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Impact of Perceived Stress, Safety Attitude and Flight Experience on Hazardous Event Involvement of Aviators

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ABSTRACT

The pilots' attitude and its influence on flying performance have an imperative bearing on flight safety. Recent studies suggest that attitude and stress correlate with flying performance and could be one of the many factors, which contribute to accidents or incidents. The objective of the current research was to study the relationship between aviation safety attitude, flight experience, perceived stress, and hazardous event involvement among aviators. The study also investigated whether aviation safety attitude, perceived stress, and flying experience predict the hazardous event involvement of aviators or not. It was hypothesised that less flying experience, perceived stress, and aviation safety attitude will predict the hazardous event involvement of aviators. The data was collected from 360 aviators by using the aviation safety attitude scale, hazardous event scale, and perceived stress scale. Correlation and regression analysis were used for analysing the obtained data. The findings of the study indicated that flight experience and safety attitude are significantly negatively correlated with hazardous event involvement and perceived stress is significantly positively associated with hazardous event involvement. In addition to this, aviation safety attitude, perceived stress, and flying experience were found to be strong predictors of hazardous event involvement. The findings of the study will help in building effective training programs as accidents can be prevented by improved pilot training involving perceived stress and attitude identification and management.

Keywords: Aviation safety attitude; Aviators; Flying experience; Perceived stress

1. INTRODUCTION

Flying is one of the most challenging and complex tasks in terms of mental skills and motor skills. Aviators are involved in highly demanding tasks and missions which require tremendous mental capacity and strength. Due to continuous working in such a challenging and demanding environment, they tend to become vulnerable, at times, in coping with some adverse situations. Aviators are responsible for safely operating complex machinery and for staying vigilant to detect minor changes that could signal a multitude of emergencies[1]. Flight Experience, safety attitude, and perceived stress are imperative factors for the success of an operation in aviation. Aviators specifically have the task of placing safety as their main priority. Their attitudes toward safety should lead them towards appropriately applying the rules of safety.

Aviation Safety attitude is a key to promote safe behaviors and decline in accidents, also it provides a strong foundation of safety culture. Safety attitudes are referred to as the avoidance of hazards and violations and, therefore reduce accidents. researchers have found that pilots with a high safety culture attitude were less prone to violate the rules than pilots with a low safety culture attitude[2]. A learned tendency to behave in a consistent manner against a particular object or circumstance is known as attitude[3]. Some researchers suggested that the safety attitude is a key to promote safe behaviors and decline in accidents, also it provides a strong foundation of safe culture[4-5]. There are three components of attitude as Cognitive, affective, and behavior. The cognitive refers to values, thoughts, and knowledge; the efficient refers to emotional (like-dislike), and the behavior refers to the desire to act in a certain way[6]. Understanding these three components is critical because they can reflect how people with positive attitudes react positively to a wide range of issues, while people with negative attitudes react negatively across the board[7].

Perceived stress has been defined as the extent to which persons perceive (appraise) that their demands exceed their ability to cope[8]. Stress is widely acknowledged as a constant presence in our everyday lives, but the impact it has on individuals and the methods they use to deal with it vary considerably. In studies, researchers discovered that flying is an inherently stressful task[9-12]. Long flights, exhaustion, occasional flight check trips, inspections, communication/ interpersonal issues, and family conflicts are all factors that contribute to pilot stress[13]. A moderate amount of stress can help pilots remain focused, while an extreme amount of stress can lead to a decrease in performance[14-15].

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The flight experience of an aircrew serves to increase his/her overall situational awareness. More the flight experience more is the comfort in dealing with routine and emergent situations. An aircrew with higher flight experience is likely not only to respond better to an accident or incident event but also his actions while in flight are likely to reduce the occurrence of an avoidable mishap. Flight experience of an aircrew can be measured in terms of the number of years of service put in while on a flying assignment and the total number of flying hours accrued. Also, with higher flight experience, an aircrew would have encountered more situations of emergent nature, thus, aviators would be better placed to draw lessons from them and put these lessons to use for future reference while in an emergent condition. Flight experience has a protective effect against the risk of hazardous event involvement.

Mostly previous studies were related to cognitive factors of aircrew like attention, memory, workload, decision making and fatigue. There are very less studies conducted on aircrew's safety attitude and perceived stress in India. The findings of the current study will be helpful to fill this research gap in literature.

2. OBJECTIVE OF STUDY

The purpose of this study was to investigate the relationship between flight experience, perceived stress, aviation safety attitude, and hazardous event involvement. Further to understand the predictive effect of flight experience, perceived stress, aviation safety attitude on hazardous event involvement among the aviators.

