

The Correlation between Sex, Age, Educational Background, and Hours of Service on Vigilance Level of ATC Officers in Air Nav Surabaya, Indonesia

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ABSTRACT

The vigilance of an Air Traffic Control (ATC) officer determines aviation safety. The number of aviation accidents tends to be increasing in recent years. Aviation accidents may be caused by human errors (i.e. errors made by pilot or ATC officer) or unsafe work condition. Sex, age, educational background, and hours of service might affect vigilance level of an ATC officer. This study was conducted to analyze the effect of sex, age, educational background and hours of service on ATC officers in Air Nav Surabaya vigilance level. This study applied cross-sectional study design with the number of samples was 41 staffs at Air Nav Surabaya. The obtained data were analyzed by using Chi-square test. The results of data analysis indicated that sex, age, and educational background variables did not significantly affect vigilance level of ATC officers in Air Nav Surabaya as indicated by chi-square values of sex variable ($p= 0.790$), age variable ($p= 0.241$), and educational background variable ($p= 0.335$). Meanwhile, hours of service variable significantly affected ATC officer vigilance level as indicated by Chi-square value (p) as much as 0.035. Based on these findings, it can be concluded that sex, age, and educational background variables did not correlate with ATC officers' vigilance level while hours of service variable significantly correlated with ATC officers' vigilance level.

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1. INTRODUCTION

Occupational health and safety must be optimal. Health can improve the ATC officers quality of work and makes them work optimally. Safety should also be taken to avoid accidents of ATC officers in their workplace. Accidents can happen due to their own fault, the fault of another person, or errors of applied system. Air Traffic Controller activity is activity full stress and performance effects to commitment in organization and productivity [1]. The level of vigilance is essential for work as driver and operator, there is strong correlation between vigilance with fatigue [2].

ATC officers must have a high level of vigilance in order to make the concentration in controlling aeroplane remain good. Management concept in Air Traffic Controller in the future envisage shared decision-making responsibilities between controllers and pilot, necessitating that controllers be supported by automated decision aids [3]. And vigilance task can be make mental workload [4]. A high level of vigilance

highly depends on individual factors, work environment, and also work systems in the company. Individual factors consists of gender, age, education. Another factor beyond the individual factors is hours of service.

Generally, men's physical ability is better than women, youth are physically stronger than older, higher education is better than lower education, and worker who has long hours of service is more skilled than short time controlling.

2. RESEARCH METHOD

This study was held at Air Nav Indonesia Branch Surabaya on November 2014. This was a cross-sectional study which analyzed the correlation between gender, age, education, and hours of service toward the level of vigilance of ATC officers at Air Nav Surabaya which independent and dependent variable were collected at the same time [5],[6].The population of this study was all ATC officers at Air Nav Surabaya. It was taken 41 people. The research sample was collected with a probability sampling technique providing equal opportunity for each element of the population to be selected as the sample [7], type of random sampling (probability) [8]. The data were collected by using questionnaires and using *The Mackworth clock vigilance* tests for the level of officers' vigilance.The Data analysis was performed to describe the collected data in the field and was then being analyzed [9]. The data were processed with non-parametric test, and statistical tests Chi-Square using version 21 of SPSS software [9],[10].

3. RESULTS AND ANALYSIS

Preparation and readiness (vigilance) of ATC officers was very significant for the safety of flight. High vigilance of ATC officers would reduce the risk of flight, either for miscommunication problems and negligence or for human error of ATC officers. ATC officers healthy would have a positive effect in guiding the flight. Pilots needed accurate information from the controller so that either data of air condition or ground condition, even the number of aircraft which was doing flight and the distance between the aircraft and the other aircrafts remained in safe condition and did not harm the flight. Factors that might reduce concentration and vigilance of officers in controlling the flight were gender, age, education level, hours of service, and others.

3.1. The Correlation Between Sex and Level of Vigilance

The correlation between sex and level of vigilance in Air Nav Surabaya Indonesia can be seen in Table 1.

Table 1. The Correlation between Sex and Level of Vigilance in Air Nav Surabaya Indonesia

Sex	Level of Vigilance		Total
	Low	High	
Man	16	12	28
Woman	8	5	13
Total	24	17	41

Table 1 shows that the correlation between sex and level of vigilance was not statistically significant, the value of $P = 0.790$ was higher than 0.05. These results indicated that sex did not correlate to the level of vigilance.Gender could influence the level of vigilance of a controller. Men are physically stronger than women. Physically, the stronger muscles gave a better work ability than the weaker one. However, this would not affect a chance to work as a controller.

Men and women had equal opportunities in officers. Men and women had equal rights to involve and to take responsibility in every profession. Profession as a controller did not distinguish the gender; both men and women were given equal rights. This study showed that men and women did not have a significant correlation to the level of vigilance with a value of $P = 0.790$. These results showed that between men and women, there was no effect on the onset of fatigue due to the decline of the level of vigilance. These results were consistent with Blatter (2006) which showed that gender did not affect the performance of PVT (*Psychomotor Vigilance Task*), which meant no correlation with the level of vigilance; however, a thing that was more dominant was the influence of awakening or little sleeping which would affect the vigilance [11].

This study indicated that men and women did not have problems in doing a hard work as controller. They could still work without the influence of gender rule. Good ATC officers were officers who were able to contribute optimally so that the flight could be done safely. VII constitution states that work practices are not unlawful for an employer to hire someone on the basis of religion, gender, or ethnicity [12].

