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# The Association of Occupational Stress with Anxiety among Chinese Civil Pilots: The Moderating Role of Type A Behavior Pattern

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**Highlights:**

- The complex relationship between the occupational stress and group anxiety symp-toms of Chinese civil aviation pilots
- Analyze the type A behavior pattern (TABP) as a mediator for occupational stress and group anxiety symptoms
- Overcommitment and TABP play moderating roles between occupational stress and anxiety.

**Abstract:** Pilots are highly susceptible to anxiety symptoms due to the uncertainty of the dangers of aviation operations and the potential terror and insecurity that pilots experience over time. This research aims to understand the complex relationship between the occupational stress and group anxiety symptoms of Chinese civil aviation pilots, and to analyze the type A behavior pattern (TABP) as a mediator for both issues. The occupational stress, anxiety symptoms and TABP of Chinese civil aviation pilots are investigated by using questionnaires based on the effort-reward-imbalance (ERI) scale, the Zung Self-Rating Anxiety Scale (SAS) and a TABP scale established based on Chinese people's inherent characteristics. The study revealed that higher occupational stress experienced by Chinese civil aviation pilots exacerbated their anxiety symptoms, and that overcommitment and TABP mediated the relationship between occupational stress and anxiety symptoms.

**Keywords:** occupational stress; type A behavior pattern; anxiety; civil pilots; occupational health



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## 1. Introduction

Anxiety disorder is a common psychological disease [1]. It is a feeling of dread with autonomic symptoms whether in or out of the stressful situation [2]. Anxiety itself is an inherently protective human response, but when it persists and evolves into an intense emotion, it can become a barrier to personal action, resulting in an anxiety disorder. Psychological changes can be caused by anxiety disorders, the symptoms of which may be intense distress, feelings and experiences of depression, vague terror of unknown origin, or negative feelings of unhappiness. This disorder not only leads to low productivity, but also increases work errors and creates safety hazards [3,4].

People who are engaged in long-term hazardous occupations are prone to temporary or permanent anxiety symptoms due to regular exertion. In the case of pilots, they are highly susceptible to anxiety symptoms due to the uncertainty of aviation operations and the potential terror and insecurity they experience over time. At the same time, the high

level of psychological stimulation from long flight hours, irregular diet, night flying and long-distance flights across time zones may also contribute to anxiety symptoms in civil aviation pilots. Some current investigations have confirmed that pilots do suffer from these symptoms. For example, the U.S. Bureau of Labor Statistics (BLS) released the Census of Fatal Occupational Injuries (CFOI), identifying pilots as the third most dangerous position. Picano reported 155 counseling records over two years from a psychological health clinic at a military pilot aviation training center in the United States, with the highest prevalence of anxiety symptoms at 26% [5].

One of the main causes of mental health issues is occupational stress [6–8]. A survey conducted by Ding et al. on a group of nursing staff showed that occupational stress has a positive predictive effect on anxiety symptoms [9]. The higher the stress level, the more pronounced the anxiety symptoms are. For civil aviation pilots, their workload is greater, their flight time is longer, and they can face various emergencies at any time, and these lead to a potentially higher level of occupational stress. In addition, due to the militarized management of Chinese civil aviation, a more complex and strict superior–subordinate relationship has developed, which may also generate and accumulate more occupational stress. Exploring the occupational stress levels of Chinese civil aviation pilots and the relationship between them and anxiety can help shed light on this topic.

Although studies have shown that occupational stress plays a direct and indirect role in the development of anxiety symptoms, few researchers have studied the potential mechanism of occupational stress on anxiety symptoms. One way to facilitate the unraveling of the mechanism is to introduce moderating variables to see how the effects occur.