3. HYPOTHESES

- Flight experience will be negatively correlated with the hazardous event involvement of aviators
- High perceived stress will be positively correlated with Hazardous event involvement among aviators
- Aviation safety attitude will have negative association with hazardous event involvement in aviators
- Perceived stress and flight experience will be the predictors of the Hazardous event involvement
- Self-confidence, risk orientation, and safety orientation (components of safety attitude) will predict the hazardous event involvement among aviators

Table 1. showing Individual characteristics (N=360)

Characteristic	F
Age	
Range (Year)	25-40
Sex	
Male	224
Female	136
Status	
Married	235
Single	125
Flight status active	
Yes	360

4. METHODOLOGY

4.1 Sample

The sample of the study consisted of a total of 360 aviators from the transport fleet of the Indian Air Force. Out of these there 220 were pilots and 140 were navigators. The two inclusion criteria used for the selection of the respondents for the present study were in the age range of 25 to 40 years (Mean=30.42, SD=4.45). Almost all the respondents had active flying status (98.6 %) as shown in Table 1.

4.2 Design of the Study

The causal design was adopted to investigate the relationship among the variables as shown in Fig. 1.

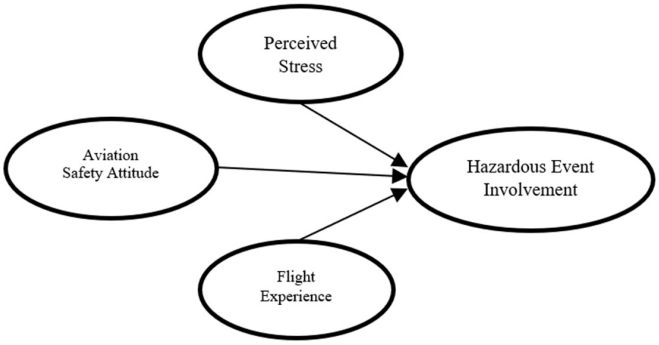

Figure 1. Regression analysis to predict hazardous event involvement from aviation safety attitude, flight experience and perceived stress.

4.3 TOOLS

4.3.1 Hazardous Event Scale[16]

The 36-item scale assessed participants' experience in potentially hazardous aviation events. Participants are asked how much they have been active in dangerous incidents in the previous 24 months. The response scale had a range of 0 to 4 or more scales. Higher scores mean that the individual has been exposed to more hazardous situations. With a scale coefficient alpha of 0.90, the internal reliability was 0.90.

4.3.2 Perceived Stress Scale[8]

The Scale consisted of 14 items that asked respondents to rate how frequently they find their lives unpredictable, uncontrollable, and overwhelming on a 5-point scale (0 = never to 4 = very often). With Cronbach alpha coefficients of 0.91, the PSS has a high internal reliability.

4.3.3 Aviation Safety Attitude Scale[17]

Aviation safety attitude scale consisting of 27 items, each designed specifically to assess pilots' attitudes concerning aviation safety matters. The ten items demonstrated hazardous attitudes. Additional questions probed attitudes towards - aviation hazards, the probability of an accident, and self-perceived capabilities. There were three sub-factors self-confidence (SC), risk orientation (RO), and safety orientation (SO). The reliability and construct validity of this scale was reported by Hunter.

5. PROCEDURE

All participants received an information letter and a

voluntary consent form before completing a demographic questionnaire, and a set of questionnaires. A cover letter explaining the purpose of the study and participants' confidentiality was assured. Participation was voluntary and anonymous to ensure accurate responses of participants. An informed consent, as well as an invitation to participate in the study, was provided on the first page of the survey. All participants had the right to discontinue the survey at any time. The questionnaires were made available to participants by emailing at their respective units. Total 380 questionnaires were distributed, out of 380 questionnaires 20 were incomplete. The incomplete questionnaires were rejected and were not included in the study.

6. DATA ANALYSIS

Pearson's product-moment correlation was applied to obtained data to examine the relationship between perceived stress, flight experience, aviation safety attitude, and hazardous accident involvement. Linear multiple regression analysis was performed to study the predictive effect of perceived stress, flight experience, aviation safety attitude on hazardous accident involvement among aviators. The statistical Package for Social Science (SPSS) 25 version was used to analyze obtained data.

Table 2. Showing the descriptive statistics of Variables under study (N=360)

Variable	Mean	SD
Perceived stress	18.84	8.46
Accident involvement	20.93	13.43
Safety attitude	74.43	12.17
a) Self confidence	38.00	6.62
b) Risk orientation	22.06	6.19
c) Safety orientation	14.36	5.19

7. RESULTS

Table 2 indicated mean and SD values of perceived stress, hazardous event involvement, safety attitude, and its components. These are 18.84, 20.93, 74.43, 38.00, 22.06 and 14.36 respectively. After descriptive statistics, the data was analyzed for intercorrelations among the variables to test the first hypothesis as shown in Table 3.

