

## Effort Reward Imbalance for Psychological Morbidity among First Year Postgraduate Residents

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### Abstract

**Objective:** Many studies have reported that the first postgraduate year (PGY-1) of residency training is marked by severe job stress. We want to investigate the mental health of PGY1 residents and to explore its relationship among job stress and personality.

**Methods:** Ninety-two PGY1 residents training at a regional teaching hospital in southern Taiwan were enrolled. The questionnaires used were tested and included the: Effort Reward Imbalance Questionnaire, Eysenck Personality Questionnaire, and Chinese version of the General Health Questionnaire, before and after participating in the psychiatry training program. The relationship between job stress, personality and psychological morbidity was tested using the generalized estimating equation-I.

**Results:** Fifty-six residents completed the follow up study. There were 23.2% (13/56) of the residents found to have psychological morbidity. There were no significant differences with regard to gender, age, and general data between two groups with or without psychological morbidity. The psychological morbidity was associated with neuroticism ( $B=0.04$ ,  $p=0.008$ ); and associate with effort reward imbalance ( $B=1.07$ ,  $p=0.012$ ).

**Conclusions:** This follow up study showed the neuroticism and effort reward imbalance might be closely related to psychological morbidity of PGY1. In designing educational program for PGY, it needs to concern the individual personality factor and job stress dimensions.

**Keywords:** Follow up study; Job stress; Neuroticism; First postgraduate year; Psychological morbidity

### Introduction

In teaching hospitals, the relative factors about practice and training performance are important issues in educational policy. Due to the toll on physical strength, the doctors' health might be affected as well as their learning capacity and quality of patient care responsibilities [1,2]. According to previous investigations, excessive pressure derives mainly from work that can easily cause physical dysfunction [3]. With regard to mental function, the response to pressure might cause anxiety, depression, impatient or indifference behavior, poor memory, attention deficits, which can cause making strategic decisions difficult, overreaction to excessive criticism, poor problem solving and loss of originality, sleep problems and substance abuse such as cigarette and alcohol use [4,5].

Compared to the general society in which psychological morbidity is reported to be between 9% and 24% in males and between 21% and 33.3% in women, psychological morbidity is more common among physicians (27 to 52%) [6,7]. In a previous report, by this group, it was around 28%, with younger subjects having a higher prevalence [5]. In

a cross sectional study, job stress and work hours explained 24.7% of the variance in subjects with burnout; in addition, personality and coping strategies explained an additional 10.4% and 5.4% of the variance, respectively. The reasons for the poor health outcomes in physicians are of critical importance; especially for the first-year postgraduate residents (PGY1) [8].

Few studies have investigated personality and the variables associated with medical school with regard to work stress and health after graduation [9]. It is of great importance to investigate these factors because this information may be used in the recruitment/admittance process of medical schools, and possibly to improve medical education [10]. Physicians show an increased prevalence of mental health problems, with the first postgraduate year being particularly stressful. Many predictors of mental health problems in medical school have included: previous mental health problems; not being married/cohabitant; the personality traits 'vulnerability' (or neuroticism); perceived stress, and lack of perceived diagnostic skills [11-13]. In comparison of measurement instruments on job strain, one study showed the decision-making authority [14], one in social support [15], the reasons of subscale and secular change show the associations between job strain on overcommitment and reward remained significant after eight years follow-up [16]. The aims of this

study were to investigate the psychological morbidity of PGY-1 residents and explore its relationship among job stress by effort reward imbalance and personality using a follow up study design at a regional teaching hospital in southern Taiwan.

