhood, unsafe neighborhood. Each physical home stressor identified was given a score of one. The total score was determined by adding all items identified. The resulting score placed the subject into one of three categories (low = less than 1; moderate = 2-3; severe =4-5).

Home tension was the responder's perception of their current home environment. The results placed the subject into one of three categories (low = small dispute and can be resolved; moderate = several tensions, but it was still tolerable; severe = the tension is very high).

Privacy was time for personal matters without interference from others. The question was "if you were at home, how often would you have time for yourself relaxing and enjoying an activity (low = always; moderate = seldom; and (severe = rare).

Sports habit was physical exercise to maintain responder health and was divided into three categories (light such as walking 2-4 km/hour; moderate such as biking 16-20 km/hour, heavy such as jogging 6-9 km/hour).⁹

Out of 171 ATCs, 135 (78%) participated this study. For this analysis we excluded 19 subjects who had severe qualitative work stressors. Data analysis used Cox regression¹⁰ using Stata version 9.

RESULTS

Table 1 shows that most of the subjects had moderate/severe QLWS were male, and aged between 27-55 years.

In addition, Table 1 shows that subjects who had slight and moderate/severe QLWS were equally distributed with respect to gender, age group, number of children, and sport habit. However, those who were not yet married were less likely had a lower risk of having moderate/severe QLWS.

Table 2 shows that subjects with slight and moderate/severe QLWS were equally distributed in terms of job title, working unit, length of employment (11-23 years), experience with accident control, and stress management training.

However, those who had 6-10 years of work experiences were less likely had lower risk to be moderate/severe QLWS than those with 11-30 years.

Table 3 shows that subjects who had slight and moderate/severe QLWS were similarly distributed with respect to working room lighting, noise, working chair, working room space, and configuration of the working room.

Table 4 shows that subjects with slight and moderate/severe QLWS were similarly distributed with respect to family role, home tension and privacy. However, those who had moderate than low physical home stressors were at a greater risk for moderate/severe QLWS than those with low physical home stressors.

Subjects who felt than did not feel the working room temperature was not too cold had 11-fold moderate/

severe QLWS [adjusted odds ratio (ORa) = 10.63]. Those who had than did not have moderate/severe role ambiguity stressor had 8.2-fold risk of moderate/severe QLWS (ORa = 8.23). Those who had than did not have moderate/severe personal responsibility stressor had 6.6-fold risk for moderate/severe QLWS (ORa = 6.64). In terms of the career development stressor, those who had it than did not have it had a 3.7-fold risk for moderate/severe QLWS (ORa = 3.67; P = 0.075).

Table 1. Some demographic, habits characteristics and risk of moderate qualitative work load stressor

	Qualitative work load stressor		Crude odds ratio	95% confidence interval	P
	Slight (n=13)	Moderate/severe (n=122)			
	n	n			
Gender					
Male	12	113	1.00	Reference	
Female	1	9	0.96	8.21-0.82	0.967
Age					
21-29 years	1	10	1.00	Reference	
30-39 years	8	59	0.73	0.08-6.65	0.785
40-49 years	2	37	1.85	0.15-22.53	0.630
50-55 years	2	16	0.80	0.09-10.01	0.863
Marital status					
Married	11	117	1.00	Reference	
Not yet married	2	3	0.14	0.02-0.93	0.043
Divorce/widow(-er)	0	2	n/a		
Number of children					
None	3	15	1.00	Reference	
1-2 children	6	78	2.60	0.58-11.55	0.209
3-4 children	4	29	1.45	0.28- 7.33	0.653
Sport habit					
None	3	31	1.00	Reference	
Mild	8	68	0.82	0.20-3.31	0.784
Moderate/	2	22	1.06	0.11-11.64	0.948
Heavy	0	1			
Smoking habits					
Never	4	65	1.00	Reference	
Ever	6	30	0.30	0.08-1.17	0.084
Current	3	27	0.55	0.11-2.64	0.459

n/a=not applicable

Table 2. Several work characteristics and risk of moderate qualitative work load stressor