Personality traits are common mediators. In the research of the Western Collaborative Study (WCGS), American cardiologists Friedman and Rosenman et al. [10] established a personal trait called TABP, which is a behavioral symptom associated with enhanced neuroendocrine responses, such as a tendency to desire to outperform others, intense competitiveness and lack of patience, and underlying TABP-type individuals live in a chronic, stressful rhythm, so that their thoughts, beliefs, emotions and behaviors develop unique patterns that consistently generate tension and stress from within. Suls et al. [11] found that people with a high neuroticism dimension more easily get anxiety symptoms, and they much more easily lose their living or working ability when they feel stressed. Research by Mcguire [12], Conger et al. [13] and others has found that accident creators tend to be emotionally unstable, impulsive, selfish, anti-social and ignorant of regulations. Shinar's research [14] indicated that outgoing or TABP pilots may incline to violate the rules much more, making it more likely to become a potential safety hazard. Evidently, there is a strong correlation between TABP-type personality traits and occupational stress and anxiety.

However, TABP's moderation of the relationship between pilots' occupational stress and their anxiety symptoms has not been studied. To explore the mechanism between occupational stress and anxiety symptoms, it is important to understand the role of Type A Behavior Pattern in this relationship.

Accordingly, the important research hypothesis of this study is: Type A Behavior Pattern plays a moderating role in the effects of occupational stress on anxiety symptoms among Chinese civil pilots.

To test this hypothesis, the following three tasks were carried out in this study. First, the anxiety symptoms of Chinese civil aviation pilots were investigated through a questionnaire. Second, the relationship between occupational stress and anxiety symptoms among Chinese civil aviation pilots was explored through statistical inference. Third, the moderating effect of TABP on the relationship between occupational stress and anxiety was discussed to discover the mechanism of the existence of pilot anxiety disorder, so as to provide a basis for, and help to improve, pilots' occupational stress and prevent their psychological anxiety.

## 2. Method

### *2.1. Participants*

A cross-sectional survey of Chinese airline pilots was conducted from December 2015 to June 2016. Anonymous, self-administered questionnaires were distributed at different state-owned airlines. A total of 213 questionnaires were distributed using a random sample for the formal questionnaire, from which 152 (71.36%) completed questionnaires were collected.

All participants participated voluntarily and signed an informed consent form prior to data collection. All data were collected anonymously. The survey was conducted with the approval of the Ethics Committee of the Faculty of Aeronautical Sciences and Engineering.

### *2.2. Measurement of Occupational Stress*

The Chinese version of the Effort-Reward-Imbalance (ERI) scale was used to assess occupational stress [15]. The reliability of the three subscales of the ERI scale (extrinsic effort, reward and overcommitment) has been demonstrated in several occupational groups [9,16–20].

The "Extrinsic effort" and "Reward" subscales consisted of 17 questions, with higher scores indicating higher levels of effort and reward. The "Overcommitment" subscale has six questions, with higher scores indicating higher levels of over-immersion in work. ERR = E/R ("E" is the mean score of Extrinsic effort, "R" is the mean score of Reward). An ERR greater than 1 means that the payoff is out of balance.

In this study, the Cronbach's Alpha for the Extrinsic effort section was 0.881, the Cronbach's Alpha for the Reward section was 0.859, and the Cronbach's Alpha for the Overcommitment section was 0.814.

### *2.3. Measurement of Anxiety*

Anxiety was measured by the Chinese version of the Zung Self-Rating Anxiety Scale (SAS) [21]. The SAS contains 20 items and each item could be scored on a self-rating scale from 1 to 4. The standard score (T score) is calculated by summing the self-rated scores of the 20 items and multiplying them by 1.25. According to the normal situation in China, a total index score $\geq$50 is considered as anxiety symptoms [22,23].

In this study, the Cronbach's alpha for this questionnaire was 0.752.

### *2.4. Measurement of Type A Behavior Pattern*

The scale of type A behavior pattern in Chinese was revised by the Chinese scholar Zhang Boyuan with his national collaborative study group in 1983 [24]. Based on some TABP scales in the United States, the Chinese version of the TABP scale with high reliability was developed after three tests and revisions, taking into account the inherent characteristics of Chinese people. The whole questionnaire consists of three subscales [25,26].

The TH subscale has a total of 25 items representing haste, urgency, rapid pace of action and other characteristics. The CH subscale has a total of 25 items representing competitiveness, lack of patience, hostility and other characteristics. The L subscale has a total of 10 items representing competitiveness, lack of patience, hostility and other characteristics. The L subscale has a total of 10 items that are used as lie detector questions to examine the confidence and attentiveness of the subjects.