## Methods

The training course of the PGY-1 residents had been carried out at the medical college, scheduled as a month at the six affiliated teaching hospitals. The PGY1 psychiatry program involves one month of training in community medical science, to foster the attitude, and responsibility of assisting patients, as they recover, to return to the community. The concrete plans during the first week focus on orientation (including a brief introduction to psychiatry); the second week focused on the community rehabilitation center (including understanding the condition of the patient and occupational therapy, and farm shelters); the third week focused on community service (including on-the-spot investigation in the community, home care conferences and visits); the fourth week focused on visiting the network hospital, visiting and understanding the network hospital connection [17]. In this study, we used a follow up study design and repeated measurement to test the causal relationship of psychological morbidity from individual or environmental reasons. The Institution Review Board of the regional teaching hospital approved this study, the informed consent from the volunteering PGY1 residents was obtained to collect basic information; the data were kept confidential by following the Helsinki principle. The subjects filled out a series of questionnaires: Eysenck personality questionnaire (EPQ), general health questionnaire Chinese version (CHQ) and the effort reward imbalance questionnaire (ERIQ) on the first day. One month later, they filled out the CHQ once again; this was done in order to determine the correlation of individual variance such as gender, age, educational level, religion, marriage, life events (such as death of a relative, economic stress, marital or divorce event, sentinel events, and malpractice problems with legal implications), medical illness (such as diabetes and hypertension and/or other history of chronic disease), personality, and/or job stress with psychological morbidity in the PGY1 residents.

## Participants

The participants were 92 PGY1 residents, from two regional teaching hospitals and four medical centers in southern Taiwan that focused on the field of community medical science, from January 2007 to December 2008. Fifty-six residents were recruited after signed the inform consent and finished the follow up study. There were 15 female and 41 male residents included in the study. The age range was from 26 to 32 years of age. There were 23.2% (13/56) of the residents found to have psychological morbidity based on the two surveys. In the first survey, 13 residents had psychological morbidity. In the repeated measurement of the CHQ, 9 residents reported improvement during the PGY1 training course, while 8 residents had worsening of their condition; two residents had persistent symptoms. Therefore, 17.9% (10/56) had psychological morbidity. Thirty-two residents came from another hospital, and 24 from our regional teaching hospital. Twenty-five residents will fix in internal medicine, 12 in surgery department, others in pediatrics, orthopedics and so on. Most of the residents were single.

## Instruments

The personal data included gender, age, job category, educational level, marital status, smoking history, alcohol consumption history, history of hypnotic drug use, and life events over the past six months. The definition of life events included the death of a relative, economic stress, marital or divorce event, sentinel events, and malpractice problems with legal implications. The survey instruments used were the: Eysenck Personality Questionnaire (EPQ), Chinese version of General Health Questionnaire (CHQ) and the Effort Reward Imbalance Questionnaire (ERIQ).

### Chinese version of General Health Questionnaire (CHQ)

The General Health Questionnaire-12 (Chinese Version) (CHQ) is a self-administered screening instrument used to assess psychological morbidity and minor psychiatric disorders. In the Chinese version of this instrument, two culturally relevant items have been added: a Chinese interpretation of anxiety ("huoqi") and somatic pain. The four answer choices for each CHQ item were assigned either a score of 0 or 1. "Not at all" and "About as usual" were assigned a score of 0, and "more than usual" and "always" a score of 1. Psychopathology was considered based on the total score of all 12 questions. The participants were subdivided into potential cases ( $\geq 3$ ) and noncases ( $\leq 2$ ). This optimum cutoff point provides the best compromise between high sensitivity and a low false-positive rate, based on the Receiver Operating Characteristic curves, with a Cronbach's alpha of 0.79 [18].

### Eysenck Personality Questionnaire (EPQ)

The EPQ was developed theoretically based on personality traits [19]; the Chinese version was developed by Lu, in 1994. The EPQ is composed of two major personality traits, extraversion and neuroticism [20, 21], with 14 and 11 items each. Higher scores tend to reveal higher levels of extraversion and neuroticism. Those that are extraverted are more sociable and impulsive, and those that are neurotic are more anxious and emotional [21]. The Chinese version demonstrated a high internal consistency of 0.90, with an internal consistency of 0.83 for the extraversion dimension and 0.80 for the neuroticism dimension which is the most widespread valid and reliable instrument in Taiwan. This study also found a high internal consistency of Chronbach's alpha of 0.87 for the extraversion dimension and 0.90 for the neuroticism dimension [22].

