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Mental Health in High-Tech System

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Abstract

Stress and mental health at the place of work have received great attention by researchers. In spite of technology improvement in high-tech systems, the operators face new problems, which can affect mental health. There is hardly any published research about stress or mental health in such workplaces in developing countries. This paper presents the application of the self-rating scale General Health Questionnaire (GHQ-28) to study mental health of 160 controllers working in a part of Air Traffic Control (ATC) as a high-tech system in Iran. Logistic regression analysis showed that demographic variables did not exhibit a statistically significant effect on scores of the test. In order to compare mental health of these operators with general population, an exposure / non-exposure study was designed. Three age groups (less than 29 years, 30 through 39 y, and more than 40 y) were compared in exposed and non-exposed groups. The results of Fisher's exact test showed that mental distress symptoms were significantly higher in the exposed group. There were significant job effects on somatization, anxiety and depression as well as on the total score of GHQ-28 for the two first age groups ($P<.05$). No significant effects of the job were found on social dysfunction symptoms in any age groups. The risk ratio of expressing depression and anxiety symptoms were more than three times greater in these operators than general population.

Keywords: *Mental health, Air traffic control (ATC), GHQ-28, High tech system, Iran*

Introduction

There is a common concern about job stress in post-industrialized countries. A study conducted in the USA concluded that 29% of workers experience various level of stress at the place of work (1). Clearly both employees and employers have to share the burden of detrimental effects of work stress on mental health problems. There is ample scientific evidence to suggest that prolonged exposure to job stress is associated with several types of chronic health problems, including cardio-vascular diseases, particularly hypertension, and musculoskeletal and psychological distress. These problems affect organizations and nations. In the USA, for example, expenditure on health care is nearly 50% higher for workers who report high levels of stress at work (2). The European Union estimates that job stress affects at least 40 million workers in its 15 Member States and that it costs the European Union at least 20 billion euros annually (3). Stress factors can affect not only job satisfaction, but also the well-being and safety of operators and can develop staff burnout (4, 5).

Some authors suggest that human factors engineering should turn its attention to a range of factors, especially social ones, which influence work performance. Stress is a social factor that has received great attention by accident causation researchers. Therefore, if information processing ability, which appears to have good

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face validity to accident occurrence in high technology systems, is susceptible to frequently occurring transient states brought on by stress, then the underlying relationship is important to accident prevention (6).

More recently studies point to the air traffic controllers as an occupational group which has to cope with a highly demanding job that involves a complex series of tasks, requiring high levels of knowledge and expertise, combined with high levels of responsibility (3). The ATC controller must constantly reorganize his or her system of processing flight information by changing operating methods (in particular, cognitive processes, conversation, coordinating with assistants, anticipation and solving problems) as they arise and interact with each other. This is carried out by means of the precise and effective application of rules and procedures that, however,need flexible adjustments according to differing circumstances, often under time pressure. At the same time, the job includes high levels of responsibility, not only with regard to risking lives, but also for the high economic costs of aeronautical activities (4).

Although the importance of relationship between mental health and productivity and company profitability has been realized (7), there is little statistical data on financial loss due to mental health problems in developing countries. Job stress study is in its early stages of development in these countries and needs more attention, even more so for high-tech systems.

With regard to the lack of information in this area, and to find the most important effect of stress in ATC; a mental health study was carried out in a part of ATC in Iran by using a Farsi version of the General Health Questionnaire in its 28-item version (GHQ-28). GHQ-28, which is being used worldwide, was used in a national health survey in Iran (8). Therefore, the data from the general public could be compared with the data from the present study to understand mental health condition in the workplace of interest.

Materials and Methods

Study design An exposure/ non-exposure design was used to conduct a study of mental health in ATC as a high-tech system.

Participants The exposed group included all controllers (195 people) working in a part of ATC in Iran. Due to small number of women operators (6 people) and the operators who worked at daytime only (10 people), they were excluded from the study. Some of the operators (15 people) were not available during the study, due to participation in a refresh course, held out of the workplace; and one operator avoided taking part in the study. Data from three operators who were on psychotherapeutic medication were also omitted. The final analysis was, therefore, limited to 160 of the controllers. After describing the study to the participants, they were especially assured that no information that they would provide would be communicated to anyone.

The non-exposed group (general population) consisted of 1540 men in the same province that was obtained by the National Health Survey in Iran in 2001 (8). The exposed and non-exposed groups were restricted to be in the age interval from 23 to 52.

Instrument and scaling The study used the General Health Questionnaire-28 (GHQ-28) to measure the dependent variables. It was a self-administered questionnaire that has been used by many researchers. The validation studies have been thorough and extensive and the questionnaire shows a high degree of validity (9). This instrument is a 28-item measure of emotional distress, which is divided into four subscales: somatic symptoms (items 1-7), anxiety/insomnia (items 8-14), social dysfunction (items 15-21) and severe depression (items 22-28). The responses were translated into scores, with a maximum of 7 points in each section. Although there are different cut points for GHQ in literatures, we used a cut-off score of two for each subscales and six for total score, because this scoring had been used previously in the

study of National Health Survey in Iran (8). By this scoring, if the total score was 5 or less (from 28) then the person was regarded healthy. The higher the GHQ-28 scores the greater the degree to which the subject may suffer from a psychiatric distress. Filling in the questionnaire is very simple and quick (5 min).