The criteria for scoring this questionnaire are as follows: 50~37 means typical type A; 36~29 means medium type A bias (type A); 28~27 means medium (type M); 26~19 means medium type B bias (type B); 18~1 means typical type B. The L scores are for user research and reference only. Once an L score is equal to or greater than 7, the questionnaire is regarded as invalid [27,28].

In this study, the Cronbach's alpha for this questionnaire was 0.863.

### *2.5. Statistical Analysis*

Data were processed by SPSS 17.0 and statistical significance was set as two-tailed $p < 0.05$. The relationship between participants' characteristics and occupational stress, anxiety symptom scores and TABP scores was assessed by Pearson correlation analysis. The PROCESS [29] macro developed by Hayes [30] for SPSS was used to investigate the moderation of TABP in the association between anxiety symptoms and occupational stress.

## 3. Results

### *3.1. Participant Characteristics*

A total of 213 Chinese civil aviation pilots participated in this survey, and 152 questionnaires were returned. According to the scores in the L section of the TABP scale, a total of 11 questionnaires were invalid because the score in the L section was greater than or equal to 7. Therefore, there were 141 valid questionnaires (66.2%).

The distribution of the basic demographic information of the pilots providing valid questionnaires in this study is shown in Table 1.

**Table 1.** Participants' characteristics.

| Variables | Level | N | % |
|---|---|---|---|
| Age | ≤25 | 11 | 7.80% |
| | 26–35 | 112 | 79.43% |
| | 36–45 | 14 | 9.93% |
| | ≥45 | 4 | 2.84% |
| Marital status | Single | 57 | 40.43% |
| | Married | 83 | 58.87% |
| | Other | 1 | 0.71% |
| Education Level | Junior College | 20 | 14.18% |
| | Undergraduate | 119 | 84.40% |
| | Postgraduate or above | 2 | 1.42% |
| Years in service | 1–5 | 69 | 48.94% |
| | 6–10 | 43 | 30.50% |
| | 11–15 | 16 | 11.35% |
| | ≥15 | 13 | 9.22% |
| Position | Flying Cadet | 6 | 4.26% |
| | Co-Pilot | 87 | 61.70% |
| | Trainee Pilot/Captain | 26 | 18.44% |
| | Flight Instructor | 22 | 15.60% |
| Work status | Normal Route | 126 | 89.36% |
| | Recurrent | 10 | 7.09% |
| | Modification | 5 | 3.55% |

### *3.2. Descriptions of Occupational Stress, Anxiety Symptom Score and TABP Score*

The descriptions of occupational stress, anxiety symptom scores and TABP scores are shown in Table 2. In this study, the mean anxiety symptom score of participants was 41.27 (SD = 12.36) and the prevalence of anxiety symptoms was 26.2%.

**Table 2.** Descriptions of occupational stress, anxiety symptom score and TABP score.

| Scale | Measure | Items | Mean | SD |
|---|---|---|---|---|
| Occupational Stress | Extrinsic effort | 6 | 8.76 | 4.71 |
| | Reward | 11 | 14.17 | 6.59 |
| | Overcommitment | 6 | 8.99 | 2.66 |
| | ERR | 17 | 1.2 | 0.61 |
| SAS | SAS score | 20 | 41.27 | 12.36 |
| TABP | TABP score | 50 | 22.17 | 7.16 |

Note: SD: standard deviation.

### 3.3. Correlations among Occupational Stress, Anxiety Symptom Score and TABP Score

Figure 1 shows that anxiety symptoms were positively correlated with occupational stress levels ($p < 0.01$). TABP scores were positively correlated with anxiety symptoms ($p < 0.01$).

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 1.Age | 1 | | | | | | | |
| 2.Flight time | 0.676** | 1 | | | | | | |
| 3.Extrinsic effort | 0.092 | 0.184** | 1 | | | | | |
| 4.Reward | 0.102 | 0.138 | 0.687** | 1 | | | | |
| 5.Overcommitment | 0.071 | 0.148 | 0.446** | 0.332** | 1 | | | |
| 6.ERR | -0.03 | 0.111 | 0.474** | -0.187* | 0.196* | 1 | | |
| 7.SAS score | -0.126 | 0.049 | 0.389** | 0.194* | 0.598** | 0.375** | 1 | |
| 8.TABP score | 0.041 | 0.239** | 0.451** | 0.275** | 0.252** | 0.325** | 0.343** | 1 |

**Figure 1.** Correlations among occupational stress, anxiety symptom score and TABP score. Note: * significant at 2-tailed 0.05 level; ** significant at 2-tailed 0.01 level.