	Qualitative work load stressor		Crude odds ratio	95% confidence interval	P
	Slight (n=13)	Moderate/severe (n=122)			
Job title					
Operator	11	95	1.00	Reference	
Supervisor	2	27	1.56	0.33-7.48	0.576
Working unit					
Air control service	7	57	1.00	Reference	
Aerodrome control/approach	6	65	1.33	0.42-4.19	0.626
Total length of employment					
0-5 years	3	33	1.00	Reference	
6-10 years	6	16	0.24	0.05-1.10	0.066
11-15 years	2	38	1.72	0.27-19.10	0.562
16-30 years	2	35	1.59	0.25-10.13	0.623
Experience controlling control near miss accident					
Never	8	58	1.00	Reference	
Near miss	5	59	1.63	0.50-5.26	0.416
Accident	0	5	n/a		
Stress management training					
Ever	1	35	1.00	Reference	
Never	12	87	0.21	0.02-1.65	0.137

n/a=not applicable

Table 3. Some environment work characteristics and risk of moderate qualitative work load stressor

	Qualitative work load stressor		Crude odds ratio	95% confidence interval	P
	Slight (n=13)	Moderate/severe (n=122)			
Working room lighting					
Bright	12	110	1.00	Reference	
Dim	1	12	1.31	0.16-10.96	0.804
Noise					
Normal	7	64	1.00	Reference	
Noisy	6	58	1.06	0.34-3.33	0.924
Working chair					
Comfortable	6	64	1.00	Reference	
Uncomfortable	7	58	0.78	0.25-2.25	0.666
Working room space					
Not crowded	12	99	1.00	Reference	
Crowded	1	23	2.79	0.34-22.54	0.336
Work station					
Comfortable	9	62	1.00	Reference	
Uncomfortable	4	60	2.18	0.64-7.45	0.215

Table 4. Several home stressors and risk of slight and moderate qualitative work load stressor

	Qualitative work load stressor		Crude odds ratio	95% confidence interval	P
	Slight (n=13)	Moderate/severe (n=122)			
Family role					
Low	3	28	1.00	Reference	
Moderate	9	75	0.89	0.23-3.53	0.872
Severe	1	19	2.03	0.20-21.07	0.551
Physical home stressor					
Low	12	92	1.00	Reference	
Moderate	1	28	3.65	0.45-29.33	0.223
Severe	0	2	n/a		
Home tension					
Low	10	91	1.00	Reference	
Moderate	3	30	1.10	0.28-4.26	0.891
Severe	0	1	n/a		
Personal privacy					
Always	5	40	1.00	Reference	
Seldom	7	63	1.13	0.33-3.79	0.849
Rare	1	19	2.38	0.26-21.77	0.44

n/a=not applicable

Table 5. The relationship among working room temperature and some of stressors and risk of qualitative work load stressor

	Qualitative work load stressor		Adjusted odds ratio	95% confidence interval	P
	Slight (n=13)	Moderate/severe (n=122)			
Working room temperature					
Cold	3	9	1.00	Reference	
Too cold	10	113	10.63	1.79-65.59	0.010
Role ambiguity stressor					
Low	1	48	1.00	Reference	0.010
Moderate/severe	2	6	8.23	1.13-59.90	0.037
Personal responsibility stressor					
Low	2	6	1.00	Reference	
Moderate/severe	11	116	6.64	1.13-38.85	0.036
Career development stressor					
Low	5	20	1.00	Reference	
Moderate/severe	8	102	3.67	0.88-15.35	0.075

*Adjusted each others for risk factors listed on this Table.

DISCUSSION

This study has some limitations such as limited subjects and a relatively high number of non-respondents among eligible subjects. Most of the non-respondent subjects were on leave or training. Though we explained as clearly as possible the questionnaire, the answers were based on subjects' perceptions.

The working room temperature in the radar controller room was 18°–19° C, and in the tower room the temperature was 20°C.

Prevalence of the low personal responsibility (6.0%) was lower than reported in the Police study,¹¹ and newspaper worker study.¹² Since the ATCs worked as a team, they shared the responsibility for passenger safety within the group and with other sectors.

Our final model revealed that subjects with low versus moderate-high personal responsibility stressor had a 6.4 times increased risk for slight qualitative work load stressor. This might be due to ATCs who felt low personal responsibility would feel the load of qualitative work was also low. This result was similar with an earlier study that found a relation between personal responsibilities and work stressor among the newspaper workers.¹²

Low role ambiguity among the ATCs (63.7%) was higher than that in the Police Brigade study (44.2%),¹¹ and with the newspaper worker study (39.1%).¹² Low role ambiguity among the ATCs is caused by duty, reporting system, competency and responsibility of ATCs to obey standard operation procedures. The model also showed subjects with low role ambiguity had a 10.59 (p 0.032) increased risk of the slight qualitative work load stressor compared to the moderate-high role ambiguity stressor. The reason was ATCs with low role ambiguity stressor had better self confidence in doing their job with the slight qualitative work load.