Variables and statistical analyses The entered data was double-checked and then analyzed statistically. Descriptive statistics were used to present the demographic variables, subscales and total scores of GHQ-28. The demographic variables included age, job experience, marital status, level of education and professional skill level in job. Age and job experience were quantitative and continuous (in years). The others were coded as follows: marital status [No wife (unmarried, divorced, and widowed)=1, married=2],level of education (graduated from level one=1, student in level two and working as a controller at the same time=2, graduated from level two=3), and professional skill level in job (low level=1, moderate=2, high level=3).

Forward Logistic regression (Likelihood Ratio) analyses were performed to find out the demographic variables associated with GHQ-28 subscales & total scores. In order to carry out logistic regression analysis based on reference cut points, the dependent variables were dichotomized. Subscales with scores 0 & 1 were regarded "without symptoms" and were coded "zero". Scores 2 or more were regarded "with symptoms" and were coded "one". Total score of GHQ-28 was dichotomized to "zero" and "one", to indicate a healthy person and a person with symptoms of mental distress, respectively ("zero" for 5 and less, and "one" for 6 and 7).

Chi-square analysis was used to compare the exposed group with non-exposed in terms of dichotomized dependent variables. All subjects were divided into three groups based on age: less than 29 years=1, 30 through 39 years=2, more than 40 years=3. In all analyses, a p-value less than .05 was considered significant.

Results

The descriptive statistics of demographic characteristics showed that half of the 160 participants were 28 years old or younger with less than or equal to 6 years of job experience. In addition, it was revealed that 70.1 % were married; and 23% were student and operator at the same time. There were 3 different professional skills, 50.6% with low, 27.5% with medium and 21.9% with high level.

The results of descriptive statistics of scores for the four subscales of GHQ-28 are presented in Table 1. The table shows that social dysfunction has the lowest mean score, while depression has the highest mean score among the subscales. The dichotomized scores for the four sub-scales and the total score of the GHQ-28 are presented in Fig. 1.

Table 1: Scores for the four subscales of the GHQ test

Sub-scales	**Somatization**		**Anxiety**		**Social dysfunction**		**Depression**	
Scores	***Frequency***	***Cumulative Percent***	***Frequency***	***Cumulative Percent***	***Frequency***	***Cumulative Percent***	***Frequency***	***Cumulative Percent***
.00	73	45.6	55	34.4	68	42.5	52	32.5
1.00	28	63.1	29	52.5	57	78.1	39	56.9
2.00	22	76.9	22	66.3	20	90.6	20	69.4
3.00	14	85.6	17	76.9	13	98.8	15	78.8
4.00	10	91.9	13	85.0	2	100.0	13	86.9
5.00	6	95.6	14	93.8			8	91.9
6.00	6	99.4	8	98.8			5	95.0
7.00	1	100.0	2	100.0			8	100.0
Total	160		160		160		160	

No relations between demographic and dependent variables were detected. There were only two exceptions: significant negative relations between depression and level of professional skill(ß=-109.38, *P*=17); and total score of GHQ and working experience (ß=-109.65, *P*=.033).

To compare mental health between exposed and non-exposed groups, we categorized all subjects into three groups according to their age. Exposed and non-exposed groups did not show any significant differences in terms of the dependent variables. Fisher's exact test was used to examine the (possible) dependence of dichotomized dependent variables on the exposed/non-exposed groups, inside each age group.

The results of this analysis showed that for two first age groups (less than 29 years and 30-39 years), mental distress symptoms were significantly higher in the exposed group than in the non-exposed group. There were significant job effects on somatization, anxiety and depression as well as on the total score of GHQ-28 for the two first age groups. No significant effects of the job were found on social dysfunction symptoms in any age group.

In the third age group (more than 40 years) significantly higher depression was seen in exposed group than in non-exposed group. The other dependent variables did not show significant difference between exposed group and non-exposed group in this age group.

Table 2 and Fig. 1 show the results of Fisher's exact tests.

Table 2: Results of Fisher's exact tests

Sub-scales	**Somatization (Cut point = 2)**		**Anxiety (Cut point = 2)**		**Social dysfunction (Cut point = 2)**		**Depression (Cut point = 2)**		**GHQ-28 (Cut point = 6)**	
Age groups	***Case %***	***Control %***	***Case %***	***Control %***	***Case %***	***Control %***	***Case %***	***Control %***	***Case %***	***Control %***
Less than 29y.	40.7	8.8	51.6	14.7	*NS		48.4	16.4	49.5	16.1
	P<.0001		P<.0001				P=.067		P<.0001	
30-39y.	36.2	12.2	46.8	17.8	NS		40.4	11.3	44.7	15.2
	P<.0001		P<.0001				P<.0001		P<.0001	
More than 40y.	NS		NS		NS		27.2	11	NS	
							P=.019			