### 3.4. Moderating Effect Analysis with Overcommitment/TABP Score as Moderator

The moderating relationships were explored using hierarchical regression models [31]. Overcommitment score is introduced to check the moderating effect between ERR and anxiety symptom score. The model is shown in Figure 2 and results are shown in Table 3.

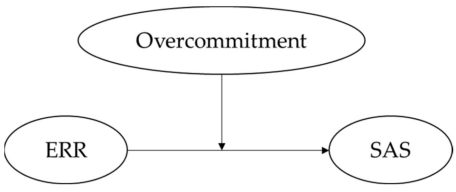


**Figure 2.** Regression analysis with overcommitment as a moderator.

**Table 3.** Regression analysis results, overcommitment as moderator.

| Variables | Coeff | *p* | LLCI | ULCI | $\Delta R^2$ |
|---|---|---|---|---|---|
| Constant | 29.446 | 0 | 41.5561 | 67.4849 | 0.254 * |
| ERR | −5.9495 | 0.1959 | −15.0015 | 3.1025 | |
| Overcommitment | 1.0102 | 0.1384 | −0.3302 | 2.3505 | |
| ERR × Overcommitment | 1.2369 | 0.0018 | 0.2783 | 2.1956 | |

Note: Age and flight time are covariates; * significant at 2-tailed 0.05 level.

The test results in Table 3 show that overcommitment moderates the interaction between occupational stress (ERR) and anxiety symptoms (SAS score) ($\Delta R^2 = 0.254$, $p < 0.05$). According to the test results, a moderating effects diagram is presented in Figure 3. Higher overcommitment scores will make the slope of the relationship between occupational stress and anxiety symptom larger. This means pilots who are overcommitted are more likely to have anxiety.

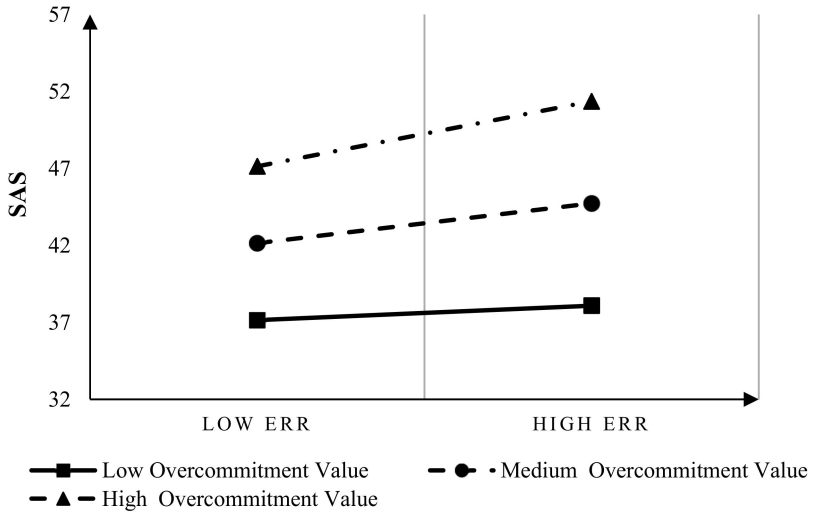


**Figure 3.** Overcommitment moderates interaction between occupational stress (ERR) and anxiety symptom (SAS score).

The TABP score is introduced to check the moderating effect between ERR and the anxiety symptoms score. The model is shown in Figure 4 and results are shown in Table 4.

