



# Comparative study on hazardous attitudes and safe operational behavior in airline pilots



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## ABSTRACT

The purpose of this study is to analyze the differences in hazardous attitudes and safe operation behavior according to cultural differences and flight experience. In particular, the study tries to analyze these differences between Korean and non-Korean airline pilots and according to total flight experience. A survey was conducted on airline pilots that work at Korean Air, and a total of 147 collected surveys were analyzed using a *t*-test and ANOVA. The analyses showed differences between Korean and non-Korean airline pilots as well as according to total flight experience.

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## 1. Introduction

Safety is the most important issue in the aviation industry, and as such, airlines are engaging in various efforts to enhance the safety of their overall operations. Recently, among issues related safety, there has been a growing interest in the hazardous attitudes and safe operation behavior of pilots. Airlines are now making a significant effort to evaluate and understand these two factors with respect to their pilots (Ji et al., 2011). Depending on how a pilot recognizes and estimates a hazard during flight, the pilot may show hazardous attitudes, which would affect safe operation behavior. The extent of these attitudes and behavior might differ depending on the personal characteristics of pilots, including their cultural background and flight experience (Hunter, 2005).

Korean Air, Korea's representative national airline, hires many of its pilots from abroad, thus creating a multicultural environment. For this reason, it is important to understand how cultural differences affect hazardous attitudes and safe operation behavior with respect to aircraft operation. Such studies on cultural differences have been conducted mainly in the domain of general management (Liao, 2015). However, there have been almost no studies on how

the cultural background of airline pilots affects hazardous attitudes and safe operation behavior. Also, according to Wetmore and Lu (2005), hazardous attitudes and safe operation behavior may change depending on flight experience. As of yet, no studies have been conducted on airlines in Korea regarding the difference in hazardous attitudes and safe operation behavior depending on flight experience. Therefore, this study aims to rectify this gap in the literature. In particular, this study tries to analyze the differences in hazardous attitudes and safe operation behavior between Korean and non-Korean pilots as well as the differences in hazardous attitudes and safe operation behavior depending on total flight experience.

## 2. Literature review

The term hazardous attitudes refers to the tendencies of individuals to react to stimuli in such a way that risks increase in a given situation or event. It is also important to note that hazardous attitudes can be changed through training (Ji et al., 2011). In other words, hazardous attitudes can be defined as a personal motivation tendency that affects an individual's ability to make good decisions and apply good judgment while piloting an aircraft (FAA, 1999). At present, this research area is receiving significant attention in the aviation field. In particular, research on hazardous attitudes and safe operational behavior is on the rise in the aviation field. The hazardous attitudes concept is a basic element that is included in

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most of the professional education program curriculums for pilots (FAA, 1999). In order to reduce hazardous attitudes, one should recognize danger and apply the appropriate behavior. Hazardous attitudes can mitigate the good judgment of a pilot, so these attitudes affect flight safety (FAA, 1991). Wiener and Nagel (1988) asserted that hazardous attitudes were one of the most important human factors influencing aeronautical decision-making processes. Hazardous attitudes can be changed and modified through training, and it was found that individual forms of hazardous attitudes were related to aeronautical decision-making (ADM), crew resource management (CRM), and self-reported accidents (Buch and Diehl, 1984; Wetmore and Lu, 2006). Ji et al. (2011) reported that it was possible to change hazardous attitudes and risk awareness in airline pilots with respect to safe operational behavior and flight safety. In the present study, a survey questionnaire on hazardous attitudes was created by referring to the relevant research. The questionnaire was designed to examine hazardous attitudes by investigating three particular elements that could subsequently be applied to an exploratory factor analysis with the collected data. These elements were (a) anxiety and worry about accidents during flight, (b) conceit regarding one's ability to handle any flight-related situation, and (c) spontaneity when responding to events, making impulsive or momentary decisions without fully considering the situation.