Table 3 indicated that flight experience has negative significant correlation with perceived stress and hazardous event involvement ($r = -.457$, $p = <0.01$, $r = -.357$, $p = <0.05$) respectively. Also, positive significant association was found between flight experience and safety attitude ($r = .515$, $p = <0.05$) and its components as self-confidence ($r = .609$, $p = <0.01$), safety orientation ($r = .423$, $p = <0.05$) however, a negative association was found with risk orientation ($r = -.487$, $p = <0.01$). A significant positive correlation was found between perceived stress and hazardous event involvement ($r = .569$, $p = <0.01$) as predicted in the current study. Aviation safety attitude is also found negative significantly correlated ($r=-.594$, $p = <0.01$) with hazardous event involvement as self-confidence ($r=-.504$, $p = <0.01$), safety orientation ($r=-.657$, $p = <0.01$) and positive with risk orientation ($r=-.633$, $p = <0.05$).

The multiple regression analysis was conducted on four variables on the outcome variable. In the first step variable stress included, in the second step, stress, and self-confidence, in the third step, stress, self-confidence, and safety orientation. Table 4 shows the results of stepwise regression analysis, whether the independent variables of the study viz Flight Experience, safety attitude, and perceived stress predict accident/incident among aviators. Table 4 revealed that all variables put together contribute 72 per cent variance in the dependent variable which is found to be significant at .001 level ($F= 285.78$). Out of these five variables, two variables, risk orientation, and flight experience have not come out as a predictor of the outcome variable.

The pictorial representation of Fig. 2 shows the relation between stress felt by an individual versus the frequency of

Table 3. Showing correlation matrix of all variables under study (N=360)

Variable	Flight experience	Perceived stress	Hazardous event involvement	Safety attitude	a) Self confidence	b) Risk orientation	c) Safety orientation
Flight experience	1	-.457**	-.357*	.515*	.609**	-.487**	.423*
Perceived stress		1	.569**	-.594**	-.385**	-.531**	-.524*
Hazardous event involvement			1	-.773**	-.504**	.633*	-.657**
Safety attitude				1	.156*	.577**	-.747**
a) Self confidence					1	.210*	.187*
b) Risk orientation						1	-.366**
c) Safety orientation							1

*significant at .05 level, ** Significant at .01 level (two tailed)

Table 4. Multiple stepwise regression analysis showing prediction of perceived stress and aviation safety attitude on accident involvement of pilots (N = 360)

Predictors	R^2	ΔR^2	SE b	β	F Ratio
Step 1	0.656	0.690			362.05***
Stress			.07	0.83	
Step 2	0.687	0.732			301.95***
Stress			.071	0.60	
Self confidence			.091	-.388	
Step 3	0.727	0.741			285.78***
Stress			.065	0.689	
Self confidence			.086	-.506	
Safety orientation			0.104	0.293	

*** Significant at .001 level.

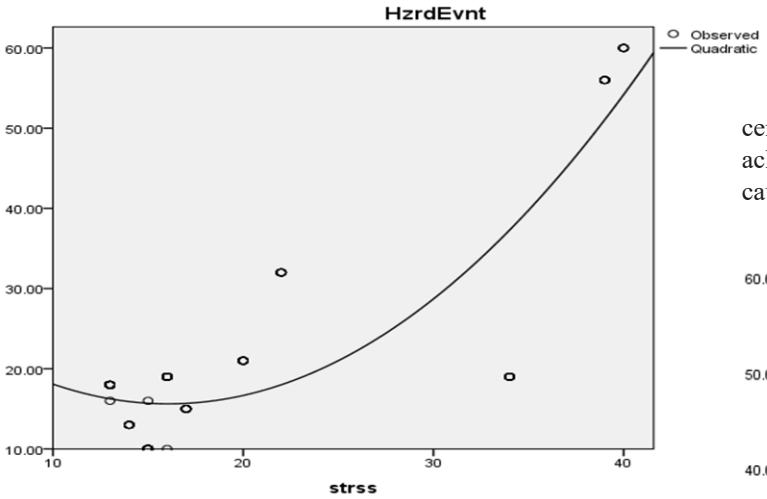

Figure 2. Showing the effect of stress on hazardous accident involvement.

hazard events. The relation curve shows a direct relationship between stress felt by an individual and hazardous events. The more the stress felt more is the frequency of hazard events. It may be noted that at a very low-stress level, there is a relative increase in hazard events, indicative of a need for optimal stress to ensure better performance. At higher ends of stress, the curve is steep, indicative of a sharp rise in the frequency of hazard events even for the small increase in stress levels.