*Not significant

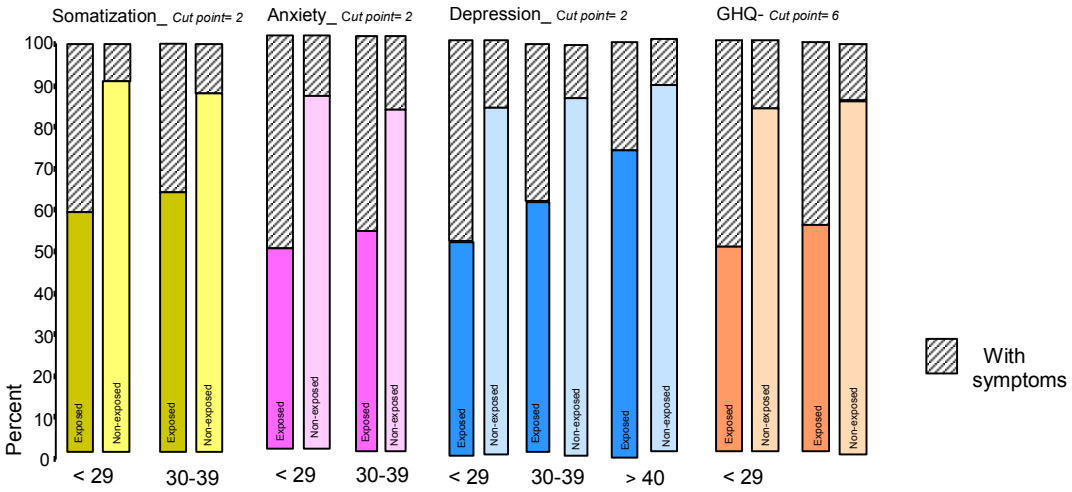

Fig.1: Comparison of mental health in exposed and non-exposed groups, according to age groups

Discussion

The objective of the study was two-fold. The first objective was to examine the relationship between levels of stress and demographic characteristic amongst controllers in ATC. The second was to compare the stress levels of controllers with those of the general population.

Descriptive statistics showed that about half of participants (43.8%)could be classified, according to the GHQ-28 (cut point 6), as suffering from mental distress.

Logistic regression analysis showed that demographic variables did not exhibit a statistically significant effect on any scores of GHQ-28. The effects of some of the demographic variables, e.g. marital status, have been found significant in some of the earlier studies on the subjects. For example, Calna et al showed that marital status was a powerful predictor of workplace mental distress for health workers (10). It is conceivable that the stress caused by the job under the present study has covered the effects of marriage and other mentioned demographic variables on our dependent variables. For example, the inherent stress of working as an ATC controller and special characteristics of the organization (e.g. high security) may explain these opposite findings. However, the level of professional skill showed significant negative effect on depression. This is also true for the effect of working experience on total score of GHQ, which is work experience, also decreases GHQ. There may be either a little coping stress strategies related to these factors, or operators with better mental health long stand on the work and do not change their job. However, finding out the reason needs more researches.

Comparison of our data with those of the National Health Survey in Iran (8) showed that the level of stress in this kind of systems was markedly higher than that found in the general population.

One way to explain these results is to suggest that the rates of stress were artificially indicated by the methodological approach, specifically, that studies which are explicitly concerned with work stress "prime" the respondent to exaggerate the reporting of psychiatric symptoms, as compared with studies where the emphasis is less on work stress and more on "health in general". Some other researchers have cited this point too. For example, Calna et al in their study on workplace stress found that stress lev-

els in doctors were higher than in general population. But, McManus et al showed that stress levels in doctors were equivalent to those in the general population (10). However, variation in stress levels can also be explained, at least in part, by the characteristics of the job.

The results of Fisher's exact test indicate that social dysfunction is less affected by mental distress, with no significant difference against the general population. This may relate to reserved Iranian culture.

It is found that as age increases, the effect of the job on the other subscales decreases. The two first age groups seem to need more attention due to higher scores of somatization, anxiety and depression, as well as total score of GHQ-28.

Also, it was evident that higher depression was associated with the job in all age groups. The other dependent variables did not show any significant difference between exposed and non-exposed in the third age group. It seems that depression is the most stable and the main problem (risk ratio= 3.45) in this job (Tables 3 and 4). Therefore, further research in ATC is recommended, using specific depression tests such as BDI (Beck Depression Inventory).

Table 3: The associated risk ratio with the job

Sub-scales / Groups	Somatization (Cut point= 2)	Anxiety (Cut point= 2)	Social dysfunction (Cut point= 2)	Depression (Cut point=2)	GHQ (Cut point =6)
Exposed (%)	36.9	47.5	21.9	43.1	43.8
Nonexposed (%)	10.8	16.9	13.4	12.5	14.5
Risk ratio	3.42	2.81	1.63 (*NS)	3.45	3.02

*Not significant

Since the lack of knowledge on stress coping strategies added further vulnerabilities (7), we emphasize on Critical Incident Stress Management (CISM). Certainly, the best way to decrease the prevalence of distress is individual treatment, combined with organizational attempts to reduce work stress (11).

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