### Effort Reward Imbalance Questionnaire (ERIQ)

The 23 item ERIQ consisted of three categories: "effort" (6 items), "reward" (11 items, including esteem, job promotion, and job security), and "overcommitment" (6 items). Responses to the items of "effort" and "reward" were scored on a fivepoint scale, 1 indicating no particularly stressful experience and 5 indicating a very highly stressful experience. The Cronbach alpha coefficients for "effort", "reward", and "overcommitment" for men were: 0.80, 0.82, and 0.66, respectively and for women, 0.83, 0.80 and 0.66 [23]. According to a predefined algorithm, the ratio between the two categories of "effort" and "reward" (weighted by item numbers) was calculated to quantify the degree of mismatch between high cost and low gain [24]. "Effort" and "reward" were coded as dichotomous variables using the median of the total sample as the cutoff point [24,25]. Similarly, a positive effortreward

imbalance was defined by both high effort and low reward; a negative effortreward imbalance was defined by only high effort or low reward as well as by neither high effort nor low reward. A high effortreward ratio (ER ratio) and overcommitment were defined as falling within the upper tertile of the total distribution [16,25].

### Data Analysis

The chi-square test, student t test were used to examine the differences in the demographic variables between the two groups with or without psychological morbidity. The generalized estimating equation analysis was used to assess the relationships among gender, age, effort, reward, and personality factors to psychological morbidity.

A p-value <0.05 was considered significant. All statistical operations were performed using the SPSS 15.0 for Windows software package (SPSS, Chicago, IL., USA).

### Results

The on duty days of residents decreased from 8 to 7 days per month. The average working hour is around 70 hours per week. There were no significant differences with regard to: gender, age, alcohol use, use of hypnotics, medical illness or life events and demographic data (p>0.05) between the two groups with and without psychological morbidity (Table 1). The total score of the first CHQ survey was  $0.9 \pm 1.4$  and for the second survey it was  $1.6 \pm 3.0$  (p=0.03).

	Psychological morbidity		t/x <sup>2</sup> /F	Sig.
	Cases 13	Non 43		
Gender			1.18	0.278
male	8	33		
female	5	10		
Age	28.2 ± 2.8	28.2 ± 2.5	0.01	0.997
Belong			1.01	0.315
RTH	4	20		
others	9	23		
Department			4.37	0.112
Internal medicine	9	16		
surgery	1	11		
others	3	16		
Marriage			0.07	0.791
single	11	35		
married	2	8		
Smoking			1.12	0.572
yes	1	1		
no	12	42		
Alcohol use			1.30	0.254
yes	0	4		
no	13	39		
Hypnotics			1.53	0.217
yes	2	1		
no	11	42		
Medical illness			0.97	0.641
yes	5	10		
no	8	33		

Life events				
yes	2	2		
no	11	41		

**Table 1:** Demographic data of first-year postgraduate residents with and without psychological morbidity, at a regional teaching hospital in southern Taiwan, RTH abbreviation of regional teaching hospital; student t, Chi-square and ANOVA were used to test between groups.

The comparison of extraversion ( $5.33 \pm 3.94$ ,  $5.74 \pm 3.85$ ,  $p=0.751$ ), neuroticism ( $6.31 \pm 1.84$ ,  $3.58 \pm 3.01$ ,  $p=0.003$ ), effort ( $38.77 \pm 6.35$ ,  $34.74 \pm 6.49$ ,  $p=0.054$ ), reward ( $27.62 \pm 3.99$ ,  $28.84 \pm 3.72$ ,  $p=0.311$ ), effort-reward imbalance ( $0.71 \pm 0.13$ ,  $0.61 \pm 0.13$ ,  $p= 0.019$ ) and overcommitment ( $18.38 \pm 2.99$ ,  $16.26 \pm 2.62$ ,  $p=0.016$ ), between the two groups with and without psychological morbidity, which showed higher neuroticism, ERI and overcommitment scores on the group with psychological morbidity (Table 2).