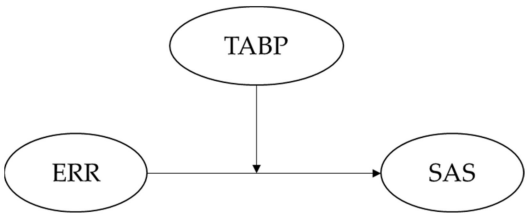


**Figure 4.** Regression analysis with TABP score as a moderator.

**Table 4.** Regression analysis results, TABP score as moderator.

| Variables | Coeff | *p* | LLCI | ULCI | $\Delta R^2$ |
|---|---|---|---|---|---|
| Constant | 13.4071 | 0 | 41.5561 | 67.4849 | 0.226 * |
| ERR | 15.8509 | 0.0028 | 5.5373 | 26.1646 | |
| TABP | 0.8735 | 0.0012 | 0.3511 | 1.3959 | |
| ERR × TABP | −0.3764 | 0.0488 | −0.7507 | −0.0021 | |

Note: Age and flight time are covariates; * significant at the 0.05 level (2-tailed).

The test results in Table 4 show that the TABP score moderates the interaction between occupational stress (ERR) and anxiety symptoms (SAS score) ($\Delta R^2 = 0.226$, $p < 0.05$). Figure 5 also shows that the TABP score moderates the interaction between occupational stress (ERR) and anxiety symptoms (SAS score). A higher TABP score will make the slope of the relationship between occupational stress and anxiety symptoms smaller. This means pilots who are the type A personality are less likely to havee anxiety.

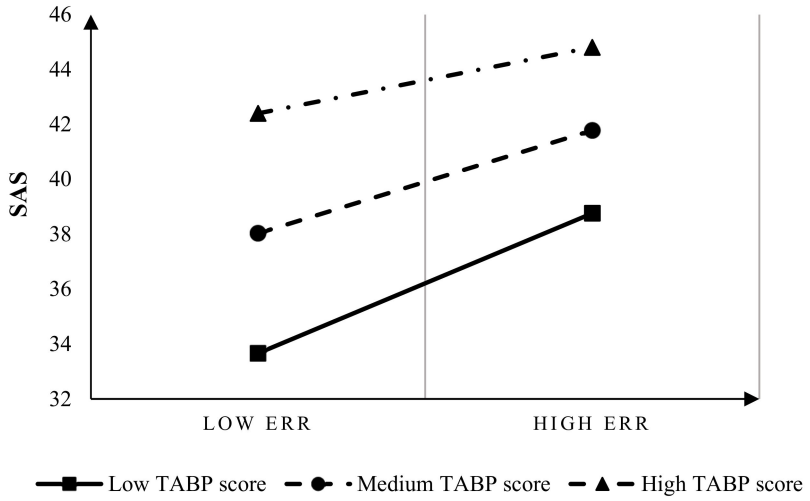


**Figure 5.** TABP score moderates interaction between occupational stress (ERR) and anxiety symptoms (SAS score).

Check the two variables (overcommitment and TABP score) as the moderators. The model is shown in Figure 6 and results are shown in Table 5. Overcommitment moderates the interaction between occupational stress (ERR) and anxiety symptoms (SAS score) while the moderating effect of the TABP score is mediated by the Overcommitment variable ($\Delta R^2 = 0.289$, $p < 0.05$).

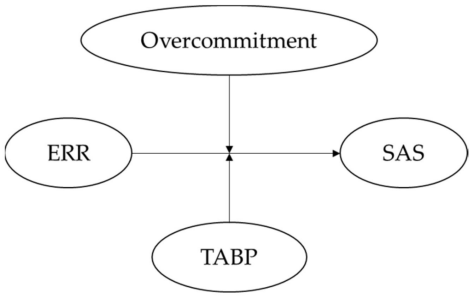


**Figure 6.** Regression analysis with overcommitment and TABP score as moderator.

**Table 5.** Regression analysis results, two variables as the moderators.

| Variables | Coeff | *p* | LLCI | ULCI | $\Delta R^2$ |
|---|---|---|---|---|---|
| Constant | 29.8667 | 0.0007 | 12.8657 | 46.8676 | 0.289 * |
| ERR | −7.3565 | 0.2906 | −21.0697 | 6.3568 | |
| Overcommitment | 0.773 | 0.258 | −0.5728 | 2.1187 | |
| ERR × Overcommitment | 1.3194 | 0.008 | 0.3503 | 2.2885 | |
| TABP | 0.2926 | 0.1962 | −0.1529 | 0.738 | |
| ERR × TABP | −0.0108 | 0.9469 | −0.3316 | 0.31 | |

Note: Age and flight time are covariates; * significant at the 0.05 level (2-tailed).