Safe operational behavior, which is similar to concepts such as communication, collaboration, decision-making, workload management, situational awareness, and flight automation management, is related to non-technical skills or social psychological skills performed or displayed by airline pilots during flight duties. Also, these skills help airline pilots to guarantee flight safety (O'Connor et al., 2002; You et al., 2009). Previous research on safe operational behavior has primarily looked at differences according to personal characteristics and social awareness variables. For example, previous studies have attempted to examine how risk tolerance and the 'big five' personality variables – honesty, integrity, extroversion, jollity, and neurosis – have affected safe operational behavior (Berg et al., 2002; Pauley et al., 2008; Poropat, 2009). Also, a continuous stream of research has been carried out on the effects of safe operational behavior by examining social awareness variables such as attitudes regarding flight safety, perceived risks, and social regulations (O'Hare, 1990; Hunter, 2005; Stewart and John, 2006; Ji et al., 2011). The present study created a survey questionnaire on safe operation behavior based on previous studies. This survey listed four factors that comprised hazardous attitudes with the intent that an exploratory factor analysis could be conducted on the collected data. The four factors were (a) leadership and management via the application of non-technical or socio-psychological competence in order to guarantee safe operation during flight, (b) communication and cooperation, (c) situation awareness and decision-making, and (d) understanding and predicting automation.

### 3. Methodology

This study aimed to analyze the differences between airline pilots in terms of hazardous attitudes and safe operational behavior in flight. To check for differences in the levels of pilot awareness for each factor, the population was divided by nationality (Korean and non-Korean) and total flight experience. The research hypotheses are shown in Table 1. On the basis of the three hazardous attitude factors and four safe operation behavior factors, the hypotheses were designed to analyze differences based on nationality and total flight experience.

Ji et al. (2011) used 24 questions to assess hazardous attitudes. These questions targeted six factors – self-confidence, impulsive,

worry/anxiety, macho, antiauthority, and resignation. Also, 27 questions were used to measure safe operation behavior. They targeted four factors – automation system understanding, leadership and management, situation awareness and decision-making, and communication and cooperation. The present study drew up its survey questions based on the factors and list of measurements used in the Ji et al. (2011) study. Some of factors that Ji et al. (2011) used to measure hazardous attitudes and safe operation behavior contained elements that were not applicable to a study of commercial airline pilots. Accordingly, in order to modify existing survey questions and create new questions that were more appropriate, in-depth interviews were conducted with Korean Air flight crews. The authors then attempted to compose survey questions that would help elicit a better understanding of the hazardous attitudes and safe operation behavior of airline pilots. In order to determine that the pilots would be able to understand the questions, and in order to test the validity of the questions, a pilot study was conducted for Korean and non-Korean crew members working for Korean Air. Pilots were asked to answer the questions and point to particular questions that needed to be modified. Through the in-depth interviews and pilot study, the final questions were determined. Ultimately, the final survey was composed of a total of 56 questions, including 18 questions measuring hazardous attitudes, 27 questions measuring safe operational behavior, and 11 questions designed to provide demographic divisions. A five-point Likert scale was used to facilitate data collection. The measurement questions for hazardous attitudes and safe operational behavior are shown in Tables 2 and 3.

To conduct an empirical analysis, the surveys were distributed to Korean and non-Korean airline pilots working at Korean Air. The survey was conducted for 24 days from May 24, 2013 to June 16, 2013. The surveys were filled out in two locations, Korean Air Headquarters at Gimpo International Airport and in Incheon International Airport's Pilot Briefing Room. A total of 150 copies were distributed to Korean pilots and 50 copies were distributed to non-Korean pilots. From the 200 distributed surveys, 165 copies were collected. In the process of filling out the survey there were almost no questions from the responders regarding question clarity, so it was determined that they had a good understanding of the questions. Excluding 18 surveys (11%) that could not be used due to incomplete responses to all questions, 147 surveys (89%) were used for the analysis. The general characteristics of the samples are represented in Table 4. The sample size of the flight crew used for the analysis in this study was relatively small. According to the central limit theorem in statistics, 30 is the usual minimum sample size (Cohen et al., 2013). As the sample size grows, the average distribution approaches a normal distribution. Statistical estimation is possible via the average and distribution, so a sample size of 30 or more is sufficient. Therefore, the sample size in this study was deemed adequate.

## 4. Empirical results

### 4.1. Reliability and validity verification

To verify the validity of the research in this study, first an exploratory factor analysis was conducted. All measurement variables were run through a principle component analysis (PCA) to derive the configuration factors. To simplify the factor load value, the orthogonal rotation method (Varimax) was used. In the results of the exploratory factor analysis for hazardous attitudes, excluding eight items among the 18 that did not meet the standard, the 10 questions were bound into three factor types – spontaneity factors (four questions), anxiety factors (three questions), and conceit factors (three questions). The Kaise-Meyer-Olkin (KMO) value of

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