	Psychological morbidity N=13	Non-cases N=43	t	Sig.
Extraversion	5.33 ± 3.94	5.74 ± 3.85	0.32	0.751
Neuroticism	6.31 ± 1.84	3.58 ± 3.01	-3.09	0.003
Effort	38.77 ± 6.35	34.74 ± 6.49	-1.97	0.054
Reward	27.62 ± 3.99	28.84 ± 3.72	1.02	0.311
ERI	0.71 ± 0.13	0.61 ± 0.13	-2.43	0.019
Overcommitment	18.38 ± 2.99	16.26 ± 2.62	-2.49	0.016

**Table 2:** The data from the Effort Reward Imbalance Questionnaire, Eysenck Personality Questionnaire, and Chinese version of the General Health Questionnaire of PGY-1 residents before a psychiatry training program. ERI: effort imbalance ratio Student t test was test between cases with non-cases.

Parameter	B	95% Confidence Interval		Wald Chi-Square	Sig.	
		S.E.	Lower			Upper
Intercept	-0.46	0.24	-0.93	0.02	3.48	0.062
Male	-0.17	0.12	-0.40	0.06	2.14	0.144
Female	0a					
Extraversion	-0.01	0.01	-0.03	0.01	0.56	0.456
Neuroticism	0.04	0.02	0.01	0.07	7.08	0.008
ERI	1.07	0.42	0.24	1.90	6.37	0.012

**Table 3:** The psychological morbidity of PGY residents analyzed with job stress and personality by the generalized estimating equation-I, Department variable: psychological morbidity of base survey and follow up , Method: parsimonious model of (intercept), gender, extraversion, neuroticism, and ERI analyzed by GEE. a: set to zero because this parameter is redundant.

When the dependent variable was set as the pre and after CHQ tests, the unstructured working correlation matrix method with factors such as gender, age, alcohol, smoking, life events, covariates such as extraversion, neuroticism, effort and reward were used in the method of estimation (Table 3). In parsimonious model under repeated measurement of generalized estimated equation, the neuroticism was associated with psychological morbidity ( $B=0.04$ ,  $p=0.008$ ); the ERI associated with psychological morbidity too ( $B=1.07$ ,  $p=0.012$ ).

## Discussion

The results of this study showed that the resident`s personality and job stress were closely related to their general health. The reasons of above might be due to firstly, the outcome variable is the nature of mental health which more correlated with personality; secondly, the well structural training course and payment system of PGY are constant which made the individual effort and reward less variable. No matter how, in assessing psychological morbidity, the personal characteristic and job stress, especially for female resident, were important factors. The prevalence of psychological morbidity for all

participating PGY-1 residents of this study was 23.2%, higher in female physicians (33.3%). In a previous report it was around 28% [5], which is consistent with the current results. The lower frequency of alcohol, smoking and hypnotic drug use in the subjects reported here with psychological morbidity might be a result of gender and department differences which affect the distribution of the substance use frequency. Therefore, this study presents a demographic picture different from other reports [6,12,13,15].

Psychiatry training is thought to be easier than other specialties; due to the shorter working hours and on call days. The definition of a case was the total score of the CHQ 3; the mean result of the total score of the first CHQ survey was lower than the second survey. The fewer on call days was not reflected in a better total CHQ score in this follow up study. This might have been due to in the fact that for the community support program, of the regional teaching hospital, had to join the community service program in the day time; the PGY1 residents had to finish their charting of patient records in the acute ward during the night, which increased the number of working hours. Another possible reason might be that the regional teaching hospital is the only open model integrative delivery system in Taiwan, which includes the high tension and work loading on duty of risky assessments in care quality for acute mental disorder patients which are unanticipated as PGY1's choice [17]. The other reason might be due to the uncertainty of questionnaire, people with a score of 3, exceeding the cut-off level, have a 50% probability of being a case; the probability highly rises with increasing scores [26]. In our previous study, we found the secular changes in perceptions of job strain to be significantly associated with psychological morbidity in our study population working in a changing work environment [16]. In the future, the investigation of different characteristics among different specialties using the electronic time clock system instead of a self-report system during working hours might improve the accuracy of the information collected.