## 4. Discussion

This research investigates the group anxiety symptoms of Chinese civil aviation pilots, studies the complex relationship between a pilot's occupational stress and anxiety symptoms, and analyzes the mediator action of Type A Behavior Pattern on the above issues. Data indicate that the prevalence of anxiety among Chinese civil aviation pilots is

26.2% and higher than that (24%) of doctors in Amsterdam [4], Netherlands, and much higher than that of Chinese middle school teachers and students [32].

The Effort-Reward-Imbalance (ERI) scale and SAS scale used in this paper were translated into Chinese versions in reliable and valid ways that are applicable to the Chinese culture background and language use habits. The correlation analysis results in Figure 1 show that the ERR index of Chinese civil aviation pilots is significantly positively correlated with anxiety symptoms ($p < 0.01$), and so is overcommitment ($p < 0.01$), which findings are consistent with existing research [33]. As a technical profession, pilots are required to devote more time and effort to repeat the numerous exercises and trainings held by the CAA and airlines due to the high work intensity, workload and risk factor of their flying tasks, so thus pilots usually have a high external effort index. Also, according to the pilots' feedback, they need to attend various company meetings and manage their business even when they are not on flight duty, which further reduces their leisure and rest time [24]. In addition, Chinese domestic airline pilots are paid far less than their foreign counterparts, and the imbalance between intense work and income generates widespread negative emotions and occupational stress, further leading to anxiety. Therefore, airlines and the CAA should consider appropriately reducing pilots' flight time, increasing their rest time, and improving their pay and cockpit environment to alleviate occupational stress and anxiety symptoms. At the same time, more convenient and comfortable recreational activities should be provided to relieve their tension and fatigue and alleviate over-commitment, thus reducing the anxiety symptoms generated by occupational stress.

From the analysis of Figure 3, the overcommitment of a Chinese civil aviation pilot functions as a moderator between anxiety symptoms and occupational stress, implying that when a pilot devotes more into work, the occupational stress is more likely to evolve into anxiety disorders. Therefore, although a high ERR is matched by a high SAS, the relationship can be adjusted to reduce the effect of ERR and SAS through the regulation of overcommitment.

Finally, as shown in Table 5, the statistical analysis revealed that the moderating effect of TABP was not significant in the overall system model, which may indicate that the moderating effect of TABP occurs through Overcommitment as a mediator. This means that pilots with atypical Type A personality traits are more likely to be prone to transform their occupational stress into anxiety disorders because they are overeager to work. Overall, effective control of overcommitment levels is the best means of managing pilots' anxiety.

This research verifies that higher occupational stress suffered by Chinese civil aviation pilots can aggravate their anxiety symptoms and that overcommitment and TABP serve as moderators between the occupational stress and anxiety symptoms. However, this research has limitations to a certain extent. First, only 141 valid questionnaires were collected and the sample size was not large enough to support a powerful conclusion. The pilot samples need to be expanded to provide a solid data basis. Second, the data used in this research were obtained through a cross-sectional investigation of pilots' current status, not the effects generated after changes in a pilot's occupational stress levels, and thus cannot represent the causal relationships. Further research requires a longitudinal investigation of pilot occupational stress and anxiety symptoms.

## 5. Conclusions

Chinese civil aviation pilots are highly likely to experience anxiety symptoms, and both their overcommitment and TABP are mediators between occupational stress and anxiety symptoms; both increase the likelihood that occupational stress leads to anxiety symptoms. In order to effectively reduce pilots' anxiety symptoms, the influence of moderating variables should be fully exploited. Although some components of Type A behavioral styles are consistent with the group atmosphere and work goals of Chinese civil pilots, the negative effects on physical and mental health must not be ignored. In addition, it should also be combined with psychological training and other measures to control pilots' overcommitment levels and ensure an effective response of psychological resources.

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