The pictorial representation of Fig. 3 shows that with an increase in self-confidence there is a reduction in the frequency of hazard events. The relation curve shows a direct relation between and self-confidence hazard events. At lower levels of self-confidence, the hazard events are very large and even with a slight increase in self-confidence, the frequency of hazard events reduces sharply. However, beyond a particular value of self-confidence, reaching towards overconfidence, there is an increase in the frequency of hazard events.

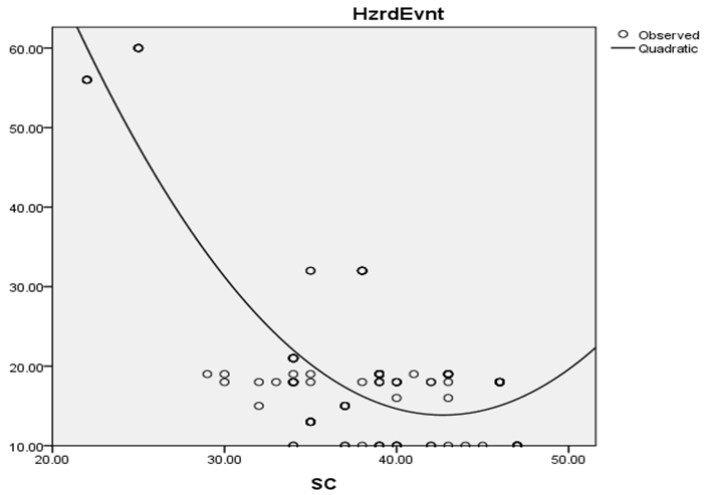

Figure 3. Showing effect of self-confidence on hazardous event involvement.

Figure 4 shows the relationship between the safety orientation of an individual versus hazard events. The relation curve shows the expected indirect relation. More the safety orientation less is the frequency of hazard events. At the end of high safety orientation, there is a mild rise in the frequency of hazard events indicative of over cautiousness leading to mistakes. For military aviators, certain calculated risk is required to be taken to successfully achieve the task at hand and over cautiousness can also be a cause for increased hazard events.

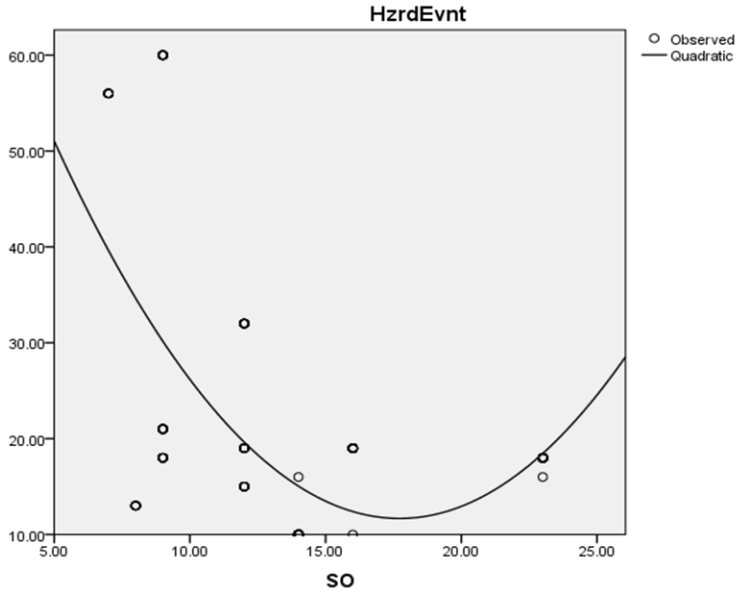

Figure 4. Showing the effect of safety orientation on hazardous accident/incident involvement.

8. DISCUSSION

The current study sought to address the roles offlight experience, safety attitude, and perceived stress among aviators. The findings of the study demonstrated that flight experience is negatively associated with hazardous event involvement, as flight experience grows, the probability of accident also gets reduced[18]. This is corroborated by the previous study[12] that experience appears to affect the decisions of pilots for hazardous

alternatives, a possible outcome of their overconfidence based on improved performance of assignments. They proposed that variations in the identified hazards of experts and non-experts could be attributed to their unique exposure to hazardous things. However, if accidents and incidents often escalate in the pilots, this could mean that considering their higher levels of experience, these pilots are unable to cope adequately with hazardous flying scenarios.