Job stress, assessed by the ERIQ in various working environments, in different countries, has been widely reported. However, application of this model to physicians has been relatively rare. The PGY-1 residents have constant and increasing extrinsic and intrinsic stress with a negative impact on health and life satisfaction. In ERI model [27], there is explicit emphasis on individual attributes, particularly coping characteristics of high intrinsic effort, which is defined by the concept of "need for control". The extrinsic efforts, defined by a high workload, are also specified. This model also takes three different sources of reward into account: financial, esteem, and occupational social status control (i.e., promotion prospects and job security). Variables measuring low reward in terms of low status control in relation to high extrinsic effort or intrinsic effort have been shown to independently predict new cardiovascular events in a prospective study [28-30]. ERI and overcommitment have been identified as biological correlates of salivary cortisol and higher blood pressure [31]. ERI has also been linked to other outcomes including sick leave [32], alcohol dependence [33], psychological wellbeing [34], burnout, and job satisfaction [35,36]. In this study, for the PGY1 physician job category; the ERI and overcommitment might be valid factors to assess the relationship of psychological morbidity with job stress in student-t test, but overcommitment did not touch the effect in the regression analysis which might be due to ERI interact with overcommitment. The other reason might be due to the overcommitment is professional culture and habit in physicians. These associations based on one baseline estimate of job strain may not be accurate because they fail to

take into account changes in perceptions of that factor over time [15,16].

The results of this study showed that overcommitment might be a good predictor of psychological morbidity for both genders. The other studies were better for men than women which might be due to the gender distribution in the study sample [31,37]. Overcommitment at work has been associated with psychological morbidity in several studies [6,16,38-40]. The ERI was used in this study, a psychometrically accepted measure of work-related stress and overcommitment grounded in sociological theory [24]. Overcommitment is an independent concept because it stems from intrinsic effort/need for control and approval [41] and the inability to withdraw from work [42]. In this study, high overcommitment revealed significantly higher psychological morbidity; however, the results were not significant when the analysis was performed with effort and reward. The reason might be the selection bias in the choice of PGY1 where psychiatry teaching run could not show the change in effort reward imbalance. The other reason might be in the characteristic of physician which needs general long duty days and working hours during the training period.

In this study, neuroticism was a good predictor to psychological morbidity. Neuroticism predicted a more negative effect on aversive and threat cues, and the aversive pictures/recovery period [13]. One reported PGY who exhibited less neuroticism, more conscientiousness and a propensity for positive affectivity, as well as a tendency to use engagement coping strategies [8]. In facing aversive events and high job stress, as with PGY-1 residents, neuroticism predicts affective responses and inverse affective recovery successfully. In this study, we found significant difference of the neuroticism and overcommitment between the case and control group. There were few published papers on investigating these two factors simultaneously in scientific field. We hypothesize the neuroticism interact to the inability withdraw from work as overcommitment [24], resulting in continued exaggerated efforts combined with disappointing rewards, might also increase the risk of poor health. In the future, we need larger sample size and follow up study to explore the role of neuroticism and overcommitment [6,16].

## Limitations

The limitations of this study include the following. The small sample size does not represent all residents including those of other hospitals, ethnicities and from other countries. The different training locations of cluster might confound the main interesting. But repeated measurement would increase the longitudinal data sets by twofold from 56 to 112 data sets which might reduce the reporting bias even GEE is a method of estimation and the standard error of parameter might be underestimated. The fact that the subjects came from six different hospitals would be better because the inherent personality profile associated with PGY1 that is associated with their choice of specialty. Another limitation is the psychiatry course of one month was a short observation time; long term effects even with the follow up design might not be predicted from such a short-term study. A pre-post questioning at the beginning and the end of the PGY-1 would be the right method. However, the examination was held in the period of the PGY-1 psychiatry program which is not as stressful as the other specialties, especially for residents who would like to specialize in internal medicine, like most of them wanted to.

## Conclusion

This follow up study showed the neuroticism and effort reward imbalance might be closely related to psychological morbidity of PGY1. In designing educational program for PGY, it needs to concern the individual personality factor and job stress dimension.

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Disclosure statement that all authors explicitly declares there are not any conflicts of interest.

## Implications for Academic Leaders

The neuroticism was closely related to psychological morbidity of PGY1.

The effort reward imbalance in job stress was closely related to their general health.

In designing educational program for PGY, it needs to concern the individual personality factor and job stress dimension.

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