ATCs with slight qualitative work load (10.4%) had a value lower than that in the Police Brigade study (13.2%),¹¹ or with the newspaper worker study (29.6%).¹² Even with responsibility for an increased frequency of airplane flights, ATCs were supported with high technology equipment such as telecommunication, radar etc that would reduce workload difficulties.

Career development stressor of ATCs (18.5%) was lower than that in the Police study (13.2%),¹¹ or

newspaper worker study (31.3%).¹² Since ATCs had specific professional jobs and a slim organizational structure they understood that their career development was limited. Result showed the subjects with low development career stressor had a 2.7 increased risk of slight qualitative work load compared to the medium-high career development stressor (P=0,161)

Of 135 subjects, 5 (5,1%) were unmarried, 2 divorced and the others (94,9%) were married. Our study shows that compared to married subjects, unmarried subjects had a 78% lower risk for a slight qualitative workload stressor. This might be due to household problems over duty, economical problems in the family that married ATCs might have and which could result an increased qualitative workload stressor.

Our model shows that subjects with the perception that the room temperature was uncomfortable had a 22-fold increased risk for moderate qualitative workload. The temperature of the working rooms was relatively low. This cold working room temperature was not for personnel but to preserve equipment. Hence, this condition needs to be managed to control the side effects of cold temperature. For example, warmer jackets could be provided.

In conclusion, a too cold room temperature and other moderate/severe stressors increased the risk of moderate qualitative workload stressor for ATCs.

Acknowledgments

We thank to Chief of Air Traffic Service Management to allow us to conduct this study. Special gratitude's for ATCs who were cooperatively participated in this study. We also thank Dr. Elisabeth Emerson for reviewing the final draft and her excellent suggestions.

REFERENCES

1. Human Factors Digest No. 8. ICAO Circular. Human factors in air traffic control. Montreal. ICAO. 1993 p. 33-4.
2. NIOSH. Stress at work. [Cited 2008 Oktober 22]. Available from <http://www.cdc.gov/niosh/topics/stres/>
3. General Directorate of Air Traffic of Indonesia. Air traffic services. [Cited 2008 Mei 14]. Available from <http://www.dephub.go.id>
4. Top 10 Most stressful jobs. [Cited 2008 October 20]. Available from www.cdc.gov/ulcer/myth.htm
5. Costa G. Occupational stress and stress prevention in air traffic control: Literature review. [Cited 2008

- October 22]. Available from www.ilo.org/public/english/protection/condtrav/pdf/wc-gc-95.pdf.
6. Sena A. Work environment and stress management in air traffic controllers at Soekarno-Hatta airport [thesis]. Tangerang. Indonesia Aviation College. 2006.
 7. Isfandari S. Instrument survey study on stress and stress strain diagnosis. Jakarta: National Institute of Health Research & Development; 1992.
 8. Kaplan PS, Stein J. Psychology of adjustment. California: Wadsworth Publishing Company; 1984.
 9. Faculty of Medicine of Universitas Indonesia. Field study guidance. Jakarta. The Faculty. 2003.
 10. Barros AJD, Hirakata VN. Alternative for logistic regression in cross-sectional studies: an empirical comparison of models that directly estimates the prevalence ratio. *BMC Med Research Method.* Oct. 2003;3. [Cited 2008 October 20]. Available from <http://www.biomedcentral.com/1471-2288/3/21>.
 11. Kanam R. Qualitative work overload and other risk factors related to hypertension risk among the Police Mobile Brigade (Brimob). *Med J Indones* 2008; 17:188-196.
 12. Setiawan ZY. Work stress and mental health trend of mental emotional in news paper editors in Jakarta [thesis]. Jakarta. Univ Indonesia. 2006.
 13. Costa G. Working and health conditions of Italian air traffic controllers. *Int J Occup Safety Ergonomic.* 2001; 6:365-82 [Cited 2008 Oktober 20]. Available from <http://www.ciop.pl/807.html>
 14. Widyahening IS, High level of work Stressors increase the risk of mental-emotional disturbances among airline pilots. *Med J Indones* 2007; 16:117-21.