The results of the study indicated that perceived stress and hazardous event involvement have a positive association. Perceived stress affects the quality and quantity of learning of pilots adversely. Perceived stress may lead to a disregard for safety measures, operational procedures, and teamwork and can lead to a higher probability of accident[19]. The results of the current study are inconsistent with the previous studies[20]. They have explored that stress has a major impact on the performance of skilled and trained pilots. Stress affects human performance, particularly the cognitive performance of pilots. Considerable evidence indicates that stress deteriorates human performance in general and judgment and decision making in particular[21]. Early work on stress and decision making showed that decisions under stress become less systematic and more hurried and those fewer choices are considered while deciding under stressful conditions[22].

Aviation safety attitude is an important factor that affects the probability of occurrence of accidents and incidents. The findings of the present study support the hypothesis that a high level of safety attitude inpilots reduces the chances of accidents/ incidents. It is quite evident in the study that an individual'sbehavior is governed to a significant degree by the attitudes we hold, and any attempt to change behavior should begin with an attempt to identify underlying attitudes and beliefs[23]. The results found that flight experience and safety attitude have a significant relationship and may lead the hazardous events. Safety attitudes act as collective beliefs in the individual towards hazards and safety[24]. The results have shown that low self-confidence and higher risk orientation may increase the likelihood of accidents. Pilots who score high on safety orientation are likely to have less hazardous event involvement. It has also been revealed in findings that the pilots with low self-confidence are likely to perceive more stress in the environment.

Safety orientation, self–confidence and perceived stress were found as strong predictors of hazardous event involvement. Pilots' positive attitude can lead to professional pride, motivation, and a higher probability of safe flight[25-26]. Pilots with higher self-confidence and less risk orientation tended to place greater importance on the execution of flight safety checklists[27]. There is a need to be considerate that there will be cases of accident and human error. Some researchers explored in their study that pilots' attitude combined with knowledge and experiences gauge their likelihood to experience hazardous circumstances[28]. Studies have shown that elevated levels of stress can have a significant impact on pilot's cognitive processes and flight performance, it was also found stresses are associated with coping, safety, and risk[29]. Some researchers found out in their studies that pilots who practice effective risk management training have predetermined personal standards and have formed habit patterns and checklists to incorporate them[30]. Pilots who make a habit of using risk management tools will find their flights considerably more enjoyable and less stressful. Researchers identified in studies that pilots' attitudes affect their decision-making ability, thought patterns, and risk perceptions during all aspects of flight, which affects how a pilot respond to a given situation[31].

This study provides empirical evidence as some Researchers have investigated in their studies that flight experience impact to some degree for age-related declines in cognitive function and that overlearned complex tasks such as piloting are less susceptible to age-related deterioration than abilities to perform in novel situations[32]. The findings of the present study indicated that flight experience and risk orientation did not predict the aviators' involvement in hazardous events. Flight experience, therefore, appeared to have a relatively minor effect on the behavior of aviators. The finding that flight experience has a protective effect against the risk of crash involvement is consistent with previous studies.

9. CONCLUSION

The study can suggest that flight experience, safety attitude, and perceived stress have an important role in predicting the hazardous event involvement among aviators. The current study supported this notion that a successful aviator needs to feel confident to control the aircraft. The study has also shown the complex relationship between flight experience and safety attitudes. Self-confidence, safety attitude, and risk orientation are components of safety attitudes among aviators that promote aeronautical decision-making.

10. IMPLICATION, LIMITATION AND FUTURE DIRECTION

These results will also facilitate the development of innovative research-based intraoperative training programs, as enhanced pilot training involving risk, attitude recognition and management. It will help to minimise accidents and incidents in IAF. Effective research-based interventional training programs for aviators should concentrate on boosting their trust in their flying abilities. The findings of this study indicate that aviator risk management training programs are tried to improve safety attitudes and stress perceptions, especially in the initial and mid stages of a pilot's career.

Few limitations have also been seen in the present study since the research used a self-reporting questionnaire. Self-reported information can at times be unreliable, as it may be distorted by the absence of participants to report on themselves, forgetfulness, prejudice, and social desirability.

To further explain this relationship between other variables, further analysis using a different method of study is needed. On the other hand, the current research provides a framework for exploratory purposes. To increase the precision of the findings, future research should include a greater number of participants.

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Navin Garg is commander for regional wing of Air India, Alliance Air at Delhi. He is presently flying the ATR-72-600 aircraft. He is trained in Flight Safety and Accident investigation and has been involved in several flight safety inspections of IAF stations.
His contribution in the current study is collection of data,