3.2. The Correlation Between Age and Level of Vigilance

The correlation between age and level of vigilance in Air Nav Surabaya Indonesia can be seen in Table 2.

Table 2. The Correlation between Age and Level of Vigilance in Air Nav Surabaya Indonesia

Age	Level of Vigilance		Total
	Low	High	
Young	7	8	15
Old	17	9	26
Total	24	17	41

The results which were showed in Table 2 tell us that the correlation between age and the level of vigilance was not statistically significant, $P = 0.241$ was higher than 0.05. The data implied an insignificant correlation of age and the value of vigilance. Age was taken as the age of the ATC officers when this study held. ATC officers' age could affect the level of interference of vigilance. The younger employee has more optimal health than the older one. Health generally decreased in older people. A decreased health could decrease the level of vigilance.

Based on the result of this study, age had no correlation with the level of vigilance of ATC officers with a value of $P = 0.241$. This result explained that between the young age and the old one did not significantly correlate with the vigilance. The result to different with result Turhan (2009) in Turkish where controller performance perception found significantly with age [13]. This was possible that the health of ATC officers should always be maintained, in order to get a license of being a controller. The license would not be given to ATC officers who had a problem with their health. The good health was absolutely needed by the controllers. When they had a problem with their health, they should take a rest and be recovered until they were ready to work without giving a risk to the safety of flight. This result is in line with the research conducted by Blatter (2006) that between the young age and old one did not affect a decrease in psychomotor performance Vigilance Task (PVT), but it was influenced by more awakening at work [12].

3.3. The Correlation Between Educational Background and Level of Vigilance

The correlation between educational background and level of vigilance in Air Nav Surabaya Indonesia can be seen in Table 3.

Table 3. The Correlation between Educational Background and Level of Vigilance in Air Nav Surabaya Indonesia

Educational Background	Level of Vigilance		Total
	Low	High	
Low	3	4	7
High	21	13	34
Total	24	17	41

Table 3 shows that the correlation between education and the level of vigilance was not statistically significant, $P = 0.355$ was higher than 0.05. This indicated that the level of ATC officers education insignificantly correlated to the level of vigilance. The result to different with result Turhan (2009) in Turkish where controller performance perception found significantly with educational background [13]. Education is a step that must be taken for someone to get knowledge, both science-related theory and practice such skills and others. An education for being a controller in Indonesia has different level such as diploma II, III and IV. Moreover, the controller would get different level of skills. A controller with the lower level would have the ability to do a control in the tower and have limitations on some of the responsibilities and roles, while the higher level would also have a higher ability. They could not only control manually at the tower but also could have the capability in radar beacon to do control and other capabilities.

Education had no effect on the level of their vigilance. ATC officers vigilance had nothing to do with the education of a controller, because the responsibility and role had been determined based on standard competency of their school. This study proven that there was no correlation between lower and higher education to the level of vigilance. The results showed statistically that the value of P was higher than 0.05, $P = 0.355$, which meant no significant decrease in vigilance of ATC officers. The education is greater the desire to utilize their knowledge and skills [14]. Expressed also by Green that educational factors can influence the behavior of employment, higher education will relate positively to the behavior of a person who

has an impact on a person's level of alertness [15]. According Saydam which states that a person's level of education affect employee motivation [16],[17].

3.4. The Correlation Between Hours of Service and Level of Vigilance

The correlation between hours of service and level of vigilance in Air Nav Surabaya Indonesia can be seen in Table 4.

Table 4. The Correlation between Hours of Service and Level of Vigilance in Air Nav Surabaya Indonesia

Hours Of Service	Level Of Vigilance		Total
	Low	High	
Long	3	7	10
Short	21	10	31
Total	24	17	41

Table 4 shows that the correlation between hours of service and level of vigilance was statistically significant with a $P = 0.035$ which was lower than 0.05. This indicated that hours of service correlated to the level of vigilance of ATC officers. Hours of Service ATC officers was time working in a day that was done by ATC officers while they were controlling. In this case, hours of service was not observed in break time on working hour, but it was only calculated while they were controlling aircraft, either as a controller or as an assistant. Hours of service could affect an ATC officers' vigilance; the longer time in controlling could reduce the level of vigilance of an ATC officers. Working as a flight controller required high concentration and optimal health in order to be able to work well.

This study showed that hours of service correlated significantly to the level of ATC officers vigilance with $P = 0.035$ which was smaller than 0.05. These results showed that doing control in long time had high risk at the level of vigilance. Long time working would affect a decrease of vigilance. It was clear that doing the control should not be too long and should follow the standard time. Working in a long time in a shift would harm the safety of flight due to decrease of vigilance. ATC employees should take a rest in each shift properly and should not do controlling-time more than the rules that had been established globally.

These result of this study is in line with Blatter's (2006) that the long awakening could affect the performance of PVT [12], which meant that it could decrease officers level of vigilance. Longer awakening could be assumed that the longer in doing control in a day which could give the effect of the decrease of someone's work ability. In other words, it could decrease the ATC officers' level of vigilance. This current study is in line with previous research conducted by Prayudi. He found that the most powerful factor associated with poor alertness level is a long work [18]. The longer people do work then vigilance will decrease and the impact on the quality of work produced.

4. CONCLUSION

This study concluded that gender, age, and education of ATC officers did not correlate significantly to the level of vigilance. Hours of service correlated to the level of vigilance of ATC officers. Moreover, ATC officers should work based on international rules, particularly in terms of time, and the controller may not cross the boundary.

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